DEPARTMENT OF NATURAL RESOURCES

December 6, 2017

Notice is hereby given that the Thief Lake Wildlife Management Area Master Plan—2017-2027 for the Minnesota Department of Natural Resources has been completed and is now adopted.

Tom Landwehr
Commissioner

12/05/2017
Date

Thief Lake Wildlife Management Area Master Plan, 2017-2027

DEPARTMENT OF NATURAL RESOURCES

June 2017

I. Executive Summary

A. DNR Mission Statement

The mission of the Minnesota Department of Natural Resources (DNR) is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

B. WMA Mission Statement

Wildlife management areas (WMAs) are part of Minnesota's outdoor recreation system and are established to protect those lands and waters that have a high potential for wildlife production, public hunting, trapping, fishing, and other compatible recreational uses. They are the backbone to DNR's wildlife management efforts in Minnesota and are key to protecting wildlife habitat for future generations, providing citizens with opportunities for hunting, fishing and wildlife watching, and promoting important wildlife-based tourism in the state.

C. Thief Lake WMA Master Plan Summary

This plan summarizes management activities for Thief Lake WMA, a 54,957 acre WMA in the northwest portion of Minnesota. The last master plan for Thief Lake was written in 1980, and was intended to cover the period from 1980-1989. Significant planning of various management activities has occurred since that time, but this is the first formal updating of the master plan. The most important change since the 1980 plan is a larger physical footprint (55,957 acres versus 33,255 acres in 1980). Many of these additions to the WMA resulted from a shift in management authority from Division of Forestry (FOR). Other changes include a shift in how forested habitats are managed, a shift in management emphasis to native plant communities, changes in wildlife use and public use of the area, new challenges including invasive species and changing climate, and changes in how we approach farming on the WMA.

The plan provides extensive reference material, including the history of the WMA and the surrounding area, the lands included in the WMA, native plant communities, wildlife populations, and the history of public use of the area. Emerging threats to the management area are discussed. Techniques for management of the different habitat types are presented including water level management in wetlands, timber harvest, brush treatments, prescribed fire, prairie restoration, and moist soil management. An annual calendar of management activities is included, as is a discussion of research activities and ongoing monitoring that occurs on the area.

There are extensive appendices included that continue to provide reference material for the management of the area, including pertinent statutes and rules, summaries of other guiding documents that were considered in making the plan, and lists and status of species found on the area.

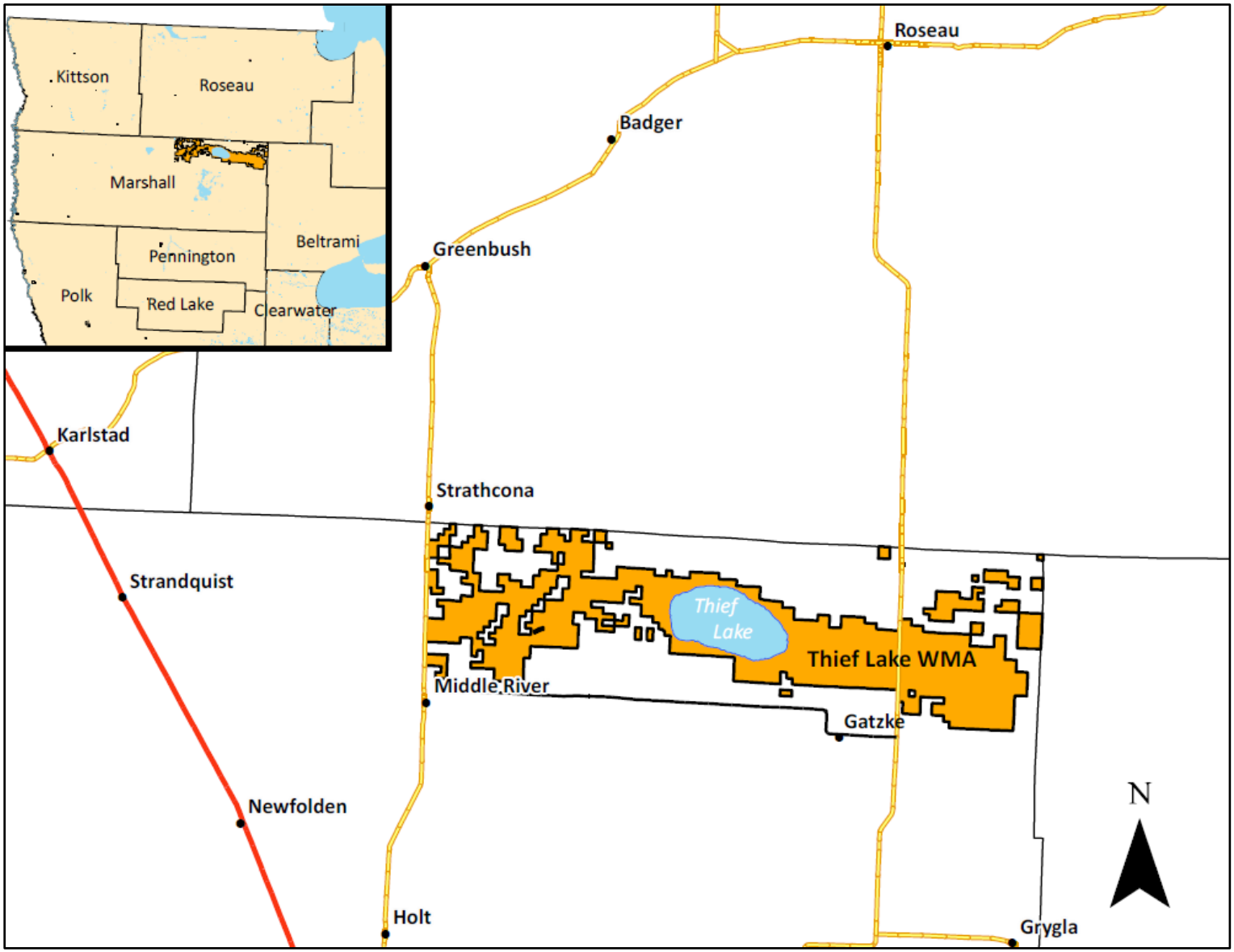


Figure 1. Thief Lake Wildlife Management Area

II. Table of Contents

Figures and Tables

Prescribed burn in a restored prairie along the Dohrman Ridge in Thief Lake WMA

III. Introduction

A. Major Unit Definition

Minnesota currently has 1541 Wildlife Management Areas (WMAs) totaling over 1.3 million acres distributed across the state. These WMAs are managed out of 37 local offices. Of the 37 local offices, eight have the distinction of being "Major Units": Carlos Avery (24,133 acres), Lac qui Parle (32,981 acres), Mille Lacs (38,729 acres), Red Lake (324,699 Acres), Roseau River (75,206 acres), Thief Lake (54,957 acres), Vermillion Highlands (2838 acres) and Whitewater (27,403 acres). Each of these major units manages a major WMA, but may also manage other units within their work area. Major Units are typically distinguished by having resident staff (Wildlife Area Supervisor and Assistant Wildlife Area Supervisor), although not all have resident staff. They also typically have greater than average WMA acreage that is more intensely managed than most WMAs, larger fleet asset lists including heavy equipment (such as dozers, tractors, graders, etc.), larger staff complements, and more capital improvements, including resident housing, office and barracks, shops with higher capabilities for repair, maintenance, fabrication, visitor infrastructure amenities, a complement of other buildings or facilities, and unit roadways for public and operational use.

Major Units also receive high levels of public use, comprised primarily of hunters and trappers, but also include bird watchers, berry pickers, and others. Major Units function at a high level of self-sufficiency using allotted area funding commensurate to budgets needed to perform habitat management and maintenance operations on a daily and seasonal basis using staff and equipment assigned to the Major Unit. When practical, the additional staff and capital found at Major Units are often available to assist other staff in the vicinity, which greatly improves efficiency.

B. Purpose of Plan

This master plan outlines the management of Thief Lake WMA through 2027, in accordance with the Minnesota Outdoor Recreation Act of 1975. The previous management plan was prepared in 1980, and many environmental and social changes have occurred since then. Minnesota's population has grown, the climate has and continues to change, invasive species have proliferated, new state and federal policies have been enacted, recreation demands and preferences have changed, and many wildlife and plant populations have declined throughout the state. A revised management plan is needed to address and manage for these changing conditions. The Department of Natural Resources is updating comprehensive management plans for the state WMA Major Units. These plans are 10-year management plans, and they will be revised as new management practices develop, new resource philosophies evolve, and new challenges are encountered.

C. Long-range Goals

1. To conserve, enhance, and restore a variety of grassland, wetland, forest, and agricultural habitats to benefit resident and migratory wildlife. Management of habitat for migratory species will remain a point of emphasis. Accommodating research and long-term monitoring will continue to be an important part of adapting and improving management in the face of challenges from surrounding land use, invasive species, and climate change.

2. To provide quality public hunting, trapping, and wildlife viewing opportunities. Other forms of outdoor recreation will be accommodated when compatible with wildlife management and public use goals.

D. Planning Process

In June 2016, a Project Consultant was hired to coordinate the update of the Thief Lake WMA Master Plan. An internal planning team was assembled of staff from multiple divisions with various areas of expertise (Table 1). The planning team met 3 times over the course of the project: on September 12, 2016, January 10, 2017, and March 9, 2017. The planning team assisted with developing the structure and content of the plan and also provided critical review for draft versions of the plan.

On July 28, 2016, DNR staff were encouraged to provide feedback via an online questionnaire on what they perceived as the most pressing issues, largest untapped opportunities, greatest successes, and biggest challenges related to the management of Thief Lake WMA. This internal scoping helped the planning team identify which resources and management issues should receive the greatest level of focus during the revision process.

On November 28, 2016, an online public user questionnaire was opened to the public. The online questionnaire was advertised directly to members of the Thief Lake WMA newsletter distribution list and was also distributed statewide via a DNR news release process. The online questionnaire collected user data and also included draft long-range goals, management objectives, and strategies. Participants were encouraged to provide feedback on the draft language and offer their insight on current management practices at Thief Lake WMA. The questionnaire was available to the public for 3 weeks.

On April 20, 2017, a complete draft of the Thief Lake WMA master plan was distributed internally to DNR staff for review and comments. Received comments were incorporated into the draft, and on May 15, 2017, the updated draft master plan was made available to the public for a 30 day review period. On May 31, 2017, a public open house was held in Thief River Falls. The public was invited to provide comments on the draft master plan through an online form or in person at the public open house.

Table 1. Thief Lake WMA Planning Team Members

Role	Name	Division	Position	Location
Executive Sponsor	Paul Telander	FAW	Wildlife Section Chief	St. Paul
Managing Sponsor	Grant Wilson	FAW	FAW Policy & Planning Supervisor	St. Paul
Managing Sponsor	John Williams	FAW	NW Regional Wildlife Manager	Bemidji
Project Manager	Laurinda Brown	FAW	Thief Lake WMA Planning Consultant	Fergus Falls
Team Member	Joel Huener	FAW	Area Wildlife Manager	Thief Lake
Team Member	Kyle Arola	FAW	Assistant Area Wildlife Manager	Thief Lake
Team Member	Phil Talmage	FAW	Area Fisheries Manager	Baudette
Team Member	Adam Munstenteiger	FOR	Area Forest Supervisor	Warroad
Team Member	Tammy Baden	FAW	Wildlife Lake Specialist	Detroit Lakes
Team Member	Jenny Eastvold	PAT	Area Supervisor	Lake Bronson
Team Member	Cheryl Kelley-Dobie	LAM	Regional Operations Supervisor	Bemidji
Team Member	Mike North	FAW	Forest Wildlife Coordinator	Brainerd
Team Member	Christine Herwig	EWR	Regional Nongame Specialist	Bemidji
Team Member	Becky Marty	EWR	Regional Plant Ecologist	Bemidji
Team Member	Stephanie Klamm	EWR	Area Hydrologist	Thief River Falls

E. Guiding Documents

1. Rules and Statutes

Minnesota Statutes, Chapter 86A Outdoor Recreation System, Section 86A.05 Classification and Purposes defines the purpose of state wildlife management areas to protect those lands and waters that have a high potential for wildlife production and to develop and manage those lands and waters for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreation uses. It also states that wildlife management areas need to be administered in a manner that will perpetuate, and if necessary, reestablish quality wildlife habitat for maximum production of a variety of wildlife species. Public hunting, fishing, trapping, and other uses will be consistent with the limitations of the resource, including the need to preserve an adequate brood stock and prevent long-term habitat injury or excessive wildlife population reduction or increase. Physical development may provide access to the area, but will be developed to minimize intrusion on the natural environment.

Minnesota Statute Section 86A.09 Development and Establishment of Units says that a master plan needs to be developed for any units that have a resident manager. The statute describes the requirements that apply to the development of the master plan.

Minnesota Statute Section 97A.135 Acquisition of Wildlife Lands, Subdivision 1, Public Hunting and Wildlife Areas says that the Commissioner may designate, by written order published in the State Register, land acquired under this subdivision as a wildlife management area for the purposes of the outdoor recreation system.

Minnesota Rule Chapter 6230 Wildlife Management has general and specific rules that apply to wildlife management areas.

Complete text from the above rules can be found in Appendix A.

2. Existing Plans

There are several existing federal, state, and local plans that guide or complement the management objectives and strategies outlined in this plan. A list of these plans can be found in Table 2. Brief summaries of each of these plans can be found in Appendix A.

Table 2. Existing plans used as guiding documents for the development of the Thief Lake WMA master plan.

Plan Name	Plan Year	Plan Owner[1]
American Woodcock Conservation Plan	2008	Multiple
Aspen Parklands Subsection Forest Resource Management Plan	2011	DNR
Audubon Minnesota Blueprints for Bird Conservation	2014	Audubon Minnesota
Beltrami Island Land Utilization Project Comprehensive Conservation Management Plan	2013	DNR/USFWS
Conservation Agenda	2015-2025	DNR
Deer Plan	In Progress	DNR
Deer Population Goal Setting	In Progress	DNR
Executive Order 11990, Protection of Wetlands	1977	Executive Order
FAW Directive No. 070605: Outdoor Recreation Area Unit Administrative Handbook	2010	DNR

Plan Name	Plan Year	Plan Owner[1]
Long-range Duck Recovery Plan	2006	DNR
Managing Minnesota's Shallow Lakes for Waterfowl and Wildlife: Shallow Lakes Program Plan	2010	DNR
Minnesota DNR Chronic Wasting Disease Response Plan	2016	DNR
Minnesota Prairie Conservation Plan	2011	Minnesota Prairie Plan Working Group
Minnesota Wolf Management Plan	2001	DNR
Minnesota's Wildlife Management Area Acquisition	2002	The Citizens' Advisory Committee
Moose Management and Research Plan	2011	DNR
Red Lake Watershed District 10 Year Plan	2006	Red Lake Watershed District
Red River Basin Stream Survey Report, Red Lake River Watershed	2004	DNR
Ruffed Grouse in Minnesota: A Long-Range Plan for Management	2012	DNR
Strategic Management Plan for Elk (Interim)	2016	DNR
Thief Lake Disease Contingency Plan	2008	DNR
Thief Lake Wildlife Management Area Master Plan	1980-1989	DNR
Water Management Plan for Thief Lake (45000100)	2011	DNR
Wetland Conservation Act	1991	BWSR
Working with Partners for Wildlife Conservation: Minnesota's Wildlife Action Plan	2015-2025	DNR

[1]All acronyms used in this plan are listed in Appendix B.

IV. History

A. Area History

The Dakota (Sioux) American Indians were the earliest known inhabitants in northwest Minnesota. By 1770, invading Ojibwe had driven the Dakota from most of the northern timbered region of Minnesota. The Ojibwe were a migratory people, seasonally traveling to different camps. As late as 1890, the Ojibwe still followed a traditional migration pattern in Marshall County (Solum, 1976). One band traveled up the Thief River during the summer, where they trapped muskrats and fished for northern pike, suckers, and bullheads. Another band had an encampment at the present location of the WMA headquarters (Solum, 1976). The land in what is now Marshall County, along with much of northwest Minnesota, was ceded to the United States by treaties with the Red Lake and Pembina bands of Ojibwe in 1863 and 1889 (Dana, Allison, & Cunningham, 1960).

The first Europeans to enter the area were French explorers and trappers during the early 1800s. Fur traders soon moved in to trade with the Ojibwe. The first settlers to the Marshall County area arrived in the early 1870s. Early immigrants, mostly Germans, Irish, and Scandinavians, homesteaded along the Red River and its tributaries (Solum, 1976). Immigration expanded with the completion of a railroad line through the area in 1878, and in less than 10 years, nearly all of the accessible land was homesteaded (Laws Minnesota 1929).

The first settlers in the Thief Lake area homesteaded on the Thief River about one-half mile south of the Thief Lake in 1890 (Solum, 1976). Within several years, most of the land south and west of Thief Lake had been homesteaded. Settlement east of the lake was discouraged by the presence of peat bogs and wet, inferior soils. The land was mostly open, and consisted of large expanses of wetlands and prairie with scattered spruce thickets and aspen groves. The settlers relied in large part on the abundant natural resources in the area for sustenance, including deer, elk, moose, waterfowl, small game, and fish. Settlement continued along the river and spread to the north and south sides of Thief Lake. The first land survey was done in 1891. Thief Lake Township was formed in 1895. By this date, most land near the lake had been homesteaded.

The Ware Store and Post Office, the first in the area, was established in 1893 along the river south of Thief Lake. Roads were primitive and were usually impassable over the large wetland expanses, so supplies for the store were transported by boat along the Red Lake and Thief rivers from the railhead in St. Hilaire. The first sawmill was started in 1893 on the south side of the lake east of the river outlet. Many of the logs were floated down the Moose River and across Thief Lake to the mill. The first school, constructed from logs, was built in 1895 along the river. The Jonstad Post Office, the second in the area, was started in 1898 east of the river outlet. In 1903, the Decoy Post Office was established on the north side of Thief Lake. The railroad was built through Middle River in 1904, which brought the town to life, and eased the burden of daily life for the area residents.

B. Wildlife Management Area History

Prior to 1915, Thief Lake was reported to be an excellent waterfowl area. Visitors described the lake as shallow, with an interspersion of reeds, rushes, and cattails, which provided prime nesting habitat for diving ducks. In 1915, a judicial ditch was constructed through the lake to the Thief River outlet to drain the lake for agricultural purposes; however, drainage was never fully successful and the area was frequently flooded. Few agricultural crops were grown and the lake bed was soon overgrown with emergent vegetation.

Efforts to restore Thief Lake, led by Dr. Paul Hagen of Crookston and local chapters of the Izaak Walton League, began in 1929. Many of the local landowners also expressed interest in reflooding the lake. Legislation passed in 1929 (Laws of Minnesota 1929, Chapter 319) gave the Commissioner of Conservation the authority to initiate proceedings to restore artificially drained lakes and to acquire title to lands affected by such proceedings. In 1930, the Department of Conservation (now the DNR) received approval to restore Thief Lake and establish it as a public hunting ground and game refuge. Condemnation proceedings began in 1930, and by 1931, 14,388 acres of private land and 205 acres of School Trust and tax-forfeited land had been acquired. Further acquisition between 1932 and 1976 brought the total acreage controlled by the Division of Fish and Wildlife to 32,895 acres.

Dam structure at the Thief Lake Outlet, 2007

The 1980 version of the Thief Lake Master Plan includes discussion and strategies for the Thief Lake Supplement, which entailed a significant increase in area for the WMA. With the exception of the acquisition of private parcels, most of what was referred to as the supplement is now part of the WMA. The transfer of control took place in several steps. In 1986, administrative control of the remaining undedicated Consolidated Conservation (hereafter con con lands), School Trust, and Volstead lands in Marshall County was transferred from the DNR's Division of Forestry to the Division of Fish and Wildlife. In 1991, Commissioner Joe Alexander signed over the con con lands in several counties as Wildlife Management Areas, which included 9332 acres appended to Thief Lake WMA. Since that time, contiguous School Trust lands have been managed as part of the WMA (and their acreage tallied in the total), with the caveat that any income generated on the School Trust lands went to the School Trust rather than the counties or Game and Fish Fund. In 1999, the Minnesota Legislature decided to re-visit the status of lands dedicated in the 1991 Commissioner's Order, and in 2002 formally dedicated these lands as Wildlife Management Areas. These actions brought the WMA to its current size of 54,957 acres.

Construction of a dam on the Thief River Outlet was initiated in 1930 under the Works Progress Administration. The dam was completed in 1931, but the lake remained dry for five years due to drought conditions. Eventually, heavy rains during 1937 restored the lake to its former level. Modifications to the dam took place in 1938, 1954, and 1968. In-depth analysis of the dam structure in 2012 showed that significant repairs to the dam were in order, and the 2014 legislature set aside money for these repairs, which are to occur in the summer of 2017. The Haraldson dam, located two miles up the Moose River from Thief Lake, was constructed as a Civilian Conservation Corps (CCC) project in 1937, but has never been operational.

Coffer dam for construction of Haraldson dam, 1937

The federal government authorized extensive relief work projects in the area during the 1930s. A U.S. Biological Survey CCC camp operated on Thief Lake WMA during the 1930s and constructed roads, firebreaks, bridges, dikes, telephone lines, buildings, and fences on the area. Additional CCC projects included food and cover plantings for wildlife, wildlife surveys, and the construction of waterfowl potholes (Minnesota Conservation Department, 1933).

Refuges and sanctuaries have always been a part of the management area. In 1937, an order by the Minnesota Commissioner of Conservation established a 3280 acre game refuge that included the northwest portion of Thief Lake. In 1962, 760 acres were added to the refuge. The refuge has been modified several times since 1962 and currently encompasses 5500 acres.

C. Archaeological Aspects

When Euro-Americans first arrived in the Thief Lake area, they reported that American Indians were encamped along the shores of the lake. It is probable that plentiful game within and around the lake basin—future state Commissioner of Conservation E.V. Willard described Thief Lake as "swarming with wildlife" after a 1908 visit (Farmes, 1960)—attracted indigenous hunters to the area from time immemorial. American Indian spear points and other artifacts found just outside the management area date to at least 8,000 years ago.

Spear point artifact recovered on private property just north of Thief Lake

Despite archaeological and documentary evidence of American Indians subsisting in the area for several millennia, no archaeological sites have been recorded on lands currently managed as the Thief Lake WMA (Johnson, 1977). However, the management area has not been the subject of a systematic archaeological survey. It is very probable that archaeological evidence of ancient encampments and hunting sites persist near the shores of the lake, as well as along the crests of the nearby beaches of glacial Lake Agassiz, which would no doubt have served as travel routes.

D. Historic Sites

The Marshall County Historical Society and the Minnesota Historical Society were asked to identify historic buildings and other constructions in the Thief Lake WMA. These inquiries revealed that there are no known historic structures within the WMA that might need special management considerations. However, many of the buildings and facilities at Thief Lake WMA were originally constructed by the CCC crew, and every effort will be made to retain the original character of these facilities. Furthermore, the removal or renovation of any structures more than fifty years old must be done in consultation with the State Historic Preservation Office. The historic significance of the 1931 Thief Lake Dam was assessed in 2015, in advance of proposed modifications; the review concluded that the dam's historic integrity had been compromised by decades of improvements and alterations.

V. Existing Conditions

A. Land Ownership

Land ownership and policies bear strongly on natural resource management. The management goals and designation type are affected by the project acquisition history, present land ownership patterns, the sources of acquisition funds, and state and county policies. There are four land type designations making up Thief Lake Wildlife Management Area: Acquired, Consolidated Conservation, School Trust, and Volstead. The acreage of each of these land type designations within Thief Lake WMA can be found in Table 3. Each designation type carries different implications and are further defined in Appendix C.

1. Acquisition of Wildlife Lands

The Commissioner of Natural Resources is authorized to acquire lands for wildlife management purposes (Minnesota Statutes 1978, Secs. 97.48 and 97.481). However, before acquisition begins, the Section of Wildlife prepares project proposals that identify areas desirable for wildlife land acquisition. The Director of the Division of Fish and Wildlife has the authority to approve project proposals for the Commissioner of Natural Resources. After approval of the project proposal, the Division of Fish and Wildlife may attempt to acquire lands within the project boundary from willing sellers. The division must also obtain approval from the appropriate county board before any purchase may be completed. Newly acquired lands are required to be designated by the Commissioner by written order published in the State Register.

Acquisition of wildlife lands has been financed primarily through appropriations from the Game and Fish Fund. For some of this land, federal matching funds derived from the Pittman-Robertson Wildlife Restoration Act were used. Since the mid-1960's, significant appropriations for wildlife land acquisition have also been made by the Minnesota Legislature from bonding funds, through the Environment and Natural Resources Trust Fund, as recommended by Legislative-Citizen Commission on Minnesota Resources (LCCMR), and the Outdoor Heritage Fund, as recommended by the Lessard-Sams Outdoor Heritage Council (LSOHC).

Federal regulation 50 CFR Part 80.134 states that real property acquired or constructed with Pittman-Robertson funds must continue to serve the purpose for which acquired or constructed. Lands acquired with Game and Fish funds must be used for the purposes for which they were acquired. Other uses of these lands could be considered a misuse of funds and could cause the federal government to suspend all Pittman-Robertson funds to wildlife projects in the state, which totals about $23,000,000 annually in recent years. Generally, the approved project activities for Thief Lake WMA are the operation of a wildlife sanctuary and public hunting ground and the improvement of wildlife habitats.

The Commissioner of Natural Resources may dedicate con con lands to wildlife management areas and transfer administrative control of these lands to the Division of Fish and Wildlife (Minnesota Statutes 1978, Sec. 97.481). Dedicated con con lands are protected from sale.

2. Acquisition and Transfer of Authority for Management of the Present WMA

Land acquisition for the Thief Lake WMA began in 1931 when 14,593 acres of private, School Trust, and tax-forfeited lands were condemned and purchased by the state for the restoration of Thief Lake. About 3571 acres of private and four acres of federal land were added between 1932 and 1970. In 1966, 1884 acres of School Trust lands were purchased. Over $164,000 has been spent on land acquisition in the Thief Lake WMA by the Division of Fish and Wildlife. Approximately 5 percent of the land was purchased through Pittman-Robertson projects. Approximately 40 percent of the land was purchased solely with Game and Fish Fund monies. The remainder of the land consists of Consolidated Conservation, School Trust, and Volstead lands dedicated at no cost to the DNR.

In 1960, 12,528 acres of con con lands were formally dedicated to the WMA by the Commissioner of Natural Resources; an additional 400 acres were dedicated between 1962 and 1980. In January of 1991, the Commissioner ordered 9312 acres of con con land be dedicated to the WMA. On January 3, 1999 the Commissioner designated all remaining con con lands, including an additional 120 acres on Thief Lake WMA, as Wildlife Management Areas in Beltrami, Marshall, and Roseau counties. That order was suspended on January 27, 1999 by the new Acting Commissioner. Public comments and recommendations pertaining to the appropriate management designations for these lands were accepted. In 2002, legislation was passed and on January 1, 2003 the con con acres were added to the WMAs.

In 1985 the Commissioner of Natural Resources transferred the administrative authority of 104,800 acres of land in Northwest Minnesota from the DNR Division of Forestry to the Division of Fish and Wildlife. This included the transfer of 12,478 acres of School Trust and 196 acres of Volstead lands to Thief Lake WMA. This transfer meant that Section of Wildlife became the land administrator for all state land use west of Roseau County Highway 9/Marshall County Highway 54.

School Trust Lands bring with them the responsibility to manage the lands with sound natural resource and conservation management principles, while providing ongoing income to the School Trust Fund. School Trust lands within Thief Lake WMA have undergone an inventory to determine the best way to meet this fiduciary responsibility. Lands having potential for revenue generation are currently providing income; agricultural lands are leased to cooperating farmers with the income generated going to the School Trust Fund. Timbered lands are managed for production of fiber and harvest opportunities are auctioned off by the Division of Forestry. In many cases, School Trust lands are held for the potential for future mineral extraction, with management of the surface under Wildlife control until that time. Other School Trust lands have limitations for revenue generation by traditional means of farming or timber harvest where cover types are predominantly wetland.

Table 3. Ownership classification at Thief Lake WMA.

Ownership Classification	Estimated Acres	Estimated Percentage
Consolidated Conservation	22,235	40%
Acquired	20,048	36%
School Trust	12,478	23%
Volstead	196	<1%
TOTAL	54,957	

B. Area Description

1. Landscape Context

Thief Lake WMA lies within the Tallgrass Aspen Parklands Province in an area that is transitional in nature between the heavily forested areas to the east, and the open prairie to the west. The gradient of an increasingly open landscape runs from east to west, and within the WMA itself we see a shift from extensive areas of aspen forest interspersed with brushlands to the east (Thief Lake Peatlands Land Type Association, or LTA – see Appendix D) grading to interspersed beach ridges to the west (Dohrman Ridge LTA), with subtle but distinct beach ridges topped by bur oak and aspen interspersed with fens and brushlands. Oak savannas and woodlands along with restored prairies are found on these ridges. In the center of the WMA lies Thief Lake itself, a natural basin that was drained between 1914 and 1916 and restored in the 1930s. The entire area is very flat, lying on the floor of glacial Lake Agassiz. Anthropogenic drainage and drainage artifacts are dominant features on the landscape. An examination of recent aerial imagery of the Thief Lake area shows very few open water wetlands or lakes, which heightens Thief Lake's unique nature and importance in the area.

The area has undergone massive drainage projects to improve agricultural productivity in the years following initial European settlement. Drainage features are immediately apparent in any examination of waterways in this portion of the state. Drainage from the time of European settlement to present day has resulted in the loss of most wetlands in the area. As of 1980, Marshall County had lost approximately 81% of its original wetlands (Anderson & Craig, 1984). Most rivers and streams have been channelized or re-routed. The Thief River downstream of the dam on the west end of Thief Lake to its confluence with the Red Lake River is known as State Ditch 83, while the waterway upstream of the dam is known as Judicial Ditch 21, or the Moose River. Flood damage reduction (FDR) projects have resulted in the development of multiple purpose impoundments on state land in surrounding WMAs. The water management plans for these impoundments include both flood damage reduction goals and natural resource enhancements.

Northwest Minnesota is fortunate to have an abundance of public lands. A number of these managed areas lie in close proximity to Thief Lake WMA. See Figure 2 for map of public lands in the vicinity of Thief Lake WMA. A table of all public lands within 30 miles of the Thief Lake WMA headquarters can be found in Appendix E.

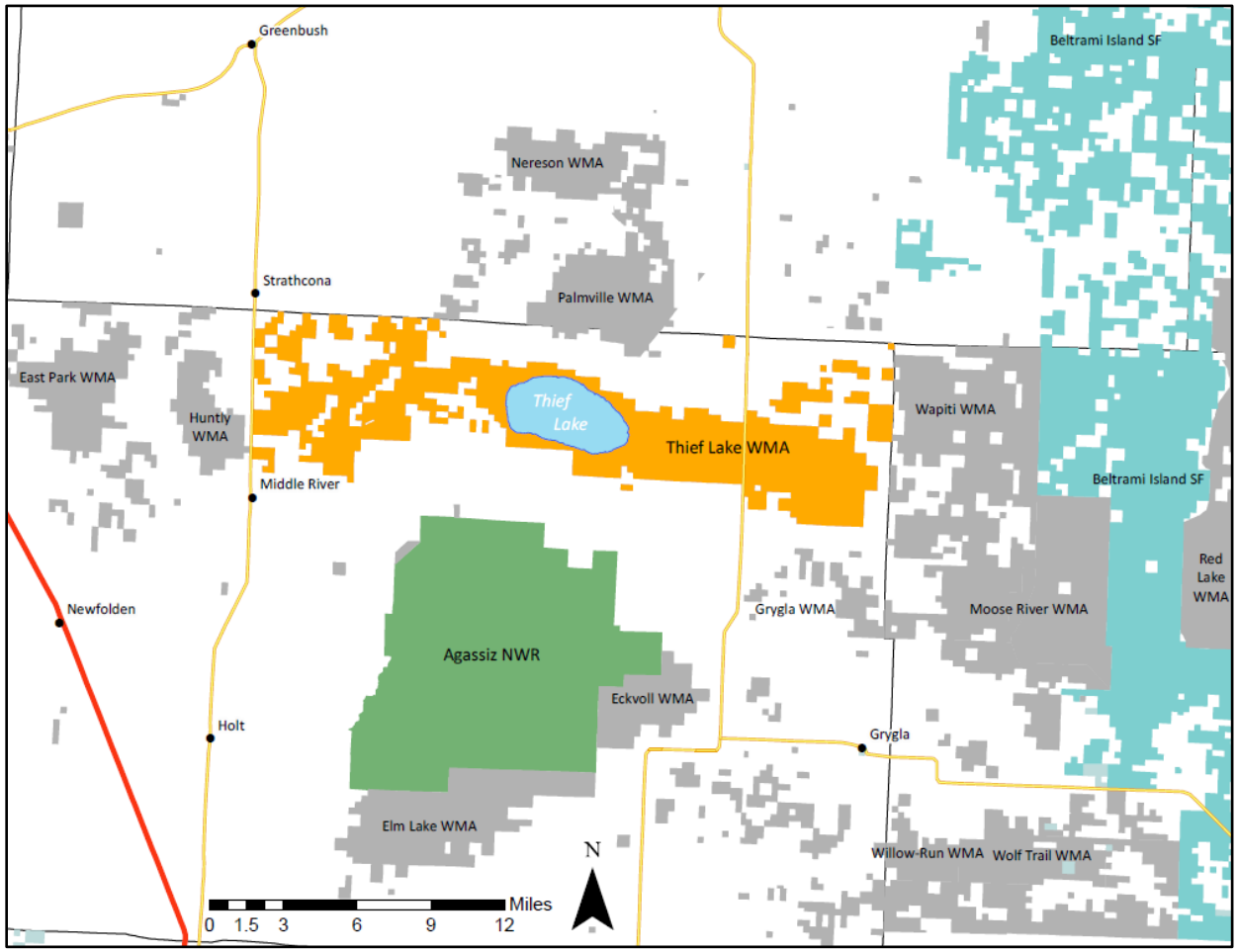


Figure 2. Public lands in the vicinity of Thief Lake WMA

The beach ridges on the western portion of the unit are underlain in areas with sand and gravel deposits. Gravel is always in demand for road projects and maintenance. There have been gravel leases on School Trust portions of the unit in the past, but none are currently in effect. Gravel deposits typically lie beneath drier portions of the area, often with bur oak woodland, savanna, and prairie at the surface. Consideration of future gravel development will need to include detailed reclamation plans.

Northwest Minnesota is the only place where the Tallgrass Aspen Parklands Province occurs within the United States. Large tracts of public land provide habitat for rare features in this unique landscape. This importance has been recognized in a number of planning initiatives including Audubon Minnesota's Important Bird Areas (IBA), the Minnesota Prairie Conservation Plan, and Minnesota's Wildlife Action Plan (MNWAP). IBAs are a conservation tool to identify habitat that should be protected for birds. Each IBA represents a place that supports species of

conservation concern (e.g., threatened and endangered species), range-restricted species (e.g., those species limited spatially), species found in only one habitat type or biome, or species or groups of species (e.g., waterfowl or shorebirds) that are vulnerable because they congregate in large numbers (Audubon, 2017). Thief Lake IBA encompasses an extensive area of aspen parkland landscape in Roseau and Marshall counties. Thief Lake provides very important habitat for waterfowl and other wetland birds, particularly colonial waterbirds.

The Minnesota Prairie Conservation Plan is an effort to accelerate conservation in the prairie region of the state by identifying core areas with high concentration of native prairie, other grasslands, wetlands, and shallow lakes as well as other prairie habitat complexes and corridors to connect these core areas. The west end of Thief Lake WMA falls within one of these core areas and provides a prairie habitat complex. Minnesota's State Wildlife Action Plan identifies this area has having medium-high to high quality habitats and species presence in the Wildlife Action Network, which indicates that this area provides important habitats for Species of Greatest Conservation Need (SGCN).

2. Socioeconomic Context

Thief Lake WMA lies in one of the more sparsely populated areas of Minnesota, and populations have declined in recent decades. The WMA covers parts of nine townships in northeast Marshall County: Huntly, Como, Thief Lake, Moose River, Linsell, Veldt, Rollis, Cedar, and Spruce Valley (Marshall County, 2017). The towns of Middle River and Strathcona abut the southwest and northwest corners of the management unit. The nearest towns exceeding 1000 people are Thief River Falls, population 8573 (35 miles to the southwest, as measured from headquarters), and Roseau, population 2663 (35 miles to the north). Large employers in the area include agriculture (although an increasing proportion of people have this as their second job), two large All-Terrain Vehicle (ATV)/snowmobile manufacturers (Polaris in Roseau and Arctic Cat in Thief River Falls) and Digi-Key (an electronic components firm) in Thief River Falls.

An examination of aerial imagery of the WMA and its vicinities shows that the lands of the WMA lie in a mosaic dominated by agriculture. Agriculture in this area has historically been dominated by small grains (wheat, barley, oats and flax), but has shifted as a result of an increase in growing season length, and as new crops, varieties, and technologies have become available. At the time of the 1980 plan, small grains dominated, but sunflowers had become much more important. Some sunflowers are still grown (as is canola, which became popular in 2000), but the current trend is toward soybeans. By 2012, more acres of soybeans were grown in Marshall County than wheat (United States Department of Agriculture, 2017). While still a minor contributor, corn acreage has also increased noticeably in recent years and is third only to soybeans and wheat in the eastern portion of the county.

Total acres in tillage have declined since the time of the 1980 plan, with significant acres enrolled in the Conservation Reserve Program (CRP) (United States Department of Agriculture, 2012). While total acres enrolled in CRP have declined in recent years, the program is still a dominant land use in the area and provides valuable habitat for local wildlife; however, in Marshall County alone, an estimated 93,778 CRP contract acres are set to expire by 2027

(United States Department of Agriculture, 2017). Private hunting land has also become more prevalent in the area, and in some cases hunting land now exceeds tillable land in cost per acre.

Timber demand and harvest at the time of the 1980 plan was negligible – there was some small local demand for fuelwood, which was accommodated by area WMAs. Timber markets and demand expanded dramatically in the 1990s (particularly for aspen) but has since shown some variability. Commercial timber harvest is now the dominant tool in the management of forests on the WMA. Because of the distance to market, timber demand and stumpage prices are very sensitive to the market dynamics of the forest products industry.

Outdoor recreation is an important emphasis locally. Hunting, trapping, and wildlife viewing on Thief Lake and the variety of surrounding managed areas attract a lot of users to the area. Waterfowl hunters on Thief Lake have periodically been asked for their home county during bag checks, and the results show that residents of the 7-county Metro area are most commonly represented, followed by Northeast Minnesota (unpublished data). This information indicates that users are willing to travel some distance to experience the recreational opportunities offered at Thief Lake WMA. In recent years, there has been a strong market for private hunting land, with proximity to WMA lands as a selling point. Most local residential development at this time consists of hunting cabins and camps.

3. Climate

The Thief Lake WMA vicinity has short, mild summers and long, cold winters. The average temperature for July is 66.6°F and for January is 3.0°F. Winter temperatures of -30°F are common. The average growing season is about 120 days. Killing frosts are expected from September 15 through May 28 (Roseau Climate, 2017). Low-lying areas may experience frost throughout the summer.

Average yearly precipitation is 23.54 inches (Table 4), ranging from 0.57 in February to 3.92 inches in June (Thief Lake Data, 1954-2016). About 16.1 inches, or 69 percent of the annual total, occurs from May through September. Although northwest Minnesota is one of the drier regions in the state, and severe droughts occur every six to eight years, it also experiences periods of extreme wetness with localized flooding. The last drought occurred in 2012. Average yearly snowfall is 40 inches, and snow cover is one inch or greater for about 93 days per year. Prevailing winds are northwest during winter, changing to the south and southwest during the spring and summer. Figure 3 shows precipitation and mean annual temperature trends at Thief Lake WMA over the past 60 years.

Table 4. Temperature, precipitation, and snowfall for the Thief Lake WMA vicinity.

Month	Average low temperature (°F)[1]	Average high temperature (°F)[1]	Average precipitation (inches)[2]	Average snowfall (inches)[1]
January	-4	16	0.83	8
February	1	23	0.57	5
March	15	36	1.04	6
April	31	55	1.74	3
May	44	69	2.82	0
June	54	77	3.92	0
July	58	81	3.69	0
August	56	80	2.99	0
September	46	70	2.71	0
October	33	55	1.79	2
November	18	35	1.18	8
December	2	20	0.84	8
MEAN	29.5	51.4		
TOTAL			23.54	40

1 US Climate Data Website

2 Thief Lake Data

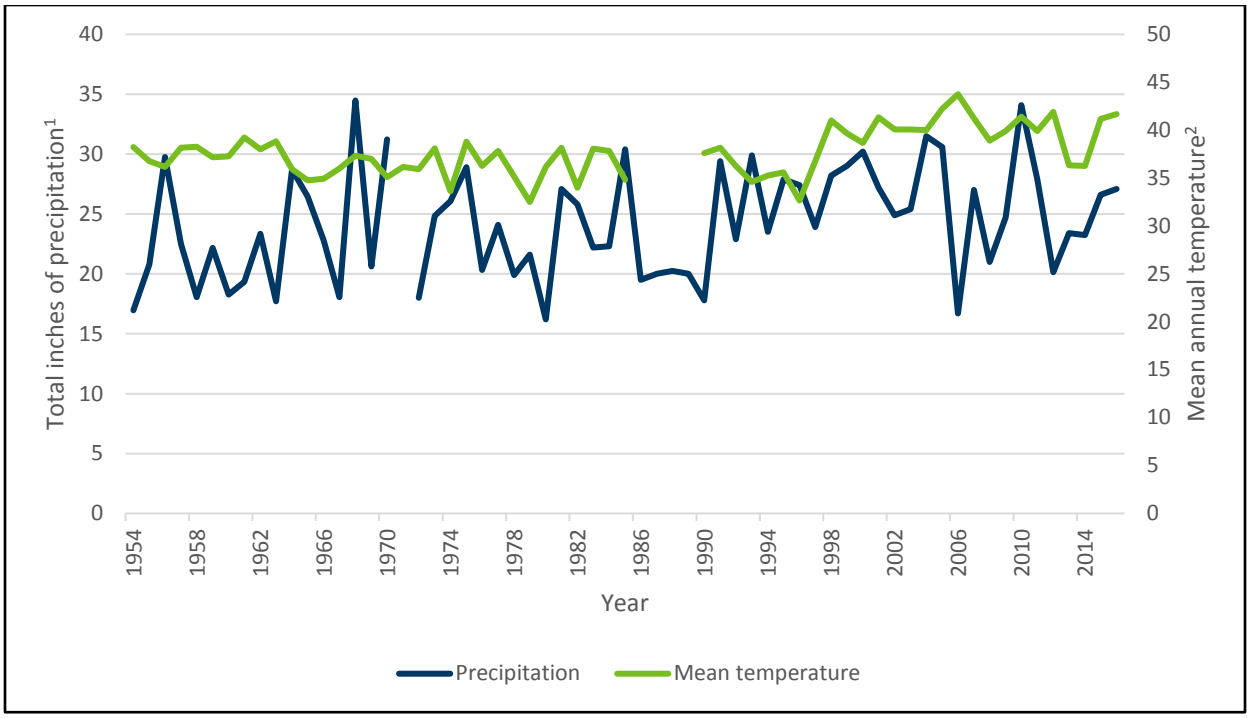


Figure 3. Total annual precipitation and mean annual temperature at Thief Lake WMA

[1]Thief Lake Data

[2] Roseau Data from Weather Underground

4. Geology

Precambrian bedrock underlies the management area. Granites, greenstones, slates, and older metavolcanic rocks predominate (Minnesota Conservation Department, 1959). Cretaceous shale, sandstone, and sand deposits of varying thickness overlie the crystalline bedrock (Bidwell, Winter, & Maclay, 1970). The present soils and topographic features of the area are a result of three geological stages: (1) Pleistocene glaciation, (2) glacial Lake Agassiz and, (3) postglaciation. Glaciers covered the area several times during the Pleistocene epoch, but present landforms and surface deposits are the result of the most recent (Wisconsin) glaciation, approximately 50,000-10,000 years ago. Approximately 200-300 feet of unconsolidated glacial drift consisting of silt, sand, clay, gravel, and boulders was deposited over the bedrock surface (Bidwell, Winter, & Maclay, 1970).

