APPENDIX A

Ecological Classification System (ECS)

Contents

I. Definition

The ECS is part of a nationwide mapping initiative developed to improve our ability to manage all natural resources on a sustainable basis.

Ecological Classification System is a method to identify, describe, and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil, and vegetation data.

In Minnesota, the classification and mapping is divided into six levels of detail. These levels are:

Province: Largest units representing the major climate zones in North America, each covering several states. Minnesota has three provinces: eastern broadleaf forest, northern boreal forest and prairie.

Section: Divisions within provinces that often cross state lines. Sections are defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. Minnesota has 10 sections (e.g.: Red River Valley).

Subsection: County-sized areas within sections that are defined by glacial land-forming processes, bedrock formations, local climate, topographic relief, and the distribution of plants. Minnesota has 24 subsections (e.g.: Mille Lacs Uplands).

Land type association: Landscapes within subsections, characterized by glacial formations, bedrock types, topographic roughness, lake and stream patterns, depth to ground water table, and soil material. Example: Alexandria Moraine.

Land type: The individual elements of land type associations, defined by recurring patterns of uplands and wetlands, soil types, plant communities, and fire history. Example: fire-dependent xeric pine-hardwood association.

Community: Unique combinations of plants and soils within land types, defined by characteristic trees, shrubs and forbs, elevation, and soil moisture.

Example: sugar maple-basswood forest

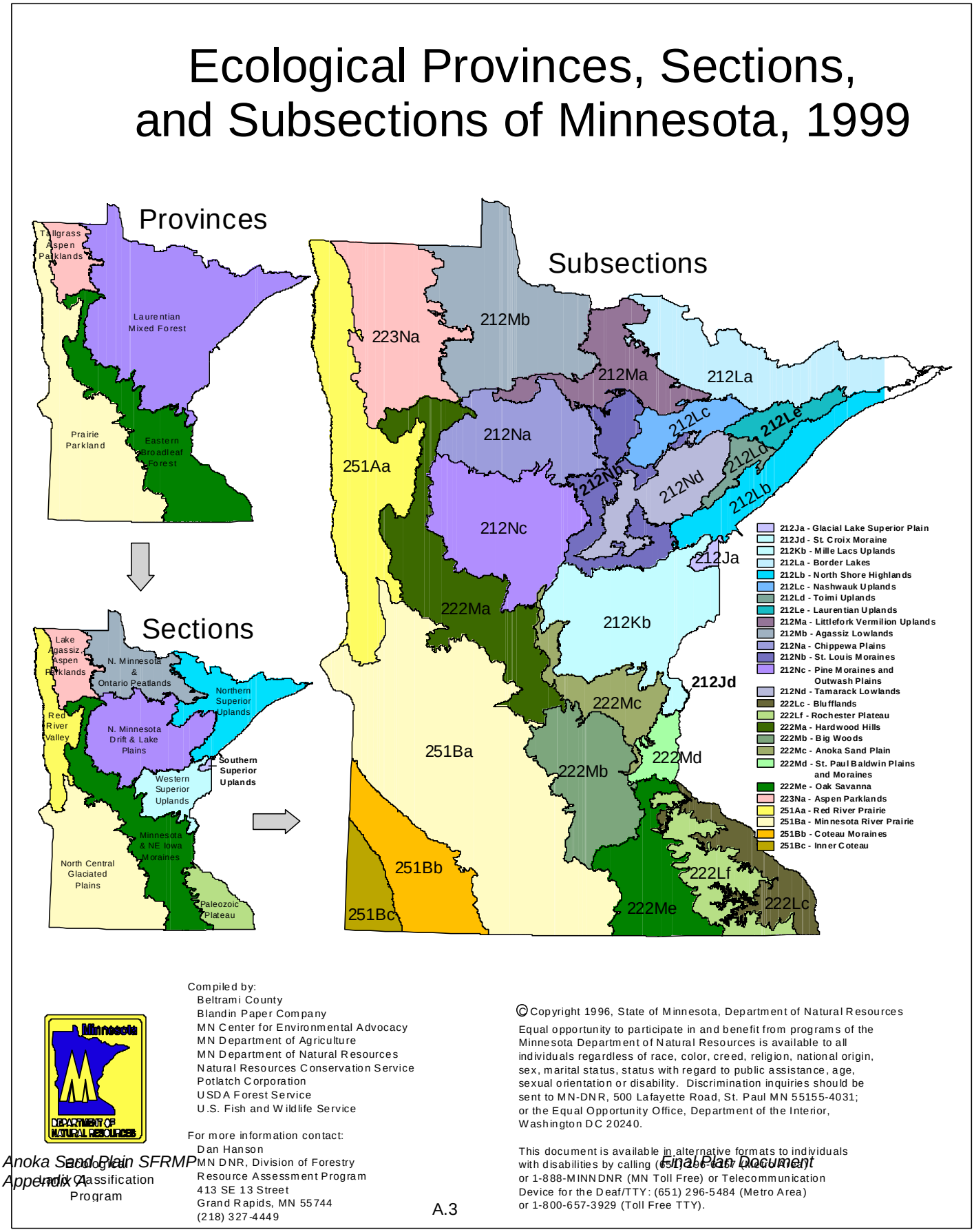
II. Purpose of an Ecological Classification System

- Define the units of Minnesota's landscape using a consistent methodology.
- Provide a common means for communication among a variety of resource managers and with the public.
- Provide a framework to organize natural resource information.
- Improve predictions about how vegetation will change over time in response to various influences.
- Improve our understanding of the interrelationships between plant communities, wildlife habitat, timber production, and water quality.

III. End Products

- Maps and descriptions of ecological units for provinces through land types.
- Field keys and descriptions to determine which communities are present on a parcel of land.
- Applications for management for provinces through communities.
- Mapping of province, section, subsection, and land type association boundaries is complete throughout Minnesota.

Figure A.1: Ecological Provinces, Sections, and Subsections of Minnesota, 1999



Compiled by:
Beltrami County
Blandin Paper Company
MN Center for Environmental Advocacy
MN Department of Agriculture
MN Department of Natural Resources
Natural Resources Conservation Service
Potlatch Corporation
USDA Forest Service
U.S. Fish and Wildlife Service

For more information contact:
Dan Hanson
MN DNR, Division of Forestry
Resource Assessment Program
413 SE 13 Street
Grand Rapids, MN 55744
(218) 327-4449

Appendix B

Notes for age class structure 2022 projections:

Added field: Age_2022; Calculated Age_2022 = NEW_AGE_UD + 10
Added field: New_CType; Calculated New_CType = MN_CTYPE

Then:

Assumption 1: MA1 with Prescription < 1800 resets Age_2022 = 0 (no cover type change).

"Prescripti" > 0 AND ("MgmtObj" = 'MA1' OR "MgmtObj" = 'MA1;CON3') and "Prescripti" <1800
(selects 84 stands; 863 acres)

Assumption 2: MA1 with Prescription = 1800 allows stands to age (Selects 85 stands; 1532 acres);

("MgmtObj" = 'MA1' OR "MgmtObj" = 'MA1;CON3')AND "Prescripti" = 1810
(Selects 85 stands,1532 acres)

Assumption 3: Prescription for clearcut resets age to 0 regardless of type conversions.

"Prescripti" >0 AND "Prescripti" <1800 and Age_2022 > 0 (Selects an additional 47 stands; 804 acres)

(sum_output_28 table)

MgmtObj	Count_MgmtObj	Sum_MAN_ACRES
0	1	23.5
CON3;CON4	9	334.9
CON3;CON4;CON5	4	57.8
COV30	1	19.9
COV52	1	20.8
COV85	1	3.7
COV86	2	14.9
INC30	10	95.9
INC35	1	20.9
INC51	12	165
INC51;CON3	1	4.4
INC51;CON3;CON4;CON5	1	25.1
INC51;CON4;CON5	1	13.1

Reset Age_2022 to 0 for these stands.

For management objectives = COV* changed New_CType to what was indicated.
The New_CType did not change for Mgmtobj = Con* or Mgmtobj = INC*

Assumption 4: Prescription of thin does not reset age to 0

"Prescripti" = 1810 AND ("MgmtObj" <> 'MA1' and "MgmtObj" <> 'MA1;CON3')
(Selects 51 stands; 772 Acres)
(sum_output_30 table)

MgmtObj	Count_MgmtObj	Sum_MAN_ACRES
0	2	17.9
CON3	5	74
CON3;CON4	20	350.1
CON3;CON4;CON5	10	140
COV30	7	111.7
COV51	4	37.8
COV52	1	13.3
INC51	2	27

For management objectives = COV* I changed New_CType to what was indicated.
The New_CType did not change for Mgmtobj = Con* or Mgmtobj = INC*

NOTE - The COV30 were from Little Falls Wildlife and are for conversion to oak savannah;
assuming there will be enough oak remaining (cds) for it to be typed oak.
If the team feels differently, we can change it to upland brush, or whatever is appropriate.

To summarize: for MgmtObj = INC*, New_CType = MN_CTYPE (no change),
but Age_2022 = 0 for all clearcut prescriptions, and thinned stands were allowed to age.

That leaves us with Mgmt_Obj = CON* stands:
"MgmtObj" = 'CON1' OR "MgmtObj" = 'CON3' OR "MgmtObj" = 'CON3;CON4' OR "MgmtObj" = 'CON3;CON4;CON5'
(sum_output_30 table)

MgmtObj	Count_MgmtObj	Sum_MAN_ACRES
CON1	3	88.3
CON3	5	74
CON3;CON4	29	685
CON3;CON4;CON5	14	197.8

let these stands age 10 years in their original Ctype if they were thinned,
and reset age to zero if clearcut.

Appendix C

Operational Plan

For Management of Sand Dunes State Forest 2013-2022

REPLACES: Appendix C of the Anoka Sand Plains Subsection Forest Resource Management Plan, "Operational Plan for Management of Sand Dunes State Forest, Sherburne County, Minnesota"; Released Feb. 4, 2013

Minnesota Department of Natural Resources

Plan finalized: November 2017

Executive Leadership Team:

Forrest Boe, Division of Forestry Director
Keith Parker, Department Region 3 Director
Luke Skinner, Division of Ecological and Water Resources Director

Operational Plan Writing Team:

Tim Edgeton
Kit Elstad-Haveles
Catherine Hansen
Liz Harper
Erica Hoaglund
Keith Jacobson
John Korzeniowski
Amanda Kueper
Virginia Loso
Jami Markle
Nicholas Snavely
Brian Stenquist

Contact:

John Korzeniowski
Area Forestry Supervisor – Little Falls
(320) 616-2450 x233
john.korzeniowski@state.mn.us

Minnesota Department of Natural Resources
Office of the Commissioner
500 Lafayette Road
St. Paul, Minnesota 55155

November 17, 2017

Dear Reader,

Thank you for taking the time to read and understand this Sand Dunes State Forest Operational Plan.

The Sand Dunes State Forest is a very important unit within Minnesota's State Forest System. There are many valuable and unique natural resources within the Sand Dunes, including valuable timber, abundant wildlife, regionally important recreational trails, and nationally important ecological features and rare species.

This plan builds on an earlier operational plan, and it is the result of many hours of conversation with neighbors, local governments, statewide interest groups, and natural resource managers. Those discussions have enhanced our understanding of stakeholder perspectives and helped us identify new opportunities to meet and balance multiple management objectives. The actions outlined in this plan will guide DNR's management of the Sand Dunes State Forest for the next five years.

We are committed to meeting annually with neighbors and other interested stakeholders to discuss our progress with implementing the plan. We look forward to our continuing collaboration with you and other members of the public.

If you have any questions about the operational plan, I encourage you to contact our Area Forester for the Sand Dunes State Forest, who is located in our Little Falls Office (320-616-2450).

Thanks again for your commitment to helping us manage Minnesota's outstanding natural resources.

Yours truly,

Tom Landwehr

Commissioner, Minnesota Department of Natural Resources

Table of Contents

Executive Summary

Sand Dunes State Forest (SDSF) contains a diverse mosaic of ecosystems that provide habitat for rare plants and animals, high-quality recreational opportunities for Minnesota residents and visitors, and valuable timber products that help fuel Minnesota's economy and fund K-12 education. The Minnesota Department of Natural Resources (DNR) manages SDSF for all of these values. This plan provides a framework for managing SDSF between the years 2013 and 2022. It is an update to the operational plan that was released February 4th, 2013.

The purpose of this operational plan is to:

1. Refine the goals of the Anoka Sand Plain Subsection Forest Resource Management Plan to fit the unique circumstances and landscape within SDSF
2. Guide DNR staff decision-making during implementation of natural resources management in SDSF
3. Inform the public about the DNR's management goals for SDSF

This plan contains three sections: Section I provides context for SDSF and a summary of the process used to develop this plan; Section II provides a detailed action plan for vegetation management, recreation, Permanent School Trust Land, and forest roads in SDSF for the 2013-2022 period; Section III discusses general operational considerations for the implementation of this plan, including health and safety, native plant community information, climate change, communication with the public, and inter-agency cooperation.

Section I: Development of the Operational Plan

An operational plan for SDSF was initially released in February 2013 as an appendix to the 2013-2022 Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP). The plan laid out 10-year and 50-year timeframes for implementing vegetation management in SDSF, dividing the State Forest into multiple zones.

After the plan was published, public concern developed over various aspects of the plan. In fulfillment of the plan's direction to continue public outreach efforts, DNR developed communication materials and held a public meeting about the plan in February 2016. Then during the 2016 legislative session, the legislature requested a report from the DNR on its progress in collaborating with citizens on managing SDSF, and also put a one-year moratorium on most timber harvesting activities in the Sand Dunes. In response, DNR launched a new, more intensive public engagement process in the summer of 2016 to discuss the management of the SDSF with interested stakeholders.

Stakeholders presented a variety of diverse viewpoints about the plan, and their concerns and preferences for management of SDSF. Particular areas of interest included land cover/vegetation choices for SDSF, and how various vegetation choices would impact wildlife and biodiversity; timber harvest techniques used in SDSF; impacts of management choices to personal/public enjoyment of SDSF; health and safety impacts of management; and issues concerning Permanent School Trust Lands.

Key Changes from the 2013 Operational Plan

As a result of this collaborative process, DNR is now replacing the 2013 plan with this revised edition. The 2017 operational plan retains the vision for SDSF as a healthy and diverse ecosystem while shortening the planning horizon to allow for more flexible response to change; expanding the plan's scope to include direction for recreation, Permanent School Trust lands, and forest roads; and responding to some specific concerns raised by stakeholders. This response includes the following actions:

1. Collaborate with adjacent landowners to address buffer requests and aesthetic concerns along the shared boundary, prior to future timber sales.
2. Retain the pine trees within the campsites of the Ann Lake Campground except when removal is necessary to maintain public safety or for forest health.
3. Communicate with local residents and local government about upcoming planned timber sales, timber harvests, prescribed burns, restoration projects, and changes to School Trust land status.
4. Continue to engage stakeholders with informational meetings, educational field trips, GovDelivery email messages, and specific SDSF web resources.
5. Work with the Orrock Town Board to resolve the township roads located on state land that do not currently have easements.
6. Use science-based adaptive management tools to inform decisions on restoring, protecting, and managing rare plants and wildlife (e.g., mechanical treatments vs. herbicide application, smaller rotation-age harvests).

2017 Legislation

This revised plan is also in compliance with 2017 Minn. Law Ch. 93, Sec. 155 which specifies, in summary:

- DNR will not convert additional land in SDSF to oak savanna or convert oak savanna to non-forest land during the life of the legislation (two years).
- Any prairie seed used for restoration in SDSF much be native species local to Sherburne or Benton County.
- DNR will comply with Minnesota Forest Resource Council guidelines for aesthetics when harvesting timber in SDSF near residential areas.
- DNR will notify local residents of upcoming prescribed burns in SDSF through a variety of mediums at least 40 days before a burn.
- DNR will provide an easement to Orrock township for any non-township-owned parts of 233rd Avenue.
- The legislation does not impact DNR's ability to manage School Trust Lands in SDSF for long-term economic return.
- The legislation sunsets two years from its enactment.

Section II: Ten-Year Action Plan

The Ten-Year Action Plan contains an overview of DNR's planned activities in SDSF's 5,732 acres for the duration of the 2013-2022 planning horizon. The action plan focuses largely on planned activities for 2017-2022, rather than activities that were completed between 2013 and 2017. This plan also does not

cover the specific management actions scheduled for the Uncas Dunes Scientific and Natural Area (676 of the 5,732 acres), which is managed through its own planning process.

Below are key points from each section of the action plan.

Vegetation Management Action Plan (2017-2022):

- SDSF has valuable timber resources in its red pine, white pine, and oak woodlands that will be managed, thinned, and harvested according to best management practices, including those described in the Minnesota Forest Resources Council Forest Management Guidelines (MFRC 2012).
- SDSF has very important high conservation value forests that will be managed to support rare plants, animals, and natural features. DNR will evaluate the effectiveness of its habitat enhancement activities.
- Invasive species are very prevalent in SDSF and controlling them will enhance habitat for a wide range of plants and animals, and improve forest health.
- 1,520 acres are proposed for commercial harvest through thinning, pending assessment.
- 679 acres are proposed for final harvest at rotation age, pending assessment.
- 336 acres are proposed for management for habitat enhancement using burning, invasive species control, and seeding.
- 73 acres are scheduled to be managed for habitat enhancement using selective tree removal
- Additional acres may be managed to control invasive species using mechanical treatment and herbicide application, pending funding.

Recreation Action Plan (2017-2022):

- SDSF is uniquely positioned between the Twin Cities and the St. Cloud metropolitan areas. As such, SDSF provides regionally important recreational opportunities.
- 29 miles of designated trails (18 equestrian and 11 multi-use) will be maintained.
- DNR will explore how to connect North Unit and South Unit trail networks.
- Pine trees in the Ann Lake Campground will be maintained unless they pose a safety or disease risk.
- SDSF will support continuing hunting and fishing opportunities.
- SDSF will provide opportunities for visitors to view wildlife and experience native ecosystems and rare natural features.

Permanent School Trust Lands Action Plan (2017-2022):

- There are no current plans to change the School Trust status of any parcels in SDSF.
- If plans to change the status arise during this planning cycle, the DNR will notify local landowners and other interested stakeholders. The DNR also will hold public informational meetings on any proposed School Trust land status change.
- Any revenues generated on School Trust lands (e.g., through timber harvest, camp fees) will be deposited in the Permanent School Fund as required by law.

Forest Roads Action Plan (2017-2022):

- 8 miles of system forest roads will be maintained in SDSF.
- Approximately 45 miles of temporary access roads will be maintained in SDSF.

- DNR will continue to work with Orrock Township to resolve the issue of township roads on state lands that do not currently have easements.
- DNR will explore routes that minimize heavy truck impacts on township roads.

Section III: Operational Considerations

In response to stakeholder concerns, this revised plan contains more detailed information and guidelines for topics including health and safety considerations related to prescribed burns and herbicide use, climate change impacts and adaptation considerations, and communication strategies for engaging the public throughout implementation of the operational plan. Section III also includes context for the native plant communities in SDSF with descriptions of oak woodland and savannah communities, and an explanation of the specific roles that various DNR Divisions will play throughout implementation of the SDSF operational plan.

I. Development of the Operational Plan

A. Reason for the operational plan

1. Purpose Statement

The purpose of this operational plan is to:

1. Refine the goals of the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) (MN DNR 2012; Appendix A) to fit the unique circumstances and landscape within Sand Dunes State Forest
2. Guide DNR staff decision-making during implementation of natural resources management in Sand Dunes State Forest
3. Inform the public about the DNR's management goals for Sand Dunes State Forest

2. Social and ecological context

Located within Orrock Township in central Sherburne County, Sand Dunes State Forest (SDSF) is approximately three miles west of Zimmerman and 5 miles north of Big Lake. The forest can be reached by taking Sherburne County Highway 5 north from Highway 10 in Big Lake, or by following Sherburne County Highway 4 west from Highway 169. Currently, over 24,000 residents live within a five-mile radius of SDSF and the population is growing as surrounding areas continue to be developed for residential use throughout the Highway 10 and Highway 169 corridors (Map 11). Much of the surrounding landscape is in private ownership and represents a mix of agricultural uses and fragmented private forest. The 30,000-acre Sherburne National Wildlife Refuge is located mainly to the north of SDSF.

SDSF has a statutory boundary of 11,040-acres and sits within the Anoka Sand Plain ecological subsection of central Minnesota. Within SDSF's statutory boundaries, 5,732 acres is owned by the State of Minnesota and is managed by the Minnesota Department of Natural Resources. Minnesota's 59 state forests were established to produce timber and other forest products, provide outdoor recreation, protect watersheds, and perpetuate rare and distinctive species of native flora and fauna. Pines and small amounts of spruce were planted in the state forest starting in the 1940s to stabilize the shifting dunes during time of drought, and planting has continued since that time to supply timber to economic markets. To date, over 2,400 acres of tree plantations have been established in SDSF, the majority of which are pine (Map 17, Map 18). These high-quality pine plantations are located on dry, sandy soils that allow for summer harvest in some locations, with minimal impact to the soil; this is valuable because many places in the state can only be harvested in the winter once the ground is frozen hard. SDSF also contains several woodland, savanna, and grassland communities. In SDSF, as in all state forests, the DNR applies multiple-use management principles to meet the needs of Minnesota citizens.

SDSF is a unique state forest with something for everyone, including 29 miles of maintained trails that provide opportunities for hiking, cross-country skiing, mountain biking, horseback riding and snowmobiling. The 353-acre Bob Dunn Recreation Area, nestled within the forest, holds the 40-unit Ann Lake Campground and Day-Use area and the 15-unit Sand Dunes Horse Camp, a popular destination on summer weekends. The recreation area also provides access to 183-acre Ann Lake and its public beach. The 676-acre Uncas Dunes Scientific and Natural Area offers ample opportunity for viewing and photographing many native plant, bird, and wildlife species.

SDSF contains a number of rare geologically and ecologically significant features (MN DNR 2009a). Sand dune formations are rare in Minnesota, and the dune fields found on the Anoka Sand Plain are the largest and best-formed dunes remaining in the state. The dune formations within SDSF (Map 12) support a diverse array of native plant communities as well as a number of rare plant and animal species. There are four globally imperiled native plant communities within the SDSF boundaries, five sites ranked by the Minnesota Biological Survey (MBS) as having outstanding biodiversity significance, and six MBS sites ranked as having high biodiversity significance. The Dry Oak Barrens Savanna native plant community is considered the most imperiled native plant community in the Midwest United States, occupying approximately 0.02% of its pre-European settlement extent. To date, nine state-listed species of plants and twenty-five state-listed species of animals have been documented in SDSF, and these species depend upon the mosaic of unique habitats that occur there (Appendix B). Minnesota's Wildlife Action Plan 2015-2025 also identifies SDSF as a hotspot for populations of Species in Greatest Conservation Need (SGCN) (MN DNR 2016).

Because of the rare and distinct ecological and geological features that occur within SDSF, key areas will be restored and managed for rare plant and animal species and the native plant communities on which they depend, including oak savanna, oak woodland, tamarack swamp, emergent marsh, and sedge meadow. At the same time, commercial timber harvest and recreational uses will be maintained and the perspectives of nearby residents and other stakeholders will be carefully considered. SDSF is designated as a Special Management Unit within the Anoka Sand Plain SFRMP. The following operational plan describes how DNR will work to implement its goals of multiple-use management, and will serve as a document to guide future management activities in SDSF as outlined in the SFRMP.

B. Public engagement during operational plan development

1. 2013 Initial Planning Process

In February 2013, an operational plan for management of SDSF was released as an appendix to the Anoka Sand Plain SFRMP, following a 30-day public review. The operational plan was created to provide direction to field managers when developing site-specific management. Neighboring landowners to SDSF were sent a letter in September 2014 to inform them that the plan had been completed (Appendix C).

After the plan was published, public concern developed over various aspects of the plan. These concerns ranged from issues such as overall land cover management direction, including proposed restoration and tree harvests, to more site-specific issues such as forest management techniques used on sites adjacent to private property. In fulfillment of the plan's direction to continue development of public outreach efforts, DNR developed communication materials and held a public meeting about the plan in February 2016. Then during the 2016 legislative session, the legislature requested a report from the DNR on its progress in collaborating with citizens on managing the SDSF, and also put a one-year moratorium on most timber harvesting activities in the Sand Dunes (MN Session Law Ch. 189 Sec. 47). In response, DNR launched a new, more intensive public engagement process in the summer of 2016 to discuss the management of SDSF and collect feedback from local and statewide interests on their issues related to SDSF.

2. 2017 Plan Revision

a. Public engagement and the Stakeholder Advisory Group

The DNR organized a Stakeholder Advisory Group that represented a range of local and statewide interests and perspectives related to the operational plan for SDSF. There were six Stakeholder Advisory Group meetings between June and December 2016. All meetings were open to the public, and audience members were invited to participate and provide verbal and written feedback during meetings as well. Based on feedback from stakeholders, meeting topics included: tree and timber management; recreation; wildlife and native plant community management; School Trust Land management; and forest road-related issues.

b. Results of collaboration

DNR collected feedback and provided responses to questions and suggestions throughout the process. While stakeholders expressed a wide range of concerns and interests related to the 2013 operational plan, major areas of concern and/or contention can be summarized as:

- Land cover (i.e., vegetation) decisions and impacts to environment/biodiversity
- Timber harvest techniques
- Impacts to public/personal enjoyment
- Health and safety concerns
- Short- and long-term fate of Permanent School Trust lands

These issues are addressed in greater detail in this operational plan revision. In response to these issues, DNR will be moving forward with the following commitments in SDSF:

1. Collaborate with adjacent landowners to address buffer requests and aesthetic concerns along the shared boundary, prior to future timber sales.
2. Retain the pine trees within the campsites of the Ann Lake Campground except when removal is necessary to maintain public safety or for forest health.
3. Communicate with local residents and local government about upcoming planned timber sales, timber harvests, prescribed burns, restoration projects, and changes to School Trust land status.
4. Continue to engage stakeholders with informational meetings, educational field trips, GovDelivery email messages, and specific SDSF web resources.
5. Work with the Orrock Town Board to resolve the township roads located on state land that do not currently have easements.
6. Use science-based adaptive management tools to inform decisions on restoring, protecting, and managing rare plants and wildlife (e.g., mechanical treatments vs. herbicide application, smaller rotation-age harvests).

Additionally, this revised plan differs in scope and timeline from the 2013 version. The original plan contained little information about recreational management and roads, as little change was expected to the current management regarding these issues. However, at the request of stakeholders the revised plan contains more information about recreation and roads, as well as other topics of interest such as School Trust Land, climate change, and pesticide use in SDSF.

The original plan divided SDSF into ‘zones’ and described 10- and 50-year strategies for managing SDSF. The revised plan addresses only the 10-year period that corresponds with the Anoka Sand Plain SFRMP,

rather than projecting a 50-year management strategy, and does not divide SDSF into 'zones', as only portions of SDSF are addressed in the shorter timeframe rather than the entire state forest. The original plan described 631 acres of "immediate" rare features management in the 10-year period, and an additional 1,398 acres of "eventual" rare features management over the 50-year time period (excluding Uncas Dunes Scientific and Natural Area). The revised plan focuses on only the most pressing habitat enhancement needs for the remainder of the 2013-2022 time period: 336 acres of maintenance work and 73 acres of selective tree removal (excluding Uncas Dunes). An additional 154 acres will be assessed for potential management needs (see Table 1 of the Vegetation Management Action Plan for more details). These changes will allow DNR to adapt more readily to findings from initial management and to changing circumstances on the landscape.

Further information about the Stakeholder Advisory Group process can be found in the *Sand Dunes State Forest Public Engagement Project* report for the Minnesota State Legislature submitted on January 13, 2017 (MN DNR 2017f).

c. 2017 Legislation

In May 2017, the Minnesota Legislature passed 2017 Minn. Law Ch. 93, Sec. 155, "Sand Dunes State Forest management." This revised plan is in compliance with the new legislation. The legislation states:

> *Subdivision 1. Forest management. When managing the Sand Dunes State Forest, the commissioner of natural resources must:*
>
> *(1) not convert additional land to oak savanna or convert oak savanna to nonforest land unless it is done as a result of a contract entered into before the effective date of this section;*
> *(2) require all prairie seeds planted to be from native species of a local ecotype to Sherburne or Benton County; and*
> *(3) comply with the Minnesota Forest Resources Council's guidelines for aesthetics in residential areas.*
>
> *Subd. 2. Prescribed burns; notification. At least 40 days before conducting a prescribed burn, the commissioner must:*
>
> *(1) publish a notice in a newspaper of general circulation in the area;*
> *(2) notify the county and township in writing; and*
> *(3) notify residents within a quarter mile of the prescribed burn in writing.*
>
> *Subd. 3. School trust lands. Nothing in this section restricts the ability of the commissioner or the school trust lands director from managing school trust lands within the Sand Dunes State Forest for long-term economic return.*
>
> *Subd. 4. Township road. If the commissioner of natural resources finds that any portion of 233rd Avenue within the Sand Dunes State Forest is not owned by the township, the commissioner must convey an easement over and across state-owned lands administered by the commissioner to the township under Minnesota Statutes, section 84.63, for the width of 233rd Avenue.*
>
> *Subd. 5. Sunset. This section expires two years from the day following final enactment.*
>
> *EFFECTIVE DATE. This section is effective the day following final enactment.*

C. Vision for Sand Dunes State Forest

The DNR wants to ensure that SDSF remains a diverse landscape that meets a variety of ecological, social, and economic needs. The future landscape of SDSF will have:

- highly engaged and well-informed neighbors and stakeholders
- a diverse mosaic of habitats that sustainably support a wide variety of plants and animals, especially the rare species and features unique to the area
- healthy forests that are managed to provide a sustainable supply of timber
- ongoing access to high-quality recreational opportunities
- ongoing financial contributions to the Permanent School Trust
- increased resilience to growing pressures – such as climate change, invasive species, and population growth – using adaptive management practices

*White pine (*Pinus strobus*) and bur oak (*Quercus macrocarpa*)*

II. Ten-Year Action Plan

This section contains an overview of the actions DNR will take in Sand Dunes State Forest (SDSF) during the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) planning horizon (2013-2022) to achieve the vision described in Section I, Part C. This includes 10-year action plans for:

- Vegetation Management
- Recreation
- Permanent School Trust Land
- Forest Roads

Note that this 10-year action plan goes into greater detail than the SFRMP (which focuses largely on vegetation/habitat management) by encompassing specific actions for recreation, roads, and School Trust lands. These issues were identified by stakeholders during the SDSF public engagement project. However, this plan is intended to broadly guide resource and management decisions for SDSF; site-specific management will be determined by annual management planning processes, after staff are able to thoroughly assess the sites and coordinate with stakeholders (e.g., annual meetings).

A. Vegetation Management Action Plan

At-A-Glance:

- SDSF has valuable timber resources in its red pine, white pine, and oak woodlands that will be managed, thinned, and harvested according to best management practices, including those described in the Minnesota Forest Resources Council Forest Management Guidelines (MFRC 2005).
- SDSF has very important high conservation value forests that will be managed to support rare plants, animals, and natural features. DNR will evaluate the effectiveness of its habitat enhancement activities.
- Invasive species are very prevalent in SDSF and controlling them will enhance habitat for a wide range of plants and animals, and improve forest health.
- 1,520 acres are proposed for commercial harvest through thinning, pending assessment.
- 679 acres are proposed for final harvest at rotation age, pending assessment.
- 336 acres are proposed for management for habitat enhancement using burning, invasive species control, and seeding.
- 73 acres are scheduled to be managed for habitat enhancement using selective tree removal.
- Additional acres may be managed to control invasive species using mechanical treatment and herbicide application, pending funding.

In Minnesota, the commissioner of the DNR is required by law to manage state forests "according to the principles of multiple use and sustained yield." These principles require DNR to manage forest resources to meet current economic, environmental, and recreational needs, without risking the ability of future generations to do the same. These multiple uses include production of timber and other forest products, providing outdoor recreation, protecting watersheds, providing wildlife habitat, perpetuating rare and distinctive species of native flora and fauna, and contributing funds to the Permanent School Trust.

Minnesota is nationally renowned for exceptional forest management – which is the art and science of managing forest vegetation and uses in ways that have important short and long-term benefits to society. Nearly 5 million acres of DNR-administered land, including SDSF, has been certified as "well-managed" by two third-party certification entities, the Forest Stewardship Council® (FSC) and the Sustainable Forestry Initiative® (SFI), since 2005. In addition to verifying sound forest management, the DNR's FSC and SFI certifications are economically important to Minnesota's forest products industries.

1. High Conservation Value Forest in SDSF

The FSC requires its certificate-holders to identify and map the presence of High Conservation Value Forests (HCVFs) for a variety of critical and globally, regionally, or nationally significant conservation values defined by FSC (FSC 2010). This aligns with DNR's statutory requirement to manage for a broad set of objectives and forest resources (M.S. 89 & M.S. 89A). DNR has identified approximately 262,000 acres of lands to be managed under the HCVF principle. Of those 262,000 acres, 174,000 acres are designated as HCVFs, while the remaining 89,000 acres are on School Trust lands and are not designated, but will be managed consistent with the FSC HCVF Principle unless there is a conflict with the DNR's legal responsibility to secure the maximum long-term economic return from School Trust lands.

Management decisions are made to maintain or enhance the 'high conservation values' in these forests (MN DNR 2015b). In most cases, HCVFs are maintained as working forests. Out of the 5,732 acres of state-owned land in SDSF, 2,055 acres are managed for HCVFs (Map 15) (MN DNR 2017a). Approximately 1,505 acres are designated HCVFs and 550 acres are on School Trust lands. These sites vary greatly in quality, but include many rare species of animals and plants that depend on the unique savanna and barren habitats of SDSF.

HCVFs provide context for vegetation management in SDSF. On HCVF lands, management activities will be tailored to maintain and enhance the natural features and rare resources of these lands. Managers will seek opportunities to foster native trees and other vegetation, enhance habitat for rare species, protect fragile dune structures, and remove non-native species that risk damaging conservation values.

2. Purpose of Vegetation Management in SDSF

a. Importance of Tree Harvest in SDSF

There are several reasons why timber harvest is an important tool for forest management in SDSF. First, timber harvest is the best tool we have to establish and maintain the wide range of forest ages and conditions needed to create diverse wildlife habitat. Some wildlife species depend on young forests, while others need older forests; and some require both. Regular timber harvest ensures that a range of different-aged forest remain on the landscape.

Harvesting trees also supports a valuable forest products industry. This brings jobs and income to communities statewide. The forest products industry is the fifth largest manufacturing sector in Minnesota by employment. Minnesota's forest products industry consistently ranks in the top 10 in the U.S. for contribution to gross state product per capita. SDSF currently has a good supply of valuable red pine and other timber species to contribute to the local forest products economy. These pines are located on dry, sandy soils, meaning they can be harvested in the summer in certain locations with minimal impact to the soil. Many places in Minnesota can only be sustainably harvested in the winter,

when the ground is frozen; so the pines in SDSF are particularly valuable since they provide summer logging work.

The wood that come from SDSF is dual-certified as sustainably managed. Wood from well-managed forests is generally a more environmentally-friendly raw material than options like metal and concrete. Wood is renewable, meaning that more grows in its place after it is used. Trees also pull carbon dioxide (a greenhouse gas) from the air, which can then be stored as carbon in long-lived wood products such as lumber for buildings. From 2012-2016, approximately 9,200 cords of pine were sold from SDSF; 75% of that volume was used for dimensional lumber (e.g., '2x4' boards). The majority of this volume resulted from thinning pine plantations, which gives remaining trees more space to grow and continue to capture carbon.

Managed forests are also at a lower risk for wildfire and attacks from forest pests than are forests that are not actively managed. Harvesting trees helps prevent dead wood from building up in the forest, which is a fire risk. It also helps reduce crowding of trees; crowded trees are at greater risk for both fire and the spread of insects and disease outbreaks. Timber harvests also give DNR an opportunity to remove certain harmful invasive woody plants. Overall, managing forests in this way helps to keep them healthy.

Finally, state law requires DNR to manage state forests for revenue production. Income from timber harvest on School Trust Lands is constitutionally dedicated to earn income for the Permanent School Trust. Timber harvest provides a revenue stream that allows DNR to keep forests on the landscape, instead of losing forests to other potential land uses such as agriculture or residential development. Forests provide a wide variety of important ecosystem services, such as clean air, healthy soils and reduced soil erosion, and healthy watersheds. Forests also provide a wide variety of recreational opportunities for Minnesotans during the decades between harvests. Timber harvest in SDSF helps DNR continue to provide these important services.

b. Importance of protecting rare species and habitat in SDSF

SDSF is part of the Anoka Sand Plain ecological subsection, a landscape characterized by broad, mostly flat outwash sands and numerous wetlands. Over 5,000 years ago the sand was shaped into dunes in a few places on the Anoka Sand Plain (Keen and Shane 1990). Many of these dunes have been destroyed by reshaping and disturbance associated with housing development. The remaining dunes support a rich array of native plant communities, some of which are sand specialists that depend on the unique features of the dune systems. The largest remaining area of intact dunes on the entire Anoka Sand Plain are found in SDSF.

With its unique sand dunes geology and ecology, SDSF serves as an oasis of global significance for a variety of rare plants and animals. Nine state-listed rare plant species have been documented in SDSF, including four state threatened species and five state special concern species. Twenty-five state-listed rare animals have been documented in SDSF, including three state-listed endangered species, two state-listed threatened species, and eight state-listed species of special concern (Appendix B).

The Dry Barrens Oak Savanna (Southern) is one of the most rare plant communities in the state, as most oak savannas have been converted to agricultural or development uses, or have succeeded to oak forest in the absence of natural disturbance. Oak savanna has a rarity rank of G2, meaning it is imperiled across its entire global range; today this plant community occupies only about 0.02% of its pre-European

settlement extent (Nuzzo, 1986). Open dry oak savanna or prairie habitats in SDSF support six state-listed rare plant species and fifteen state-listed rare animal species. Oak woodlands are more prevalent than savannas, but even they have been greatly reduced from their original extent (Wovcha et al 1995). High quality examples of these communities are rare in the present-day Anoka Sand Plain subsection. Oak woodlands and associated wetlands provide habitat for red-shouldered hawks *(Buteo lineatus)*, a state-listed species of special concern. In addition, diverse wetland communities occur here that support a state-listed threatened plant species *(Viola lanceolata)* and provide habitat for the state- listed threatened Blanding's turtle *(Emydoidea blandingii)*.

Pines and other evergreen conifers, including white pine, Norway (red) pine, jack pine, and spruce, have been planted throughout the dunes in SDSF since the 1930s, originally for the purpose of stabilizing the shifting dunes during a time of prolonged drought across the Great Plains. "Though white pine was found elsewhere in the Anoka Sand Plain, we do not have evidence that these conifers occurred naturally in the SDSF dune communities prior to European Settlement (Map 13). Their presence has resulted in conversion of portions of the site to forests that consist of a mix of large oak trees, pines, tall shrubs, and understory plants adapted to shady environments. Pine plantations have had a major impact on the upland dune native plant communities in SDSF (which include Southern Dry-Mesic Oak (Maple) Woodland, Dry Barrens Oak Savanna (Southern), Dry Barrens Prairie (Southern), and Southern Mesic Prairie) (MN DNR 1995). In some cases, pines have formed dense plantations that have displaced oak savanna vegetation, and in other cases, the pines are interspersed with oak savanna vegetation. There are still excellent examples of native plant communities occurring throughout the state forest in places where pines have failed or have not been planted.

During the writing of this operational plan, federally endangered rusty-patched bumblebees (*Bombus affinis*) were found within SDSF along with several other new occurrences of species of conservation concern. Management of the state forest will adapt as needed, over time, to new significant discoveries like this. Managers of the SDSF will coordinate with the US Fish and Wildlife Service as needed when federally listed species are found. The annual stand review process considers all rare features during management planning.

Species profiles (see the Rare Species Guide for more information - MN DNR 2017e)

Plains Hog-nosed Snake (*Heterodon nasicus*)

Plains hog-nosed snakes are found in sparsely vegetated habitats like the dry prairie and oak savannas in SDSF. They also use the wetlands in SDSF for hunting grounds. Plains hog-nosed snakes are well adapted for SDSF's sandy habitat, as they have sharply upturned snouts that they use to dig into the sand to create burrows or escape predators. Plains-hognose snakes have unique defense mechanisms. They may flatten their head and look like a cobra when threatened. They may also feign death by writhing around, rolling onto their back, and remaining motionless with their mouth open and tongue hanging out. They will lift their head occasionally to see if the threat has passed, if it is still there they will pretend they are dead again, if not they will turn over and slither away. The major threat to this species is habitat loss.

Plains Pocket Mouse (*Perognathus flavescens*)

The Plains Pocket Mouse gets its name because it has fur-lined pockets on its cheeks. They use these pockets to store food, usually seeds. This species lives in areas of sparsely vegetated, sandy habitats like the dry prairie and oak savannas in SDSF. This species was once fairly common in the dune-sand region of Sherburne County, but habitat loss has led to this species decline. Human intervention, such as prescribed fire, is necessary to prevent their open habitats from becoming over-grown, as meadow voles may outcompete them by moving into the denser habitat.

3. Vegetation Management Techniques Used in Sand Dunes State Forest

Choice of vegetation management techniques are driven by:

- Objectives or goals for the management such as providing wildlife habitat, improving the health of the land, providing recreational opportunities, and income generation/provision of raw materials.
- The type of vegetation that is on the land (or the desired vegetation) and its need for light, moisture, and nutrients.
- The ecology of the site; factors such as climate, soils, and topography impact which type of vegetation is a good "fit" for a particular site, and which is not.

a. Timber Harvest

Commercial timber harvest is a common technique used to remove mature and/or less-desirable trees to make more room for remaining or young regenerating trees. Timber is sold on the open market to the highest bidder; all permit contracts require compliance with DNR's harvest practices. DNR foresters oversee permits during the harvest to ensure that the work is done as directed. Funds received from timber harvest on state land help pay for future forest management as well as K-12 education via the Permanent School Trust.

Thinning

Thinning is the selective removal of trees, primarily undertaken to improve the growth rate or health of the remaining trees. Thinning is often used in pine plantation stands, and can also be used in hardwood stands such as oak. Most often in SDSF, the first red pine plantation thinning occurs around age 25 for the stand, when the trees first become "commercial," meaning they can be sold to cover the costs of the harvest. Thinning can be repeated every 10 to 15 years or so until the trees reach their rotation age and a final regeneration harvest is desired. Thinning cannot be used to regenerate tree species that require almost full sunlight, such as red pine and oak.

Red pine plantation; source: myminnesotawoods.com

Rotation-age Harvest

Rotation-age harvests occur at a stand's rotation age – which is the age that the stand will bring peak commercial value. It is the most economically efficient means of harvesting trees and delivers the highest rate of return. During a rotation-age harvest on state land, some trees are almost always left somewhere on site as "reserve" trees for habitat, aesthetics, or natural re-seeding. Rotation-age harvest has the biggest immediate visual impact, but also reduces the total number of logging entries over a period of time, thus reducing risk of invasive plant introduction and movement, as well as disruption of native species. Further, rotation-age harvests create blocks of different-aged forests; some wildlife species need young forest, some need older forest, and some require a mix. Finally, some rotation-age harvests will be needed to achieve restoration goals and desired future conditions outlined in the SDSF operational plan. For these reasons, total exclusion of rotation-age harvests would not be desirable or practical in SDSF.

b. Reforestation

All areas designated to continue in forest cover are reforested with tree species that are appropriate for the site and provide a variety of benefits such as habitat, aesthetics, and revenue. This usually takes place within one or two years after a timber harvest. However, reforestation may also occur after a storm, disease, or some other event has damaged a stand, or in some cases in advance of a harvest to allow establishment of the next generation (shade-tolerant species only). DNR uses direct seeding and planted seedlings to reforest SDSF, in addition to the trees that grow back naturally.

As pine plantations in SDSF are thinned to improve timber production, hardwoods will be allowed to naturally seed into understory openings. When these stands reach final harvest stage, hardwoods will be

harvested also and allowed to regenerate along with pine. In stands where oak is predominant, pines will be encouraged to blend into the stand through artificial planting and natural seeding, where doing so does not conflict with other management goals for SDSF. Diversification of forest stands (at an individual stand and landscape scale) can help increase resilience to threats such as climate change (see Section III, Part C – "Climate Change Considerations) and disease.

It is often necessary to control competing vegetation to allow desirable tree regeneration to grow freely on reforested sites. Similar methods may be used to control competing native vegetation as are used to control invasive vegetation (see next section, Invasive Species Control). These methods are designed to set back, not eliminate, the competing vegetation. Once the trees are taller than the competing vegetation and considered "free to grow," vegetation control ceases. On an average tree planting site in SDSF, there may be 2-4 mechanical treatments or 1-2 herbicide treatments (depending on which method is applied) over a 60-year period.

Red oak seedling

c. Invasive Species Control

Invasive species are plants, animals, and microorganisms that are not native to a particular area and are capable of causing damage. Invasive species can cause significant harm to the economy, environment, or human health once they become established. European buckthorn, Amur maple, and fungi that cause Dutch elm disease and oak wilt are among the most damaging invasive species in SDSF. These and other currently known invasive species in SDSF include:

- Common and glossy buckthorn (*Rhamnus cathartica* and *Frangula alnus* respectively)
- Amur maple (*Acer ginnala*)
- Exotic honeysuckles (*Lonicera tatarica, L. morrowii, L. x bella, L. maackii)*
- Black locust (*Robinia pseudoacacia*)
- Canada thistle (*Cirsium arvense*)
- Cow vetch (*Vicia cracca*)
- Hoary alyssum (*Berteroa incana*)
- Leafy spurge (*Euphorbia esula*)

- Norway maple (*Acer platanoides*)
- Perennial sow thistle (*Sonchus arvensis*)
- Siberian elm (*Ulmus pumila*)
- Siberian peashrub (*Caragana arborescens*)
- Spotted knapweed (*Centaurea stoebe spp. micranthos*)
- White sweet clover (*Melitotus alba*)
- Two fungal diseases:
    - Dutch elm disease (caused by the *Ophiostoma novo-ulmi*)
    - Oak wilt (caused by *Ceratocystis fagacearum*)

Historically, invasive species were not as prevalent in these habitat communities. However, introductions of invasive species thrive when conditions are suitable for their growth, natural predators are lacking, and historical disturbances are absent. Successful invasive species control requires an integrated pest management approach. This may include the use of one or a combination of the following methods:

- Herbicide treatments
- Mechanical treatments
- Cultural treatments
- Biological control treatments

Treatment options are evaluated for each management scenario based on their availability, efficacy, cost, environmental persistence, and site characteristics, including context of the neighboring landscape.

Herbicide treatments

Herbicides treatments are utilized because they are an important tool for successful habitat restoration and maintenance. Mechanical and prescribed burning treatments alone may not achieve the desired outcomes without follow-up applications of herbicide, often through spot treatments with direct targeting of invasive species. The MN DNR has a responsibility to manage invasive species on SDSF under Operational Order 113 (MN DNR 2007). Avoiding herbicide use can lead to much more expensive treatments and loss of initial restoration investment. Herbicide application is often a cost-effective means to control undesirable species (e.g., invasive woody plants in an oak savanna or oak woodland). All herbicides used in SDSF are approved by DNR's third-party certifiers (i.e., FSC and SFI) and DNR follows herbicide label instructions for environmental and human safety..

Multiple stems sprout from this common buckthorn plant after it has been cut (no herbicide application).
Source: http://ipaw.org/TheSolution/Control/UsingHerbicides.aspx

More information about DNR's use of herbicides in SDSF can be found in Section III, Part A (Health and Safety Considerations) and Appendix D (List of Herbicides Used in SDSF).

Mechanical treatments

Mechanical treatments include:

- Mowing
- Vibratory plow
- Rotation-age timber harvest
- Timber thinning
- Cut stump
    - Used alone could require multiple entries depending on the target species being managed.
        - Eastern redcedar = one treatment
        - Common and glossy buckthorn = multiple treatments
- Prescribed burning

Cultural treatments

Cultural Treatments to reduce the spread of invasive species include:

- Boot brushes for removing dirt, seeds, etc.
- Public information campaigns (e.g. "Come Clean, Leave Clean" and "Play, Clean, Go)

Biological control treatments

Biological controls use natural enemies to control non-native pests, which can be an effective tool in managing invasive plants. Non-native plants can become invasive because they lack the insects and diseases that control them in their native environments. Biological controls reunites natural enemies, such as herbivores and pathogens, with their host (invasive plant) to reduce impacts caused by the pest. The goal of biological control is to reduce the target pest population and its corresponding impact to an acceptable level. Biological control agents are specialized insects or pathogens that were tested extensively to ensure they specifically target a specific non-native invasive plant and produce the desire reduction result without harming native species.

The following successful biological control programs have been implemented statewide (Chandler, Skinner, and Van Riper):

- Leafy spurge
- Spotted knapweed
- Purple loosestrife

Development of new biological controls for buckthorn and others continue to be researched in an effect to discover new tools for controlling invasive species.

d. Habitat enhancement

Habitat enhancement uses a variety of management techniques to establish and maintain native vegetation, including prescribed burns, invasive species management, and selective removal of trees where necessary to restore critical habitat. Section III (Operational Considerations), Part B (Native Plant Communities in SDSF) provides details on the composition of oak savanna and oak woodland native plant communities in SDSF.

Habitat continuity is important for rare animals and other wildlife species. Small, isolated habitat patches will not generally be sufficient to ensure the survival of animals into the future. Corridors for animals to travel from one part of their habitat to another and to disperse to new habitats must be protected and managed appropriately. Protection of intact ecosystems is generally believed to be the most effective way to manage and protect rare features. In the case of SDSF, the natural landscape consists of dunes, and upland continuum of oak savanna to woodland to forest, and a diversity of wetland communities from forested swamps to fens, wet meadows, and marshes. Connectivity in the SDSF between wetlands, upland savanna habitat, and the St. Francis River is important for Blanding's turtles and other native turtles.

Protecting rare features requires mimicking their natural history. Historically, regular fires were an important process in oak savannas and associated communities. The natural history of SDSF fire-dependent communities indicates that light surface fires occurred every 10 years on average, and catastrophic fires occurred every 110 years on average. Fire intensities depended on fire frequency and the amount of fuel accumulated between fires. Information on prescribed fire safety procedures can be found in Section III, Part D (Health and Safety Considerations).

However, some rare species such as creeping juniper and Leonard's skipper may be harmed by intense fires, so it is important to manage fire carefully. The dune topography, wetlands, lakes, and rivers in the area may have resulted in a pattern of frequent, relatively small, low-intensity fires much of the time, with hotter and more expansive fires burning during periods of drought. The shifting of dunes over time in response to wind and climate maintained open sand habitats that protected these species from fires.

Management techniques for restoring oak savanna

On portions of the SDSF being restored to oak savanna, all tree species that are not part of this plant community type will be removed. Tree species native to oak savanna will be retained. These include bur oak, northern pin oak, black cherry, quaking aspen, and eastern redcedar. Eastern redcedar will be thinned to one to three trees per acre, with a focus on retaining larger trees. Bur oak, northern pin oak, black cherry, and quaking aspen will be thinned to meet the age class and density goals for the canopy (10-50% canopy density), with an emphasis on retaining older trees. Where possible, northern pin oak

should be largely removed and bur oak should be retained, as the proportion of northern pin oak to bur oak is currently much higher than what is naturally found in this plant community. Stumps of the hardwood trees for which sprouting is not desirable should be treated with an appropriate herbicide that meets all legal and forest certification requirements. All non-native shrubs will also be removed either by cutting and treating stumps with herbicide or by direct herbicide application. Staging areas will be located in already disturbed sites that do not have rare species populations. Slash should be removed or burned.

Fire is a critical component in restoring and maintaining oak savanna and will be used as a management tool to maintain an open canopy, and may also reduce prevalence of invasive species, particularly through repeated prescribed fires early in the restoration process. Adaptive management techniques will be used to determine whether or not prescribed fire is resulting in desired conditions; techniques will be adjusted accordingly. Fire breaks will be established and maintained to facilitate prescribed burning. These breaks can also be used to access stands for management activities. Burn units will be planned to ensure that animals will have unburned habitat for refugia. Timing of burns may vary depending on specific burn objectives and weather.

Seeding of understory or dune slopes will use locally-harvested plant seed (grasses, sedges, forbs); seed will come from within SDSF whenever possible. Plants that are important to rare animal species include hairy grama grass (*Bouteloua hirsute*), blazing star (*Liatris* spp.), large-flowered beard-tongue (*Penstemon grandiflorus*), round-headed bush clover (*Lespedeza capitata*), and leadplant (*Amorpha canescens*).

Oak savanna pictured at different canopy densities. Oak savanna in SDSF ranges from 10-70% (typically 25-50%) canopy cover.

Management techniques for restoring oak woodland

For portions of the SDSF being restored to oak woodland, a number of different vegetation management activities will be employed including timber harvest, invasive species removal and control, and prescribed burning. All tree species that are not part of this plant community type will be removed and eastern redcedar can be removed if desired, particularly from areas where they may have become dense due to exclusion of fire. All non-native shrubs will be removed either by cutting and treating

stumps with herbicide or by direct herbicide application. Staging areas are to be located in already disturbed sites that do not have rare species populations.

Stands will be evaluated for their potential older forest characteristics. These stands may include woodlands adjacent to wetlands, which presumably were less likely to have historical catastrophic fires compared to stands not adjacent to wetlands; those with non-game wildlife that utilize older forests such as red-shouldered hawks; and those that have diverse, high quality native plant communities. These stands will receive non-native species control and may have longer rotation ages. In other stands, management will focus on oak regeneration to achieve canopy cover goals and to reduce fire-intolerant sub-canopy species such as elm, red maple, ironwood, and green ash.

Fire will be used as a management tool to control invasive species and enhance native species habitat. Adaptive management techniques will be used to determine whether or not prescribed fire is resulting in desired conditions; techniques will be adjusted accordingly. Fire breaks will be established and maintained to facilitate prescribed burning. These breaks can also be used to access stands for management activities. Burn units will be planned to ensure that animals will have unburned habitat for refugia. Timing of burns may vary depending on specific burn objectives and weather.

In cases where prescribed burning is not feasible, understory timber stand improvement (TSI) techniques can be used to kill or remove undesirable species and enhance the quality of the native plant community.

Oak woodland ranges from 50-70% canopy cover in SDSF.

4. Vegetation Management Activities in SDSF: 2013-2022

With each subsection plan DNR develops a Stand Examination List. The Stand Examination List is a set of forest stands to be considered for treatment (e.g., harvest, thinning, regeneration, prescribed burning, reinventory) over the planning period based on established criteria (e.g., rotation age, site index, basal area, desired future cover type composition). Our forest inventory data is queried for stands that currently meet these criteria. These stands are assigned preliminary prescriptions and an associated year for a field evaluation. Most receive the prescribed treatment. However, based on the field evaluation, prescriptions may change for some stands because of new information on the stand or its condition. Examples of when a prescription might change: a) a stand with a preliminary prescription code of Thinning may be changed to a rotation-age harvest if an insect or disease problem is discovered during the field evaluation; b) it may be discovered that the stand composition has changed since the last inventory data was collected and all that's needed at this time is the collection of new inventory data; c) some large stands with a preliminary prescription code of Rotation-Age Harvest may be treated in several blocks over a period of years rather than harvesting the entire stand in one year; d) it may be decided to defer the treatment to a future year.

Between 2013-2022, sites were or will be assessed annually as part of the annual work planning and annual stand review processes. Specific harvest and management plans for each site were or will be developed after site evaluations, invasive species surveys, silvicultural assessments, and rare species surveys are completed. These areas were or will be actively managed with appropriate techniques including timber harvest, prescribed burning, invasive species control, and other restoration practices. Management of the Uncas Dunes SNA units will continue to follow the Uncas Dunes SNA Management Plan (MNDNR 2009).

It should be noted that from 2013-2017, approximately 1,000 acres in SDSF were sold for treatments of either thinning or rotation-age harvest. Not all of these stands were harvested as of May 2017.

Table 1 provides a summary of remaining proposed vegetation management actions in SDSF (excluding Uncas Dunes SNA) for the 2013-2022 planning period, as of March 2017. Plans will be adjusted as needed based on site assessments.

Table 1: Vegetation management proposed for 2017-2022

Proposed vegetation management action	**Number of acres in SDSF affected (excluding Uncas Dunes SNA)**
Thinning assessment	1,443
Rotation-age harvest assessment	654
Habitat enhancement, selective tree removal	73
Habitat enhancement, other maintenance (invasive species treatment*, seeding, slash management, prescribed burns, etc.)	336

Proposed vegetation management action	Number of acres in SDSF affected (excluding Uncas Dunes SNA)
Habitat enhancement assessment (management need unknown)	154
Total	**2,577****

*More invasive species management throughout SDSF may be necessary, depending on results of site assessments, which sometimes lead to discovery of new infestations. Acres planned for treatment will be discussed at the annual management planning meeting.
**The total number of acres to be managed is fewer than the sum of the various management actions because some acres will receive more than one type of management treatment.

These management actions are detailed in a series of maps and tables located in Section VI of this plan. These maps (and supplemental tables) include:

- Proposed vegetation management: thinning and rotation-age harvest for 2017-2022
  - Map 1: 2017 proposed thinning and rotation-age harvest
  - Map 2: 2018 proposed thinning and rotation-age harvest
  - Map 3: 2019 proposed thinning and rotation-age harvest
  - Map 4: 2020 proposed thinning and rotation-age harvest
  - Map 5: 2021 proposed thinning and rotation-age harvest
  - Map 6: 2022 proposed thinning and rotation-age harvest
- Summary of proposed harvest actions for 2017-2022:
  - Map 7: Summary of proposed thinning, 2017-2022
  - Map 8: Summary of proposed rotation-age harvest, 2017-2022
  - Table 4: Total acres of proposed thinning and rotation-age harvest, by year, 2017-2022
- Map 9: Summary of acres sold in 2013-2016, but not yet harvested (separated by thinning and rotation-age harvest)
- Proposed vegetation management: habitat enhancement for 2017-2022
  - Map 10: Proposed habitat enhancement for SDSF, 2017-2022
  - Table 5: Detailed descriptions of proposed habitat enhancement actions

5. Monitoring and Evaluation: Vegetation Management Impacts on Rare Species

DNR is working to assess the effectiveness of habitat enhancement activities in SDSF on a suite of six focal species: lark sparrows, eastern towhee, plains hog-nosed snake, gophersnake, northern barrens tiger beetle, and the Leonard's skipper butterfly. Improved understanding of the factors that influence rare wildlife habitat use on the Anoka Sand Plain will help inform management and predict how habitat enhancement activities are likely to influence the occurrence of these species.

Monitoring efforts will build upon rare species research in SDSF that has been ongoing since 2008 (Harper et al. 2010; Hoagland, Smith, and Texler 2012). We will continue to gather information before and after habitat enhancement work to be able to assess the impact of management. The adaptive management approach used in SDSF will allow lessons from early habitat enhancement efforts to be

applied to any future enhancement efforts in SDSF's High Conservation Value Forest (HCVF), and will be applicable to habitats hosting our focal species statewide.

B. Recreation Action Plan

At-a-Glance:

- SDSF is uniquely positioned between the Twin Cities and the St Cloud metropolitan areas. As such, SDSF provides regionally important recreational opportunities.
- Maintain 29 miles of designated trails (18 equestrian and 11 multi-use).
- Explore how to connect North Unit and South Unit trail networks.
- Maintain pine trees in the Ann Lake Campground unless they pose a safety or disease risk.
- Support continuing hunting and fishing opportunities within SDSF.
- Provide opportunities for visitors to view wildlife and experience native ecosystems and rare natural features.

1. Summary of Recreational Opportunities - Features and Amenities

State forests provide a tremendous recreational asset to the public, allowing access to lands that provide a variety of recreational opportunities. Outdoor recreation opportunities offered in the Sand Dunes State Forest (SDSF) are particularly significant for many Minnesotans because it is the closest State Forest to the metro area. This proximity to high population centers makes SDSF a popular destination year-round. This Recreation Action Plan for SDSF incorporates recreational opportunities with timber management and rare features management objectives, to successfully manage SDSF for multiple uses in a safe, sustainable, environmentally-sound, and fiscally efficient manner.

Recreational opportunities offered in SDSF provide the public an array of outdoor based activities to select from. Outdoor recreation facilities in SDSF include the Bob Dunn Recreation Area, which features the Ann Lake Campground, the Ann Lake Day Use area, and the Sand Dunes Horse Camp (Map 14). In addition, both within and outside of the Bob Dunn Recreation Area are many miles of multi-use recreational trails. There is also a Public Water Access on the St. Francis River, offering fishing and kayak/canoeing opportunities. The PWA is located east of where County Road 10 and County Road 15 join. The carry-in access provides parking and direct access to the St. Francis River and into the Sherburne National Wildlife Refuge.

The Bob Dunn Recreation Area is located in the north unit of SDSF. It encompasses 353 acres and borders Ann Lake to the east and the Uncas Dunes SNA to the south. The Ann Lake Campground provides a rustic camping experience with 30 drive-in campsites, 6 walk-in sites, and 4 group campsites. It offers firewood sales, council ring seating for interpretive programs, drinking water, vault toilet facilities, and an onsite campground host. It also provides access to many miles of year-round hiking trails, and options for ungroomed cross-country ski trail access in the winter. The campground is close to the Ann Lake Day Use Area, which features a popular swimming beach and offers scattered picnic areas, access to hiking trails, shoreline fishing, and a large parking area. The SDSF Horse Camp is located west of the Campground and Day Use Area and features rustic camping with 13 individual campsites and 2 group campsites. It offers access to 18 miles of designated equestrian trails. The Horse Camp provides a day use parking area, drinking water, toilet facilities, picket lines for tying up horses, manure bunkers, and an accessible loading ramp.

Overall, SDSF has over 29 miles of maintained trails, including 18 miles of designated equestrian and 11 miles of multi-use trail. These trails offer a journey through the mosaic of native and managed landscapes in SDSF. Among the most popular trail activities in SDSF are hiking, biking, hunting, skiing, bird watching and other nature viewing, and snowmobile riding. There are many additional trails maintained as fire breaks that are also open for recreational use but not signed, mapped, or maintained for specific recreational uses.

There are two designated trailheads in SDSF that provide parking and direct access to the trail system. The North Trailhead is located at the intersection of County Road 4 and 168th Street. It offers truck/trailer parking, direct access to equestrian, hiking, and snowmobile trails, a picnic table, a vault toilet, picket lines for tying up horses, and manure bunkers. The South Trailhead is located in the South Unit of the Sand Dunes along 233rd Ave, approximately 1 mile east of County Road 15. It offers truck/trailer parking, direct access to equestrian, hiking, and snowmobile trails, hand well pump, a vault toilet, and manure bunkers.

Trail-oriented recreational opportunities within the Sand Dunes are guided by principles that consider ecological sustainability and trail experience, among other things. For example, SDSF is classified as a "Closed Forest", indicating that no motorized OHV-ATV use is allowed (MN DNR 2017d). This designation was a result of an earlier evaluation, assessment, and public review process. Public requests for events or activities that may have the potential to cause significant environmental effects, are likely to attract large numbers of people, or are not normally allowed are reviewed through an application process. Approved activities are managed through special use or special event permits.

Through the implementation of this action plan, the landscape of SDSF will offer ongoing access to high quality recreational opportunities while providing a diverse mosaic of habitats that enrich and complement recreational experiences.

The recreation action plan for SDSF includes guidance on:

- Vegetation management
- Hunting and fishing
- Trail systems

2. Vegetation Management

Implementation of land management techniques applied within the Bob Dunn Recreational Area (BDRA) and along the recreational trails throughout the state forest will be conducted in accordance with the plant community objectives outlined in the 10-year Vegetation Management Action Plan.

Trail users can refer to Maps 1-10 to identify the management efforts planned near trails and the BDRA. In addition to the management identified on these maps, DNR will continue to inventory and apply invasive species control techniques to high priority invasive species found along trail corridors. This is ongoing work consistent with the agency's commitment to comply with DNR Operational Order 113 (MN DNR 2007). As directed in the general procedures of the MN DNR Parks and Trails (PAT) Division Guidelines for Implementation of Operational Order 113, trail managers will monitor and apply rapid response treatments to new infestations of invasive species (MN DNR 2015a). Integrative pest management techniques and treatments will be applied as time and resources allow.

Throughout the eastern portion of the BDRA, invasive species control treatments will be applied in an effort to maintain and strengthen the oak savanna and oak woodland native plant communities present. Invasive species within the BDRA will be managed in accordance with the procedures outlined in the MN DNR PAT Division Guideline for Implementation of Op Order 113 (MN DNR 2007). Current practices include both mechanical and chemical treatments. Chemical spot treatments are designed to minimize non-target exposure. Invasive species control treatments will be applied to non-native woody species that are encroaching on native habitats. Non-native invasive species such as garlic mustard, Siberian pea shrub, and Amur maple will be surveyed and controlled as time and labor resources allow. Native species that are considered noxious such as poison ivy, will be controlled using spot treatments, where deemed necessary.

DNR will reserve existing pine trees immediately within and bordering campsites in the Ann Lake Campground. Pine trees will not be removed from the campsites unless they are found to be a hazard to recreational users or forest health. Permanent School Trust lands can be found in the northern most portion of the BDRA. Land management efforts planned for this area can be found within the Permanent School Trust Lands Action Plan.

3. Hunting and Fishing

As a large contiguous tract of public land, SDSF is a popular destination for hunting and fishing recreation in the central part of the state. The optimal mix of habitat types paired with the diversity of vegetation and terrain create many opportunities for hunting and fishing recreation. Seasons and game species include:

- White-tailed deer: firearms, archery, and muzzleloader seasons in the fall; SDSF is part of deer permit area 223.
- Turkey: both spring and fall seasons; SDSF is included in turkey permit area 507.
- Small game: many species including squirrel, rabbit, grouse, pheasant, woodcock and partridge; refer to regulations for season dates.
- Waterfowl: opportunities on the marshy fringe of Ann Lake, Larson Slough, and along the St. Francis River; SDSF is in the central zone for waterfowl hunting.
- Fishing: Ann Lake is a popular pan fish and bass fishing lake, and the St. Francis River also provides angling opportunities.

SDSF and Uncas Dunes SNA are open to public hunting and fishing according to the annual regulations, seasons, and bag limits, except in the Bob Dunn Recreation Area, where hunting is not allowed. Hunting and fishing regulations handbooks are available each year on the DNR's website and in print anywhere licenses are sold.

4. Trail Systems

DNR will consider opportunities to improve or enhance the recreational trail system in SDSF based on ecological impacts, social trends, use compatibility, and public safety to create a positive, sustainable trail experience. Opportunities to improve trail systems may arise from planned timber harvests, vegetation management plans, natural events, or public inquiries. Where feasible and justified, trail re-routes are considered to avoid sensitive soils, steep slopes, rare plant communities, or unsafe trail

conditions. DNR follows Division of Forestry Policy 12: Timber Harvest and/or Extractive Operations on State Lands Adjacent to Recreational Trails, where timber harvests occur adjacent to designated recreational trails (MN DNR DOF 2016). In addition, as part of the DNR's State Forest trail use review process, recreational trails are re-evaluated based on established use designations. DNR is scheduled to review trail designations and/or special management areas for SDSF in the next few years through a public scoping and formal review process that solicits ideas, comments, and feedback. This will be discussed at the SDSF annual meeting.

SDSF is a destination for equestrians, offering many miles of equestrian trails. In 2017, the DNR held a public hearing to consider a change in equestrian and snowmobile trail use at Uncas Dunes SNA. The DNR will develop a new designation order for the SNA to replace the original order (MN DNR 1997) that will clarify trail opportunities on the unit.

The northern unit of SDSF contains about 15 miles of designated trails and the southern unit contains about 14 miles of designated trails. Currently, the trail systems in the two units are not connected, limiting the value of the overall trail system and posing a safety risk for users who wish to cross County Road 15 to experience the entire system. This affects hikers, bikers, equestrians, and snowmobilers alike. The DNR, based on requests and inquiries from user groups, has identified the need for a safe trail connection between the north and south units of SDSF to enhance recreational opportunities. A shared partnership among the user groups, local units of government, and the DNR is needed to build a route across County Road 15 and the St. Francis River. Funding a project of this scope will likely require multiple partnerships and funding sources.

C. Permanent School Trust Lands Action Plan

At-a-Glance:

- There are no current plans to change the School Trust status of any parcels in SDSF.
- If plans to change the status arise during this planning cycle, the DNR will notify local landowners and other interested stakeholders. The DNR also will hold public informational meetings on any proposed School Trust land status change.
- DNR will deposit net revenues generated on School Trust lands (e.g., through timber harvest and camp fees) to the Permanent School Fund as required by law.

Permanent School Trust lands are owned by the state in trust for all K-12 public schools of Minnesota. The DNR manages the School Trust lands *as trustee*, for maximum long-term economic return under sound natural resource and conservation practices.

1. School Trust Land in SDSF

There are 1,035.63 acres of Permanent School Trust land in SDSF (Map 16).

2. Generating Revenue on School Trust Lands

State law provides that it is the goal of the Permanent School Trust to secure maximum long-term economic return from the School Trust lands consistent with the fiduciary responsibilities imposed by the School Trust relationship established in the Minnesota Constitution, with sound natural resource

conservation and management principles, and with other specific policy provided in state law. (Minnesota Statute, Section 127A.31)

Net revenue generated from School Trust land is deposited into the Permanent School Fund, which is managed by the State Board of Investment. Interest and dividends from the Permanent School Fund are distributed to school districts based on the number of students.

Across the state, revenue from the School Trust lands comes from:

- Mineral leases - iron ore/taconite, nonferrous metallic minerals, industrial minerals, and others
- Timber sales
- Surface leases - gravel, hunting cabins, miscellaneous, agriculture, and others
- Utility licenses
- Easements
- State forest campground fees
- Sale of land
- Compensation for other uses (e.g. public water access sites)

Some examples of revenue generation on School Trust land in the SDSF include Grant-in-Aid snowmobile trail leases (paid annually), easements (one-time payments), and timber sale revenue (paid as the timber sale occurs).

3. Sale of School Trust Land

School Trust land can be sold (Minn. Const., Art. XI, Sec. 8; M.S. 92.01-92.29). Pursuant to M.S. 92.13, the commissioner shall hold public sales of school and other state lands when it is advantageous to the state and to intending buyers and settlers. Sale of School Trust land must first be approved by the Regional Director (DNR), Land Administrating Director (DNR), Lands and Minerals Director (DNR), and the Land Asset and School Trust Administrator (DNR). In addition, the School Trust Lands Director (MN) has authority under M.S. 127A.353 to advise the commissioner of natural resources on the management of school trust lands, including land sales. Prior to sale, the DNR publishes a notice of the sale in a newspaper of general distribution in the county in which the real property to be sold is situated (M.S. 94.10 Subd. 2). Prior to the sale, there is also notification provided to adjacent landowners. After the above listed requirements are met, the DNR holds a public auction (M.S. 92.13).Sale of School Trust land must be done at public auction and sold to the highest bidder.

As of May 2017 there were no plans to sell School Trust land in SDSF. However, should management of the school trust lands in SDSF be impacted so as to restrict or prohibit revenue generation; it would then be in the best interest of the school trust to consider a divestment strategy.

4. Exchange of School Trust Land

The School Trust designation of one parcel may be exchanged with another parcel of state-owned land. This is considered an internal exchange and would need to adhere to the authorities granted to the commissioner of natural resources under M.S. 94.343. Any proposed exchange involving trust lands requires approval by the Regional Director (DNR), Land Administrating Director (DNR), Lands and Minerals Director (DNR), and the Land Asset and School Trust Administrator (DNR). In addition, the

School Trust Lands Director (MN) has authority under M.S. 127A.353 to advise the commissioner of natural resources on the management of school trust lands, including land exchanges. A public hearing would be required by statute. Prior to exchange, the DNR coordinates the notification of the required public hearing (per M.S. 94.343, subd. 7) and also holds the public hearing. Following the public hearing, the appropriate next step is to brief the DNR Commissioner and the Land Exchange Board (LEB) on the land exchange proposal and request approval of the exchange (per M.S. 94.341). All exchanges involving public lands of the state for any publicly or privately held lands must receive the approval of the LEB. The Land Exchange Board consists of the Governor, State Auditor, and Attorney General. Meetings of the LEB are held quarterly.

There are several reasons why the state may consider exchange of School Trust lands. For example, the horse camp in Sand Dunes State Forest is located on School Trust land. The revenue from camping fees is deposited into the Permanent School Fund. There is currently no provision to use any of those funds for campground upkeep or improvement. If the School Trust designation is exchanged and the horse camp is situated on acquired land, fee income can be used to help offset the cost of maintaining and improving the campground. Another situation where the state may wish to exchange School Trust designation is in cases when managing for the high conservation values on HCVF land may prohibit or limit the ability to generate revenue. In these cases, DNR may first seek opportunities to compensate the School Trust before considering an exchange. No tree removal for habitat enhancement would occur on SDSF School Trust land until the School Trust is financially compensated.

A real estate analysis including the revenue-generating capability of all involved parcels must be completed before any exchange could occur. There must be a reasonable expectation that the parcel receiving the new School Trust designation has at least equal capability to generate revenue as the parcel with the current School Trust designation. In addition, School Trust lands cannot be exchanged for lands of lesser market value.

Exchange of School Trust designation has been considered in SDSF but is on hold as of May 2017.

For more information on School Trust lands and DNR's management of them visit the DNR's School Trust lands webpage.

D. Forest Roads Action Plan

At-a-Glance:

- Maintain the 8 miles of System Forest Roads in SDSF.
- Maintain the approximately 45 miles of temporary access roads in SDSF.
- Work with Orrock Township to resolve the issue of township roads on state lands that do not currently have easements.
- Explore routes that minimize heavy truck impacts on township roads

1. Overview of Roads in SDSF

The DNR maintains a variety of forest roads and access routes, and trails for public access to forest lands and for forest management. "Forest roads" are defined in statute (M.S. 89.001 subd. 14) as "a road constructed, acquired, maintained, or administered by the commissioner for the purpose of carrying out forest resource management policy."

Some key features of forest roads include:

- Forest roads are generally open to the public for recreational use.
- A forest road is not considered a public road, and DNR is not a road authority.
- Forest roads do not provide legal access to private land or property.
- State forest roads can be closed for "wildfire hazards" and during conditions that "render forest trails impassable by driving thereon during wet seasons" (M.S. 88.22 subd.1).
- Forest roads are normally not plowed in winter. Loggers and other contractors are allowed to plow forest roads in order to complete work under contracts on state land. Private individuals who wish to plow state forest roads to access private property will need an Access Permit, an easement, or a lease.

There is one class of forest road present in SDSF: system forest roads. System forest roads are usually well-maintained with a gravel surface and generally capable of accommodating two-way traffic. Most of these roads are connected to state, county, or township public highways. In SDSF, only highway-licensed vehicles are allowed on system forest roads; off-highway vehicles are prohibited throughout SDSF.

All other forest access features in SDSF are defined as "temporary access routes". These are most often associated with forest management activities, particularly timber harvesting. Temporary access routes do not have legal standing as forest roads, and are generally not maintained or managed beyond the lifespan of the temporary access need, such as a timber sale (Jacobson, Pitt, and Deckard 2013). Forest roads and temporary access routes may be used for multiple purposes. Some temporary access routes are also designated snowmobile trails, for example.

"Trails" are forest access features designated for specific uses like horseback riding or snowmobile use. For more information on trails in SDSF, see the 10-year Recreation Action Plan.

2. Roads in the Sand Dunes State Forest

Road Type	Road Name	Miles
System Forest Roads	North Sand Dunes Road	2.0
	Day Use Road	0.5
	Ann Lake Campground Road	1.5
	South Sand Dunes Road	3.0
	South Sand Dunes Road – North Branch	1.0
Temporary Access Roads	Unnamed, multiple	45

In addition to State Forest Roads, there are a number of County and Township roads that provide access to the SDSF. These roads are controlled and maintained by their respective governing agency.

An issue has been identified with some township roads that are located on state land that do not currently have easements. DNR has committed to work with the Orrock Town Board to resolve this.

DNR recognizes that easements for many township roads on what is now DNR-owned land were likely established while in private ownership; however, the easements were not recorded on the deed. There are about 2.35 miles of designated township roads on DNR-owned land that do not have recorded easements.

On School Trust Fund land, the handling of easements is outlined in MN Statutes 84.63, 84.631, 84.632, and 85.015. There are about 1.5 miles of designated township roads on School Trust Fund land that do not have recorded easements.

Approximately 6.5 miles of road and trail segments in the North Unit of the SDSF have been identified as "persistence corridors" for rare features. The rights-of-way of these segments contain native grasses and forbs that provide habitat for rare animals, amphibians, and insects such as butterflies. Disturbances in these persistence corridors should be minimized and coordinated with staff from DNR's Division of Ecological and Water Resources.

III. Operational Considerations

A. Health and Safety Considerations

In all of the DNR's work, safety is our number one priority. Therefore, habitat and facility management activities implemented within SDSF will be carried out with in a manner that prioritizes the health and safety of the general public, DNR employees, private contractors, conservation partners, public recreational users, and neighboring landowners inside and outside SDSF's boundaries. Habitat management activities include restoring, enhancing, and maintaining SDSF's fire-dependent plant communities using various management activities that mimic historical natural disturbances. These activities include timber thinning, rotation-age timber harvest, tree planting, prescribed burning, and invasive species control. Facility management requires developing, maintaining, or improving user facilities under our care; this includes work on parking lots, gates, trails, access roads, etc., in and around SDSF with township, county and state partners.

Following are some specific health and safety considerations for prescribed burning and herbicide application in SDSF.

1. Health and safety considerations for prescribed burns

Prescribed burn plans are based on ecological objectives to maintain SDSF's fire-dependent or fire-adapted plant communities. These native plant communities have been damaged by the exclusion of natural fire, due to invasion of non-native plants as well as native plants that normally would have succumbed to frequent fires. Therefore, prescribed burns can be used to restore these globally rare ecosystems. The frequency, timing, and location of prescribed burns are designed to minimize impacts on species with limited home-ranges and or mobility (such as invertebrate communities); certain areas are left unburned to provide refuge for sensitive species.

Use of prescribed burns to manage these native plant communities will follow the MN DNR Prescribed Burn Guidelines outlined in Operational Order 47 (MN DNR 2010a) and the MN DNR Prescribed Burn Handbook (MN DNR 2010b), which provides information on appropriate personal protective equipment for personnel implementing prescribed fire. Importantly: the safety of firefighters and the public is the number one priority when planning and implementing a prescribed burn project.

SDSF prescribed burns are typically implemented during the months of April and May with ignition times occurring during the day. Upcoming planned burns will be discussed with interested stakeholders at the annual management planning meeting for SDSF, and a news release will be distributed at the start of the season detailing the planned prescribed burning activity. Local emergency services will also be contacted about planned burns. Weather conditions suitable for safe burning can vary from day to day, limiting the amount of advance notice that can be given to the public for the implementation of any particular planned prescribed burn. However, when weather conditions are favorable to implement a burn, day-of notice is provided to adjacent landowners.

Prescribed burn personnel obtain fire qualifications through required in-depth training on firefighting roles and specialized equipment. SDSF prescribed burn unit plans provide guidance on smoke management, fuel loading reduction strategies, timing of treatment, and other considerations, including addressing adjacent landowner concerns.

Prescribed burn unit plans include several specific components to insure safety (MN DNR 2010c):

- **Fire complexity rating**: Identifies items that need mitigation using a rating system guide.
- **Burn unit maps:** Identify burn locations.
- **Overall safety plan**: Identifies safety zones and escape routes for the burn. Includes a communications plan to ensure adequate communications with burn staff and emergency resources, and a traffic control plan if burning near roads.
- **Medical plan**: Identifies locations and contact information for ground and air ambulance, 9-1-1 dispatcher, nearest hospital, availability and location of first aid supplies at the burn site, and any key medical supply contacts.
- **Smoke management plan**: Describes how smoke effects on roads, firefighters, neighbors, and other sensitive receptors will be mitigated. All prescribed fire must follow the Minnesota Smoke Management Plan (MNICS 2016). Considerations include avoiding "smoke sensitive areas" such as livestock barns, airports, residences, and towns (usually located within a 2-3 mile radius of the burn); ensuring the smoke dispersion index is sufficient the day of the burn to adequately disperse smoke (based on wind speed and other weather elements); and posting appropriate signage (e.g. "Controlled Burn" or "Smoke on Road") when burning near roads.

Final prescribed burn unit plans require review by appropriate Area Forestry Office staff or designee to obtain burn permits. Burn plans can be shared with other interested groups (e.g., Orrock Township). On the day of the burn, the burning permit must be activated by the prescribed burn boss by contacting the appropriate Area Forestry Office staff. Next, all items on the "Go/No Go checklist" must be completed before a burn can be ignited. If any item is a "no go," the burn will not be carried out.

Go/No Go checklist items include the following:

- ALL burn prescription elements met.
- ALL personnel have the required PPE with them.
- ALL smoke management specifications met.
- ALL pre-burn considerations (line preparation) identified in the plan addressed.
- ALL current and projected fire weather forecasts have been obtained and are favorable.
- ALL the required notifications been made (landowners, media, cooperators, sheriff etc.)
- ALL planned operations personnel and equipment on-site, available and operational.
- ALL permits and approvals been obtained. (open burning permit, non-DNR land permission)
- APPROPRIATE contingency resources have been confirmed and are available
- ALL on-site holding forces adequate for containment under the expected conditions.
- ALL personnel briefed on the burn objectives, their assignment, safety hazards, escape routes, communications and contingency plan.
- Burn Boss believes the burn can be carried out according to the prescribed burn unit plan and will meet the planned objectives.

Once the checklist is completed, the prescribed burn crew is authorized to move forward with a test fire on the downwind side of the prescribed burn unit under the direction of the prescribed burn boss. This ensures the observed fire behavior matches closely with the predicted fire behavior. Assuming this is confirmed, implementation proceeds. Firefighters provide the resources needed to contain the fire within the prescribed burn unit boundaries, while igniters use wind patterns to provide strategic

ignitions around the burn unit, eventually encircling it. After the prescribed burn unit fuels are consumed, firefighters mop-up the burn unit from the boundaries inward ensuring smoldering snags and other fuels are extinguished.

2. Health and safety considerations for herbicide application

All herbicides used in SDSF are approved by DNR's third-party certification providers and are used per the label restrictions. Herbicide application is used in SDSF when:

- Biological controls are not an option.
- Mechanical control alone does not kill the targeted plant.

SDSF herbicide treatments of invasive species utilize licensed applicators. Application methods include backpack sprayers and ATVs equipped with tanks for wand application. Spot spraying of herbicides (i.e. basal bark & cut stump treatments) are used following mechanical treatments (cut stump) to reduce or eliminate the need for additional reentry into managed areas that have been treated this way. See **Appendix D** for common label names of herbicides used within SDSF and target plants.

Broadcast spraying using BTK (*Bacillus thuringiensis,* subspecies *kurstaki*), a bacterial insecticide, was accomplished by helicopter in 2007 for a severe outbreak of jack pine budworm in SDSF (MN DNR 2017b).

Herbicide application signage is located at entrances to treated sites for the growing season and describes the following:

- Pesticide used
- Purpose
- Treatment date
- Re-entry period

Personal protective equipment (PPE) is utilized as appropriate and directed according to the labeled instructions of any pesticide or herbicides used within SDSF for the safety of those individuals directly

using them. Safety Data Sheets are available for additional information on each pesticide; these are usually available through the manufacturer.

Minnesota pesticide applicator certification and licensing is handled by the Minnesota Department of Agriculture. The agency encourages the use of integrated pest management to control invasive species, noxious weeds, and other pests. Pesticide applicators are responsible for recording application locations, weather, and date of application. Mixed solutions must be labeled with an EPA tracking number including the mixing rate and date. Each targeted invasive species typically has multiple recommended herbicide options to consider; the applicator can choose the most appropriate option for the health and safety of the applicator and public, as well as nearby non-target plants. Herbicide containers and applicators are triple rinsed after use.

Testing for potential groundwater contamination attributable to herbicide use in SDSF would be difficult and costly, as it would be difficult to distinguish between the inputs from SDSF and inputs from surrounding agricultural and residential lands. However, as most wells in and around SDSF are greater than 20 feet deep, and herbicide use in SDSF is limited and done per label instructions, it is unlikely that the herbicides used to treat invasive and undesirable plants in SDSF are leaching into the groundwater at that depth. The Minnesota Pollution Control Agency or the Environmental Protection Agency may be able to provide additional information regarding herbicides potentially reaching groundwater.

B. Native Plant Community Context in SDSF: Oak Savanna and Oak Woodlands

The habitat enhancement prescriptions in this operational plan focus on oak savanna and oak woodland native plant communities. A summary table comparing and contrasting the desired characteristics of oak savanna and oak woodland native plant communities can be found below (Table 2). More detailed information and species lists can be found in the Native Plant Communities of Minnesota Field Guide (MN DNR 2005).

There are a number of other important native plant communities within SDSF including southern dry barrens prairie, southern mesic prairie, emergent marsh, tamarack swamp, and sedge meadow. In this plan, goals and methodology for restoration of southern dry barrens prairie and southern mesic prairie are treated as part of the oak savanna native plant community because rare species and management needs are similar. There is no scheduled maintenance for emergent marsh, tamarack swamp, and sedge meadow for the duration of this plan.

Table 2: Desired characteristics of oak woodland and oak savanna native plant communities in SDSF.

Characteristic*	**Oak Woodland**	**Oak Savanna**
NPC Classification	FDs37	UPs14a2
Tree Canopy Cover	50-70% canopy cover 25-70% sub-canopy cover 25-70% shrub cover	10-50% tree canopy cover (lowest on south- to west-facing slopes) Less than 30% shrub cover
Growth Form	Open- or moderately open-grown	Open-grown
Basal Area	80 – 150 square feet/acre	5 – 50 square feet/acre
Tree Species Canopy	Bur oak and northern pin oak as canopy dominants. Also northern red oak, white oak, red maple, black cherry, quaking aspen, paper birch	Bur oak as dominant, northern pin oak in lower density in all age classes from seedlings and stump sprouts to mature trees. Other hardwoods kept in very low density by fire include black cherry, quaking aspen
Subcanopy	Ironwood, red maple, black cherry, quaking aspen, paper birch, bigtooth aspen in subcanopy	
Shrub Cover	Chokecherry, American hazelnut, gray dogwood, prickly ash	Eastern redcedar density reduced to 1-3 trees/acre
Ground Layer	Generally shade-tolerant with some prairie/savanna species present. Species include pointed-leaved tick trefoil, Clayton's sweet cicely, hog peanut, Canada mayflower, wild geranium, Pennsylvania sedge	Dominated by mix of native graminoids and forbs typical of prairies/savannas. Areas of bare sand, especially on steep dune slopes

*Please refer to the Native Plant Communities field guide for more detailed information and species lists (MN DNR 2005).

1. Oak savanna NPC considerations

The oak savanna in SDSF is classified as Dry Barrens Oak Savanna (Southern) (Southern) Oak Subtype, referred to here as Dry Barrens Oak Savanna (Southern). This type of savanna occurs on sand on landforms varying from level to steeply sloping dune formations. It is dominated by northern pin oak *(Quercus ellipsoidalis)* and bur oak *(Quercus macrocarpa)*, generally with open-grown forms, occurring individually or in groves. Dune crests, south to southwest-facing slopes, and sand blowouts are generally open and sparsely vegetated by grasses and forbs. Some common and characteristic herbaceous species include porcupine grass *(Stipa spartea),* June-grass *(Koeleria pyramidata)*, sand reed-grass *(Calamovilfa longifolia)*, gray goldenrod *(Solidago nemoralis)*, tall wormwood *(Artemisia campestris)*, hoary frostweed *(Helianthemum bicknellii)*, and prairie golden aster *(Chrysopsis villosa)*. More than eighty-five native plant species have been recorded in Dry Barrens Oak Savanna (Southern) in SDSF in recent years.