As the glacial ice sheets retreated late during the Wisconsin stage (approximately 12,000 years ago) meltwaters impounded behind a major drainage divide crossing northern South Dakota and south-central Minnesota, forming glacial Lake Agassiz (Elson, 1967). During its maximum extent, Lake Agassiz covered over 200,000 square miles in parts of North Dakota, South Dakota, Minnesota, Saskatchewan, Manitoba, and Ontario (Arndt, 1977). Calcareous, lacustrine clay, water-sorted sand and gravel, and lake-modified till were deposited over the area (Heinselman, 1963). As new discharge outlets eroded and the ice margin alternately retreated and advanced, the lake level fluctuated. Ridges of sand and gravel, some with boulders, marked the former shorelines of the lake. Locally, one group of beach ridges extends from the northeast corner of

Marshall County, southwesterly past Thief Lake (Dohrman Ridge), to the southern county border (Allison, 1932). Another remnant beach, the Randen Ridge, lies along the northeast boundary of the management area.

Final drainage of Lake Agassiz occurred around 7300 years ago, leaving the area as a level, nearly featureless plain, interrupted by intermittent remnant beach ridges (Minnesota Conservation Department, 1959). Remnants of Lake Agassiz within Minnesota include the Red Lakes in Beltrami County, Thief Lake and Mud Lake (now Agassiz National Wildlife Refuge) in Marshall County, and Rainy Lake and Lake of the Woods on the Canadian Border (Wright, 1972).

5. Soils

Soil development in the Thief Lake vicinity was influenced by parent materials, topography, climate, and vegetation. Underlying parent materials consist of unconsolidated lacustrine deposits of silts, clays, and sands plus lake-modified till.

The majority of the Thief Lake WMA is covered by organic soils belonging to the Seelyeville-Markey-Cathro association, which formed in deposits of herbaceous materials on low-lying, relatively flat, and poorly drained areas (Figure 4). The surface layers vary from very dark brown to black mucky peats or mucky sandy loams from 4 to more than 60 inches thick underlain by loamy till, sandy loams, or fine sand (United States Department of Agriculture, 1977). Most of these soils are not well suited to agriculture.

Mineral soils on the management area occur on better drained sites (Figure 4) and belong to six major soil associations. The Syrene-Sioux-Lohnes-Arvilla and Marquette-Karlstad associations occur on or adjacent to remnant beach ridges with 1 to 8% slopes and are found along the Randen and Dohrman Ridges on the WMA. Surface layers are composed of black loams or sandy loams ranging in depths from 0 to 10 inches and are underlain by sands and coarse gravelly sands. The Vallers-Rollis-Hamerly and Ulen-Rosewood-Flaming associations formed under prairie vegetation. These soils have black loam, sandy loam, or loamy fine sand surface layers about 10-12 inches thick underlain by clay loams, loamy sands, or gravelly sandy loams. The Smiley-Rockwell-Kratka association is characterized by black sandy clay loams or fine sandy loams over loamy sands or fine sands. The Smiley-Reiner association formed under deciduous forests. These soils have dark brown to gray fine sands over yellowish-brown fine sands. Portions of all of these associations are in cropland, but low fertility, wind erosion, and wetness are limitations for agriculture (United States Department of Agriculture, 1977). Even in the more productive soils, excess water may be a problem.

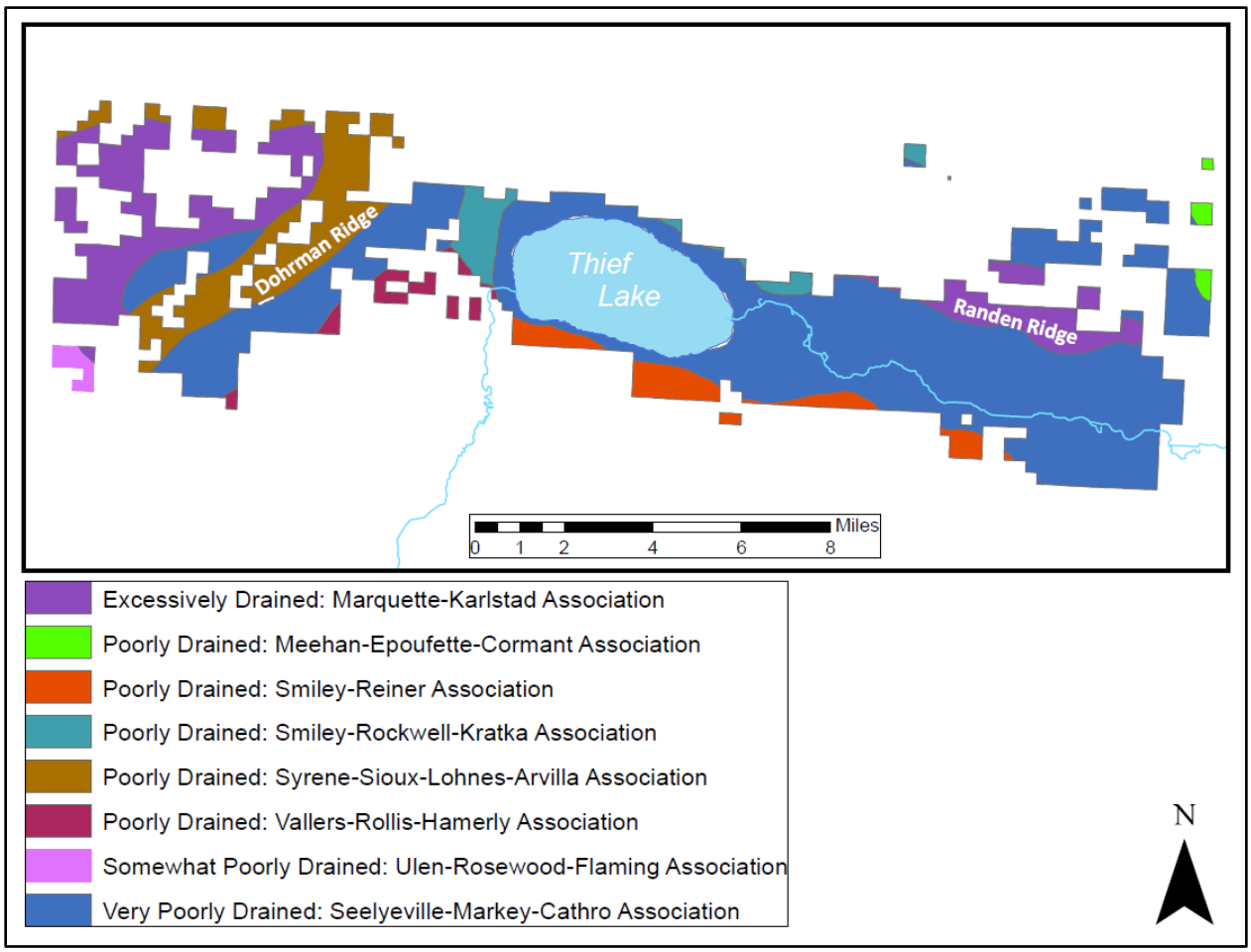


Figure 4. Thief Lake WMA soils

6. Underground Hydrology

Impermeable bedrock forms the base of the groundwater reservoir. The primary source of groundwater is from sand and gravel beach ridges and from aquifers in glacial deposits. Local groundwater flow is from recharge areas in the permeable morainic deposits and beach ridges to discharge areas in adjacent lowlands, where it is dissipated by evapotranspiration or runoff. The regional water flow generally moves westward toward the Red River lowland (Bidwell, Winter, & Maclay, 1970).

Well depths and water-yielding capabilities vary, depending on the type, capacity, and depth of the groundwater source. In the WMA vicinity, water yields adequate for domestic and livestock uses can generally be obtained from wells less than 50 feet deep on most upland sites. Wells drilled in glacial till commonly yield less than 10 gallons per minute (gpm). Yields of more than 20 gpm can usually be obtained from wells located in larger beach ridge aquifers (Bidwell, Winter, & Maclay, 1970). In the bog areas, the water table generally remains at or near the surface.

Annual groundwater recharge is primarily from precipitation and snowmelt, and usually equals the groundwater losses. Approximately 88 percent (19.4 inches) of the annual precipitation is

dissipated through evapotranspiration, mostly from lakes and lowland bog areas; 12 percent (2.6 inches) is lost through runoff (Bidwell, Winter, & Maclay, 1970). Areas underlain with lacustrine clay deposits are relatively impermeable, allowing only limited groundwater recharge (Minnesota Conservation Department, 1959). As a result, the water table is normally high and peat bogs have formed on many of these areas.

Groundwater quality varies widely, depending on the distance of movement, physical and chemical characteristics of the water-bearing materials, and the contact time with these materials. In the WMA vicinity, most groundwater within the upper 50 feet of the surface is of the calcium magnesium bicarbonate type, high in total hardness. Sodium bicarbonate water occurs at depths generally greater than 100 feet and is associated with clayey Cretaceous sediments (Bidwell, Winter, & Maclay, 1970). Groundwater is suitable for domestic and livestock uses in most places. In the WMA vicinity, groundwater hardness is between 200 and 300 parts per million (ppm) and dissolved solids content is about 200 ppm (Bidwell, Winter, & Maclay, 1970). Levels of iron and nitrate may exceed Minnesota Pollution Control Agency (1972) limits for domestic consumption. Groundwater becomes increasingly mineralized in western Marshall County and levels of sulfate and total dissolved solids may exceed recommended domestic consumption levels.

7. Surface Hydrology

Portions of Thief Lake WMA occur in four different watersheds: Thief River, Snake River, Tamarac River, and Roseau River (Figure 5). The majority of the WMA lies within the Thief River watershed (37,414 acres or 68%), while the Snake River (6664 acres or 12%), Tamarac River (9889 acres or 18%), and Roseau River (989 acres or 2%) watersheds cover lesser proportions. Drainage in the Thief River watershed is toward the Moose and Thief Rivers, and is generally flowing west and then south. Drainage in the Snake, Tamarac, and Two Rivers watersheds is generally to the west, and drainage in the Roseau River watershed is generally to the northeast.

The total drainage area of Thief Lake is 174 square miles. The Moose River flows into the east end of Thief Lake and drains approximately 150 of these 174 square miles, much of which is lowland peat bog. The lower portions have been dredged, widened, and straightened, resulting in a channel that is on average 50 feet in width and eight feet in depth. The Thief River outlets from the west end of Thief Lake and flows southwesterly to Thief River Falls, where it joins the Red Lake River and an artificial reservoir has been constructed. The upper reaches of the river average 40 feet in width and six feet in depth (Minnesota Conservation Department, 1959).

In 1982, work was initiated on the Moose River Project, a cooperative project with the Red Lake Watershed District (RLWD) that developed two impoundments. The project was completed in 1988. The South Pool impoundment captures the headwaters of the Mud River that flows downstream into Agassiz National Wildlife Refuge (NWR), while the North Pool impoundment is built on the headwaters of the Moose River, which is the primary water source for Thief Lake. Incoming flows are pooled and water delivery downstream is regulated to provide flood storage and minimize bounce from precipitation events. Summer and winter target level ranges are set forth in the operating plan and are set annually in February at a meeting between the Minnesota DNR, Agassiz NWR and the RLWD.

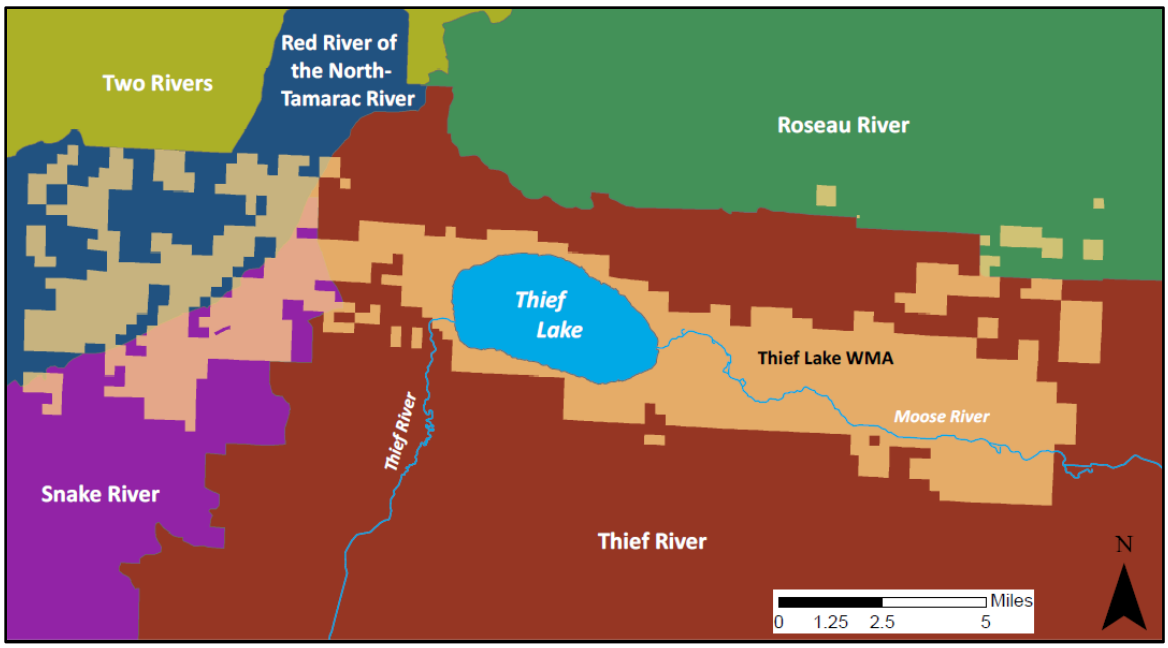


Figure 5. Watersheds surrounding Thief Lake WMA

Thief Lake (7140 acres) is entirely within the management area boundary and is approximately five miles long and three miles wide with a regular, or relatively straight, shoreline. It has a maximum and average depth of 4.5 and 3.2 feet, respectively (Minnesota Conservation Department, 1964). Approximately 45 percent of the lake surface is covered by standing emergent vegetation in large clumps or islands. The lake bottom is mostly firm clay often covered by a layer of muck (Minnesota Conservation Department, 1964).

The entire lake is navigable by motorboat or canoe. A number of ditches drain into the lake. Frequent flooding of surrounding lowland areas occurs following spring snowmelt. The lake level is controlled by a 60 foot, 10-bay, concrete dam located one-third of a mile west of the lake on the Thief River. The dam was constructed in 1931 with a crest elevation of 1160 feet above sea level. Additional control to 1163 feet was provided by the use of stop-logs. Renovation of the dam in 1938 lowered the crest by 18 inches to 1158.5 feet, providing more water control. In 1951, the stop-logs were removed and water levels were lowered to improve waterfowl habitat. In 1968, sliding gates with a sill elevation of 1155.5 feet were installed in the center two 10.5 foot bays. A major renovation of the dam is scheduled for the summer of 2017. The revised dam will retain the two central screw gates and central sill level (1155.5' above mean sea level, or MSL), but will decrease the number of stop-log bays from 8 to 6, and the sill in the stop-log bays will be 1157.5' above MSL. Target level for the fall will still be 1158.5', but winter partial drawdowns can be accommodated through stop-log manipulation rather than screw gates, which is safer and easier during frozen conditions.

The resident manager monitors lake levels from gauges at the dam. Since 1941, annual high water levels have ranged from 1157.8 feet in 2012 to 1164.5 feet in 1948. The target level for the lake during the open water season is 1158.5 feet unless deliberately drawn down for management purposes. At lake levels between 1157 and 1163 feet, flood storage capacity is

about 50,000 acre feet. The lake level is gradually drawn down in the fall and winter to an elevation of 1157 to 1157.5 feet by April 1.

Numerous wildlife lake habitat surveys have been completed on Thief Lake. Survey methods used between 1938 and 1964 were variable, but from 2004 to the present, surveys have consisted of visiting point-intercept stations distributed over the lake to document aquatic plant distribution, water depth, and clarity. Water chemistry analysis has been conducted in conjunction with most surveys. The goals of the surveys are to assess current habitat conditions, define spatial and temporal habitat trends, and assess management effectiveness. A summary of survey data is provided in Table 5.

Table 5. Wildlife lake survey data for Thief Lake WMA.

Year	Mean Depth (ft)	Mean Secchi (ft)	Total Phosphorus (ppm)	pH	Dissolved Solids (ppm)	Alkalinity (ppm)	Sulfate (ppm)	Percent of Plots Vegetated	Vegetation Species Richness
1938				7.7	784.2	260	154.7		
1949	3.5	0.9				130	133		
1955	3	1.5							
1956	3.5	2				160	140		
1964	3.2	2.0							
2004	3.6	1.7	0.046	9.1	292	149		98%	18
2007	3.4	2.1	0.048	8.6	300	153		88%	20
2010	3.3	3.2	0.016	8.8	324	170		97%	23
2016	3	3	0.022				26	99%	23

During the 1980s, a number of small wetland impoundments were constructed around the lake. Some are managed as semi-permanent wetlands (Mound, Little Thief, Angle East and Dewitt) while others are managed as Moist Soils Units (Stockpile, Northwest Feeding Site, Spillway, Angle and Headquarters South). All the units have water control capability, and the Moist Soils Units (MSUs) are manipulated seasonally. Water levels are typically checked weekly, and dikes and control structures need periodic mowing and maintenance. Filling of MSUs is typically done with a Crisafulli® pump and power unit (on site), and pumping any given unit typically takes several days.

Other than Thief Lake, permanent water bodies on the management area include wetlands on the west and north sides of the lake, peat burnouts, beaver impoundments, and scattered, natural and excavated potholes. Open water acreages fluctuate annually, depending on precipitation levels and beaver activity.

C. Habitats and Plant Communities

1. Introduction

Thief Lake WMA is a diverse site with many native plant communities (NPCs). In this document, habitat types are divided in 5 general categories: Lakes, Wetlands, and Waterways; Forests; Brushlands; Prairies and Grasslands; and Agricultural Lands (Figure 6). Native plant communities are grouped under these habitat types based on dominant vegetative characteristics. As a result, forested wetlands are listed as forest habitats, and lowland shrubs are listed as brushland, even though they are also wetlands. Table 6 shows the relative percentage of each habitat type found at Thief Lake WMA. The wetlands shown in this table are a combination of open water, marsh and emergent wetlands.

Table 6. Relative percentage of habitat types found at Thief Lake WMA.*

Habitat Types	Acres	Percentage
Lakes and Wetlands	13,761	25.2%
Forests	21,330	39.0%
Brushlands	15,928	29.1%
Prairies and Grasslands	2370	4.3%
Agricultural Lands	1276	2.3%

*Total acres does not include headquarters complex or roads

Some of the plant communities found at Thief Lake WMA are very high quality and are uncommon for this area, for Minnesota, and even on a global scale. The uncommon state and globally ranked plant communities can be found in Table 7. Rare plants found at Thief Lake WMA are listed in Table 8. Detailed information on rare plant species can be found in the DNR Rare Species Guide.

There are two types of ranks frequently discussed and addressed in native plant community management. These are the Conservation Status Ranks (state ranks referred to as S-ranks, and global ranks referred to as G-ranks) and the Condition Ranks. More information on Conservation Status Ranks can be found in Table 9.

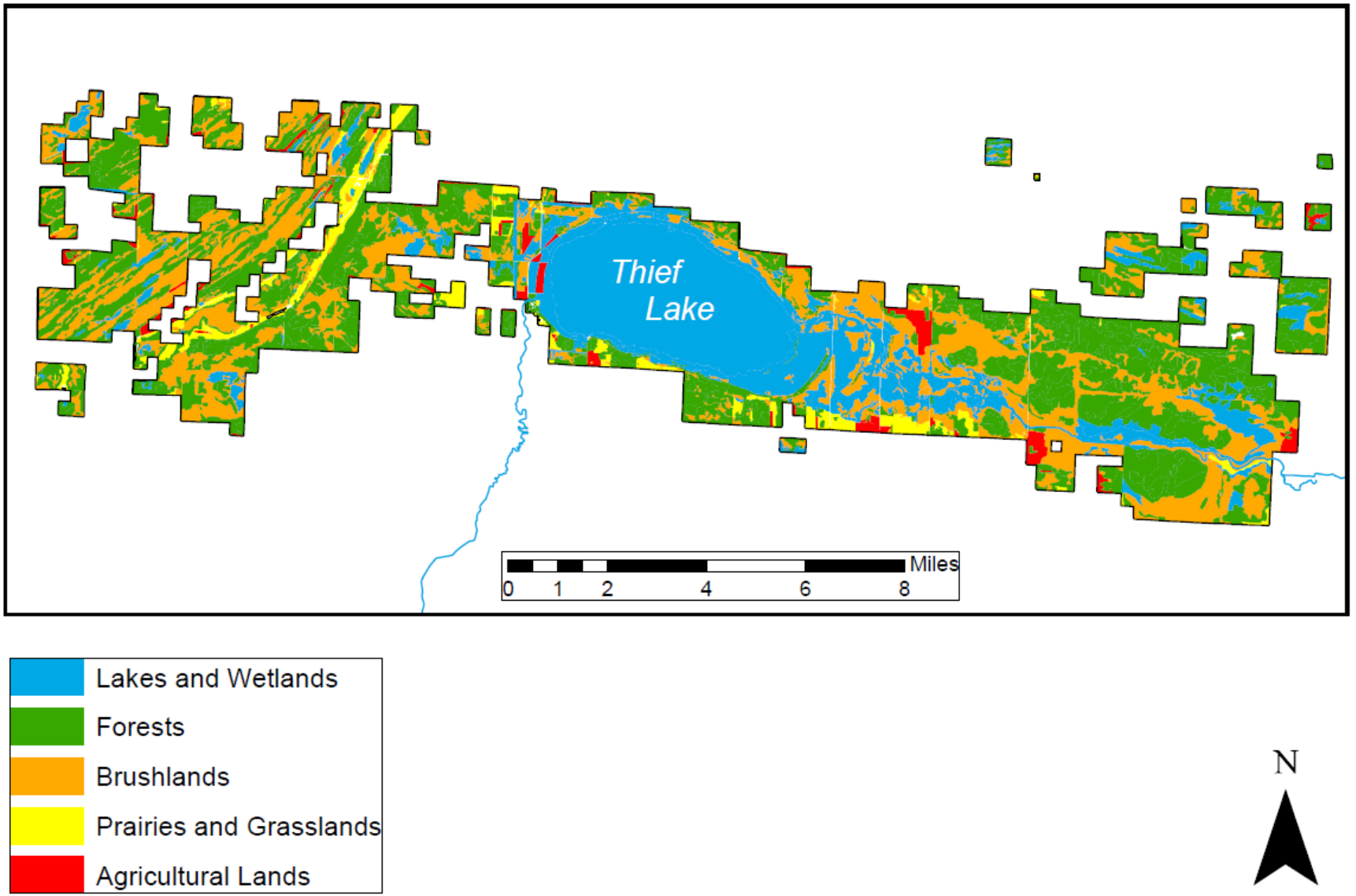


Figure 6. Overview of general habitat types found at Thief Lake WMA

Table 7. Rare native plant communities known to occur at Thief Lake WMA.

NPC	Description	Status Rank	Condition Rank
FDw24a	Bur Oak- (Prairie Herb) Woodland	S2	Undocumented
FPw63a	Tamarack-Black Spruce Swamp	S3	Undocumented
UPn12b	Dry Sand - Gravel Prairie (Northern)	S2	Undocumented
UPn13	Northern Dry Savanna	S1/S2; G1/G2	B/C
UPn13c	Dry Sand - Gravel Oak Savanna (Northern)	S1; G1	Undocumented
WFn53b	Lowland White Cedar Forest (Northern)	S3	Undocumented
WMp73a	Prairie Meadow/Carr	S3; G2/G3	Undocumented

Table 8. Rare plant species known to occur at Thief Lake WMA.

Species (Common Name)	Species (Scientific Name)	State Status[1]
Siberian Yarrow	*Achillea aplina*	THR
Northern Androsace	*Androsace septentrionalis*	SPC
Small-leaved Pussytoes	*Antennaria parvifolia*	SPC
Spike Oat	*Avenula hookeri*	SPC
Prairie Moonwort	*Botrychium campestre*	SPC
Common Moonwort	*Botrychium lunaria*	THR
Mingan Moonwort	*Botrychium minganense*	SPC
Least Moonwort	*Botrychium simplex*	SPC
Spatulate Moonwort	*Botrychium spathulatum*	END
Hair-like Sedge	*Carex capillaris*	Watchlist
Hooker's Sedge	*Carex hookerana*	SPC
Blunt Sedge	*Carex obtusata*	SPC

Species (Common Name)	Species (Scientific Name)	State Status[1]
Dry Sedge	*Carex xerantica*	SPC
Rock Sandwort	*Minuartia dawsonensis*	THR
False Mountain Willow	*Salix pseudomonticola*	SPC
Sheathed Pondweed	*Stuckenia vaginata*	END

[1] END = endangered, THR = threatened, SPC = special concern

Table 9. Conservation status ranks.

Rank Code	Rank Label	Rank Description
S1/G1	Critically Imperiled	At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
S2/G2	Imperiled	At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
S3/G3	Vulnerable	At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
S4/G4	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5/G5	Secure	Common; widespread and abundant.

More information on Conservation Status Ranks and Condition Ranks can be found at the MNDNR Biodiversity Guidelines webpage.

2. *Lakes, Wetlands, and Waterways*

Lakeshore. Lakeshore habitats in Thief Lake WMA tend to be dominated by emergent vegetation, with an increasing dominance of hybrid cattail.

Inland Lake Sand/Gravel/Cobble Shore (LKi32)

Plant communities characterized by variable cover of shrubs, forbs, graminoids, and aquatic plants on well-drained, wave-washed sand, gravel, or small cobbles on shores along inland lakes. Present in the zone between low-water level and the upper reach of storm waves or ice scouring.

Inland Lake Clay/Mud Shore (LKi54)

Plant communities on clay, mud, or silt substrates—often mixed with organic detritus—on shores of inland lakes and ponds. Vegetation is typically zonal, reflecting seasonal changes in water level. LKi54 includes plant communities in shallow basins and along the edges of ponds and lakes where spring flooding is followed by summer drawdown, exposing mudflats that are colonized by plants.

In-Lake. In-lake communities in Thief Lake are dominated by submersed vegetation interspersed with stands of hardstem bulrush and native phragmites.

Shallow, Open Water Communities

Shallow, open water plant communities generally have water depths of less than 6.6 feet. Submersed, floating and floating-leaved aquatic vegetation including pondweeds, water milfoil, coontail and duckweeds characterize this wetland type. Size can vary from a one-quarter acre pond, to a long oxbow of a river, or shallow bay of a lake. The presence or absence of floating vegetation depends upon the effects of the season, wind, availability of nutrients, and aquatic weed control efforts (Eggers & Reed, 2015).

River Shore. River shore communities occur along the shorelines of rivers and streams in the zone between annual low-water level and the upper limit of impacts from currents and ice scouring.

Sand/Gravel/Cobble River Shore (RVx32)

Sparsely to densely vegetated plant communities on sand, gravel, or small cobbles on river shores. Characterized by annual herbaceous species, firmly rooted perennial species tolerant of inundation, and species dispersed by tubers and other floating propagules. Scoured annually during spring breakup and flooding by ice and currents, and following heavy rains.

Clay/Mud River Shore (RVx54)

Sparsely to densely vegetated plant communities on clay or silt substrates on river shorelines that flood in spring but are exposed as water levels recede over summer. RVx54 includes plant communities on slumping river embankments as well as river shorelines.

In-Stream. In-stream habitat refers to the physical habitat (water velocity, depth, substrate, and cover). Most rivers and streams in Thief Lake WMA have been modified to facilitate drainage, which impacts vegetation establishment.

Natural Streams

Streams include a degree of habitat and biological diversity along a longitudinal gradient, from the headwaters to the lower reaches. The structure of the stream and its biological communities evolve along the length of the river. In general, as the size of the stream grows, so does the diversity of habitat, invertebrates, and fish; however, migration barriers limit potential biotic diversity of invertebrates and fish.

Ditches

Ditches and altered stream segments to facilitate drainage are anthropogenic systems provided for drainage of the landscape. Ditches provide low quality aquatic habitat, and the majority of ditches lack natural stream morphology and have a uniformed design and bottom slopes (lack riffle/pool complexes). While heavily modified, these habitats are used extensively by beaver and otter.

Acid Peatland. Muskeg and stagnant black spruce/tamarack management cover types. These are wet, nutrient-poor plant communities dominated by sphagnum moss. Shrub layers are typically leatherleaf and bog birch, and tree cover is sparse and consists of stunted black spruce and tamarack.

Northern Poor Fen (APn91)

Open sphagnum peatlands with variable development of hummocks and hollows. Dominated either by fine-leaved sedges or low ericaceous shrubs. Present in small basins, on floating mats near lakes and ponds, and in large peatlands on glacial lake plains.

Open Rich Peatland. Lowland grass management cover type. These are sedge and grass dominated communities with a variable shrub component comprised of willows, shrubby cinquefoil, and bog birch.

Prairie Rich Fen (OPp91)

Open graminoid-dominated peatlands in glacial lake plains and broad glacial drainageways in the prairie region. Dominated by fine-leaved sedges and grasses, with low shrubs absent to common.

Prairie Extremely Rich Fen (OPp93)

Open graminoid-dominated fens on permanently saturated peat sustained by mineral-rich groundwater discharge, with little influence from surface water inputs. Typically present on sloping sites; peat is sometimes mounded or domed. Small pools and sparsely vegetated marly peat areas are commonly present.

Wet Meadow/Carr. Lowland brush and marsh management cover types. These are habitats along a moisture gradient that can fall into either of two of the broad categories. Those dominated by shrubs (largely willow and dogwood) will fall into the brushland category, while those dominated by sedges will fall into the wetland category.

Prairie Wet Meadow/Carr (WMp73)

Open wetlands dominated by a dense cover of graminoids. Present in small, shallow depressions in the western and southern parts of the state. Specific community type WMp73a, Prairie Meadow/Carr, is currently ranked as S3, G2/G3, or Vulnerable/Imperiled. WMp73a is currently the only community type recognized in the Prairie Wet Meadow/Carr class.

Southern Seepage Meadow/Carr (WMs83)

Open wetlands dominated by a dense cover of hummock-forming broadleaved sedges or tall shrubs. Present in areas of groundwater seepage along streams and drainage ways, on sloping terraces, and at bases of slopes.

Southern Basic Wet Meadow/Carr (WMs92)

Open wetlands dominated by dense cover of broad-leaved sedges. Typically present in small, closed, shallow basins isolated from groundwater inputs.

Marsh. Marsh management cover type. These are robust emergent plant communities along a moisture and often depth gradient dominated by cattail and hardstem bulrush.

Northern Mixed Cattail Marsh (MRn83)

Emergent marsh communities, typically dominated by cattails. Present on floating mats along shorelines in lakes, ponds, and river backwaters or rooted in mineral soil in shallow wetland basins.

Northern Bulrush-Spikerush Marsh (MRn93)

Emergent marsh communities, typically dominated by bulrushes or spikerushes. Present mainly along lakeshores and stream borders.

Wetland Prairie. Lowland grass and lowland brush management cover types. These plant communities are dominated by native grasses, but often have a strong shrub (willow) component.

Northern Wet Prairie (WPn53)

Grass-dominated but forb-rich herbaceous communities, often with a strong shrub component, on somewhat poorly drained to poorly drained loam soils formed in glaciolacustrine sediments, unsorted glacial till, or less frequently outwash deposits. Present primarily on level to very gently sloping sites. Flooded for brief periods at most; upper part of rooting zone is not saturated for most of growing season. Drought stress is infrequent, usually brief, and not severe. Fires were very frequent historically.

3. Forests

Fire-Dependent Woodland. Oak and aspen management cover types. These communities lie on more upland sites and are dominated by aspen and bur oak. In Thief Lake WMA, the only jack pine is found in plantations on the Dohrman Ridge.

Northwestern Dry-Mesic Oak Woodland (FDw24)

Dry-mesic bur oak–dominated woodlands on gently sloping, sandy and gravelly beach ridges. Surface fires were common historically, with catastrophic crown fires occasional. Specific community type FDw24a, Bur Oak – (Prairie Herb) Woodland, is currently ranked as S2, or Imperiled. FDw24a has a canopy dominated by bur oak. The understory and shrub layers also have bur oak, but it is not abundant. American hazelnut, snowberry or wolfberry, juneberries, and poison ivy are common in the shrub layer.

Northwestern Mesic Aspen-Oak Woodland (FDw34)

Mesic woodlands dominated by quaking aspen and bur oak with occasional jack pine. Present on level, sandy soils, occasionally capped with loamy sediment, on the Glacial Lake Agassiz plain. Moderate surface fires were common historically, and catastrophic fires occasional.

Northwestern Wet-Mesic Aspen Woodland (FDw44)

Wet-mesic woodlands dominated by quaking aspen. Present on poorly drained, flat, sandy soils, occasionally capped with loamy sediment, on the Glacial Lake Agassiz plain and rarely on the Anoka Sand Plain. Surface fires were common historically, and catastrophic crown fires were occasional.

Mesic Hardwood Forest. Aspen management cover type. These are plant communities dominated by aspen in Thief Lake WMA, but with components of balsam poplar, white spruce and balsam fir.

Northwestern Wet-Mesic Boreal Hardwood-Conifer Forest (MHn44)

Wet-mesic or mesic hardwood and hardwood-conifer forests, most commonly on level, clayey sites with high local water tables on glacial lake deposits, stagnation moraines, and till plains.

Northwestern Wet-Mesic Hardwood Forest (MHw36)

Wet-mesic hardwood forests on somewhat poorly drained, fire-protected sites on alluvial deposits along rivers draining the Glacial Lake Agassiz plain and on broad flats associated with shoreline features of Glacial Lake Agassiz.

Floodplain Forest. Ash, lowland hardwoods and northern hardwoods management cover types. These forested communities are seasonally inundated, and are dominated by black ash, box elder and elm.

Northern Terrace Forest (FFn57)

Wet-mesic deciduous forests on silty or sandy alluvium on level, occasionally flooded sites along medium and large rivers in the northern half of Minnesota.

Northern Floodplain Forest (FFn67)

Deciduous riparian forests on sandy or silty alluvium on low, level, annually flooded sites along medium and large rivers in central and northern Minnesota. Characterized by pools and evidence of recent flooding, such as rows and piles of debris, ice scars on trees, and freshly deposited silt and sand.

Wet Forest. White cedar, ash, and aspen management cover types. These forested communities are arrayed along a nutrient gradient and are dominated by northern white cedar, black ash and aspen.

Northern Wet Cedar Forest (WFn53)

Wet conifer or conifer-hardwood forests on muck or peat soils. Typically present in settings where saturated soils are present through most of the growing season such as depressions; low, level terrain along lakes, rivers, or wetlands; and gently sloping upland drains. Specific community type WFn53b, Lowland White Cedar Forest (Northern), is currently ranked as S3, or Vulnerable. WFn53b has a canopy dominated by white cedar, sometimes with abundant black ash. Balsam fir and paper birch are occasionally present in the canopy. White cedar, balsam fir, and black ash are sometimes abundant in the subcanopy, but most often the community is relatively open below the canopy.

Northern Wet Ash Swamp (WFn55)

Wet hardwood forests on mucky mineral soils in shallow basins and groundwater seepage areas and on low, level terrain near rivers, lakes, or wetlands. Typically with standing water in the spring but draining by late summer.

Northwestern Wet Aspen Forest (WFw54)

Wet hardwood and hardwood-conifer forests in depressions and on level to gently sloping lacustrine deposits in the Glacial Lake Agassiz plain.

Forested Rich Peatland. Cedar, tamarack, and black spruce management cover types. These are conifer dominated communities on wetter sites, with northern white cedar, black spruce and tamarack dominant.

Northern Cedar Swamp (FPn63)

White cedar–dominated swamps on wet peat soils. Often present in areas influenced by mineral-rich subsurface flow or groundwater seepage along the margins of uplands and peatlands.

Northwestern Rich Conifer Swamp (FPw63)

Tamarack- or occasionally black spruce–dominated swamps in peat-filled depressions on glacial lake plains. Typically associated with sandy beach deposits. Specific community type FPw63a, Tamarack-Black Spruce Swamp, is currently ranked as S3, or Vulnerable. FPw63a has a canopy dominated by tamarack or black spruce. It is typically present at bases of beach ridges on somewhat drier sites, and usually not associated with obvious groundwater seepage zones.

Acid Peatland. Stagnant spruce/tamarack/cedar management cover types. These are nutrient poor, damp plant communities dominated by lowland conifers (black spruce, tamarack and northern white cedar).

Northern Poor Conifer Swamp (APn81)

Conifer-dominated peatlands with sparse canopy of stunted trees. Understory is lacking in species richness and dominated by ericaceous shrubs, fine-leaved graminoids, and low sphagnum hummocks. Minerotrophic plant species are present.

4. Brushlands

These are plant communities at two ends of a moisture spectrum. The wet meadow carr is dominated by sedges and shrubs such as willow. The savannah is on drier sites with an overstory of bur oak and understory of juneberry, hazel and prairie grasses.

Northern Wet Meadow/Carr (WMn82)

Open wetlands dominated by dense cover of broad-leaved graminoids or tall shrubs. Present on mineral to sapric peat soils in basins and along streams.

Northern Mesic Savanna (UPn24)

Sparsely treed and usually shrubby communities with grass-dominated ground layers on somewhat poorly drained to well-drained loam soils mainly formed in glacial till (sometimes water-reworked) and outwash deposits, and less frequently in lacustrine sediments. Present primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe. Historically, these communities burned every few years.

5. Prairies and Grasslands

Upland Prairie. Upland grass and upland brush management cover types. These communities occur on drier sites mostly in the western and southern portions of the WMA. Big bluestem is the dominant grass cover, with a variety of forbs, and the savanna areas include an overstory of bur oak.

Northern Dry Prairie (UPn12)

Grass-dominated herbaceous communities on nearly level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur during most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Historically, fire probably occurred every few years. Specific community type UPn12b, Dry Sand – Gravel Prairie (Northern) is currently ranked as S2, or Imperiled. UPn12b are graminoid-dominated, forb-rich herbaceous communities on coarse-textured, usually gravelly soils on gentle slopes on wave-reworked Glacial Lake Agassiz shoreline deposits and rarely on moderate slopes on outwash and ice-contact deposits. Plant cover is less than 100%, and lichens may encrust the bare areas among the plants.

Northern Dry Savanna (UPn13)

Sparsely treed and often shrubby communities with grass-dominated herbaceous ground layers on nearly level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur during most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Trees are open grown, typically small, and gnarled. Historically, fire occurred every few years. This community class is currently ranked as S1/S2, G1/G2, or Imperiled/Critically Imperiled. Specific community type UPn13c, Dry Sand – Gravel Oak Savanna (Northern) is currently ranked as S1/G1, or Critically Imperiled. UPn13c are sparsely treed, graminoid-dominated, forb-rich communities on coarse-textured, usually gravelly soils on glacial lake beach ridges, outwash, and ice-contact deposits. They are present mainly on gentle slopes. Bur oak is the principal tree; trembling aspen is sometimes present as shrub- or sapling size root suckers. The shrub layer is sparse to patchy.

Northern Mesic Prairie (UPn23)

Grass-dominated but forb-rich herbaceous communities (very shrubby in the Tallgrass Aspen Parklands Province) on somewhat poorly drained to well drained loam soils formed in lacustrine sediments, in glacial till (sometimes reworked by water), or less frequently in outwash deposits. Present primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe. Fires were very frequent historically.

6. *Agricultural Lands*

Cropland. Crops grown on the agricultural lands of the WMA vary depending on moisture and the goals of the cooperator or food plot and crop rotation. Crops grown by cooperators tend toward small grains, dense-cover legumes (clover and alfalfa), and soybeans. Crops grown for food plots depend on the target species. Goose food plots are focused on winter wheat so that geese can graze on newly sprouted grain. Occasionally fields are allowed to mature so that geese and dabbling ducks can feed on the grain. Food plots left for elk, deer, turkeys, and sharp-tailed grouse are varied and can include the crops listed above, along with sunflowers, corn, and mixed forage (rape, radishes, turnips, peas, and oats).

Cooperative Farming Agreements

Cooperative Farming Agreements (CFAs) are contracts with private cooperators to farm agricultural lands on the WMA on a sharecrop basis, with the state typically receiving a quarter share. Crops are mutually agreed upon, and there are a variety of options for disposition of the state's share. Farming practices on state lands are currently under review and moving toward more environmentally friendly practices focused on soil health and land stewardship.

Food Plots

Food plots are agricultural lands on the WMA that are farmed by state personnel using state equipment. Crops are typically unharvested and left for wildlife consumption. Farming practices on state lands are under review and moving toward more environmentally friendly practices focused on soil health and land stewardship.

Staff seeding a sunflower food plot

D. Wildlife

1. Birds

Thief Lake WMA's diverse habitats attract a large variety and number of birds. A checklist of bird species known to occur or probably occurring on or near the unit was initially compiled by Shelly Steva, local naturalist, and also by comparing lists from Robert Janssen of the Minnesota Ornithologists' Union, the Agassiz National Wildlife Refuge, and DNR personnel with species lists and accounts available in the literature and has been supplemented by observations by station personnel over time (Appendix F). Many species, especially migrants, may be uncommon or rare because preferred habitat on the WMA may be lacking or because the unit lies near the normal limit of a species' range.

Most bird species found on the WMA probably occurred before settlement; however, human activities have altered the relative abundance of some species and have caused the introduction, extirpation, or range expansion of other species. As settlement progressed, populations of species able to utilize human-altered habitats increased, while other bird populations requiring specialized habitats decreased.

Of the 237 bird species that may occur on the WMA, 151 are permanent or summer residents and commonly nest on the WMA. Fall and spring migrants account for 87 species and 19 occur as winter residents. Common species are found in Table 10. Sixteen species are listed on Minnesota's Endangered, Threatened or Special Concern Species list that was updated in 2013 (Appendix F). Species of Greatest Conservation Need (SGCN) were identified in Minnesota's State Wildlife Action Plan (2016). SGCN include all of Minnesota's species listed as Endangered, Threatened or Special Concern, along with an additional 47 non-listed birds species that can be thought of as "watch list species" (Appendix F).

Black tern nest at Thief Lake

Table 10. Common bird species found at Thief Lake WMA and their associated habitats.

Habitat	Game Species	Nongame Species
Lakes, Wetlands, and Waterways	Canada Goose, Wood Duck, Gadwall, Mallard, Blue-winged Teal, Northern Shoveler, Green-winged Teal, Canvasback, Redhead, Ring-necked Duck, Lesser Scaup, Common Goldeneye, American Wigeon, Northern Pintail, Virginia Rail, Sora, American Coot, Sandhill Crane, American Woodcock, Wilson's Snipe	Trumpeter Swan, Tundra Swan, Pied-billed Grebe, Horned Grebe, Red-necked Grebe, Eared Grebe, Western Grebe, Lesser Yellowlegs, Wilson's Phalarope, Bonaparte's Gull, Franklin's Gull, Ring-billed Gull, Black Tern, Forster's Tern, Common Loon, Double-crested Cormorant, American White Pelican, Great Blue Heron, Great Egret, Black-crowned Night-Heron, Bald Eagle, Northern Harrier, Belted Kingfisher, Alder Flycatcher, Willow Flycatcher, Tree Swallow, Sedge Wren, Marsh Wren, Gray Catbird, Common Yellowthroat, Swamp Sparrow, Red-winged Blackbird
Forests (Coniferous, Deciduous and Mixes)	Ruffed Grouse, American Woodcock	Black-billed Cuckoo, Common Nighthawk, Ruby-throated Hummingbird, Turkey Vulture, Sharp-shinned Hawk, Cooper's Hawk, Broad-winged Hawk, Great Gray Owl, Red-bellied Woodpecker, Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Merlin, Eastern Wood-Pewee, Yellow-bellied Flycatcher, Least Flycatcher, Eastern Phoebe, Warbling Vireo, Red-eyed Vireo, Blue Jay, American Crow, Cliff Swallow, Black-capped Chickadee, White-breasted Nuthatch, House Wren, Winter Wren, Ruby-crowned Kinglet, Veery, Hermit Thrush, American Robin, Brown Thrasher, Bohemian Waxwing, Cedar Waxwing, Purple Finch, Common Redpoll, Pine Siskin, Evening Grosbeak, numerous warbler species, Fox Sparrow, White-throated Sparrow, Dark-eyed Junco, Rose-breasted Grosbeak, Indigo Bunting, Baltimore Oriole
Brushlands	Sharp-tailed Grouse	Alder Flycatcher, Willow Flycatcher, Brown Thrasher, Gray Catbird, Yellow Warbler, Swamp Sparrow
Prairies, Grasslands, Savannas	Gray Partridge, Sharp-tailed Grouse	Killdeer, Rough-legged Hawk, Snowy Owl, American Kestrel, Western Kingbird, Eastern Kingbird, Horned Lark, Bank Swallow, Barn Swallow, Eastern Bluebird, Chestnut-collared Longspur, Snow Bunting, Clay-colored Sparrow, Vesper Sparrow, Savannah Sparrow, Bobolink, Western Meadowlark
Agricultural Areas	Canada Goose, Mallard, Gray Partridge, Sharp-tailed Grouse, Sandhill Crane, Mourning Dove	Killdeer, Rock Pigeon, Turkey Vulture, Northern Harrier, Red-tailed Hawk, Great Horned Owl, American Kestrel, Black-billed Magpie, European Starling, House Sparrow, Song Sparrow, American Goldfinch, Common Grackle, Brown-headed Cowbird

All migratory birds, except non-native species such as house sparrows, European starlings, mute swans, and rock pigeons, are protected under the federal Migratory Bird Treaty Act (16 USC 703–712; 40 Stat. 755 as amended), which prohibits the take of any migratory birds without authorization from U.S. Fish and Wildlife Service. Minnesota also has state regulations that protect birds. Hunting regulations are developed and authorized by U.S. Fish and Wildlife Service and MNDNR. Thirty-four bird species may be taken only during authorized hunting seasons.

Waterfowl and Gamebirds. Prior to drainage, Thief Lake was a prime waterfowl area. After a visit in 1901, Roberts (1936) reported that "thousands of ducks and some Canada geese were nesting at that time in that paradise for waterfowl." Drainage of the lake in 1916 virtually destroyed the area for waterfowl. Restoring waterfowl habitat, populations, and hunting opportunities was the driving force behind the restoration of Thief Lake and the creation of the WMA.

Thief Lake is an important stopping place for waterfowl in migration. A total of 29 waterfowl species have been detected at Thief Lake WMA. Aerial counts (focused primarily on ducks) and ground counts (focused on geese) are done approximately weekly each fall to document waterfowl use. Since these counts began, the most abundant duck species has varied depending on local habitat conditions and continental populations, and has included mallard, ring-necked duck, and lesser scaup. Peak duck counts have exceeded 30,000 birds in 2003. Duck species most commonly taken by hunters from 1968 to 2016 were mallard, lesser scaup, ring-necked duck, redhead, blue-winged teal, green-winged teal, American wigeon, and gadwall.

Management of the lake plays an important role in waterfowl use of the lake and the surrounding area. Three facets of management (sanctuary, water level management, and food plots and MSUs) are particularly important in determining use of the area by staging and migrating birds. Thief Lake includes a 5500 acre sanctuary that includes substantial portions of the north central and west end of the lake. The sanctuary provides an area free of disturbance where birds can roost and feed undisturbed by human pressure.

Over the years, a lake level of 1158.5’ above MSL has emerged as a desirable target during the hunting and nesting seasons. At this water level, hunter access and emergent cover for hunting have proven adequate – deeper water provides better access at the expense of cover, while shallower water improves cover at the expense of access. Bag checks during a year when lake level is at 1158.5’ show a bag comprised of a variety of species, with both dabbling and diving ducks well represented. Deeper lake levels tend to have a bag dominated by diving ducks, while shallower lake levels tend to favor dabblers (Figure 7). Submersed aquatic vegetation is varied and luxuriant at this level in most years.

Food resources are also an important factor holding birds on the WMA. To this end, a number of food plots are planted within the sanctuary to allow undisturbed use by geese during migration. These fields are typically planted to cereal grains to allow use of sprouting plants as well as matured grain. MSUs within the sanctuary are managed to provide seeds from wetland annual plants along with invertebrates for use by dabbling ducks. Thief Lake itself is managed at

a level that provides a variety of natural submersed aquatic plants and the associated invertebrates for use by a variety of waterfowl, particularly diving ducks.

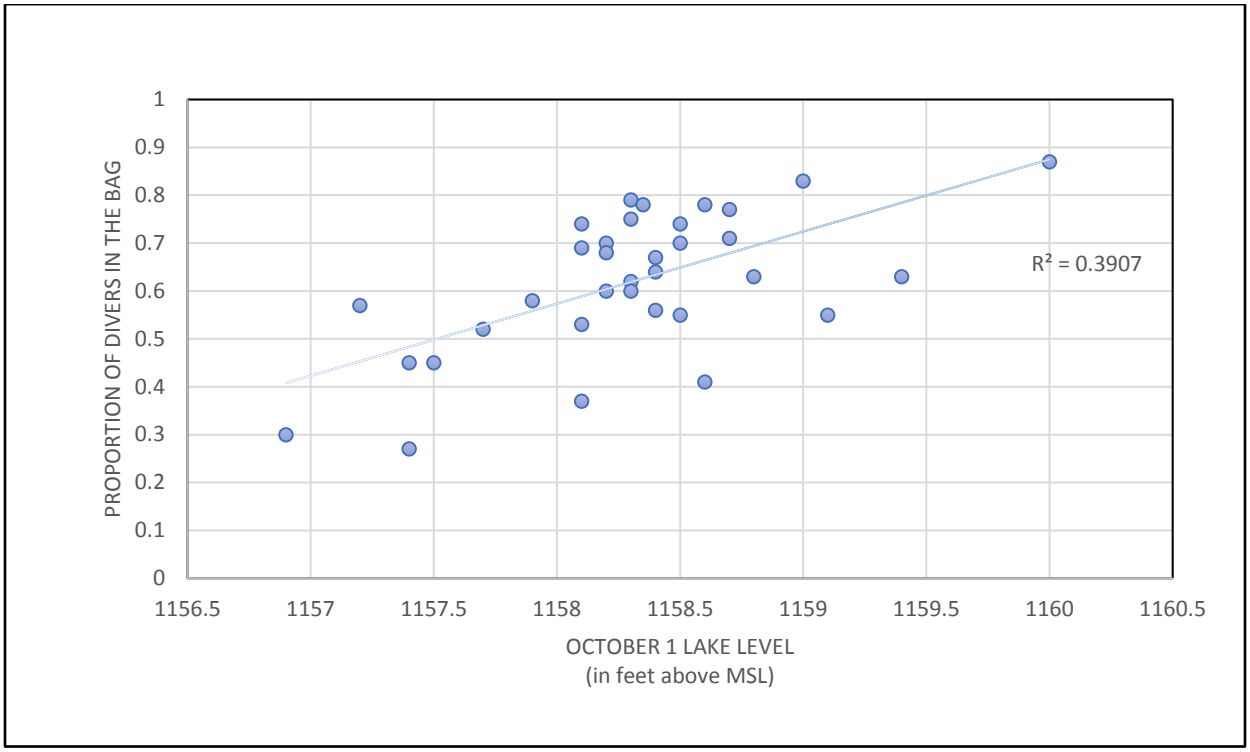


Figure 7. Thief Lake water levels on October 1 versus proportion of divers in the bag

Continental populations and regional habitat conditions can have a profound influence on migrating waterfowl use of Thief Lake by migrating waterfowl. Wet conditions in the prairie pothole region can provide an attractive migration route for birds pouring down from breeding areas in Canada, and funnel birds west of Thief Lake. During years of dry conditions in the Dakotas, an increasing proportion of the migrants come through western Minnesota with a potential to stop at Thief Lake. Regional and continental populations exert an influence on the species complement of birds using Thief Lake, and this is reflected in year to year variations in bag composition.

Of the 29 species of waterfowl commonly observed at Thief Lake WMA, 16 of these species commonly nest on the area. Annual waterfowl nesting estimates (also referred to as production) on the WMA is determined by aerial and roadside counts of breeding pairs. Breeding pair counts conducted by DNR personnel from 1950 to 2016 indicate that mallards, blue-winged teal, and ring-necked ducks were the most abundant breeding ducks on the WMA. The estimated breeding population on the management area is between 1,000 and 3,000 duck pairs.

Beginning in 1959, giant Canada geese were transferred to Thief Lake from the Carlos Avery Game Farm to reestablish a resident flock and to attract migrating geese. From 1959 to 1961, a total of 192 goslings were wing-clipped and released in an enclosure constructed near the WMA headquarters. The birds were held until after their first breeding season and then were

allowed to fly free along with their progeny. This process continued through 1969; after which, birds were allowed to gain flight capability and fly free. Between 1993 and 1996 local breeding populations of geese were supplemented with geese captured in the Metro area of the Twin Cities and transplanted to Thief Lake. The program was discontinued when the local breeding population seemed well-established.

Use of the WMA by Canada goose subspecies during migration has changed noticeably in the years since the 1980 plan was prepared. The Canada geese at Thief Lake are primarily of three subspecies. These subspecies can be distinguished by bill morphology and tail feathers. In 1979, subspecies were harvested in approximately the following proportions: 84 percent medium-sized Canada geese ("Todd's" or "interior"), 7 percent giant Canada geese ("maxima"), and 9 percent small Canada geese ("Richardson's", now considered to be a separate species: cackling geese). In 1980, migrant geese were mostly medium-sized interior birds from the Eastern Prairie Population (EPP), which nests near the southwestern shore of Hudson Bay and winters in Missouri (Bellrose, 1976). By 2016, the proportions were 92% giant Canada geese and 8% small or cackling geese. No medium-sized interior geese were measured during bag checks in 2016.

The number of fall migrating geese using the management area peaked in 1969 at 20,000 birds. Peak numbers of geese have declined since that time, as new staging areas were used by birds in Manitoba, and as harvest opportunity shifted to more regionally produced geese. The first geese usually arrive in early to mid-September, with numbers building to a peak in late September or early October.

Other game birds associated with wetlands include snow goose, American coot, sora, Virginia rail, Wilson’s snipe, and sandhill crane. Snow geese stop at the WMA during spring and fall migrations. Peak numbers of snow geese in spring are usually less than 100 but fall peaks in recent years have ranged from 25 to several thousand. American coots, soras, rails, and snipe are less frequently targeted by hunters on the WMA.

Prior to 1890, greater sandhill cranes were common summer residents in Marshall County (Roberts, 1936); however, a drastic decline in crane numbers occurred as settlement progressed. During this period, large numbers of cranes were harvested and critical wetland habitat was drained for agriculture. A gradual recovery has occurred in Minnesota in recent years, and the species was removed from the U.S. Fish and Wildlife Service "Endangered List" in 1973 (United States Department of the Interior, 1974). Recovery of crane populations has continued, and cranes have been common summer residents in Marshall County for a number of years. Research has shown that two populations of cranes – the Mid-continent population and the Eastern population – nest in and migrate through Minnesota. The Mid-continent population occurs in Northwest Minnesota, and is hunted throughout its range. It has been hunted in Northwest Minnesota since 2010. Hunters are required to get a crane permit, and harvest is limited to one bird per day for the 37 day season.

Six species of upland game birds occur on the management area. Ruffed grouse, sharp-tailed grouse, wild turkey, and gray or Hungarian partridge are permanent residents, while the American woodcock and mourning dove are summer residents. Woodcock and ruffed grouse

are found mainly in the forested areas, while sharp-tailed grouse, gray partridge and mourning dove occur in more open areas such as grasslands, brushy areas, and croplands (Table 10). Turkeys are relatively new to the area and are expanding primarily into the western portion of the WMA. Wild turkeys roost in timbered areas, but often feed in more open or agricultural areas. Each spring, ruffed grouse drumming is recorded along established routes to provide an index to population levels (Figure 8). Ruffed grouse numbers on the management area have generally been slightly above the average for northwest Minnesota (1.36 vs. 1.1 drums per stop). Surveys to estimate woodcock and sharp-tailed grouse are conducted in the vicinity of the WMA. Woodcock are surveyed on a specified route at dusk using a singing-ground survey protocol organized by the U.S. Fish and Wildlife Service (USFWS), with the nearest route conducted in southern Roseau County. Sharp-tailed grouse are surveyed in the early morning on a series of known leks (or dancing grounds) along two routes in the vicinity of the WMA.

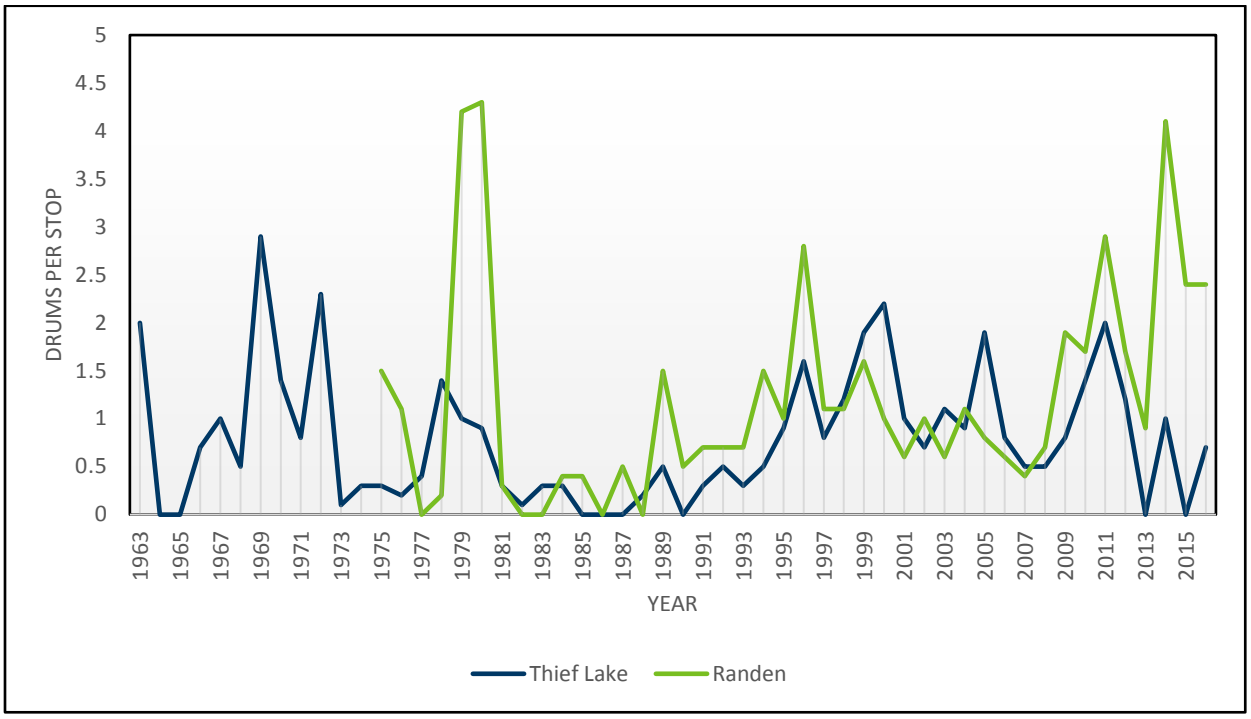


Figure 8. Ruffed grouse drumming counts along the Thief Lake and Randen routes

Nongame Birds. The management area is also important for a variety of nongame birds. Migrating and resident shorebirds, grebes, herons, egrets, gulls, terns, cormorants, and pelicans are commonly observed in the wetlands or on the lake (Table 10). American white pelicans are observed on Thief Lake during spring and fall migrations, and are common throughout the summer months (likely birds breeding on Lake of the Woods that make feeding flights to Thief Lake). Abandoned cropland, restored prairies, and agricultural fields provide habitat for such species as the horned lark, western meadowlark, bobolink, and savannah sparrow. Wood warblers, flycatchers, vireos, woodpeckers, and thrushes occur in the forests. In general, nongame birds are most abundant during the fall and spring migrations.

Twenty-five species of migrant and resident raptors may occur on the WMA. The red-tailed hawk, broad-winged hawk, American kestrel, and great horned owl are the most common resident raptors. Bald eagles are commonly observed during spring and fall, and there are several bald eagle nests in the WMA.

Trumpeter swans were first noted nesting on Thief Lake in 2007, and now several pairs produce broods most years. In addition, non-breeding subadults are found on the lake during summer months, and are also found among tundra swans migrating through the area spring and fall.

Thief Lake is one of a few places in Minnesota where five species of grebes can be observed (western, red-necked, eared, horned, and pied-billed). Four of the species (western, red-necked, eared, and pied-billed) have been documented nesting on the WMA. Grebes are diving birds that forage primarily on small fish and invertebrates.

A large colony of nesting Franklin's gulls is found in the bulrush stands in the northcentral part of the lake during the summer. This colonial species is listed as Special Concern in Minnesota and is only known to regularly nest at four locations in Minnesota each year. These birds exchange readily with birds on Agassiz NWR, and nesting activity seems to shift annually depending on habitat conditions on the two areas.

Franklin's gulls at Thief Lake

2. Mammals

Most mammal species found in the vicinity today were present during pre-settlement times. As settlement progressed, habitat destruction and uncontrolled hunting and trapping resulted in the decimation and, in some cases, the elimination of several larger mammals from the area. The historical distribution of small, inconspicuous species is unknown.

Mammal species present on the management area were determined from information supplied by Bemidji State University records, DNR Section of Wildlife records, and observations from staff working at the WMA (Table 11). Fifty-three mammal species are known to occur on or near the management area. An additional 7 species possibly occur, but no positive evidence is available. Nineteen of these 60 mammal species are identified as game species. One species, the northern pocket gopher, is listed as Threatened in Minnesota, and 8 additional species are listed as Species of Special Concern in Minnesota. Six species are not listed in Minnesota, but are considered SGCNs.

Large Mammals and Big Game. White-tailed deer are the most common large mammal in the area, but were probably uncommon in the prairie-forest transition zone at settlement. Deer numbers increased somewhat after settlement, then increased even more with greater protection after the 1930s. Deer are near the northern limit of their historic range here, and populations may be severely reduced by hard winters. Deer have benefitted from habitat work and timber harvest in the area. Deliberate efforts to reduce population densities in the area following the discovery of bovine tuberculosis (BTb), an infectious bacteria that affects a broad range of mammals including domestic cattle, near Skime in 2005 reduced populations noticeably in the 2009-2014 period. Deer populations are currently increasing once again.

Elk originally occupied much of the prairie and open woodland in Minnesota. As settlement expanded during the late nineteenth century, the elk population declined drastically, and by the early 1900s, elk had disappeared from the state. Reintroduction efforts began in 1913, when 55 animals were obtained from Wyoming and released into a 700-acre enclosure in Itasca State Park. Between 1914 and 1934, surplus animals were released in various state parks and the Superior National Forest. In 1934, the remaining 27 animals were released in the Beltrami Island area, north of Upper Red Lake (Gunderson & Beer, 1953). By 1940, the herd had expanded to about 100 animals and ranged in portions of Lake of the Woods, Beltrami, and Roseau counties. Only about 20 elk currently remain in the Grygla population, primarily in a 6-township area in eastern Marshall and northwest Beltrami counties which includes a portion of the Thief lake WMA. This population has occasionally exceeded the population goal for this herd established in Minnesota's elk plan. Elk hunting has been permitted in Minnesota since 1987 and is done on a permit basis when populations exceed population goals established for the specific population. A portion of Thief Lake WMA is open when there is a hunt for the Grygla herd. Two other elk populations have become established in northeast Kittson County, thought to be animals that emigrated from Manitoba. The degree of exchange between populations is unknown.

Table 11. Mammal species known or suspected to occur at Thief Lake WMA.

Common Name	Scientific Name	Habitat[1]	Game Species[2]	State Status[3]	Federal Status[3]
Snowshoe Hare	*Lepus americanus*	F,B	X		
White-tailed Jackrabbit	*Lepus townsendii*	P	X	SGCN	
Eastern Cottontail	*Sylvilagus floridanus*	F,B	X		
Masked shrew	*Sorex cinereus*	F,B,W,P			
Water Shrew	*Sorex palustris*	B,W			
Arctic Shrew	*Sorex arcticus*	B,W			
Pygmy Shrew	*Sorex hoyi*	B,W			
Short-tailed Shrew	*Blarina brevicauda*	B,W,P,A			
Star-nosed Mole	*Condylura cristata*	F,B			
Little Brown Myotis	*Myotis lucifugus*	F,B,W		SPC	
Silver-haired Bat[4]	*Lasionycteris noctivagans*	F,B,W		SGCN	
Big Brown Bat	*Eptesicus fuscus*	F,B,W,P,A		SPC	
Red Bat	*Lasiurus borealis*	F,B,W		SGCN	
Hoary Bat	*Lasiurus cinerus*	F,B		SGCN	
Coyote	*Canis latrans*	F,B,P,A			
Gray Wolf	*Canis lupus*	F,B,P,A			THR
Red Fox	*Vulpes vulpes*	F,B.P	X		
Canada Lynx	*Lynx canadensis*	F		SPC	THR
Bobcat	*Lynx rufus*	F,B	X		
Mountain Lion[5]	*Puma concolor*	F,B		SPC	
Striped Skunk	*Mephitis mephitis*	F,B,P,A			
Northern River Otter	*Lontra canadensis*	W	X		
American Marten	*Martes americana*	F	X		
Ermine (Short-tailed Weasel)	*Mustela erminea*	F,B,P			
Long-tailed Weasel	*Mustela renata*	F,B,P			
Least Weasel	*Mustela nivalis*	B,P		SPC	
American Mink	*Neovison vison*	W	X		
Fisher	*Pekania pennanti*	F	X		
American Badger	*Taxidea taxus*	P,A	X	SGCN	
Northern Raccoon	*Procyon lotor*	F,B,P,A	X		
American Black Bear	*Ursus americana*	F,B	X		
Pronghorn[5]	*Antilocapra americana*	P			
Moose	*Alces americanus*	F,B,W,P,A		SPC	
Elk	*Cervus elaphus*	F,B,P,A	X	SPC	
Mule Deer	*Odocoileus hemionus*	F,B	X		
White-tailed Deer	*Odocoileus virginianus*	F,B,P,A	X		
American Beaver	*Castor canadensis*	W	X		
Deer Mouse	*Peromyscus maniculatus*	F,B,P,A			

Common Name	Scientific Name	Habitat[1]	Game Species[2]	State Status[3]	Federal Status[3]
White-footed Mouse	*Peromyscus leucopus*	F,B,A			
Southern Red-backed Vole	*Myodes gapperi*	F,B			
Meadow Vole	*Microtus pennsylvanicus*	B,P			
Common Muskrat	*Ondatra zebethicus*	W	X		
Northern Bog Lemming[4]	*Synaptomys borealis*	B,W		SPC	
Southern Bog Lemming[4]	*Synaptomys cooperi*	F,B,W,P			
Woodland Jumping Mouse	*Napaeozapus insignis*	F			
Meadow Jumping Mouse	*Zapus hudsonius*	B,W,P			
Plains Pocket Gopher[4]	*Geomys bursarius*	P,A			
Northern Pocket Gopher[4]	*Thomomys talpoides*	P,A		THR	
North American Porcupine	*Erethizon dorsatum*	F			
House Mouse	*Mus musculus*	F,B,P,A			
Norway Rat	*Rattus norvegicus*	A			
Northern Flying Squirrel	*Glaucomys sabrinus*	F			
Thirteen-lined Ground Squirrel	*Ictidomys tridecemlineatus*	P			
Woodchuck	*Marmota monax*	B,P,A			
Franklin's Ground Squirrel	*Poliocitellus frankinii*	W,P,A		SGCN	
Eastern Gray Squirrel	*Sciurus carolinensis*	F	X		
Eastern Fox Squirrel[4]	*Sciurus niger*	F	X		
Eastern Chipmunk	*Tamias striatus*	F			
Least Chipmunk[4]	*Tamias minimus*	F			
Red Squirrel	*Tamiasciurus hudsonicus*	F			

[1]Habitat Key: F=Forest, B=Brushlands, W=Wetlands, P=Prairies and Grasslands, A=Agricultural Lands

[2]Game species, may be taken only under DNR regulations

[3]END = endangered, THR = threatened, SPC = special concern, SGCN = Species of Greatest Conservation Need; all of Minnesota's endangered, threatened, and special concern species are SGCN, those listed as SGCN in the table are species not on the Minnesota's endangered, threatened, and special concern list.

[4]Possible occurrence

[5]Rare or transient occurrence

Moose were probably common in this region during presettlement times. Settlement resulted in drainage, land clearing, and unregulated hunting, which by the 1920s had nearly eliminated the moose. Much of this farmland was abandoned during the 1930s and reverted back to brushland and forests. In addition, moose were protected between 1922 and 1970, and as a result, the moose population expanded during that time period (Phillips, Berg, & Siniff, 1973). A regulated harvest was initiated in alternate years starting in 1971. Declining populations brought a cessation of hunting in 1995. Moose populations declined precipitously in NW Minnesota in subsequent years, and populations in NE Minnesota and elsewhere across the southern portion of their range have seen declines in recent years as well.

Mule deer have been documented on the WMA and occasionally harvested during the firearms season. A doe pronghorn antelope was sighted and photographed on the area in 2013.

Doe pronghorn antelope observed at Thief Lake WMA in 2013

Woodland caribou were once found over much of northern Minnesota but by the 1930s had been reduced to a small remnant herd in the Red Lake bog, north of Upper Red Lake. In 1938, 10 caribou from Canada were released in the bog in an attempt to replenish the herd. This effort failed, and there have been no reports of caribou in the area since 1943 (Gunderson & Beer, 1953).

Black bear populations are doing well in the Thief Lake area and have been expanding their range in northwest Minnesota. At the time of the 1980 plan, bears were found on the Randen Ridge and less commonly around the lake itself. Bear populations have expanded readily across the beach ridges west of Thief Lake, including those that comprise the Dohrman Ridge portion of Thief Lake and beyond. The landscape becomes more agricultural as you go west, and black bears in this area have been shown to have the largest home ranges currently documented (Garshelis, personal communication).

The gray wolf (eastern timber wolf) was afforded special protection as a Federally Threatened species under the Endangered Species Act (ESA) in 1978. In 2012, the wolf was delisted and

management responsibility was shifted to the state. Wolf hunting and trapping seasons in Minnesota were held in 2012-14. A court decision on December 19, 2014 placed the wolf back on the endangered species list.

Mid-sized Mammals, Small Game, and Furbearers. Thief Lake WMA is home to a number of mid-sized mammals, many of which are classified as "small game" in hunting regulations or as furbearers in trapping regulations. Common small game and furbearers hunted or trapped include beaver, bobcat, coyote, fisher, red fox, muskrat, river otter, rabbits and hares, raccoon, striped skunk, squirrels, and weasels. Many furbearers are associated with water and wetlands (e.g., muskrats, otters, beavers, weasels). Rabbits, raccoons, and coyotes can be found in a wide variety of habitats, including croplands, open areas, and forests. Squirrels require forested habitats with abundant acorn bearing trees. Canada lynx are rare, but are occasionally found on the management area, especially in years of high populations when individuals may emigrate from Canada.

Small Mammals. Small mammals are important to ecosystems, serving as food for predators, distributors of seeds, grazers, and consumers of invertebrates. Although generally inconspicuous, small mammals representative of deciduous forest, coniferous forest, bog, wetland, and grassland communities occur on the management area. Several species of voles, mice, shrews, bats, and moles are common.

3. Fish

Water bodies on the area are managed primarily for waterfowl and other wetland wildlife and not for fish production. Thief Lake, Moose River, and Thief River do not support a large or diverse fish population because of frequent low water levels, oxygen depletions, and winter freeze outs.

Twenty-eight fish species are known to occur in the Thief and Moose rivers (Table 12). Species common to the Moose River are also likely to occur in Thief Lake. An additional 41 fish species have been found in lakes and streams within the Red Lake River watershed (Table 12).

Table 12. Fish species known to occur in the Red Lake River Watershed.

Family	Common Name	Scientific Name	Thief River	Moose River
Petromyzontidae	Chestnut Lamprey	*Ichthyomyzon castaneus*		
Petromyzontidae	Silver Lamprey	*Ichthyomyzon unicuspis*		
Acipenseridae	Lake Sturgeon[1]	*Acipenser fulvescens*		
Hiodontidae	Goldeye	*Hiodon alosoides*		
Hiodontidae	Mooneye	*Hiodon tergisus*		
Cyprinidae	Spotfin Shiner	*Cyprinella spiloptera*		
Cyprinidae	Common Carp	*Cypinius carpio*		
Cyprinidae	Brassy Minnow	*Hybognathus hankinsoni*	X	X
Cyprinidae	Common Shiner	*Luxilus cornutus*	X	

Family	Common Name	Scientific Name	Thief River	Moose River
Cyprinidae	Silver Chub	*Machybopsis storeriana*		
Cyprinidae	Pearl Dace	*Margariscus margarita*	X	X
Cyprinidae	Hornyhead Chub[2]	*Nocomis biguttatus*	X	
Cyprinidae	Golden Shiner	*Notemigonis crysoleucas*		
Cyprinidae	Emerald Shiner	*Notropis atherinoides*	X	
Cyprinidae	River Shiner	*Notropis blennius*		
Cyprinidae	Bigmouth Shiner	*Notropis dorsalis*	X	
Cyprinidae	Blackchin Shiner	*Notropis heterodon*		
Cyprinidae	Blacknose Shiner	*Notropis heterolepis*		
Cyprinidae	Spottail Shiner	*Notropis hudsonius*	X	
Cyprinidae	Carmine Shiner	*Notropis percobromus*		
Cyprinidae	Sand Shiner	*Notropis stramineus*		
Cyprinidae	Weed Shiner[2]	*Notropis texanus*		
Cyprinidae	Mimic Shiner	*Notropis volucellus*		
Cyprinidae	Northern Redbelly Dace	*Phoxinus eos*	X	X
Cyprinidae	Finescale Dace	*Phoxinus neogaeus*	X	X
Cyprinidae	Bluntnose Minnow	*Pimephales notatus*		
Cyprinidae	Fathead Minnow	*Pimephales promelas*	X	X
Cyprinidae	Western Blacknose Dace	*Rhinichthys obtusus*		
Cyprinidae	Longnose Dace	*Rhinichthys cataractae*		
Cyprinidae	Creek Chub	*Semotilus atromaculatus*		X
Catastomidae	Quilback	*Carpoides cyprinus*	X	
Catastomidae	White Sucker	*Catostomus commersoni*	X	X
Catastomidae	Bigmouth Buffalo	*Ictiobus cyprinellus*		
Catastomidae	Silver Redhorse	*Moxostoma anisurum*		
Catastomidae	Golden Redhorse	*Moxostoma erythrurum*	X	
Catastomidae	Shorthead Redhorse	*Moxostoma macrolepidotum*	X	
Ictaluridae	Black Bullhead	*Ameiurus melas*		
Ictaluridae	Yellow Bullhead	*Ameiurus natalis*		
Ictaluridae	Brown Bullhead	*Ameiurus nebulosus*		
Ictaluridae	Channel Catfish	*Ictalurus punctatus*		
Ictaluridae	Stonecat	*Noturus flavus*		
Ictaluridae	Tadpole Madtom	*Notorus gyrinus*		

Family	Common Name	Scientific Name	Thief River	Moose River
Esocidae	Northern Pike	*Esox lucius*	X	
Umbridae	Central Mudminnow	*Umbra limi*	X	X
Salmonidae	Cisco	*Coregonus artedi*		
Salmonidae	Lake Whitefish	*Coregonus clupeaformis*		
Salmonidae	Rainbow Trout	*Onchorhyncus mykiss*		
Salmonidae	Brown Trout	*Salmo trutta*		
Salmonidae	Brook Trout	*Salvelinus fontinalis*		
Gadidae	Burbot	*Lota lota*		
Percopsidae	Trout-Perch	*Percopsis omiscomaycus*		
Cyprinodontidae	Banded Killifish	*Fundulus diaphanus*		
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	X	X
Cottidae	Mottled Sculpin	*Cottus bairdi*		
Centrarchidae	Rock Bass	*Ambloplites rupestris*	X	
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*		
Centrarchidae	Bluegill	*Lepomis macrochirus*	X	
Centrarchidae	Smallmouth Bass	*Micropterus dolomieu*	X	
Centrarchidae	Largemouth Bass	*Micropterus salmoides*		
Centrarchidae	Black Crappie	*Pomoxis nigromaculatus*	X	
Percidae	Iowa Darter	*Etheostoma exile*	X	X
Percidae	Johnny Darter	*Etheostoma nigrum*	X	
Percidae	Yellow Perch	*Perca flavescens*	X	
Percidae	Logperch	*Percina caprodes*		
Percidae	Blackside Darter	*Percina maculata*	X	
Percidae	River Darter	*Percina shumardi*		
Percidae	Sauger	*Sander canadense*		
Percidae	Walleye	*Sander vitreus*	X	
Scianenidae	Freshwater Drum	*Aplodinotus grunniens*	X	

[1]Minnesota Species of Special Concern (SPC)

[2]Species of Greatest Conservation Need (SGCN)

4. *Herpetofauna*

Assemblages of reptiles and amphibians (collectively herpetofauna) become more simplified as you get farther north due to the necessity for over-wintering strategies to deal with conditions that are increasingly hostile to these animals. Nonetheless, Thief Lake WMA sustains native populations of both (Table 13). Ten amphibians including frogs, toads and salamanders and eight reptiles including turtles, skinks and snakes have been documented on the WMA. Many amphibians and reptiles move between aquatic and terrestrial habitats and as such are major links in the flow of energy between these habitats. Gophersnake is listed as a species of Special Concern in Minnesota, and smooth greensnake is listed as a SGCN. None are harvested for commercial or sport purposes. Personnel from Thief Lake WMA have participated in Minnesota's frog and toad calling survey by conducting surveys on a route that runs from Roseau County north of the unit with stops in the sanctuary and along the South Lake Road. This is a dusk/nighttime listening survey to determine presence/absence at 10 pre-determined stops.

Table 13. Reptiles and amphibians known to occur in the vicinity of Thief Lake WMA.

Taxa	Common Name	Scientific Name
Amphibian	Eastern Tiger Salamander	*Ambystoma tigrinum*
Amphibian	American Toad	*Anaxyrus americanus*
Amphibian	Canadian Toad	*Anaxyrus hemiophrys*
Amphibian	Cope's Gray Treefrog	*Hyla chrysoscelis*
Amphibian	Gray Treefrog	*Hyla versicolor*
Amphibian	Spring Peeper	*Pseudacris crucifer*
Amphibian	Boreal Chorus Frog	*Pseudacris maculata*
Amphibian	Northern Leopard Frog	*Lithobates pipiens*
Amphibian	Mink Frog	*Lithobates septentrionalis*
Amphibian	Wood Frog	*Lithobates sylvaticus*
Reptile	Snapping Turtle	*Chelydra serpentina*
Reptile	Painted Turtle	*Chrysemys picta*
Reptile	Prairie Skink	*Plestiodon septentrionalis*

Taxa	Common Name	Scientific Name
Reptile	Smooth Greensnake[1]	*Opheodrys vernalis*
Reptile	Gophersnake[2]	*Pituophis catenifer*
Reptile	Red-bellied Snake	*Storeria occipitomaculata*
Reptile	Plains Gartersnake	*Thamnophis radix*
Reptile	Common Gartersnake	*Thamnophis sirtalis*

[1] Species of Greatest Conservation Need (SGCN)

[2]Minnesota Species of Special Concern (SPC)

5. Invertebrates

Invertebrates are an essential component of the food chain in many ecosystems. Invertebrate populations in the many habitats that comprise Thief Lake WMA are diverse and often not well understood or documented. There has been some interest in invertebrate populations within Thief Lake itself since the invertebrates are an important food resource for birds using the lake. This is particularly true for amphipods that are an important food resource for scaup. A long-term invertebrate monitoring survey focusing on amphipod resources has been conducted, and information has been collected on a variety of taxa. This study has allowed some measure of response of invertebrate populations to management actions.

Some initial sampling of tiger beetle populations was done on the oak savanna communities on the WMA west of the lake. A variety of species were encountered, and further sampling is planned.

Oblique lined tiger beetle

E. Public Use

Minnesota's wildlife management areas are used for public hunting, trapping, fishing, and other activities compatible with wildlife and fish management. Outdoor recreation has always accounted for the largest share of public use on the Thief Lake WMA, but the WMA is also used for non-recreational activities such as environmental education, timber harvest, and farming. Knowledge of the present use levels is necessary to predict the future demand for outdoor recreation and to guide management objectives and strategies. All recreational user facilities at Thief Lake WMA are shown in Figure 9.

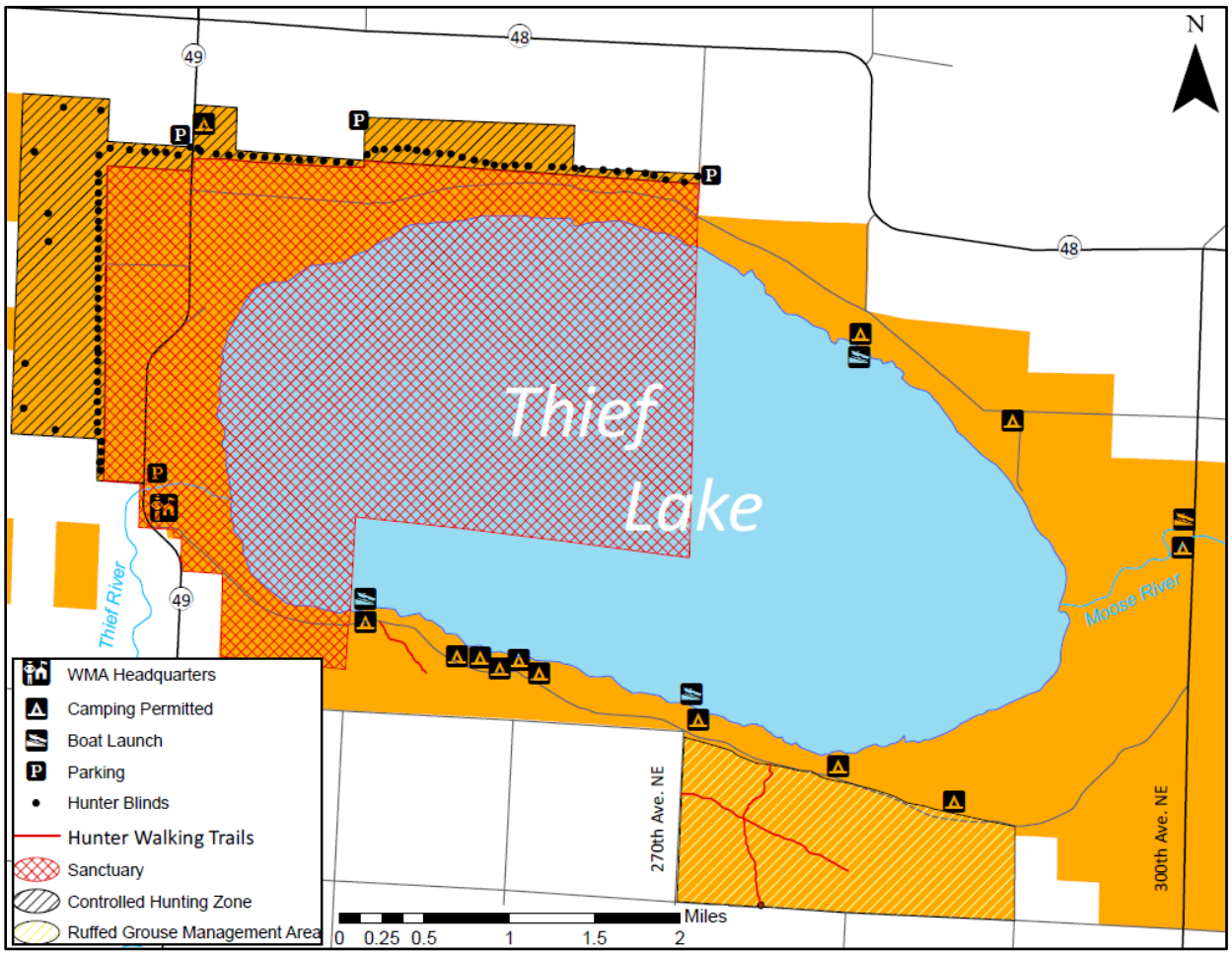


Figure 9. Thief Lake WMA user facilities

1. Hunting

Hunting is the dominant recreational use of Thief Lake WMA. WMA staff collect information on public use for those activities where a measure of participation can be quantified, such as waterfowl hunting. Other hunting activities, such as ruffed grouse hunting, occur at such low density or the users are so widely distributed that they can be challenging to quantify.