The goal for oak savanna habitat enhancement within SDSF is to ensure that conditions match the native plant community classification of UPs14a2: Dry Barrens Oak Savanna (Southern) (Southern) Oak Subtype (MN DNR 2005). Oak savanna is a fire-dependent community characterized by scattered open-grown oak trees with a diverse understory dominated by warm season grasses and prairie forbs (USFWS 2005). The guidance provided for oak savanna is also applicable to the two prairie native plant community classifications found in the state forest: UPs13a – Dry Barrens Prairie (Southern), and UPs23a – Southern Mesic Prairie.

The desired canopy cover for oak savanna in the state forest is between 10-50% with trees displaying an open-grown growth form and consisting of an overall patchy horizontal structure on the landscape. Basal area should fall within the range of 5-50 square feet per acre (Law et al. 1994, USFWS 2010). Tree cover will vary with slope and aspect, with south- to west-facing dune slopes having the lowest tree cover. Bur oak is the target dominant tree species, with northern pin oak serving as a co-dominant species in much lower density. All size classes of bur oak should be present, from seedlings and stump sprouts to mature trees. Other hardwood trees, generally kept in very low density by fire, may include black cherry and quaking aspen. Eastern redcedars should be reduced in density to 1-3 scattered trees per acre that are at least 15 feet in height. Shrub cover is patchy, short in stature, and should be less than 30%. The ground layer should be dominated by a mix of native grasses and forbs typical of prairie and savanna habitat. Small exposed areas of bare sand amongst the vegetation are of the utmost importance for certain rare species, especially on steep dune slopes.

2. Oak woodland NPC considerations

Southern Dry-Mesic Oak (Maple) Woodland in SDSF are native plant communities dominated by northern pin oak and/or bur oak. They often have dense to patchy tall brush cover of American hazel, red raspberry, smooth sumac, prickly ash, and/or redcedar. Groundlayers contain a mix of savanna species in openings and species more typical of dry oak forest in denser areas such as poison ivy *(Toxicodendron rydbergii)*, Canada mayflower *(Maianthemum canadensis)*, woodbine *(Parthenocissus quinquefolia*, and sun-loving sedge *(Carex pensylvanica)*. Quality of these communities in SDSF is highly variable, ranging from high quality areas to lower quality areas; characteristics of the latter include dense European buckthorn *(Rhamnus cathartica)*, disturbed groundlayers, presence of planted pines, and presence of dense saplings of shade-tolerant deciduous forest trees such as basswood *(Tilia americana)* and elm *(Ulmus spp.)*.

The goal for oak woodland habitat enhancement within SDSF is to ensure that conditions match the native plant community classification of FDs37: Southern Dry-Mesic Oak (Maple) Woodland (MN DNR 2005). The desired canopy cover for this fire-dependent community in SDSF is between 50-70% (up to 100% in some areas) with trees displaying an open-grown or moderately open-grown growth form. The basal area should range between 80 – 150 square feet per acre. Bur oak and northern pin oak are the target dominant canopy tree species. Other canopy species include northern red oak, white oak, red maple, black cherry, quaking aspen, and paper birch. Sub-canopy cover should range between 25-70% and consist of species such as ironwood, red maple, black cherry, quaking aspen, paper birch, and bigtooth aspen. Shrub cover should also range between 25-70% and consist of species such as chokecherry, American hazelnut, gray dogwood, and prickly ash. Ground layer species are generally shade-tolerant, but some prairie/savanna species will be present as well. Common species include

pointed-leaved tick trefoil, Clayton's sweet cicely, hog peanut, Canada mayflower, wild geranium, and Pennsylvania sedge.

C. Climate change considerations

Minnesota's climate has been undergoing changes over the last several decades, and is projected to continue changing well into the future. Excess greenhouse gases (such as carbon dioxide) that have been rapidly accumulating in our atmosphere since the mid-1850s are trapping more of the sun's heat, leading to observed changes such a warming temperatures and shifting precipitation patterns. These changes are impacting and will continue impacting Minnesota's lands and natural resources in multiple ways, including potential heat and water stress on vegetation; increased damage from insects, diseases, and invasive plants that thrive under the new conditions; increased storm damage; and shifts in the natural ranges of native species. A key management consideration for state lands both now and looking forward is how best to adapt to these impacts and maintain healthy ecosystems on the landscape.

Climate change impacts will increasingly stress already vulnerable species and habitats. Habitat enhancement efforts in SDSF should aim to increase the resistance and resilience of rare species through protection of refugia and restoration of degraded habitat in order to increase the likelihood that these species will be able to persist in the future (Stein et al. 2013; Groves et al. 2012).

In terms of tree management, climate models indicate that some species of trees are projected to do better in SDSF under expected climate changes while some will do worse, due to changes in the availability of suitable habitat. Table 3 summarizes the expected impact to SDSF tree species across the entire Anoka Sand Plain subsection, under low and high future greenhouse gas emissions scenarios. Red pine, the most abundant plantation species in SDSF, is expected to decrease across the Anoka Sand Plain under the new climate regime, while white pine is expected to increase. Northern red oak and northern pin oak are expected to decrease, while bur oak—which was once the most common tree species in the Sand Dunes—is expected to remain steady, and white oak will increase.

Increasing tree diversity in pine plantations may help to offset the expected loss of red pine. Increasing the focus on bur oak in SDSF, as the historically dominant tree species in SDSF's oak woodlands and savannas, may also help create climate resilience, as even under a high greenhouse gas emissions scenario bur oak is not expected to be negatively impacted by climate change in the region.

Table 3: Sand Dunes State Forest Trees—Response to Climate Change across the Entire Anoka Sand Plain

Species name*	**Predicted change low emissions scenario**	**Predicted change high emissions scenario**
Northern red oak	Decrease	Large Decrease
Quaking aspen	Large Decrease	Large Decrease
Bur oak	No Change	No Change
American Elm	Increase	Increase
Green ash	No Change	No Change
Basswood	No Change	No Change
Black cherry	Increase	Large Decrease
Paper birch	Large Decrease	Large Decrease

Species name*	Predicted change low emissions scenario	Predicted change high emissions scenario
Northern pin oak	Decrease	Large Decrease
Red pine**	Decrease	Large Decrease
Red maple	Increase	Increase
Ironwood	No Change	No Change
White oak	Large Increase	Increase
Eastern redcedar (juniper)	Large Increase	Large Increase
Jack pine**	Increase	Increase
White pine**	Increase	Increase
Big-toothed aspen	No Change	Large Decrease
Tamarack	Increase	Increase
White spruce**	Decrease	No Change

*Listed in order of abundance, relative to other tree species across the entire Anoka Sand Plain.
**Not known to be native to SDSF; planted for timber

D. Communications and Public Engagement

DNR is committed to sustaining communications and outreach around SDSF following a series of in-depth stakeholder engagement meetings in 2016. Information about upcoming planned timber sales, timber harvests, prescribed burns, restoration projects and changes to School Trust land status will be shared with local residents, local government and other stakeholders in a variety of ways. Opportunities for public input will be provided through annual meetings each winter, and during 10-year revisions of the Anoka Sand Plain Subsection Forest Resource Management Plan and SDSF Operational Plan. Comments and questions specific to SDSF can best be addressed to the Little Falls Area Forestry office (320-616-2450).

Communication and outreach efforts will include:

- Maintaining a dedicated SDSF stakeholder webpage and information repository on DNR's website.
- Continuing the GovDelivery listserv email messages specific to SDSF.
- Hosting annual meetings to review upcoming SDSF management.
- Creating informational posters, kiosks, or interpretive signage located at SDSF parking lots, forest campsite areas, or at specific sites on trails that are in the process of restoration or timber harvest to highlight active forest management techniques, native plant communities, rare species, and unique geological features.
- Collaborating with adjacent private landowners to address buffer requests and aesthetic concerns along shared boundaries, prior to future timber sales.
- Contacting neighboring landowners prior to prescribed burns and other management activities that require notification.

It should also be noted that this plan contains references and links to a variety of DNR policies and documents that may not be immediately accessible to the public. These links will help DNR staff access these documents on our intranet site. However, we are always pleased to share these documents with the public. Please contact DNR staff at any time for assistance with accessing these documents.

E. DNR Intra-agency Roles and Cooperation

The DNR has a common mission of working with citizens to manage diverse natural resources for a sustainable quality of life. The agency is organized as a set of divisions that work together to provide sound natural resource management. The DNR Division of Forestry is delegated responsibility to manage Minnesota State Forests, and it coordinates with other DNR divisions to accomplish this important charge.

As such, the Division of Forestry staff will be responsible for all 5,732 acres of the state forest. This includes the protection and restoration of the rare ecological features as well as harvest and reforestation. Based on guidance set forth in this plan, Forestry will implement adaptive management prescriptions for SDSF and provide silvicultural and economic expertise. Ecological and Water Resources staff will partner with Forestry in helping to set strategic direction, providing the essential technical assistance, and formulating on-the-ground tactics for habitat enhancement. Division of Fish and Wildlife staff will partner in setting strategic direction for habitat enhancement and restoration projects, along with plan implementation. The Scientific and Natural Areas program, with its goals of protection and restoration, manages Uncas Dunes SNA in consultation with Forestry. The recreational facilities of SDSF are administered by the Division of Parks and Trails; this includes trail maintenance, campground management, facility care and upkeep, and development.

F. Looking Forward: The Sand Dunes State Forest 2023-2032 Operational Plan

This operational plan provides overall management direction for SDSF through the year 2022. The next round of planning (which will occur in conjunction with planning the next SFRMP for the region) will build upon this 2013-2022 plan, rather than replace it. The vision for SDSF described in Section I of this plan is intended to be long-term, encompassing goals that DNR should strive to implement indefinitely into the future. This vision will guide future planning efforts for SDSF.

IV. References

Chandler, Monika A., Luke C. Skinner, and Laura C. Van Riper. "Biological Control of Invasive Plants in Minnesota." MN Dept. of Agriculture; MN Dept. of Natural Resources. Available at: http://files.dnr.state.mn.us/natural_resources/invasives/biocontrolofplants.pdf. 2pp.

Folke, C., S. R. Carpenter, B. Walker, M. Scheffer, T. Chapin, J. Rockstrom. 2010. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society* 15(4): 20.

Forest Stewardship Council (FSC). 2010. "FSC-US Forest Management Standard (v1.0)." Available at: https://us.fsc.org/preview.fsc-us-forest-management-standard-v1-0.a-188.pdf. 109 pp.

Groves, Craig R., Edward T. Game, Mark G. Anderson, Molly Cross, Carolyn Enquist, Zach Ferdaña, Evan Girvetz, Anne Gondor, Kimberly R. Hall, Jonathan Higgins, Rob Marshall, Ken Popper, Steve Schill, Sarah L. Shafer. 2012. "Incorporating climate change into systematic conservation planning". Biodiversity Conservation 21: 1651-1671.

Handler, Stephen and others. 2014. Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the Northwoods Climate Change Response Framework Project. USDA Forest Service. Available at: https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs133.pdf/. 230 pp.

Harper, L., E.P. Hoaglund, C.E. Smith, and H. Texler. 2010. Rare wildlife and habitat surveys in oak savannas of the Anoka Sand Plain subsection. Final report submitted to the State Wildlife Grants Program. State Wildlife Grants Program final report. Available at: http://files.dnr.state.mn.us/eco/nongame/projects/consgrant_reports/2010/swg_2010_harper_etal.pdf. 135 pp.

Hoaglund, H. C.E. Smith, and H. Texler. 2012. Microhabitat components of key habitat types in the Anoka Sand Plain that influence habitat selection among Species in Greatest Conservation Need. Final report submitted to the State Wildlife Grants Program. 93 pp. State Wildlife Grants Program final report. Available at: http://files.dnr.state.mn.us/eco/nongame/projects/consgrant_reports/2012/swg_2012_hoaglund_etal_nolocations.pdf. 93 pp.

Jacobson, K., D. Pitt, D. Deckard. 2013. "Forest Roads Program and Summer Access Assessment Overview." Summer Access Assessment Project Brief. Minnesota Department of Natural Resources - Division of Forestry. Completed October 10, 2013.

Keen, K.L. and Shane, L.C.K. 1990: A continuous record of Holocene eolian activity and vegetation change at Lake Ann, east-central Minnesota. *Geological Society of America Bulletin* 102, 1646–57.

Law, J.R., P.S. Johnson, and G. Houf. 1994. A crown cover chart for oak savannas. Technical brief from the silviculture and ecology of upland central hardwood forests research unit, TB-NC-2. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, Columbia, Missouri. 4 pp.

Laws of Minnesota 2017, chapter 93, article 2, section 155, "Sand Dunes State Forest Management." Available at: https://www.revisor.mn.gov/laws/?year=2017&type=0&doctype=Chapter&id=93

Marschner, F.J. 1975. The Original Vegetation of Minnesota (map). U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, MN.

Minnesota Constitution, Article XI, Section 8, "Permanent school fund; source; investment; board of investment." Available at: https://www.revisor.leg.state.mn.us/constitution/#article_11. Accessed May 4th, 2017.

Minnesota Department of Natural Resources (MN DNR). 1997. Commissioner's Scientific and Natural Area Order No. 115: Uncas Dunes Scientific and Natural Area; Superseding Scientific and Natural Area Order No. 51.

Minnesota Department of Natural Resources (MN DNR). 2005. Field guide to the native plant communities of Minnesota: the eastern broadleaf forest province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul, Minnesota. 394 pp.

Minnesota Department of Natural Resources (MN DNR). 2007. Minnesota DNR Operational Order #113: Invasive Species. 9 pp.

Minnesota Department of Natural Resources (MN DNR). 2009. An evaluation of the ecological significance of the Sand Dunes State Forest, Sherburne County, Minnesota. Division of Ecological Resources, Central Region, Minnesota Department of Natural Resources. 28 pp.

Minnesota Department of Natural Resources (MN DNR). 2010a. Operational Order #47: Prescribed Burn Guidelines. Effective date March 1, 2010.

Minnesota Department of Natural Resources (MN DNR). 2010b. Prescribed Burn Handbook. 116pp.

Minnesota Department of Natural Resources (MN DNR). 2010c. "Specific Instructions for Completing a Prescribed Burn Unit Plan." From: MN DNR Prescribed Burn Handbook. Available at: http://files.dnr.state.mn.us/forestry/wildfire/rxfire/burnplaninstructions.pdf. 12 pp.

Minnesota Department of Natural Resources (MN DNR). 2012. Anoka Sand Plain Subsection Forest Resource Management Plan. Available at: http://www.dnr.state.mn.us/forestry/subsection/anoka/plan.html. 121pp.

Minnesota Department of Natural Resources (MN DNR). 2015a. Department of Natural Resources, Parks and Trails Division Guidelines for Implementation of Operational Order 113: Preventing the Introduction and Spread of Invasive Species. 7 pp.

Minnesota Department of Natural Resources (MN DNR). 2015b. "High Conservation Value Forests (HCVFs) Fact Sheet". Available at: http://files.dnr.state.mn.us/forestry/certification/hcvf-factsheet.pdf. 1p.

Minnesota Department of Natural Resources (MN DNR). 2016. Minnesota's Wildlife Action Plan 2015-2025. Available at: http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/mnwap/wildlife-action-plan-2015-2025.pdf. 240pp.

Minnesota Department of Natural Resources (MN DNR). 2017a. HCVF Informational Report (Sand Dunes State Forest). Available at: http://eco-app.dnr.state.mn.us/hcvf/hcvf_link.php?hcvf_num=711760. Accessed March 20, 2017.

Minnesota Department of Natural Resources (MN DNR). 2017b. MN DNR public webpage: "Bt microbial insecticide." Available at: http://www.dnr.state.mn.us/treecare/forest_health/spraying/bt_insecticide.html Accessed March 20, 2017.

Minnesota Department of Natural Resources (MN DNR). 2017c. MN DNR public webpage: "Ecological Classification System." Available at: http://www.dnr.state.mn.us/ecs/index.html. Accessed March 22, 2017.

Minnesota Department of Natural Resources (MN DNR). 2017d. MN DNR public webpage: "Forest reclassification and road/trail designation status." Available at: http://www.dnr.state.mn.us/input/mgmtplans/ohv/designation/status.html. Accessed March 20, 2017.

Minnesota Department of Natural Resources (MN DNR). 2017e. MN DNR public webpage: "Rare Species Guide." Available at: http://www.dnr.state.mn.us/rsg/index.html. Accessed March 20, 2017.

Minnesota Department of Natural Resources (MN DNR). 2017f. Sand Dunes State Forest Public Engagement Project: Report prepared by the Minnesota Department of Natural Resources for the 2017 Minnesota Legislature In fulfillment of 2016 Minnesota Session Law Chapter 189 Section 47. Available at: http://files.dnr.state.mn.us/aboutdnr/reports/legislative/2017-sdsf-report.pdf. 15pp.

Minnesota Department of Natural Resources, Division of Forestry (MN DNR DOF). Division Policy 12: Timber Harvest and/or Extractive Operations on State Lands Adjacent to Recreational Trails. Effective date: May 5, 2016. 5pp.

Minnesota Forest Resources Council (MFRC). *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guideline for Landowners, Loggers and Resource Managers.* 2012. Minnesota Forest Resources Council, St. Paul, Minnesota.

Minnesota Incident Command System (MNICS), Prescribed Fire/Fuels Working Team. 2016. Minnesota Smoke Management Plan. Available at: http://mnics.org/wpress/wp-content/uploads/2011/02/Smoke-Mangement-Plan.pdf. 41 pp.

Minnesota Session Law Chapter 189 Section 47, "Sand Dunes State Forest; Report." Available at: https://www.revisor.mn.gov/laws/?id=189&year=2016&type=0. Accessed April 24, 2017.

Minnesota Statute 84.63, "Conveyance of interests in lands to State and Federal governments." Available at: https://www.revisor.mn.gov/statutes?id=84.63. Accessed March 21, 2017.

Minnesota Statute 84.631, "Road easements across State land." Available at: https://www.revisor.mn.gov/statutes?id=84.631. Accessed March 21, 2017.

Minnesota Statute 84.632, "Conveyance of unneeded state easements." Available at: https://www.revisor.mn.gov/statutes/?id=84.632. Accessed March 21, 2017.

Minnesota Statute 85.015, "State trails." Available at: https://www.revisor.mn.gov/statutes/?id=85.015. Accessed March 21, 2017.

Minnesota Statute 88.22 subd.1, “Wildfire prevention; prohibitions; banning; penalties – Imposition of restrictions.” Available at: https://www.revisor.mn.gov/statutes/?id=88.22. Accessed March 21, 2017.

Minnesota Statute 89, “State Forests; tree planting; forest roads.” Available at: https://www.revisor.mn.gov/statutes/?id=89. Accessed March 21, 2017.

Minnesota Statute 89A, “Sustainable forest resources.” Available at: https://www.revisor.mn.gov/statutes/?id=89A. Accessed March 21, 2017.

Minnesota Statute 89.001 subd. 14, “Definitions - Forest Land”. Available at: https://www.revisor.mn.gov/statutes/?id=89.001. Accessed March 21, 2017.

Minnesota Statute Chapter 92, “State lands; sales, investment of proceeds.” Available at: https://www.revisor.mn.gov/statutes/?id=92. Accessed May 4th, 2017.

Minnesota Statute 94.10 Subdivision 2, “Public sale requirements.” Available at: https://www.revisor.mn.gov/statutes/?id=94.10#stat.94.10.2. Accessed May 4th, 2017.

Minnesota Statute 92.13, “State lands, date of sale.” Available at: https://www.revisor.mn.gov/statutes/?id=92.13. Accessed May 4th, 2017.

Minnesota Statute 94.343, “Class A land exchanged; conditions.” Available at: https://www.revisor.mn.gov/statutes/?id=94.343. Accessed May 4th, 2017.

Minnesota Statute 94.343 Subdivision 7, “Public hearing.” Available at: https://www.revisor.mn.gov/statutes/?id=94.343. Accessed May 4th, 2017.

Minnesota Statute 94.341, “Minnesota Land Exchange Board.” Available at: https://www.revisor.mn.gov/statutes/?id=94.341. Accessed May 4th, 2017.

Minnesota Statute 127A.353, “School Trust Lands Director.” Available at: https://www.revisor.mn.gov/statutes/?id=127A.353. Accessed May 4th, 2017.

Prasad, A. M, L. R. Iverson., S. Matthews., M. Peters. 2007-ongoing. A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. https://www.nrs.fs.fed.us/atlas/tree, Northern Research Station, USDA Forest Service, Delaware, Ohio. Accessed March 20, 2017.

Nuzzo, V. 1986. Extent and status of Midwest oak savanna: presettlement and 1985. Natural Areas Journal 6: 6-36.

Stein, Bruce A, Amanda Staudt , Molly S Cross, Natalie S Dubois, Carolyn Enquist, Roger Griffis, Lara J Hansen, Jessica J Hellmann, Joshua J Lawler, Erik J Nelson, and Amber Pairis. 2013. “Preparing for and managing change: climate adaptation for biodiversity and ecosystems.” Frontiers in Ecology and Environment 11(9):502-510.

U.S. Fish and Wildlife Service. 2005. Sherburne National Wildlife Refuge Comprehensive Conservation Plan. http://www.fws.gov/Midwest/Planning/sherburne/ccp/FinalCCP.pdf. Accessed 05 May 2011.

U.S. Fish and Wildlife Service. 2010. Working definition of oak savanna for restoration efforts at Sherburne National Wildlife Refuge. Zimmerman, Minnesota. (unpublished).

Winchell, N. H. and Upham, W. 1882-1885. The Geology of Minnesota. Volume II, of the Final Report, 1888, The Geological and Natural History Survey of Minnesota, Final Report, Volume 2 : 695 pages with 42 plates and 32 figures

Wovcha, D.S., B.C. Delaney, G.E. Nordquist, Minnesota Department of Natural Resources. 1995. Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats. University of Minnesota Press, Minneapolis.

V. Glossary

adaptive management: A decision process that promotes flexible decision making in the face of uncertainty or changing conditions, and allows for adaptation as the effect of management actions and outcomes become better understood. Monitoring of conservation actions and outcomes is a key component of adaptive management.

basal area: The common term used to describe the average amount of an area (usually an acre) occupied by tree stems. It is defined as the total cross-sectional area of all stems in a stand measured at breast height, and expressed as per unit of land area (typically square feet per acre).

biodiversity (biological diversity): The variety of living organisms that are recognized and analyzed by biologists at three levels of organization: ecosystems; the species that comprise those ecosystems; and the genetic variability within those species (Wilson 2001). Species present in an ecosystem include animals, plants, fungi, protists, and bacteria and range enormously in size and ecological functions. **functional diversity** (see definition) is an aspect of biological diversity that some scientists believe may be of particular importance to ecosystem resilience. Biological diversity can be measured at different spatial scales (Whittaker 1960):

alpha-diversity: the number of species found in a small homogeneous area.

beta-diversity: extent of change in species composition among habitats or communities.

gamma-diversity: total species diversity in a landscape.

canopy: The layer of foliage formed by the crowns of the tallest trees, which shades the layers of vegetation below

canopy cover: The area of ground covered by a vertical projection of the canopy, expressed as a percent.

canopy closure: The proportion of the sky hemisphere obscured by vegetation when viewed from a single point, expressed as a percent.

climate change: A long-term change in the earth's climate, especially a change due to an increase in the average atmospheric temperature.

conditions: attributes that characterize the Priority Feature and describe the quality, or degree of intactness of the priority feature or the suitability of the site to provide for its designated uses. It can include measures of the composition, structure, biotic interactions and population variables or comparable measures for abiotic Priority Features.

conifer: A tree that bears cones and evergreen needlelike or scale-like leaves. Conifers present in SDSF include red (Norway) pine, white pine, jack pine, scotch pine, white spruce, eastern redcedar, Norway spruce, tamarack, and northern white-cedar.

Conservation Focus Areas: Priority areas for working with partners to identify, design, and implement conservation actions and report on the effectiveness toward achieving the goals and objectives defined in the Wildlife Action Plan. Conservation Focus Areas are intended to focus conservation efforts over the next 10 years to maintain and enhance the resiliency of the *Wildlife Action Network*.

Desired Future Conditions: Desired Future Conditions (DFCs) identify goals for management and restoration activities. The term acknowledges that natural landscapes change over time and that humans play a key role in determining the degree and direction of that change. Desired Future Conditions are targeted native plant communities, and will guide the implementation and management direction.

dune: A mound or ridge of sand or other loose sediment formed by the wind.

ecological classification system: A system used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. Map units for six levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases (MN DNR 2017c).

factors: Aspects of the environment or human activities that have potential to affect the Condition of the Priority Feature or usage of the site either positively or negatively. Negative factors are also known as 'threats'.

fire break: An obstacle to the spread of fire, such as a short-mowed swath of grass, a plowed line in the soil, or a strip of open space in a forest.

forest roads: Defined in statute (M.S. 89.001 subd. 14) as "a road constructed, acquired, maintained, or administered by the commissioner for the purpose of carrying out forest resource management policy."

Forest Stewardship Council© (FSC): An international non-profit organization focused on protecting forests for future generations by initiating standards and certifications under which companies and forests are rated.

functional diversity: A component of biodiversity that generally concerns the range of things that organisms do in communities and ecosystems. functional diversity can help explain and predict the impact of organisms on ecosystems

ground cover: The assemblage of plants such as grasses ferns, mosses and low shrubs growing close to the ground and covering the soil in a specific area.

growth form: The general shape of an individual tree's canopy and spreading branches. An open-grown oak tree covers more horizontal area and is suggestive of open growing conditions and lower tree density over a specific area.

habitat: A place (ecosystem) where a species lives and interacts with the physical environment and other species. Some species require multiple habitats at different stages in their life cycle.

habitat continuity: Large continuous blocks of habitat or connected blocks of habitat, rather than small, isolated and separated patches of habitat.

habitat enhancement: Changes made to a habitat that serve to improve its ecological value and ability to meet the requirements of one of more organisms.

High Conservation Value Forest: A Forest Stewardship Council management designation used to describe forests that meet forest stewardship criteria, including forests that contain rare, threatened and endangered species and ecosystems.

implementation plan: A multiple (typically ten) year plan of activities to meet objective(s).

indicators: Measurable descriptions of Conditions. They define what is measured to keep track of the status of the Condition or Factor attributes.

indicator ratings: Used to place the indicator value in an appropriate context or frame of reference to assess current condition relative to a desired target condition. Ratings provide a range of values that place indicator in three to four categories such as poor, fair, good, and excellent.

invasive species: An organism that causes ecological or economic harm in a new environment where it is not native.

locally-harvested seed: Refers to seed from non-woody species such as grasses, sedges, and forbs which is collected within SDSF whenever possible; when SDSF seed is not available, seed will come from within the county or the multi-county plant zone.

management plan: A written document that provides management guidelines specific to a single site. It includes a description and location of the site; the significance of the site in the landscape or ecological province or subsection; lists significant features related to a site including: rare plants and animals, Species in Greatest Conservation Need (SGCNs), Minnesota Biological Survey (MBS) Sites of Biodiversity Significance, MBS native plant communities, soils and geology, and historic vegetation; provides recommended management practices; outlines on a map locations of development and management needs; and an Implementation Table.

Minnesota Biological Service (formerly MCBS): A program of MNDNR's Ecological and Water Resources Division that inventories the plants and animals of Minnesota, maintains the Natural Heritage Information System (NHIS), produces publications and survey summaries, and provides technical assistance and education.

MBS sites of Biodiversity Significance: A ranking of biodiversity significance for a survey site based on the presence of rare species, condition of native plant communities and landscape location context of the site. Rankings include outstanding, high, moderate or below as an expression of biodiversity significance.

native plant community: A unique plant species composition and structure related to geography, to important ecological processes, and linked to abiotic environmental factors.

oak savanna: A type of savanna, or lightly forested grassland, where oaks are the dominant trees. Typically 10-70% (typically 25-50%) crown closure, these savannas were maintained historically through wildfires set by lightning or humans, grazing, low precipitation, and/or poor soil.

oak woodland: An oak-dominated community with a crown closure of 50% to as much as 70%, intermediate between the more open oak savanna and the more closed oak forest.

oak forest: A more dense and closed forest type dominated by oak trees with a typical crown closure of 70% - 95%.

objectives: Measurable outcomes, results, or targets that aim to maintain or improve the condition of the priority features and/or maintain a factor that affects their condition. Objectives should be SMART (Specific, Measurable, Achievable, Relevant, Time bound) and relate to the condition and factor indicators as well as be directed at the goals or desired future conditions.

prescribed burn: The controlled application of fire to a predetermined area of vegetative fuels, under specified environmental conditions and following appropriate precautionary measures, to achieve specific objectives such as maintaining or enhancing fire-dependent native plant communities (prairies, savannas, woodlands), controlling brush, producing high-quality browse, or reducing fuel hazards.

priority features: the key (priority) ecological and socioeconomic attributes (features or functions) of the site. This is not an exhaustive list of features on the site, but rather they are key components of the site that require management attention and specific objectives.

- An ecological Priority Feature could be the ecosystem, ecological processes, native plant communities, rare features, groups of species, Species in Greatest Conservation Need, Threatened &Endangered species, individual species, other significant natural resources.
- Socioeconomic Priority Features are the public, educational and/or research purposes of the site that need management attention. (Note: "management" as used in this context includes development, management, and administrative activities included in this plan.)

rare features: The general term used to encompass rare plants, rare animals, native plant communities, geologic features, and animal aggregations (such as breeding bird colonies). This includes all State- or Federally-listed endangered, threatened, and special concern species, S1-S3 native plant communities, and colonial waterbird colonies.

restoration: Ecosystem restoration is the process of assisting in the recovery of ecosystems that have been degraded, damaged, or destroyed and focuses on establishing the ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions.

rotation-age harvest: A logging practice in which trees are harvested upon reaching optimal age and/or when attaining maximum economic value, usually associated with an even-aged stand of trees all of the same species. This optimal harvest age tends to be fairly consistent for a given species over a fairly large geographic area and is based on economics, site condition, growth rates, and other factors.

reconstruction: a restoration that includes the conversion of an area where the native plant community has been removed, usually by cultivation for agriculture or other development.

rehabilitation: a restoration that includes enhancement or improvement of an existing native plant community that has endured some degree of disturbance yet still harbors elements of that community.

refugia: an (often localized) area where special environmental circumstances have enabled a species or a community of species to survive through a period of unfavorable conditions or persist after extinction in surrounding areas.

resilience: The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, and feedbacks, and therefore identity (Folke et al. 2010)

selective tree removal: The harvesting of trees in which individual trees or small groups of trees are harvested based on pre-determined objectives and desired results, leaving minimal damage to the remaining stand. This generally results in the removal of about one third of the trees on a given site with

the purpose of improving the growing space for the remaining trees. Selective tree removal in this plan also refers to removing a specific tree species from a given site.

Special Management Unit: An area of land with specific goals or objectives that typically is managed or monitored differently than the surrounding area and typically has features or resources that warrant additional attention.

Species in Greatest Conservation Need (SGCN): An official statewide designation for native animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. All states are required to maintain a SGCN list and Wildlife Action Plan to receive certain federal funding.

stem density: Measure of the density of a stand of trees based on the number of trees per unit area. In forestry, also defined as the degree of crowding within stocked areas, using various growing space ratios based on crown length or diameter, tree height or diameter, and spacing.

subcanopy: The layer of a forest immediately beneath the upper layer of forest cover commonly referred to as the canopy, which can include or refer to an area directly below a single tree or group of trees. The subcanopy is comprised of trees (and tall shrubs) that do not reach as high as the tallest trees (often termed dominants or co-dominants) in the forest.

Sustainable Forestry Initiative© (SFI): A North American 'forest certification standard' and program of SFI Inc., a non-profit organization. The Sustainable Forestry Initiative is the world's largest single forest certification standard by area of land under certification. It is considered a commitment to sustainable forest management protecting water quality, soil, wildlife and unique resources; promoting human health and safety; providing employee training and education; and communicating the benefits of the practice of *sustainable forestry* to the general public.

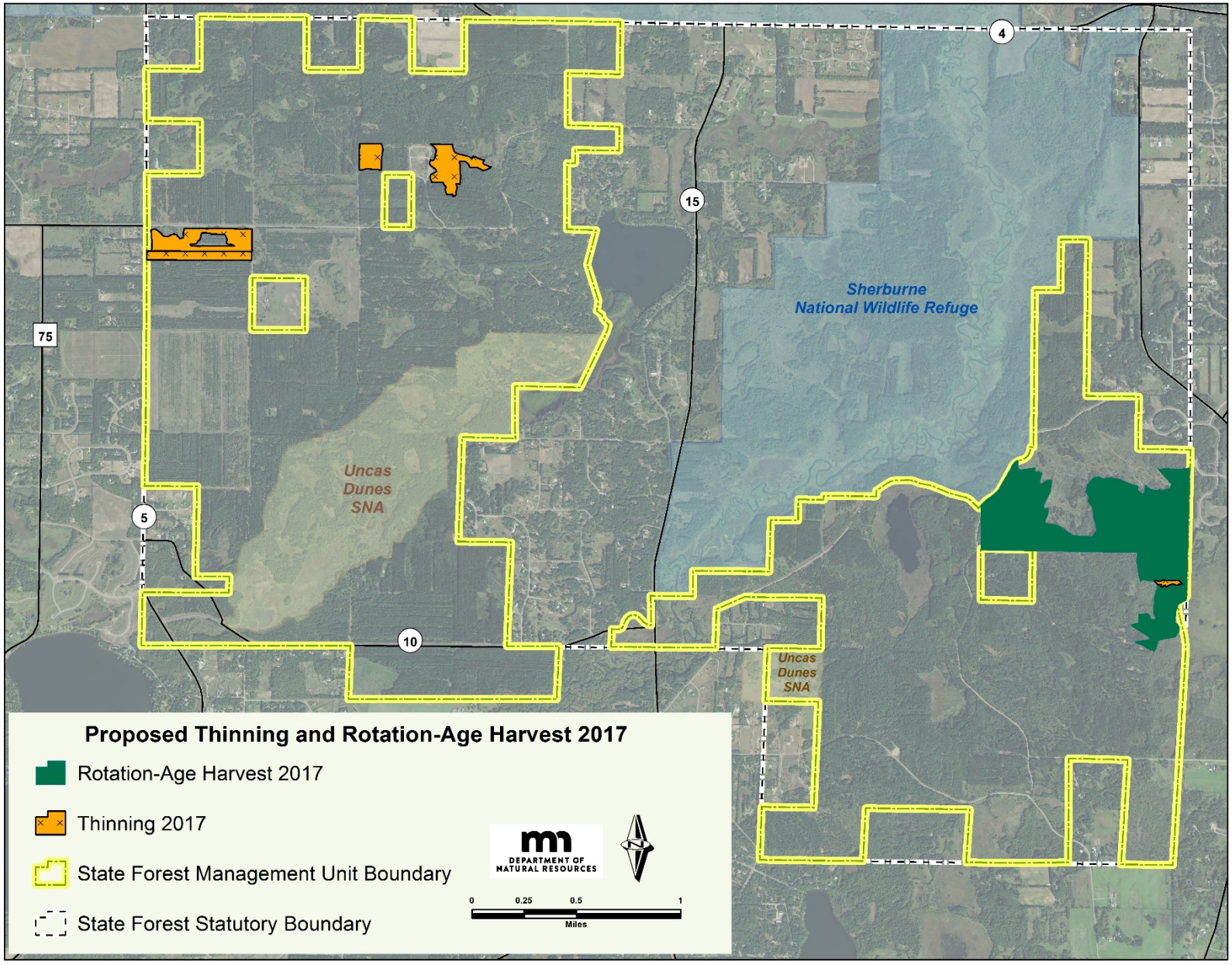
thinning: A silvicultural treatment made to reduce the density of trees within a forest stand primarily to improve growth rates of the remaining trees or utilize potential mortality (e.g., selective thinning, row thinning).

Wildlife Action Network. Mapped aquatic and terrestrial habitats, buffers, and connections that represent a diversity of quality habitats that contain populations of Species in Greatest Conservation Need.

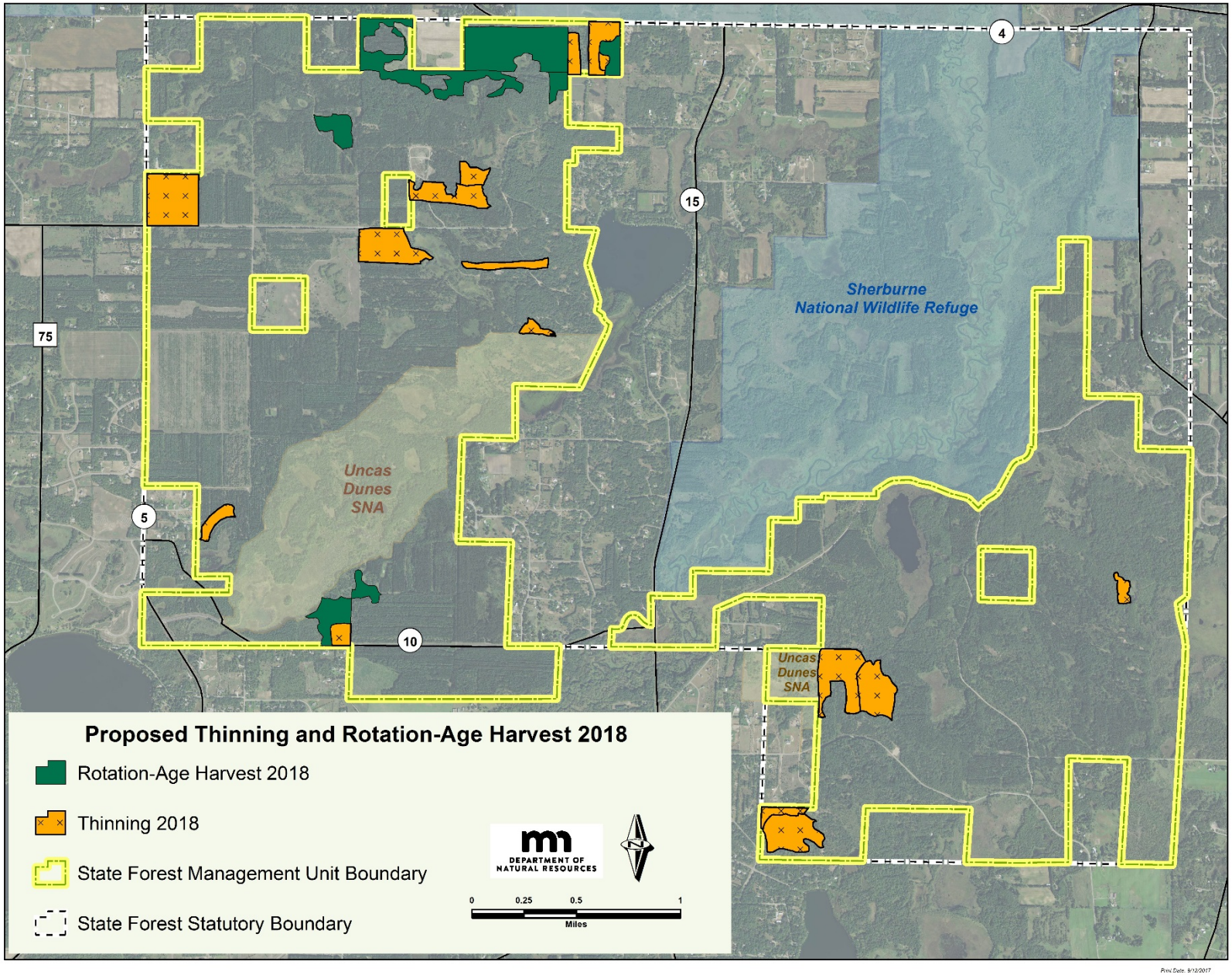
VI. Maps

- Proposed vegetation management: thinning and rotation-age harvest for 2017-2022
  - Map 1: 2017 proposed thinning and rotation-age harvest
  - Map 2: 2018 proposed thinning and rotation-age harvest
  - Map 3: 2019 proposed thinning and rotation-age harvest
  - Map 4: 2020 proposed thinning and rotation-age harvest
  - Map 5: 2021 proposed thinning and rotation-age harvest
  - Map 6: 2022 proposed thinning and rotation-age harvest
- Summary of proposed harvest actions for 2017-2022:
  - Map 7: Summary of proposed thinning, 2017-2022
  - Map 8: Summary of proposed rotation-age harvest, 2017-2022
  - Table 4: Total acres of proposed thinning and rotation-age harvest, by year, 2017-2022
- Map 9: Summary of acres sold in 2013-2016, but not yet harvested (as of March 2017)
- Proposed vegetation management: habitat enhancement for 2017-2022
  - Map 10: Proposed habitat enhancement for SDSF, 2017-2022
  - Table 5: Detailed descriptions of proposed habitat enhancement actions
- Map 11: Population Block Group Density (from American Community Survey, 2013)
- Map 12: Topological Relief and Dunes in SDSF
- Map 13: Bearing Trees from the 1848–1907 Public Land Survey (Marschner 1974)
- Map 14: Recreational Features in SDSF
- Map 15: High Conservation Value Forest (HCVF) in SDSF
- Map 16: Permanent School Trust Land (shown by 40-acre parcel)
- Map 17: Cover Types in Northern SDSF, Forest Inventory Management (FIM) Database, 2017
- Map 18: Cover Types in Southern SDSF, Forest Inventory Management (FIM) Database, 2017

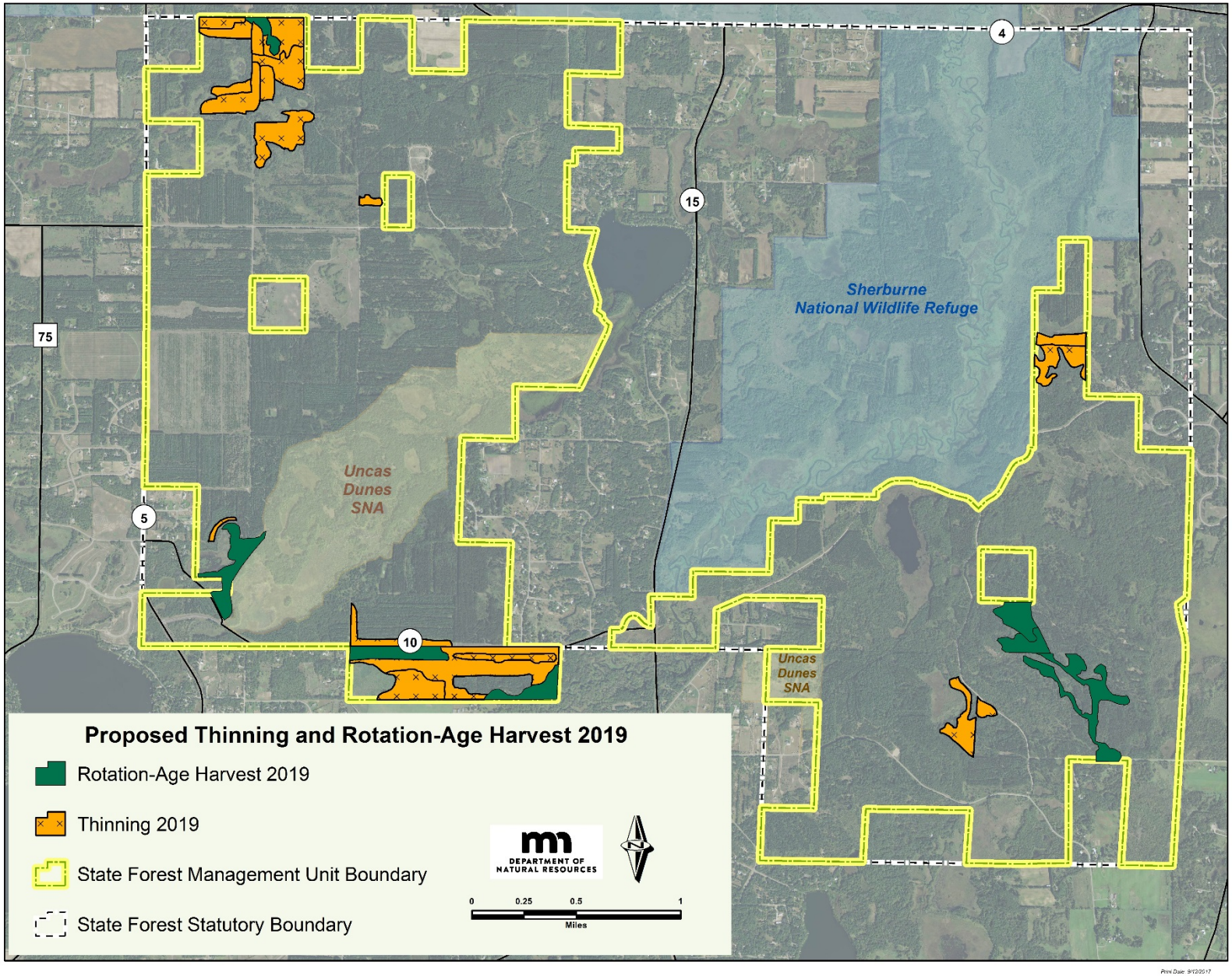
Map 1: Proposed Thinning and Rotation-Age Harvest, 2017



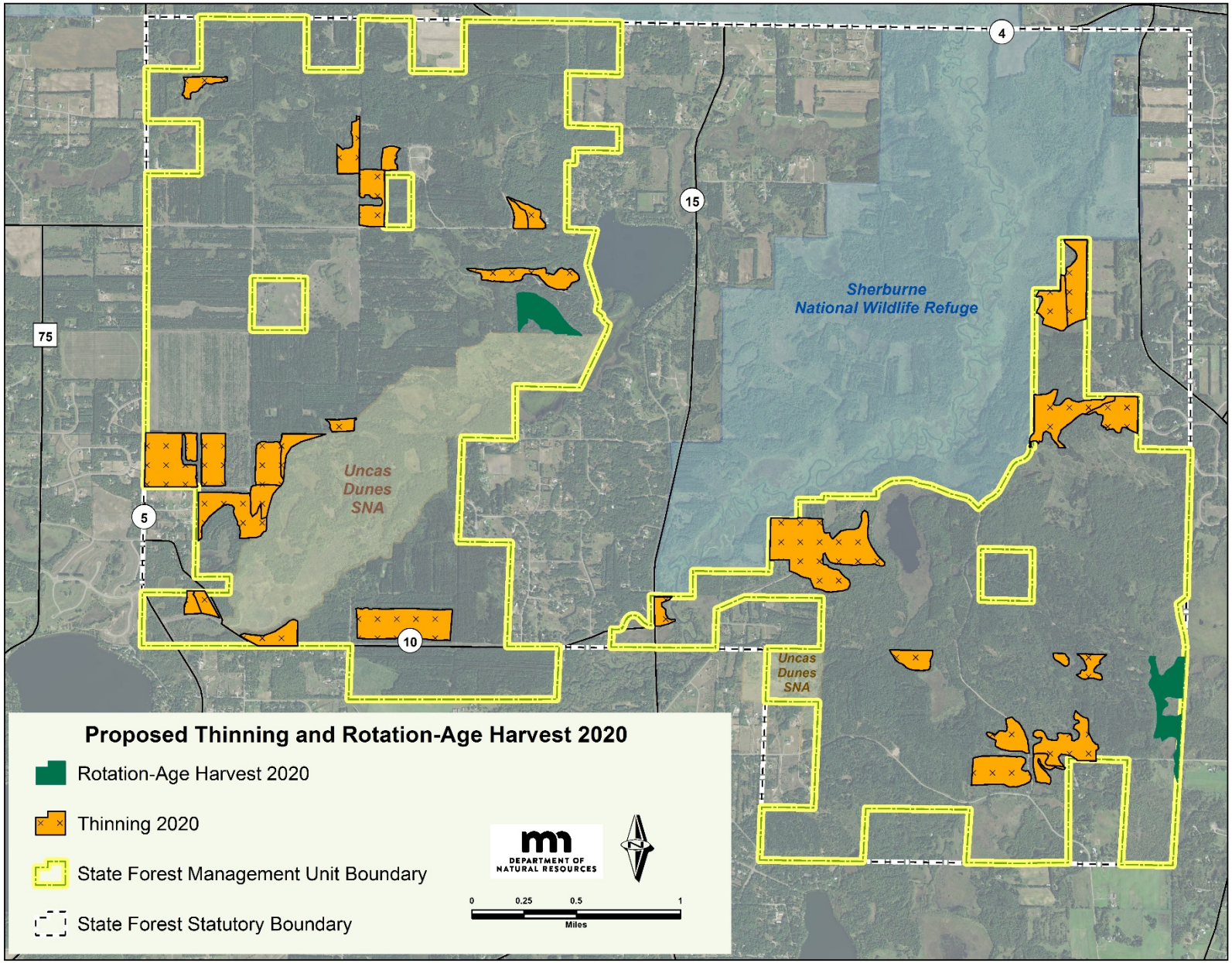
Map 2: Proposed Thinning and Rotation-Age Harvest, 2018



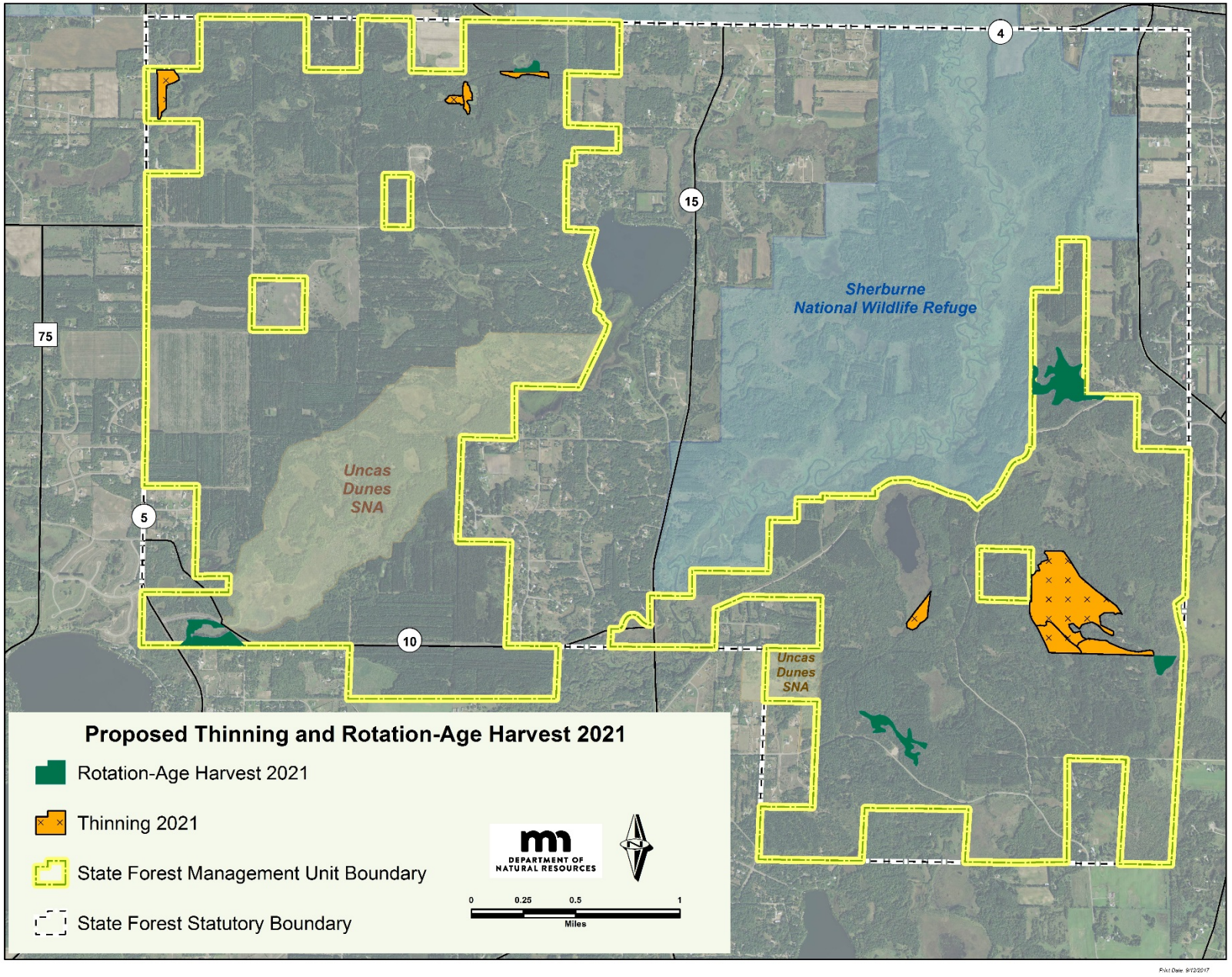
Map 3: Proposed Thinning and Rotation-Age Harvest, 2019



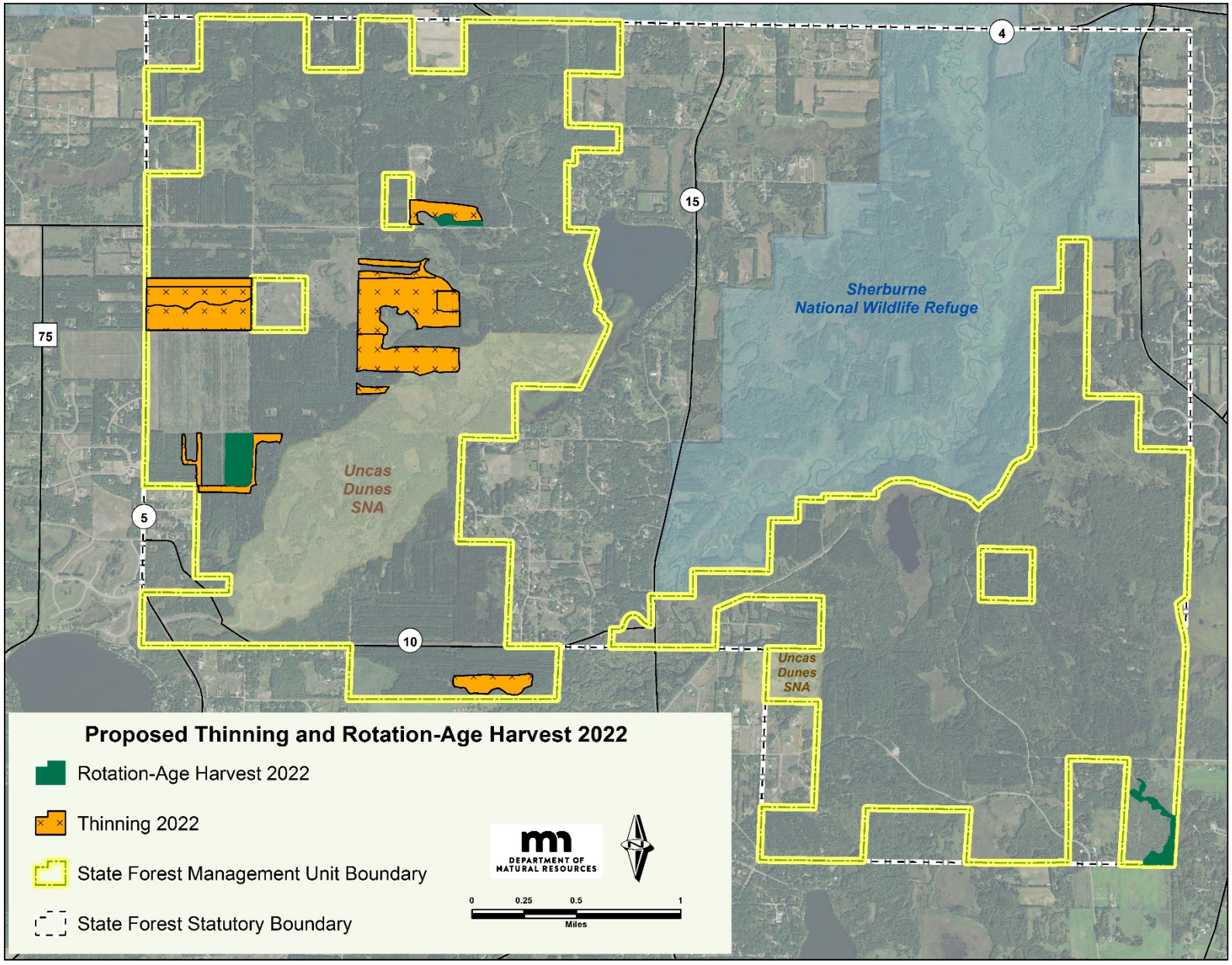
Map 4: Proposed Thinning and Rotation-Age Harvest, 2020



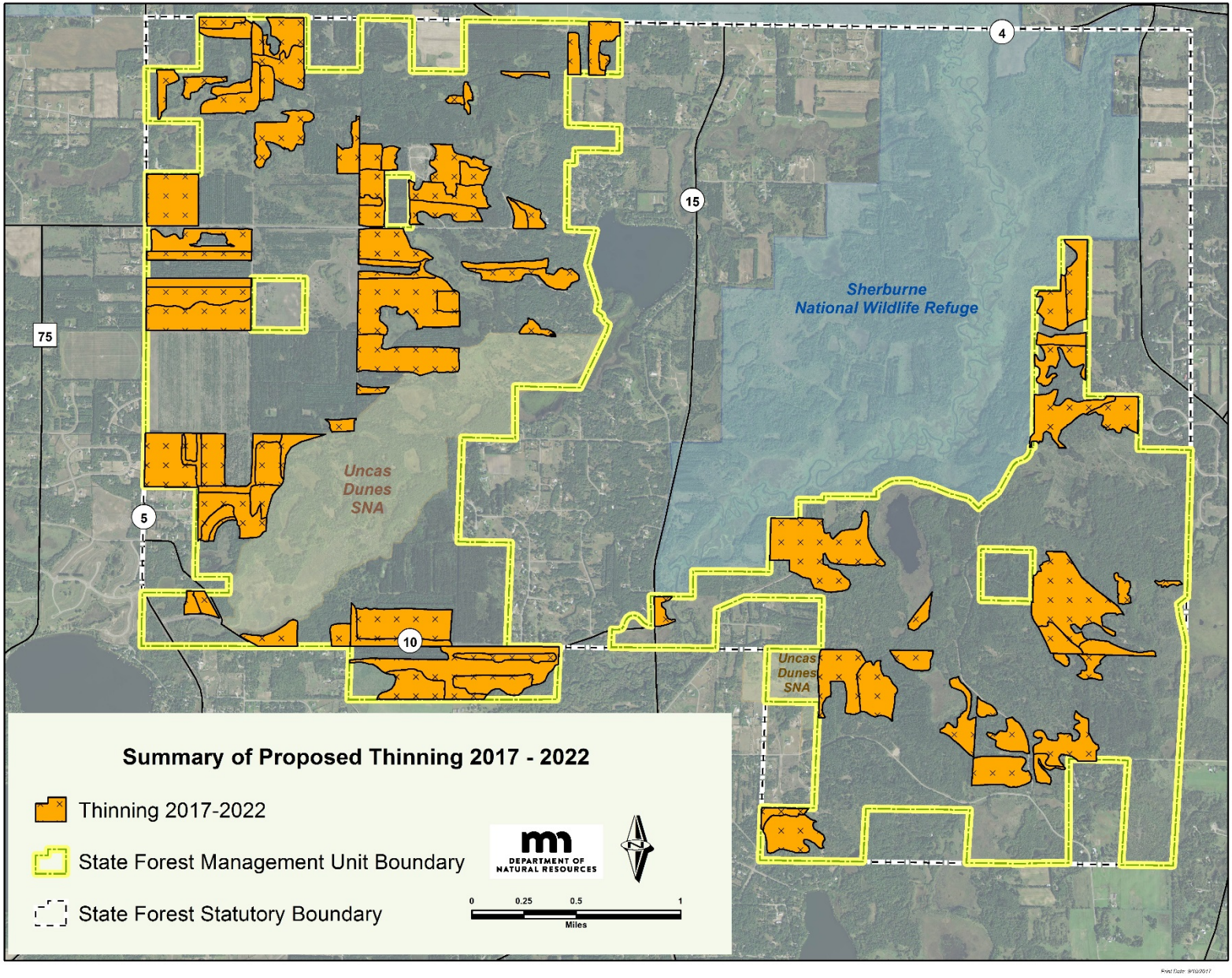
Map 5: Proposed Thinning and Rotation-Age Harvest, 2021



Map 6: Proposed Thinning and Rotation-Age Harvest, 2022



Map 7: Summary of Proposed Thinning, 2017-2022



Map 8: Summary of Proposed Rotation-age Harvest, 2017-2022

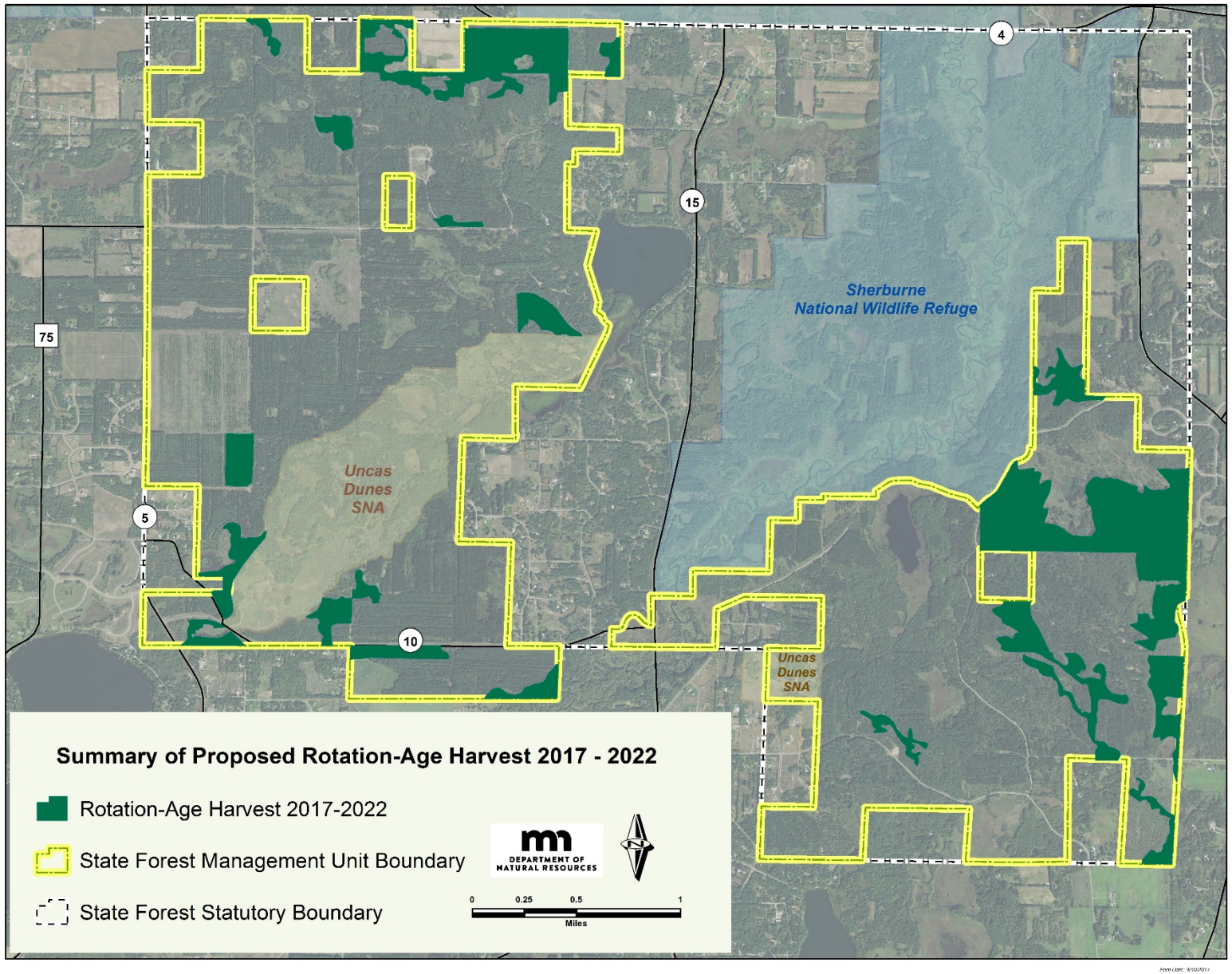
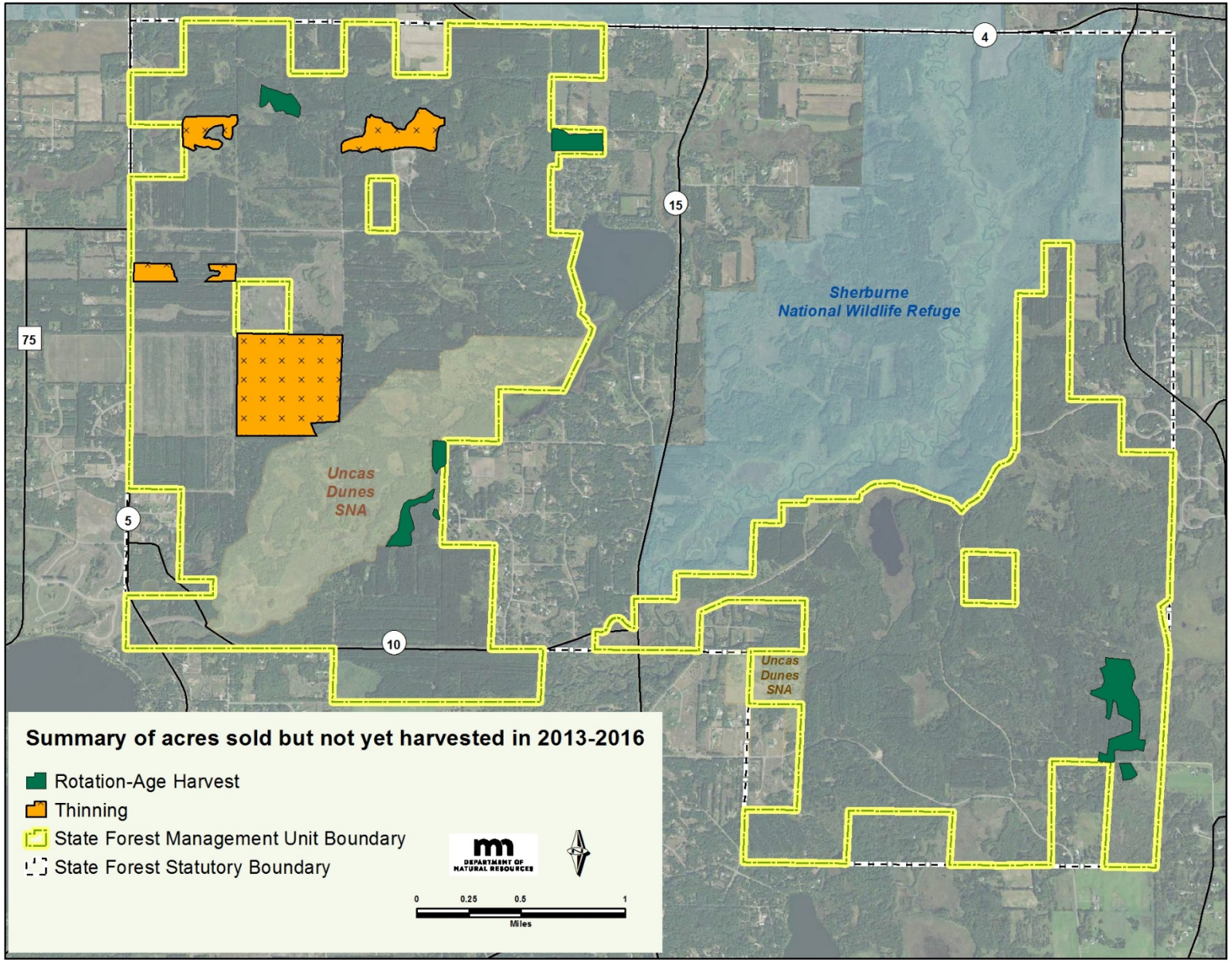


Table 4: Total acres of proposed thinning and rotation-age harvest, by year, 2017-2022 (Maps 7 and 8)

Fiscal Year	Rotation-age Harvest (acres)	Thinning (acres)
2017	234	80
2018	156	273
2019	124	267
2020	50	536
2021	50	108
2022	65	256
Total	**654**	**1,443**

Map 9: Summary of acres sold in 2013-2016, but not yet harvested (as of March 2017)



Map 10: Proposed Habitat Enhancement, 2017-2022

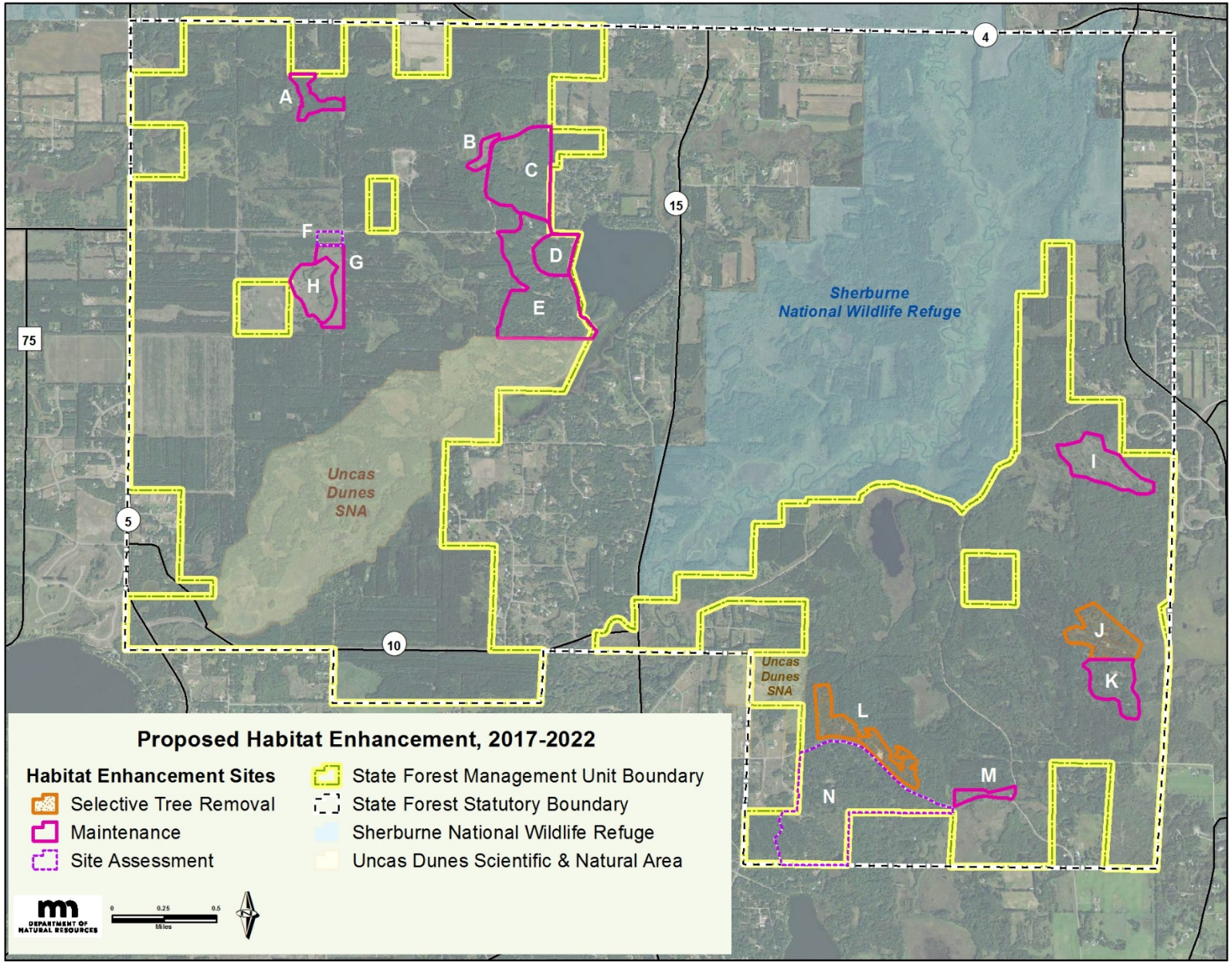


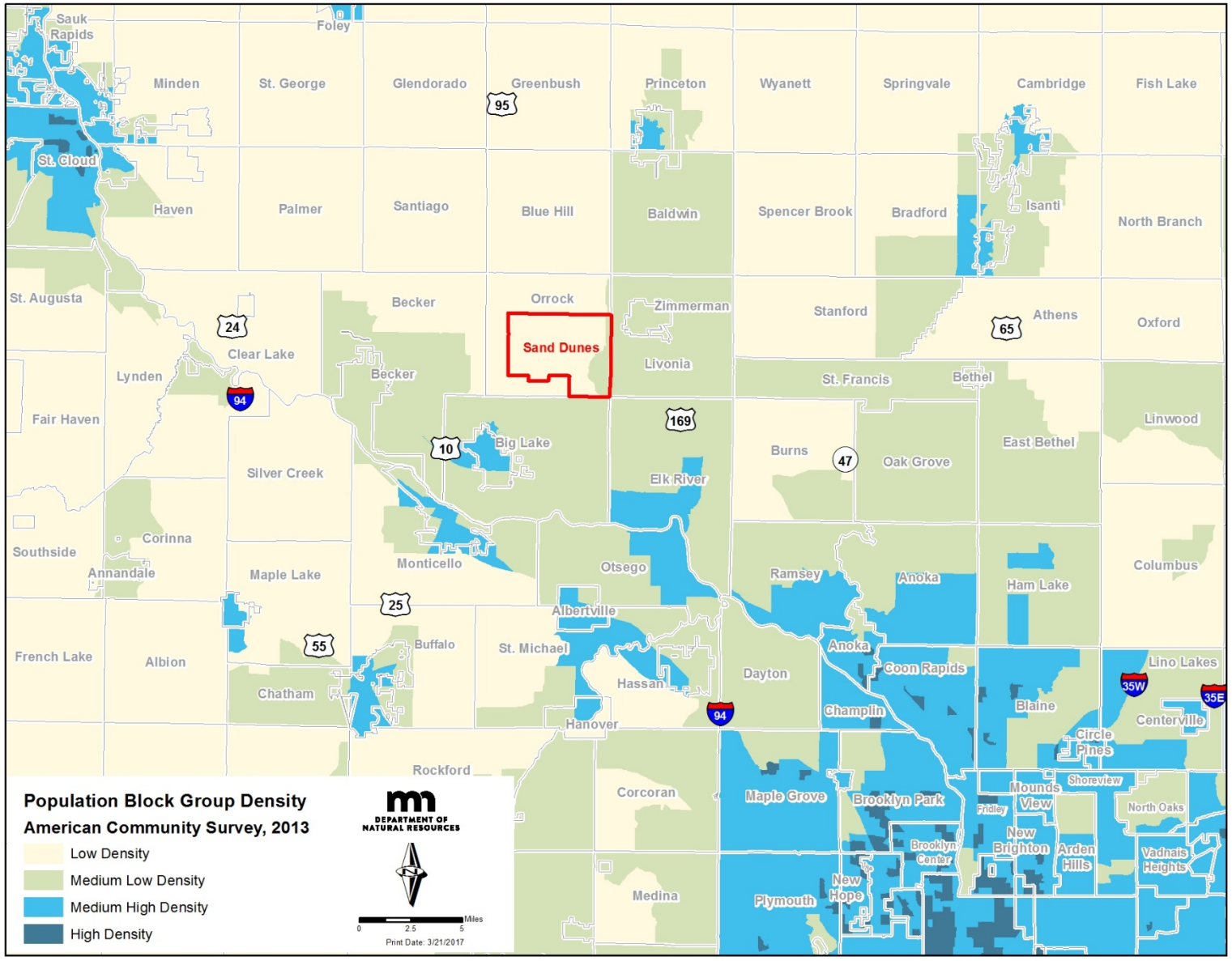
Table 5: Detailed descriptions of proposed habitat enhancement actions (Map 10)

Map 10 Label	Acres	10 year management plan	Comments/Challenges/Management Practices
A	15	Restore understory to oak savanna native plant species post timber harvest. Invasive species survey, invasive species control, site assessment, rare plant surveys, slash removal, install mineral fire breaks, prescribed fire, possible seeding	Site has been harvested recently. Slash left from the commercial timber harvest will be removed or piled and burned. Assess site after management work for native seed regeneration. If poor regeneration seeding may be needed.
B	6	Restore to oak savanna post timber harvest. Invasive species survey, invasive species control, silvicultural assessment, fuel reduction, prescribed fire, seeding	Site has been harvested recently and restoration is needed. Invasive species removed and treated and/or burned. The site will be monitored for invasive species. Mineral soil burn break installed along north boundary of units. Will most likely require native seeding, there are potential remnant savanna seed sources nearby.
C	70	Site assessment, possible invasive species control, silvicultural assessment, rare features survey, possible prescribed burn and seeding	Site is with Bob Dunn and contains Trust Lands
D	21	Follow-up on Invasive species surveys with invasive species control, silvicultural assessment, rare features assessment	Site is within Bob Dunn. Garlic mustard, Siberian pea shrub, requires treatment; steep slopes present so work must take this into consideration.
E	116	Follow-up on Invasive species surveys with invasive species control, assess for prescribed burn, special considerations for camp ground	Site is within Bob Dunn
F	5	site assessment; possible invasives removal, future management planning	Cow vetch treatment.
G	17	Invasive species survey, rare plant surveys, prescribed burn	Site management plan drafted
H	30	Invasive species survey, rare plant surveys, prescribed burn	Site management plan drafted

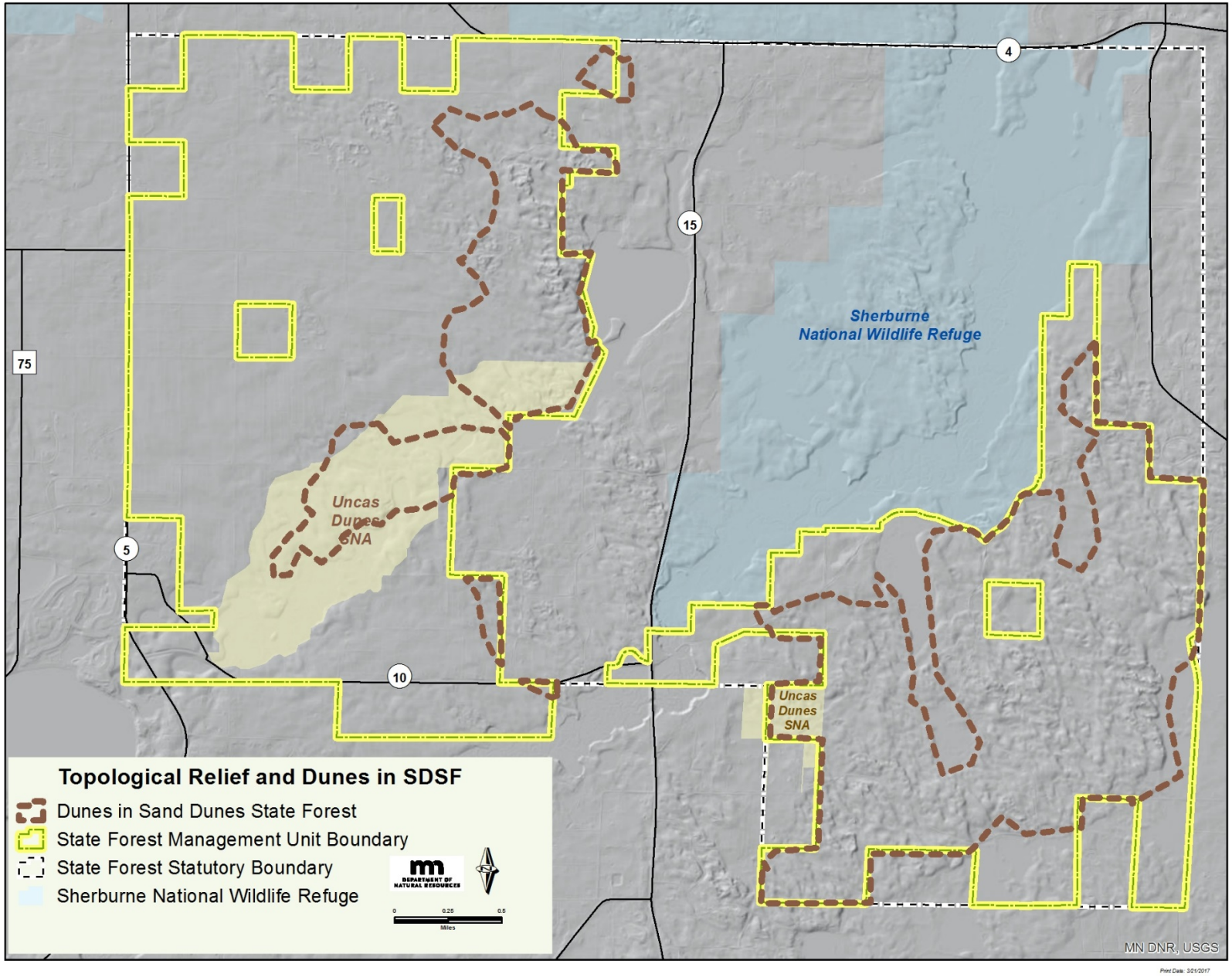
Map 10 Label	Acres	10 year management plan	Comments/Challenges/Management Practices
I	41	Invasive species survey, invasive species control, prescibed burn units determined, fuel reduction, prescribed fire, possible seeding	Site is already open habitat. Burn and invasive treatment are priorities, followed by an assessment of management needs after those actions are implemented; mineral fire break needed on north site of site and burn unit subdivision needed; remove remaining wood chip piles before burning; leave aspen around wet areas.
J	36	Site assessment, invasive species survey, invasive species control, silvicultural assessment, rare features survey, possible commercial timber harvest, possible prescribed fire, seeding	Oak woodland should be sought on north sides of slopes and lower pockets. Dunes faces and summits should be maintained open.
K	31	Site assessment, invasive species survey, invasive species control, silvicultural assessment, rare features survey, possible commercial timber harvest, slash removal, possible prescribed fire, possible seeding	Site was recently harvested, and site restoration is needed. Trust fund site, management beyond reparation and maintenance will wait until trust status determinations are made. Dunes faces and summits will be maintained in sparse grasses/open. Approximately 4 acres remain to be harvested in current sale. North-facing slopes can be burned to encourage grass on unstable slopes. Creative patch burns are desired. Monitoring North-facing slopes is needed in the future. This site cannot support further soil disturbance from heavy machinery. Remaining slash and debris will need to be removed sufficient to permit a prescribed burn in the area in the future. All mounds of slash and debris that have been mounded along and around logging roads need to be removed by hand.
L	37	Site assessment, invasive species survey, invasive species control, silvicultural assessment, commercial timber harvest (thinning)	This unit is scheduled for a commercial thinning. unit and follow-up invasive species treatment.

Map 10 Label	Acres	10 year management plan	Comments/Challenges/Management Practices
M	8	Site assessment, invasive species survey, invasive species control, rare features survey, possible commercial timber harvest, possible prescribed fire	Invasive species needs to be removed and then site assessed for further management needs.
N	219	Site assessment, invasive species survey, invasive species control, silvicultural assessment, rare features survey, possible commercial timber harvest, possible prescribed fire, possible seeding	Some of this site was recently harvested and has not been assessed since. Site needs to be assessed for further management direction and order of operations.