Therefore, participation in these low density or widely distributed activities is best measured in a regional or statewide context.

Waterfowl. Thief Lake is probably best known as a destination for waterfowl hunting. People come from all over Minnesota and the upper Midwest to hunt waterfowl each year. Waterfowl hunting can be subdivided into duck and goose hunting over water on Thief Lake, and goose hunting from the blinds in the Controlled Hunt Zone (CHZ). Estimates of hunter participation and harvest are made each year for both of these activities.

Waterfowl hunting on Thief Lake is done primarily from small boats and canoes, and four major access landings are located around the lake. Camping areas along the South Lake Road provide additional access to the lake (Figure 9). To estimate hunter participation from over water hunting, the number of vehicles are counted at these boat access points. Vehicle counts are conducted twice a day on three days of each week during the waterfowl hunting season: one weekend day, either Monday or Friday, and one day from Tuesday through Thursday. Hunters are then interviewed at the access points and records on hunter success (numbers of ducks harvested) and bag composition (species harvested) are collected. From the weekly three days of sampling, a seasonal tally of hunter use days is calculated by multiplying vehicle counts by the long-term average number of hunters per vehicle to arrive at a daily estimate of hunter use days. Using the stratified sampling protocol, estimates are then made for sequential five day periods throughout the season. These five day estimates are then added at the end of the season to arrive at an estimate of total use days for the season. Hunting success is estimated by dividing total daily bag (total ducks) by the number of hunters to arrive at ducks per hunter per day. Applying this information by species allows daily, 5-day period, and total season estimates of harvest by species.

Although variable from year to year, the number of hunter use days has been relatively stable during the time of these surveys (Figure 10). Sharp declines were observed in 1976, when duck season was delayed three weeks by the Commissioner due to fire danger, and in 2012, when lake levels were very low, impacting access. Hunter use days were elevated in 1975, 1977, 1978, and from 1994 to 1996, likely due to good fall flight forecasts following years of more restrictive regulations. With the exception of 2012, hunter numbers at Thief Lake in the past 20 years have generally been increasing. In contrast, hunter participation at the statewide level has been decreasing, particularly in the last 20 years (Figure 11).

Hunter success (number of ducks per hunter per day) has been generally increasing since 1973 based on the data collected as outlined above (Figure 12). Differences are noted between seasons in bag composition that probably reflect differing habitat conditions and continental abundance. Participation tends to be highest early in the season, and then tapers as the season progresses and the potential for icing increases. A variety of influences impact hunter participation in any given year. Shorter waterfowl hunting seasons typically coincide with lower continental waterfowl populations. Early freeze-up of the lake results in a truncated hunting season. High gas prices result in fewer hunters and fewer trips by hunters. Finally, water levels on the lake can influence participation, with low lake levels leading to difficult access and travel in and around the lake.

Waterfowl hunters on Thief Lake

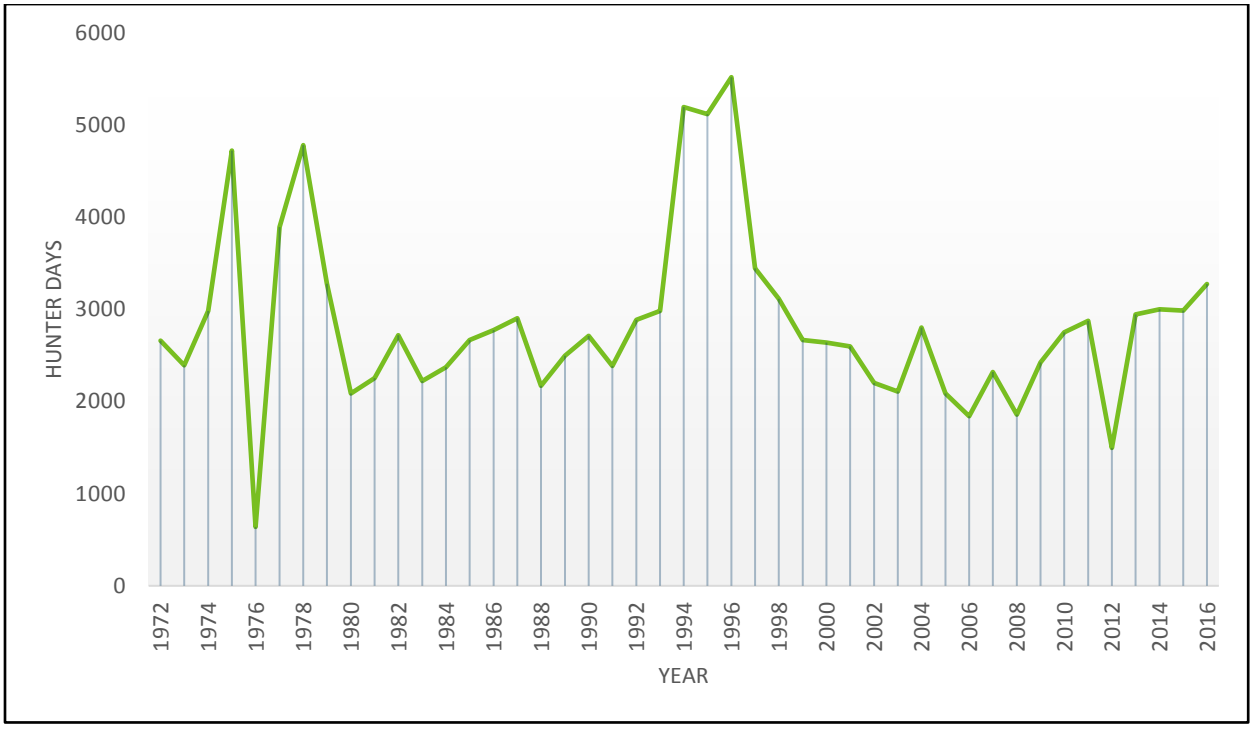


Figure 10. Season-long hunter use days on Thief Lake

Figure 11. Minnesota waterfowl stamp sales over the past 20 years

For a number of years, Thief Lake was known as a destination for goose hunting within the state. In the 1960s and 1970s, the majority of the geese being harvested in the state were interior Canada geese (*Branta canadensis interior*) of the Eastern Prairie Population (EPP) that nest on the western shore of Hudson Bay. Historically, Thief Lake and Roseau River WMAs were among the first stopovers on their journey south, and high numbers of birds staged within the sanctuary portion of the Thief Lake. Hunting pressure grew during this period to the point where some system of distributing hunting pressure seemed advisable. In 1973, a Controlled Hunt Zone (CHZ) (Figure 9) was created to manage the number of hunters and distribute harvest pressure. In the CHZ, hunters are required to hunt from one of the established blinds west and northwest of the sanctuary on Thief Lake. Drawings were held twice a day to determine priority in choosing blinds. In 1973, 58 blinds were built for the lottery. The system proved effective, and in 1982 the area was expanded to the east to include a total of 85 blinds and shooting stations.

All geese taken in the CHZ or checked with hunters on Thief Lake are measured to assign sub-specific affiliation. In the 1970s and 1980s, the clear majority of geese taken were EPP birds. In the 1990s, an increasing proportion of the harvest was comprised of locally nesting (within the region) giant Canada geese (*B. c. maxima*), and goose hunting opportunities became generally available throughout the state. Goose numbers staging at Thief Lake began to decline, as did hunter days in the CHZ as new staging areas became available in Manitoba (Figure 13). As hunter days in the CHZ declined, the necessity for conducting twice a day drawings and staffing the CHZ decreased. Starting in 2001, hunters using the CHZ were allowed to do so on a first-come, first-served basis, and hunters were checked periodically at the access points. Hunting pressure and success are assessed through a combination of stratified car counts and weekend bag checks.

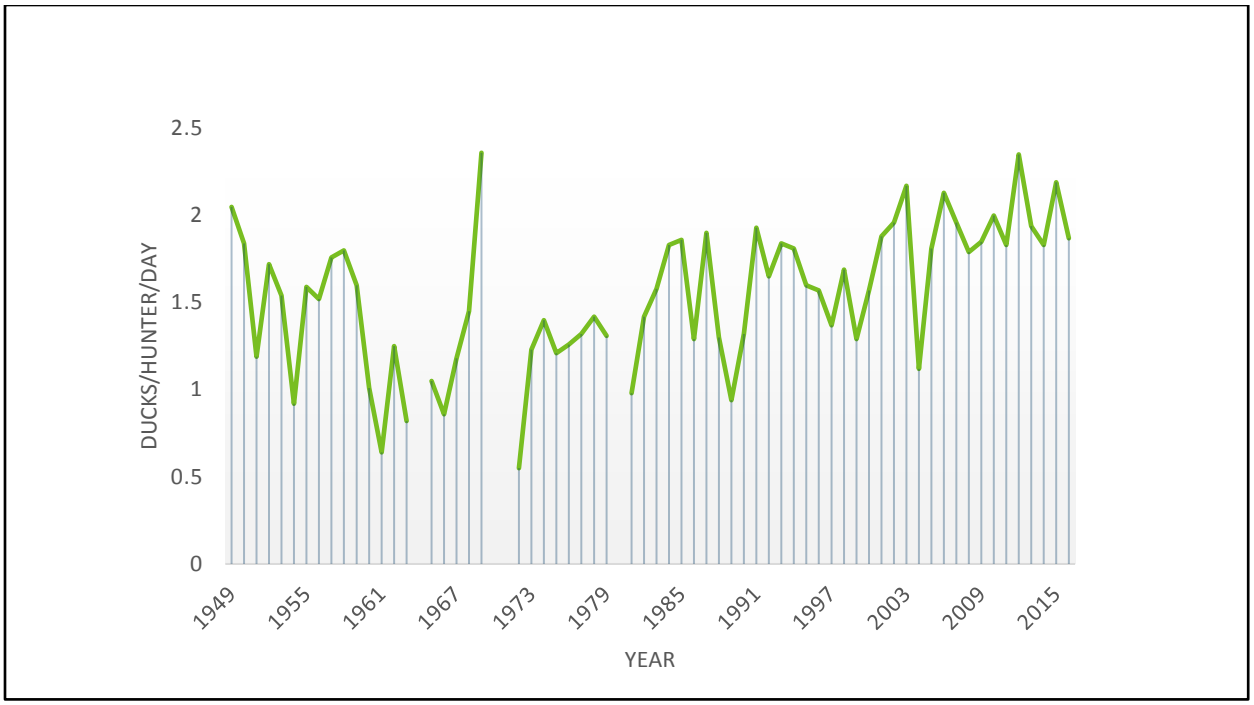


Figure 12. Hunter success on Thief Lake as determined by ducks per hunter per day

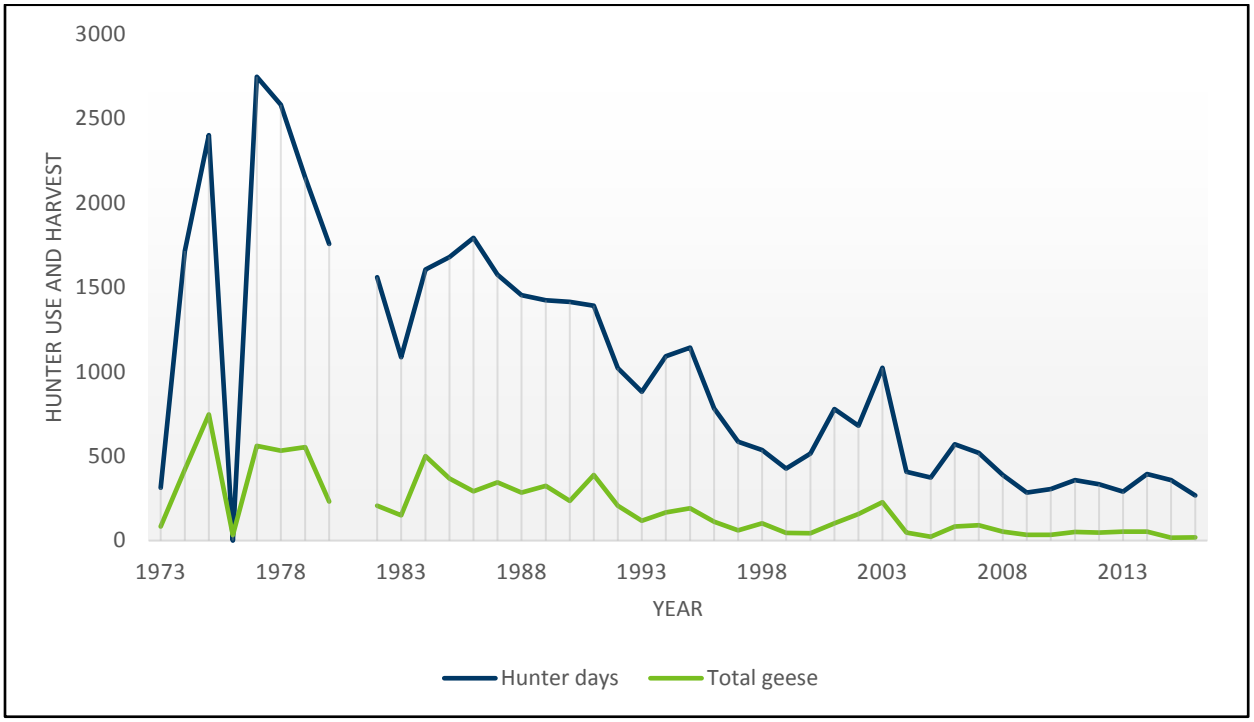


Figure 13. Controlled Hunt Zone hunter use and harvest at Thief Lake WMA

Deer. Deer hunting is a popular activity on Thief Lake WMA. The WMA provides a mix of habitats preferred by deer. The deer hunting opportunities on the WMA are available to the public from mid-September through the end of December in a combination of archery, firearms and muzzleloader seasons. Historically, Thief Lake WMA was contained entirely within Permit Area (formerly killblock) 202, which was essentially the WMA and adjacent private lands. The discovery of bovine tuberculosis near Skime in 2005, and subsequent efforts to control and eliminate it from 2007 to 2011, resulted in new Permit Areas (Figure 14). The western half of Thief Lake WMA now lies in Permit Area 268, while the eastern half is in Permit Area 101. A 100 series Permit Area allows a firearms season that is one week longer than those in Zone 2. Vehicle counts are conducted during the first three days of the firearms deer season to get an index of hunter effort on the WMA (Figure 15). The counts are divided into three segments – the Randen Ridge is the eastern-most segment of the unit, while the Thief Lake core describes the center, and the Dohrman Ridge characterizes pressure in the western part of the unit. Counts were not conducted in 2002 to 2005, when Section of Wildlife staff statewide were conducting sampling for Chronic Wasting Disease (CWD).

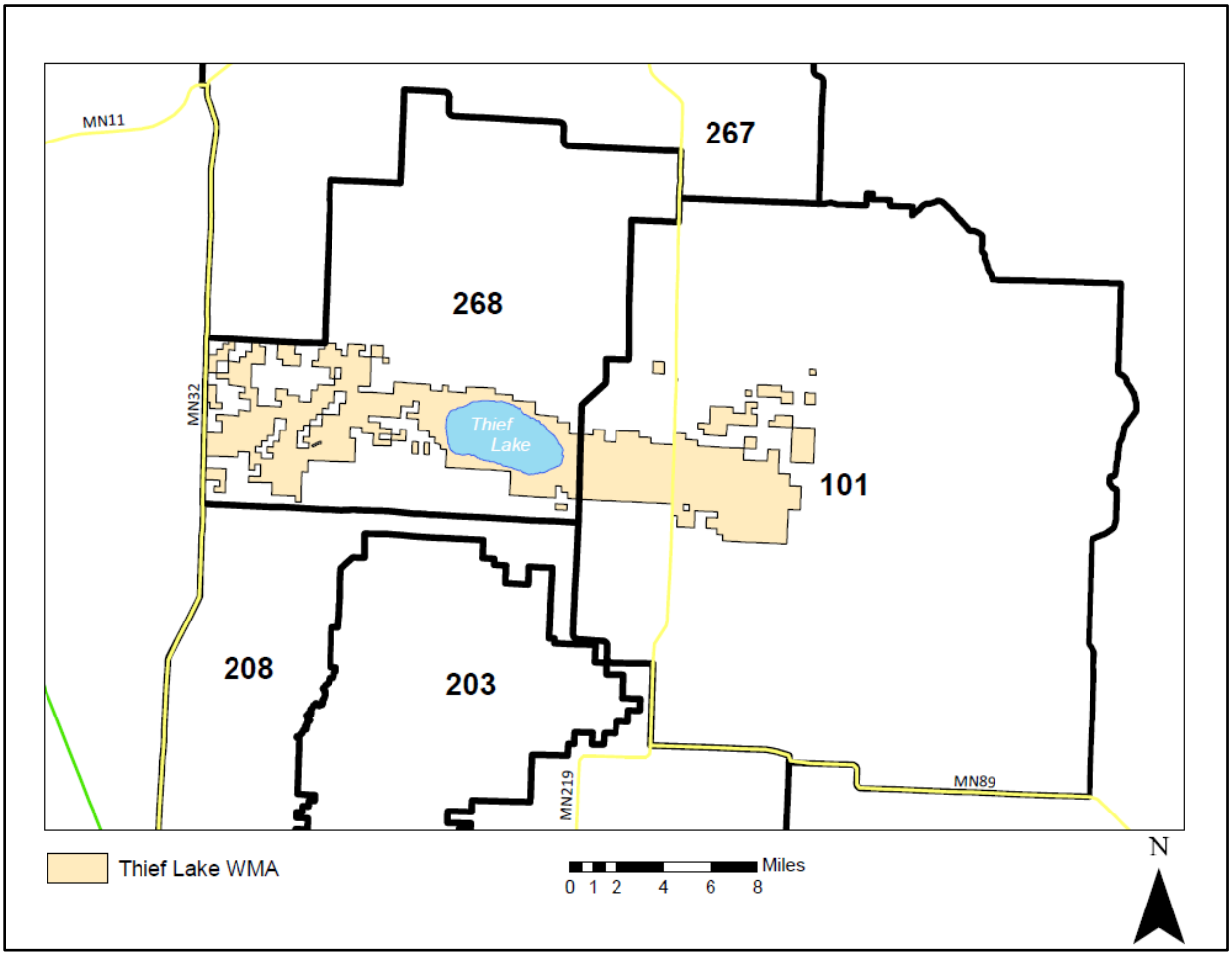


Figure 14. Deer permit areas at Thief Lake WMA

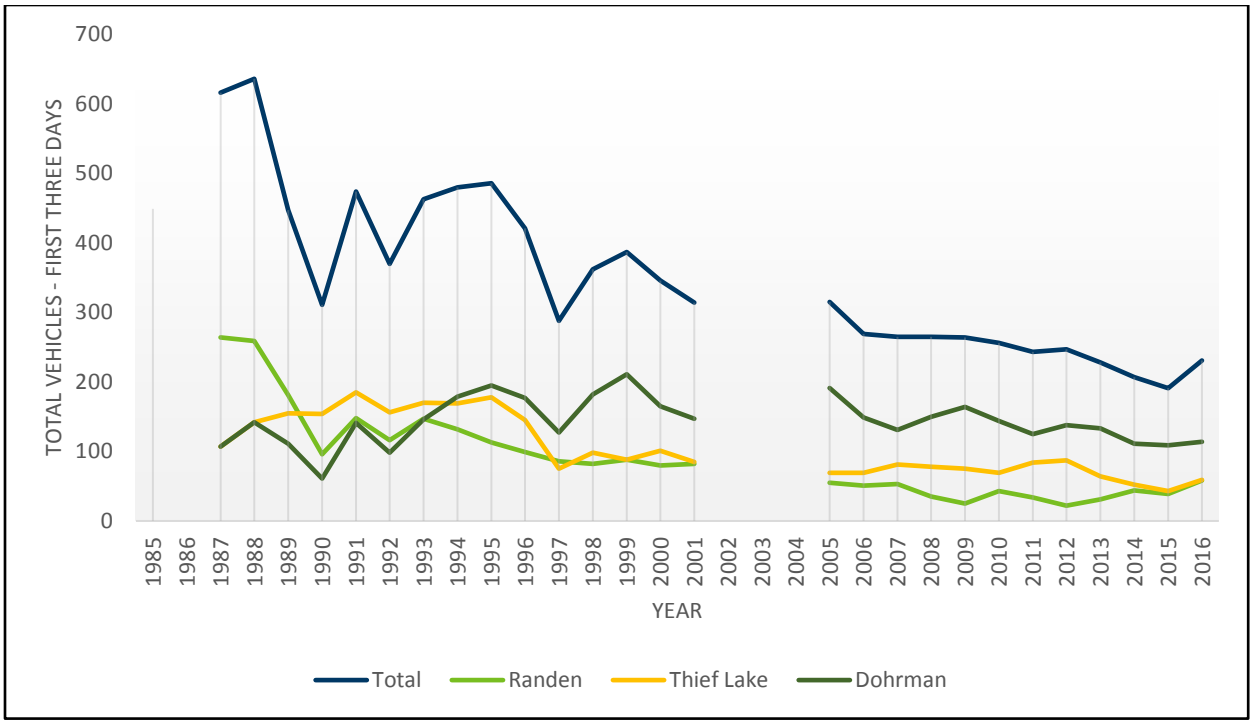


Figure 15. Deer hunter effort at Thief Lake WMA

Bear. Bear hunting is an increasingly popular activity on the unit. The Randen Ridge portion of the WMA lies within Bear Management Unit (BMU) 12 (with limited permits), while the remainder lies in the No-quota area, where permits are available over the counter. No discrete measures of bear hunting on the unit are available, although there is competition with outfitters for bait site locations.

Moose. While moose were hunted on an alternate year basis at the time of the 1980 plan, moose have not been hunted in the Thief Lake area since 1995, due to population declines.

Elk. In years when the Grygla elk herd is above the population goal, public hunting seasons are used to bring the herd back into the desired range. Only a small portion of Thief Lake WMA has historically been included in the hunt zone for this herd (south of the Moose River in Veldt and Linsell Townships). The herd has spent more time along the south boundary of the unit in recent years, and if this pattern persists, consideration should be given to expanding the hunt zone to include more of the WMA.

Grouse. Ruffed grouse hunting is a popular pursuit on the WMA, and a variety of hunter walking trails (HWT) are maintained to facilitate access. Many hunters hunt grouse while already camping in the area for waterfowl hunting, and no separate estimates of hunter activity are undertaken.

Sharp-tailed grouse are also present and occasionally taken on the area, although informal conversations with hunters on the unit suggest that the majority of hunting pressure for this species is on adjoining private lands.

Turkey. Turkeys are a relatively recent addition to the WMA's complement of wildlife. The birds on the unit are believed to have originated from birds introduced in 2006 to New Maine WMA, which is located about 4 miles to the southwest of Thief Lake WMA. Turkey populations are working their way eastward, but seem well established on the oak ridges of the Dohrman Ridge. Turkeys may be legally taken there with a permit for Permit Area 509, which includes the whole of the northwest portion of the state.

Other Small Game. A variety of other species of small game are present on the unit. Many are taken in combination with other species (e.g. woodcock taken by grouse hunters, sandhill cranes taken by goose hunters). Mourning doves are present through summer but tend to leave the area as the hunting season begins, and relatively little hunting pressure is expended on them. Snowshoe hares are present, along with small numbers of white-tailed jackrabbits and gray and fox squirrels, but very little hunting pressure is exerted for these species.

Huntable Furbearers. Huntable populations of furbearers are present on the unit, although hunting activity is minimal. These include red fox, coyote (unprotected), bobcat, raccoon, and when regulations allow, gray wolf (by permit).

2. Trapping

Trapping is permitted on the WMA, and all trappers on the unit are required to have a special use permit (no associated cost) to trap on the unit (MN Rule 6230.0200). At the time of the 1980 plan, trappers were assigned to discrete exclusive trapping areas. Trapper numbers declined to the point where trappers are now allowed to trap anywhere on the unit with the exception of the sanctuary. Trapper numbers on the unit have shown some increase over the last two decades with some fluctuation driven by fur markets (Figure 16). Trapping is a very traditional pursuit, and many of the trappers have been trapping on the unit for a number of years. On rare occasions, the sanctuary has been opened to trapping to control muskrat numbers when necessary. This allowance is done via special use permit. Trappers are occasionally issued special use permits to trap beaver in specific locations where problems occur. As a condition of their permit, trappers are required to report harvest on the unit at the end of the trapping season.

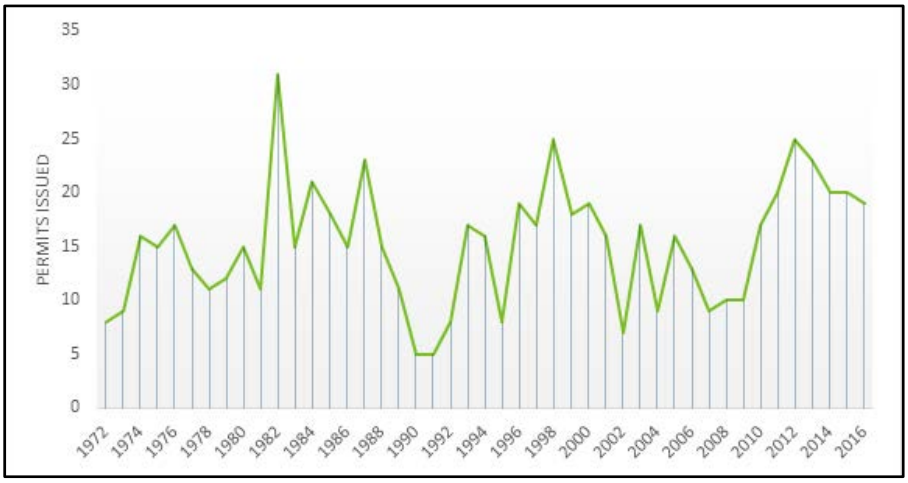


Figure 16. Number of fall trapping permits issued at Thief Lake WMA

3. Wildlife Observation

Wildlife observation is an activity that occurs widely, but it is often difficult to quantify. Nearly all visitors to the area are looking to observe wildlife whether they are hunting or not. Several improvements have been made to facilities and free handouts to enhance the experience of visitors looking to observe wildlife. These improvements include the following:

- Construction of the observation mound and picnic area. This installation offers a scenic overview of the lake, interpretive signage, and picnic facilities.
- Creation of and updating of the area bird list in a checkoff format for birders interested in knowing what species are typically observed at the WMA (Appendix F)
- Inclusion of Thief Lake on the Pine to Prairie birding trail (Pine to Prairie Bird Trail Website).
- Maintenance of the South Lake Road to enhance public access during summer months.
- Boat launches and camping areas originally created and maintained for duck hunters are also available to the public beyond the waterfowl season.
- Development of WMA map with guides to facilities and cover types.
- Historical sign kiosks at four locations explain the history and layout of the area.

American bittern observed at Thief Lake WMA

4. Other Recreational Opportunities

A variety of wild foods are available for harvest for personal use on the WMA. This includes, but is not limited to, picking mushrooms, raspberries, blueberries, juneberries, chokecherries, and highbush cranberries.

Snowmobiling is allowed on WMAs north of Highway 2 (Minnesota Statute Section 282.001), including Thief Lake WMA. In certain areas, Grant-in-Aid snowmobile trails have been established through the WMA. A warming shack is located on the south boundary.

ATV and Off-Highway Vehicle (OHV) use on Thief Lake WMA is restricted to deer retrieval for two hours after shooting time during the firearms deer season. They are also allowed on several short con con ATV trail segments. Their use is prohibited on WMA roads but is allowed on Township roads.

5. Other Public Use

Other public uses that do not fit into a recreational category occur on the WMA. These activities include environmental education, timber harvest, and farming.

Environmental education opportunities occur when school groups, university classes or Ducks Unlimited Greenwing groups arrange for tours or field days on the unit. Job shadow requests are accommodated as schedules allow. Occasionally displays (such as the wing board or antlers and skulls) are taken from the check station for presentations at schools.

Most of the timber harvest that occurs on the WMA is done by private logging operations with contracts administered by Division of Forestry. Sales are setup and administered by Division of Forestry with input from Section of Wildlife. Fuelwood sales to private individuals are largely accommodated by salvage permits offered to the public at log landings. In certain specific instances, salvage permits may be allowed for wind or fire damage salvage.

Farming by private individuals on WMA lands takes two forms depending on the underlying land ownership status. On acquired WMA and con con WMA lands, farming is done under a Cooperative Farming Agreement (CFA). In most situations, the cooperator is entitled to three-quarters of the crop, and the state is entitled to one quarter. The state's share can be in the form of a food plot left standing on site, taken as harvested crops for use as seed or for banding operations, as a service, or as cash with the payment deposited in the Game and Fish Fund. In some instances, the underlying lands within the WMA are School Trust lands. In these instances, any farming that occurs is done via a lease with proceeds going to the School Trust.

VI. Threats to Resources

A. Climate Change

The following excerpt on climate change is taken from the Minnesota Department of Natural Resources Division of Fish and Wildlife Guidance for Operational Order 131 (Climate Adaptation and Mitigation in Natural Resource Management):

"The mission of the Division of Fish and Wildlife is to work with the people of Minnesota to conserve aquatic and terrestrial habitat, manage fish and wildlife populations and habitat, provide fisheries and wildlife related recreation, and preserve and foster Minnesota's outdoor heritage. Climate change has and will continue to affect our ability to fulfill this mission for the foreseeable future.

Climate change is affecting Minnesota's fish and wildlife populations—altering behavior, distribution, development, reproduction, and survival. Although some populations are directly affected (e.g. altered snow cover, high temperatures, advance of spring conditions, drought), many of the effects are indirect (e.g. changes in plant communities, change in interspecific interactions, expansion of invasive species, changing agricultural practices). Not all species are adversely affected by climate change; however, it is widely accepted that detrimental changes will exceed beneficial changes in fish and wildlife populations.

Climate change is also altering habitat conditions in Minnesota's lakes, streams, grasslands, wetlands, and forests. Some invasive species, previously limited by cold temperatures, are expanding their reach and impact. Temperatures and dissolved oxygen regimes in lakes are shifting— reducing cold water habitat. Stream temperatures are increasing and flow regimes are altered— reducing aquatic habitat. Although at slower rates, the quality and availability of terrestrial habitat is also changing. Boreal forests will face increasing stress, dominance in grassland plant communities will shift, and wetland hydroperiods will be altered."

The Nelson Institute Center for Climatic Research has published projections for climate variables across timeframes. Between 1980 and 2055, average temperatures in Minnesota are projected to increase by 5 to 7^{o}F in winter and 3 to 5^{o}F in summer. The projections toward the end of the 21st century (2090) show even more dramatic increases of 11 to 13^{o}F in winter and 7 to 9^{o}F in summer (Nelson Institute Center for Climatic Research, 2017). These projections indicate that Minnesota will warm slightly faster than the Midwest as a whole (Pryor, et al., 2014).

Precipitation is projected to increase by 1.6 to 4 inches per year by mid-century (Pryor, et al., 2014) and by 3 to 5 inches per year by late-century (Nelson Institute Center for Climatic Research, 2017). The frequency of heavy precipitation events (defined as upper 2 percentile of historic rainfalls) has increased by 37% since the 1950s (Walsh, et al., 2014). This change is especially notable given that over 40% of annual total precipitation in Minnesota occurs during the 10 wettest days of the year (Kunkel, et al., 2013). The frequency of 2 inch precipitation events (defined here as the number of days per decade with precipitation of at least two inches) is projected to increase by 1.5 to 6 days by the end of the 21st Century and days with 3

inches of precipitation will increase by as much as 2 days per decade (Nelson Institute Center for Climatic Research, 2017). Such extreme precipitation events will result in greater surface runoff and less percolation into the soil (Pryor, et al., 2014).

Despite an increase in the number of heavy precipitation events, summers are expected to become hotter and drier. Increasing temperatures and declining soil moisture during summer will have dramatic effects on land use practices and plant communities (Pryor, et al., 2014). As summer precipitation amounts decrease, the potential need for other forms of water will increase. Increases in ground water use will increase, having a negative impact on ground water recharge and aquifers. Reductions in groundwater and recharge will also affect streams and rivers that are groundwater dependent to continue summer base flows. Many perennial streams utilize groundwater for their summer base flows.

Vegetation patterns are expected to adjust in response to climate change (Pryor, et al., 2014). Even minor changes in the ratio of precipitation to evapotranspiration can shift biomes from forests to grasslands (Frelich, Reich, Danz, & Fisichelli, 2012). Tree species composition in forests will likely change. Research suggest that black spruce, white spruce, balsam fir, tamarack, and paper birch may be extirpated due to direct mortality; that deer herbivory may prevent white cedar from germinating, and that bur oak, white oak, red maple, American elm, red elm, hackberry, and basswood may become more prevalent (Galatowitsch, Frelich, & Phillips-Mao, 2009).

Climate change may also affect forest disturbances by changing the frequency, duration, and severity of fires, droughts, tornados, outbreaks for insects and pathogens, and severe storms (Dale & et al., 2001). Several climate change models predict warmer, drier conditions for existing deciduous forests. Under this scenario, if managed with fire, deciduous forests will tend toward savanna types (fire-dependent hardwood systems) and the range of mesic (moist but well drained) hardwood forests will likely contract in size and range. If not managed with fire, these areas will likely become brushlands or become dominated by non-native woody invasive species (Hansen, et al., 2001). Expansions of oak-hickory and oak-pine forests (fire dependent drier forest types) as well as reductions in aspen/birch forests (a mesic hardwood type) are also predicted (Prasad, Iverson, Matthews, & Peters, 2007).

Predicted changes in climate could influence the wildlife habitat within Thief Lake in many ways. Increased variability in the drought/deluge cycle could cause changes to the aquatic vegetation community. Drought periods could increase hybrid cattail expansion, as was seen during the low water levels in the summer of 2012, and deluges could decrease aquatic vegetation diversity and abundance. Research indicates that the likelihood of winter fish kill is strongly reduced in northern states under several predicted climate change scenarios (Fang & Stefan, 2000). Decreased frequency and intensity of winter fish kills in Thief Lake could lead to lower water clarity, lower invertebrate populations, and fewer submersed aquatic plants. Larger rain events and the effects of consolidated drainage in the watershed could cause increases in both nutrient and pollution levels within the basin.

B. Invasive Species

An invasive species is defined as a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Clinton, 1999). Invasive species include plants, animals, and other organisms. Human activities, either intentional or unintentional, are the primary means of spread and cause of new introductions. Unintentional movement of invasive species is of great concern in regard to natural resources. The unintended movement of an animal, plant, plant part, or seed has the potential to adversely impact an entire system. There are many invasive plants and animals within and adjacent to Thief Lake WMA that pose significant risks to native species. Educating users, early detection, and aggressive treatment of invasive species can be effective tools in minimizing new introductions and their further spread.

1. Animals

Invasive terrestrial earthworms are present within Thief Lake WMA. The current extent and abundance of them is unclear. These worms first arrived to North America from Europe, likely through soils and plants that were transported by Europeans. The worms alter the composition of the forest floor by consuming the fallen leaves that make up the duff layer. This leads to a lower survival rate of tree seedlings and other forbs and can facilitate the establishment of invasive plants.

Animals that are not known to be present within the WMA but have the potential to be in the future include mute swans (*Cygnus olor*), emerald ash borers (*Agrilus planipennis*), feral swine (*Sus scrofa*), common carp (*Cyprinus carpio*), faucet snails (*Bithynia tentaculata*), and gypsy moths (*Lymantria dispar*).

2. Terrestrial Plants

Woody Plants. There are four woody invasive species known to occur within the WMA (Figure 17). The one posing the largest threat is European buckthorn (*Rhamnus cathartica*). Buckthorn was first brought to Minnesota from Europe in the mid-1800s as a popular species for hedges. Shortly after its introduction, it was found to be highly invasive. It is a concern to managers because it outcompetes native plants, degrades wildlife habitat, serves as a host to other pests, and forms an impenetrable layer of vegetation. Buckthorn occurs in a large patch one mile northeast of Middle River. Additionally, scattered individuals occur along the South Lake Road.

The three other species are exotic honeysuckles (*Lonicera* spp.), Siberian elm (*Ulmus pumila*), and Siberian peashrub (*Caragana arborescens*). Exotic honeysuckles are present around headquarters and are also scattered throughout the WMA. These honeysuckles were once commonly planted for wildlife. They often invade savanna and woodland edge habitats, where they compete with native plant species.

Siberian peashrub and elm occur at very low densities in the WMA. Siberian peashrub is only known to occur ¼ mile southeast of headquarters. One Siberian elm tree has been documented on the WMA approximately one mile northeast of Middle River.

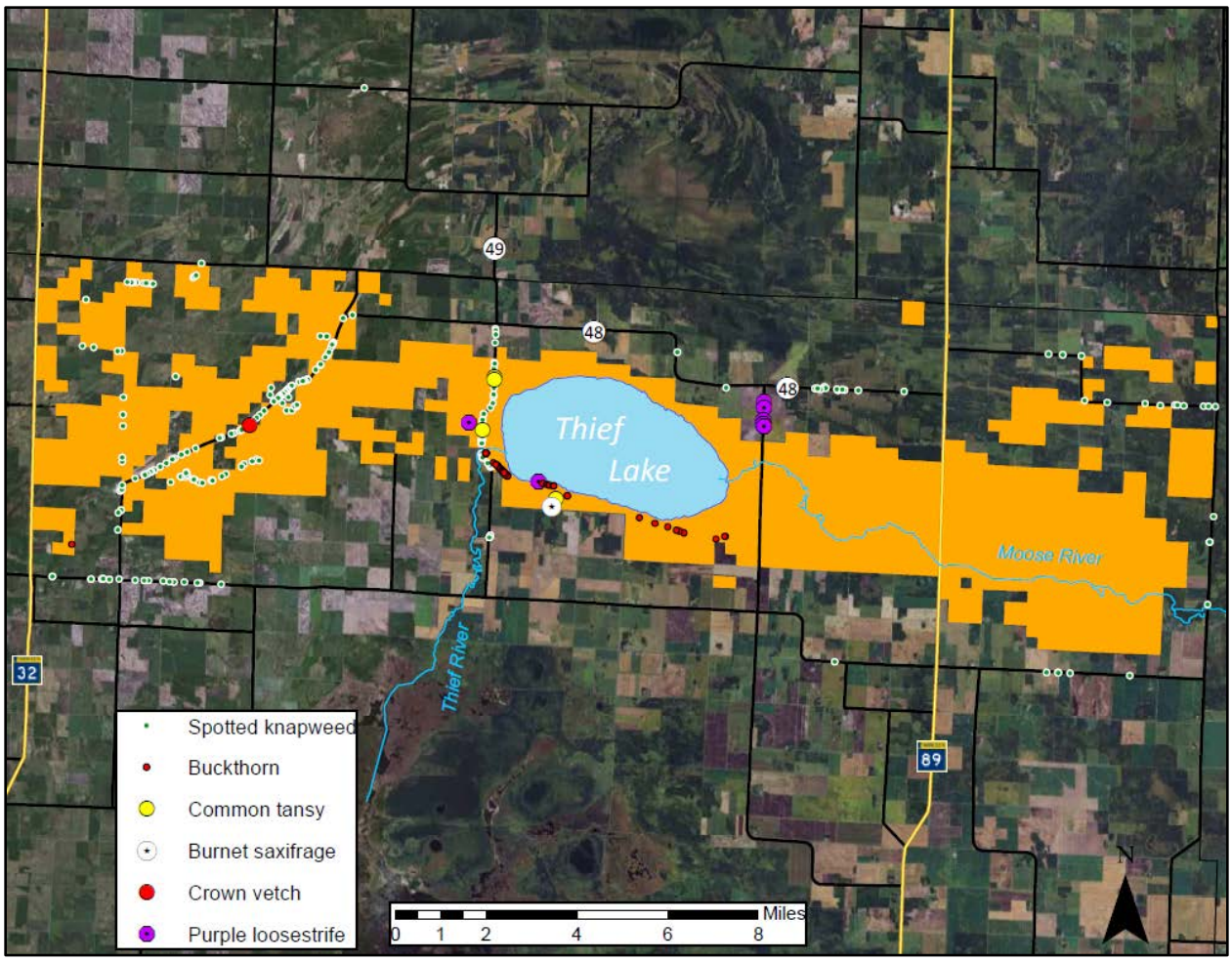


Figure 17. Known locations of select invasive species at Thief Lake WMA

Herbaceous Plants. There are three species present within the WMA that are on the Minnesota's prohibited noxious weed list and must be controlled: Canada thistle (*Cirsium arvense*), common tansy (*Tanacetum vulgare),* and spotted knapweed (*Centaurea stoebe*). Efforts are being taken to prevent the spread, maturation, and dispersal of propagating parts of these species. A fourth species, leafy spurge (*Euphorbia esula*), occurs within Nereson Wildlife Management Area, approximately eight miles north of Thief Lake.