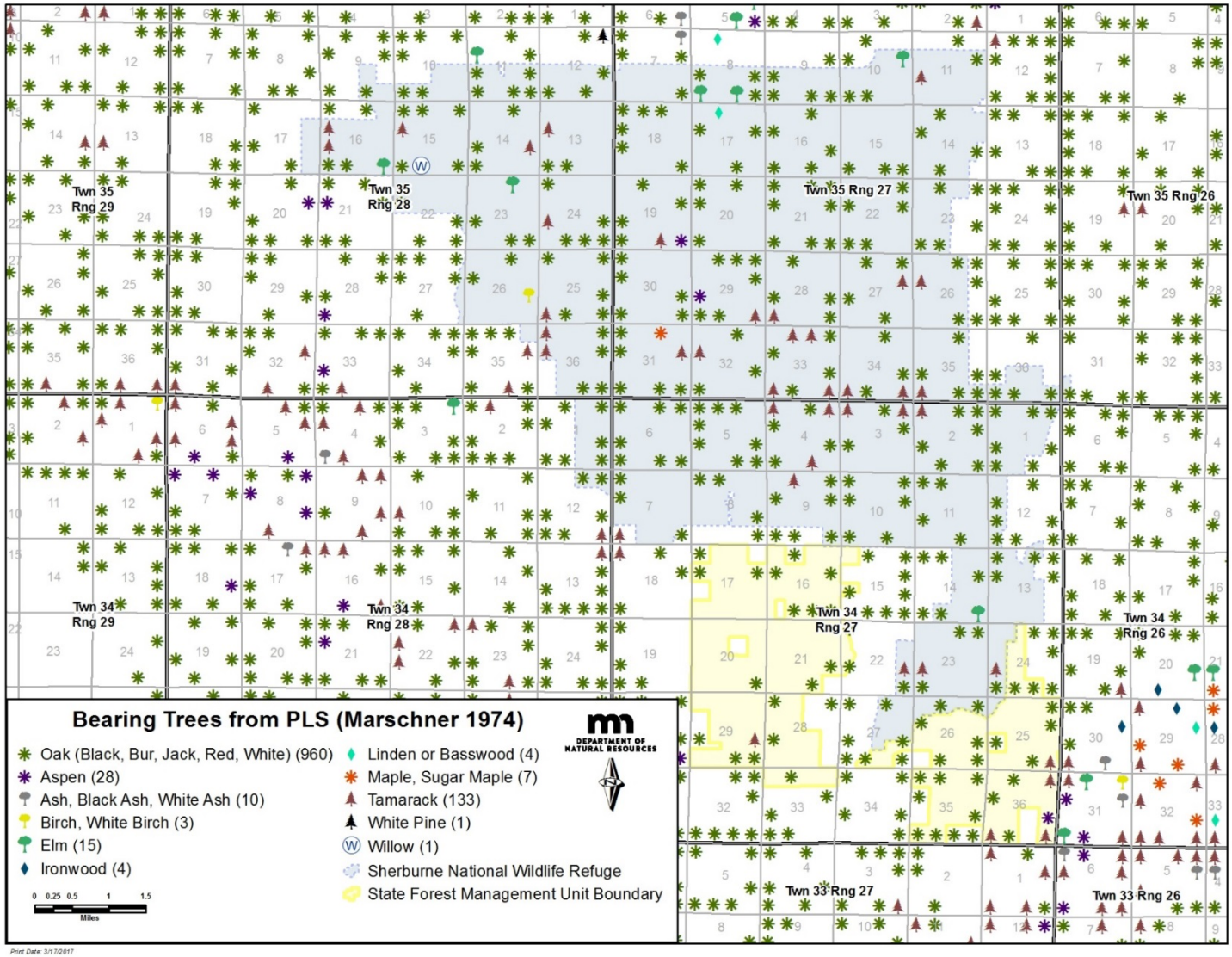
Map 11: Population Block Group Density (from American Community Survey, 2013)



Map 12: Topological Relief and Dunes in SDSF

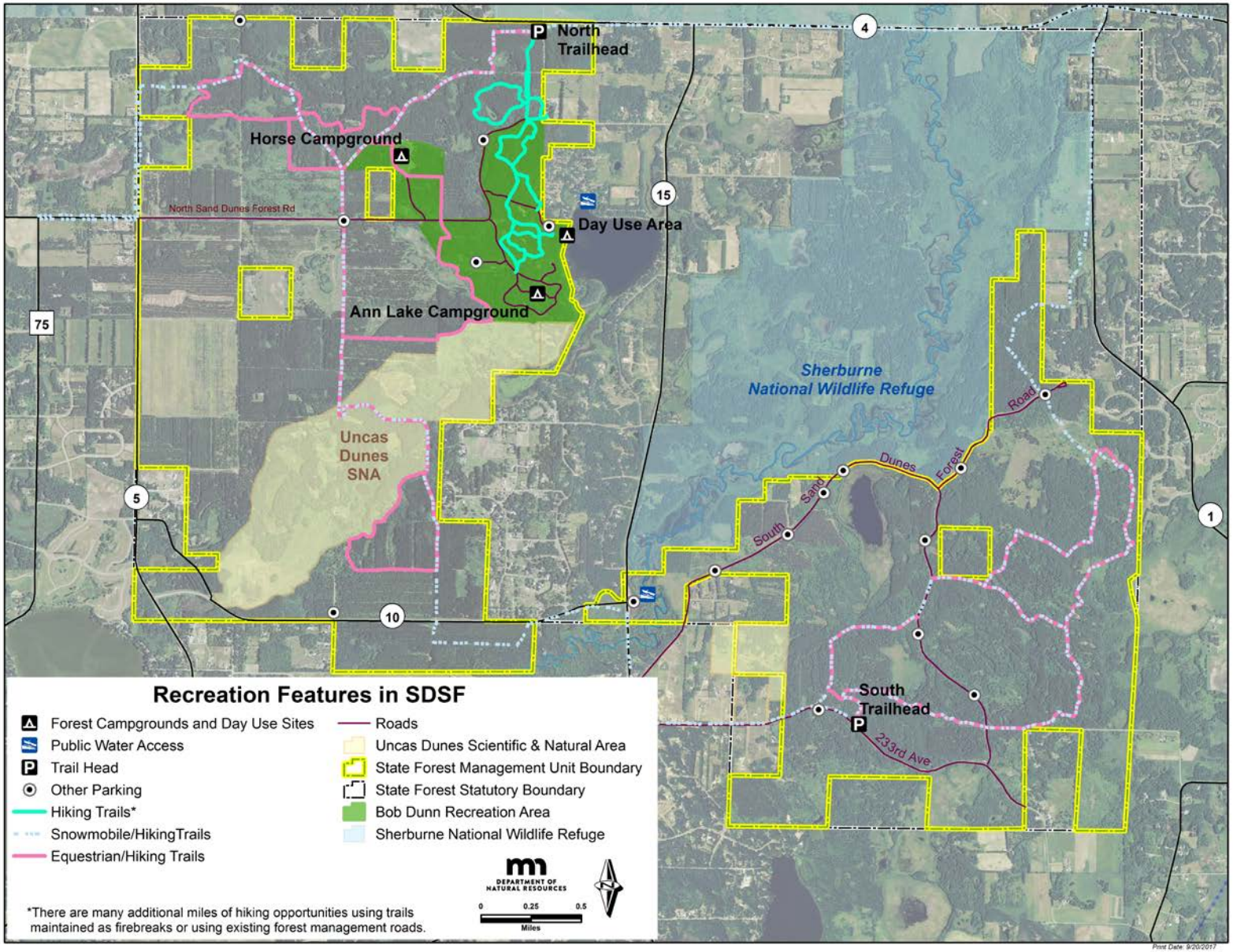


Map 13: Bearing Trees from the 1848–1907 Public Land Survey (Marschner 1974)

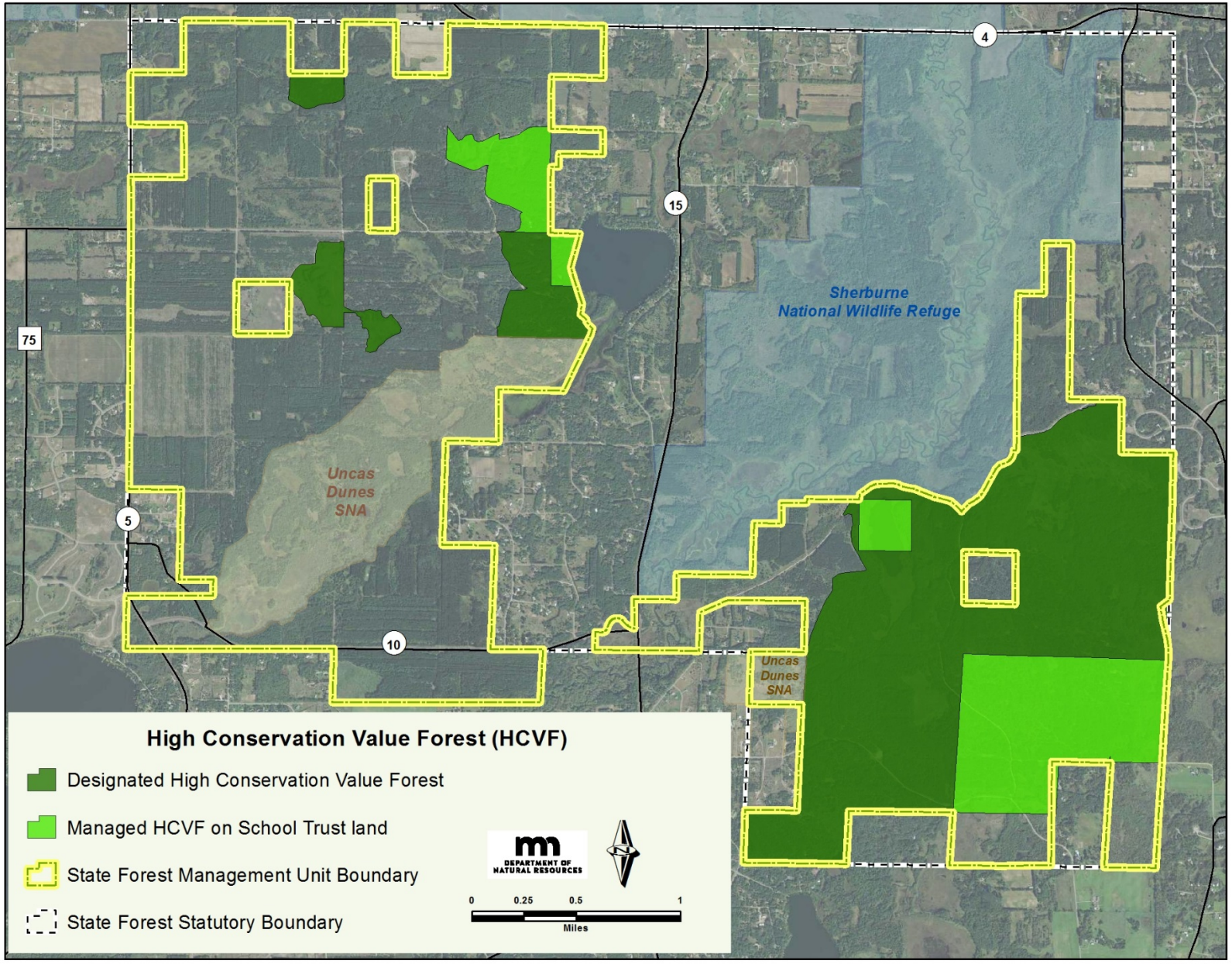


Note: This map shows bearing trees chosen during the late 19th century Public Land Survey (PLS). PLS records include bearing trees, meander trees, line trees, note trees, and the trees listed in summary of each mile of line surveyed. These records suggest that the only forests and timber in SDSF occurred either in swamp forests or in the bottoms of the St. Francis River. Most of the area was occupied by brushland or widely spaced trees variously described as openings, oak barrens, scattering of oak, or thickets. Extremely flat portions of SDSF were described as open prairie, including the Craig Prairie as documented on the survey plat and in the Geological and Natural History Survey of Minnesota (Winchell and Upham ca. 1882).

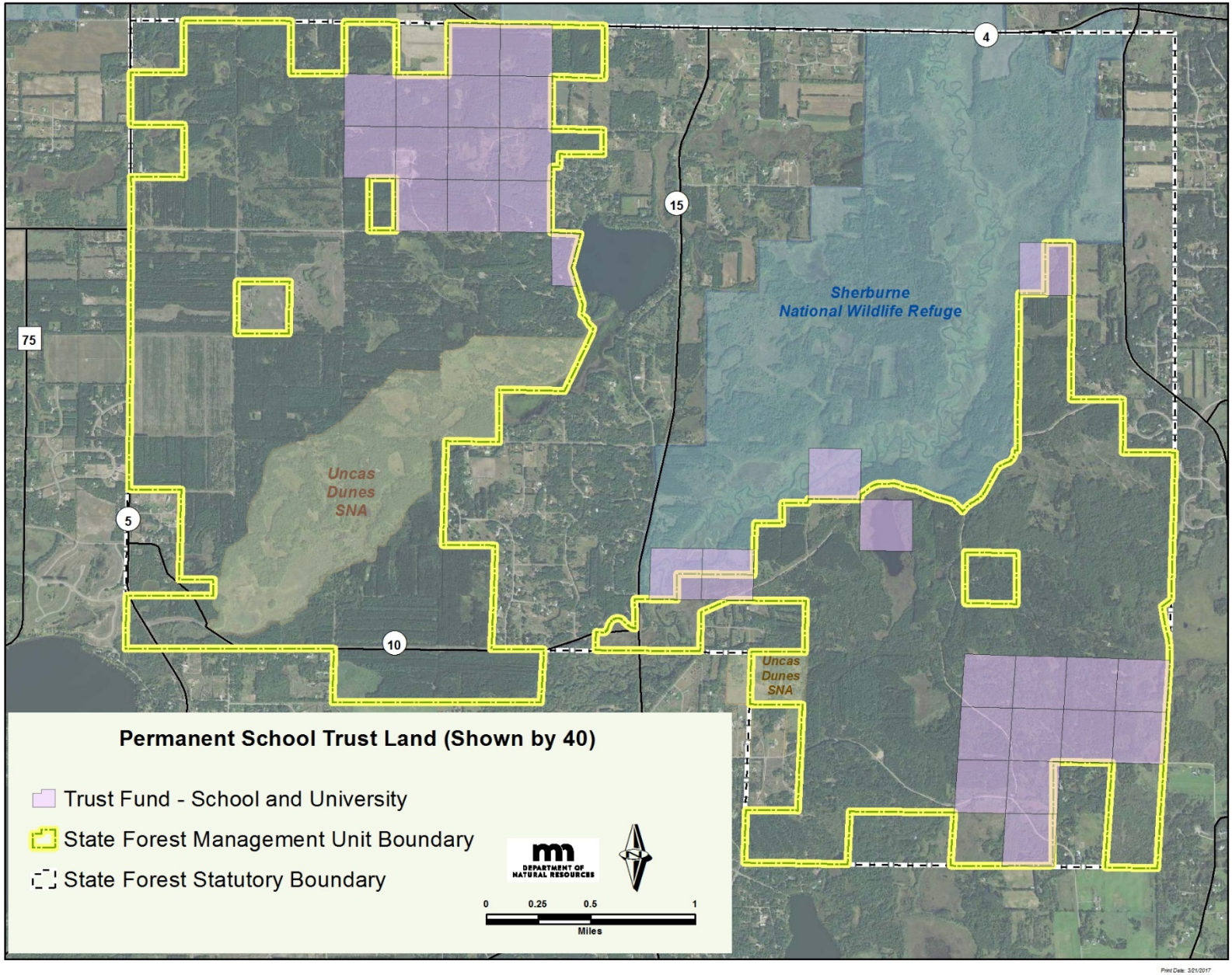
Map 14: Recreation Features in SDSF



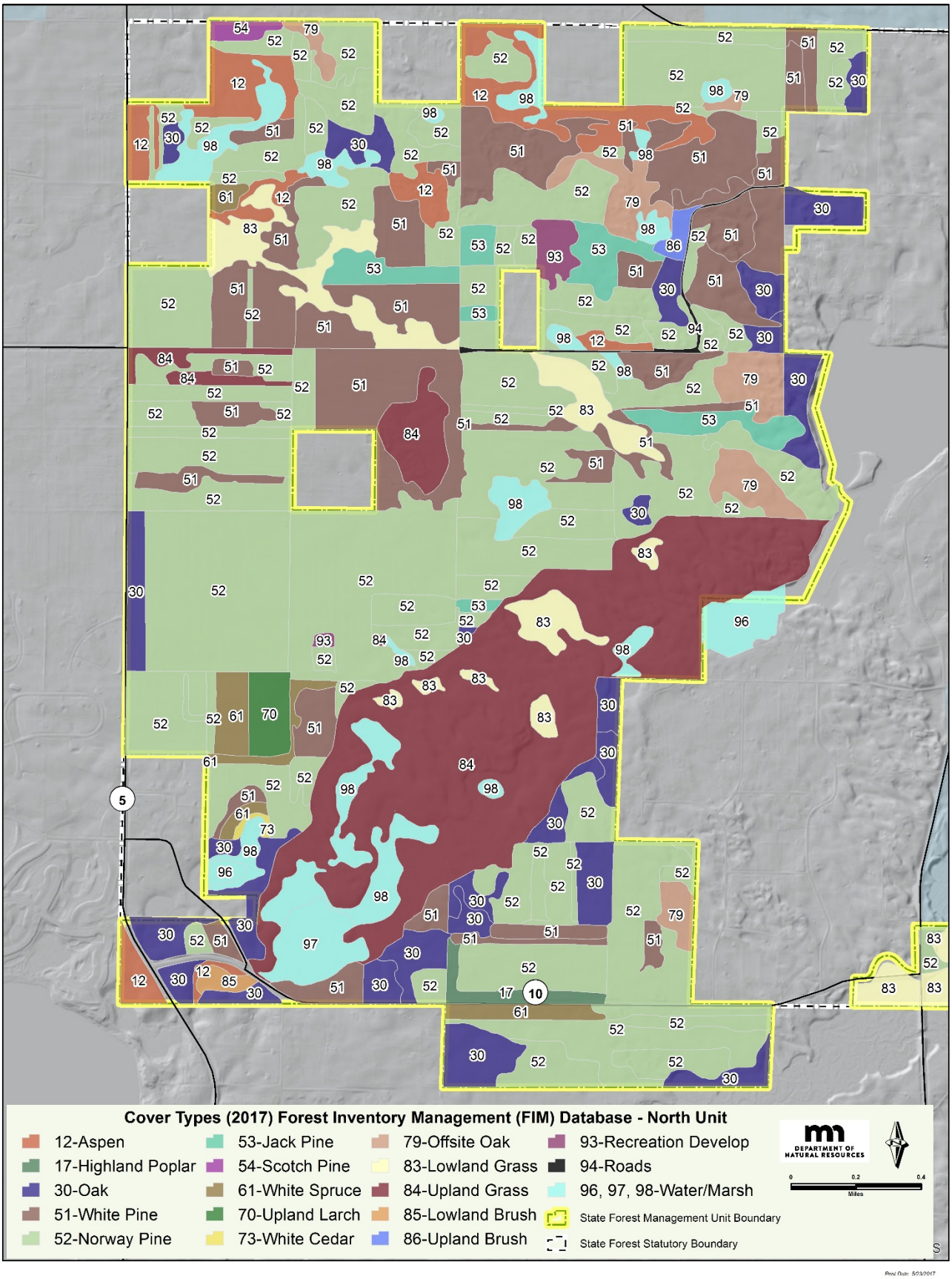
Map 15: High Conservation Value Forest (HCVF) in SDSF



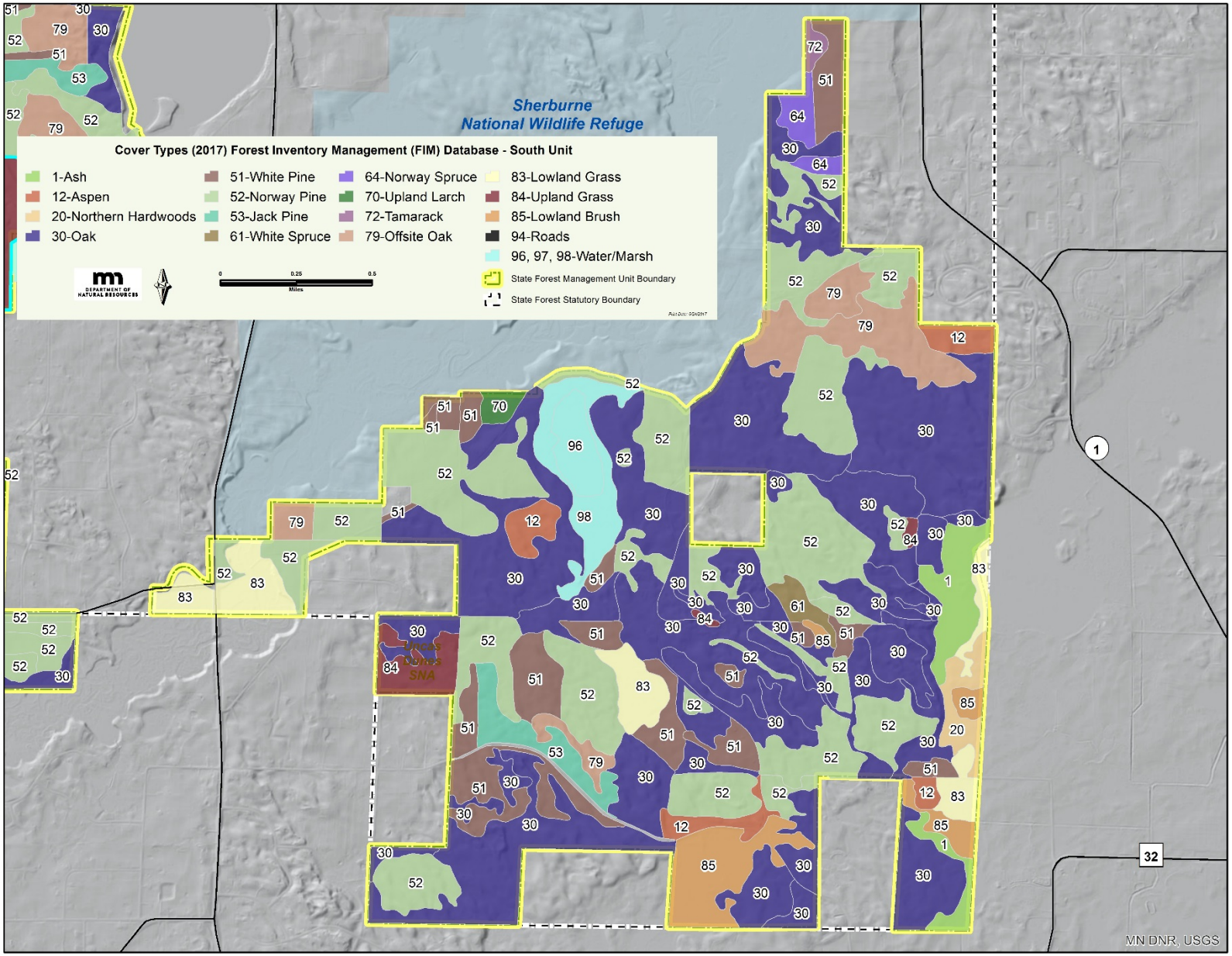
Map 16: Permanent School Trust Land (shown by 40-acre parcel)



Map 17: Cover Types in Northern SDSF, Forest Inventory Management (FIM) Database, 2017



Map 18: Cover Types in Southern SDSF, Forest Inventory Management (FIM) Database, 2017



VII. Appendices

Appendix A: General Direction Statements from the Anoka Sand Plain SFRMP

The overall desired management objective of the Sand Dunes State Forest (SDSF) is broad ecosystem health that balances opportunities to enhance recreation, economic investments, water quality, biodiversity, and wildlife habitat. This objective is reflective of the management direction laid out in the Anoka Sand Plain Subsection Forest Resources Management Plan (SFRMP), the guiding document for the landscape which surrounds and encompasses SDSF.

The following statements are drawn from the Anoka Sand Plain SFRMP, and reflect the objectives of the SDSF operational plan (MN DNR 2012).

- Some stands on state lands will be managed to reflect the composition, structure, and function of native plant communities.
- Species, age, and structural diversity within some stands will be maintained or increased.
- The SFRMP treatment level for each cover type moves toward the desired age-class structure of even-age managed cover types (both normal and extended rotation forest), and improves the age-structure of managed forest areas and Native Plant Communities of uneven-age managed cover types.
- The harvest of non-timber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity.
- Old forest in this subsection is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity.
- Species in Greatest Conservation Need and Key Habitats are maintained or enhanced in the subsection.
- Forest cover-type composition on state lands moves closer to the range of cover-type composition that historically occurred within the ecosystems found in the subsection.
- Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to sustain or minimize the loss to the biodiversity significance factors on which these MCBS sites were ranked
- Rare native plant communities are protected, maintained, or enhanced in these subsections.
- Even-age managed cover types will be managed to move toward a balanced age-class structure.
- ERF stands in even-age managed cover types will be managed to achieve a declining age-class structure from the normal rotation age to the maximum rotation age
- State lands will include representation of each of the Native Plant Community growth stages that historically occurred in these subsections.
- Adequate habitat and habitat components exist, simultaneously at multiple scales, to provide for nongame species found in these subsections.
- Adequate habitat and habitat elements exist, simultaneously at multiple scales, to provide for game species found in these subsections.
- Riparian areas are managed to provide critical habitat for fish, wildlife, and plant species.
- Reduce the negative impacts caused by exotic species on forest vegetation on state forest lands.
- Forest management on state lands adequately protects wetlands and seasonal ponds.

- Timber productivity and quality on state timber lands is increased.
- Limit damage to forests from native and introduced insects and diseases to acceptable levels where feasible.
- Reduce the negative impacts caused by wildlife species on forest vegetation on state forest lands.
- Forest management on state lands attempts to mitigate global climate change effects on forest lands. Management is based on our current knowledge and will be adjusted based on future research findings.
- Cultural resources will be protected on state-administered lands.
- Natural disturbance events that occur on state land within these subsections are promptly evaluated to determine the appropriate forest management needed to respond to impacts.
- Continue to use prescribed fire as a forest vegetation management tool in the Anoka Sand Plain subsection
- The changing structural development and urbanization pattern will be considered as forest management is implemented in the subsection.
- Continue to cooperate and coordinate with adjacent land owners (public and private) supporting the overall multiple use and enjoyment concept that applies to state administered land.

Appendix B: Rare or Specially Protected Species of Sand Dunes State Forest

Group	Common Name	Scientific Name	State Status	Federal Status
Bird	American Bittern	*Botaurus lentiginosus*	SGCN	
Bird	American Kestrel	*Falco sparverius*	SGCN	
Bird	American White Pelican	*Pelecanus erythrorhynchos*	SPC	
Bird	Bald Eagle	*Haliaeetus leucocephalus*	NL	protected*
Bird	Belted kingfisher	*Megaceryle alcyon*	SGCN	
Bird	Black-billed Cuckoo	*Coccyzus erythropthalmus*	SGCN	
Bird	Brown Thrasher	*Toxostoma rufum*	SGCN	
Bird	Chimney Swift	*Chaetura pelagica*	SGCN	
Bird	Common Gallinule	*Gallinula galeata*	SPC	
Bird	Common Loon	*Gavia immer*	SGCN	
Bird	Eastern Towhee	*Pipilo erythrophthalmus*	SGCN	
Bird	Eastern Whip-poor-will	*Antrostomus vociferus*	SGCN	
Bird	Field Sparrow	*Spizella pusilla*	SGCN	
Bird	Golden-winged Warbler	*Vermivora chrysoptera*	SGCN	
Bird	Grasshopper Sparrow	*Ammodramus savannarum*	SGCN	
Bird	Henslow's Sparrow	*Ammodramus henslowii*	END	
Bird	Hooded Warbler	*Setophaga citrina*	SPC	
Bird	Lark Sparrow	*Chondestes grammacus*	SPC	
Bird	Least Bittern	*Ixobrychus exilis*	SGCN	
Bird	Loggerhead Shrike	*Lanius ludovicianus*	END	
Bird	Northern Harrier	*Circus cyaneus*	SGCN	
Bird	Northern Pintail	*Anas acuta*	SGCN	
Bird	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	SGCN	
Bird	Olive-sided Flycatcher	*Contopus cooperi*	SGCN	
Bird	Peregrine Falcon	*Falco peregrinus*	SPC	
Bird	Prothonotary Warbler	*Protonotaria citrea*	SGCN	
Bird	Purple Martin	*Progne subis*	SPC	
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*	SGCN	
Bird	Red-necked Grebe	*Podiceps grisegena*	SGCN	
SGCN	Species in Greatest Conservation Need (MN DNR 2016)			
NL	Not Listed			
*	Protected specially under the Bald and Golden Eagle Protection Act			
**	As of March2017 this status is petitioned for this species			
MBTA	Protected under the Migratory Bird Treaty Act			
SPC	Special Concern			
THR	Threatened			
END	Endangered			

Group	Common Name	Scientific Name	State Status	Federal Status
Bird	Red-shouldered Hawk	*Buteo lineatus*	SPC	
Bird	Sedge Wren	*Cistothorus platensis*	SGCN	
Bird	Veery	*Catharus fuscescens*	SGCN	
Bird	Virginia Rail	*Rallus limicola*	SGCN	
Bird	Western Kingbird	*Tyrannus verticalis*	SGCN	
Bird	Wood Thrush	*Hylocichla mustelina*	SGCN	
Bird	Yellow-billed Cuckoo	*Coccyzus americanus*	SGCN	
Insect	A jumping spider	*Marpissa formosa*	SPC	
Insect	A Jumping Spider	*Pelegrina arizonensis*	SPC	
Insect	Dusted Skipper	*Atrytonopsis hianna*	SGCN	
Insect	Ghost Tiger Beetle	*Cicindela lepida*	THR	
Insect	Golden Northern Bumble Bee or Yellow Bumble Bee	*Bombus fervidus*	SGCN	
Insect	Leonard's Skipper	*Hesperia leonardus*	SPC	
Insect	Monarch	*Danaus plexippus*	SGCN	THR**
Insect	Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	SPC	
Insect	Regal Fritillary	*Speyeria idalia*	SPC	
Insect	Rusty Patched Bumble Bee	*Bombus affinis*	SGCN	END
Insect	Uncas Skipper	*Hesperia uncas*	END	
Insect	Yellowbanded Bumble Bee	*Bombus terricola*	SGCN	THR/END**
Mammal	American Badger	*Taxidea taxus*	SGCN	
Mammal	Big Brown Bat	*Eptesicus fuscus*	SPC	
Mammal	Grey Wolf	*Canis lupus*	NL	THR
Mammal	Hoary Bat	*Lasiurus cinereus*	SGCN	
Mammal	Little Brown Myotis	*Myotis lucifugus*	SPC	Under Review
Mammal	Northern Long-eared Bat	*Myotis septentrionalis*	SPC	THR
Mammal	Plains Pocket Mouse	*Perognathus flavescens*	SPC	
Mammal	Prairie Vole	*Microtus ochrogaster*	SPC	
Mammal	Red Bat	*Lasiurus borealis*	SGCN	
Mammal	Silver-haired Bat	*Lasionycteris noctivagans*	SGCN	
Mammal	Tri-colored bat	*Perimyotis subflavus*	SPC	Under Review
SGCN	Species in Greatest Conservation Need (MN DNR 2016)			
NL	Not Listed			
*	Protected specially under the Bald and Golden Eagle Protection Act			
**	As of March 2017 this status is petitioned for this species			
MBTA	Protected under the Migratory Bird Treaty Act			
SPC	Special Concern			
THR	Threatened			
END	Endangered			

Group	Common Name	Scientific Name	State Status	Federal Status
Plant	Annual Skeletonweed	*Shinnersoseris rostrata*	THR	
Plant	Autumn Fimbry	*Fimbristylis autumnalis*	SPC	
Plant	Beach Heather	*Hudsonia tomentosa*	THR	
Plant	Creeping Juniper	*Juniperus horizontalis*	SPC	
Plant	Lance-leaf Violet	*Viola lanceolata var. lanceolata*	THR	
Plant	Old Field Toadflax	*Nuttallanthus canadensis*	SPC	
Plant	Seaside Three-awn	*Aristida tuberculosa*	THR	
Plant	Small-leaved Pussytoes	*Antennaria parvifolia*	SPC	
Plant	St. Lawrence Grapefern	*Botrychium rugulosum*	SPC	
Reptile	Blanding's Turtle	*Emydoidea blandingii*	THR	THR/END**
Reptile	Gophersnake	*Pituophis catenifer*	SPC	
Reptile	Plains Hog-nosed Snake	*Heterodon nasicus*	SPC	
Reptile	Smooth Greensnake	*Opheodrys vernalis*	SGCN	
SPC	Special Concern			
THR	Threatened			
END	Endangered			
**	As of March 2017 this status is petitioned for this species			

Appendix C: Letter sent to neighboring landowners

Minnesota Department of Natural Resources
Little Falls Area Forestry
16543 Haven Road, Little Falls, MN 56345
Telephone: (320) 616-2450 Ext. 626
Fax: (320) 616-2473

September 3, 2014

To Sand Dunes State Forest adjacent property owners:

The Minnesota Department of Natural Resources (DNR) has conducted an extensive planning process for future management of the Sand Dunes State Forest. This plan is part of a larger planning process that addresses management of all state land within the Anoka Sand Plain. The goal of the plan specific to the Sand Dunes State Forest is to identify, protect, restore and enhance rare or unique geological, plant, and animal features of the Anoka Sand Plain that occur within the state forest boundary. In order to protect rare features found in the state forest, DNR land management will shift away from pine plantations to restoration and management of native plant communities in some designated areas. On the attached map you will see an *Immediate Rare Features Restoration Zone* in which restoration work will begin over the next 5-10 years, and the *Eventual Rare Features Restoration Zone* which will be phased in more gradually.

Over the next decade management changes will become apparent in the southeastern unit of the Sand Dunes State Forest. In the *Immediate Rare Features Restoration Zone* all of the pine and spruce will be harvested. Work will begin to convert this zone to resemble native plant communities that existed prior to European settlement. In this portion of the state forest, shifting sand dunes were created by the wind as the glaciers retreated. A mosaic of plant communities developed on the dunes including prairie openings, oak savanna, oak brush land, and oak woodland. Timber harvesting will continue to be one of the management tools used to regenerate forests and savannas as older trees mature and decline. Other management tools include prescribed burning to restore fire-dependent plant communities and targeted application of herbicides to reduce non-native invasive plant species.

A slightly different approach will be used in the *Eventual Rare Features Restoration Zone*. Pine and spruce will continue to grow to the size and age at which they would normally be considered for harvest. This is a long-term process that will take 70 years or more to complete. Gradually pine and spruce will be eliminated or reduced to a minor component of the forest and native plant communities will be restored.

Outside of the *Immediate* and *Eventual Rare Features Restoration Zones*, pine and spruce will continue to be planted or allowed to naturally reproduce by seed. In these areas the

dominant tree cover will include a mix of white pine, pin oak, bur oak, aspen, red pine, and other species.

To maintain healthy natural resources for public benefit, the entire Sand Dunes State Forest will continue to be managed for compatible multiple uses including recreation, economic gain through harvest of timber, biomass and other products, wildlife habitat enhancement, and restoration of native plant communities. In some locations, visual changes on the landscape will be noticeable within the next few years. In other locations the changes will be gradual. Through a large portion of the forest there will be no major changes in management approach.

DNR land managers will make every effort to minimize the impact on adjacent landowners and continue to be good neighbors by following best management practices. If you have any questions or would like additional information, please feel free to contact me via phone or email at the addresses listed below.

Best Regards,

John Korzeniowski
Little Falls Area Forestry Supervisor
16543 Haven Road
Little Falls, MN 56345
320-616-2450 ext. 233
john.korzeniowski@state.mn.us

Appendix D : List of Herbicides Used in SDSF

Note: This list may not be exhaustive. For more information, see: Weed Control Methods Handbook, The Nature Conservancy, Tu *et al.*

Brand Name Examples	Herbicide	Target Species	Average Soil Half-life	Soil Mobility	Average Half-Life in Water
Garlon® 3A & Garlon® 4 Ultra	Triclopyr	Siberian Elm (*Ulmus pumila*), Common and Glossy Buckthorn (*Rhamnus cathartica* and *Frangula alnus*), and Amur Maple (*Acer ginnala*)	30 Days	Moderate - High	4 Days
RoundUp®	Glyphosate	Western Poison Ivy (*Toxicodendron rydbergii*)	47 Days	Low	12 Days to 10 Weeks
Transline®	Clopyralid	Spotted Knapweed (*Centaurea stoebe spp. micranthos*) and Cow Vetch (*Vicia cracca*)	40 Days	Moderate - High	8 to 40 Days

The Minnesota DNR prohibits discrimination in its programs and services based on race, color, creed, religion, national origin, sex, public assistance status, age, sexual orientation or disability. Persons with disabilities may request reasonable modifications to access or participate in DNR programs and services by contacting the DNR ADA Title II Coordinator at info.dnr@state.mn.us or 651-259-5488. Discrimination inquiries should be sent to Minnesota DNR, 500 Lafayette Road, St. Paul, MN 55155-4049; or Office of Civil Rights, U.S. Department of the Interior, 1849 C. Street NW, Washington, D.C. 20240.

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
1	Work_Area	LOCATION	SLABEL	NEW_AGE	MAN_ACRE	Prescription	MgmtObj	SE_Year	JSV	SMA	HCVF
2	Brainerd Wildlife	t04332w1260003	3 A 44	32	5.0	1212	MA1	2013			0
3	Brainerd Wildlife	t04332w1260002	2 JP 53	62	1.8	1117	MA1	2013			0
4	Brainerd Wildlife	t04332w1260020	20 A 54	60	1.8	1212	INC51	2013			0
5	Cambridge Forestry	t03427w1360343	343 NP 45	46	6.2	1810	CON3;CON4	2020		Eventual	1
6	Cambridge Forestry	t03427w1210117	117 NP 44	33	26.2	1810	MA1;CON3	2018	ECO		0
7	Cambridge Forestry	t03427w1360303	303 WP 59	57	6.2	1810	CON3;CON4	2020		Eventual	1
8	Cambridge Forestry	t03427w1290282	282 NP 46	27	6.4	1810	MA1	2015			0
9	Cambridge Forestry	t03427w1290189	189 NP 59	51	5.8	1810	MA1	2022			0
10	Cambridge Forestry	t03427w1210151	151 OX 53	82	21.3	1110	CON3;CON4	2013	ECO		1
11	Cambridge Forestry	t03427w1250269	269 NP 56	57	11.8	1810	CON3;CON4	2019		Eventual	1
12	Cambridge Forestry	t03427w1240161	161 NS21	22	7.8	1810	MA1	2016			0
13	Cambridge Forestry	t03427w1360302	302 WP 54	42	2.0	1810	CON3;CON4	2020		Eventual	1
14	Cambridge Forestry	t03427w1350320	320 JP19	21	35.8	1810	CON3;CON4	2022	ECO	Immediate	0
15	Cambridge Forestry	t03427w1280272	272 HP12	19	13.3	1810	COV52	2016			0
16	Cambridge Forestry	t03427w1240143	143 NS31	27	15.4	1810	MA1	2020			0
17	Cambridge Forestry	t03427w1150034	34 O52	42	8.1	1110	MA1	2018			0
18	Cambridge Forestry	t03427w1250270	270 O54	69	14.7	1110	CON3;CON4	2019	ECO	Eventual	1
19	Cambridge Forestry	t03427w1170018	18 OX 55	112	6.3	1110	INC51	2019			0
20	Cambridge Forestry	t03427w1170061	61 WP 59	58	5.5	1810	MA1	2019			0
21	Cambridge Forestry	t03427w1160096	96 WP55	66	7.4	1810	MA1	2018			0
22	Cambridge Forestry	t03427w1240173	173 NP 47	31	17.3	1810	CON3;CON4	2020		Eventual	1
23	Cambridge Forestry	t03427w1240170	170 NP 46	28	28.4	1810	MA1	2020			1
24	Cambridge Forestry	t03427w1210145	145 NP 56	51	35.8	1810	CON3	2013			0
25	Cambridge Forestry	t03427w1250211	211 O55	73	82.5	1110	CON3;CON4	2017	ECO	Eventual	1
26	Cambridge Forestry	t03427w1360325	325 NP 59	47	3.7	1810	CON3;CON4	2019		Eventual	1
27	Cambridge Forestry	t03427w1360300	300 O 51	63	34.9	1110	CON3;CON4	2019	ECO	Eventual	1
28	Cambridge Forestry	t03427w1210138	138 NP53	35	5.6	1810	MA1	2013			0
29	Cambridge Forestry	t03427w1360307	307 T52	112	4.0	1110	CON3;CON4	2016		Eventual	1
30	Cambridge Forestry	t03427w1250271	271 O55	68	4.7	1110	CON3;CON4	2017	ECO	Immediate	1
31	Cambridge Forestry	t03427w1210134	134 WP 21	20	7.3	1810	MA1;CON3	2022	ECO		0
32	Cambridge Forestry	t03427w1350319	319 WP 57	47	15.5	1810	CON3;CON4	2019	ECO	Eventual	0
33	Cambridge Forestry	t03427w1160108	108 NP48	51	4.9	1810	CON3;CON4	2020	ECO		1
34	Cambridge Forestry	t03427w1150026	26 NP 59	49	14.4	1810	MA1	2018			0
35	Cambridge Forestry	t03427w1210159	159 NP 42	20	16.7	1810	MA1	2013			0
36	Cambridge Forestry	t03427w1170038	38 NP 56	40	18.0	1810	INC51	2019			0
37	Cambridge Forestry	t03427w1280238	238 NP56	55	63.2	1810	MA1	2014			0

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
38	Cambridge Forestry	t03427w1210168	168 JP 21	9	3.1	1810	MA1	2022			0
39	Cambridge Forestry	t03427w1210171	171 NP56	60	3.9	1810	MA1	2015			0
40	Cambridge Forestry	t03427w1160397	397 NP 57	61	5.8	1810	CON3;CON4	2020	ECO		1
41	Cambridge Forestry	t03427w1200174	174 NP44	40	10.9	1810	MA1	2015			0
42	Cambridge Forestry	t03427w1160040	40 A 42	24	46.2	1110	INC51	2018			1
43	Cambridge Forestry	t03427w1210157	157 NP 58	44	4.3	1810	CON3;CON4	2013	ECO		1
44	Cambridge Forestry	t03427w1150041	41 NP 46	49	2.0	1810	MA1	2018			0
45	Cambridge Forestry	t03427w1330291	291 NP56	52	61.8	1810	MA1	2016			0
46	Cambridge Forestry	t03427w1240164	164 NP22	22	16.3	1810	MA1	2016			0
47	Cambridge Forestry	t03427w1280240	240 NP 55	28	18.6	1810	MA1	2014			0
48	Cambridge Forestry	t03427w1280250	250 O53	122	6.7	1110	INC51	2014			0
49	Cambridge Forestry	t03427w1170069	69 A 51	39	12.4	1110	INC51	2015			0
50	Cambridge Forestry	t03427w1280265	265 WP12	18	8.1	1810	MA1	2014			0
51	Cambridge Forestry	t03427w1160092	92 NP 21	47	5.2	1810	MA1	2014			0
52	Cambridge Forestry	t03427w1160023	23 WP54	66	10.5	1810	MA1	2013			0
53	Cambridge Forestry	t03427w1290221	221 NP 46	31	26.0	1810	MA1	2015			0
54	Cambridge Forestry	t03427w1290228	228 WP 49	31	7.0	1810	MA1	2015			0
55	Cambridge Forestry	t03427w1290230	230 WS 45	36	2.1	1810	MA1	2015			0
56	Cambridge Forestry	t03427w1290234	234 O 54	54	24.4	1110	INC51	2015			1
57	Cambridge Forestry	t03427w1330317	317 NP 44	31	18.5	1810	MA1	2022			0
58	Cambridge Forestry	t03427w1210140	140 JP42	42	18.1	1810	CON3;CON4	2020	ECO		1
59	Cambridge Forestry	t03427w1170074	74 NP54	48	11.7	1810	MA1	2020			0
60	Cambridge Forestry	t03427w1350358	358 NP 56	42	26.0	1110	CON3;CON4	2013	ECO	Immediate	1
61	Cambridge Forestry	t03427w1290215	215 NP 41	20	9.1	1810	MA1	2020			0
62	Cambridge Forestry	t03427w1290278	278 WP 59	56	11.7	1810	MA1	2020	ECO		0
63	Cambridge Forestry	t03427w1160089	89 JP 42	30	8.5	1810	COV51	2014			0
64	Cambridge Forestry	t03427w1170100	100 WP 43	29	36.9	1810	MA1;CON3	2015	ECO		0
65	Cambridge Forestry	t03427w1240131	131 WP21	20	22.2	1810	MA1	2020			0
66	Cambridge Forestry	t03427w1200148	148 NP 43	21	26.8	1810	MA1	2013			0
67	Cambridge Forestry	t03427w1160109	109 NP 10	20	15.6	1810	MA1;CON3	2022			0
68	Cambridge Forestry	t03427w1250251	251 NP 57	46	4.7	1810	CON3	2017		Eventual	1
69	Cambridge Forestry	t03427w1170017	17 NP 43	32	8.5	1810	MA1	2019			0
70	Cambridge Forestry	t03427w1210135	135 NP54	59	5.1	1810	MA1	2022			0
71	Cambridge Forestry	t03427w1160093	93 NP53	55	3.7	1810	MA1	2014			0
72	Cambridge Forestry	t03427w1170102	102 NP 43	22	39.1	1810	MA1;CON3	2015	ECO		0
73	Cambridge Forestry	t03427w1290194	194 NP 41	20	7.1	1810	MA1	2020			0
74	Cambridge Forestry	t03427w1160094	94 JP 20	27	19.6	1810	COV51	2014			0

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
75	Cambridge Forestry	t03427w1360329	329 NP59	52	24.4	1810	CON3;CON4	2020		Eventual	1
76	Cambridge Forestry	t03427w1210121	121 WP 53	46	8.4	1810	CON3	2020			0
77	Cambridge Forestry	t03427w1250360	360 NP 58	48	66.3	1810	CON3;CON4	2021		Eventual	1
78	Cambridge Forestry	t03427w1160053	53 NP 41	22	2.9	1810	MA1	2021			0
79	Cambridge Forestry	t03427w1160098	98 NP55	57	18.3	1810	MA1;CON3	2020			0
80	Cambridge Forestry	t03427w1160111	111 NP58	44	8.9	1810	MA1;CON3	2020			0
81	Cambridge Forestry	t03427w1360345	345 NP45	45	23.0	1810	CON3;CON4	2020		Eventual	0
82	Cambridge Forestry	t03525w1360061	61 NP59	52	1.4	1810	MA1	2014			0
83	Cambridge Forestry	t03427w1290258	258 O 41	26	16.2	1110	INC51	2015			1
84	Cambridge Forestry	t03427w1210152	152 WP 11	27	6.6	1810	MA1	2022			0
85	Cambridge Forestry	t03427w1200184	184 NP 41	19	4.5	1810	MA1	2020			0
86	Cambridge Forestry	t03427w1210123	123 NP 52	34	23.0	1810	CON3;CON4	2020	ECO		1
87	Cambridge Forestry	t03427w1160068	68 NP 41	20	36.9	1810	MA1	2014			1
88	Cambridge Forestry	t03427w1170075	75 NP 41	22	21.6	1810	MA1	2015			0
89	Cambridge Forestry	t03427w1160065	65 NP 57	56	1.9	1810	MA1	2021			0
90	Cambridge Forestry	t03427w1160054	54 NP56	66	6.0	1810	MA1	2021			0
91	Cambridge Forestry	t03427w1330301	301 NP13	17	9.8	1810	MA1	2016			0
92	Cambridge Forestry	t03427w1330314	314 O53	69	13.1	1110	INC51	2019			0
93	Cambridge Forestry	t03427w1200375	375 NP42	28	6.3	1810	MA1	2020			0
94	Cambridge Forestry	t03427w1210156	156 O 54	78	3.8	1110	INC51	2013			1
95	Cambridge Forestry	t03427w1150033	33 WP 55	31	7.3	1810	MA1	2018			0
96	Cambridge Forestry	t03427w1160107	107 JP19	16	2.7	1810	COV51	2014			0
97	Cambridge Forestry	t03427w1160103	103 NP 57	58	20.0	1810	CON3	2018			0
98	Cambridge Forestry	t03427w1270380	380 NP 44	32	5.3	1810	MA1	2020			0
99	Cambridge Forestry	t03427w1250284	284 O53	71	11.2	1110	CON3;CON4	2019	ECO	Eventual	1
100	Cambridge Forestry	t03427w1350296	296 WP 59	62	9.8	1810	CON3;CON4	2013		Eventual	0
101	Cambridge Forestry	t03427w1210163	163 NP 55	45	41.8	1810	MA1	2022			0
102	Cambridge Forestry	t03427w1160030	30 NP55	66	61.6	1810	MA1	2021			0
103	Cambridge Forestry	t03427w1280273	273 NP 47	31	41.7	1810	MA1	2016			0
104	Cambridge Forestry	t03427w1250281	281 WS 45	46	10.7	1810	CON3;CON4	2021			1
105	Cambridge Forestry	t03427w1280226	226 NP 58	46	16.7	1810	MA1	2014			0
106	Cambridge Forestry	t03427w1250286	286 NP 56	67	9.9	1810	CON3;CON4	2021		Immediate	1
107	Cambridge Forestry	t03427w1170058	58 O 52	61	13.1	1110	INC51;CON4	2015	ECO	Immediate	1
108	Cambridge Forestry	t03427w1350339	339 WP 59	47	39.3	1810	CON3;CON4	2013	ECO	Immediate	1
109	Cambridge Forestry	t03427w1360306	306 NH54	52	29.1	1110	CON3;CON4	2016	ECO	Eventual	1
110	Cambridge Forestry	t03427w1330316	316 NP 46	31	20.8	1810	MA1	2019			0
111	Cambridge Forestry	t03427w1360331	331 NP54	45	12.1	1810	CON3;CON4	2020		Eventual	1

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
112	Cambridge Forestry	t03427w1290402	402 O 53	70	6.5	1110	INC51	2016			0
113	Cambridge Forestry	t03427w1170063	63 NP 43	30	15.3	1810	CON3;CON4	2014	ECO	Immediate	1
114	Cambridge Forestry	t03427w1210119	119 NP 56	48	5.1	1810	CON3	2020			0
115	Cambridge Forestry	t03427w1210165	165 NP 56	52	12.8	1810	MA1	2015			0
116	Cambridge Forestry	t03427w1290201	201 WP 56	37	16.0	1810	MA1	2020			0
117	Cambridge Forestry	t03427w1250212	212 O53	79	125.2	1110	CON3;CON4	2017	ECO	Eventual	1
118	Cambridge Forestry	t03427w1200122	122 NP 44	30	25.9	1810	MA1;CON3	2013			0
119	Cambridge Forestry	t03427w1210136	136 WP 58	55	8.7	1810	CON3;CON4	2018	ECO		1
120	Cambridge Forestry	t03427w1210144	144 NP 46	27	59.5	1810	MA1;CON3	2022			0
121	Cambridge Forestry	t03427w1170042	42 NP57	58	18.5	1810	MA1	2019			0
122	Cambridge Forestry	t03427w1200137	137 NP 43	28	8.3	1810	MA1	2020			0
123	Cambridge Forestry	t03427w1350330	330 OX56	132	9.9	1110	CON3;CON4	2013	ECO	Immediate	0
124	Cambridge Forestry	t03427w1350294	294 NP 57	39	30.2	1810	CON3;CON4	2013		Eventual	1
125	Cambridge Forestry	t03427w1200155	155 NP45	44	122.8	1810	MA1	2015			0
126	Cambridge Forestry	t03427w1170078	78 WS 42	36	4.7	1810	MA1	2020			0
127	Cambridge Forestry	t03427w1170019	19 NP 31	19	16.8	1810	MA1	2019			0
128	Cambridge Forestry	t03427w1350324	324 WP 59	48	8.0	1810	CON3;CON4	2013		Eventual	1
129	Cambridge Forestry	t03427w1200183	183 NP43	38	3.7	1810	MA1	2015			0
130	Cambridge Forestry	t03427w1290261	261 WP 55	49	4.9	1810	MA1	2020			0
131	Cambridge Forestry	t03427w1290188	188 NP22	14	38.6	1810	MA1	2015			0
132	Cambridge Forestry	t03427w1170016	16 SCP 15	11	7.0	1810	COV51	2019			0
133	Cambridge Forestry	t03427w1170025	25 NP 59	57	5.0	1810	MA1	2019			0
134	Cambridge Forestry	t03427w1260262	262 NP12	11	5.4	1810	CON3;CON4	2021		Eventual	0
135	Cambridge Forestry	t03427w1290193	193 WS11	18	11.2	1810	MA1	2022			0
136	Cambridge Forestry	t03427w1240150	150 O55	90	22.8	1110	INC51	2016			0
137	Cambridge Forestry	t03427w1290190	190 WS22	28	18.2	1810	MA1	2015			0
138	Cambridge Forestry	t03427w1170057	57 NP 57	61	6.7	1810	MA1	2016			0
139	Cambridge Forestry	t03427w1170044	44 NP 11	57	6.9	1810	MA1	2019			0
140	Cambridge Forestry	t03525w1360060	60 O63	85	22.4	1110	MA1	2014			0
141	Cambridge Forestry	t03427w1250256	256 Ash41	53	23.4	1110	CON3;CON4	2017	ECO	Eventual	1
142	Cambridge Forestry	t03427w1330290	290 WS 57	57	17.8	1110	COV51	2019			0
143	Cambridge Forestry	t03427w1200147	147 NP56	56	13.3	1810	MA1	2022			0
144	Cambridge Forestry	t03425w1160044	44 LH55	82	5.9	1110	MA1	2015			0
145	Cambridge Forestry	t03427w1280237	237 NP43	44	30.4	1810	MA1	2014			0
146	Cambridge Forestry	t03427w1290400	400 NP 43	29	3.9	1810	MA1	2020			0
147	Cambridge Forestry	t03427w1290401	401 A 53	44	4.9	1110	INC51	2016			0
148	Cambridge Forestry	t03427w1160066	66 OX 53	94	25.1	1110	INC51;CON3	2014	ECO	Immediate	1

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
149	Cambridge Forestry	t03427w1170049	49 NP 55	65	7.8	1810	MA1	2016			0
150	Cambridge Forestry	t03427w1260229	229 NP41	29	76.0	1810	MA1	2020			0
151	Cambridge Forestry	t03427w1200133	133 NP 56	53	13.6	1810	MA1	2013			0
152	Cambridge Forestry	t03427w1200153	153 NP 41	21	39.8	1810	MA1	2013			0
153	Cambridge Forestry	t03427w1350309	309 NP 57	56	35.5	1810	CON3;CON4	2013		Eventual	0
154	Cambridge Forestry	t03427w1150024	24 JP41	31	9.0	1810	INC51	2013			0
155	Cambridge Forestry	t03427w1350311	311 WP 58	49	24.6	1810	CON3;CON4	2013		Eventual	0
156	Cambridge Forestry	t03427w1200167	167 NP 41	21	16.3	1810	MA1	2015			0
157	Cambridge Forestry	t03427w1170047	47 NP 51	28	10.7	1810	CON3;CON4	2014	ECO	Immediate	1
158	Cambridge Forestry	t03427w1170070	70 NP58	60	25.1	1810	MA1	2019			0
159	Cambridge Forestry	t03427w1160060	60 WP 59	53	2.9	1810	MA1	2021			0
160	Cambridge Forestry	t03427w1350414	414 O 54	91	5.8	1110	CON3;CON4	2013	ECO	Immediate	1
161	Cambridge Forestry	t03427w1360415	415 Ash 52	70	13.5	1110	MA1	2015	ECO		0
162	Cambridge Forestry	t03427w1160394	394 OX 53	89	2.1	1110	COV51	2021			0
163	Cambridge Forestry	t03427w1160112	112 A 11	14	4.4	1110	INC51;CON3	2022			0
164	Cambridge Forestry	t03427w1290192	192 UL21	28	20.8	1110	COV52	2022			0
165	Cambridge Forestry	t03427w1250385	385 O55	79	1.6	1810	CON3;CON4	2017		Eventual	1
166	Cambridge Wildlife	t03423w1080018	18 O 55	1	19.0	1111	MA1	2019			0
167	Cambridge Wildlife	t03521w1340006	6 A52	54	2.9	1110	MA1	2014			0
168	Cambridge Wildlife	t03521w1340014	14 A52	54	26.0	1110	MA1	2014			0
169	Cambridge Wildlife	t03624w1240043	43 A56	45	3.8	1120	MA1	2018			0
170	Cambridge Wildlife	t03423w1050012	12 A41	1	4.6	1110	MA1	2014			0
171	Cambridge Wildlife	t03625w1360061	61 JP 47	71	7.5	1810		2018	WLD		0
172	Cambridge Wildlife	t03521w1340001	1 O53	49	9.6	1111	MA1	2020	WLD		0
173	Cambridge Wildlife	t03423w1050009	9 A24	41	12.8	1110	MA1	2019			0
174	Cambridge Wildlife	t03624w1240045	45 A56	47	22.6	1120	MA1	2018			0
175	Cambridge Wildlife	t03525w1280047	47 O54	1	5.4	1111	MA1	2018			0
176	Cambridge Wildlife	t03525w1280046	46 O54	1	5.0	1111	MA1	2018			0
177	Cambridge Wildlife	t03521w1270004	4 A52	53	0.9	1110	MA1	2014			0
178	Cambridge Wildlife	t03525w1280036	36 O53	1	23.6	1111	MA1	2020			0
179	Cambridge Wildlife	t03422w1210033	33 O53	112	10.2	1111	MA1	2020	WLD		0
180	Cambridge Wildlife	t03422w1210035	35 O64	112	27.1	1111	MA1	2013	WLD		0
181	Cambridge Wildlife	t03422w1210031	31 NH55	110	6.0	1100	MA1	2013			0
182	Cambridge Wildlife	t03625w1350068	68 JP 48	60	3.6	1100	INC30	2018			0
183	Cambridge Wildlife	t03422w1210037	37 O44	75	12.5	1111	MA1	2020	WLD		0
184	Cambridge Wildlife	t03422w1210029	29 O45	81	4.2	1111	MA1	2020	WLD		0
185	Cambridge Wildlife	t03521w1340002	2 A53	43	10.2	1110	MA1	2014			0

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
186	Cambridge Wildlife	t03521w1340003	3 A53	54	5.6	1110	MA1	2014			0
187	Cambridge Wildlife	t03521w1340013	13 O55	79	8.5	1111	MA1	2020			0
188	Cambridge Wildlife	t03423w1050010	10 A 42	1	28.0	1110	MA1	2014			0
189	Cambridge Wildlife	t03525w1330057	57 O54	77	5.0	1111	MA1	2018			0
190	Cambridge Wildlife	t03521w1340005	5 O55	79	35.2	1111	MA1	2020	WLD		0
191	Cambridge Wildlife	t03424w1030046	46 A 55	52	11.7	1110	MA1	2014			0
192	Carlos Avery	t03322w1120040	40 O54	90	10.5	1111	MA1	2016			1
193	Carlos Avery	t03322w1260286	286 A46	67	3.6	1110	MA1	2014			1
194	Carlos Avery	t03322w1140111	111 NH55	82	9.4	1110	INC30	2017	ECO		1
195	Carlos Avery	t03322w1340384	384 A42	51	5.9	1111	MA1	2020			0
196	Carlos Avery	t03321w1160119	119 O73	126	18.1	1111	MA1	2020			0
197	Carlos Avery	t03322w1140076	76 T51	137	5.7	1117	MA1	2013	ECO		1
198	Carlos Avery	t03322w1260234	234 A42	57	19.7	1111	MA1	2015			1
199	Carlos Avery	t03222w1040018	18 O54	89	9.2	1111	MA1	2018			1
200	Carlos Avery	t03222w1170108	108 A41	43	4.7	1100	MA1	2016			1
201	Carlos Avery	t03322w1260388	388 A46	67	1.2	1110	MA1	2014			1
202	Carlos Avery	t03222w1200132	132 A42	47	11.3	1110	MA1	2018			1
203	Carlos Avery	t03421w1270143	143 WP74	127	23.5	1110		2016	ECO		0
204	Carlos Avery	t03222w1080252	252 A 36	44	2.1	1111	MA1	2018			1
205	Carlos Avery	t03322w1140062	62 T53	137	6.2	1117	MA1	2013	ECO		1
206	Carlos Avery	t03321w1040017	17 O81	116	10.0	1111	MA1	2017			0
207	Carlos Avery	t03421w1270150	150 O58	1	40.0	1111	MA1	2017	ECO		0
208	Carlos Avery	t03321w1090085	85 A 54	47	10.8	1100	MA1	2020			0
209	Carlos Avery	t03421w1140060	60 A 42	54	7.1	1111	MA1	2014			0
210	Carlos Avery	t03322w1260265	265 A44	60	6.2	1111	MA1	2014			1
211	Carlos Avery	t03421w1230114	114 Bi45	88	3.2	1111	MA1	2014			0
212	Carlos Avery	t03222w1200152	152 A44	51	3.8	1111	MA1	2018			1
213	Carlos Avery	t03222w1070075	75 Ash53	82	5.2	1110	MA1	2015	ECO		1
214	Carlos Avery	t03421w1270173	173 JP 53	56	3.6	1100	COV30	2014			0
215	Carlos Avery	t03321w1060007	7 A43	1	12.2	1111	MA1	2017			0
216	Carlos Avery	t03322w1110049	49 T53	137	20.9	1117	MA1	2013	ECO		1
217	Carlos Avery	t03322w1140093	93 NH53	111	2.0	1110	INC30	2019			1
218	Carlos Avery	t03322w1350305	305 NH54	76	18.4	1120	INC30	2014			1
219	Carlos Avery	t03421w1150061	61 Bi43	67	5.0	1111	MA1	2016			0
220	Carlos Avery	t03421w1260176	176 O73	117	20.0	1111	MA1	2021			0
221	Carlos Avery	t03421w1230120	120 Bi43	56	2.7	1111	MA1	2018			0
222	Carlos Avery	t03222w1060049	49 Ash44	79	7.4	1110	MA1	2015	ECO		1

Appendix D Anoka Sand Plain 10-Year Stand Exam List

	A	B	C	D	E	F	G	H	I	J	K
223	Carlos Avery	t03322w1140103	103 NH55	89	3.2	1110	INC30	2019	ECO		1
224	Carlos Avery	t03222w1080074	74 A 42	1	2.7	1111	MA1	2019			1
225	Carlos Avery	t03322w1140067	67 T53	137	9.0	1117	MA1	2013	ECO		1
226	Carlos Avery	t03322w1260287	287 A53	45	20.0	1110	MA1	2013			1
227	Carlos Avery	t03421w1220086	86 Bi 43	42	6.8	1111	MA1	2020			0
228	Carlos Avery	t03222w1170109	109 A55	1	13.1	1111	MA1	2016			1
229	Carlos Avery	t03322w1230130	130 Bi55	72	3.9	1111	MA1	2014			1
230	Carlos Avery	t03222w1080082	82 Bi55	62	2.7	1111	MA1	2015			1
231	Carlos Avery	t03222w1040032	32 O 54	89	3.9	1111	MA1	2015			1
232	Carlos Avery	t03421w1230077	77 O73	127	16.3	1111	MA1	2021			0
233	Carlos Avery	t03322w1220127	127 NH58	83	5.7	1110	INC30	2019			1
234	Carlos Avery	t03322w1140122	122 Bi55	72	6.4	1111	MA1	2014			1
235	Carlos Avery	t03322w1140081	81 O86	107	5.3	1111	MA1	2014			1
236	Carlos Avery	t03321w1070077	77 O54	91	13.3	1111	MA1	2019			0
237	Carlos Avery	t03421w1230101	101 Bi42	56	8.1	1111	MA1	2020			0
238	Carlos Avery	t03321w1160124	124 O73	126	11.5	1111	MA1	2018			0
239	Carlos Avery	t03322w1260300	300 NH54	1	7.1	1120	INC30	2013			0
240	Carlos Avery	t03322w1260248	248 LH53	107	10.4	1110	MA1	2015			1
241	Carlos Avery	t03322w1130102	102 NH42	77	10.4	1810		2014			1
242	Carlos Avery	t03222w1030014	14 O74	118	19.0	1111	MA1	2016			0
243	Carlos Avery	t03421w1330194	194 O64	116	11.3	1111	MA1	2020			0
244	Carlos Avery	t03322w1160421	421 NH 54	75	16.6	1120	INC30	2019	ECO		1
245	Carlos Avery	t03322w1250430	430 NH 68	80	25.0	1120	INC30	2014	ECO		1
246	Carlos Avery	t03322w1150422	422 NH 58	83	4.9	1110	INC30	2019			1
247	Little Falls Forestry	t13029w1160077	77 JP 56	49	18.9	9100		2016			0
248	Little Falls Wildlife	t03931w1040030	30 A42	40	16.8	1810	COV30	2021	ECO		1
249	Little Falls Wildlife	t03831w1220050	50 Mh	29	13.2	1118	COV86	2021			0
250	Little Falls Wildlife	t04031w1330061	61 O 43	52	57.6	1810	COV30	2021	ECO		1
251	Little Falls Wildlife	t03931w1030035	35 NH52	10	3.2	1810	COV30	2021	ECO		1
252	Little Falls Wildlife	t03932w1210001	1 NH43	47	1.7	1118	COV86	2022			0
253	Little Falls Wildlife	t04031w1320058	58 O55	69	3.7	1116	COV85	2021	ECO		1
254	Little Falls Wildlife	t03931w1040037	37 UB	10	9.0	1810	COV30	2021	ECO		1
255	Little Falls Wildlife	t03931w1130080	80 A43	49	20.9	1111	INC35	2022			0
256	Little Falls Wildlife	t03931w1130081	81 RC43	43	19.9	1810	COV30	2022			0
257	Little Falls Wildlife	t03931w1030038	38 UG	10	3.7	1810	COV30	2021			1
258	Little Falls Wildlife	t03931w1040034	34 NH52	10	1.5	1810	COV30	2021	ECO		1
259	N. Metro Wildlife	t03424w1260006	6 O51	79	11.3	1100	MA1	2014			0

Appendix D Anoka Sand Plain 10-Year Stand Exam List

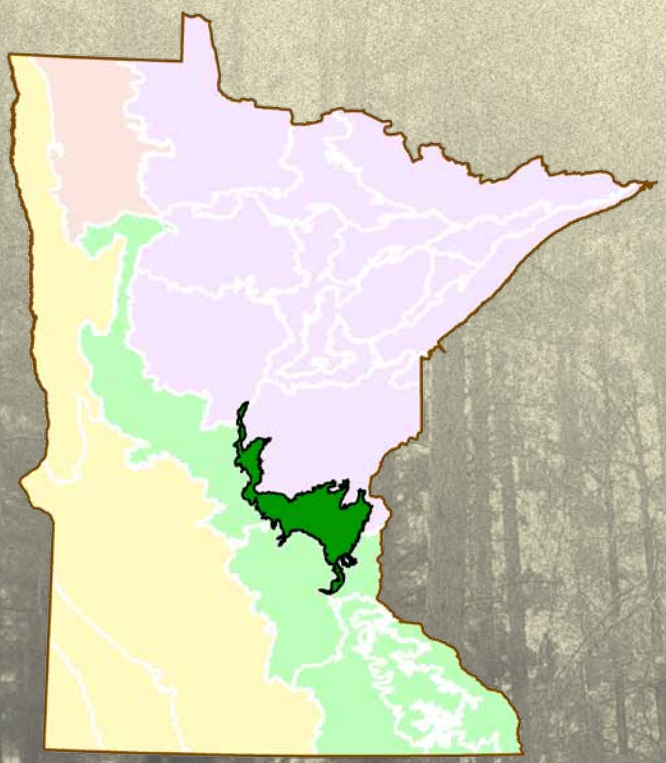
	A	B	C	D	E	F	G	H	I	J	K
260	N. Metro Wildlife	t03424w1260005	5 A51	29	5.4	1100	MA1	2014			0
261	N. Metro Wildlife	t03322w1070403	403 O55	70	10.0	1100	MA1	2013			1
262	N. Metro Wildlife	t03322w1050402	402 O54	79	10.0	1100	MA1	2013			1
263	N. Metro Wildlife	t03322w1060409	409 O53	84	24.0	1100	MA1	2013			1
264	N. Metro Wildlife	t03424w1260004	4 A51	60	5.7	1100	MA1	2014			0
265	N. Metro Wildlife	t02920w1220072	72 A43	54	4.1	1100	MA1	2015			0
266	N. Metro Wildlife	t03121w1220014	14 A53	47	1.6	1100	MA1	2020			0
267	N. Metro Wildlife	t02920w1220081	81 NH43	82	10.2	1100	MA1	2015			0
268	N. Metro Wildlife	t03121w1210008	8 A53	47	5.0	1100	MA1	2020	ECO		0
269	N. Metro Wildlife	t03121w1220011	11 A45	43	2.1	1100	MA1	2020			0

Tomorrow's Habitat for the Wild & Rare

An Action Plan for Minnesota Wildlife

Anoka Sand Plain

Subsection Profile



Minnesota's Comprehensive Wildlife Conservation Strategy

Minnesota Department of Natural Resources

Anoka Sand Plain

SUBSECTION OVERVIEW

The Mississippi River forms the western boundary of the Anoka Sand Plain Subsection. A broad, flat, sandy lake plain dominates the majority of this area and forms the eastern and northern boundaries. Historically, the predominant vegetation was oak savanna and upland prairies surrounded by varied wetland complexes.

This subsection stretches across the northern Twin Cities metropolitan area, including St. Cloud to the west and North Branch to the east, and has the second fastest-growing population in the state. Urban development and agriculture (primarily sod and vegetable crops), which occurs in about one-third of the subsection, has resulted in the loss of prairie and savanna and drainage of peatlands.

Quick facts

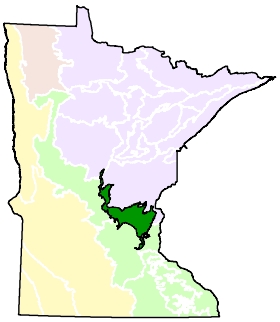
Acres: 1,199,711 (2.2% of state)

Ownership

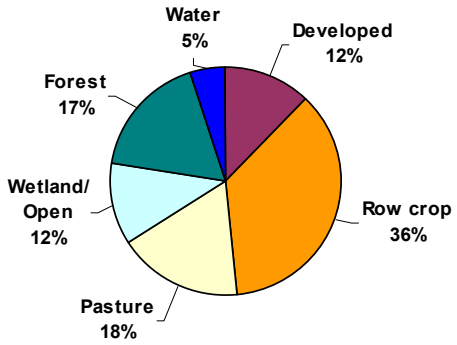
Public	Private	Tribal
9.7%	90.3%	0.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
627	+103



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

97 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Anoka Sand Plain. These SGCN include 39 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 8 mammal SGCN are known or predicted to occur in the Anoka Sand Plain, approximately 36% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	Common Mudpuppy
Birds	56	57.7	Eastern meadowlark
Fish	3	6.4	Greater redhorse
Insects	9	16.1	Uncas skipper
Mammals	8	36.4	American badger
Mollusks	9	23.1	Fawnsfoot
Reptiles	8	47.1	Gopher snake
Spiders	3	37.5	*Tutelina formicaria*

HIGHLIGHTS

- This subsection is well-known for sandhill cranes, trumpeter swans, bald eagles, bobolinks, and lark sparrows. Other important species are badgers, Blanding's turtles, and gopher snakes.
- Important habitat features include dry prairie associated with scattered wetlands, rivers, and streams, which provide excellent habitat for Blanding's turtles, both species of hognose snakes, and bullsnakes.
- Some of the best examples of dry oak savanna in the state occur in this subsection.
- Carlos Avery WMA and Sherburne NWR are important stopover sites for migratory birds.

SPECIES SPOTLIGHT

Blanding's turtle *(Emydoidea blandingii)*

Distribution Found in marshes, ponds, and river bottoms of Central, East-Central, Southeastern, and Southwestern MN, especially where adjacent uplands have sandy soil suitable for nesting.

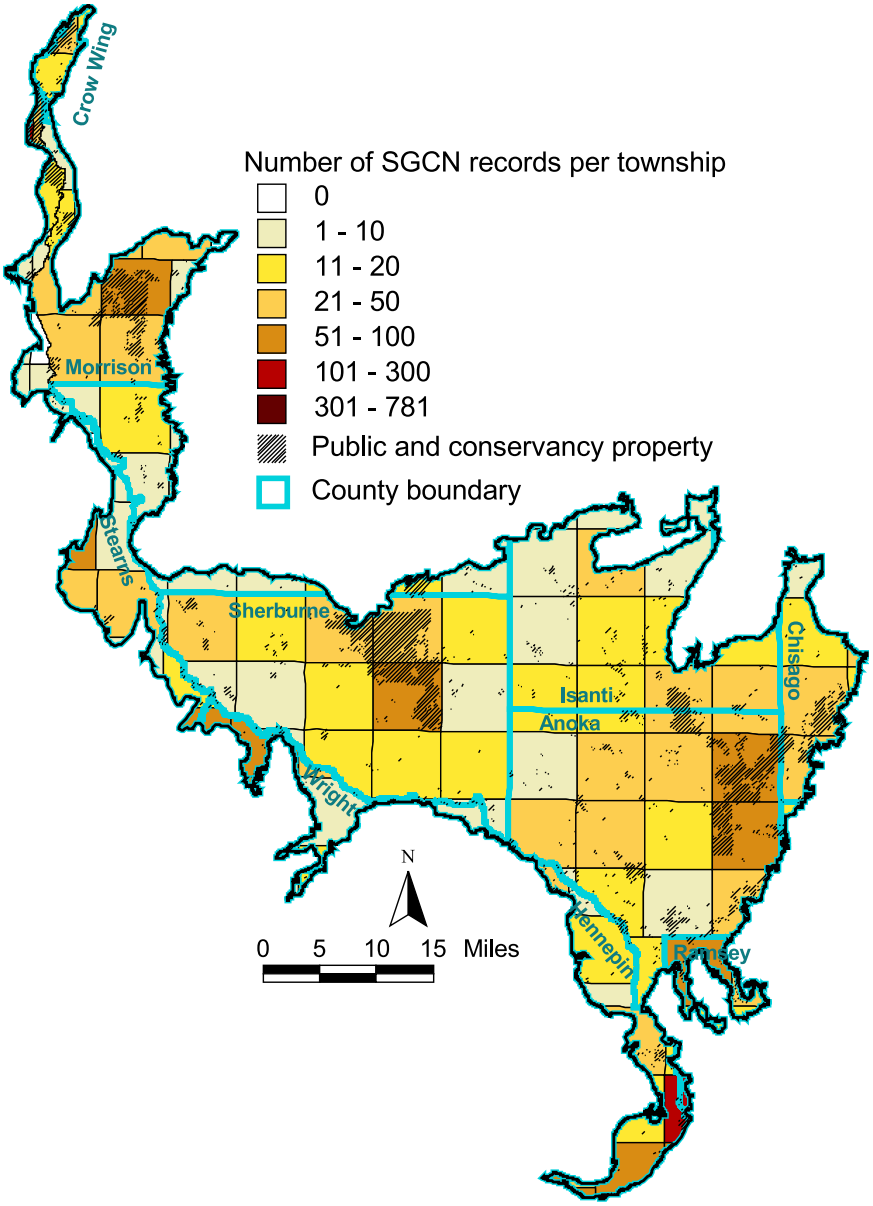
Abundance Abundant in some localized areas of SE MN, but also regularly encountered in the Anoka Sand Plain and recently found to be more common than previously known along small streams adjacent to prairies and grasslands of SW MN. Reasons for decline include changes due to land use, urban sprawl into former nesting areas, and fragmentation of remaining habitats.

Legal Status State list-Threatened.

Comments Travels up to a mile from wetlands to uplands for nesting, and moves between wetlands throughout the summer, making it vulnerable to road traffic.

SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys may have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	82
Habitat Degradation in MN	87
Habitat Loss/Degradation Outside of MN	31
Invasive Species and Competition	26
Pollution	36
Social Tolerance/Persecution/Exploitation	24
Disease	3
Food Source Limitations	2
Other	12

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	A	B	C	D	E
Oak Savanna	X		X		
Prairie	X	X	X		
Wetland-Nonforest	X	X	*		
Grassland	X				
Shoreline-dunes-cliff/talus (Dune habitat)		X			
Lake-Shallow				X	
River-Headwater to Large					X

*Wetlands had not changed by more than 50% at the time of the 1984 Anderson & Craig study, but recent changes in this subsection indicate further wetland loss has occurred.

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with $p<0.01$.

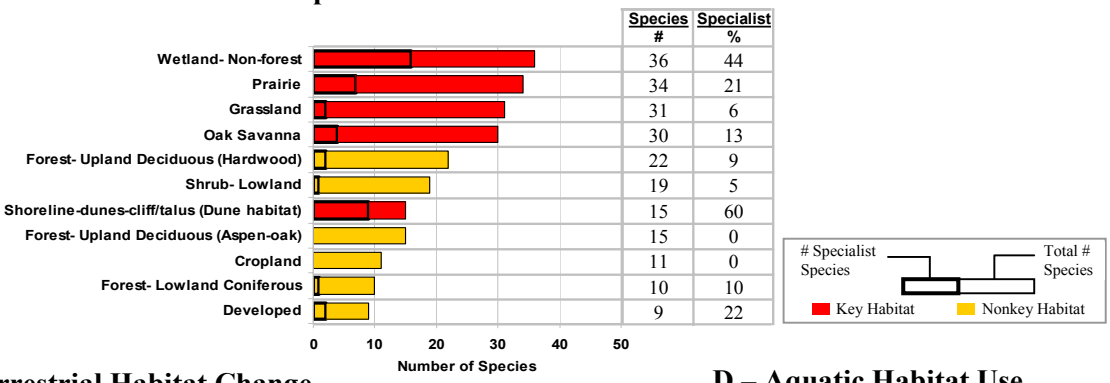
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

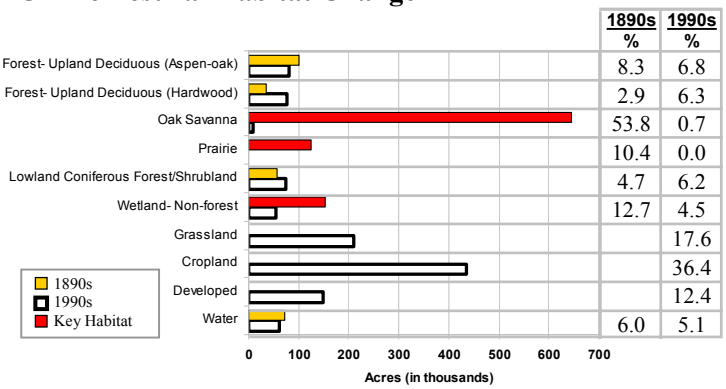
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

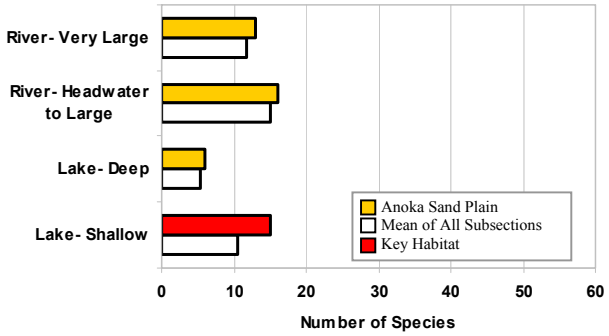
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



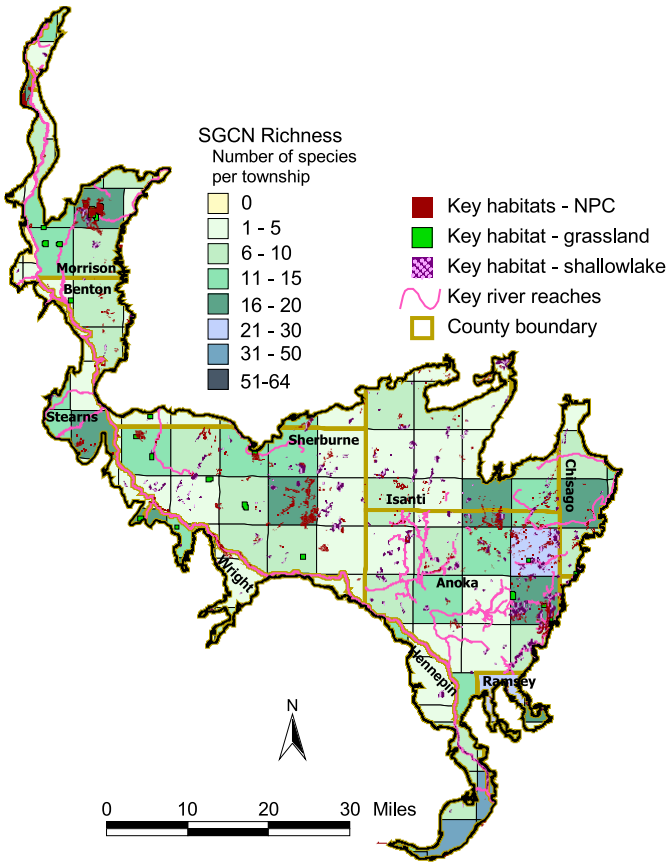
D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources:
Grassland Bird Conservation Areas (GBCA), 2002
Major River Centerline Traces in Minnesota, 1984
MCBS Native Plant Communities (NPC), 2005
MN DNR 24K Rivers and Streams, 2005
MN DNR County Biological Survey (MCBS), 2005
MN DNR Fish database, 2005
MN DNR Natural Heritage database, 2005
MN DNR Statewide Mussel Survey, 2005
Shallow Lakes in Minnesota, 2005
The Nature Conservancy Rivers and Streams combined dataset, 2005

For more information on how this map was constructed, please see the Subsection Profile Overview in Chapter 5.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Cropland	N/A	36.4		6			4		1		11
Grassland	N/A	17.6		17			8		6		31
Developed	N/A	12.4		5		1	3				9
Forest-Upland Deciduous (Hardwood)	2.9	11.0		14		2	4		2		22
Forest-Lowland Coniferous	4.7	6.2		7		1	1			1	10
Wetland-Nonforest	12.7	4.5		29		1	3		2	1	36
Lake-Shallow	N/A	2.8		12					2		14
Forest-Lowland Deciduous	1.2	2.4		13			2		2		17
Lake-Deep	N/A	2.3	1	2	2				1		6
Forest-Upland Deciduous (Aspen-oak)	8.3	2.1		13			2				15
Forest-Upland Coniferous	0.0	1.6		12		2	4		4		22
Oak Savanna	53.8	0.7		15		5	6		4		30
Prairie	10.4	0.0		15		3	7		6	3	34
Shoreline-dunes-cliff/talus (Dune habitat)	N/A	N/A		11			2		2		15
Shrub-Lowland	N/A	N/A		14		1	3		1		19
River-Headwater to Large	N/A	N/A	1	3	2	1		6	3		16
River-Very Large	N/A	N/A	1	1	1			8	2		13

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain, Enhance, and Protect the Key Habitats

1. **Oak savanna habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain savanna
   c. Encourage oak savanna restoration efforts
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
2. **Native prairie habitats**, actions include:
   a. Manage invasive species
   b. Use prescribed fire and other practices to maintain prairie
   c. Manage grasslands adjacent to native prairie to enhance SGCN habitat
   d. Encourage prairie restoration efforts
   e. Provide technical assistance and protection opportunities to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
4. **High-quality grassland habitats**, actions include:
   a. Maintain high-quality grasslands
   b. Support the maintenance of pasture and grassland habitats valuable to SGCN
   c. Encourage when appropriate transformation of plowed fields into pasture/grasslands
   d. Provide technical assistance and protection opportunities to interested individuals and organizations
5. **Dune habitats**, actions include:
   a. Support the protection of dune habitats from damaging development
   b. Enhance dune habitats to support SGCN
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
6. **Shallow lake habitats**, actions include:
   a. Maintain good water quality in shallow lakes
   b. Enhance near-shore terrestrial and aquatic habitats
   c. Provide technical assistance and protection opportunities to interested individuals and organizations
7. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance and protection opportunities to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues
3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people
Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

How to use this subsection profile

Intended audience: Natural resource professionals and interested stakeholders

- Identify how the priority conservation actions and key habitats intersect and inform your current and future priorities.
- Using your additional insights and local knowledge, "step-down" the priority conservation actions into more detailed actions and practical on-ground tasks.
- Use it to understand species in greatest conservation need priorities and tell a story about the subsection (its history, biology, ecology, demography) to other natural resource professionals, managers, decision makers and land owners.
- Visit our website, or give us a call, and tell us how you're using it, how others are using it, and ideas that "step-down" the priority conservation actions.

Website:

www.dnr.state.mn.us/cwcs

For more information, please contact:

Emmett Mullin, Project Manager, MN DNR, phone: 651-259-5566, email: emmett.mullin@dnr.state.mn.us

Daren Carlson, Ecologist/GIS Analyst, MN DNR, phone: 651-259-5079, email: daren.carlson@dnr.state.mn.us

Brian Stenquist, Strategic Planner, MN DNR, phone: 651-259-5144, email: brian.stenquist@dnr.state.mn.us

How to cite this document:

Minnesota Department of Natural Resources, 2006. *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife*, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4040
(651) 296-6157 (Metro Area)
1-888-MINNDNR (646-6367) (MN Toll Free)

Appendix F Stands on the 10-Year Stand Exam List with a White Pine component

Work_Area	LOCATION	SLABEL	NEW_AGE_UD	MAN_ACRES	Prescripti	MgmtObj	SE_Year
Cambridge Forestry	t03427w1360303	303 WP 59	57	6.2	1810	CON3;CON4	2020
Cambridge Forestry	t03427w1360302	302 WP 54	42	2.0	1810	CON3;CON4	2020
Cambridge Forestry	t03427w1170061	61 WP 59	58	5.5	1810	MA1	2019
Cambridge Forestry	t03427w1160096	96 WP55	66	7.4	1810	MA1	2018
Cambridge Forestry	t03427w1210134	134 WP 21	20	7.3	1810	MA1;CON3	2022
Cambridge Forestry	t03427w1350319	319 WP 57	47	15.5	1810	CON3;CON4	2019
Cambridge Forestry	t03427w1280265	265 WP12	18	8.1	1810	MA1	2014
Cambridge Forestry	t03427w1160023	23 WP54	66	10.5	1810	MA1	2013
Cambridge Forestry	t03427w1290228	228 WP 49	31	7.0	1810	MA1	2015
Cambridge Forestry	t03427w1290278	278 WP 59	56	11.7	1810	MA1	2020
Cambridge Forestry	t03427w1170100	100 WP 43	29	36.9	1810	MA1;CON3	2015
Cambridge Forestry	t03427w1240131	131 WP21	20	22.2	1810	MA1	2020
Cambridge Forestry	t03427w1210121	121 WP 53	46	8.4	1810	CON3	2020
Cambridge Forestry	t03427w1210152	152 WP 11	27	6.6	1810	MA1	2022
Cambridge Forestry	t03427w1150033	33 WP 55	31	7.3	1810	MA1	2018
Cambridge Forestry	t03427w1350296	296 WP 59	62	9.8	1810	CON3;CON4	2013
Cambridge Forestry	t03427w1350339	339 WP 59	47	39.3	1810	CON3;CON4;CON5	2013
Cambridge Forestry	t03427w1290201	201 WP 56	37	16.0	1810	MA1	2020
Cambridge Forestry	t03427w1210136	136 WP 58	55	8.7	1810	CON3;CON4;CON5	2018
Cambridge Forestry	t03427w1350324	324 WP 59	48	8.0	1810	CON3;CON4	2013
Cambridge Forestry	t03427w1290261	261 WP 55	49	4.9	1810	MA1	2020
Cambridge Forestry	t03427w1350311	311 WP 58	49	24.6	1810	CON3;CON4	2013
Cambridge Forestry	t03427w1160060	60 WP 59	53	2.9	1810	MA1	2021
Carlos Avery	t03421w1270143	143 WP74	127	23.5	1110		2016
				300.3			

Appendix G Anoka Sand Plain SFRMP Monitoring Plan

As this subsection plan is implemented, monitoring of forest management activities is critical to achieve the goals of the ASP SFRMP. Many DNR forest management activities are currently tracked, such as cover type acres treated; treatment methods and acres; timber volumes sold and harvested; and regeneration methods, species, and success. However, some management activities and objectives are not readily tracked, such as stand composition changes. Monitoring of forest activities includes both site-level monitoring (*MFRC Voluntary Site Level Forest Management Guidelines*) and landscape-level monitoring (forest management consistent with the goals of the ASP SFRMP). Discussed below are the annual reviews and tracking of stand treatments and the landscape-level monitoring that will be used to monitor the implementation of ASP SFRMP.

5.1 Annual Stand Examination Plan Review among Divisions of DNR

Each year as Annual Stand Exam Plans are developed from the subsection plan, the Divisions of Fish and Wildlife and Ecological Resources will provide input to forestry staff regarding selection of stands and stand treatments. The Annual Stand Exam Plans developed by each Forestry Area are based on the state's fiscal year, July 1 – June 30. These annual harvest plans are typically prepared and cruised during the fall and winter months leading up to the start of the fiscal year. During development of the ASP Stand Exam List and also during each Forestry Area's identification of their Annual Stand Exam Lists other divisions are provided an opportunity to identify stands where they would like to participate in a joint field visit/stand evaluation. These joint visits allow all divisions to affect the stand prescriptions applied and stand management objectives. These review opportunities are also provided for annual plan additions (i.e., stands added during the year due to windthrow salvage, new information about a stand, etc.). A public review process is included for both the annual plans and additions.

5.2 Stand Treatments and Site level Monitoring

Approximately one-tenth of the stands selected for treatment, as identified in the ASP SFRMP, will be field visited each year during the 10-year plan period. Final stand treatment prescriptions will be determined after the field visit/stand examinations are completed. Prescriptions and objectives assigned to stands during the SFRMP planning process are preliminary and may be adjusted based on current stand conditions and other information and input at the time of the stand examination.

Following timber sales or after forest development projects are contracted, forestry staff administers timber harvest permits, forest development projects (e.g., site preparation and tree planting), and road projects as the work is completed. Forestry staff regularly monitors these activities to ensure that permit regulations and contract specifications are being met. In addition, standardized timber sales inspections are completed on at least 10 percent of active timber sales each year. The application of site-level forest management guidelines (e.g., riparian management zone guidelines) is monitored during permit and contract supervision and inspections.

In addition to Division of Forestry monitoring, the MFRC site-level monitoring program will also periodically sample sites in these subsections as part of its overall statewide monitoring program. The objective of this statewide monitoring program is to evaluate the implementation of the MFRC's *Voluntary Site-Level Forest Management Guidelines* through field visits to randomly selected, recently harvested sites across the various forest land ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.). The monitoring results from sites on state lands in these subsections will be used to determine implementation of the MFRC's site-level guidelines.

5.3 Landscape level monitoring

To monitor landscape-level forest management by DNR against the goals of the ASP SFRMP, two types of monitoring questions will be addressed:

1. Implementation Monitoring, which determines whether the management actions are being implemented as written in the ASP SFRMP, meaning:

   Are management actions being carried out in a manner that is consistent with the plan? and,

2. Effectiveness Monitoring, which determines the appropriateness or effectiveness of specific management actions designed and implemented to accomplish specific objectives identified in the ASP SFRMP, meaning:

   Are management actions having the desired on-the-ground effect?