Canada thistle invades natural areas such as prairies, savannas, wet prairies, and sedge meadows where disturbance exists. Once established, it outcompetes native plants and forms dense stands. The seeds are tufted for dispersal by the wind and remain viable in the soil for over 20 years. Canada thistle is currently widespread throughout the work area.

Common tansy was introduced to the United States from Europe for medicinal and horticultural purposes. Common tansy displaces native vegetation and forms dense stands in disturbed sites. It has been documented at three separate locations within the WMA, all presumably old homestead sites.

Spotted knapweed is native to Europe and Asia. It threatens dry prairie, oak savannas, and sandy ridges where it is phytotoxic and spreads rapidly. It currently occurs scattered along County Road 48, near the Dohrman Ridge. In the summer of 2016, staff observed an infestation at a private gravel pit just north of the WMA. It is also present at a private gravel pit on the west side of the WMA, off of County Road 48.

A plant on the restricted noxious weed list that occurs within the management area is crown vetch (*Coronilla varia*). A restricted noxious weed is defined as being widely distributed in Minnesota and is detrimental to human or animal health, the environment, public roads, crops, livestock or other property (Minnesota Department of Agriculture, 2017). Crown vetch invades prairies, disturbed sites, woodland edges, and roadsides. It is known to occur at one location in a parking lot on the north County Road 48 along the Dohrman Ridge.

Other nonnative species of concern occurring within the WMA include birdsfoot trefoil (*Lotus corniculatus*), burnet saxifrage (*Pimpinella saxifrage*), common burdock (*Arctium minus*), and stinking chamomile (*Anthemis cotula*). Although these species aren't listed on the Minnesota's noxious weed list, they do pose threats to native communities.

Birdsfoot trefoil and burnet saxifrage both invade prairies, roadsides, and disturbed open areas. Birdsfoot trefoil forms dense mats that choke and shade out native plants. Birdsfoot trefoil is currently present along roadsides within the WMA, but has yet to be documented invading any open areas or prairies. Burnet saxifrage was first documented on the WMA in 2013; to date, it has only been officially verified in four Minnesota counties. In addition to invading open areas, burnet saxifrage can also invade woodland edges.

Common burdock occurs in the woods near headquarters and scattered along the South Lake Road. It invades pastures, fields, and other open areas. It produces burs that readily stick to clothing and fur.

Stinking chamomile flourishes in disturbed areas, especially areas that are tilled for agricultural purposes. It forms dense stands, and the finely-divided leaves make it difficult to control with herbicide. Within the WMA, it is not yet known to invade open areas that are undisturbed.

Other nonnative species that occur on the management area include oxeye daisy (*Chrysanthemum leucanthemum*), perennial sow thistle (*Sonchus arvensis*), and smooth brome grass (*Bromus inermis*). These species appear to be present mostly along roadsides and are not posing an immediate threat to habitats within the WMA.

3. Aquatic Plants

There are three known invasive aquatic plant species occurring within the WMA: purple loosestrife (*Lythrum salicaria*), hybrid cattail (*Typha x glauca*), and reed canarygrass (*Phalaris arundinacea*). Each of these species has the potential to negatively impact the quality of wetlands.

Purple loosestrife invades marshes and replaces native species such as sedges, broadleaf cattails, and other wetland plants. It forms dense stands and infested areas become unusable to native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and

turtles. Staff is currently aware of three small infestations around Thief Lake and are actively working to control them.

Hybrid cattail has been present around and within the Thief Lake basin for decades. It forms dense stands and outcompetes native species. It has been slowly encroaching into the lake. In 2012, drought conditions and the lake being 1-1.5 feet below target level throughout the growing season caused the encroachment to become much more extensive. Treatment of cattail within the Thief Lake basin began in July 2015; the treatments appear to be successful at setting the cattail back at this point.

Reed canarygrass is present throughout the WMA in many wetlands. It is a major threat to wetland habitats as it often outcompetes native species by forming dense stands. Invasion by reed canarygrass is generally associated with disturbance.

Invasive aquatic plants that are not known to exist on the WMA but would likely have negative impacts if introduced include Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), non-native phragmites (*Phragmites australis subsp. australis*), and starry stonewort (*Nitellopsis obtuse*).

Staff treating invasive buckthorn at Thief Lake WMA

C. Operational Constraints

A number of operational constraints limit habitat management and facility maintenance on Thief Lake WMA, and many of these influences are intertwined (e.g. budget, which in turn limits staffing and fleet). A brief discussion of different categories of constraints follows.

1. Budget/Funding

Wildlife and fish administration and management in Minnesota is financed primarily through appropriations from the Game and Fish Fund. Receipts from hunting, trapping, and fishing license sales, and income derived from WMAs along with Wildlife and Sport Fish Restoration grant funds are deposited into the Game and Fish Fund. These monies are dedicated for statewide fish and wildlife management and are appropriated by the Legislature to the Minnesota DNR.

Wildlife and Sport Fish grant funds are derived for the Pittman-Roberson Federal Aid in Wildlife Restoration Act and the Dingell-Johnson Sport Fish Restoration Act. These Acts impose excise taxes on sporting arms and ammunition, archery equipment, and fishing tackle, and a fuel tax for motor boat use. Funds from these taxes are used to match State Funds for federally approved wildlife and fish projects.

Since the time of the 1980 plan, a number of dedicated income sources that provide income for wildlife management have come into play, with limitations on activities that can occur with these funds. These include the State Duck Stamp, Pheasant and Turkey Stamps, LCCMR, LSOHC, and specific additions to small and big game licenses over the years. These additions have made funding of wildlife more robust to the year to year fluctuations in Legislative funding, but have resulted in complex budgets with funding focused for specific activities. Area budgets are apportioned to Wildlife Area offices by the Regional office. Annual funding by category will determine the money available for fleet and supplies after accounting for staff, building maintenance assessments, PILT payments (Payments-In-Lieu-of-Taxes) and other assessments. Baseline funding for staff, fleet, and assessments comes in the form of a Basic Programs and Services (BPS) budget. Additional, project specific funding is competed for annually and apportioned by the DNR's Northwest Region.

2. Staffing

The number of personnel on site and their capabilities is a big determinant of what work gets done on the WMA. Staffing has varied over time and has included both full-time and seasonal personnel. Current staffing consists of a resident manager and assistant manager, along with a full-time general repair worker and a laborer. A half-time Office and Administrative Specialist serves on alternate days.

A DNR Roving Crew stationed in Mentor provides additional support on WMAs throughout the DNR's Northwest Region. The crew consists of a leader and up to six technicians and laborers. Their work is funded by the Outdoor Heritage Fund and is limited to prairie and wetland habitats. At Thief Lake WMA, they have been used for prescribed burning (both to supplement

Thief Lake staff and conducting burns by themselves) and for wetland work (primarily hybrid cattail spraying using the station Marsh Master II®).

3. Fleet

As a Major Unit, Thief Lake WMA is fortunate to possess a variety of fleet equipment that allows the staff to take on a number of projects. Much of this equipment is shared but located at Thief Lake WMA with the intent to allow use by nearby wildlife stations. Frequent use in rugged or wet conditions can shorten the expected performance window of the equipment. Over the years, staff have been able to upgrade performance and have more equipment with tracked and amphibious capabilities.

Because some of the equipment is specialized or for specialized applications, the equipment often is only used seasonally. When this equipment is shared the result is more demand than supply, and there is a need to prioritize equipment use, with the result that not all work can be accommodated in a given year.

4. Operational Orders

The DNR has Operational Orders, which guide how business is conducted. These Orders define the limits and ways that specific work is undertaken. Operational Orders are revised periodically as new tools or techniques become available, and occasionally Orders are rescinded as technology or other changes renders them obsolete. Operational Order 135, for example, deals with farming on WMA lands, and is currently undergoing revisions. The standards for pesticide use, tillage, crop rotation, and fertilizer use are all being revised, and may not conform to current conventional methods. The goal of this operational order is for healthier soils and improved conditions for wildlife populations including pollinators on WMA lands.

5. Weather

Weather has an overriding influence on what work is completed on the WMA. Weather plays a controlling role in unit farming, determining what fields staff can access, what crops can be sown, and how well those crops fare. Frost conditions determine whether staff can shear brush in a given winter, harvest timber, or whether staff can access areas for fall and winter brush mowing. Recent rainfall and wind conditions determine whether staff can get the desired effects from prescribed burns, or even if they can be accomplished at all. Rain and snow can determine access and whether areas need to be plowed or graded. Rainfall and snowmelt events need to be monitored so that water level management in wetland pools can be maintained and desired levels achieved, or so that bounce can be minimized during the nesting season. Season long weather (e.g. temperature and snow) can impact overwinter survival of resident wildlife populations.

6. Water Supply

Water supply is a closely related subset of weather effects. Specific wetland management strategies (e.g. pumping water onto a Moist Soils Unit, or achieving a specific pool level for access following a drawdown) are contingent on having a water supply either upstream or within pumping distance for smaller units.

D. Wildlife Disease and Parasites

A variety of wildlife diseases threaten wildlife populations that use Thief Lake WMA. Methods for dealing with disease outbreaks are outlined in the Thief Lake Disease Contingency Plan last updated in 2007 (Appendix A). A variety of disease and parasite outbreaks have occurred or have the potential to impact wildlife populations on the WMA and are summarized below.

1. Waterfowl Diseases

Waterfowl are susceptible to a number of infectious diseases that cause mortality including avian cholera, avian botulism, avian tuberculosis, avian salmonellosis, chlamydiosis, duck plague, aspergillosis, and avian influenza. A common denominator among outbreaks is a concentration of waterfowl, and often poor water quality. Avian botulism outbreaks have occurred at Thief Lake. Similarly, Newcastle disease virus kills colonial nesting waterbirds such as cormorants, pelicans, gulls, and terns. Both botulism and Newcastle disease are most commonly observed in late summer, and weekly airboat surveys looking for mortality are usually done from late August until the week before waterfowl season. Avian influenza (AI) occurs naturally in waterfowl and other bird populations. Extensive sampling for avian influenza has occurred at Thief Lake. While a number of birds have been detected with low-pathogenic AI, no birds in this area have yet tested positive for high-pathogenic AI. Avian salmonellosis and aspergillosis also infect songbirds, but the source of these outbreaks is usually moldy, contaminated food at feeders, which also serve as the requisite concentration point.

2. Bovine Tuberculosis

Bovine tuberculosis (BTb) is an infectious disease caused by the bacterium *Mycobacterium bovis* that is transmitted by the exchange of respiratory secretions between infected and uninfected animals. Thus, transmission is a function of inter-deer-proximity, which is a function of deer density. Transmission is also a function of interactions with domestic cattle. Although BTb transmission to humans is unlikely, in Michigan it has been transmitted to omnivores and carnivores such as black bear, raccoon, coyote, bobcat and red fox. Even after BTb is eradicated locally, it is a disease that will probably be remembered in future management decisions.

In 2005, BTb was discovered in a wild white-tailed deer near Skime. Since that time, BTb has been found in 27 wild deer in a small area (within a 10-mile radius of infected cattle herds) that includes the eastern half of the WMA. Deer populations were controlled by intensive harvest in an effort to eradicate the disease, and no deer have tested positive for the disease since 2009. The disease has been reduced to an undetectable level and therefore considered eradicated since no additional infected deer were found for three consecutive years.

3. West Nile Virus

West Nile Virus is a mosquito-borne virus that can kill some birds (particularly waterfowl, crows, and jays) and mammals (including elk and moose). The disease was found in 71% of elk tested from 2004-2009, many of which were from the nearby Grygla herd.

4. Eastern Equine Encephalitis

Eastern equine encephalitis is another mosquito-borne virus that can kill mammals and is a greater mortality threat for most species than is West Nile Virus. It has been detected in 13.6% of elk tested from 2004-2009, many of which were from the nearby Grygla herd.

5. Mycobacterium Paratuberculosis

Mycobacterium paratuberculosis is a disease of ungulates, including moose, which causes poor body condition and can lead to death. It is caused by the bacteria *Mycobacterium avium* ssp *paratuberculosis*. It was found in 29% of elk tested from 2004-2009, many of which were from the nearby Grygla herd.

6. Chronic Wasting Disease

Chronic wasting disease (CWD) is a contagious neurological disease affecting deer, elk, and moose. It causes a characteristic spongy degeneration of the brains of infected animals resulting in emaciation, abnormal behavior, loss of bodily functions and death. See Appendix A for the Minnesota Department of Natural Resources CWD response plan.

7. Mange

Mange, particularly sarcoptic mange, is a disease transmitted by mites, and affects mainly canids (wolves, foxes, coyotes), but also bears, raccoons, porcupines, and some rabbits and squirrels. The mites are transferred from one individual to another through direct contact or transfer at den sites. The disease causes hair loss, and in some cases the exposed skin becomes encrusted or oozes fluids, often resulting in death. Red foxes are particularly susceptible to mange, and thousands can die during an outbreak. There was an outbreak of mange in the local wolf population in the mid-1990s, and some evidence of a recurrence in 2009-2010. Infested animals can be treated by orally administering Ivermectin, which can be laced in food left for the animal to consume, although this is usually not very practical.

8. Rabies

Rabies is an acute infectious disease of the central nervous system caused by a virus that is transmitted in saliva through bites. Rabies is most common in raccoons, skunks, bats, and foxes, but can occur in any mammal. Once signs of the illness manifest themselves, rabies is 100% fatal; however, proper post-bite treatment is nearly 100% effective in preventing onset. As with mange, rabies outbreaks in the wild can be controlled by oral vaccinations in food items left out for consumption, but this is difficult and expensive.

9. Liver Fluke

The liver fluke (*Fascioloides magma*) is a trematode that can be present in cervid livers. In Minnesota it has been found in white-tailed deer, elk, and moose. The life cycle of the liver fluke includes lymnaeid snails as an intermediate host (Laursen, Averbeck, & Conboy, 1989). Although it generally doesn't appear to negatively impact white-tailed deer, it has the potential to be detrimental to moose populations. A study conducted on moose in northeast Minnesota by Murray et al. (2012) found pathogens, including liver flukes and brainworm

(*Paralaphostrongylus tenuis*), to be the principal cause of death in 37-62% of radio-collared animals.

10. Brain Worm

Brain worm (*Paralaphostrongylus tenuis*) is a nematode that uses white-tailed deer as a definitive host and, like liver flukes, doesn't appear to cause adverse effects in deer at the population level. The intermediate hosts include gastropods and are infective to cervids if ingested after the third larval stage within the gastropod (Lankester & Samuel, 1998). Signs of illness in moose include the animal becoming unafraid of humans, appearing weak, drooping ears, and often time walking in circles. The nematode can ultimately kill the moose or predispose them to other sources of mortality such as predation or secondary infections.

11. Faucet Snail

The faucet snail (*Bithynia tentaculata*) is an aquatic snail native to Europe and was introduced to the Great Lakes in the 1870s. The snail is an intermediate host for three intestinal trematodes, or flukes, (*Sphaeridiotrema globulus, Cyathocotyle bushiensis, Leyogonimus polyoon*) that cause mortality in waterfowl. These parasites have a complex life history and require two intermediate hosts, the first of which must be a faucet snail to develop. When waterfowl consume the infected snails, the adult trematodes attack the internal organs and cause lesions and hemorrhage. Infected birds appear lethargic and have difficulty diving and flying before eventually dying. The trematodes have contributed to the deaths of about 9,000 scaup and coots in 2007 and 2008 on Lake Winnibigoshish.

Staff collecting data during bovine tuberculosis sampling at Thief Lake WMA headquarters

E. Forest Insects and Disease

Forest insects and disease organisms influence forest ecosystem dynamics. These influences have both positive and negative impacts. Insects and diseases can reduce timber production and lumber grade and increase fire hazard. Alternatively, they can promote diversity of tree species, direct forest development and forest structure and generate dead wood, which provides important habitat and soil nutrients. Native insects and disease organisms are usually well-balanced with their respective host trees. Non-native insect and disease organisms have not co-evolved with our tree species, so they can cause a range of problems once they become established. Depending on the organisms involved, these effects can range from impacts to individual tree health to widespread and rapid tree mortality.

1. Forest Tent Caterpillar

Affects aspen species, birch, basswood and oak. The forest tent caterpillar (FTC) is a native defoliator of a wide variety of hardwood trees and shrubs and can be found throughout the range of all hardwood forests in North America. FTCs are often mistakenly called army worms. Populations peak every 10–16 years. Defoliation causes little damage. A second set of leaves will develop by mid-July. There are natural control mechanisms that will cause populations to collapse. FTCs are native insects and play critical roles in structuring aspen mixed-wood forests and helping to improve forest dynamics.

2. Hypoxylon Canker

Affects aspen species. A common disease of aspen, Hypoxylon canker (*Entoleuca mammata* =*Hypoxylon mammatum*) causes mortality and is the most destructive pathogen of young aspen in the Lake States. It is estimated that Hypoxylon canker infects 12 percent and kills 1 to 2 percent of the aspen in the Lake States each year (Schipper & Anderson, 1976). Hypoxylon canker is primarily a disease of quaking aspen, but bigtooth aspen is also occasionally infected. Aspen of all age classes is susceptible; however, mortality is usually greatest in young trees. The fungus kills the trees by girdling the stem, which leads to stem breakage. Some clones (genetically related stands of aspen) appear to be much more susceptible to Hypoxylon canker than others, and mortality in susceptible clones may approach 100 percent. Infection levels are not strongly correlated to site characteristics but do appear to be related to stand density. Insect wounds made by cicadas, poplar-gall saperdas, and tree hoppers serve as infection courts for the fungus-causing Hypoxylon canker. These insects prefer open grown stands and stand edges. Because of this preference, there tends to be a greater amount of insect wounding and Hypoxylon canker incidence in the more open grown stands and along stand edges (Ostry, Wilson, McNabb, Jr., & Moore, 1989).

3. Stem Decay/White Trunk Rot

Affects aspen species. White trunk rot (*Phellinus tremulae)* is the major cause of decay in aspen. It starts to show up in stands at about 20 years of age and increases as the stands age. There does not seem to be a strong correlation between amount of decay and site factors. The genetic susceptibility to decay of individual clones seems to override any observable

correlations between decay and site factors. The best external indicator of decay is the presence of conks (Jones & Ostry, 1998). However, only about 50 percent of the trees with decay have visible conks, and lack of conks generally leads to an underestimation of decay. Wounds and branch stubs serve as infection sites. Stands with a larger incidence of wounds from such things as equipment scrapes, fire, hail, and storm breakage may have higher levels of decay. Studies have indicated that the pathological rotation age (the age at which the loss of wood volume from decay begins to exceed the annual increment of sound wood) is from 40 to 50 years (Schmitz & Jackson, 1972). Others indicate that in many parts of the Lake States, aspen stands begin to deteriorate rapidly when they reach 50 to 60 years (Ostry & Walters, 1983). Some stands (or clones) may have relatively little decay even when they exceed 50 years of age while others may suffer high losses before 50 years (Christensen, Anderson, Hodson, & Rudolf, 1951).

4. Larch Sawfly

Affects tamarack. Larch sawfly (*Pristiphora erichsonii*) is the most destructive defoliator of larch in North America and has historically been considered the major mortality-causing pest of larch in Minnesota. The larvae eat tamarack needles; repeated defoliations eventually kill the trees. Larch sawfly has been a historically spectacular insect defoliator across North America. Between 1910 and 1926, this defoliator killed an estimated one billion board feet of timber in Minnesota (Baker, 1972). Another outbreak occurred in northern Minnesota in the late 1940s and early 1950s. Forest managers introduced parasites into Minnesota in the 1970s to try to keep this insect under control and reduce tree mortality. In the past 20 to 25 years, relatively small pockets of defoliation have occurred frequently, but have collapsed after a couple of years. It is not known if this pattern of small outbreaks of short duration will continue or if large destructive outbreaks will occur again. Historic levels of damage show that larch sawfly should not be ignored.

5. Tamarack Larch Beetle

Affects tamarack. This is a native bark beetle that attacks and kills tamarack and exotic larches. Beetles overwinter in attacked trees. Adults emerge in the spring and seek live trees or fresh slash to attack. Eggs are laid, larvae construct galleries under the bark, and adults are produced. Most adults stay in the tree until the following spring. Eastern larch beetles attack trees of most any age or diameter class, on the full range of sites from wet lowlands to drier uplands. Widespread outbreaks in recent decades and have killed numerous stands in NW MN. Infestations are often associated with trees under stress. Flooding, drought, defoliation, and old age have been associated with larch beetle attacks. However, not all outbreaks have been associated with obvious stress events. Larch beetles appear to be capable of attacking and killing trees when no predisposing condition or factor is apparent.

6. Dwarf Mistletoe

Affects black spruce. Dwarf mistletoe (*Arceuthobium pusillum*) is a native parasitic seed plant that infects and kills black spruce. It is the major mortality agent of black spruce. It primarily affects black spruce but is found occasionally on white spruce and tamarack. It causes “witches

brooms" on infected trees; trees of all sizes become infected and killed. In the past, natural fire was the major factor that kept this disease in check. Once a stand is infected, it stays infected until fire, harvesting, or shearing kills all the mistletoe-infected trees. Residual infected trees left behind on the site or in surrounding stands after harvesting introduce the disease to the regenerating stand. Mistletoe spreads locally by seeds that are explosively discharged and can travel up to 60 feet. Seeds stick to bird feet and feathers and can be carried long distances. When an even-aged stand becomes infected, large trees die and create openings in the stand. Young trees seed into these openings and become infected. The stand then gradually changes to an all-aged stand with heavy infections of all ages which have very little to no merchantable volume.

7. Dutch Elm Disease

Affects elm species. Dutch elm disease is an exotic disease that has reshaped Minnesota's forested landscape. First detected in Minnesota in 1961, it quickly spread throughout the entire state. The disease kills individual branches and eventually the entire tree within one to several years. The disease can infect and kill all species of elm in the state. The disease remains active in the forest, killing most elm trees before they can reach a size much over four or five inches in diameter. The disease did not eliminate all elms because many trees are able to grow long enough to set seed and reproduce before being killed. But it has eliminated elm as a tree of large stature. Dutch elm disease often exhibits "wave years of infection" when infections are very heavy for a number of years. Then very few new infections occur for a period of years. As the "new generation" of elms begins to reach the pole size, it appears we are beginning to see a return of the wave years of infections.

8. Oak Wilt

Affects oak species. Oak wilt is an aggressive disease that affects all species of oaks found in Minnesota. It is caused by a nonnative fungus that invades the water vessels of oak trees and eventually kills most infected trees. In Minnesota, oak wilt is typically found in the southern half of the state.

9. Two-lined Chestnut Borer

Affects oak species. The two-lined chestnut borer (TLCB) is a native beetle that attacks weakened oak trees. It attacks all oak species found in Minnesota, with red oak its preferred host. When trees and stands are healthy, TLCB confines its attack to low-vigor trees or broken branches. When drought stress, construction, and/or defoliation have reduced tree vigor, oaks are predisposed to TLCB attack. Under severe stress conditions, widespread outbreaks of TLCB can occur.

10. Emerald Ash Borer

Affects ash. Emerald ash borer is our newest non-native threat. Emerald ash borer, from eastern Asia, is expected to cause 99.99% mortality of black and green ash and cause deforestation of our Wet Forest sites as it spreads into our forests. It is anticipated that it will

take more than a few decades to accomplish the infestation of the 950 million ash trees that are currently growing in Minnesota.

11. Gypsy Moth

Affects aspen and oak. Gypsy moth is an exotic insect pest spreading across the U.S. and Canada, but is not currently widely established in Minnesota. Natural spread of the gypsy moth is slow, but the unintentional spread by humans can be rapid. Egg masses are transported on cars, recreational vehicles, logs, firewood, and nursery stock. Gypsy moth caterpillars feed on most hardwood trees and shrubs, and when populations are high they will also feed on conifers. Repeated defoliations lead to tree decline and death. Defoliated trees that are already under stress will suffer higher levels of mortality. Aspen, birch, basswood, willows, mountain ash, and oaks are among the tree species gypsy moth prefer. The extent and severity of impact in northern Minnesota is unknown at this time. However, in areas where gypsy moth becomes established, forest composition is often changed. The occurrence of gypsy moth will make management planning more difficult and will likely adversely impact tourism and homeowners.

12. Root Diseases

All tree species are susceptible to root rot diseases caused by fungi such as *Armillaria spp*. Root rots reduce tree growth, and if severe, result in death or windthrow. Damage and death from root rots are likely very common, but impact is not well documented since the damage is hidden below ground. Armillaria root rot is present on most or all sites and attacks both hardwoods and softwoods. Trees weakened by drought, defoliation, wounding, soil compaction, and old age can be predisposed to Armillaria root disease.

F. Habitat Alteration

Habitat alteration can and have had a profound impact on wildlife habitat in the WMA. Historically, drainage eliminated the majority of wetlands in Marshall County, and has resulted in extensive modification of hydrology in the area. Development for agriculture resulted in the destruction of most of the native prairie on the WMA and surrounding lands. Habitat alteration has resulted in the introduction of an array of non-native species, including aggressive invasive species that displace more desirable native vegetation. Development has brought the introduction of pollutants to the landscape, including pesticides that impact non-target species. Increased human presence on the landscape has resulted in disturbance that impacts wildlife's use of the area.

1. Divestiture of Lands

Thief Lake WMA consists of four different ownership types: acquired lands, School Trust lands, Volstead, and con con lands. Acquired lands could be sold based on legislative action, but USFWS approval would be required for any lands acquired with Pittman-Robertson funds, and sale proceeds from other acquired lands would have to be used for the administration of FAW. School Trust lands bring with them a financial responsibility to provide income for the School Trust. If the School Trust decided that divestiture (sale) of lands benefitted the School Trust, it could result in the loss of that habitat, connectivity, and access for recreation; fragmentation of

habitats; and possibly loss of individuals or wildlife populations. Similarly, although the con con lands were dedicated as WMA by the Legislature in 2002, legislative action could change that status, which could result in the associated losses.

2. Resource Development

Resource development (e.g. forest products, sand and gravel, peat, water) has potential for altering the habitat and thus species abundance, composition, behavior, and distribution in Thief Lake WMA. Common resource developments that occur on or near the WMA include mining of sand and gravel or peat, and future withdrawal of groundwater.

Various quantities of timber are harvested annually, usually during winter. The harvest currently follows sustainable forestry practices and is the basis for habitat management in timbered areas. While timber harvest results in changes to habitats, viable habitats are still available for wildlife. Timber practices are also used to enhance and restore some habitats that benefit wildlife on the WMA.

The demand for sand and gravel is ever present. Gravel deposits frequently underlie oak and oak savanna covered beach ridges in the western portion of the WMA. Sand and gravel operations result in permanent loss of prairie and savanna habitats that are already rare in Minnesota. These operations often result in limited or diminished use by wildlife. Surrounding private lands are already undergoing significant alteration to accommodate gravel extraction. Soil disturbance can result in alteration of local hydrology and establishment of invasive species. Development of gravel on adjacent lands has already resulted in localized spotted knapweed invasions.

Peat mining occurs on WMA lands to the west of Thief Lake WMA and has the potential to disrupt habitats if sufficient depths of peat are found that would lend themselves to extraction. Peat mining changes hydrology. If drainage remains, the site will eventually become revegetated, but typically at a lesser value than pre-mining conditions. If drainage is lost, sedge meadows and similar habitats can convert to open water systems, resulting in long-term changes to habitat and wildlife use. Peat mining offsite but adjacent to WMA lands could adversely affect the hydrology of peatlands on the WMA.

Future demand for water is an issue that should be considered as demands increase. There could be an increased demand for agricultural irrigation or dewatering associated with gravel or peat mining. Groundwater extraction can result in change to vegetation (e.g., shrubbier habitats), resulting in a permanent shift in plant and animal populations and loss of specialized species that use these groundwater-maintained system. This could have severe impacts on the ecosystem; however, any such initiatives would require review through a permitting process.

3. Renewable Energy

There is potential demand for biofuel resource development in the WMA. Potential biofuels include slash left over after logging and brush sheared from brushlands. Biofuel demand could potentially benefit the resource by increasing the amount of brushlands that are sheared at non-state expense. A potential detriment would be the net export of nutrients and minerals

that would not be returned to the soil. Currently transport costs to handling facilities that can use this fuel source are prohibitive.

4. Transmission Lines and Pipelines

Transmission lines and pipelines can fragment habitats, impact bird and bat flyways, encourage establishment of invasive species, disrupt hydrology, and are often planted with non-native species or plant species that do not provide adequate habitat or food for wildlife and pollinator species.

New transmission lines and pipelines that pass through the northwest corner of the state have been proposed. When new proposals are made, alternate routes are commented on and debated. Whenever possible, lines are routed along existing rights-of-way that already have some level of disturbance and maintenance.

5. Ditching and Drainage

Ditches and maintenance activities may negatively impact the WMA by altering habitat, modifying hydrology, and changing wildlife use. These activities can also result in increased exposure to fertilizers and herbicides, erosion or increased sedimentation, and establishment of invasive species.

The WMA and surrounding area was extensively ditched nearly 100 years ago. Some of the ditches have become, or are becoming, non-functional. These non-functional ditches can be candidates for abandonment if no benefits are found where the ditch only affects state lands. Other ditches provide drainage benefits for landowners adjacent to the WMA (with outlets on the WMA), and periodic maintenance is allowed through ditch law in the case of legal ditches and through ditch leases for private ditches. No new ditches are likely to be constructed within the boundaries of the WMA.

VII. Desired Conditions

A. All Habitat Types

Management Objectives

A variety of habitat types occur in Thief Lake WMA, and it is important to recognize the differences and management strategies that maintain them. All habitat types will be managed to provide outdoor experiences, restore, maintain, or enhance natural plant and wildlife diversity, conserve rare features, protect the associated watersheds, minimize the impacts of invasive species, and foster communities that are resilient to climate change.

Strategies

1. Provide the local community and visitors the opportunity to experience and enjoy natural habitats and ensure a sustainable functioning landscape that can support wildlife-based recreation. Staff will maintain opportunities for diverse quality hunting, trapping, and other compatible wildlife-based recreation, including bird-watching, photography, hiking, and foraging. User facilities will be maintained in good condition so that visitor experiences are enhanced and sensitive resources are protected.

2. Maintain or enhance natural diversity of plant and wildlife communities. Before management activities are planned, staff will check the Natural Heritage database for rare plants, animals, and communities. In many cases, managing for natural habitat and native plant communities will help rare plants and animals. However, some activities or the timing of activities can be detrimental to individuals or populations. If any rare features are found, staff will consult rare species experts for advice on managing habitat to maintain or enhance these species or communities.

3. Identify and conserve rare native plants, animals, and natural features. Thief Lake WMA has a variety of rare species and features. Plants, animals, and habitats become rare for a number of reasons including habitat loss and degradation, invasive species and competition, pollution and disease, habitat specificity (being dependent upon rare, declining or vulnerable habitats), persecution and exploitation, existing at the edge of their natural range or being an isolated population, vulnerable characteristics (such as low dispersal ability or low reproductive rates), and global climate change.

The DNR is required to identify and manage high-quality and rare native plant communities so they are maintained or enhanced (A through B ranks of S1 and S2 dry communities and S1 through S3 wet communities). For this reason, it is important to know which plant communities are rare, their condition rank, and how we might best manage within and adjacent to them. Additional survey work is needed to assess the conditions of the rare plant communities of Thief Lake WMA.

Additionally, the DNR is committed, through Forest Certification, to maintain or enhance all G1 through G2 native plant communities with condition ranks greater than “C”. There are few “G” ranks for NPCs here because these plant communities have not been scored at this time. The

survey process to determine condition could also provide necessary information to complete the G ranking of these communities.

Some locations with rare NPCs are best managed by avoidance, while other sites can either be maintained or enhanced by using appropriate harvest or other prairie/forest/brushland management activities, as recommended through the Ecological Classification System (ECS) Silvicultural Interpretations and other current ecological research. Resource managers will work closely with statewide, tribal, and federal cooperators and adjacent land owners on all management activities that will affect these native plant communities.

4. Incorporate best management practices on lands within the WMA to control erosion, improve water quality of Thief Lake and its tributaries, and help protect the Red Lake River watershed. A variety of techniques and standards are in place to protect water and aquatic habitats depending on the area where work is being done. In forested habitat types, Minnesota Forest Resources Council Site Level Guidelines spell out the best management practices (BMPs) for timber harvest that prevent damage to the soils and vegetation on site, and minimize or prevent runoff. Timber harvest on state land is required to abide by these guidelines, and sales are overseen by DNR Foresters that administer the sales.

Any work that disturbs soils in proximity to wetlands is subject to Minnesota Pollution Control Agency, Army Corps of Engineers, and Wetlands Conservation Act regulations. Actions are coordinated with Soil and Water Conservation Districts (SWCDs) and the appropriate watershed office. Work is subject to permitting restrictions, and disturbed sites (e.g. where a water control structure is replaced) are revegetated with an area appropriate seed mix and tools including silt fences and wildlife friendly erosion control mesh.

Farming on the WMA is moving toward more soil friendly tillage practices that emphasize soil coverage for as much of the year as possible to both promote improved soil health and to minimize erosion.

5. Monitor, control, and prevent new infestations of invasive species as needed. There are multiple avenues for controlling invasive species. These include hand pulling, spraying, burning, cutting, importing biological control agents (usually exotic insects), and quarantine and prevention. Hand pulling can be effective for eradicating new small populations of invasive plant species before they spread. Spraying and burning can be effective tools against larger infestations, but require more commitment of resources and may be unsuccessful at completely eradicating exotics. Mowing, followed by spraying herbicide, can also be an effective treatment option. Biological controls are the best alternative for eradicating widespread, abundant infestations, but they can take a long time to be evaluated and approved.

Prevention is the best alternative for resisting incoming infestations. Seeds of some plants such as purple loosestrife and spotted knapweed can be carried in by machinery, vehicles, and off-highway vehicles; they can also be brought in with other seed mixes or contaminated erosion control mulch. Some species seem to invade where ground cover is sparse, such as spotted knapweed along roadways. Better initial revegetation efforts following construction projects could slow the spread of spotted knapweed and other disturbance-tolerant species. Aquatic

invasive species can be unintentionally introduced when carried on boats, trailers, and hunting equipment such as waterfowl decoys. Wind, water, and wildlife can also transport exotic species, but these are more difficult to prevent. Operational Order 113 sets forth DNR policy and procedures to prevent or limit the introduction, establishment and spread of invasive species.

6. Promote intact communities that are resilient to climate change by minimizing aggregated impacts of habitat loss, pollution, and invasive species. The DNR is committed to enhancing ecosystem resilience and reducing the negative impacts of climate change on the state's resources in accordance with Operational Order 131. In particular, staff are responsible for managing habitat to reduce vulnerability to environmental stresses. Stressors such as habitat loss, pollution, and invasive species can exacerbate or amplify the effects of climate change on ecosystems. Anticipating and minimizing these stressors is an important step towards climate change adaptation, and in many cases is part of work staff are already doing to manage Minnesota's natural resources.

A variety of strategies exist to maintain resilient communities. For each strategy there are numerous approaches that are applicable to a variety of habitat types. These approaches are not suitable for all situations everywhere, but could be selected for use because they work well for specific habitat types, site conditions, and objectives. Staff will consider the best available information on climate change impacts to habitats and incorporate a range of adaptation ideas when selecting approaches appropriate for particular habitat types. The DNR's Climate Change Staff Handbook compiles recent, peer-reviewed information on climate change, mitigation, adaptation, vulnerability assessments, and management. The Keeping Up with Climate Change webpage contains the most recent version and related policies and resources.

In addition to minimizing environmental stressors, staff will promote resilient communities with strategies such as sustaining fundamental ecological functions (e.g. soil quality, nutrient cycling, hydrology), promoting species or structural diversity, increasing ecosystem redundancy, increasing landscape connectivity, increasing genetic diversity, and planning for and responding to disturbance. Furthermore, staff will consider additional management actions designed to assist ecosystems in responding new climate conditions. Such actions include creating or maintaining climate refugia and facilitating species transitions.

B. Lakes, Wetlands, and Waterways

Management Objectives

Thief Lake and its associated wetlands will be managed primarily to provide high quality habitat for wetland wildlife use, waterfowl production, and migratory waterfowl use by maintaining a diverse community of emergent and submersed aquatic vegetation and abundant aquatic invertebrates. The lake and wetlands will also provide for public hunting and trapping, furbearer production, and secondarily for flood water storage. Because Thief Lake is a flow-through system, planned management actions are often superseded by precipitation events. Management actions are often best approached with flexibility to take advantage of seasonal conditions.

Strategies

1. Implement partial winter drawdowns on Thief Lake to provide storage for spring runoff and encourage winterkill conditions in the basin. A partial winter drawdown balances competing goals to achieve desired wildlife habitat while providing storage for spring runoff. Winter drawdowns should be sufficient to induce winterkill conditions in the lake basin to minimize overwinter survival of fish. High densities of fish can increase turbidity by suspending sediment during foraging, affecting invertebrate populations and changing the rate of nutrient cycling. An additional benefit of reduced winter lake levels is the creation of additional storage space for spring runoff. Spring runoff can create high water conditions, and waterbird nesting habitat can be negatively impacted. Partial winter drawdowns allow lake levels to be managed in spring at appropriate levels for nesting birds in summer. Spring runoff in most years will be sufficient to fill the lake to summer target levels after the partial winter drawdowns. In some years, water levels may exceed the summer target level, but without the partial drawdown, these very high water levels would negatively impact nesting birds. The benefits of not drawing the lake down completely are that muskrats and invertebrates are able to overwinter and water is available for spring migrants regardless of snowpack or spring precipitation.

A partial winter drawdown will be undertaken whenever the level of Thief Lake in late October exceeds 1157.5’ above MSL with the goal of reducing the lake to an elevation of 1157.0’-1157.5’ above MSL by freeze up. A drawdown will be initiated in early to mid-November, or at freeze-up, whichever is earlier. Lake levels exceeding 1159.0’ in early fall will result in an earlier drawdown initiation date. Under high water level conditions, a drawdown could begin in October, where higher lake levels will result earlier initiation dates. Determining when this goal has been achieved can be difficult, because the lake usually freezes for the winter during this process, and the staff gauge at the dam is no longer a viable measure of the water in the basin. At times, shallow water in the dredged channel freezes. If ice collapses during this process, outflow is prevented until melting occurs in spring. When this occurs, the best estimate of water level comes from calculating outflow and subtracting it from basin storage to estimate remaining water volume. Additionally, closing the dam once the desired winter level has been achieved can be challenging, since this typically occurs in December when temperatures can be quite cold. Staff often have to chip and melt ice to free the screw gate to close the aperture.

Once the desired water level is achieved, water is allowed to flow through the lake to prevent water levels from rising by allowing a maintenance flow (<10 cubic feet per second, or cfs) under the gate. Freezing action may further reduce this flow.

2. When necessary, implement partial summer drawdowns to enhance conditions for emergent and submersed aquatic vegetation. Because of the potential impacts to public use, management-driven partial summer drawdowns should only be undertaken when emergent vegetation coverage is less than desirable. This would occur when the emergent vegetation coverage on the lake falls below 20%, or total vegetation falls below 60%, as measured by a wildlife lake survey, or if flooding events the previous growing season result in a noticeable reduction in aquatic vegetation. Wildlife lake surveys are typically done every 2-3 years.

Reducing the lake level during June and July to 1156.5'-1157.5' allows greater sunlight penetration in the water column and warming of the substrate. Both emergent and submersed aquatic vegetation respond to these conditions with more vigorous growth, and the result is increased coverage of the basin with vegetation. This vegetation provides habitat for both birds and invertebrates. The reduced lake level has been shown to achieve the vegetation goals in the past, while still maintaining wetland habitat for populations breeding in the basin. While further reductions in lake level might accelerate vegetative response, it would be at the expense of habitat availability, and hunter access in the fall. Stop-logs should be in place by early to mid-August to capture late summer rains to start refilling the basin.

Expected outcomes of a partial summer drawdown are stands of emergent vegetation within the basin to be more vigorous and cover at least 20% of the basin, and total vegetative coverage, including submersed aquatic vegetation, is expected to increase to 80-90% of sample stations that were established in 2004.

3. Actively manage the Moist Soils Units (MSUs) adjacent to the north and west sides of the lake to provide food resources for dabbling ducks during the fall. MSUs will be managed with the goal of providing a diversity of vegetation and food resources for waterfowl on the WMA. The submersed vegetation and associated invertebrates in Thief Lake provide food resources for a variety of waterfowl (particularly diving ducks) and other wetland birds. Many species of dabbling ducks benefit from the roosting habitat of Thief Lake, but prefer the seeds of wetland annual plants. Actively managing the MSUs adjacent to the lake for these food resources allows greater use of this wetland complex by a greater variety of birds, including shorebirds.

Wetlands are dynamic systems, and the capability for independent water control on the MSUs allows us to favor different vegetation types. In the case of MSUs, we are typically focusing on providing wetland annuals (e.g. smartweed or millet) for their generous seed production and food value they provide for dabbling ducks. Moist soils annuals are best established from existing seed banks by providing mudflat situations where the wetland plants can germinate. This is done by drawing the unit down. In the process, invertebrates are exposed that are a valued food resource for breeding waterfowl and shorebirds. A slow drawdown lengthens the time these resources are available, and moves the water/exposed soil interface slowly across the unit to allow foraging by wetland birds. MSUs are re-flooded in the fall to make these foods

available for migrants. Varying the timing of drawdown and flooding among units can favor different wetland species and can provide a more diverse and sustained array of wetland foods.

The same drawdowns that favor wetland annuals also provide the proper conditions for the establishment of emergent vegetation – some of which is desirable (e.g. river bulrush) and some not so desirable (e.g. hybrid cattail or reed canarygrass). When a MSU basin is dominated by less desirable vegetation, the best course of action is to draw the unit down and dry it until it can be accessed by a tractor. The unit is then disked to break up the cattail and root mat, and re-flooded. An intermediate course of action that works well (particularly in reed canarygrass) at times is to mow openings in the grass cover and then reflood. Weed seeds are made available as are a number of wetland invertebrates that colonize the reflooded straw.

MSUs can also be drawn down and then planted conventionally. This works particularly well with crops like millet, but can also be done with other grain crops.

4. Monitor vegetation conditions and invertebrate populations to detect changes that might prompt management actions. Monitoring is imperative to help managers make decisions about when to conduct various management actions. Vegetative characteristics of the basin are monitored formally through the wildlife lake surveys, and informally through the anecdotal observations during field work on the lake. These surveys provide information on vegetative cover and water depth, clarity, and quality. Staff have continued amphipods ("scud") sampling that was initiated in 1989. Amphipods are an important food source to waterfowl, particularly scaup. Following the same protocols, staff are able to monitor invertebrate densities in late summer. All invertebrate taxa sampled are recorded to document diversity and changes in composition.

5. Minimize water level bounce during open water periods, particularly during the nesting season. While wetlands are naturally dynamic systems with variable water levels, altered hydrology has influenced timing and duration of runoff events, sometimes resulting in detrimental effects on habitats and nesting populations. Even short-term increases in lake elevations of >6" can inundate fixed over-water nests (e.g. canvasback or redhead) resulting in their destruction. It can also increase exposure of floating nests (e.g. Franklin's gulls) to wave action. Longer term inundation reduces vigor of both emergent and submersed vegetation.

Spring runoff typically results in the biggest single pulse of water into the basin in most years. Thief Lake is a flow-through system, and there is no bypass to route high runoff around the basin. It is desirable to anticipate runoff from late spring and early summer precipitation events and allow it to flow through to the extent possible. The goal is to achieve a lake level of <1159.0' by May 1 when conditions allow. While no MOUs exists with the Red Lake Watershed District to mandate storage during runoff events, the DNR has committed to a "good neighbor" policy, and coordinates with Agassiz National Wildlife Refuge and Red Lake Watershed District.

6. Maintain the existing sanctuary area located on the northern and western portions of Thief Lake and the associated uplands. Maintenance of the sanctuary allows birds to use that portion of the basin without disturbance with the result that use of the basin as a whole is increased. There is a long history of sanctuary areas on and around Thief Lake. The original 3280 acre sanctuary was established in 1937 by order of the Commissioner of Conservation,

which corresponded with the first filling of the lake following the dust bowl years when the dam was constructed. An additional 760 acres were added in 1962, and additions since that time have brought the total area of the sanctuary to 5120 acres. Freedom from disturbance allows fuller use of the basin by breeding, staging, and migrating birds.

7. Maintain the existing motorized use constraints on Thief Lake. On most wildlife management areas, motorized access to wetland basins is not allowed. Thief Lake is large enough that prohibitions on motorized access would sharply restrict recreational use of the basin. The compromise reached that has proven to be a workable and equitable is a protected sanctuary on the north and west portions of the lake and a 10 horsepower maximum on the remainder of the lake. Together, the sanctuary area and motor restrictions limit disturbance to birds. This compromise allows recreational use without the increased noise or prop path through vegetation that bigger motors would cause. As new technologies become available, their effects will have to be monitored to determine whether different regulations are appropriate. There is very little recreational boating use of Thief Lake outside of the waterfowl season, and that use is largely non-motorized (canoes). Non-waterfowl season use should also be monitored, especially during the nesting season, and if conflicts arise, additional restrictions may be advisable.

8. Provide suitable access to the lake for waterfowl hunting, while maintaining quality habitat. The goal is to have lake levels at or above 1158.5' for waterfowl hunting season. Thief Lake is a shallow system, and subtle changes in lake level can have dramatic impacts on access. At the same time, precipitation and water delivery to the lake can supersede water level decisions. Lake levels below 1158.0' make for difficult access conditions at both of the boat launches on the south side of the lake (Maanum's and Henning's landings). When sufficient water is present in the system, management should strive for a lake level above 1158.0' during October. Because waterfowl use and hunter use is substantially less on the Moose River impoundment upstream, water stored in the north pool of the Moose River impoundment can be considered for early release to increase levels in Thief Lake in time for hunting season.

Increasing sediment and vegetation at boat accesses has been an ongoing concern that warrants monitoring and dredging may become necessary to maintain access. Sediment loads in the Moose River are being released when flows slow down as they enter the lake. The result is that a delta is forming where the river enters the lake, and complicating access to the lake from the boat launch on the Moose River. The delta should be monitored to determine if the delta grows to the point where mechanical removal of some of the sediment is warranted, and actions to reduce sediment loading upstream should be investigated. Both the Northeast Landing and Henning's Landing access the lake through short channels that connect the boat launch and the main lake basin. Silt has also filled these channels to the point where they have been dredged several times (most recently in 2006). Conditions need to be monitored to determine when dredging may be necessary again.

Henning's landing as viewed from an aerial survey

9. Maintain the diversity of submersed vegetation on Thief Lake, and maintain sheathed pondweed (*Stuckenia vaginata*) as a component of the submersed vegetation community. Thief Lake will be managed in a way to sustain diverse submersed vegetation, including the endangered sheathed pondweed, for food and habitat for wildlife. These plants are important habitat features, and in turn are the substrates for a diverse aquatic invertebrate community that supports a variety of wetland birds. Plants play an important role in stabilizing substrates and reducing suspension of sediments in the water column within the basin. Thief Lake has a diverse and luxuriant complement of wetland vegetation. Wildlife lake surveys on Thief Lake going back to the 1940s have always documented >10 species of submersed aquatic plants. It is desirable to maintain this diversity for the variety of habitats that they provide.

Sheathed pondweed is a State Endangered submersed aquatic plant with long, fine leaves that appear bushy. This species looks similar to the more common sago pondweed (*Stuckenia pectinata*). By 2015, when Minnesota Biological Survey had surveyed 2025 lakes for plants in Minnesota, sheathed pondweed had only been found in five. Sheathed pondweed has been documented on Thief Lake since at least 1949, when the first lake survey was conducted. Careful water level management has not decreased its prevalence and in fact, its prevalence

has increased since that time. Continued management using the guidelines listed above should protect this species and ensure its long-term presence at Thief Lake.

10. Target and maintain open water areas for waterfowl breeding habitat. Wetlands will be managed when invading vegetation decreases open water habitats. Changes in the landscape have resulted in fewer wetlands, elevating the ecological importance of the remaining wetlands. Restoration of small temporary and seasonal wetlands (discussed in the next strategy) and creation of open water wetlands are ways to offset some of these deficiencies. At the time of the 1980 plan, openings were created using dozers, draglines, or explosives to create potholes or level ditches, but these are of limited utility with today's wetland regulations.

Smaller wetland basins throughout the WMA and along the perimeter of Thief Lake itself have been invaded by hybrid cattail (*Typha x glauca*), which displaces native vegetation and tends to form monotypic stands that can cover open water portions of smaller basins. Invasions by hybrid cattail result in reduced diversity, displacement of native vegetation, and structural changes to the environment that make it less attractive to breeding and migrating birds. Hybrid cattail control is not well understood, and experimentation continues. Currently, spraying with a chemical designed for aquatic use, such as Imazapyr, while utilizing a Marsh Master II® and a boom system, allows focused control on areas of cattail while avoiding impacts to native vegetation. It will be important to monitor the efficacy of these treatments and treatments used in surrounding work areas to limit cattail spread.

11. Explore opportunities for wetland and riparian habitat restoration. As funding allows, opportunities will be taken advantage of to offset losses of wetlands and riparian habitat by restoring and enhancing wetland and riverine habitats. Drainage activities dating back to the early 1900s resulted in the degradation and loss of significant wetland habitat on the WMA. LiDAR is an emerging tool that can help to identify opportunities where drainage has occurred at the expense of the original wetlands. A feasibility study is currently under way to evaluate opportunities to restore seasonal basins along the south boundary. Another project to consider is the restoration of meanders to the Moose River on the WMA. This river was channelized and increased flow velocities are carrying increased sediment into Thief Lake. Restoring the natural sinuosity of the river would allow similar drainage while allowing natural flow regimes, stable banks and less erosion/sedimentation, and improved water quality and habitats.

C. Forests

Management Objectives

Forests will be managed to provide quality habitats for wildlife as well as forest products by maintaining and creating a diversity of forest types and age classes. Habitat management will focus on game species such as white-tailed deer, ruffed grouse, and elk, although a variety of nongame wildlife species will benefit as well.

Strategies

1. Manage forests for wildlife by coordinating forest habitat management with the Divisions of Forestry and Ecological and Water Resources through the Subsection Forest Resource Management Plan (SFRMP) for the Aspen Parklands Subsection. A variety of forest habitat types occur in Thief Lake WMA, and it is important to recognize the differences and management strategies that maintain them. Staff at Thief Lake WMA work closely with the Divisions of Forestry and Ecological and Water Resources to develop and implement plans to manage forest habitats as part of the SFRMP. The Aspen Parklands SFRMP covers Thief Lake WMA. This plan identified Land Type Associations (LTAs) that would be managed for timber, brushlands, and open lands. It also identified Management Opportunity Areas (MOAs) (previously called Special Management Areas) – specifically ruffed grouse management areas – that further refine management actions. It is important to note that market forces can result in deviations from SFRMP. The current SFRMP runs through 2021.

2. Maintain wildlife habitats through managed disturbance activities. Many of the habitat types at Thief Lake WMA historically experienced some level of disturbance (e.g., grazing, fire, wind storms, etc.) that resets the vegetation, including the aspen and balm of Gilead stands that comprise the bulk of the forested habitats in Thief Lake WMA. Commercial harvest is an important tool used to provide this disturbance and manage forested habitats. In this process, timber is typically evaluated and treated at the stand level, and care needs to be exercised to provide some balance in age classes of trees so that life requisites for various wildlife species are provided on a local scale. In some instances, MOAs are harvested in a geometry different than the whole stand level to provide smaller scale cuts where ruffed grouse management is being emphasized (Figure 9).

Catastrophic events including high winds or disease outbreaks occur that result in departures from the harvest strategies laid out in the SFRMP. In these instances, harvest is typically accommodated to utilize the resource and provide for regeneration of the stand.

At the time of the 1980 plan, there was no effective market for aspen, and the only way to regenerate stands was through dozing or fuelwood harvest. Commercial harvest of timber is now a more reliable and larger scale tool for timber management, allows management at the whole stand level, and is the primary tool to manage these stands. Fuelwood is provided via salvage permits at log landings. Occasionally stands are too small for commercial harvest and may be considered for fuelwood harvest.

D. Brushlands

Management Objectives

Brushlands will be managed to provide important habitat for a variety of wildlife species, including deer, elk, ruffed and sharp-tailed grouse, and a diversity of songbirds. A variety of brushland conditions will be maintained on the landscape largely through disturbance.

Strategies

1. Maintain willow and alder brushlands through periodic disturbance via shearing. In old age willow and alder stands where stems exceed 2" diameter, shearing with a dozer during winter will be used to set back the age of stands and make browse more available through resprouting. Like many plant communities in the Tallgrass Aspen Parklands, willow stands were historically maintained via disturbance, in this case, primarily fire. While prescribed fire is often used as a disturbance source, the proliferation of roads and ditches on the landscape, along with wet conditions, often limits how effective prescribed fire can be in providing this disturbance. Using a dozer in winter (in years where there is adequate frost to assure that brush shears rather than uproots plants) provides a mechanism for setting back succession in these stands. In some cases, shearing can be used in combination with prescribed fire. Shearing provides more fine fuel to carry the fire, which makes fire a more feasible option.

Shearing is typically conducted in willow or alder dominated brushlands where basal stems exceed 2" in diameter. Shearing in Thief Lake WMA has traditionally involved using a straight blade rather than a shear blade, and brush is knocked down rather than windrowed. Large areas are often targeted to offset the costs involved in moving the dozer to new sites. Oftentimes brush shearing sites are in areas that don't lend themselves to maintenance by prescribed fire; these sites will be re-treated at 20+ year intervals.

2. Use prescribed fire and mowing singly or in combination to set back the age of brushlands. In drier brushland habitats, disturbance through prescribed fire and mowing are typically more cost effective and therefore used more often than shearing. Brushlands that are in earlier successional stages can often be kept at that stage with periodic prescribed burns. To this end, a number of burn units have been established in brushlands where fire can more easily be used to manage habitats (Figure 18). Mowing with a tractor and mower can also be used in settings that do not lend themselves to prescribed fire. In some cases, it may be necessary to mow sites to establish burn units or increase fine fuels on site to allow later use of prescribed fire.

Brush shearing with dozers as a management tool

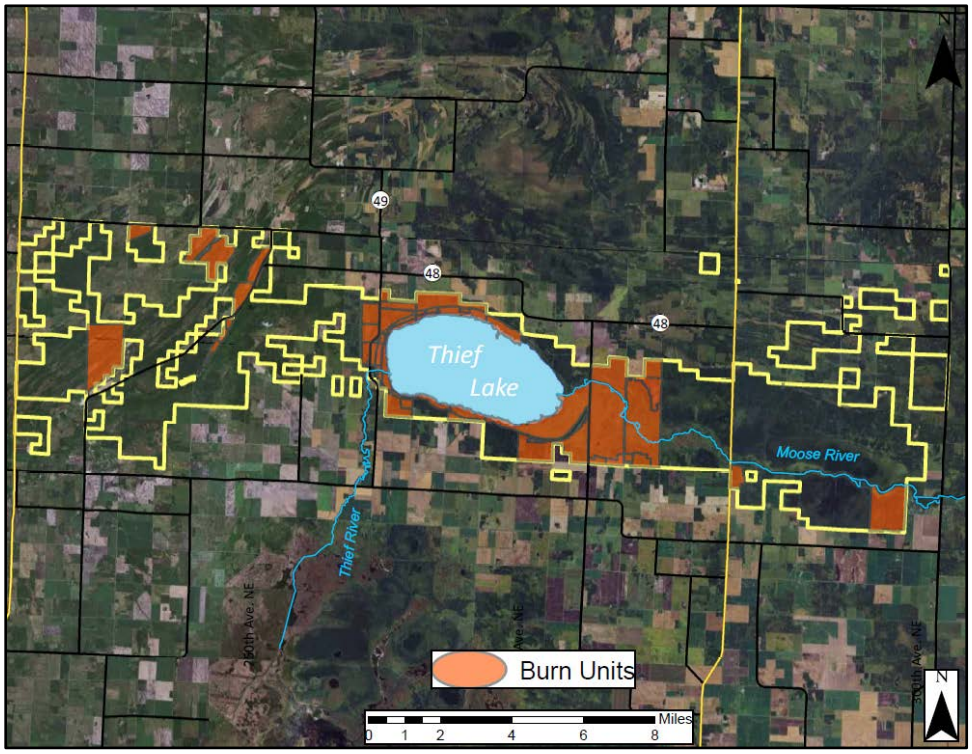


Figure 18. Burn unit boundaries at Thief Lake WMA

E. Prairies and Grasslands

Management Objectives

Prairies and grasslands will be managed to provide habitat and food for a variety of wildlife including elk, sharp-tailed grouse, nesting waterfowl, nongame birds, and pollinators. Oak savannas, which occur in the transition zone between prairies and woodlands and provide another important habitat type, will also be actively managed.

Strategies

1. Manage prairies, savannas, and grasslands with prescribed burning and mowing to provide nesting cover and open areas for wildlife. Most of the habitat types found on Thief Lake are early successional and maintained by managed disturbance. This is particularly true in the more grass dominated plant communities. Where conditions permit, prescribed fire is one of the best tools to maintain early successional habitat types. A number of burn units have been established on the WMA with firebreaks and burn plans that allow these areas to be burned at varying fire return intervals (Figure 18). Varying the timing of burns may help to enhance native plant diversity and prairie health.

In oak savannas, grasslands, and prairies, where woody encroachment can alter the structure and function of these habitats, these same techniques can be used. Fire is generally more feasible in these systems, but mowing can aid in restoring these sites and setting back woody vegetation. In some instances, a skid-steer mounted mower will be used in upland sites to suppress hazel under bur oak in open savannas. In other instances these mowers will be used to treat smaller areas where the dozer is not as applicable.

2. Incorporate local seed mixes with a diversity of native forbs and grasses into prairie restorations and reconstructions to preserve genetic diversity, promote pollinator use, and restore soil health. Where possible, former fields and grasslands dominated by non-native vegetation are restored to native vegetation. Operational Order 124 requires the use of local seed sources when considering these restorations, which is important for retaining local genotypes. When possible, seed sources from within 50 miles should be utilized. Experience has shown that it is easy for grasses (e.g. big bluestem *Agropyron gerardii*) to dominate restorations at the expense of native forbs. It is important to include a substantial portion of native forbs in the seed mixture and consideration should be given to supplementing seed mixes with forbs to enhance pollinator use. Restored and reconstructed prairies will be maintained and enhanced through management activities (e.g. prescribed burns, mowing).

F. Agricultural Lands

Management Objectives

Agricultural lands on the WMA will be managed to provide food for resident and migratory wildlife, reduce wildlife crop depredations on private lands, provide public hunting opportunities, or for reconstructed prairie site preparation purposes.

Strategies

1. Focus unit farming on improving soil health, and incorporate techniques such as crop rotation, use of cover crops, residue management, conservation tillage, and minimizing soil inputs. The state is moving toward more sustainable farming practices on state land. Starting in 2016, farming done by area staff will not utilize seed treated with fungicides or insecticides (e.g. neonicotinoids). Efforts will also be made to minimize use of genetically modified organism (GMO) seed when possible. Soil health will be foremost when making management decisions. The practice of keeping soil covered with vegetation as much as possible through use of minimal tillage, no-till applications, or cover crops is desired and currently under Operational Order review. Fertilizer use will be minimized and based on soil tests.

Food plots on the WMA are traditionally grouped into three broad categories, although a variety of wildlife benefit from all. Food plots targeted for geese are mostly in the sanctuary at the west end of the lake and focused on small grains (often winter wheat grown for newly sprouted plants to be grazed by geese) or legumes that are hayed. Food plots in areas frequented by elk are varied and include corn, soybeans, sunflowers, oats, clover, alfalfa, and mixed forage (rape, turnips, radishes, and peas). While the bulk of this work in the past has been focused in Grygla WMA, elk have shown an increasing inclination to use the south and east ends of Thief Lake WMA. The third category of food plot is targeted for deer and sharp-tailed grouse use, and often located in traditional deer wintering areas like the Randen and Dohrman Ridge areas. Many of the same crop types as the elk food plots are utilized.

2. Manage a major portion of the cropland on the WMA by Cooperative Farming Agreements (CFAs) with local farmers. Use agricultural leases when the underlying land is School Trust. The majority of the lands being farmed on the WMA are farmed by cooperators through CFAs. In return for allowing farming on the WMA, the cooperator provides the state with a share of the crop (typically one quarter of the harvest) or services equivalent to the state's share. New standards for cooperating farmers on state land are being instituted in 2017. Soil health will be emphasized, and treated seed will not be allowed starting in the 2017 crop year. Emphasis will be placed on conservation tillage.

In instances where the underlying land is School Trust land, farming is conducted under the auspices of an agricultural lease, where the proceeds go to the School Trust. Lease rates are set on a county by county basis based on soil types and comparable leases on private lands.

3. Use grain grown on the WMA for seeding of future food plots, as bait for the waterfowl banding program at feeding and capture sites around Thief Lake, and for the prevention of waterfowl crop depredations on nearby private lands during late summer. The state receives wheat and barley (grain) as its share in some of the CFAs depending on crop rotation, and this grain is stored in bins at Thief Lake WMA for re-distribution to three feeding sites established on the north river bank at the outlet to the lake, and at the northwest and northeast feeding sites. Grain is spread at these sites starting in late summer to help deter depredation on private grain fields by staging waterfowl. The grain also attracts waterfowl to these sites for capture during waterfowl banding operations. Waterfowl banding operations and grain distribution at the banding sites are halted prior to the general waterfowl season to comply with federal regulation regarding hunting over baited sites**.**

4. Develop additional food plots in old fields depending on management needs. New food plots may be developed in fallow or previously farmed fields when and where needs become apparent. Food plots have become an important tool in preventing elk depredation in the eastern and southern portions of the WMA. Provision of attractive food sources on these sites has helped to keep elk on state land rather than on private agricultural lands.

Elk using a wheat field near Thief Lake WMA

VIII. Implementation Process

A. Operational Plan

Specific operations at Thief Lake WMA are dependent on a number of factors, including weather conditions, funding, and changing priorities. To allow flexibility in the operational plan, specific work activities will be determined annually by unit staff. Figure 19 shows an overview of annual work activities that are performed at Thief Lake WMA in a typical year. Specific work activities are broken down by month in Appendix G.

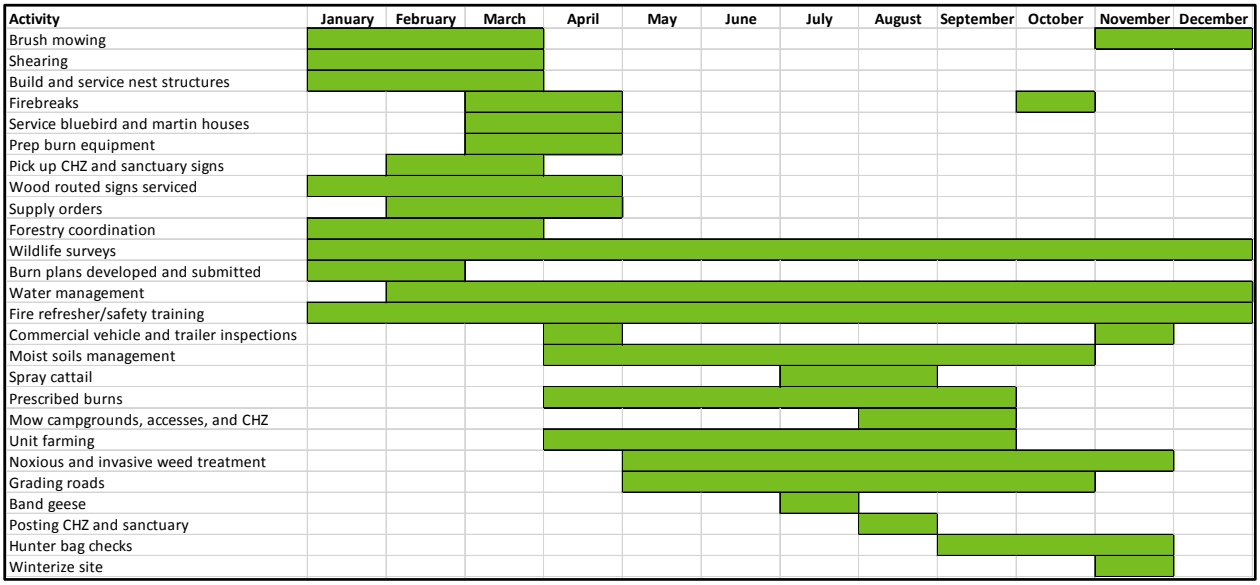


Figure 19. Annual work activities in a typical year at Thief Lake WMA

Bear research at Thief Lake WMA

IX. Research, Monitoring, and Adaptive Management

A. Current Research and Monitoring Projects

1. Waterfowl Monitoring

- Aerial waterfowl counts (fall)
- Breeding pair counts (ducks) at Thief Lake, Nereson, and Moose River Impoundment
- Breeding pair counts (geese) at Thief Lake
- Brood counts (ducks) at Thief Lake, Nereson, and Moose River Impoundment
- Duck banding (research group – rocket netting and night lighting)
- Goose banding
- Thief Lake invertebrate sampling
- Waterfowl nest structure use
- Weekly goose counts (fall)

2. Game Species Monitoring

- Aerial deer surveys (periodic when recalibrating deer models)
- Annual aerial elk survey
- August bear food survey
- August roadside counts (on each in Marshall and Roseau Counties)
- Elk route
- Furbearer harvest
- Muskrat survey (periodically)
- Predator scent post survey (5 segments)
- Radio collared bears
- Radio collared elk
- Ruffed grouse drumming count routes (2)
- Sharp-tailed grouse lek counts (2 areas)
- Winter predator track count route
- Woodcock singing ground survey

3. Water Monitoring

- River stages during runoff events
- Thief Lake water levels
- Water level monitoring on Moist Soils Units and impounded wetlands

4. Weather and Climate Monitoring

- Precipitation
- Snow depth
- Winter severity index

5. Public Use Monitoring

- CHZ hunter use
- Deer season car counts
- Nereson waterfowl hunter car counts
- Thief Lake trapping permits
- Waterfowl hunter use

6. Invasive Species Monitoring

- Invasive and noxious weed treatment effectiveness monitoring
- Thief Lake access point AIS monitoring

7. Other Monitoring

- Forest health monitoring
- Season phenology (see table)
- Bluebird nest boxes
- Shallow lakes survey (every 3-5 years)

B. Potential Research and Monitoring Projects

- Climate change parameters (e.g. temp, soils, phenology, migration and food availability)
- Dove banding
- Effects of prescribed fire
- Efficacy of cattail control
- Franklin's gulls nesting
- Glyphosate impacts on amphipods
- Multispecies food plots
- Nongame surveys
- Restored and reconstructed prairie species composition
- Wildlife inventory

C. Adaptive Management

The management objectives and strategies set forth in this document will be reviewed annually by regional and area staff and adjusted as necessary. A revision of the master plan is recommended in 10 years, or 2027.

X. References

Allison, I. S. (1932). *The geology and water resources of northwestern Minnesota.* Minnesota Geological Surv., Bull. 32.

Anderson, J. P., & Craig, W. J. (1984). *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective.* Minneapolis, MN: Center for Urban and Regional Affairs, University of Minnesota.

Arndt, B. M. (1977). *Stratigraphy of offshore sediment Lake Agassiz-North Dakota.* North Dakota Geol. Surv. Rep. Invest. 60.

Audubon. (2017). *Audubon: Birds & Science*. Retrieved from Audubon: http://web4.audubon.org/bird/iba/iba_intro.html

Baker, W. L. (1972). *Eastern Forest Insects.* United States Department of Agriculture, Forest Service Miscellaneous Publications 1175.

Bellrose, F. C. (1976). *Ducks, geese, and swans of North America.* Harrisburg, PA: Stackpole.

Bidwell, L. E., Winter, T. C., & Maclay, R. W. (1970). *Water Resources of the Red Lake River watershed, northwestern Minnesota.* Atlas HA-346. Washington, D.C: U.S Geol. Surv.

Christensen, C. M., Anderson, R. L., Hodson, A. C., & Rudolf, P. O. (1951). *Enemies of Aspen, Lake States Aspen Report No. 22.* United States Department of Agriculture, Forest Service, Lake States Forest Experimentation Station.

Clinton, W. J. (1999, February 3). Executive Order 13112- Invasive Species. *The American Presidency Project*. Online by Gerhard Peters and John T. Wooley.

Dale, V. H., & et al. (2001). Climate change and forest disturbances. *BioScience, 51*, 723-734.

Dana, S. T., Allison, J. H., & Cunningham, R. N. (1960). *Minnesota lands: ownership, use, and management of forests and related lands.* Washington, D.C.: The American Forestry Association.

Dessecker, D. R. (2008). Bird Conservation Region 12: Boreal Hardwood Transition. In J. S. Kelley, S. Williamson, & T. R. Cooper, *American woodcock conservation plan* (pp. 25-31). Wildlife Management Institute.

Eggers, S. D., & Reed, D. M. (2015). *Wetland Plants and Plant Communities of Minnesota and Wisconsin.* St. Paul: U.S. Army Corps of Engineers.

Elson, J. A. (1967). Geology of Glacial Lake Agassiz. *Life, land, and water: proceedings of the 1966 conference on environmental studies of the Glacial Lake Agassiz region.* (pp. 37-96). Winnipeg: University of Manitoba Press.

Fang, X., & Stefan, H. (2000). Projected climate change effects on winterkill in shadow lakes in the Northeastern United States. *Environmental Management, 25*(3), 291-304.

Farmes, R. E. (1960). Thief Lake Waterfowl Hunter Bag Checks. *The Flicker, 32*(1), 20-24.

Frelich, L. E., Reich, P., Danz, N., & Fisichelli, N. (2012). Ecosystem changes due to climate change. *Paper presented at Adaptive Management in the Face of Climate Change, Sustainable Forests Education Cooperative, Cloquet, MN*.

Galatowitsch, S. L., Frelich, L., & Phillips-Mao, L. (2009). Regional climate change adaptation strategies for biodiversity conservation in a midcontinental region of North America. *Biological Conservation, 142*, 2012-2022.

Gunderson, H. L., & Beer, J. R. (1953). *The mammals of Minnesota.* Minneapolis, MN: The University of Minnesota Press.

Hanowski, J., Niemi, G. J., Jones, T., Lind, J., & Danz, N. (2000). *Forest breeding bird population trends in east-central and southeast Minnesota.* Paper Presented by G.J Niemi at 62nd Midwest Fish and Wildlife Conference, December 3-6, 2000, Minneapolis, MN.

Hansen, J., Ruedy, R., Sato, M., Imhoff, M., Lawrence, W., Easterling, D., . . . Karl, T. (2001, October 27). A closer look at United State and global surface temperature change. *Journal of Geophysical Research, 106*(D20), 23947-23963.

Heinselman, M. L. (1963). Forest sites, bog processes, and peatland types in the Glacial Lake Agassiz region, Minnesota. *Ecol. Monogr., 33*, 327-374.

Johnson, E. (1977). *Archaeological sites in nine wildlife management areas.* Minneapolis: State archaeologist, University of Minnesota.

Jones, A. C., & Ostry, M. E. (1998). Estimating White Trunk Rot in Aspen Stands. *Northern Journal of Applied Forestry, 15*(1), 33-36.

Kelley, J. S., Williamson, S., & Cooper, T. R. (2008). *American woodcock conservation plan.* Wildlife Management Institute.

Kunkel, K. E., Stevens, S. E., Stevens, L. S., Janssen, E., Wuebbles, D., Hilberg, S. D., . . . Dobson, J. G. (2013). *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 3. Climate of the Midwest U.S. NOAA Technical Report NESDIS 142-3.* Washington, D.C.: National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Retrieved from http://www.nesdis.noaa. gov/technical_reports/NOAA_NESDIS_Tech_Report_142-3-Climate_of_the_Midwest_U.S.pdf

Lankester, M., & Samuel, W. (1998). Pests, parasites and diseases. In A. Franzmann, & C. Schwartz, *Ecology and Management of the North American moose* (pp. 479-517). Washington, D.C., USA: Smithsonian Institution Press.

Laursen, J. R., Averbeck, G. A., & Conboy, G. A. (1989). *Preliminary Survey of pulmonate Snails.* Minneapolis: University of Minnesota.

Laws Minnesota 1929 (chapter 319).

Marshall County. (2017). Retrieved from Minnesota Compass: http://www.mncompass.org/profiles/county/marshall

Minnesota Conservation Department. (1933). *First biennial report of the Commission of Conservation, 1931-1932.* St. Paul.

Minnesota Conservation Department. (1959). *Hydrologic atlas of Minnesota Division of Waters.* Bull. No. 10.

Minnesota Conservation Department. (1964). *Game lake survey report, Thief Lake, Marshall County.* St. Paul, MN: Div. of Game and Fish, Fed. Aid Proj. FW-1-R-9.

Minnesota Department of Agriculture. (2017). *Minnesota Noxious Weeds*. Retrieved from Minnesota Department of Agriculture: http://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist.aspx

Murray, D. L., Hussey, K. F., Finnegan, L. A., Lowe, S. J., Price, G. N., Benson, J., . . . Wilson, P. J. (2012). Assessment of the status and viability of a population of moose (Alces alces) at its southern range limit in Ontario. *Can. J. Zool., 90*, 422-434.

Nelson Institute Center for Climatic Research. (2017). *Central-Eastern Landscape Conservation Cooperatives (LCCs)*. Retrieved from Graphic illustration of A2 climate scenario: http://nelson.wisc.edu/ccr/resources/LCC/index.php

Ostry, M. E., & Walters, J. W. (1983). *How to Identify and Minimize White Trunk Rot of Aspen.* United States Department of Agriculture, Forest Service HT-63.

Ostry, M. E., Wilson, L. F., McNabb, Jr., H. S., & Moore, L. M. (1989). *A Guide to Insect, Disease, and Animal Pests of Poplars.* United States Department of Agriculture, Forest Service Agricultural Handbook.

Phillips, R. L., Berg, W. E., & Siniff, D. B. (1973). Moose movement patterns and range use in northwestern Minnesota. *Journal of Wildlife Management, 37*, 266-278.

Prasad, A. M., Iverson, L. R., Matthews, S., & Peters, M. (2007). *A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [Database].* U.S. Department of Agriculture, Forest Service, Northern Research Station. Retrieved from http://www.nrs.fs.fed.us/atlas/tree

Pryor, S. C., Scavia, D., Downer, C., Gaden, M., Iverson, L., Nordstrom, R., . . . Robertson, G. P. (2014). Ch. 18: Midwest. In J. M. Melillo, T. C. Richmond, & G. W. Yohe, *Climate Change Impacts in the United States: The Third National Climate Assessment* (pp. 418-440). Washington, D.C.: U.S. Global Change Research Program. Retrieved from http://nca2014.globalchange.gov/report/regions/midwest

Red Lake Watershed District. (2006). *Red Lake Watershed District: Mission and Purpose*. Retrieved from http://www.redlakewatershed.org/RLWD_Info.html

Roberts, T. S. (1936). *The birds of Minnesota* (Vol. 1). Minneapolis: University of Minnesota Press.

Roseau Climate. (2017). Retrieved from US Climate data: http://www.usclimatedata.com/climate/roseau/minnesota/united-states/usmn0641

Schipper, A. L., & Anderson, R. L. (1976). *How to identify Hypoxylon canker of aspen. How To Leaflet.* St. Paul: United States Department of Agriculture, Forest Service, North Central Forest Experiment Station.

Schmitz, H., & Jackson, L. W. (1972). *Heartrot of Aspen. With Special Reference to Forest Management in Minnesota.* University of Minnesota Agricultural Experiment Station Technical Bulletin.

Solum, N. (1976). *Self portrait of Marshall County.* Dallas, TX: Taylor Publ. Co.

United States Department of Agriculture. (1977). *General soil map of Marshall County, Minnesota.* Lincoln, NE: USDA Soil Conserv. Serv.

United States Department of Agriculture. (2012). *USDA Census of Agriculture*. Retrieved from https://www.agcensus.usda.gov/Publications/2012/

United States Department of Agriculture. (2017). *USDA FSA Conservation Programs.* Retrieved from USDA Farm Service Agency: http://www.fsa.usda.gov/programs-and-services/conservation-programs/index

United States Department of Agriculture. (2017). *USDA National Agriculture Statistics Service*. Retrieved from https://www.nass.usda.gov/

United States Department of the Interior. (1974). *United States list of endangered fauna.* Washington, D.C.: U.S. Fish and Wildlife Service.

Walsh, J., Wuebbles, D., Hayhoe, K., Kossin, J., Kunkel, K., Stephens, G., . . . Somerville, R. (2014). Ch. 2: Our Changing Climate. In J. M. Melillo, T. C. Richmond, & G. W. Yohe, *Climate Change Impacts in the United States: The Third National Climate Assessment* (pp. 19-67). Washington, D.C.: U.S. Global Change Research Program.

Wright, H. E. (1972). Physiography of Minnesota. In P. K. Sims, & G. B. Morey, *Geology of Minnesota: A centennial volume* (pp. 515-547). St. Paul: Minnesota Geol. Surv.

Photo Credits: MNDNR

Appendix A. Guiding Documents

A. Rules and Statues

1. 86A.05 CLASSIFICATION AND PURPOSES.

Subdivision 1. Classification. The outdoor recreation system shall be comprised of units classified as follows, and each unit shall be authorized, established, and administered to accomplish the purpose and objectives of its classification.

Subd. 8. State wildlife management area; purpose; resource and site qualifications; administration.

(a) A state wildlife management area shall be established to protect those lands and waters which have a high potential for wildlife production and to develop and manage these lands and waters for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreational uses.

(b) No unit shall be authorized as a state wildlife management area unless its proposed location substantially satisfies the following criteria:

(1) includes appropriate wildlife lands and habitat, including but not limited to marsh or wetlands and the margins thereof, ponds, lakes, stream bottomlands, and uplands, which permit the propagation and management of a substantial population of the desired wildlife species; and

(2) includes an area large enough to ensure adequate wildlife management and regulation of the permitted recreational uses.

(c) State wildlife management areas shall be administered by the commissioner of natural resources in a manner which is consistent with the purposes of this subdivision to perpetuate, and if necessary, reestablish quality wildlife habitat for maximum production of a variety of wildlife species. Public hunting, fishing, trapping, and other uses shall be consistent with the limitations of the resource, including the need to preserve an adequate brood stock and prevent long-term habitat injury or excessive wildlife population reduction or increase. Physical development may provide access to the area, but shall be so developed as to minimize intrusion on the natural environment.

2. 86A.09 DEVELOPMENT AND ESTABLISHMENT OF UNITS.

Subdivision 1. Master plan required. No construction of new facilities or other development of an authorized unit, other than repairs and maintenance, shall commence until the managing agency has prepared a master plan for administration of the unit in conformity with this section. No master plan is required for wildlife management areas that do not have resident managers, for scientific and natural areas, for water-access sites, for aquatic management areas, for rest areas, or for boater waysides.

Subd. 2. Master plan; preparation and public review. The managing agency shall supervise preparation of the master plan and shall utilize the professional staffs of any agency of the state when the expertise of the staff of such agency is necessary to adequately prepare the master plan; the master plan shall present the information in a format and detail that is appropriate to the size and complexity of the authorized unit. When the master plan has been completed the managing agency shall announce to the public in a manner reasonably designed to inform interested persons that the master plan is available for public review and in the case of any major unit shall hold at least one public meeting on the plan in the vicinity of the unit. The managing agency shall make the master plan available for review and comment by the public and other state agencies for at least 15 days prior to the public meeting and shall accept comments on the plan for at least 30 days before approval. The managing agency shall prepare a record of the public meeting and any comments received during the comment period.

Subd. 3. Master plan content. All master plans required by this section shall:

(1) provide for administration of the unit in a manner that is consistent with the purposes for which the unit was authorized and with the principles governing the administration of the unit, as specified in section 86A.05 and the statutes relating to each type of unit; and

(2) recognize values and resources within the unit that are primarily the responsibility of another managing agency to protect or develop and provide for their protection or development either through a cooperative agreement with the other managing agency or through designation of the appropriate area as a secondary unit.

Subd. 4. Development. Construction of necessary facilities and other development of the unit shall commence as soon as practicable and shall be carried out in conformity with the master plan.

Subd. 5. Establishment. When, in the opinion of the managing agency, acquisition and development of the unit are sufficiently complete to permit operation and administration of the unit in substantial conformity with the master plan as approved, the managing agency shall declare the unit established and ready for use.

Subd. 6. Master plan amendment. The managing agency shall prepare an amendment to a master plan to address changes proposed for a unit that would vary from the approved master plan. The master plan amendment shall address the impacts of the proposed changes to the natural and cultural resources, interpretive services, recreational opportunities, and administrative activities at the unit. The master plan amendment supersedes the master plan for those areas addressed by the amendment. The managing agency shall hold a public meeting for master plan amendments that constitute a significant change in public use or access to the unit or that may be controversial. Public notice and approval of the master plan amendment shall follow the process described in subdivision 2. Construction of necessary facilities and other development of the unit shall commence as soon as practicable after the master plan amendment is adopted.

3. 6230.0200 SPECIAL PROVISIONS FOR WILDLIFE MANAGEMENT AREAS.

Subpart 1. Areas requiring a permit to trap. The following wildlife management areas are open to trapping with a permit:

A. Carlos Avery in Anoka and Chisago Counties;

B. Hubbel Pond in Becker County;

C. Red Lake in Beltrami and Lake of the Woods Counties;

D. Talcot Lake in Cottonwood and Murray Counties;

E. Mille Lacs in Mille Lacs and Kanabec Counties;

F. Lac qui Parle in Big Stone, Lac qui Parle, Swift, and Chippewa Counties;

G. Roseau River in Roseau County;

H. Thief Lake in Marshall County; and

I. Whitewater in Olmsted, Wabasha, and Winona Counties.

Subp. 2. Trapping permits. On areas where trapping permits are required, the number of trapping permits may be limited to avoid undue depletion of the furbearer resources or to prevent excessive crowding of trappers. The wildlife manager may establish a method, including a drawing, for impartially selecting the persons who may trap. An application for a trapping permit may be rejected if the trapper has failed to submit a trapping report for the previous season. Permits may be revoked at any time if the permittee violates any law or regulation or fails to comply with the requirements of the permit.

B. Existing Plans

1. American Woodcock Conservation Plan (2008)

The overall goal of this joint-partnership plan written by Kelley et al. (2008) is to halt the decline of woodcock populations and return them to densities (not populations) that occurred in the 1970s. Specific objectives include halting population declines by 2012, halting the decline of early successional forests by 2012, and seeing an increase in early successional forests by 2022. It is widely believed that the loss of early successional forest habitat is responsible for declines in woodcock populations (Kelley, Williamson, & Cooper, 2008) but it may be that ground nesting species overall are more susceptible to changes in predator populations (Hanowski, Niemi, Jones, Lind, & Danz, 2000). Thus woodcock may not respond to increases in habitats as projected. For the purposes of this plan, Thief Lake WMA lies within the Boreal Hardwood Transition zone. In the Minnesota portion of the Boreal Hardwood Transition zone, woodcock populations have declined about 1%/year since 1968, but elsewhere in the Boreal Hardwood Transition zone the declines have been 1.9%/year (Dessecker, 2008).

The woodcock plan recognizes this area as a “coarse priority area” and calls for using a landscape-level approach involving using management units of 500-1,000 acres which would support approximately 500 woodcock, with several units located within 1-2 miles of each other.

Management treatments should be centered on broad-leaved deciduous or on deciduous shrub-scrub wetlands where moist soils are found. Even-aged forest management treatments of >5 acres would stimulate sprouting of shade-intolerant species such as aspen to create ideal woodcock habitat, short rotation cutting cycles of about 20 years would ensure the forest not become too mature for woodcock use, and cuttings should cross riparian areas to assure the full moisture gradient is represented in the regenerating stand (Kelley, Williamson, & Cooper, 2008). More specifically, in the Boreal Hardwood Transition zone, the prescription is to create 3.5 million more acres of early successional forest and sustaining aspen/birch communities through traditional clearcut regeneration (Dessecker, 2008). However, the plan recognizes that these prescriptions run contrary to current public agency trends against managing clearcuts for regenerating aspen monocultures and for greater riparian area protections in the Boreal Hardwood Transition zone. Furthermore, agencies are trending away from single-species management.

2. Aspen Parklands Section Forest Resource Management Plan (2011)

The DNR develops vegetation management plans for forested lands in the state using boundaries based on its Ecological Classification System (ECS). DNR's ECS divides Minnesota's forested landscapes based on local geology and ecology. The resulting Section Forest Resource Management Plans (SFRMPs) establish forest management direction for nearly 5 million acres of land administered primarily by the Divisions of Forestry and Fish & Wildlife.