It is often not possible to see the results of prescriptions and objectives assigned to stands, for many years. Many of the treatments assigned to stands in this plan may not be accomplished until after the 10-year plan is over. Some reasons are: 1) a portion of the stands identified for treatment won't be field - examined (and for many, offered for sale) until late in the 10-year planning period, 2) the harvest of timber sales occurs up to five years after the sale date, 3) forest development activities may be needed to regenerate the site to the desired species after the timber sale harvest is completed, 4) desired structural changes in stands may take many years or decades to occur, and 5) forest inventory data may not capture the forest stand composition components or changes for many years or capture it at all. Because of this, preliminary stand-management objectives (see Appendix I *Standard Codes in SFRMP*) have been developed to record the intent or objectives of stand treatments. Preliminary objectives may be assigned to some stands during the SFRMP process to provide preliminary guidance for the appraiser to consider during the on-site stand evaluation. Final objectives will be assigned after the stand examination/appraisal for a timber sale or other treatment is completed. The assignment of objectives to stands allows recording of the various stand treatments on an annual basis to assist in monitoring the implementation of the ASP SFRMP. This will help determine if strategies are being applied and if management objectives and goals are being met.

A significant portion of the data needed to monitor plan implementation and effectiveness will be collected from existing databases. Other data, especially those relating to effectiveness of management actions, are more difficult to obtain.

The following data sources and existing forestry management tools will be used to implement ASP monitoring:

1. Forest Inventory Module (FIM)
   The primary source of information about the current condition of DNR forest lands is the Forest Inventory Module (FIM). FIM is a stand-level forest inventory. A stand is a contiguous group of trees similar in age, species composition, and structure; and growing on a site of similar quality, to be declared a distinguishable forest unit. A forest is comprised of many stands. FIM captures essential information about every forest stand on more than four million acres of DNR forest land. It is the basic data set from which decisions are made about if, when, where, and in what manner DNR forest stands will be treated. Information gathered includes overstory and understory tree species, stand age, timber volumes, site productivity, shrub and ground species, insects and diseases, and other specific site conditions. Native plant community (NPC) classification will be captured on stands for which evaluations have been completed.

2. Silvicultural and Roads Module (SRM)
   The Silviculture and Roads Module (SRM) enables foresters to plan and record management objectives and actions on state lands. An SRM site is the piece of land for which the manager has developed a prescription (i.e., a series of actions). The site may be a FIM stand, part of a stand, or more than one stand. SRM allows for multi-year prescriptions for sites to manage the site for a specified objective. The site prescription consists of all the actions prescribed for a site to obtain a desired future condition. Actions include all the timber harvesting, site prep, planting, and seeding, TSI, and regeneration survey work needed to manage a stand for a specified objective. This long-range schedule and record of completed work helps track management

activities, obligations, and management objectives. It is the foundation for budget requests and work plans.

3. Timber Sales Module (TSM)
   The Timber Sales Module (TSM) includes the following functions: timber sales reporting, supports the appraisal and sale of timber harvest permits, tracking security provided by permit holders, accounting for harvested timber, and collecting revenue.

4. ASP SFRMP Stand Exam List Shapefile
   The SFRMP shapefile includes FIM stand data for all state-administered forest lands in the subsection plans. Subsection boundaries may have been slightly adjusted to avoid splitting of stands for consideration of access, etc. Therefore, the SFRMP subsection shapefile boundaries may be somewhat different than the original ECS subsection shapefile.

   In addition to the standard FIM data fields, the SFRMP shapefile includes fields added during the planning process to identify stands for specific purposes (e.g., ERF, EILC, SMAs, and stand-selection fields). This will make it possible to create a statewide shapefile and provide a uniform set of fields for importing into SRM, posting on the DRS, reporting, and monitoring purposes

5. Annual Harvest List and Annual Plan Additions Shapefiles
   Annual Harvest Lists and Plan Additions are drawn from SFRMP shapefiles and include additional information (including prescription, treatment acres, etc.). Adjustments can be made to add or remove stands, revise comment fields, or change joint visits (etc.).

6. DNR Data Resource Site (DRS)
   The Data Resource Site (DRS) is a standardized collection of GIS data, metadata and programs. A DRS is a place where GIS resources are stored and made available to the users. The layers available on the DRS are designed such that use by DNR staff is intuitive and efficient. Many layers have been converted to shapefiles that are statewide in extent and targeted to a specific piece of information.

7. Internal Assessments and Inventories
   Data from existing and pending assessments and inventories conducted by the Divisions of Ecological Resources, Fish and Wildlife, and Waters will be used. Examples of possible data sources include: wildlife population surveys (ruffed grouse, deer, goshawk, red-shouldered hawk, etc.); harvest reports; and water sampling results (impaired waters).

8. External Assessments and Inventories including resource management information, studies, and surveys conducted by other stakeholders.

9. Imagery available through the Forestry Resource Assessment Center.

Sampling of Sites

Because so much of the monitoring data comes from the SRM database, it is important to attempt to validate the accuracy of SRM data entry and consistency between the site objective and vegetation conditions (incorporating both implementation and effectiveness monitoring). The SFRMP Process Work Group will develop a method of site sampling (number of sites, site selection, techniques, etc.), emphasizing the application of existing survey tools/efforts such as timber sale inspections and regeneration surveys to gather validation data.

Baseline Data

Every effort will be made to identify baseline data for each indicator. The subsection assessments done at the beginning of the planning process contain all or most of the necessary data. Some indicators are tracked as a frequency or occurrence, for which there was not prior record keeping (e.g., the number of treatment deferrals). Although most pre-plan implementation data is lacking, data will be recorded annually so trend information during the plan's time frame will be available.

Data Collection, Analysis and Interpretation

Data from the SRM and FIM databases, and GIS shape files (primarily for implementation monitoring) will be collected periodically during the life of the plan. Effectiveness monitoring data will be collected and compiled at a mid point and at the end of a plan's time frame (2017). This information will be provided to

the subsection team for interpretation and analysis as the basis for preparing the landscape level monitoring of implementation of the ASP SFRMP.

Data is entered into the FIM, SRM, and TSM continually. Fiscal year entries must be completed by September 1 of the following year. Data for the previous fiscal year can be extracted anytime after September. Plan shape files and DRS files are continually available.

5.4 Monitoring Roles and Responsibilities

Monitoring implementation of the ASP SFRMP will be the responsibility of the following individuals:

Forestry Field Staff has responsibility to:

Accurately record data and clearly document decisions regarding site objectives and associated actions for entry into appropriate databases.

Timber Sales, Silviculture and Inventory Program Foresters have responsibility to:

Accurately record data into the appropriate database (FIM, SRM, TSM) in a timely manner. Screens field data/decisions for consistency between actions and objectives, and with SFRMP plan directions.

ASP Team Core 4 has the responsibility to:

Review the monitoring results and is responsible for follow up on issues that arise. Follow up may include convening the full team, conducting additional training, re-emphasizing certain plan goals, initiating the plan amendment process, etc. The existing SFRMP decision-making process will be followed to guide the Core 4 process as monitoring issues are addressed. The ASP Core 4 consists of a regional wildlife member, regional forestry member; an ecological resources member, and the forest planner.

ASP Team

The ASP Team meets at the request of the Teams' Core 4 to discuss and interpret monitoring results and determine appropriate course of action.

ASP Forest Planner

The forest planner has the responsibility to: incorporate monitoring in SFRMP training for field staff, communicate the nature and importance of SFRMP monitoring to field staff, work with SFRMP Teams to incorporate monitoring considerations in formulating goals (i.e., measurable DFFCs) during plan development, convene the Core 4 to review monitoring reports, provide brief summaries of monitoring reports for review by FRIT, and assist with preparation of monitoring reports.

Central Office Forest Planner

The Central Office Forest Planner works with the subsection Teams' forest planner and the Core 4 to compile baseline data; facilitates annual extraction of data from databases and other sources, and assists the subsection Teams' Core 4 in obtaining and analyzing monitoring data; coordinates the preparation of monitoring reports; and maintains a central data and report storage system.

Monitoring questions and indicators have been identified for both implementation and effectiveness monitoring (Table 5.1). Indicators are a particular unit of information that, when measured over time, document changes in a specific condition referenced in the monitoring question.

5.5 Communicating Results

Each subsection team's Core 4 will analyze and summarize monitoring results following collection of the data. A written report, summarizing results of the annual efforts, will be prepared mid-term and at the end of the plan's time frame. These reports will be distributed internally and be accessible via the DNR Web site. Monitoring will guide future actions for ASP Plan amendments or plan adjustments.

The ASP SFRMP, maps, and Appendices can be viewed online at:
http://www.dnr.state.mn.us/forestry/subsection/anoka/plan.html

Table 5.1 SFRMP Monitoring questions, indicators, outcomes, data sources, frequency, and priority.

*1 - measurements we can do fairly easily and will start immediately; 2 - measurements we are currently working on and hope to do soon; 3 - measurements we want to do and will continue to investigate, but are currently not able to undertake.

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
Implementation Monitoring: are management actions being carried out in a manner that is consistent with the plan? (numbers 1 – 27)						
1. Are the numbers of acres treated (by cover type) consistent with the plan?	Acres treated	Acres by cover type by type of treatment	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Location Detail Properties and Actual Actions	Annual	1
2. Which management actions (prescriptions) were carried out or scheduled (by cover type)?	Management actions (prescriptions) carried out	Actions by cover type and acres		SRM Location Detail Properties and Actual Actions	Annual	1
3. Are the numbers of acres reforested and the species used consistent with the plan (by cover type)?	Acres reforested and the species used	Acres and species by reforestation method		SRM Objectives and Actual Actions	Annual	1
4. Are the acres and age of ERF stands treated in a way that is consistent with the plan (by cover type)?	Acres and age of ERF stands treated	Acres and age by cover type		FIM SFRMP Shape File	Annual?	1
5. Are the numbers of "normal rotation" acres treated consistent with the plan (by cover type)?	"Normal Acres" treated	Acres by cover type	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	FIM SFRMP Shape File	Annual?	1
6. Were all selected stands field visited?	Stands field visited	Number of stands (percent)		SRM Actual Actions	Annual	1
7. What is the frequency of stand treatment being a deferral (by cover type)?	Stand treatment = deferral	Number of stands by cover type and acres		SRM Location Detail Properties Actual Actions	Annual	1
8. What is the frequency of stand treatment being a FIM alteration (by cover type)?	Stand treatment = alteration	Number of stands by cover type and acres		SRM Actual Actions	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
9. Is the number of stands managed to maintain cover type consistent with the plan (by cover type)?	Stands managed to maintain cover type	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
10. Is the number of stands managed to maintain cover type but increase stand species composition consistent with the plan (by species)?	Stands managed to maintain cover type but increase stand species composition	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
11. Is the number of stands managed to maintain cover type but change structural composition consistent with the plan (by type of change)?	Stands managed to maintain cover type but change structural composition	Number of stands by cover type and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
12. Is the number of stands managed to convert to another cover type consistent with the plan (by cover type)?	Stands managed to convert to another cover type	Number of stands by desired cover type and acres		SRM Objectives and Actual Actions	Annual	1
13. Is the frequency and location of stand management to maintain a large patch consistent with the plan?	Stand management to maintain a large patch	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
14. Is the frequency of stand management to increase patch size consistent with the plan?	Stand management to increase patch size	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
15. Is the frequency and location of stand management to enhance smaller patches consistent with the plan?	Stand management to enhance smaller patches	Number of instances and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
16. Are the numbers of RMZ acres managed for long-	RMZ acres managed for	Acres		SRM Objectives and Actual	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
lived conifers consistent with the plan?	long-lived conifers			Actions, GIS		
17. Are the numbers of RMZ acres managed to maintain shade to trout streams consistent with the plan?	RMZ acres managed to maintain shade to trout streams	Acres		SRM Objectives and Actual Actions, GIS	Annual	1
18. Is the frequency of stand management to maintain existing NPC and structure (by NPC) consistent with the plan?	Stand management to maintain existing NPC and structure	Number of stands by NPC and acres		SRM Objectives and Actual Actions	Annual	1
19. Is the frequency of stand management to retain NPC older growth stage components consistent with the plan?	Stand management to retain NPC older growth stage components	Number of stands by NPC and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
20. Is the number of stands managed to protect rare plant and animal locations consistent with the plan (by species)?	Stands managed to protect rare plant and animal locations	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
21. Is the frequency of stands under special management for species or habitat consistent with the plan?	Stands under special management for species or habitat	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
22. Is the frequency of stand management to maintain adequate residual BA within an identified corridor consistent with the plan?	Stand management to maintain adequate residual BA within an identified corridor	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
23. Are the known locations of rare native plant considered and protected (by species)?	Stands managed to protect a rare native plant	Number of stands and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
24. Is the frequency of use	Use of prescribed	Number of		SRM Objectives	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
of prescribed burning as a management tool consistent with the plan?	burning as a management tool	instances and acres		and Actual Actions		
25. Is the frequency of use of less intensive TSI or site preparation techniques consistent with the plan?	Use of less intensive TSI or site preparation techniques	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
26. Are the known locations of cultural resource considered and protected (by species)?	Stands managed to protect a known cultural resource	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
27. Is the number of new access miles built and closure methods used consistent with the plan?	New roads built and road closure methods used	Miles and methods		SRM	Annual	1
Effectiveness Monitoring: are management actions having the desired on-the-ground effect? (numbers 28 – 41)						
28. Change in the amount of forest land and timberland?	Amount of forest land and timber	Acres of forest land and timberland	Increase	FIM Satellite Imagery GIS/DRS	Plan Mid Point & Renewal	1
29. Change in representation of forest cover types?	Cover type representation	Total forest acres in each cover type and percent change	To be specified based on subsection plan	FIM Satellite Imagery	Plan Mid Point & Renewal	1
30. Change in forest size and age-class distribution?	Forest size and age-class distribution	Total forest acres in each size and age-class and percent change	Desired outcome varies; to be specified based on subsection plans	FIM	Plan Mid Point & Renewal	1
31. Change in percent of young forest?	Young forest	Acres and percent of total forest	Increase	FIM	Plan Mid-Point & Renewal	1
32. Change in percent of old forest?	Old forest	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1
33. Change in the percent of effective ERF?	Effective ERF	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
34. Change in the number of stands with long-lived conifers?	Stands with long-lived conifers	Total acres and percent change	Increase	FIM Possibly Satellite Imagery	Plan Mid-Point & Renewal	2
35. Change in area of forest affected by potentially damaging agents (tree mortality and damage, wildfire, flooding, invasive/exotic species, insects and diseases, animals, and utility/road construction)?	Area of forest affected by potentially damaging agents	Acres affected by agent and percent change	Decrease affected acres	FIM (look into surveys by Forest Health staff)	Plan Renewal	2
36. Change in forest spatial patterns (patch and connectivity)?	Forest spatial patterns	Number of and size (acres) of patch and index of connectivity	Larger patches with greater connectivity	FIM GIS/modeling	Plan Renewal	2
37. Change in miles of impaired streams within forests?	Miles of impaired streams within forests	Miles of impaired streams and change	Decrease in miles of impaired streams	Work with Waters GIS/DRS	Plan Renewal, when data is available	2
38. Change in forest-associated species of concern by taxonomic group?	Forest-associated species of concern	Indicator of population size and change	Healthier populations	Work with Wildlife & Eco Services, etc.	Plan Renewal, when data is available	2
39. Change in forest game populations?	Forest game populations	Population estimates	Healthier populations			
40. Change in forest bird populations?	Forest bird populations	Indicator of population size and change; possibly red-shouldered hawk, goshawk	Healthier populations	Collaborate, possibly with university study, Eco Services	Plan Renewal, when data is available	3
41. Change in known rare plant communities (number of sites, area, and composition)?	Known rare plant communities	Number of and size (acres) of sites, and measure (indices) of health	Maintain or enhance	Work with Eco Services	Plan Renewal, when data is available	3

*1 - measurements we can do fairly easily and will start immediately; 2 - measurements we are currently working on and hope to do soon; 3 - measurements we want to do and will continue to investigate, but are currently not able to undertake.

High Conservation Value Forests (HCVFs) — FACT SHEET

What Are HCVFs?

As a Department, MN DNR is committed and required by statute *(MS 89 & MS89A)* to manage for a broad set of objectives and forest resources, including the management and protection of rare species, communities, features, and values across the landscape. This commitment coincides with Principle 9 in the Forest Stewardship Certification Council (FSC) Forest Management Standard, which requires certificate holders to identify High Conservation Value Forests (HCVFs) and manage such sites to "maintain or enhance" identified High Conservation Values (HCVs). FSC broadly defines HCVFs as *"areas of outstanding biological or cultural significance."* Certificate holders are required to develop a practical definition and process for implementing the HCVF concept, relative to their scope and scale of operations.

MN DNR has emphasized the biological components of the HCVF concept, in part because FSC provides clearer guidance relative to the ecological components and there is more information available. In the future, MN DNR will place more emphasis on cultural values in defining and identifying HCVs.

What Does This Mean for Me?

MN DNR is currently operating in an interim period and few final decisions regarding HCVFs have been made. All decisions regarding MN DNR's HCVF interim approach have been based on the interpretation that most sites managed as HCVFs will remain working forests. This interpretation and expectation was based on a careful review of Principle 9 and the HCVF Assessment Framework in the FSC-US National Forest Management Standard, Draft 7. Principle 9 states: *"Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach."*

MN DNR and others have struggled to operationalize this "Precautionary Principle." FSC suggests the following application: *"This principle establishes that a lack of information does not justify the absence of management measures. On the contrary, management measures should be established in order to maintain the conservation of the resources." (FSC HCVF Toolkit)* As outlined in the Directors' Memo (May, 2009) management decisions must be documented and management should maintain or enhance the HCVs.

Background – MN DNR's Early Efforts

MN DNR has received several corrective action requests (CARs) related to HCVFs. Earlier CARs required MN DNR to operationally define the HCVF concept, identify HCVFs, and implement appropriate management to maintain or enhance the HCVs. As noted in MN DNR's Minor CAR 2006.10, *"Identifying, conserving, and monitoring HCVFs is an ongoing process, especially for managers of large public forests. Arguably, the most important aspect of this work is developing and implementing necessary guidelines to ensure proper management of High Conservation Values (HCVs) within high and outstanding MCBS sites, ecologically important lowland conifers, and old forest management complexes."*

Note: MN DNR has addressed old growth issues separate of its HCVF interim approach. See MN DNR's 2008.2 CAR response.

In 2006, MN DNR began a comprehensive approach to operationally define the HCVF concept. The Department created a HCVF workgroup to develop a systematic approach to identify, conserve, and monitor HCVs within already established special management and protected areas. Wherever possible, the HCVF workgroup referenced existing policies, directives, stand designations, and interdisciplinary processes to address the above requirements. In 2007, the Department developed a document titled *"Framework for Identifying, Managing, and Monitoring High Conservation Value Forests on State Lands."* This working document identified several priority actions and provided the initial framework for resource managers to begin identifying, managing, and monitoring HCVF sites. This report, which may need to be updated, is posted on the I:drive and intranet.

HCVF Major CAR (2008.1)

By the 2008 annual surveillance audit, MN DNR was required to develop guidelines to ensure appropriate management of HCVs within *high* and *outstanding* MCBS sites. However, by the 2008 audit, DNR had not identified or begun to manage specific sites as HCVFs. Therefore, the auditors concluded that there had been insufficient progress in specifying which *high* or *outstanding* areas were to be managed under the HCVF principle. As a result, the Department's minor CAR 2006.10 was replaced with Major CAR 2008.1.

Prepared by: Rebecca Barnard
Forest Certification Coordinator

High Conservation Value Forests (HCVFs) — FACT SHEET

Interim Approach – Major CAR Requirements

MN DNR's HCVF Major CAR (2008.1) required the Department to develop an interim approach to identify and appropriately manage HCVFs to ensure the maintenance or enhancement of HCVs. MN DNR's interim period will conclude when MN DNR formally defines HCVs and demonstrates which sites, or portions of sites, will be managed as HCVFs.

MN DNR's HCVF Framework report, mentioned above, identifies MCBS sites of *outstanding* and *high* biodiversity significance as candidates to manage in accordance with FSC-US' HCVF Principle. Therefore, as an interim approach, MN DNR is required to:

1) Manage all MCBS *Outstanding* Sites as HCVFs;
2) Manage all MCBS *High* Sites as HCVFs until MN DNR identifies a subset of *high* sites to manage as HCVFs; and
3) Conduct an analysis to identify which *high* sites will be treated as HCVFs *(thereby meeting #2)*

MN DNR's Recent Progress

Since the 2008 audits, MN DNR has made significant progress towards meeting the above requirements.

1) Directors Epperly, Schad and Hirsch sent a Memo (May 6, 2009) to Regional and Area staff, outlining a process for determining management of stands that occur within *high* or *outstanding* MCBS sites.
2) MN DNR developed a gap analysis process *(see below)* to determine which *high* sites will be managed as HCVFs during the interim period.
   a) MCBS plant ecologists reviewed and updated information for all *outstanding* and *high* sites that include DNR Forestry and Wildlife land.
   b) Based on this MCBS information, Ecological Resources' GIS Specialist generated Site summaries for all *high* and *outstanding* sites. Site summaries include a list of the rare species and NPCs present, and summarize the biodiversity values within each MCBS site.
   c) Using this information, along with GIS maps and imagery of MCBS Sites in each ECS Section, Ecological Resources staff identified gaps in the coverage of biodiversity values within *outstanding* sites and recommended *high* sites to fill those gaps.

   Note: Steps a-c are complete for the MDL and NSU Sections. Sites not included in Eco's recommendations no longer need to be treated as HCVFs.

MN DNR's Next Steps

MN DNR has made great progress since 2006, however, there is still work to be done to fully address the HCVF concept. Next steps are outlined below:

Step 1 – Interdisciplinary Review of Eco's Recommendations of *High* Sites – MDL & NSU:

- Interdisciplinary teams will review and refine the list of *high* sites in the MDL and NSU Sections that Ecological Resources recommended for continued treatment as HCVFs *(see Recent Progress #2c)*.
- Determine structure, representation, and decision authority for these interdisciplinary teams.
- Only those *high* sites included in MN DNR's recommendations will continue to be managed as HCVFs during the remainder of the interim period.

Note: Until this is completed (Spring, 2010), high sites appearing on Eco's recommendations and on annual stand exam lists (ASEL) or proposed as an annual planned addition will be managed as HCVFs to maintain/enhance the biodiversity values.

Step 2 – Subset of *High* Sites – Statewide:

Using the same process described above, Ecological Resources staff will review all MCBS sites of *outstanding* and *high* biodiversity significance in the remaining ECS sections and look for gaps in rare features or lack of sufficient representation of *outstanding* sites. Ecological Resources staff will then recommend which *High* sites to continue considering as HCVFs. Interdisciplinary teams will review these recommendations before final decisions are made on which sites to continue managing as HCVFs.

Step 3: Identification of HCV attributes:

HCVF attributes will be developed and defined by FCIT and the HCVF Work Group, based on existing written guidance from FSC-US. HCVs will be identified in HCVFs via interdisciplinary discussions.

Step 4: Management of HCVFs:

Appropriate management of HCVFs and prescriptions to maintain and enhance HCVs will be determined through interdisciplinary discussions and consensus. This process will be ongoing, likely handled at the Area/Region level. As MN DNR moves forward, a practical HCVF definition will be developed that also incorporates additional social and cultural values.

Step 5 – Provide Information & Guidance to Field:

Ecological Resources staff have developed a MCBS Site Information Access Tool that allows DNR staff to access site summaries and generate information on each MCBS high and outstanding site.

Prepared by: Rebecca Barnard
Forest Certification Coordinator

High Conservation Value Forests (HCVFs) — FACT SHEET

MN DNR's Long-term Approach *(proposed)*

Step 1 – Continue Providing Guidance to Field:

Step 2 – Stakeholder Consultation:
Indicator 9.2.a of the newly revised FSC-US Draft Forest Management Standard requires certificate holders to *"hold consultations with stakeholders and experts to confirm that proposed HCVF locations and their attributes have been accurately identified and that appropriate options for the maintenance of their HCVF attributes have been adopted."* Based on a review of this language and discussions with MN DNR's auditor, MN DNR intends to focus the stakeholder consultation process on developing management guidance for sites being considered as HCVFs. Stakeholder consultation will likely be obtained through a variety of existing avenues, including MFRC Landscape Committee Meetings, Minnesota Forest Industry (MFI) meetings, SFRMP public comment periods and meetings, and information accessible on MN DNR's website.
Note: Per FSC, "experts" may include DNR employees "who possess the requisite expertise, but external stakeholders with experience pertinent to the HCVF attribute must always be consulted."

For more details on this process and requirement, please refer to MN DNR's response to FSC CAR 2008.3.

Step 3 – Establish a consensus-based process and a threshold for identifying HCVs and HCVFs:
A variety of information and resources will be referenced when determining HCVs for future HCVFs site identification. This process will be ongoing, likely starting in late winter/early spring, 2010.

Step 4 – Monitoring Plan for HCVs:
Certificate holders are also required to conduct monitoring to ensure that the HCVs are being maintained or enhanced. MN DNR has not yet developed a specific monitoring plan and this will likely be contingent upon when and how MN DNR transitions from an interim into a long-term HCVF approach.

It has been suggested that MN DNR develop a short-term and a long-term monitoring process. Short-term monitoring could include additional (i.e., more frequent) sale supervision and/or possible follow-up joint-site visits to ensure the maintenance or enhancement of HCVs. Possible longer-term monitoring may include a re-analysis of HCVs at periodic intervals (e.g., 3, 5, 10 years).

Answers to Common Questions:

- HCVFs are not intended to be static, "set-asides," or "preservation / wilderness" areas.
- MN DNR is not planning to create new designations or polygons for HCVFs. It has not been decided how HCVFs will be identified in lieu of this.
- MN DNR is working to effectively address HCVFs by building on existing policies.
- Management objectives in HCVFs will be established through the existing planning and management processes. Specific management objectives may include a variety of multiple uses applicable to State Lands.
- The overall goal in HCVFs must be to maintain or enhance the site's HCVs. Prescriptions may need to be adjusted in order to meet this goal.
- Definitive HCVs have not yet been determined via an interdisciplinary process for most HCVFs sites. However, Appendix F of the FSC-US Forest Management Standard (Draft 7) and FSC's HCVF Assessment Framework list a variety of features that may have HCV attributes for the Lakes States.
- The HCVF concept offers a great opportunity for MN DNR to demonstrate how it integrates multiple purposes/objectives into resource management.

Additional Resources

- MN DNR's CAR Responses (2006.10, 2008.1 & 2008.3)
  - I:\FOR\Forest Certification\DNR's CAR Responses & Memos\2008 CAR Responses
  - DNR Intranet
- MCBS Information @
  - ftp://ftp.dnr.state.mn.us/pub/eco/HCVF/
  - MCBS Site Information Access Tool
- Additional Documents:
  - Directors' Memo *(Signed May 6, 2009)*
  - MN DNR's *"Framework for Identifying, Managing, and Monitoring High Conservation Value Forests on State Lands"* 2007 report
- FSC-US Standard & Website @ www.fscus.org

Contacts

For questions regarding interpretation of this information or the attached materials, please contact Kurt Rusterholz (651-259-5135), Rebecca Barnard (651-259-5256) or Mike Locke (218-308-2368).

7.2 Wildife Habitat Relationships- Amphibiasn and Reptiles

Amphibian habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Non-Forest land cover types>>> Forest land cover types>>>

SPECIES GROUP			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest type size class				
Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous sh	Lowland evergreen sh	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Catta	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruc	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Ce	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mi	Black Ash	Silver Maple	Cottonwood	Lowland deciduous m	Low. deciduous/coniferous mi	Seedling	Sapling	Pole timber	Saw timber	Uneven
AMPHIBIANS																																														
TOADS AND FROGS																																														
American Toad	RV		Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Treefrog	DRV									Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Spring Peeper	DRV			Y						Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Western Chorus Frog	RV		Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y
Green Frog	R									Y	Y	Y	Y	Y	Y										Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y					
Northern Leopard Frog	R							Y	Y	Y		Y	Y	Y	Y											Y		Y		Y	Y						Y	Y	Y	Y	Y					
Mink Frog	R										Y	Y	Y		Y										Y	Y	Y	Y	Y	Y	Y										Y					
Wood Frog	DV									Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
SALAMANDERS																																														
Blue-spotted Salamander	DV									Y		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Tiger Salamander	V		Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Four-toed Salamander	DV																								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	
Redback Salamander	D															Y	Y	Y					Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Eastern Newt	DR											Y				Y	Y	Y					Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
REPTILES																																														
LIZARDS																																														
Prairie Skink							Y	Y																									Y													
SNAKES																																														
Eastern Hognose Snake	D						Y	Y								Y	Y							Y								Y	Y	Y	Y	Y	Y	Y	Y	Y						
Smooth Green Snake				Y			Y	Y	Y	Y	Y			Y	Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										
Redbelly Snake	D						Y							Y		Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Plains Garter Snake				Y			Y	Y						Y	Y																															
Common Garter Snake	D		Y	Y			Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
TURTLES																																														
Snapping Turtle	R											Y	Y		Y																															
Painted Turtle	DR										Y	Y	Y		Y																															
Blanding's Turtle							Y	Y				Y	Y	Y	Y																															

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP Species Common Name	Habitat feature	Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest								Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous s	Lowland evergreen sh	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Catt	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruc	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Ce	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous m	Black Ash	Silver Maple	Cottonwood	Lowland deciduous m	Low. deciduous/coniferous m	Seedling	Sapling	Pole timber	Saw timber	Uneven
LOONS AND GREBES																																												
Common Loon												Y	Y																																
Pied-billed Grebe												Y	Y	Y	Y																														
Red-necked Grebe												Y	Y		Y																														
PELICANS AND CORMORANTS																																												
American White Pelican												Y	Y	Y																														
Double-crested Cormorant	RS											Y	Y	Y	Y																				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HERONS AND BITTERNS																																												
American Bittern	R						Y	Y		Y		Y	Y	Y	Y																														
Least Bittern	R									Y		Y	Y	Y	Y																														
Great Blue Heron	RS											Y	Y	Y	Y																				Y	Y	Y		Y	Y	Y	Y	Y			Y	Y
Green Heron	R								Y	Y		Y	Y	Y	Y													Y	Y									Y	Y	Y	Y	Y			Y	Y
VULTURES																																												
Turkey Vulture	S						Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y							Y	Y	
SWANS AND GEESE																																												
Canada Goose	R			Y		Y	Y	Y	Y	Y		Y	Y	Y	Y																														
Trumpeter Swan										Y		Y	Y	Y	Y																														
DUCKS AND																																												
Wood Duck	CMRS									Y		Y	Y		Y																				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
American Wigeon	R						Y	Y	Y	Y		Y	Y	Y	Y																														
American Black Duck	R						Y	Y	Y	Y		Y	Y	Y	Y																									Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Mallard	RM			Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																							Y	Y	Y	Y	Y				Y	Y

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

SPECIES GROUP / Species Common Name	Habitat feature	Non-Forested types>>>: Barren	Urban/Dev.: High intensity urban	Urban/Dev.: Low intensity urban	Urban/Dev.: Transportation	Ag./Grass: Cropland	Ag./Grass: Grassland	Ag./Grass: Prairie	Shrub: Upland shrub	Shrub: Lowland deciduous	Shrub: Lowland evergreen	Aquatic: Water	Aquatic: Floating aquatic	Aquatic: Sedge Meadow	Aquatic: Broadleaf sedge/Cattail	Forest land cover types>>> Upland Coniferous Forest: Jack Pine	Upland Coniferous Forest: Red Pine	Upland Coniferous Forest: White Pine mix	Upland Coniferous Forest: Balsam Fir mix	Upland Coniferous Forest: White Spruce	Upland Coniferous Forest: Upland Black Spruce	Upland Coniferous Forest: Up. N. White Cedar	Upland Coniferous Forest: Upland Conifer	Up. coniferous/deciduous mix	Lowland Coniferous Forest: Lowland Black Spruce	Lowland Coniferous Forest: Stagnant black spruce	Lowland Coniferous Forest: Tamarack	Lowland Coniferous Forest: Stagnant tamarack	Lowland Coniferous Forest: Low. N. White Cedar	Lowland Coniferous Forest: Stagnant N. White Cedar	Lowland Coniferous Forest: Stagnant conifer	Upland Deciduous Forest: Aspen/White Birch	Upland Deciduous Forest: Bur/White Oak	Upland Deciduous Forest: Red Oak	Upland Deciduous Forest: Maple/Basswood	Upland Deciduous Forest: Upland deciduous mix	Lowland Deciduous Forest: Black Ash	Lowland Deciduous Forest: Silver Maple	Lowland Deciduous Forest: Cottonwood	Lowland Deciduous Forest: Lowland deciduous mix	Low. deciduous/coniferous mix	Forest size class: Seedling	Forest size class: Sapling	Forest size class: Pole timber	Forest size class: Saw timber	Forest size class: Uneven
Blue-winged Teal	R					Y	Y	Y	Y	Y		Y	Y	Y	Y																															
Northern Pintail	R					Y	Y	Y				Y	Y	Y	Y																															
Green-winged Teal	R						Y	Y	Y	Y		Y	Y	Y	Y																															
Ring-necked Duck										Y		Y	Y	Y	Y																															
Common Goldeneye	CRS											Y	Y		Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Hooded Merganser	CRS									Y		Y	Y	Y	Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Common Merganser	CRS											Y																				Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
OSPREYS																																														
Osprey	RS											Y																																Y	Y	
HAWKS AND EAGLES																																														
Bald Eagle	R											Y					Y	Y					Y	Y								Y	Y	Y	Y	Y	Y			Y	Y				Y	Y
Northern Harrier						Y	Y	Y	Y		Y															Y		Y									Y	Y	Y	Y	Y					
Sharp-shinned Hawk																Y	Y	Y	Y	Y	Y		Y	Y	Y																				Y	Y
Cooper's Hawk							Y		Y							Y	Y	Y														Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Northern Goshawk																Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y									Y	Y
Red-shouldered Hawk	R																															Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Broad-winged Hawk							Y		Y							Y	Y	Y	Y	Y			Y	Y								Y	Y	Y	Y	Y									Y	Y
Red-tailed Hawk							Y	Y						Y		Y	Y	Y						Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
FALCONS																																														
American Kestrel	CS					Y	Y	Y																																						
Merlin							Y	Y	Y		Y			Y		Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> Forest land cover types>>>

			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
GROUSE AND TURKEYS																																														
Ruffed Grouse									Y	Y														Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
Spruce Grouse	D										Y					Y			Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Sharp-tailed Grouse						Y	Y	Y	Y	Y	Y			Y																																
Greater Prairie Chicken						Y	Y	Y																																						
Wild Turkey	M					Y	Y																										Y	Y		Y									Y	
RAILS AND COOTS																																														
Yellow Rail										Y		Y	Y	Y	Y																															
Virginia Rail	R									Y		Y	Y	Y	Y																															
Sora	R									Y		Y	Y	Y	Y																															
Common Moorhen	R									Y		Y	Y		Y																															
American Coot	R											Y	Y	Y	Y																															
CRANES																																														
Sandhill Crane						Y	Y	Y		Y	Y		Y	Y	Y																															
PLOVERS																																														
Killdeer	R	Y		Y		Y	Y	Y	Y																																					
SANDPIPERS																																														
Spotted Sandpiper	R	Y		Y			Y	Y	Y		Y	Y		Y	Y																															
Upland Sandpiper						Y	Y	Y	Y	Y				Y	Y																															
Common Snipe										Y	Y	Y		Y	Y											Y		Y		Y	Y															
American Woodcock							Y		Y	Y																						Y	Y	Y	Y	Y						Y				
Wilson's Phalarope							Y	Y				Y	Y	Y	Y																															

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> (Barren through Broadleaf sedge/Cattail); Forest land cover types>>> (Jack Pine through Low. deciduous/coniferous mix)

SPECIES GROUP / Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous s	Lowland evergreen s	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
JAEGERS, GULLS AND TERNS																																														
Ring-billed Gull	R	Y		Y		Y	Y					Y		Y	Y																															
Herring Gull	R	Y		Y			Y					Y																																		
Forster's Tern												Y	Y	Y	Y																															
Black Tern												Y	Y	Y	Y																															
PIGEONS AND DOVES																																														
Rock Dove							Y																																							
Mourning Dove				Y		Y	Y									Y	Y	Y	Y	Y	Y		Y																			Y		Y	Y	Y
CUCKOOS																																														
Black-billed Cuckoo									Y	Y																																				
Yellow-billed Cuckoo									Y	Y																						Y	Y	Y	Y	Y		Y				Y				Y
OWLS																																														
Great Horned Owl	CS			Y			Y		Y							Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Barred Owl	C															Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Great Gray Owl	S								Y	Y	Y			Y											Y	Y	Y	Y	Y	Y	Y						Y				Y				Y	Y
Long-eared Owl							Y							Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Short-eared Owl						Y	Y	Y		Y	Y			Y	Y																															
Northern Saw-whet Owl	C								Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y				Y	
NIGHTJARS																																														
Common Nighthawk		Y	Y	Y		Y	Y	Y																																						
Whip-poor-will	FD						Y		Y							Y								Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
SWIFTS																																														
Chimney Swift	CS	Y	Y	Y																												Y	Y	Y	Y	Y						Y	Y	Y	Y	
HIMMINGBIRDS																																														
Ruby-throated Hummingbird	R			Y			Y		Y																							Y			Y		Y	Y	Y		Y				Y	Y

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> | Forest land cover types>>>

Urban/ | Ag./Gra | Shrub | Aquatic | Upland Coniferous Fores | Lowland Coniferous | Upland | Lowland | Forest size

SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shr	Lowland evergreen shr	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/conifero	Seedling	Sapling	Pole timber	Saw timber	Uneven
KINGFISHERS																																													
Belted Kingfisher	B	Y										Y	Y		Y																														
WOODPECKERS																																													
Red-headed Woodpecker	CMS																															Y	Y	Y	Y								Y	Y	
Red-bellied Woodpecker	CMS																																	Y		Y	Y	Y		Y				Y	Y
Yellow-bellied Sapsucker	CMS																							Y								Y	Y	Y	Y	Y							Y	
Downy Woodpecker	CDS																							Y								Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Hairy Woodpecker	CDS															Y	Y	Y						Y	Y		Y		Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Black-backed Woodpecker	CDS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y									Y			Y	Y	Y
Northern Flicker	CS								Y	Y						Y	Y	Y	Y	Y	Y		Y	Y							Y	Y	Y	Y	Y						Y			Y	Y
Pileated Woodpecker	CDMS																							Y								Y	Y	Y	Y	Y	Y	Y		Y			Y	Y	Y
FLYCATCHERS																																													
Western Kingbird				Y		Y	Y	Y	Y	Y						Y	Y	Y						Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				
Eastern Kingbird	MRS			Y			Y	Y	Y	Y				Y	Y	Y	Y	Y						Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				
Olive-sided Flycatcher	RS									Y	Y					Y			Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y											Y	Y	Y
Eastern Wood-Pewee				Y													Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	
Yellow-bellied Flycatcher	D										Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y												Y	Y	
Alder Flycatcher	R									Y																																			
Least Flycatcher									Y	Y														Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Eastern Phoebe	R			Y	Y				Y	Y		Y																				Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	
Great Crested Flycatcher	CS			Y						Y	Y													Y								Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	
SHRIKES																																													
Northern Shrike							Y		Y																							Y	Y	Y	Y	Y						Y	Y			
Loggerhead Shrike						Y	Y	Y	Y																							Y	Y	Y	Y	Y									

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP Species Common Name	Habitat feature	Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Up. coniferous/deciduous mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mix	Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
VIREOS																																												
Yellow-throated Vireo	R			Y					Y	Y														Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Blue-headed Vireo																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y												Y	Y	
Warbling Vireo	R			Y					Y																						Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Red-eyed Vireo																	Y	Y		Y	Y		Y								Y	Y	Y	Y	Y									Y	Y	
JAYS, CROWS AND RAVENS																																												
Gray Jay	M															Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y												Y	Y	
Blue Jay	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Black-billed Magpie						Y	Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	
American Crow	M			Y		Y	Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Common Raven	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	
LARKS																																												
Horned Lark		Y		Y		Y	Y	Y	Y	Y																																			
SWALLOWS																																												
Purple Martin	RS		Y	Y			Y					Y			Y																														
Tree Swallow	CS						Y	Y		Y	Y	Y	Y	Y	Y																Y	Y	Y	Y	Y	Y	Y	Y	Y						
Northern Rough-winged	BR	Y		Y								Y																																	
Bank Swallow	BR	Y		Y			Y	Y				Y	Y																																	
Cliff Swallow	R			Y	Y	Y	Y					Y																																	
Barn Swallow				Y	Y	Y	Y					Y	Y	Y	Y																															
CHICKADEES																																												
Black-capped Chickadee	CS			Y					Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Boreal Chickadee	CS								Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y				Y	Y	Y

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>>

SPECIES GROUP / Species Common Name	Habitat feature		Urban/ Dev.			Ag./Grass			Shrub			Aquatic			
		Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail
NUTHATCHES															
Red-breasted Nuthatch	CS														
White-breasted Nuthatch	CS														
CREEPERS															
Brown Creeper	CS														
WRENS															
House Wren	CS			Y					Y	Y					
Sedge Wren							Y	Y		Y				Y	Y
Marsh Wren	R									Y		Y		Y	Y
KINGLETS															
Golden-crowned Kinglet															
Ruby-crowned Kinglet															
Blue-gray Gnatcatcher															
THRUSHES															
Eastern Bluebird	CS			Y			Y	Y	Y	Y					
Veery	M														
Swainson's Thrush	M														
Hermit Thrush	M														
Wood Thrush	M			Y											
American Robin	M			Y			Y		Y						
MIMICS AND THRASHERS															
Gray Catbird	MR			Y					Y	Y	Y				
Brown Thrasher	M			Y					Y						

Forest land cover types>>>

Species Common Name	Upland Coniferous Forest									Lowland Coniferous Forest						
	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer
NUTHATCHES																
Red-breasted Nuthatch	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-breasted Nuthatch																
CREEPERS																
Brown Creeper																
WRENS																
House Wren																
Sedge Wren											Y		Y		Y	Y
Marsh Wren																
KINGLETS																
Golden-crowned Kinglet	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruby-crowned Kinglet	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Blue-gray Gnatcatcher																
THRUSHES																
Eastern Bluebird																
Veery	Y								Y							
Swainson's Thrush	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		
Hermit Thrush	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wood Thrush									Y							
American Robin	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIMICS AND THRASHERS																
Gray Catbird											Y		Y		Y	Y
Brown Thrasher																

Species Common Name	Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
NUTHATCHES															
Red-breasted Nuthatch										Y			Y	Y	Y
White-breasted Nuthatch	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
CREEPERS															
Brown Creeper						Y	Y		Y	Y			Y	Y	Y
WRENS															
House Wren	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			
Sedge Wren															
Marsh Wren															
KINGLETS															
Golden-crowned Kinglet										Y			Y	Y	Y
Ruby-crowned Kinglet										Y			Y	Y	Y
Blue-gray Gnatcatcher	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
THRUSHES															
Eastern Bluebird	Y	Y	Y	Y	Y						Y				
Veery	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Swainson's Thrush	Y									Y			Y	Y	
Hermit Thrush													Y	Y	Y
Wood Thrush	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y
American Robin	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIMICS AND THRASHERS															
Gray Catbird	Y	Y	Y	Y	Y						Y	Y			
Brown Thrasher	Y	Y	Y	Y	Y						Y	Y			