Interdisciplinary DNR teams with members from the Divisions of Forestry, Fish & Wildlife, and Ecological & Water Resources develop each SFRMP under guidance from DNR leadership. Each SFRMP includes:

- an assessment of forest conditions within the Section
- long-term (10– and 50-year) strategic direction and desired future forest composition goals related to vegetation management on DNR lands within the Section
- selection of forest stands to be visited over the 10-year planning period and potentially treated (e.g., harvested) to implement the identified strategic direction and goals.

The 10-year Subsection Forest Resources Management Plan (SFRMP) for the Aspen Parklands Ecological Subsection was finalized in 2011. The Aspen Parklands Subsection, which includes Thief Lake WMA, covers approximately 2.9 million acres in an area from near Gully to Roseau and from Lancaster to Crookston. Approximately 95,000 acres of DNR land is forest and woodlands that are part of the forest management plan. About 250,000 acres are non-forested, but are also included in this plan. Another 9,000 acres of state lands include state parks and scientific and natural areas (SNAs) which are not considered for resource management under this plan but do contribute to some of the plan's goals:

In the Aspen Parkland Subsection, 1,951 stands were identified for the 10-year stand exam list to move them toward the long-term desired future forest composition (DFFC) identified in the plan. Preliminary treatment prescriptions were assigned when each stand was selected. Final management objectives and final prescriptions will be determined as each stand is field visited. Approximately 3,800 acres will be evaluated for treatment annually.

Some of the significant strategic direction and goals of the Aspen Parklands SFRMP plan include:

- Vegetation composition will be managed according to ecological classifications to more closely reflect vegetation that developed under natural disturbance regimes.
- Increase the acres of oak, oak savannah, lowland and upland brush, and prairie using the following actions: timber harvest, prescribed burning, shearing, natural succession.
- Move Even-aged cover types toward a balanced age class structure to provide an even flow of wildlife habitat and timber harvest.
- Manage forests to sustain forest products while minimizing impacts on wildlife and biodiversity
- Maintain or increase within stand plant and structural diversity.
- Protect aquatic resources.

3. Audubon MN Blueprints for Bird Conservation (2014)

The Blueprint for Minnesota Bird Conservation was developed to assist natural resource managers, conservation groups, birders, and anyone interested in protecting and restoring Minnesota's birds, prioritize and implement conservation activities across the state.

The Blueprint was designed to push conservation beyond broad habitat protection goals, enabling anyone interested in the conservation of Minnesota's avifauna to assess whether we, as a community, are implementing the correct actions and targeting the most important species and places to sustain these species as integral components of Minnesota's landscape.

The Blueprint for Minnesota Bird Conservation is divided into four geographic regions: Tallgrass Aspen Parkland, Prairie Parkland, Prairie Hardwood Transition, and Boreal Hardwood Transition.

The Blueprint for each region includes the following:

- Overview of the region including avifauna, landscape features, and management issues and opportunities
- List of Highest, High and Moderate Priority birds in the region
- Assessment of monitoring efforts currently underway for the highest priority species and recommendations for future monitoring
- Identification of:
    - Target Conservation Species in the region
    - Stewardship Species that should be primary targets in the region
    - Priority habitats on which to focus conservation actions
    - Habitat protection and restoration goals in the region
    - Habitat management considerations for the highest priority species
    - Important Bird Areas to target conservation actions by Audubon and our partners

Thief Lake WMA falls within the Tallgrass Aspen Parklands Bird Conservation Region. The Conservation Blueprint for Minnesota's Tallgrass Aspen Parklands Bird Conservation Region includes the following:

- A descriptive overview of the region including its avifauna, landscape features, and management issues and opportunities
- A list of Highest, High and Moderate Priority birds in the region
- Identification of Target Conservation Species in the region
- Identification of Stewardship Species that should be primary targets in the region
- Assessment of monitoring efforts currently underway for the highest priority species and recommendations for future monitoring
- Identification of priority habitats to focus conservation actions on
- Identification of habitat protection and restoration goals in the region
- Identification of habitat management considerations for the highest priority species
- Identification of Important Bird Areas that are a target for future work by Audubon and its conservation partners

4. Beltrami Island Land Utilization Project Comprehensive Conservation Management Plan (2013)

The executive summary from the Beltrami Island Land Utilization Project Comprehensive Conservation Management Plan states the following:

"We propose to manage the 86,000 acres that comprise the Beltrami Island Land Utilization Project (LUP) under a landscape perspective. This Comprehensive Conservation Management Plan (CCMP) identifies and describes a series of goals, objectives, and strategies devised for managing wildlife, wildlife habitat, the human environment, and land assets and is intended to guide the management of LUP lands for at least the next 15 years. We developed three alternatives to accomplish the goals, objectives, and strategies: Alternative A: Current Management Direction (No Change/No Action), Alternative B: Manage the Landscape, and Alternative C: Manage by Species. Alternative B (Manage the Landscape) is the Proposed Alternative. The alternatives were fully described in the Environmental Assessment in the Draft CCMP.

The Beltrami Island Land Utilization Project CCMP does not include any proposed changes to existing public access (including motorized access) or hunting, fishing and trapping opportunities. Artificial water storage would be allowed on LUP lands if storage also provides mutual wildlife benefits.

The primary focus of the CCMP is managing habitat to provide a diverse array of habitats for wildlife species. A landscape approach that considers the quality, quantity and interspersion of habitat throughout the entire project area – essentially the statutory boundaries of the Beltrami Island State Forest (see inset) – is deemed the most effective mechanism for assuring the habitat needs of all native wildlife species are met, and that wildlife populations may be maintained within their natural range of variability. An assessment of the habitat needs of key game and nongame species revealed three groups of particular management interest: nongame

species and furbearers that require mature forests; openland species that require early successional graminoid-dominated wetlands; and game species that thrive in early successional forest habitats. LUP lands were identified as being particularly important in providing habitat for species requiring mature forests. Therefore, the CCMP envisions managing LUP lands in part to provide more conifers and older forests on the landscape. This vision is complementary with the Agassiz Lowlands Subsection Forest Resource Management Plan (SFRMP). A landscape approach allows management decisions for a particular LUP parcel to be made in a holistic manner with the condition of surrounding state, tribal, or private lands taken into consideration.

The CCMP establishes a vision for the desired future condition of LUP lands while still honoring existing management plans. A few strategic land exchanges within the LUP project area are proposed that would benefit both the state and the purpose for which LUP lands were designated by President Franklin Roosevelt by Executive Order in 1942. These include exchanging LUP lands out of Hayes Lake State Park, exchanging some red pine plantations and some gravel pits with the state for ecologically sensitive areas, and consolidating LUP ownership of yellow birch stands on the north shore of Upper Red Lake. An area containing 4,477 acres of LUP lands in the Spina area within the Red Lake Wildlife Management Area (WMA) has been identified as containing wilderness values and characteristics. Under the CCMP we will manage the area to retain these wilderness values and characteristics."

5. Conservation That Works: Conservation Agenda (2015-2025)

Minnesota DNR's strategic direction for the agency's work is the 2015-2025 Conservation Agenda. It sets strategic direction toward 4 goals that drive our work: 1) Natural Resources Conservation; 2) Outdoor Recreation; 3) Natural Resources Economy; and 4) Operational Excellence. Managing Thief Lake WMA addresses the first three goals, and goal four sets expectations for how the work is done. DNR is currently working to achieve these goals through Conservation that Works, a document that sets specific priorities for each goal. Regional Wildlife Manager and division leadership will provide direction on how Conservation that Works priorities influence Thief Lake WMA's management.

6. Deer Plan (In Progress)

With concerns regarding deer populations statewide in 2014 and 2015, an audit of the MN DNR Deer Management was requested. This was subsequently done and published in May of 2016. One of the findings of the audit pointed to the need for a Statewide Deer Management Plan. Efforts ensued in 2016 to begin development of the plan with a completion date sometime in late 2017. The efforts would include a formation of 20 member Deer Management Advisory Committee, public input meetings for important topics and goals to be included in the plan, a draft plan mid-2017, public comment on the draft plans, and finalization near the end of 2017.

Currently, all efforts up to and including the public input meetings for important topics and goals have been completed. Deer hunting at Thief Lake has a long and successful history of public use and recreation of this important natural resource. While the statewide deer management plan will not set direct population goals for deer on the WMA, the plan's overall

topical and goal components will impact habitat management designed to keep deer a major feature of public interest and occurrence at Thief Lake.

7. Deer Population Goal Setting Process (In Progress)

In 2005 to 2007, a major statewide effort to revisit the population goals for each Deer Permit Area (DPA) was made. The population metric was the estimated spring pre-fawn number of deer per square mile averaged over the DPA. The Thief Lake WMA DPA (202 at that time) was one of the first evaluated in 2005. Statewide in the previous few years, the deer population was at all-time highs, including Northwest Minnesota. Much of the recommendations that followed prescribed for a lowering of deer numbers over the current estimated levels. DPA 202 had population goals set at 8 to 11 deer per square mile. Shortly after this evaluation, bovine Tuberculosis (BTb) was discovered in DPA 111, just east of Thief Lake.

Over the course of control efforts for this disease, DPAs near the location of the outbreak were redrawn and re-numbered. Much of DPA 202 was assigned a new number (268) and the eastern portion of the former DPA 202 put into the intensively managed TB control DPA 101. DPA 101's principle management efforts were designed to minimize deer to deer and deer to cattle contact. This was largely accomplished by an intensive effort to reduce deer numbers and impose a large deer feeding ban in the geographical area centered around 101. DPA goals were superseded by an all-out effort to reduce deer numbers, which eventually included hiring sharpshooters to further this reduction effort.

In 2013, TB was considered eliminated, at least to the level beyond detection possibilities. In the years that followed and up to the present, harvest management strategies in DPA 101 and surrounding DPAs (including 268) have been to rebuild the deer population back to goal numbers set in mid 2000s. Beginning in 2012, another statewide deer goal setting exercise was initiated. About two thirds of the state had been accomplished through 2015, with the remainder of the state scheduled for 2016. With the work started on the Statewide Deer Management Plan beginning in 2016, the DPA goal setting exercise for the remainder of the state was put on hold. Largely, the DPAs that remained were north central going west to the border and then south. This included the Thief Lake WMA DPAs. This will delay goal setting at Thief Lake until 2018, when the remainder of the state is scheduled to be finished.

8. Executive Order 11990, Protection of Wetlands (1977)

Federal Executive Order 11990 for the protection of wetlands was signed by President Jimmy Carter on May 24, l977. In essence, the E.O. directed each federal agency to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities. In carrying out the activities described in Section I of this Order, each agency shall consider factors relevant to a proposal's effect on the survival and quality of the wetlands. Among these factors are: (a) public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion; (b) maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources; and (c) other uses of wetlands in the public interest,

including recreational, scientific, and cultural uses. All WMA lands would be subject to E.O. 11990.

9. FAW Directive No. 070605: Outdoor Recreation Area Unit Administrative Handbook (2010)

FAW Directive No. 070605: Outdoor Recreation Area Unit Administrative Handbook is a collection of documents that gives specific guidance to activities on wildlife management areas.

10. Long-Range Plan for the Wild Turkey in Minnesota

This plan was finalized in 2007, and was to cover the period from 2005 to 2011. At the time it was written, turkey populations had not yet been established within 100 miles of Thief Lake, and the nearest planned releases were over 70 miles to the southwest.

Since the time this plan was released, turkeys have been released as far north as New Maine WMA (10 miles west of Thief Lake WMA's western edge). These birds have now been observed east of Thief Lake on the WMA, and are well established on the beach ridges in the western portion of the WMA. Turkey hunting is now permitted across the entirety of northwest Minnesota.

The current plan as written does not directly pertain to the management of Thief Lake, nor does it describe the current system of permitting or license distribution. Updated versions of the plan, however, will cover the current licensing system, which includes options for hunting birds in the Thief Lake area, and will also describe management direction that will include populations that are establishing themselves on Thief Lake.

11. Long-Range Duck Recovery Plan

The plan was originally adopted in 2006 and is currently being revised and updated. It sets forth a Strategic Vision for Minnesota's waterfowl. The Vision consists of several parts, including goals for a breeding population of 1,000,000 birds, a fall flight of 1.4 million birds, a waterfowl harvest by Minnesota hunters that comprises 16% of the Mississippi Flyway total, and an annual mean of 140,000 waterfowl hunters and 600,000 waterfowl watchers. The plan also discusses the status and history of each of these goals, along with primary strategies for achieving the goals and interim measures and costs.

The status of the breeding population in Minnesota and its history are discussed at length, with additional scrutiny on mallard populations. This section of the plan then goes on to propose a primary strategy for achieving this goal of the restoration and protection of 2 million acres of additional land, with 70% of this total in grassland and 30% in wetlands. It goes on to discuss interim measures and estimated costs for the process.

The migration objective discusses the status and history of the fall flight in Minnesota, and harvest statistics over time. The primary strategy listed for achieving this strategy centers on the protection, enhancement, and ongoing management of 1,800 shallow lakes. The plan goes on to discuss interim measures of success and anticipated cost.

The recreation objective discusses the status and history of hunter and waterfowl watchers in Minnesota. The primary strategy for restoring those numbers to the goals listed is largely achieved in the strategies for the breeding population and migration objectives. Mention is made of monitoring hunter satisfaction through periodic questionnaires.

12. Managing Minnesota's Shallow Lakes for Waterfowl and Wildlife: DNR Shallow Lakes Program Plan (2010)

Minnesota has long recognized quality shallow lakes as critical habitat for waterfowl production and migration. This plan provides wildlife managers with criteria and tools to focus shallow lake management efforts undertaken by the DNR Section of Wildlife Management to maximize waterfowl and wildlife habitat while also providing public benefit. The plan establishes a statewide goal to manage and protect 1,800 shallow lakes across the state for the benefit of wildlife and waterfowl.

The following objectives identified in the plan are aimed at managing those basins with high management potential and maximum wildlife benefit:

- Fully assess habitat of Minnesota's shallow lakes and document resource condition, determine management potential, and evaluate results of management activities on the subset of shallow lakes that are actively managed,
- Maximize management of shallow lakes for waterfowl and wildlife habitat that are Designated Wildlife Lakes or are located completely within public lands,
- Maximize management of shallow lakes for waterfowl and wildlife that are adjacent to public lands managed specifically for wildlife or public lands with wildlife habitat value,
- Increase waterfowl and wildlife habitat in shallow lakes with public access that do not have tracts of shoreline specifically managed for wildlife,
- Designate "Important Wild Rice Lakes" to further increase awareness of the historic, cultural and habitat importance of wild rice.
- The plan identifies Thief Lake as one of Minnesota's most famous waterfowl hunting lakes and as a unique lake due to the large numbers of colonial nesting water birds. Management problems identified in the plan that are applicable to Thief Lake include water quantity and quality concerns, climate change, land use and development within the watershed, hydrological alterations, invasive species, and physical disturbance from boat traffic.

13. Minnesota DNR Chronic Wasting Disease Response Plan (2016)

The Executive Summary from the Minnesota DNR Chronic Wasting Disease Response Plan state: "Chronic wasting disease (CWD) is an infectious neurological disease that occurs in North American deer (*Odocoileus* spp.), Rocky Mountain elk (*Cervus elaphus*), moose (*Alces alces*), and reindeer (*Rangifer tarandus*) and belongs to a group of diseases called transmissible spongiform encephalopathies. Chronic wasting disease is progressively fatal and has no known immunity, vaccine or treatment. Since 2002, over 40,000 hunter-harvested and 1,000 opportunistic or targeted wild deer have been tested for CWD in Minnesota, with one positive case identified.

This plan establishes general procedures to be followed for managing CWD if it is found in wild deer and procedures for wild deer surveillance if CWD is detected in a captive cervid facility."

14. Minnesota Prairie Conservation Plan (2011)

The Executive Summary from the Minnesota Prairie Conservation Plan states: "Minnesota's conservation partners in the Prairie Region of the state collaborated to develop a twenty-five year strategy for accelerating conservation. This strategy was precipitated by several factors:

1. Continuing loss and degradation of prairies, grasslands, wetlands and associated habitats along with the fish and wildlife dependent upon them.
2. An acknowledged need to better coordinate between programs and organizations to maximize efficiency.
3. Tremendous opportunities provided by the passage of the Clean Water, Land and Legacy Amendment by voters in 2008 that will provide significant conservation funding through 2034.

The plan calls for three approaches to conservation in the Prairie Region of the state. First, core areas with a high concentration of native prairie, other grasslands, wetlands, and shallow lakes were identified. Within these core areas, partners will work to ensure a minimum of 40% grassland and 20% wetland with the remainder in cropland or other uses. Second, habitat corridors connecting core areas were designed that include grassland/wetland complexes nine square miles in size at about six mile intervals along and within the corridors. Within the corridor complexes a goal of 40% grassland and 20% wetland was set and for the remainder of the corridors, 10% of each legal land section is to be maintained in permanent perennial cover. Third, in the remainder of the Prairie Region a goal to maintain 10% of each Land Type Association in perennial native vegetation was established. The existing wildlife management area plan, pheasant plan, duck plan and other resource plans provided guidance in setting goals for protection, restoration and enhancement in each conservation approach. These earlier plans set a habitat goal for the Prairie Region of protecting all 204,000 acres of native prairie while protecting and restoring a total of 2.0 million acres of grassland and savanna along with a 1.3 million acres of wetlands and shallow lakes.

Based on this framework and background, we propose the following:

1. Permanent protection through the acquisition from willing sellers of fee title or easement of native prairies, wetlands and other habitats (including land to be restored): about 222,100 acres in core areas, 82,000 acres in corridors, and 547,300 acres elsewhere.
2. Restoration activities on grasslands, wetlands and other habitats: 180,900 acres in core areas, 84,100 acres in corridors, and 251,000 acres elsewhere.
3. Enhancement of prairies and grasslands via prescribed fire, conservation grazing, haying and invasive species control: 100,560 acres annually in core areas, 42,050 acres annually in corridors, and 334,397 acres elsewhere. Enhancement of 335,047 acres of existing wetlands and shallow lakes through control of invasive species and intensive water level management is also included.

4. Incorporation of conservation into “working lands” so that some conservation lands contribute directly to local economies via “grass-based” agriculture and agricultural lands in turn provide some natural resources benefits as a result of applying using the full range of conservation practices.

The Minnesota Prairie Plan Working Group established organizational goals and cost estimates associated with these outcomes. The goals are accompanied by measures of success to gauge progress towards creating functioning landscapes. In addition, strategies should be re-evaluated regularly following monitoring activities and then management practices should be adjusted accordingly. The overall cost from all sources of the actions described in this plan is $3.6 billion. Given that certain activities will be accomplished with “traditional” funding sources, partners anticipate a need of $1.1 billion from the Outdoor Heritage Fund over the next 25 years to achieve desired outcomes.”

15. DNR Wolf Management Plan (2001)

This plan was prepared in anticipation of an imminent federal de-listing of gray wolves from the protections of the Endangered Species Act. The plan reaffirmed a position statement adopted by the DNR in 1998: “The Minnesota Department of Natural Resources is committed to ensuring the long-term survival of the wolf in Minnesota, and also to resolving conflicts between wolves and humans.”

The plan establishes two wolf management zones; Zone A with a minimum population of 1,600 wolves, and Zone B with no minimum goal set. The east end of the WMA (Randen Ridge) is within Zone A. The zones also differ in the extent to which landowners who shoot wolves to protect livestock and pets must document the level of threat actually posed by the wolf that was taken. In Zone A, the “killing of depredating wolves is limited to situations of immediate threat, and immediately following verified losses of livestock, domestic animals, or pets.” Also, “A person who destroys a wolf under these circumstances must protect all evidence and report the taking to a conservation officer as soon as practicable, but no later than 48 hours after the wolf is destroyed.”

16. Minnesota’s Wildlife Management Area Acquisition (2002)

The plan summarizes the history of WMA acquisition in Minnesota, and sets goals for acquisition for the next 50 years. There is an evaluation of Minnesota’s human population growth and the growth in outdoor related recreation. This leads to a recommendation for the acquisition of 702,200 acres over the 50 years following the creation of this plan (2002). There is a recommendation that acquisition be focused on the southern half of the state where current holdings are not as extensive, and where existing habitats are most at risk. This also results in increased holdings in proximity to Minnesota’s population centers.

The plan also includes a breakdown of the state into 10 ecological sections and evaluates current public ownership by category, and availability for outdoor based recreation. In the process it makes recommendation for acquisition within the ecological section in terms of habitat types to focus on and wildlife species most in need of habitat protection. It sets targets

for acquisition within the section for the entire 50 year period, and for intermediate time periods.

Within Ecological Section 3, Northern Prairie Parklands (the area containing Thief Lake WMA) there is a recommendation to obtain an additional 43,400 acres of WMAs over the course of 50 years. Of this total, 32,000 acres of acquisition would be focused on rounding out and completing existing WMAs, and 11,400 acres would be focused on new WMAs. Species of emphasis in this process would be waterfowl, sharp-tailed grouse, moose, deer, and ruffed grouse.

The plan also provides extensive history of acquisition, management, and acquisition programs that have contributed to Minnesota's WMA program. There is a discussion of the difference between major units and other WMAs, and also the legal basis for WMA purpose and use. The procedures for acquisition are discussed, as are PILT options. Challenges to the future of the acquisition program are also discussed.

17. DNR Moose Management and Research Plan (2011)

The DNR plan for preserving and recovering moose populations is focused heavily on northeast Minnesota where the moose population is currently around 3,710 animals. Highlights of the moose plan focus on more research to understand causes of mortality and to identify critical habitats during periods of summer heat. It also sets guidelines for when to close and reopen moose hunting, and sets a spring pre-fawn goal of <10 deer/mi^2 in moose range. Deer are implicated in spreading diseases to moose, and a threshold of 13 deer/mi^2 has been suggested as the density at which transmissions readily occur.

It should be noted that the current moose range in Minnesota lies in the northeast part of the state. While a remnant moose population still persists in the northwest, management of deer populations and habitats to enhance moose use is not being proposed in this area.

The plan notes important habitat differences between the northwestern and northeast moose populations. The northwest population occupied a mixture of public and private lands dominated by brushlands, mesic hardwood forests, aspen parklands, peatlands, agriculture and prairie; the northeast population ranges over boreal forest dominated by large blocks of public land containing large numbers of lakes and rivers. The plan notes the DNR expended significant effort at regenerating brushlands to improve browse in the northwest, but those efforts did not prevent the significant decline of moose there. Otherwise, most moose habitat management in Minnesota is accomplished through commercial timber harvest management. Some key timber harvesting guidelines to benefit moose include conifer retention, protecting aquatic resources, legacy patches, and riparian guidelines as found in the *Sustaining Minnesota Forest Resources: Voluntary Site-Level forest management Guidelines*.

Some other habitat management recommendations include:

- Increase stand complexity
- Promote regeneration of mixed-species stands
- Protect desirable browse vegetation while reducing competition with conifer seedlings
- Promote more use of prescribed fire and take appropriate advantage of wild fire

- Maintain upland brush communities
- Increase rotation age of aspen to increase understory browse while retaining summer thermal cover
- The use of prescribed fire, timber harvest, and mechanical treatment to create early successional habitats, and managing for patches of mature aspen are both elements of the Agassiz Lowlands SFRMP. The moose plan identifies using the SFRMP update process as an avenue for giving moose habitat needs more consideration on state lands in moose range.

18. Red Lake Watershed District Overall Plan (2006)

The Red Lake Watershed District's (RLWD) mission is to "reduce flooding and flood damages, to seek to improve water quality and enhance fish and wildlife habitat through sound water management" (Red Lake Watershed District, 2006).

The purpose of RLWD is to solve and prevent water related problems and coordinate all water management decisions in the watershed.

The intent of the RLWD is to partner to focus water flow management to meet a goal of reducing flooding, increased recreational opportunities, improved water quality and wildlife habitat by making the wisest possible use and conservation of the water and other related resources through water detention and other best management practices.

The RLWD identified one specific issue that is pertinent to the Thief Lake WMA: Large deltas forming at the east end of Thief Lake, long term solution would be to work on upstream storage, drainage and best management practices to reduce sediment coming into Thief Lake.

The RLWD has also adopted the following goal and strategies that may be pertinent to the Thief Lake Major Unit:

Goal 1: Focus on Improved fish habitat in the Mud, Moose and Thief Rivers

Strategies include: Support activities that reduce flashiness and enhance base flows, stabilize stream banks in areas of accelerated erosion.

Reduce sediment loads into streams, buffer all watercourses, large deltas are forming on the east end of Thief Lake (this sediment has been contributed from the lands in the watershed above the lake).

Implement agricultural BMPs to reduce wind and water erosion throughout the subwatershed, other strategies include ditches with side water inlets, buffer and grassed waterways, residue management, tree plantings, reduce farming into road ditches.

Goal 2: Maintain and Improve Wildlife Habitat

Strategies include: Re-establish habitat corridors along all major waterways, identify key areas and connect existing habitats along the corridors by promoting land use changes,

Connect existing corridor woodland habitats, promote, protect and enhance existing brushland habitats. Retain or increase CRP acres in areas with considerable loss of acres.

Protect grassland habitats, encourage active vegetation management for grassland quality (Rx burning, weed control, etc). Target CRP to increase number of large blocks of grassland habitats.

Protect wetland habitats, support efforts to retain WRP acres, enhance existing wetland habitat, encourage vegetation management that maintains wetland quality (MSU, Rx burning, weed control etc.).

Reduce flows or change timing into Thief Lake to help optimize management of waters for wildlife production and recreation.

Goal 3: Increase Recreational Opportunities

Strategies include: Partner with other groups to highlight existing opportunities, wildlife viewing/birding, hunting and trails.

19. Red River Basin Stream Survey Report, Red Lake River Watershed (2004)

This report represents the results of sampling efforts conducted in the year 2004 in streams and waterways that lie in the portion of the Red Lake River watershed that is managed by the Red Lake River Watershed District, Minnesota that are located downstream of Lower Red Lake.

Specifically this report describes the landscape setting, presents and discusses the results of current sampling, identifies factors impacting aquatic resources and outlines potential strategies to improve the condition of stream resources within the Red Lake River watershed downstream of Lower Red Lake and outside of the Red Lake Indian Reservation.

This report extensively evaluated the biology, hydrology, connectivity, habitat, and water quality of the watershed. The rivers and streams in the Red Lake River watershed have the capacity to provide a variety of high quality habitats for fish and other animals. Hydrologic conditions and unstable channels limit many reaches of streams from achieving their potential. This report recommends several methods of habitat protection and enhancement, as well as data and monitoring needs.

20. Ruffed Grouse in Minnesota: A Long-Range Plan for Management (2012)

This plan establishes a long-range vision for ruffed grouse, which includes sufficient quantity, quality and spatial distribution of habitat to support robust populations throughout the species range in the state, along with a fairly stable number of hunters enjoying a range of quality hunting experiences and having adequate access to public lands. A guiding principal of this plan is that management strategies implemented for ruffed grouse will contribute to the overall health of Minnesota's forested landscapes.

The plan identifies 1) quality hunting issues and quality hunting strategies, and 2) quality habitat issues and quality habitat strategies. Highlights of the former topic (hunting) include:

DNR will enhance the quality of hunting opportunities by providing more hunter access to grouse habitat and offering a balanced mix of hunting opportunities.

Establish new Hunter Walking Trails (HWTs), maintain HWTs by mowing, and expand efforts to inform the public of HWTs. HWTs are trails through mixed forest types where motorized vehicles are not permitted.

Promote Ruffed Grouse Management Areas (RGMAs). RGMAs are areas of forest land, often several sections in size, where management is prescribed to benefit ruffed grouse. RGMAs will be established through the SFRMP process.

Highlights of the latter topic (habitat) include:

- Convert a percentage of aspen stands to mixed conifer-hardwood stands.
- Where appropriate, apply silvicultural practices (winter harvest, clumped residual leave trees) that create high stem densities during early growth stages.
- Implement more habitat projects on WMAs.
- Emphasize ruffed grouse management in landscape-level management plans (e.g., SFRMP plans).
- Develop and communicate BMPs for ruffed grouse.
- Identify additional RGMAs.

21. Strategic Management Plan for Elk, Interim (2016)

This plan is an update of the plan drafted in 2009, based on work done in 2014 and 2015 in consultation with two advisory working groups (one for the Grygla herd and one for the Kittson County herds). Legislative action has served to keep the plan in draft status.

Elk are managed to maintain a free-ranging, wild population in northwest Minnesota. Current elk population goals were established in the 2009 elk management plan, which the Minnesota Department of Natural Resources developed with local advisory groups. The 2016-2020 draft elk management plan reflects a priority to maintain and further increase landowner acceptance of elk while increasing the herd sizes in Kittson County and bringing the Grygla herd up to the population goal established in 2009. This draft plan includes input from elk advisory work groups made up of a broad spectrum of stakeholders in northwest Minnesota.

Three distinct herds totaling approximately 130 animals roam portions of far northwest Minnesota and comprise the state's entire elk population, according to the DNR's most recent population survey.

The Caribou-Vita herd is Minnesota's largest herd. It is estimated at 120-150 elk that migrate between northern Kittson County and Manitoba. Seventy-nine elk were counted on the Minnesota side in the 2015 aerial survey. The current population goal is 150-200 elk inhabiting both sides of the border.

The Kittson-Central herd is located near Lancaster in Kittson County and contains roughly 35 elk. The 2009 population goal was 20-30 animals; whereas the draft 2016 plan sets a new goal range of 65-75 elk.

The Grygla herd in Marshall County has declined in recent years and is currently estimated to include about 20 elk. The 2009 population goal for the Grygla herd was 30-38 animals; the draft plan maintains that original goal.

There are several issues to consider when managing for the long-term survival of small elk populations, such as those found in Minnesota. Population dynamics, habitat availability and management, public acceptance, and risk of dis-ease exposure and transmission are some of the many factors that must be taken into account when managing for elk population viability.

Due to the proximity of the Kittson County elk herd to the international border, coordination with the Manitoba Ministry of Natural Resources is also an important component of management for this herd.

22. Thief Lake Disease Contingency Plan (2008)

This plan was last updated in March 2008, and as such is in need of some updating for contact information. It provides an overview of disease history on the WMA, disease surveillance procedures, responses to various disease scenarios, and a listing of equipment and supplies available, along with contacts for reference in outbreak situations.

23. Thief Lake Wildlife Management Area Master Plan (1980-1989)

The Thief Lake Wildlife Management Area Master Plan provides a detailed description of the setting and management programs in place for the WMA at the time it was written. There is an excellent discussion of the historical and archeological setting, both of the WMA and for the area as a whole. This is followed by an inventory of abiotic and biotic conditions for the area.

The plan provides plenty of detail of the lands, facilities, and public use programs in place at that time, serving as a snapshot of conditions. It goes on to describe public use in some detail with data from ongoing monitoring efforts.

These descriptions provide a basis for discussion of a variety of management programs in place at the time the plan was written. Many of these programs are still in place (e.g. water management of Thief Lake itself), while others have seen substantial modification. Management programs that have seen substantial change are mentioned below.

Since the time the plan was written, the wetland management program has seen the addition of the Moose River Impoundment, which regulates water storage and delivery in the headwaters of the Moose River, the largest water source for Thief Lake. A number of moist soils units have been constructed and added to the wetland management program, as have managed semi-permanent wetland impoundments.

Forest management has become much more complex since the plan was written. At that time, there was essentially no timber market in the area, and management tools consisted of personal use fuelwood sales and bulldozing aspen to provide diversity of age classes. Now forests on the WMA are managed cooperatively with the Division of Forestry through the SFRMP process. Commercial timber harvest is used to achieve management goals.

Prescribed fire remains a preferred management tool for a variety of cover types. The WMA is no longer divided into compartments for this effort, and additional tools for both modeling effects and achieving goals, such as the regional roving crew, are now available.

At the time of the original plan, Canada geese were still expanding their range across the state, and a resident flock was still being maintained to serve as a source for expanding locally nesting

goose populations. Geese now nest throughout all appropriate habitats in the state, and the resident flock is no longer maintained. Concurrent intensively regulated public hunting programs for migrant Canada geese in place at that time were expanded, and have since undergone some de-emphasis in time commitments.

The 1980 plan included an extensive discussion of a supplement to the WMA, which was to expand the WMA by over 70%. This supplement has since been largely achieved by the dedication of con con lands (along with the interspersed School Trust lands) in Linsell, Como and Huntly Townships to WMA status. This expansion was originally done by Commissioner Joe Alexander in 1991. The Legislature decided in 1999 that the authority to do this rested with them, and dedication of the lands as WMA was suspended until ultimately dedicated by the Legislature in 2002.

Appendices to the plan include inventories of species present on the WMA, details on some public use surveys that were conducted for the writing of the plan, and pertinent policies governing management of the area.

24. Water Management Plan for Thief Lake, 45000100 (2011)

This plan was finalized in 2011 and discusses management actions relative to Thief Lake (the water body rather than the entire WMA). It presents the history of Thief Lake and management actions, along with describing the lake and its tributaries. It discusses normal operating levels and the historical range of levels, and presents a description of annual operations and coordination.

In addition to the management of the basin, the plan includes sections on aquatic vegetation, water quality, fish populations, invertebrates and rare features. The final portion of the plan includes a list of management objectives relating to the management and maintenance of water levels, wetland habitats and access. For each objective there is a discussion of thresholds and actions to be taken to achieve the listed objectives.

25. Wetland Conservation Act (1991)

The Minnesota Wetland Conservation Act of 1991 is more than an Act codifying wetland protection measures. It also established 18 peatland Scientific and Natural Areas, gave special protections to calcareous fens, and it established a state policy towards wetlands. The state policy is to "A) achieve no net loss in the quantity, quality, and biological diversity of Minnesota's existing wetlands; B) increase the quantity, quality, and biological diversity of Minnesota's wetlands by restoring or enhancing diminished or drained wetlands; C) avoid direct or indirect activities that destroy or diminish the quantity, quality, and biological diversity of wetlands; and D) replace wetland values where avoidance of activity is not feasible and prudent." The added protections provided to calcareous fens are: "Calcareous fens may not be drained or filled or otherwise altered or degraded except as provided for in a management plan approved by the [DNR] commissioner." A calcareous fen exists in the Bemis swamp area.

The Wetland Conservation Act also provides extra protections to endangered and threatened species, rare natural communities, and special fish and wildlife resources by requiring denial of permit applications that do not adequately mitigate adverse impacts.

In addition, DNR has an Executive Order Policy imposing a higher mitigation standard for DNR projects: any project that impacts more than 0.10 acres of wetlands that would otherwise be exempt under WCA, except for incidental wetlands, shall be replaced at a minimum 1:1 ratio.

26. Working with Partners for Wildlife Conservation: Minnesota's Wildlife Action Plan (2015-2025)

The Minnesota Wildlife Action Plan is an update to the 2005 State Wildlife Action Plan. The purpose of the plan is to proactively address conservation needs of sensitive species before a species reaches the need for listing under the Endangered Species Act. The plan identifies wildlife in greatest need of conservation, evaluates their conservation needs, and outlines the necessary action steps.

The 2015-2025 plan lists the following goals:

1) Ensure the long-term health and viability of Minnesota's wildlife, with a focus on species that are rare, declining, or vulnerable to decline

2) Enhance opportunities to enjoy Species in Greatest Conservation Need and other wildlife and to participate in their conservation

3) Acquire the resources necessary to successfully implement the Minnesota Wildlife Action Plan

The plan takes a three-pronged approach to ensuring the long-term health and viability of Minnesota's wildlife. The first and most comprehensive is the habitat approach.

In identifying Minnesota's 2015 list of SGCN, experts considered a number of causes for decline, including habitat loss, habitat degradation and fragmentation, disease, pollution, and exploitation. They also considered life-history traits of species that could increase their vulnerability to threats. The primary causes of decline are habitat-related. The habitat approach focuses on sustaining and enhancing terrestrial and aquatic habitats for SGCN in the context of the larger landscapes.

To facilitate the implementation of this approach, the plan identifies a Wildlife Action Network that represents quality habitats for terrestrial and aquatic SGCN, and it provides for updating the network as new SGCN population and habitat information become available.

The second approach focuses on specific SGCN or groups of species that are affected by non-habitat related issues. The species approach identifies a prioritized group of species whose needs cannot be sufficiently addressed by the habitat approach, and suggests specific conservation actions. The plan also identifies species for which more information is needed to assess their conservation status or the factors contributing to population declines.

The Wildlife Action Network and many of the habitat-related conservation actions identified in the plan also may mitigate specific life-history traits (such as limited dispersal ability or requirements for multiple habitats throughout a species life time) that may increase a species' or a population's sensitivity to climate change and other stressors.

The third approach recognizes that providing people with opportunities to enjoy wildlife and habitats and to actively participate in their conservation helps to ensure an engaged conservation community now and into the future that supports conservation funding and contributes to Minnesota's outdoor recreation-based economies.

Appendix B. Acronyms Used in the Thief Lake WMA Master Plan

Acronym	Explanation	Page First Occurs
AI	Avian Influenza	76
ATV	All-Terrain Vehicle	21
BMP	Best Management Practices	86
BPS	Basic Programs and Services	74
BTb	Bovine Tuberculosis	49
BWSR	Board of Water and Soil Resources	12
CCC	Civilian Conservation Corps	15
CCMP	Comprehensive Conservation Management Plan	112
CFA	Cooperative Farming Agreement	41
CFS	Cubic Feet per Second	89
CHZ	Controlled Hunt Zone	59
Con Con	Consolidated Conservation	15
CRP	Conservation Reserve Program	21
CWD	Chronic Wasting Disease	63
DFFC	Desired Future Forest Composition	110
DNR	Minnesota Department of Natural Resources	2
DPA	Deer Permit Area	114
ECS	Ecological Classification System	86
END	Endangered	32
EPP	Eastern Prairie Population	46
ESA	Endangered Species Act	52
EWR	Division of Ecological and Water Resources	10

Acronym	Explanation	Page First Occurs
FAW	Division of Fish and Wildlife	10
FDR	Flood Damage Reduction	19
FOR	Division of Forestry	2
FTC	Forest Tent Caterpillar	79
GPM	Gallons per Minute	26
HQ	Headquarters	135
HWT	Hunter Walking Trails	64
IBA	Important Bird Area	20
LAM	Division of Lands and Minerals	10
LCCMR	Legislative-Citizen Commission on Minnesota Resources	17
LSOHC	Lessard-Sams Outdoor Heritage Council	17
LTA	Land Type Association	19
LUP	Land Utilization Project	112
MNWAP	Minnesota Wildlife Action Plan	20
MOA	Management Opportunity Area	94
MSL	Mean Sea Level	28
MSU	Moist Soils Unit	29
NPC	Native Plant Community	30
NWR	National Wildlife Refuge	20
OHV	Off-Highway Vehicle	67
PAT	Division of Parks and Trails	10
PILT	Payment in Lieu of Taxes	74
PPM	Parts per Million	27
RGMA	Ruffed Grouse Management Area	122

Acronym	Explanation	Page First Occurs
RLWD	Red Lake Watershed District	27
SFRMP	Subsection Forest Resource Management Plan	94
SF	State Forest	20
SGCN	Species of Greatest Conservation Need	21
SPC	Species of Special Concern	32
SWCD	Soil and Water Conservation District	86
THR	Threatened	32
TLCB	Two-Lined Chestnut Borer	81
USFWS	U.S. Fish and Wildlife Service	11
WMA	Wildlife Management Area	2

Appendix C. Land Ownership Designations and Implications

A. Consolidated Conservation

At settlement times in the late 1800s and early 1900s, settlers from the world over were enticed to northern parts of Minnesota to acquire land and make a living in agricultural endeavors. Much of this land was not farmable due to vast wetlands that occurred there, and large drainage projects ensued to accommodate farming practices. Settlers on these lands were assessed for the drainage projects to cover the costs of development of legal ditch systems. When these assessments came due, many of the settlers found the additional financial burden of the ditch assessments greater than they could bear and the land went tax forfeit. Counties assumed responsibility for delinquent drainage bonds, but also experienced difficulty in making payments on the debt. Through three separate laws passed in 1929, 1931, and 1933, the state paid the cost of the drainage bonds for the counties. In return, the state accepted fee title on all forfeited land within specific areas established by the legislature in seven counties: Aitkin, Beltrami, Koochiching, Lake of the Woods, Mahnomen, Marshall and Roseau. These lands now owned in fee by the state became known as Consolidated Conservation lands.

Between 1929 and 1984, the state acquired title to more than 1.9 million acres of Consolidated Conservation area lands in the seven counties. Effective May 3, 1984, the Minnesota legislature ended the policy of conveying title to the state, free from the trust to the taxing districts, for tax forfeitures within the consolidated conservation areas.

The Department of Conservation classified the lands as suitable for agriculture, afforestation, reforestation or wildlife preservation, propagation, breeding and hunting. The laws authorized the sale of lands that were classified for agriculture. By the mid-1980s, about 53 percent (an estimated 78,438 acres) of the original con con land in Marshall County was sold into private hands.

All remaining con con lands are under the management of the Commissioner of the Department of Natural Resources; see Minnesota Statutes, Chapter 84A for additional information.

B. Acquired

Acquired lands are a general category that refers to lands the DNR has acquired through purchase, gift, condemnation, and transfer of custodial control. The type of funds used for acquisition may restrict divestiture or land use.

The DNR acquires land to meet resource management objectives. Land is acquired by purchase from willing sellers under county board approval. Lands are also gifted to the state for use for natural resource purposes. An increasingly common practice today is for non-profit land trust organizations or conservation organizations to gift property to the state for the mutual goals of resource management objectives and recreational use.

The DNR also receives land from other state agencies through transfer of custodial control. The land is already in state ownership, and the transfer moves the responsibility for and management of the land to another state agency. The DNR received several parcels of land upon closure of a sizeable portion of the state hospital system.

C. School Trust Land

School Trust lands are held in trust by the state with the revenue used for the public schools of the state.

It had been a long established tradition in the United States to set aside lands in trust for the support of schools. The roots of this extend back to colonial practice and to English tradition. The United States passed a General Land Ordinance in 1785, which allowed for the sale of western lands and provided for section 16 of each public land survey township to be set aside "for the maintenance of public schools" within the township. With the formation of the states from the western territories, these reserved lands would become School Trust lands. This was first put into practice with the admission of Ohio to the Union in 1802. All states admitted to the Union since 1802 have received some amount of School Trust land, except those few cases where the federal government owned no land.

The federal Organic Act of 1849 created the Territory of Minnesota and reserved sections 16 and 36 of each public land survey "for the purpose of being applied to the schools in said territory." (In 1848 Oregon was the first territory to have two sections reserved for the use of schools; Minnesota was the second territory to receive this double grant.) The federal Enabling Act of 1857 granted Minnesota these reserved lands and the state's citizens accepted this grant with the adoption of a Constitution on October 13, 1857.

Minnesota's Constitution established the Permanent School Trust Fund. Revenue from the School Trust lands is deposited into the fund. The School Trust Fund supports public schools (non-tuition education grades K- 12).

Minnesota's original Constitution provided that the school lands could only be disposed of by public sale, a condition that is still found in the state's Constitution. The first sale of school lands was in 1862. The lands in the southern part of the state that were valuable for agriculture sold more quickly than the lands in the northern part of the state. About two-thirds of the lands from the original grant were sold.

The management of School Trust lands on WMAs, including the 12,478 acres of School Trust lands on Thief Lake WMA, receives direction under Operational Order 121.

D. Swampland

(Now managed as School Trust Fund)

In 1860, the U.S. Congress granted Minnesota all the swamp and overflowed waters in the state that had not been previously reserved or conveyed. Only 15 states received this land grant. The money from the sale of the lands was to be used to construct levees and drains. Minnesota

chose the option of identifying the swamp lands by the field notes of the government surveys. The granted swamp lands totaled about 4.7 million acres of land being given to the state.

Instead of following the requirement to use the money from the sale of the lands to drain lands, the state granted about 2.8 million acres of land to the railroads. Specific grants of swamp lands were also made for the Stevens Seminary in McLeod County, the Madelia and Sioux Falls Wagon Road and the Cannon River Manufacturing Association. Swamp lands were also granted for a psychiatric institution, a state prison, three schools, and the Faribault Regional Center, which closed July 1, 1998.

The federal government took no action to stop the action of the state. The practice was halted by an amendment to Minnesota's Constitution in 1891. After that time, the swamp lands were sold in the same manner as the School Trust lands. Money from the sale of swamp lands was placed into a permanent trust fund that eventually merged with the Permanent School Trust Fund. About three-fourths of the swamp lands were sold or given away.

E. Volstead

Volstead Lands were purchased by the state from the federal government. In 1908, the U.S Congress authorized the establishment of liens for drainage ditches on unpatented federal lands. The United States was not liable to pay the liens, but the purchasers of the land from the federal government were liable for the assessment. The intention was that with drainage the lands would be settled and become suited for agricultural development.

The U.S. Congress in 1958 authorized Minnesota to purchase certain of these lands which were subject to the liens. The purchase price was the appraised value less the amount of the drainage liens assessed against the lands. Minnesota was not liable for the drainage ditch assessment lien, but future revenue would provide compensation to the counties.

In 1961, the State Legislature appropriated funds to purchase 33,221 acres of these lands. The lands were placed under the jurisdiction of the Commissioner of Conservation. The lands are leased, sold or exchanged in the same manner as School Trust lands. Any revenue is split 50% to the county in which the lands are located (to compensate for the drainage ditch lien that was not paid) and 50% to the general fund (to compensate for the cost of purchasing the land).

Appendix D. Land Type Associations in Thief Lake WMA

Land Type Associations (LTAs) are the product of the geology, soils, topography, hydrology, and plant history of a given area. Thief Lake WMA is superimposed over five LTAs, which are further described below.

A. Dohrman Ridge LTA

Concept: A complex of prominent beach ridges separated by nearly level areas of shallow water lake sediments. Soil materials are sand and gravel to sandy loam. Areas of upland soils formed under both prairie and forest vegetation exist (NRCS, 1994). Pre-settlement vegetation included prairie, aspen-oak land, aspen-tamarack forest (GLO Bearing Trees and Marschner, 1974). Uplands occupy 69%, wetlands occupy 31%, and lakes occupy <1% of the LTA. NOTE that the WMA represents a large portion of this LTA.

B. Thief Lake Peatlands LTA

Concept: A level landscape with a complex of peatlands intermixed with upland beach ridges, lake-washed till, and shallow-water lake sediments. The peatlands are formed primarily of herbaceous (grass and sedge) plant material. Soil parent material on the uplands ranges from sand to sandy loam. Most of the upland soils were formed under prairie communities. The eastern edge has soils that formed under forest vegetation. Dominant pre-settlement plant community was conifer bogs and swamps with minor amounts of wet prairie, aspen-tamarack forest, and aspen-oak land (GLO Bearing Trees and Marschner, 1974). Uplands occupy 26%, wetlands occupy 64%, and lakes occupy 10% of the LTA. NOTE the WMA represents a large portion of this LTA.

C. Newfolden Lake Plain LTA

Concept: A nearly level landscape comprised by a lake plain deposited by Glacial Lake Agassiz (west) and a wave-washed till formed by the Red River Lobe glacier (east). Soil materials in the lake plain are sandy and is sandy over clay loam or clay in the till plain. All soils have characteristics of being formed under prairie vegetation (NRCS, 1994). Presettlement vegetation was predominantly brush prairie, prairie, and wet prairie (Marschner, 1974). Uplands occupy 95%, wetlands occupy 5%, and lakes occupy <1% of the LTA.

D. Goodridge Till Plain LTA

Concept: A nearly level till plain that was covered for a short time by Glacial Lake Agassiz. The wave action of the shallow water smoothed the terrain and deposited sandy material on top of the till. Soil materials are typically clay loam or loam in texture; thin layers of sandy loam may occur on the surface. Most of the upland soils have characteristics of forming under both prairie and forest vegetation, perhaps savannas (NRCS, 1994). Scattered areas contain prairie soils (NRCS, 1994). Presettlement vegetation was predominantly brush prairie, prairie, and wet

prairie with minor amounts of aspen-oak woodlands and oak openings/barrens. (Marschner, 1974). Uplands occupy 86%, wetlands occupy 14%, and lakes occupy <1% of the LTA.

E. Beltrami-Pine Island Peatlands LTA

Concept: This LTA is a flat landscape dominated by peatland complexes of fens and bogs with isolated small areas of upland mineral soil. Wetlands occupy 97%, uplands occupy 3%, and lakes occupy <1% of the LTA (MNDNR 1998). There are 0.7 miles of streams per square mile. The majority of the mineral soils in the LTA have clay, loam, or sandy textures. All mineral soils were formed under forest vegetation (NRCS 1994). Vegetation patterns due to differences in water flow and chemistry are present throughout the LTA. Bogs tend to be more abundant in areas with loamy or clayey soil material while fens are associated with sandy material (Glaser 1992). The majority of the upland presettlement vegetation was wet-mesic hardwood-conifer with very minor amounts of dry (jack) pine (Shadis 1999, Marschner 1974). The majority of lowland presettlement vegetation was conifer bog and swamp (Marschner 1974).

F. Beltrami-Pine Island Beach Ridges LTA

Concept: This LTA's beach ridges were formed by Glacial Lake Agassiz. Uplands occupy 26%, wetlands occupy 74%, and lakes occupy <1% of the LTA (MNDNR 1998). Soil parent material is sand and gravel that formed under forest vegetation (NRCS 1994). Dominant presettlement communities were wet-mesic hardwood-conifer (white pine) and dry jack pine (Marschner 1974). Historic disturbance regimes for these communities are high intensity forest replacement fires occurring every 150-350 years and low intensity forest maintenance fires every 5-50 years, respectively (Shadis 1999).

Appendix E. Public Lands within 30 Miles of the Thief Lake WMA Headquarters (HQ)

Area Name	Size (acres)	Distance and Direction from HQ	Administration
Palmville WMA	14,891	4 miles north	DNR Wildlife (Thief Lake)
Agassiz NWR	61,487	4 miles south	US Fish and Wildlife Service
Whiteford WMA	76	4 miles south	DNR Wildlife (Thief Lake)
Mud Lac WMA	240	6 miles south	DNR Wildlife (Thief River Falls)
Nereson WMA	9583	9 miles north	DNR Wildlife (Thief Lake)
Cedar II WMA	164	9 miles SW	DNR Wildlife (Thief River Falls)
Elm Lake WMA	15,750	14 miles south	DNR Wildlife (Thief River Falls)
Strathcona WMA	35	15 miles NW	DNR Wildlife (Karlstad)
East Park WMA	10,427	15 miles west	DNR Wildlife (Karlstad)
Wapiti WMA	31,759	16 miles east	DNR Wildlife (Thief Lake)
Moylan WMA	1715	16 miles SE	DNR Wildlife (Thief River Falls)
Valley WMA	656	17 miles SE	DNR Wildlife (Thief River Falls)
Espelie WMA	3644	18 miles SE	DNR Wildlife (Thief River Falls)
McKinock WMA	40	19 miles NE	DNR Wildlife (Norris Camp)
Hereim WMA	184	19 miles NW	DNR Wildlife (Karlstad)
Lind WMA	653	19 miles NW	DNR Wildlife (Karlstad)
Agder WMA	274	19 miles south	DNR Wildlife (Thief River Falls)
Snowshoe WMA	228	20 miles south	DNR Wildlife (Thief River Falls)
Marbel WMA	87	21 miles NE	DNR Wildlife (Norris Camp)
Benville WMA	1194	21 miles SE	DNR Wildlife (Thief River Falls)
Newfolden WMA	200	21 miles SW	DNR Wildlife (Karlstad)
Beltrami Island State Forest	703,360	22 miles east	DNR Forestry

Area Name	Size (acres)	Distance and Direction from HQ	Administration
Moose River WMA	14,323	22 miles ESE	DNR Wildlife (Thief Lake)
Twin Lakes WMA	8874	22 miles NW	DNR Wildlife (Karlstad)
Willow-Run WMA	3564	22 miles SE	DNR Wildlife (Thief River Falls)
Sharp WMA	161	24 miles south	DNR Wildlife (Thief River Falls)
Bear Creek WMA	285	25 miles NE	DNR Wildlife (Baudette)
Reiner WMA	121	27 miles SE	DNR Wildlife (Thief River Falls)
Red Lake WMA	210,857	29 miles east	DNR Wildlife (Norris Camp)

Appendix F. Complete Bird Checklist for Thief Lake WMA

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Greater White-fronted Goose	*Anser albifrons*		
Snow Goose	*Chen caerulescens*		
Ross's Goose	*Chen rossii*		
Canada Goose	*Branta canadensis*		
Trumpeter Swan	*Cygnus buccinator*	SPC	
Tundra Swan	*Cygnus columbianus*		
Wood Duck	*Aix sponsa*		
Gadwall	*Anas strepera*		
American Wigeon	*Anas americana*		
American Black Duck	*Anas rubripes*	SGCN	
Mallard	*Anas platyrhynchos*		
Blue-winged Teal	*Anas discors*		
Northern Shoveler	*Anas clypeata*		
Northern Pintail	*Anas acuta*	SGCN	
Green-winged Teal	*Anas crecca*		
Canvasback	*Aythya valisineria*		
Redhead	*Aythya americana*		
Ring-necked Duck	*Aythya collaris*		
Greater Scaup	*Aythya marila*		
Lesser Scaup	*Aythya affinis*	SGCN	
Surf Scoter	*Melanitta perspicillata*		
White-winged Scoter	*Melanitta fusca*		
Long-tailed Duck	*Clangula hyemalis*		

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Bufflehead	*Bucephala albeola*		
Common Goldeneye	*Bucephala clangula*		
Hooded Merganser	*Lophodytes cucullatus*		
Common Merganser	*Mergus merganser*	SGCN	
Red-breasted Merganser	*Mergus serrator*		
Ruddy Duck	*Oxyura jamaicensis*		
Gray Partridge	*Perdix perdix*		
Ruffed Grouse	*Bonasa umbellus*		
Sharp-tailed Grouse	*Tympanuchus phasianellus*	SGCN	
Greater Prairie-Chicken	*Tympanuchus cupido*	SPC	
Pied-billed Grebe	*Podilymbus podiceps*		
Horned Grebe	*Podiceps auritus*	END	
Red-necked Grebe	*Podiceps grisegena*	SGCN	
Eared Grebe	*Podiceps nigricollis*	SGCN	
Western Grebe	*Aechmophorus occidentalis*	SGCN	
Rock Pigeon	*Columba livia*		
Mourning Dove	*Zenaida macroura*		
Black-billed Cuckoo	*Coccyzus erythropthalmus*	SGCN	
Common Nighthawk	*Chordeiles minor*	SGCN	
Eastern Whip-poor-will	*Antrostomus vociferus*	SGCN	
Ruby-throated Hummingbird	*Archilochus colubris*		
Yellow Rail	*Coturnicops noveboracensis*	SPC	
Virginia Rail	*Rallus limicola*	SGCN	
Sora	*Porzana carolina*		

Common Name	Scientific Name	State Status[1]	Fed Status[1]
American Coot	*Fulica americana*		
Sandhill Crane	*Grus canadensis*		
Whooping Crane	*Grus americana*		END (exp pop)
American Avocet	*Recurvirostra americana*		
Black-bellied Plover	*Pluvialis squatarola*		
Semipalmated Plover	*Charadrius semipalmatus*		
Killdeer	*Charadrius vociferus*		
Upland Sandpiper	*Bartramia longicauda*	SGCN	
Hudsonian Godwit	*Limosa haemastica*		
Marbled Godwit	*Limosa fedoa*	SPC	
Ruddy Turnstone	*Arenaria interpres*		
Red Knot	*Calidris canutus*	SGCN	THR
Stilt Sandpiper	*Calidris himantopus*		
Sanderling	*Calidris alba*		
Dunlin	*Calidris alpina*		
Least Sandpiper	*Calidris minutilla*		
Pectoral Sandpiper	*Calidris melanotos*		
Short-billed Dowitcher	*Limnodromus griseus*	SGCN	
Long-billed Dowitcher	*Limnodromus scolopaceus*		
Wilson's Snipe	*Gallinago delicata*		
American Woodcock	*Scolopax minor*	SGCN	
Spotted Sandpiper	*Actitis macularius*		
Greater Yellowlegs	*Tringa melanoleuca*	SGCN	
Willet	*Tringa semipalmata*		

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Lesser Yellowlegs	*Tringa flavipes*		
Wilson's Phalarope	*Phalaropus tricolor*	THR	
Bonaparte's Gull	*Chroicocephalus philadelphia*		
Franklin's Gull	*Leucophaeus pipixcan*	SPC	
Ring-billed Gull	*Larus delawarensis*		
Herring Gull	*Larus argentatus*		
Caspian Tern	*Hydroprogne caspia*		
Black Tern	*Chlidonias niger*	SGCN	
Forster's Tern	*Sterna forsteri*	SPC	
Common Loon	*Gavia immer*	SGCN	
Double-crested Cormorant	*Phalacrocorax auritus*		
American White Pelican	*Pelecanus erythrorhynchos*	SPC	
American Bittern	*Botaurus lentiginosus*	SGCN	
Least Bittern	*Ixobrychus exilis*	SGCN	
Great Blue Heron	*Ardea herodias*		
Great Egret	*Ardea alba*		
Cattle Egret	*Bubulcus ibis*		
Green Heron	*Butorides virescens*		
Black-crowned Night-Heron	*Nycticorax nycticorax*	SGCN	
Yellow-crowned Night-Heron	*Nyctanassa violacea*		
Turkey Vulture	*Cathartes aura*		
Bald Eagle	*Haliaeetus leucocephalus*		
Northern Harrier	*Circus cyaneus*	SGCN	
Sharp-shinned Hawk	*Accipiter striatus*		

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Cooper's Hawk	*Accipiter cooperii*		
Northern Goshawk	*Accipiter gentilis*	SPC	
Broad-winged Hawk	*Buteo platypterus*		
Swainson's Hawk	*Buteo swainsoni*	SGCN	
Red-tailed Hawk	*Buteo jamaicensis*		
Rough-legged Hawk	*Buteo lagopus*		
Golden Eagle	*Aquila chrysaetos*		
Great Horned Owl	*Bubo virginianus*		
Snowy Owl	*Bubo scandiacus*		
Burrowing Owl	*Athene cunicularia*	END	
Barred Owl	*Strix varia*		
Great Gray Owl	*Strix nebulosa*		
Short-eared Owl	*Asio flammeus*	SPC	
Northern Saw-whet Owl	*Aegolius acadicus*		
Belted Kingfisher	*Megaceryle alcyon*	SGCN	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	SGCN	
Red-bellied Woodpecker	*Melanerpes carolinus*		
Yellow-bellied Sapsucker	*Sphyrapicus varius*		
Downy Woodpecker	*Picoides pubescens*		
Hairy Woodpecker	*Picoides villosus*		
Northern Flicker	*Colaptes auratus*		
Pileated Woodpecker	*Dryocopus pileatus*		
Crested Caracara	*Caracara cheriway*		
American Kestrel	*Falco sparverius*	SGCN	

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Merlin	*Falco columbarius*		
Peregrine Falcon	*Falco peregrinus*	SPC	
Olive-sided Flycatcher	*Contopus cooperi*	SGCN	
Eastern Wood-Pewee	*Contopus virens*		
Yellow-bellied Flycatcher	*Empidonax flaviventris*		
Alder Flycatcher	*Empidonax alnorum*		
Willow Flycatcher	*Empidonax traillii*		
Least Flycatcher	*Empidonax minimus*		
Eastern Phoebe	*Sayornis phoebe*		
Great Crested Flycatcher	*Myiarchus crinitus*		
Western Kingbird	*Tyrannus verticalis*	SGCN	
Eastern Kingbird	*Tyrannus tyrannus*		
Northern Shrike	*Lanius excubitor*		
Yellow-throated Vireo	*Vireo flavifrons*		
Blue-headed Vireo	*Vireo solitarius*		
Philadelphia Vireo	*Vireo philadelphicus*	SGCN	
Warbling Vireo	*Vireo gilvus*		
Red-eyed Vireo	*Vireo olivaceus*		
Gray Jay	*Perisoreus canadensis*		
Blue Jay	*Cyanocitta cristata*		
Black-billed Magpie	*Pica hudsonia*		
American Crow	*Corvus brachyrhynchos*		
Common Raven	*Corvus corax*		
Horned Lark	*Eremophila alpestris*		

Common Name	Scientific Name	State Status[1]	Fed Status[1]
Purple Martin	*Progne subis*	SPC	
Tree Swallow	*Tachycineta bicolor*		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	SGCN	
Bank Swallow	*Riparia riparia*		
Cliff Swallow	*Petrochelidon pyrrhonota*		
Barn Swallow	*Hirundo rustica*		
Black-capped Chickadee	*Poecile atricapillus*		
Red-breasted Nuthatch	*Sitta canadensis*		
White-breasted Nuthatch	*Sitta carolinensis*		
Brown Creeper	*Certhia americana*		
House Wren	*Troglodytes aedon*		
Winter Wren	*Troglodytes hiemalis*	SGCN	
Sedge Wren	*Cistothorus platensis*	SGCN	
Marsh Wren	*Cistothorus palustris*		
Golden-crowned Kinglet	*Regulus satrapa*		
Ruby-crowned Kinglet	*Regulus calendula*		
Eastern Bluebird	*Sialia sialis*		
Mountain Bluebird	*Sialia currucoides*		
Veery	*Catharus fuscescens*	SGCN	
Gray-cheeked Thrush	*Catharus minimus*		
Swainson's Thrush	*Catharus ustulatus*		
Hermit Thrush	*Catharus guttatus*		
American Robin	*Turdus migratorius*		
Varied Thrush	*Ixoreus naevius*		

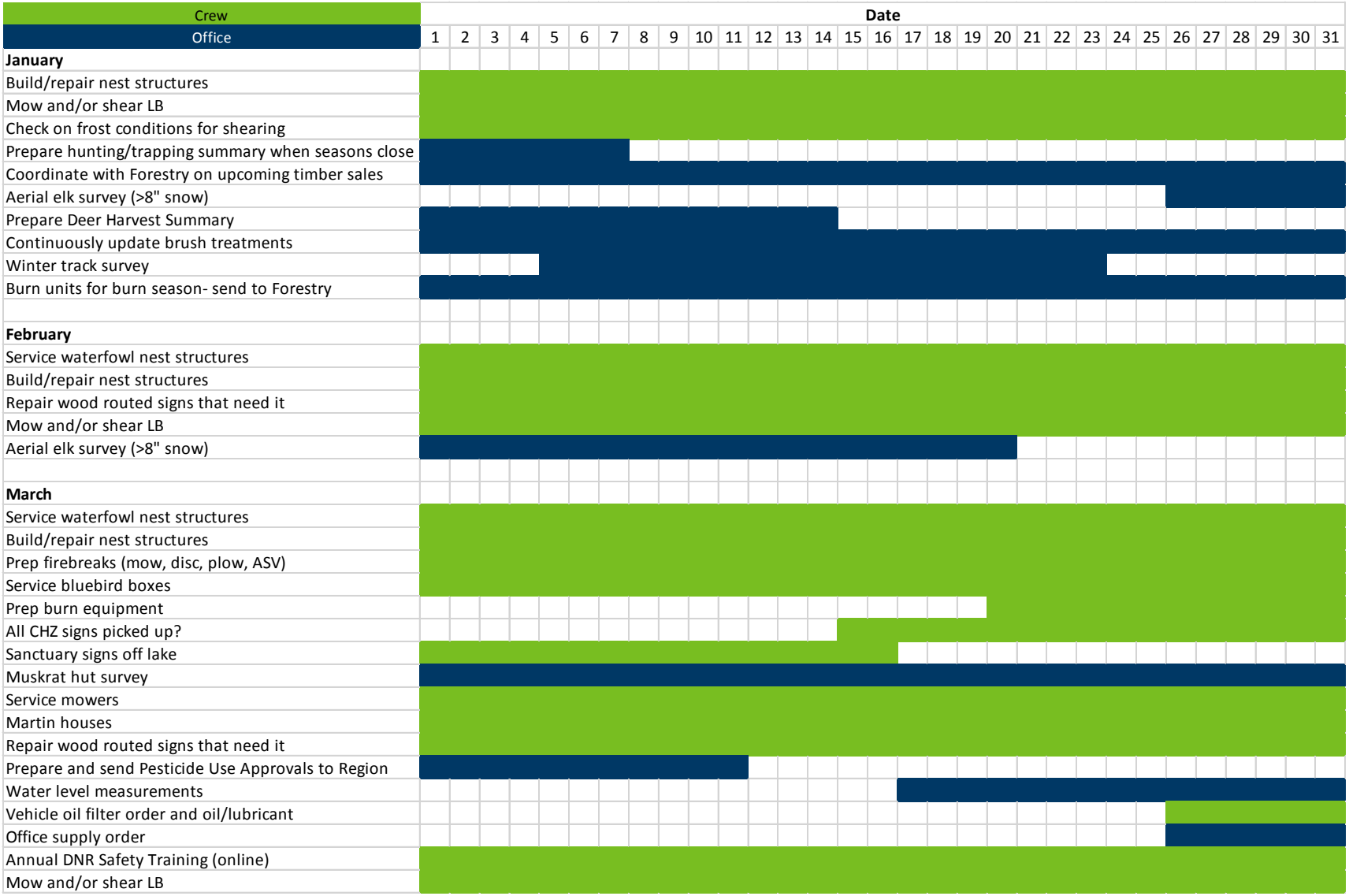
Common Name	Scientific Name	State Status[1]	Fed Status[1]
Gray Catbird	*Dumetella carolinensis*		
Brown Thrasher	*Toxostoma rufum*	SGCN	
European Starling	*Sturnus vulgaris*		
Bohemian Waxwing	*Bombycilla garrulus*		
Cedar Waxwing	*Bombycilla cedrorum*		
House Sparrow	*Passer domesticus*		
Pine Grosbeak	*Pinicola enucleator*		
Purple Finch	*Haemorhous purpureus*	SGCN	
Red Crossbill	*Loxia curvirostra*		
White-winged Crossbill	*Loxia leucoptera*		
Common Redpoll	*Acanthis flammea*		
Hoary Redpoll	*Acanthis hornemanni*		
Pine Siskin	*Spinus pinus*		
American Goldfinch	*Spinus tristis*		
Evening Grosbeak	*Coccothraustes vespertinus*	SGCN	
Chestnut-collared Longspur	*Calcarius ornatus*	END	
Snow Bunting	*Plectrophenax nivalis*		
Ovenbird	*Seiurus aurocapilla*		
Northern Waterthrush	*Parkesia noveboracensis*		
Golden-winged Warbler	*Vermivora chrysoptera*	SGCN	
Black-and-white Warbler	*Mniotilta varia*		
Tennessee Warbler	*Oreothlypis peregrina*		
Orange-crowned Warbler	*Oreothlypis celata*		
Nashville Warbler	*Oreothlypis ruficapilla*		

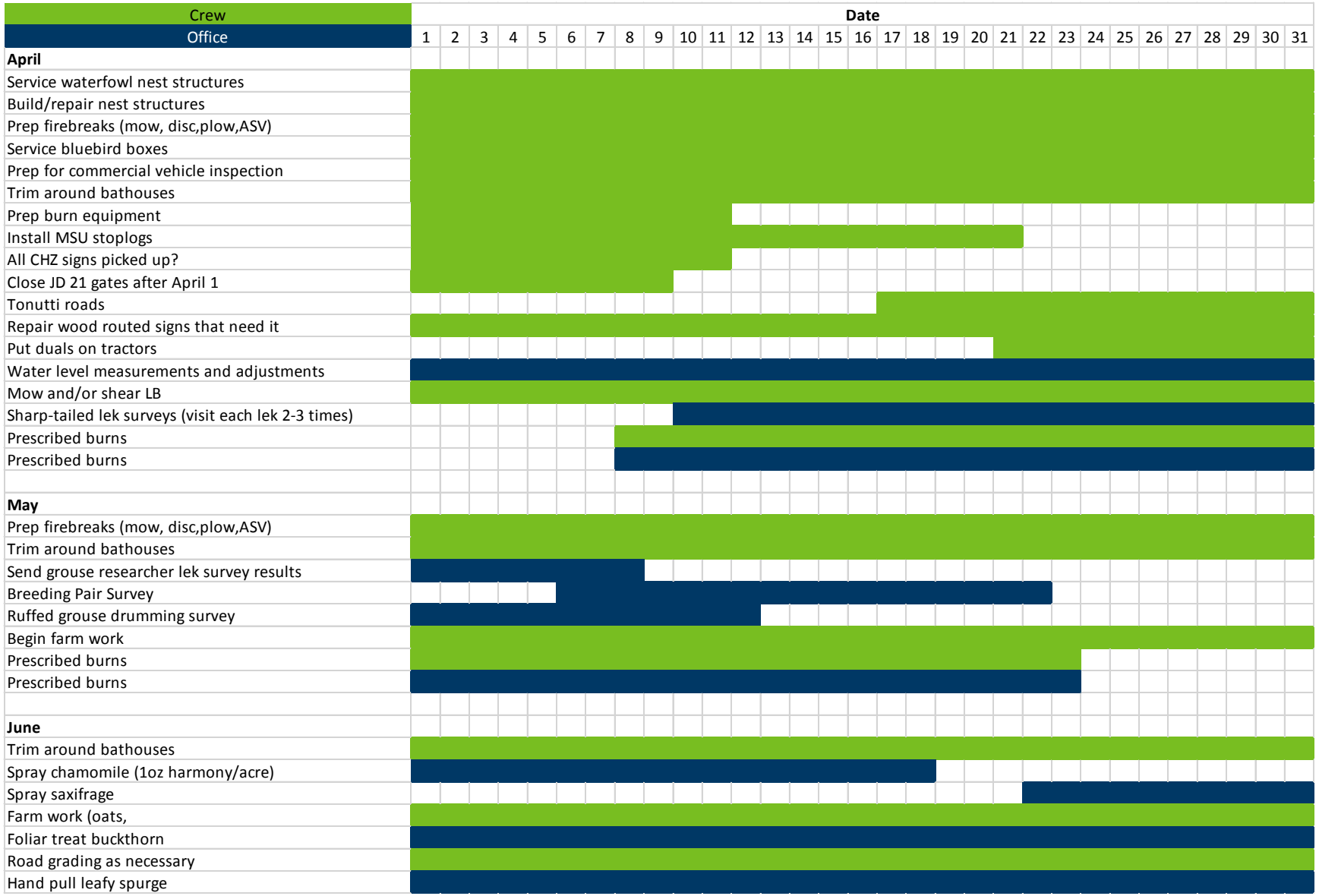
Common Name	Scientific Name	State Status[1]	Fed Status[1]
Connecticut Warbler	*Oporornis agilis*	SGCN	
Mourning Warbler	*Geothlypis philadelphia*		
Common Yellowthroat	*Geothlypis trichas*		
American Redstart	*Setophaga ruticilla*		
Cape May Warbler	*Setophaga tigrina*	SGCN	
Magnolia Warbler	*Setophaga magnolia*		
Bay-breasted Warbler	*Setophaga castanea*	SGCN	
Blackburnian Warbler	*Setophaga fusca*		
Yellow Warbler	*Setophaga petechia*		
Chestnut-sided Warbler	*Setophaga pensylvanica*		
Blackpoll Warbler	*Setophaga striata*		
Palm Warbler	*Setophaga palmarum*		
Yellow-rumped Warbler	*Setophaga coronata*		
Black-throated Green Warbler	*Setophaga virens*		
Canada Warbler	*Cardellina canadensis*		
Wilson's Warbler	*Cardellina pusilla*		
Eastern Towhee	*Pipilo erythrophthalmus*	SGCN	
American Tree Sparrow	*Spizelloides arborea*		
Chipping Sparrow	*Spizella passerina*		
Clay-colored Sparrow	*Spizella pallida*		
Vesper Sparrow	*Pooecetes gramineus*		
Savannah Sparrow	*Passerculus sandwichensis*		
Grasshopper Sparrow	*Ammodramus savannarum*	SGCN	
Le Conte's Sparrow	*Ammodramus leconteii*	SGCN	

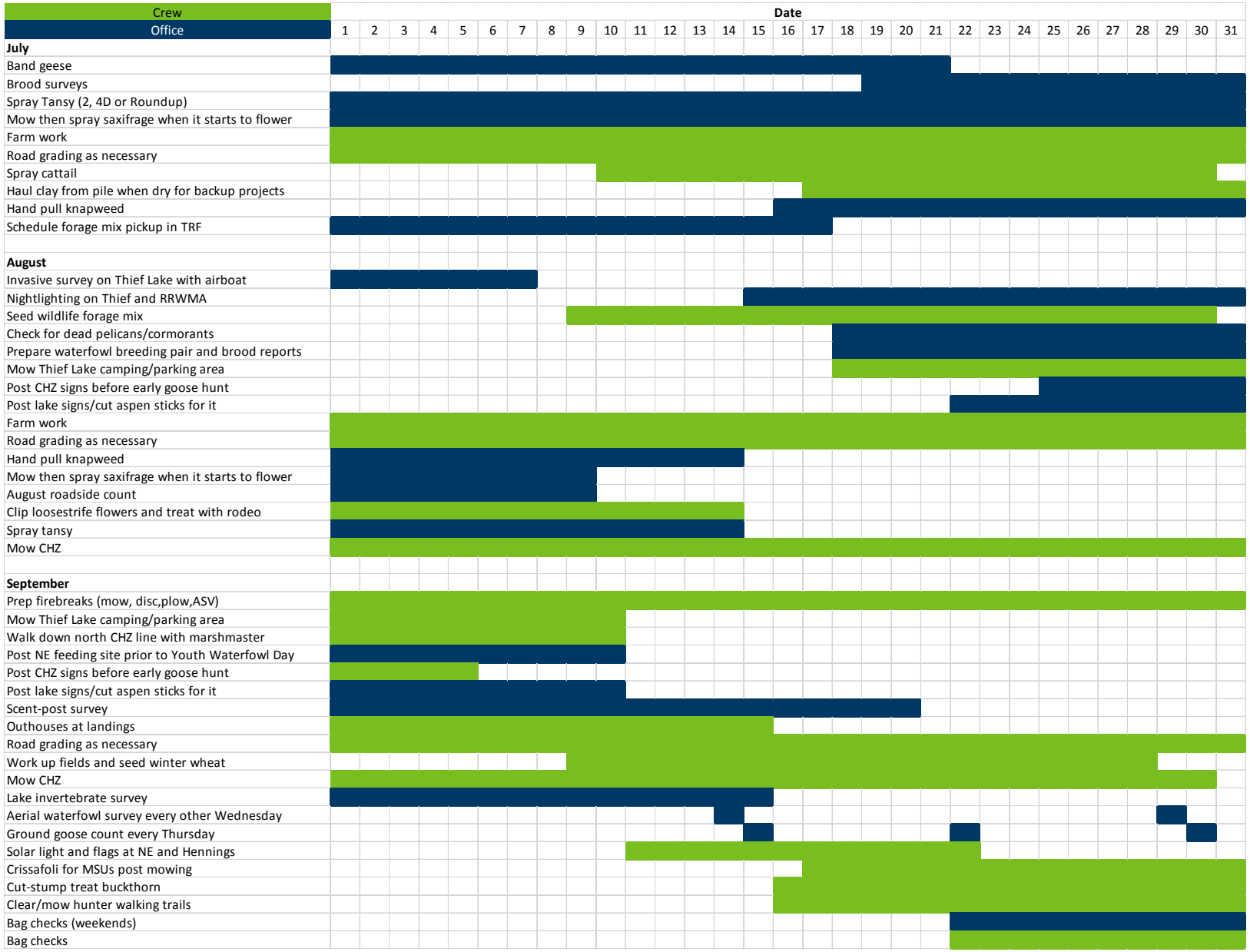
Common Name	Scientific Name	State Status[1]	Fed Status[1]
Nelson's Sparrow	*Ammodramus nelsoni*	SPC	
Fox Sparrow	*Passerella iliaca*		
Song Sparrow	*Melospiza melodia*		
Lincoln's Sparrow	*Melospiza lincolnii*		
Swamp Sparrow	*Melospiza georgiana*		
White-throated Sparrow	*Zonotrichia albicollis*		
Harris's Sparrow	*Zonotrichia querula*		
Dark-eyed Junco	*Junco hyemalis*		
Scarlet Tanager	*Piranga olivacea*		
Northern Cardinal	*Cardinalis cardinalis*		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		
Indigo Bunting	*Passerina cyanea*		
Dickcissel	*Spiza americana*	SGCN	
Bobolink	*Dolichonyx oryzivorus*	SGCN	
Red-winged Blackbird	*Agelaius phoeniceus*		
Western Meadowlark	*Sturnella neglecta*	SGCN	
Rusty Blackbird	*Euphagus carolinus*		
Brewer's Blackbird	*Euphagus cyanocephalus*		
Common Grackle	*Quiscalus quiscula*		
Brown-headed Cowbird	*Molothrus ater*		
Orchard Oriole	*Icterus spurius*		
Baltimore Oriole	*Icterus galbula*		

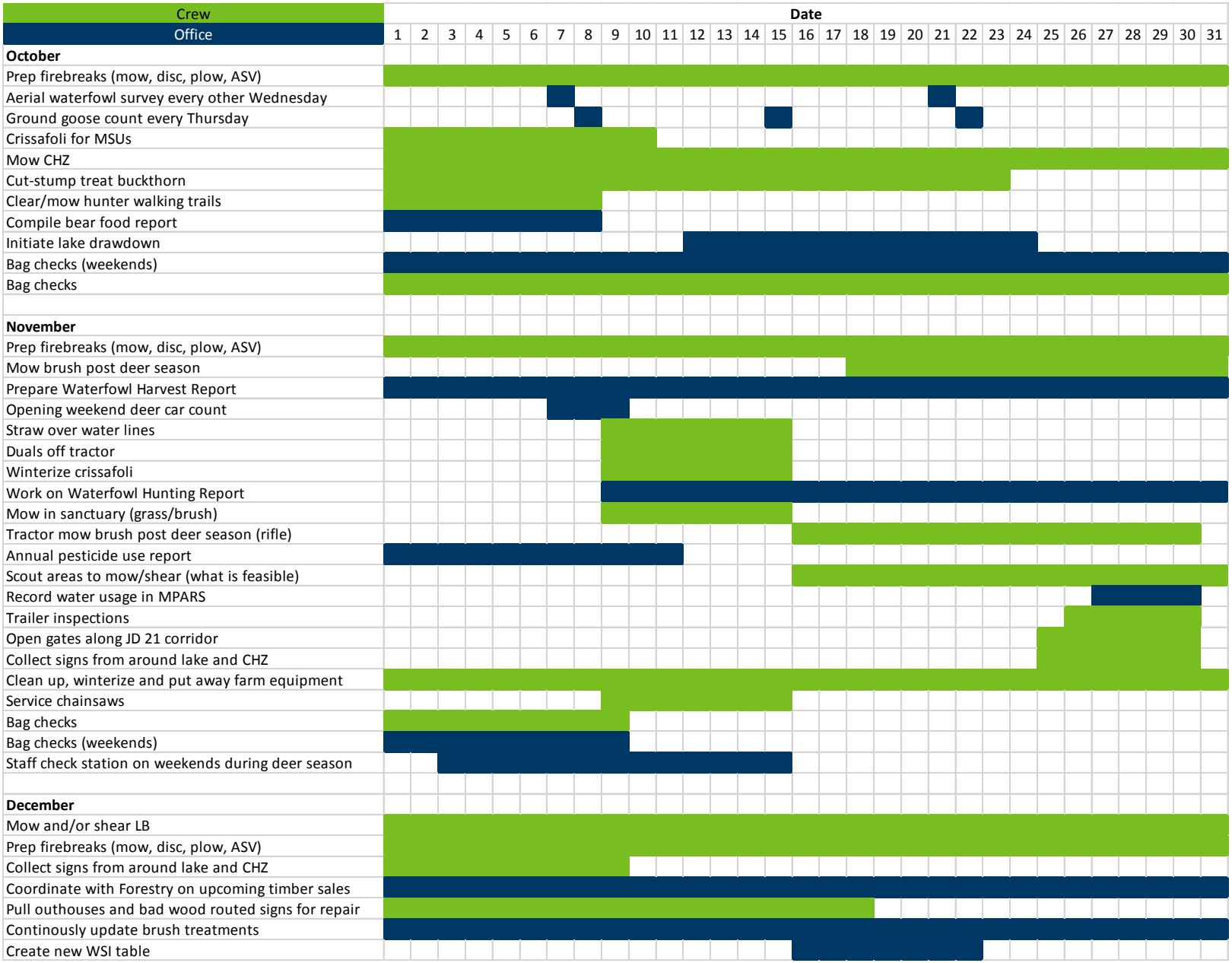
[1] END = endangered, THR = threatened, SPC = special concern, SGCN = Species of Greatest Conservation Need; all of Minnesota's endangered, threatened, and special concern species are SGCN, those listed as SGCN in the table are species not on the Minnesota's endangered, threatened, and special concern list.

Appendix G. Annual Work Tasks




Crew
Office
Date
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
April
Service waterfowl nest structures
Build/repair nest structures
Prep firebreaks (mow, disc,plow,ASV)
Service bluebird boxes
Prep for commercial vehicle inspection
Trim around bathouses
Prep burn equipment
Install MSU stoplogs
All CHZ signs picked up?
Close JD 21 gates after April 1
Tonutti roads
Repair wood routed signs that need it
Put duals on tractors
Water level measurements and adjustments
Mow and/or shear LB
Sharp-tailed lek surveys (visit each lek 2-3 times)
Prescribed burns
Prescribed burns
May
Prep firebreaks (mow, disc,plow,ASV)
Trim around bathouses
Send grouse researcher lek survey results
Breeding Pair Survey
Ruffed grouse drumming survey
Begin farm work
Prescribed burns
Prescribed burns
June
Trim around bathouses
Spray chamomile (1oz harmony/acre)
Spray saxifrage
Farm work (oats,
Foliar treat buckthorn
Road grading as necessary
Hand pull leafy spurge


Crew
Office
Date
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
July
Band geese
Brood surveys
Spray Tansy (2, 4D or Roundup)
Mow then spray saxifrage when it starts to flower
Farm work
Road grading as necessary
Spray cattail
Haul clay from pile when dry for backup projects
Hand pull knapweed
Schedule forage mix pickup in TRF
August
Invasive survey on Thief Lake with airboat
Nightlighting on Thief and RRWMA
Seed wildlife forage mix
Check for dead pelicans/cormorants
Prepare waterfowl breeding pair and brood reports
Mow Thief Lake camping/parking area
Post CHZ signs before early goose hunt
Post lake signs/cut aspen sticks for it
Farm work
Road grading as necessary
Hand pull knapweed
Mow then spray saxifrage when it starts to flower
August roadside count
Clip loosestrife flowers and treat with rodeo
Spray tansy
Mow CHZ
September
Prep firebreaks (mow, disc,plow,ASV)
Mow Thief Lake camping/parking area
Walk down north CHZ line with marshmaster
Post NE feeding site prior to Youth Waterfowl Day
Post CHZ signs before early goose hunt
Post lake signs/cut aspen sticks for it
Scent-post survey
Outhouses at landings
Road grading as necessary
Work up fields and seed winter wheat
Mow CHZ
Lake invertebrate survey
Aerial waterfowl survey every other Wednesday
Ground goose count every Thursday
Solar light and flags at NE and Hennings
Crissafoli for MSUs post mowing
Cut-stump treat buckthorn
Clear/mow hunter walking trails
Bag checks (weekends)
Bag checks


Crew
Office
Date
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
October
Prep firebreaks (mow, disc, plow, ASV)
Aerial waterfowl survey every other Wednesday
Ground goose count every Thursday
Crissafoli for MSUs
Mow CHZ
Cut-stump treat buckthorn
Clear/mow hunter walking trails
Compile bear food report
Initiate lake drawdown
Bag checks (weekends)
Bag checks
November
Prep firebreaks (mow, disc, plow, ASV)
Mow brush post deer season
Prepare Waterfowl Harvest Report
Opening weekend deer car count
Straw over water lines
Duals off tractor
Winterize crissafoli
Work on Waterfowl Hunting Report
Mow in sanctuary (grass/brush)
Tractor mow brush post deer season (rifle)
Annual pesticide use report
Scout areas to mow/shear (what is feasible)
Record water usage in MPARS
Trailer inspections
Open gates along JD 21 corridor
Collect signs from around lake and CHZ
Clean up, winterize and put away farm equipment
Service chainsaws
Bag checks
Bag checks (weekends)
Staff check station on weekends during deer season
December
Mow and/or shear LB
Prep firebreaks (mow, disc, plow, ASV)
Collect signs from around lake and CHZ
Coordinate with Forestry on upcoming timber sales
Pull outhouses and bad wood routed signs for repair
Continously update brush treatments
Create new WSI table

Ongoing Tasks:

- WCIL/CDMA end of each month to Wildlife Damage Program
- Check dam water levels
- Precip and send monthly to Observing Program Leader at NWS Grand Forks
- Snow depth every Friday
- Timesheets every other Tuesday