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP Species Common Name	Habitat feature	Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Up. coniferous/deciduous mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mix	Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
WAXWINGS																																													
Cedar Waxwing	MR			Y					Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y									Y		Y	Y	Y	Y	Y
WARBLERS																																													
Golden-winged Warbler	R								Y	Y						Y	Y	Y	Y					Y							Y	Y	Y			Y	Y		Y		Y	Y	Y	Y	
Tennessee Warbler																										Y		Y		Y	Y												Y	Y	
Nashville Warbler									Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Northern Parula																Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y												Y	Y	
Yellow Warbler	R			Y					Y	Y																									Y	Y		Y		Y	Y				
Chestnut-sided Warbler				Y					Y																						Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			
Magnolia Warbler																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													Y	Y	
Cape May Warbler																			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y											Y	Y	Y	Y	
Yellow-rumped Warbler																Y	Y		Y	Y	Y		Y		Y	Y	Y	Y			Y										Y			Y	Y	Y
Black-throated Green																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y								Y	Y	Y
Blackburnian Warbler																Y	Y	Y	Y	Y	Y		Y	Y																				Y	Y	Y
Pine Warbler																Y	Y	Y					Y	Y																					Y		
Palm Warbler											Y															Y		Y		Y	Y												Y	Y	Y	Y	
Cerulean Warbler																																		Y					Y						Y	Y	Y
Black-and-white Warbler	D								Y	Y						Y	Y	Y					Y	Y		Y								Y	Y	Y	Y	Y	Y	Y		Y	Y	Y		
American Redstart									Y	Y						Y																		Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	
Ovenbird																Y	Y	Y	Y	Y			Y	Y										Y	Y	Y	Y	Y						Y	Y	
Northern Waterthrush	DR									Y															Y	Y	Y	Y	Y	Y	Y						Y	Y		Y	Y			Y	Y	Y
Connecticut Warbler											Y					Y									Y	Y	Y	Y	Y	Y	Y												Y	Y	Y	Y	
Mourning Warbler									Y	Y						Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				
Common Yellowthroat	R								Y	Y				Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y												Y	Y			
Canada Warbler	D								Y		Y							Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y			Y	Y								Y	Y	

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> Forest land cover types>>>

			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
TANAGERS																																														
Scarlet Tanager																Y								Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	
TOWHEES AND SPARROWS																																														
Eastern Towhee	M								Y	Y						Y							Y										Y	Y		Y						Y	Y	Y	Y	
Chipping Sparrow				Y					Y							Y	Y	Y	Y	Y	Y	Y	Y	Y																	Y			Y	Y	
Clay-colored Sparrow							Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		Y			Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			
Field Sparrow							Y	Y	Y							Y	Y	Y						Y								Y	Y	Y	Y	Y				Y		Y				
Vesper Sparrow						Y	Y	Y	Y					Y																		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Lark Sparrow				Y		Y	Y	Y	Y					Y																		Y	Y	Y	Y	Y	Y									
Savannah Sparrow						Y	Y	Y	Y	Y	Y			Y	Y													Y		Y	Y		Y													
Grasshopper Sparrow				Y		Y	Y	Y	Y					Y																																
Le Conte's Sparrow						Y	Y	Y		Y	Y			Y	Y																															
Nelson's Sharp-tailed							Y	Y		Y				Y	Y													Y		Y	Y															
Song Sparrow									Y	Y				Y		Y																Y					Y	Y	Y	Y		Y	Y	Y		
Swamp Sparrow							Y			Y	Y			Y	Y																															
White-throated Sparrow									Y	Y						Y			Y	Y	Y		Y	Y	Y		Y		Y												Y	Y	Y	Y		
Dark-eyed Junco									Y							Y			Y	Y	Y		Y	Y												Y						Y	Y	Y	Y	Y
GROSBEAKS																																														
Northern Cardinal	M			Y					Y	Y													Y									Y	Y	Y	Y	Y	Y	Y		Y		Y	Y			
Rose-breasted Grosbeak	M			Y																												Y	Y	Y	Y	Y								Y	Y	
Indigo Bunting									Y	Y																						Y	Y	Y	Y	Y	Y	Y		Y		Y	Y			

7.2 Wildlife Habitat Relationships- Bird Habitats

Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP Species Common Name	Habitat feature	Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Up. coniferous/deciduous mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mix	Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
BLACKBIRDS AND ORIOLES																																												
Bobolink						Y	Y	Y	Y	Y	Y			Y																															
Red-winged Blackbird	R					Y	Y		Y	Y		Y	Y	Y	Y																														
Eastern Meadowlark						Y	Y	Y		Y				Y	Y																	Y													
Western Meadowlark						Y	Y	Y	Y	Y				Y	Y																														
Yellow-headed Blackbird	R											Y		Y	Y																														
Brewer's Blackbird	R			Y		Y	Y	Y	Y	Y	Y			Y	Y											Y		Y		Y	Y	Y	Y				Y							
Common Grackle				Y		Y	Y	Y		Y	Y			Y	Y																								Y						
Brown-headed Cowbird						Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y						Y				
Baltimore Oriole	MR			Y																				Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
FINCHES																																												
Purple Finch	M			Y														Y	Y	Y	Y		Y			Y		Y	Y	Y	Y									Y			Y	Y	Y
House Finch	M		Y	Y																																								
Pine Siskin	M			Y												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y			Y	Y	
American Goldfinch				Y			Y		Y	Y																						Y	Y	Y	Y	Y						Y			
Evening Grosbeak	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		Y											Y	Y	Y	Y	

7.2 Wildlife Habitat Relationships- Mammal Habitats.

Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Non-Forest land cover types>>> | Forest land cover types>>>

SPECIES GROUP Species common name	habitat Feature		Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous sh	Lowland evergreen sh	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Catta	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruc	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Ce	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mi	Black Ash	Silver Maple	Cottonwood	Lowland deciduous m	Low. deciduous/coniferous mi		Seedling	Sapling	Pole timber	Saw timber	Uneven
				Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest size class				
INSECTIVORES																																																
Northern Short-tailed	D				Y			Y	Y	Y	Y	Y			Y	Y	Y	Y	Y		Y				Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Arctic Shrew	R										Y	Y			Y	Y										Y	Y	Y	Y	Y	Y	Y										Y		Y	Y	Y	Y	Y
Cinereus Shrew	D							Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Pygmy Shrew	D							Y	Y	Y	Y	Y			Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y				Y		Y			Y	Y		Y	Y	Y	Y	Y
Water Shrew	DR										Y	Y	Y		Y	Y										Y	Y	Y	Y	Y	Y	Y														Y	Y	Y
Star-nosed Mole	DR										Y	Y			Y	Y										Y	Y	Y	Y	Y	Y	Y						Y	Y		Y	Y				Y	Y	Y
BATS																																																
Big Brown Bat	CRS				Y			Y	Y				Y				Y	Y	Y		Y	Y			Y								Y	Y	Y		Y			Y	Y	Y				Y	Y	
Silver-haired Bat	CRS												Y					Y	Y		Y			Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Eastern Red Bat	CR			Y	Y			Y		Y	Y		Y			Y					Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y
Hoary Bat	R				Y			Y		Y			Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Little Brown Bat	CRS							Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y		Y	Y		Y				
Northern Myotis	CRS			Y	Y												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y		Y	Y					Y	Y
CARNIVORES																																																
Coyote	M		Y		Y		Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Gray Wolf	M						Y	Y		Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Gray Fox	CDM						Y	Y	Y	Y	Y																							Y	Y	Y	Y	Y	Y	Y	Y						Y	Y
Red Fox			Y		Y		Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Bobcat	CD									Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y		Y	Y	Y	Y	Y
Northern River Otter													Y	Y	Y	Y																																
American Marten	CDS																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y				Y	Y	Y
Fisher	CDRS										Y									Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Ermine	DR									Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Long-tailed Weasel	DR									Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
American Mink	DR										Y		Y	Y	Y	Y																																

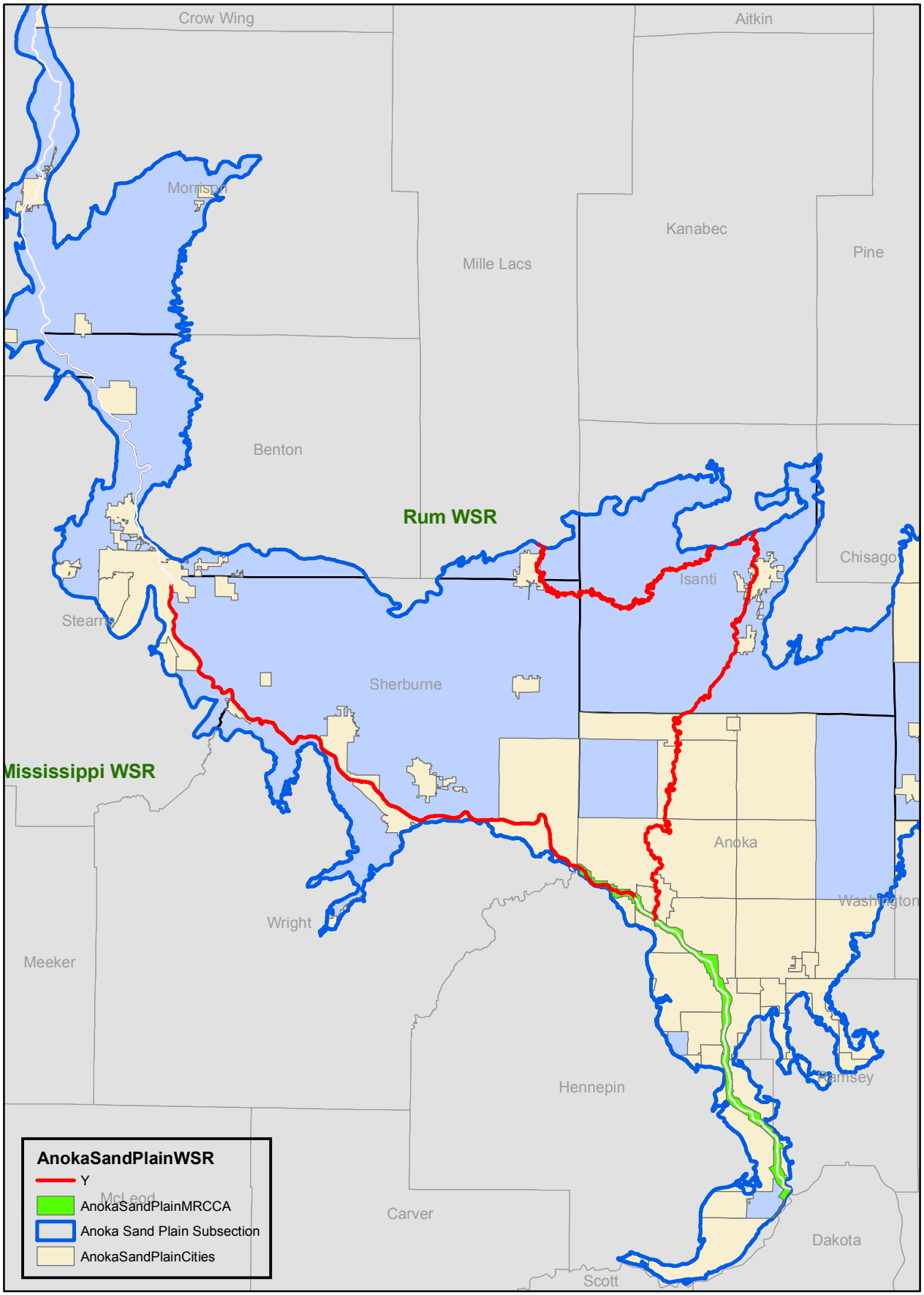
7.2 Wildlife Habitat Relationships -Mammal Habitat

Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Non-Forest land cover types>>> | Forest land cover types>>>

SPECIES GROUP Species common name	Habitat Feature		Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Up. coniferous/deciduous mix	Lowland Coniferous Forest								Upland Deciduous Forest					Lowland Deciduous Forest					Low. deciduous/coniferous		Forest size class				
				High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous	Lowland evergreen	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix			Seedling	Sapling	Pole timber	Saw timber	Uneven
American Badger							Y	Y	Y	Y																							Y															
Striped Skunk	DM				Y		Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y							Y	Y	Y	Y	Y
Northern Raccoon	CMRS		Y		Y		Y	Y		Y	Y		Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Black Bear	CDMR									Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
EVEN-TOED UNGULATES																																																
White-tailed Deer							Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
RODENTS																																																
Northern Flying Squirrel	CDMS																Y	Y	Y	Y	Y	Y	Y	Y	Y										Y								Y				Y	Y
Southern Flying Squirrel	CDMS																																Y	Y	Y	Y	Y	Y	Y						Y	Y	Y
Woodchuck					Y		Y	Y		Y	Y																						Y	Y									Y				
Eastern Gray Squirrel	CDM				Y		Y																	Y									Y	Y	Y	Y	Y									Y	
Eastern Fox Squirrel	CDM				Y			Y																									Y	Y	Y	Y		Y								Y	Y
Franklin's Ground Squirrel					Y			Y	Y	Y																																				Y	Y	
Thirteen-lined Ground					Y		Y	Y	Y	Y																																						
Least Chipmunk	DM								Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y						Y					Y									Y	Y	Y	Y	Y
Eastern Chipmunk	DM				Y			Y		Y	Y							Y	Y		Y	Y	Y	Y	Y								Y	Y	Y	Y	Y				Y				Y	Y	Y	Y	Y
Red Squirrel	CDMS																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y												Y			Y	Y	Y
American Beaver	R									Y	Y		Y												Y							Y													Y	Y	Y	Y	Y
Plains Pocket Gopher							Y	Y	Y	Y															Y	Y	Y	Y	Y				Y	Y	Y	Y	Y							Y	Y			
Woodland Jumping Mouse	DM																			Y	Y	Y		Y												Y	Y	Y			Y					Y	Y	Y	Y	Y
Meadow Jumping Mouse								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y		Y																						Y				
Woodland Deer Mouse								Y		Y							Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y		Y				Y	Y	Y	Y	
Prairie Deer Mouse																																																	
White-footed Mouse	CDMS									Y							Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y
Southern Red-backed Vole	DM									Y	Y	Y					Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Meadow Vole								Y		Y					Y	Y	Y	Y															Y	Y	Y	Y	Y											

Special River Features- Anoka Sand Plain Subsctn



Appendix J

Special Land Use Areas in Anoka Sand Plain Ecological Subsection

Wild and Scenic Rivers:

1. Mississippi- St. Cloud, Clearwater, Sherburne County, Becker, Monticello, Wright County, Elk River, Otsego, Ramsey, Dayton, Anoka County, Hennepin County
2. Rum- City of Anoka, City of Ramsey, Andover, Isanti County, Oak Grove, St. Francis, City of Isanti, Cambridge, Sherburne County, Mille Lacs County, Princeton

Mississippi River Critical Area Corridor: Ramsey, Dayton, Anoka, Champlin, Coon Rapids, Brooklyn Park, Fridley, Brooklyn Center, Minneapolis, St. Paul

Links

General Mississippi Scenic Riverway Management Plan:

http://files.dnr.state.mn.us/waters/watermgmt_section/wild_scenic/missplan_07-01-2004.pdf

General Rum River management Plan:

http://www.dnr.state.mn.us/waters/watermgmt_section/wild_scenic/wsrivers/rum_rules.html

City- and County-specific ordinances and plans

St. Cloud:

1. Mississippi WSR Corridor Plan: http://www.ci.stcloud.mn.us/Planning/RiverCorrPlan.aspx
2. Zoning Ordinance (Overlay Districts): http://www.ci.stcloud.mn.us/MainTopics/archive/LDC/Art12%20OVERLAY.pdf

City of Clearwater:

Comprehensive Plan: http://www.clearwatercity.com/vertical/Sites/%7B5630ACC5-D33A-4829-930C-570052E7B128%7D/uploads/%7B9B3476A8-B1B6-4494-A92F-4A1FE1C93A83%7D.PDF

Sherburne County:

1. Comprehensive Plan: http://www.co.sherburne.mn.us/zoning/pz/compplan.php
2. Zoning ordinance: http://www.co.sherburne.mn.us/zoning/pz/zoningord.php

City of Becker:

Zoning Ordinance: http://www.ci.becker.mn.us/vertical/Sites/%7BC7773ACF-6EFD-49C3-92E6-9C66D821361B%7D/uploads/%7B3454B212-A480-4BA8-96B3-7EFC88C60B8F%7D.PDF

Monticello:

1. Zoning Ordinance: http://www.ci.monticello.mn.us/index.asp?Type=B_BASIC&SEC={6EAAF2C4-E5F1-46EE-8310-5E14734F8566}&DE={E8F3021B-1F1B-417B-9E92-CD39396F2FF7}
2. Comprehensive Plan: http://www.ci.monticello.mn.us/index.asp?Type=B_BASIC&SEC=%7B7E69C402-ED23-4BF2-8D63-B77887B3BC71%7D

Wright County:

1. Comprehensive Plan: http://www.co.wright.mn.us/forms/pandz/Land%20Use%20Plan%20NEQ%20Adopted%207-31-07.pdf
2. Zoning Ordinance: http://www.co.wright.mn.us/forms/pandz/ordinance.pdf

Elk River:

1. Comprehensive Plan: http://www.ci.elk-river.mn.us/vertical/Sites/%7B18493844-E9A7-4BC5-BA1B-5149BB77ECC4%7D/uploads/%7B54AB0630-8AE6-439B-B479-6EBE534B43AC%7D.PDF
2. Zoning Ordinance: http://library.municode.com/index.aspx?clientId=13427&stateId=23&stateName=Minnesota

Otsego:

Zoning Ordinance: http://www.ci.otsego.mn.us/index.asp?Type=B_BASIC&SEC={9731CC57-AF4F-46B6-BCC4-1A93E991BEBE}

City of Ramsey:

1. Ordinances: http://library.municode.com/index.aspx?clientId=14286&stateId=23&stateName=Minnesota
2. Comprehensive Plan: http://www.ci.ramsey.mn.us/departments/commdev/planning/compplan.aspx

Dayton:

1. Comprehensive Plan: http://www.cityofdaytonmn.com/comprehensiveplan.html
2. Zoning Ordinance: http://www.amlegal.com/nxt/gateway.dll?xhitlist_q=zoning&f=xhitlist&xhitlist_x=Advanced&xhitlist_s=&xhitlist_d=&xhitlist_hc=&xhitlist_xsl=xhitlist.xsl&xhitlist_vpc=first&xhitlist_sel=title%3Bpath%3Bcontent-type%3Bhome-title%3Bitem-bookmark&global=hitdoc_g_&hitdoc_g_dt=altmain-nf.htm

Hennepin County:

Comprehensive Plan: http://www.co.hennepin.mn.us/files/HennepinUS/Transportation/Road%20and%20Bridges/Road%20&%20Bridge%20General%20Information/2030%20Comprehensive%20Plan/2030%20Comprehensive%20Plan%20Small.pdf

City of Anoka:

1. Environmental Code: http://www.ci.anoka.mn.us/index.asp?Type=B_BASIC&SEC={D49D28C8-4188-44A6-9CDB-3FA3CEC59250}&DE={87CE0AF2-798E-4684-B45E-1305CAC08C2C}
2. Comprehensive Plan: http://www.ci.anoka.mn.us/index.asp?Type=B_BASIC&SEC={42247A76-3351-4BF7-9AF4-EF8D4B9E26FD}&DE={8DC25683-AC84-42FE-B9C8-AFCD63DDE009}

Andover:

1. Water Resource Management Plan: http://files.andovermn.net/pdfs/Planning/CompUpdate/2008%20Comp%20Plan_Final%20Approved%20Documents/Chapter%20Four_Water%20Resources%20Management%20Plan.pdf
2. Planning and Development ordinance: http://files.andovermn.net/pdfs/Clerk/CityCode/TITLE_13_Planning_and_Development.pdf

Isanti County:

1. County Comprehensive Plan: http://www.co.isanti.mn.us/zoning/IsantiCoFinalComprehensivePlan-020509.pdf
2. County Zoning Ordinance: http://www.co.isanti.mn.us/zoning/zoningordinancefinalcopy2010.pdf

Oak Grove:

List of Ordinances: http://www.ci.oak-grove.mn.us/index.asp?Type=B_BASIC&SEC={C781C6E7-8A52-44B1-88FB-1ADE7FC7C3CC}

St. Francis:

1. Rum River Management Plan: http://www.stfrancismn.org/uploads/Code_Z_-_Chapter_82_-_Rum_River_Management.PDF
2. Wetland Management Plan: http://www.stfrancismn.org/uploads/Code_Z_-_Chapter_91_-_Wetland_Impacts.PDF
3. Rivers, Streams, Public Waters Plan: http://www.stfrancismn.org/uploads/Code_Z_-_Rivers___Streams_Impacts.PDF

City of Isanti

1. Comprehensive Plan: http://www.cityofisanti.us/government/comprehensive-plan

2. Zoning Ordinances: http://www.cityofisanti.us/government/ordinances-code

Cambridge:

Land Use Ordinance: http://www.ci.cambridge.mn.us/vertical/Sites/%7B5533C7E1-8680-4785-B452-36CB5E1255D8%7D/uploads/Title_XV_Land_Usage.pdf

Mille Lacs County:

1. Zoning Ordinance: http://www.co.mille-lacs.mn.us/vertical/Sites/%7BC9C389E6-53AB-4A89-94CA-D3EE1F5EB922%7D/uploads/%7B21533139-5C4C-442E-9EC8-6C95CB59877D%7D.PDF
2. Local Water Management Plan: http://www.millelacsswcd.org/water_plan.htm
3. Shoreland/Wild and Scenic Regulations: http://www.co.mille-lacs.mn.us/index.asp?Type=B_BASIC&SEC={5BE1136A-4116-4394-9C22-436CDF546F1B}&DE=
4. Wild and Scenic/Wetland Regulations: http://www.co.mille-lacs.mn.us/index.asp?Type=B_BASIC&SEC={7E63A77A-DD0B-4D0A-BA33-C616F2DEEAA0}

Princeton:

Zoning Ordinance: http://princetonmn.org/index.asp?Type=B_LIST&SEC={268FC4DA-5DBD-40B4-915A-990284771185}

Champlin:

Comprehensive Plan: http://ci.champlin.mn.us/2030ComprehensivePlan.html

Coon Rapids:

1. Comprehensive Plan: http://www.ci.coon-rapids.mn.us/planning/ComprehensivePlan.htm
2. Land Development Regulations: http://www.ci.coon-rapids.mn.us/citycode/index.htm

Brooklyn Park: relevant ordinances and plans are not on the city website.

Fridley:

Comprehensive Plan: http://www.ci.fridley.mn.us/2030-comprehensive-plan-final

Brooklyn Center:

1. Zoning Ordinance: http://bc-img.ci.brooklyn-center.mn.us/WebLink8/DocView.aspx?id=233616&dbid=0
2. Comprehensive Plan: http://www.cityofbrooklyncenter.org/index.aspx?NID=606

Minneapolis:

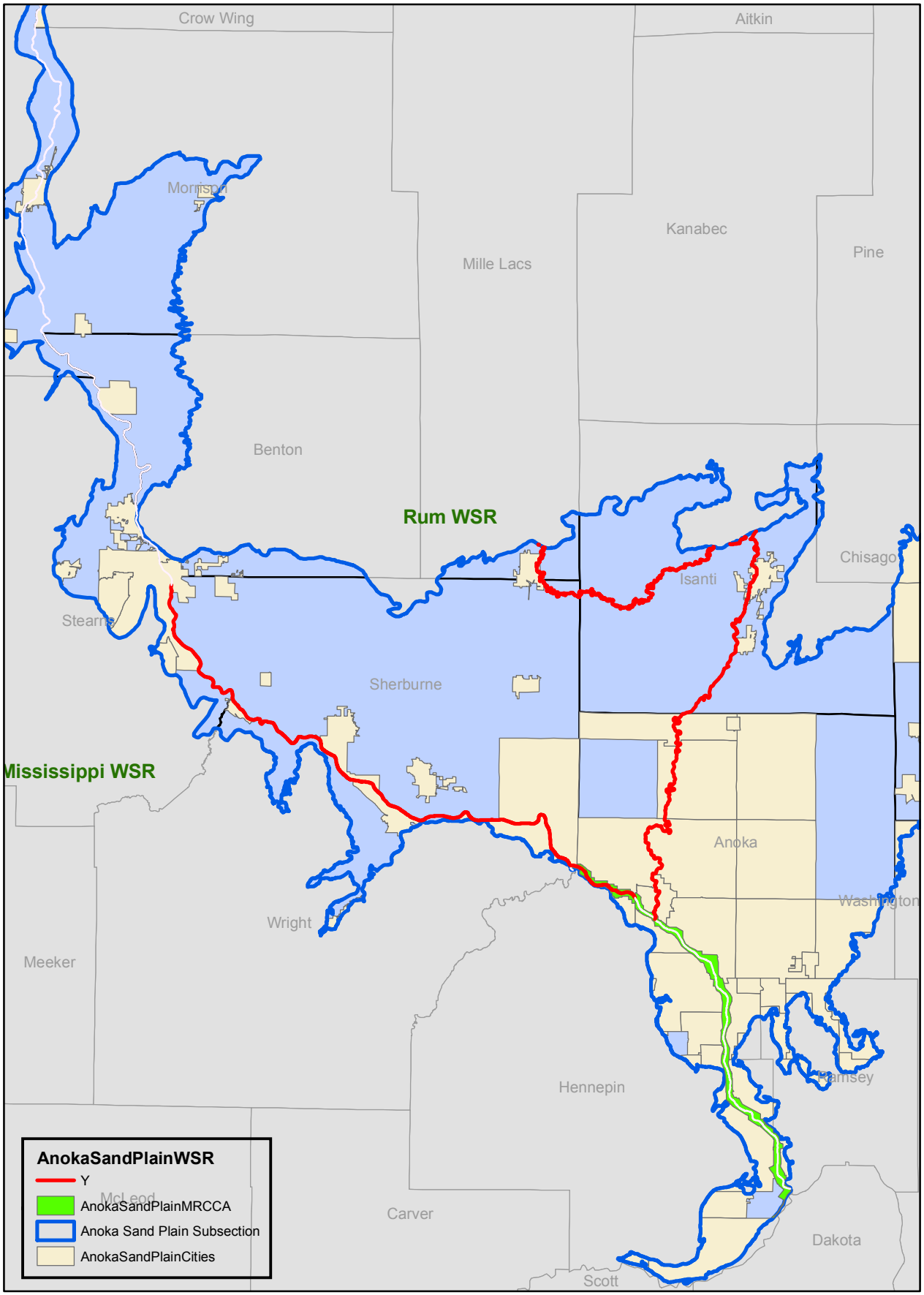
1. Zoning Ordinance (overlay districts): http://library.municode.com/index.aspx?clientId=11490&stateId=23&stateName=minnesota&ds=zoning

2. Comprehensive Plan: http://www.minneapolismn.gov/CPED/comp_plan_update_draft_plan.asp

St. Paul:

1. Comprehensive Plan: http://www.stpaul.gov/index.aspx?NID=3427
2. Mississippi River Corridor Plan: http://www.stpaul.gov/DocumentView.aspx?DID=11023
3. Zoning Ordinance: http://library.municode.com/index.aspx?clientID=10061&stateID=23&statename=Minnesota

Special River Features- Anoka Sand Plain Subsctn



Appendix K MN USFWS and MN DNR Local Agreement Statement

FWS MN - MN DNR local agreement statement:
On prescribed fire, FWS and MN DNR may accept each other's qualifications including fitness, at the discretion of the FWS Project Leader or designee, and MN DNR Region or Area discipline Supervisor or designee. This will involve review and concurrence by FWS and MN DNR, of prescribed fire projects to mutually determine appropriate qualifications. Qualifications will be based on the agencies respective databases (IQCS for the FWS, IQS for MN DNR).

FWS constraint: FWS policy (621 FW 3) requires that if a cooperator will be supervising FWS employees on the burn operation, he/she must meet FWS qualification and experience standards. FWS qualification and experience standards are essentially the same as the NWCG Interagency Wildland Fire Qualifications Guide (310-1). This constraint may be mitigated by the FWS providing a Chief of Party. The FWS Chief of Party will be responsible for working with MNDNR resources to jointly provide for the general oversight and safety of all personnel involved in the project.

Agency/Burn Unit:
Resources provided:

APPENDIX L

Comments Received
and
Responses to Comments

Background
A public comment period for the *Anoka Sand Plain Subsection Forest Resource Management Plan* ended on March 8, 2012. Comments were accepted via letter, email, or fax. The comments received are identified below and is an excerpt from the complete submitted comment. The complete correspondence is available by contacting the department. For each comment a response is provided. Where appropriate, actions resulting from the comment are identified.

Comments were received from the following:

- Daniel R. Vollhaber, a landowner adjacent to the Sand Dunes State Forest by email dated February 14, 2012; and,
- Steve Nelson, a consulting forester located in Kanabec County, by email dated March 8, 2012.

Responses to Comments Received

Comments from Daniel R. Vollhaber:
Comment 1:
Under the heading "Background and Impetus for Plan", it states that "pines were planted to stabilize the shifting dunes during times of drought". With the proposed plan to remove the pines now growing in the "Immediate Rare Features Management" area, and to periodically burn the area, why won't erosion and shifting dunes be a problem again?

Response:
Within the Immediate Rare Features Management Area the intent is to establish prairie species. Prescribed burning will not permanently remove ground cover, the root layer remains. The ground cover will re-vegetate and will be enhanced. Some exposed soils may evolve, particularly on south facing slopes and drier sites. This however is anticipated and specifically intended. Over time, monitoring of the implemented management objectives will be completed to determine the impact of the specific prescriptions such as unintended erosion with appropriate actions taken as necessary.

Comment 2:
ATV encroachment has and continues to be a problem in this area. Removing most of the forest will certainly make access easier for illegal ATV riding. Won't this be a problem while trying to promote the new vegetation goals of the plan?

Response:
The Sand Dunes State Forest is currently a Closed Forest, meaning it is closed to ATV use. This SFRMP does not alter the status of Sand Dunes State Forest as a Closed Forest. Illegal ATV use is addressed as needed throughout the state forest system. As appropriate, the department imposes enforcement actions. The department has a comprehensive procedure to address illegal ATV operations. The department's position is that appropriate forest management is the priority and should be implemented. Secondary effects of the adopted forest management such as the potential for illegal ATV impacts will be addressed as necessary. The potential for secondary effects, such as illegal ATV use should not drive forest vegetation management.

Comment 3:
As stated above, with Oak Wilt being an on-going problem, is a healthy Oak Savanna ecosystem really likely to work? I know from first hand experience that the Bur Oaks do indeed succumb to Oak Wilt. I have personally lost Bur Oaks on many occasions, some dying quickly and some very slowly.

Response:
Oak savannas are naturally less susceptible to oak wilt because there is less opportunity for root grafting (i.e., trees are generally more spread out), which is a primary means of infection between trees. Savannas usually contain more bur oak, which is less susceptible to oak wilt than pin and red oak.

One primary objective of the *Operational Plan for the Management of the Sand Dunes State Forest (SDSF Operations Plan)* is to restore the native plant communities that were once more prevalent in the area. For the SDSF, the department has arrived at this objective following a comprehensive process designed to consider all appropriate factors. This direction, as developed for the SDSF is consistent with broader department-wide effort to more fully incorporate native plant community information as vegetation management decisions are implemented across all state-administered lands.

In managing for the native plant community, the department, and the *SDSF Operations Plan* recognizes that disease, insects or catastrophic events may require continual reevaluation of any particular management objective. The department and the draft *SDSF Operations Plan* recognizes that "adaptive management" must always be considered and implemented where appropriate. The draft *SDSF Operations Plan* states:

> "Adaptive Management entails a multi-step process:
> 1. Considering various actions to meet management objectives;
> 2. Predicting the outcomes of these management actions based on what is currently known;
> 3. Implementing management actions;
> 4. Monitoring to observe the results of those actions; and
> 5. Using the results to update knowledge and adjust future management actions accordingly."
>
> Further, the Operations Plan states that:
>
> "With uncertainties of reintroducing certain management practices within Sand Dunes State Forest, such as the introduction of prescribed fire into this landscape that is considered a fire dependent forest/woodland ecosystem with some areas similar to an oak savanna community and others more open prairie or woodland due to the additional influence on the dunes landscape of slope and aspect, adaptive management will be utilized to make educated management decisions with the ability to observe and evaluate if management objectives are being accomplished or if future management practices need to be implemented to obtain the desired habitat conditions."

Examples of "adaptive management" techniques that may be implemented in areas where oak wilt is a concern include:

- Root graft disruption (vibratory plowing);
- Remove infected trees;
- Manage for less susceptible species (white or bur oak);
- Plant oak seedlings among the dying oaks in an infection center (most of the seedlings will not graft to the roots of the dying oaks); and,
- Maintain wider spacing between individual trees or groupings of trees to minimize the chance of spread throughout the site.

- In some instances, field staff may find that oak wilt poses such a challenge that diversification with non-oak timber species is the adapted direction.

Comment 4:
Page 2 of the Sand Dunes plan states that "2,538 acres would be managed permanently for rare and natural features (zones 2, 3, and 4)". It does not mention recreation. Would hunting and the recreation currently allowed continue??

Response:
Hunting and recreation would be continued in the future consistent within the overall rules / policies for the SDSF. The specific forest vegetation management implemented for any area or stand does not affect the overall hunting and recreation use rules or policies in place for that area or stand.

Comment 5:
Found on Page 3, Zone 3: Immediate Rare Features Management: It states that "areas within this zone have few pine plantings other than Jack Pine". I would disagree with this, much of the Jack Pine in this region has already been removed because of disease and insect problems.

Response:
The response to this comment is a point of clarification: The *SDSF Operations Plan* states that few pine plantings have occurred, meaning an observation on the historical practices ("few pine plantings") have occurred. This statement from the *Operations Plan* observes only that few plantings have occurred. It is not attempting to state that jack pine is a dominant cover type. The comment observes that jack pine has been removed because of disease and insects. Both statements are correct. These are viewed as different observations. The *SDSF Operations Plan* will be revised to clarify the meaning of "few pine plantations."

Comment 6:
In addition, there is an area of Norway Pine (approximately 30 acres) located in the most SW portion of the SE area of the State Forest that was just recently thinned. This area of red pine is far from mature and is shown on Appendix 7 – Planned Ten Year Timber Harvest. This area is shown to be removed in 2013 (shaded light blue). Why would this area not be allowed to reach maturity? The plan discusses how Norway Pine harvested by commercial loggers brings a premium due to summer harvest. There are other areas in the "Immediate Rare Features" zone that also have a mixture of White and Norway Pine. The same question here: why not allow the pine to reach maturity before removal?

Response:
In the Immediate Rare Features Management Areas as identified in the *SDSF Operational Plan*, management for rare species and management for the native plant community have been identified as the priority direction. The presence of the pine as questioned by the commenter prevents the restoration to the native plant community. Because of the rare and distinct ecological and geological features that occur within Sand Dunes State Forest, the DNR Divisions of Forestry, Ecological and Water Resources, and Fish and Wildlife have determined to protect and restore these unique natural features in selected areas of the state forest (i.e. the Immediate Rare Features Areas). These areas will be restored to conditions that support sustaining these rare plant and animal species and the underlying native plant communities including oak savanna, prairie, oak woodland, tamarack swamp, emergent marsh, and sedge meadow, on which they depend. When lands, such as are found in the SDSF, offer high quality competing resources, management efforts are made to balance these competing objectives.

This balance will be achieved through the identification of the Immediate Rare Features area (as noted by the commenter); the Eventual Rare Features area; and, the Long Term Forest Management zone. Within the Immediate Rare Features Area (513 acres) during the ten-year plan implementation period, the objective is to manage for rare features and species and the native plant community. In the Eventual Rare Features area (1,348 acres), the objective is also to manage for the rare features and native plant community, but to allow the pines to reach their normal rotation age (80 years) before final harvest. In some stands, within the Eventual area, this will take up to 50 to 60 years. Until they reach final harvest these pine stands will be thinned, consistent with normal stand management practices. In the Long Term Forest Management area (2,840 acres) intensive forest management for pine, oak, and other species will continue, (thinning, final harvest, followed by planting or regeneration). Management for timber production will be the priority direction.

The underlying support for the Immediate, Eventual and Long Term Forest Management directions includes that the Sand Dunes State Forest contains a number of rare geologically and ecologically significant features. Sand dune formations are rare in Minnesota, and the dune fields found on the Anoka Sand Plain are the largest and best formed dunes remaining in the state. The dune ecosystem within the state forest supports a diverse array of native plant communities as well as a number of rare plant and animal species of conservation concern. There are four globally-ranked native plant communities within the SDSF boundaries, five sites ranked by the Minnesota County Biological Survey (MCBS) as outstanding biodiversity significance, and six MCBS sites ranked as high biodiversity significance. One of the native plant communities, dry barrens oak savanna, is considered the most imperiled native plant community in the Midwest, occupying approximately 0.02% of its pre-European settlement extent. Sand Dunes State Forest also contains five state-listed species of plants and nine state-listed species of animals that depend upon the open dry prairie and savanna habitats that occurs in the dune areas. Oak woodland and associated wetland habitat also support a number of rare species.

Comment 7:

Page 7 under the heading "Methods for Oak Savanna Restoration" it discusses fire and controlled burns being a key element. This western portion of the SE State Forest is bounded by private properties on three sides, of which my property lies along most of the western edge. This area is only about 1,300' wide north and south. I am concerned that using prescribed burns in this type of an area is not safe or practical. The private property lying along the northern edge of this area is homes surrounded by field grasses. It would seem likely, that eventually a controlled burn would escape either my direction of elsewhere! Once would obviously be once too many. In my opinion, this area is not the ideal place for controlled burns. It is too narrow and is surrounded by private property on three sides. Using prescribed burns elsewhere, where there is more room, would seem to make more sense.

Response:

The department has identified and practices rigorous protocol to ensure that prescribed burns are carried out in a safe and effective manner. Where prescribed fire may result in risk to adjacent property, alternatives to accomplishing the management objective will be implemented. A specific Strategy in the ASP SFRMP has been recommended in response to situations as identified in the comment:

> *"When use of prescribed fire presents challenges, consider alternative techniques (e.g. herbicides, mechanical treatment, etc.) to accomplish resource management objectives where variables make prescribed fire inappropriate."*

The ASP SFRMP recognizes that the use of prescribed fire will not be possible in many instances. Before fire is prescribed as a management technique site visits, contingency planning and all appropriate precautions and safeguards are established. Further as recognized elsewhere in these Responses, when on-the-ground factors do not allow the use of a preferred management technique, "adaptive management" guidelines and directions are explored.

Comments from Steve Nelson:
Comment 1:
Step # 1 should be (to) correct Ecosystem I.D.
The Anoka Sandplain proper -- about 650,000 acres -- is 95 % or more a Forest Ecosystem and cannot sustain prairie or oak savanna (a prairie) ecosystems.

The Anoka Sandplain LTA should be changed, so prairie ecosystems like the west part (see attached map) will be part of the Mississippi- St Croix River Terraces Sub Section, which are Prairie Ecosystems.
So, call that west part a new LTA and name it something like West Sand Plain Savannas LTA or whatever.
*On the east side of the Anoka Sand Plain LTA, you will have an inclusion of 4 oak savanna parcels (2 in Isanti Co, 2 in Chisago Co) totalling between 5,000 and 6,000 acres. These are prairie ecosystems and vary considerably from the Anoka Sandplain (Entisol Soils) Forest Ecosyste*m.

Response:
The department recognizes the expertise of the commenter and observes that the information and maps supplied offer details which may have a bearing on future SFRMP planning processes, but is considered to be beyond the scope of this particular SFRMP. The ecological classification system landscapes and land type associations adopted by the department result from a comprehensive and thorough evaluation of all relevant factors. The Minnesota Department of Natural Resources and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota following the National Hierarchical Framework of Ecological Units (ECOMAP 1993). Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. ECS mapping enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale.

Subsections are units within Sections that are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief, and the distribution of plants, especially trees. Minnesota has 26 subsections.

Land Type Associations are units within Subsections that are defined using glacial landforms, bedrock types, topographic roughness, lake and stream distributions, wetland patterns, depth to ground water table, soil parent material, and pre-European settlement vegetation. Minnesota has 291 land type associations.

The information supplied by the commenter will be made available to appropriate department personnel as ECS subsection or land type association boundaries are considered for revisions.

Comment 2:
Step 2. Your e asking for trouble if you want to turn 3,000 acres of Sand Dunes State Forest into oak savanna. If you--DNR-- would just look at your results over the past 30 - 40 years at Sherburne Refuge, Cedar Creek, Uncas Dunes SNA and Rice Lake Savanna SNA ...All forest ecosystems by the way,

*you would see that these lands are growing back to northern pin oak monoculture forests that sustain inoculum of oak wilt disease. These monoculture forests are not oak sav*annas and not prairie ecosystems.

Response:
The department has adopted an overall objective of managing for the native plant community. This objective applies to the ASP subsection as well as all state administered lands. In implementing this direction the native plant community database is continually updated though on-site soils information. As stated above in these Responses, the ECS and land type association system and boundaries implemented are consistent with national standards designed to consider the broadest range of factors which influence plant communities. There is no intent to return to a monoculture forest of pin oak. Specifically stand treatment prescriptions will manage to reduce densities to reflect natural woodland, savanna and prairie systems. To combat oak wilt, the *SDSF Operations Plan* recognizes that adaptive forest management will be practiced. As site visits are made, all relevant factors will be taken into consideration to arrive at the final stand management objectives and prescriptions implemented to achieve the objective. Where oak wilt is seen as a stand concern, treatments will be adapted to reduce the potential for oak wilt to become established.

Comment 3:
If you encourage aspen growth in other than Lino or Anoka soils, you could run into trouble because aspen clones don't allow forest species diversity.

Further clarification from the commenter: There was a reference or inference in the plan to having or increasing / maintaining certain acreages of aspen. And, since the biggest threats to forests and savannas nowadays are monocultures and the pests that invade them...

Aspens grow in clones so can be lumped into the category of monocultures; they (aspen clones) are pretty exclusive in that they don't allow for other hardwood and conifer species to survive/reproduce within those clones.

Everybody from every discipline or point of view Cannot Argue against the need for species diversity. When you get a northern pin oak monoculture forest growing back as a result of ill-conceived oak savanna restorations, or you reproduce aspen clones (monoculture) resulting from prescribed burning....you 've just reduced hundreds if not several thousand acres of species diversity.

Response:
Over the ten year plan implementation period, the ASP SFRMP identifies a slight decrease in the aspen cover type. Aspen is not the primary cover type within the Anoka Sand Plain as can be found in some other portions of the state. Although aspen reproduces as clones, typically other secondary species are found such as northern hardwoods, white pine and black ash. In the ASP, encouraging aspen does not necessarily lead to a monoculture cover type.

Soils are considered when final prescriptions and management objectives are determined at the time of site visit. Field staff assesses soils as part of the Silviculture Prescription Worksheet. Field staff make on site decisions concerning if the soils are suitable for the intended management objective (meaning encourage aspen). Further, not all management objectives are intended to encourage forest species diversity. Some forest is managed primarily for timber production and not necessarily for diversity.

Comment 4:
Step #4. We've been waiting for you to find the only genuine, native oak savanna on public lands on the Anoka Sandplain...all 6 acres worth, a mile and a half southwest of Santiago. You haven't restored it yet, and by now, half of this six acres of native oak savanna is dead of oak wilt. So, shouldn't the DNR, USFWS, Great River Greening and UofM lead by example before they get any more Funding?

Response:
As stated in Responses above, a primary objective of the department is to manage for the native plant community. The department utilizes the ecological classification system / native plant community observation to provide direction on appropriate management for the site. By applying these methods, lands are successfully managed as savanna restorations. The department notes that soil is not the only factor which determines a successful savanna restoration. Other factors including slope, aspect and frequency of fire play significant roles in savanna restoration.

List of organizations and individuals that submitted Comments on the Draft Anoka Sand Plain Subsection Forest Resource Management Plan

The following individuals / organizations have submitted comments on *the Draft Anoka Sand Plain Subsection Forest Resource Management Plan*

1. Daniel R. Vollhaber, 16124 231st Avenue, Elk River, MN.
2. Steve Nelson, Consulting Forester, 2033 140th Ave, Mora, MN.

APPENDIX M
Glossary

Acre: An area of land containing 43,560 square feet, roughly the size of a football field, or a square that is 208 feet on a side. A "forty" of land contains 40 acres and a "section" of land contains 640 acres.

Area forest resource management plan (AFRMP): Successor to timber management planning (TMP), recognizing that TMP discussions and decisions affected or included a lot more than the decision to harvest. This should not be confused with the comprehensive FRMPs developed for a number of areas in the mid to late-1980s.

Access route: A temporary access or permanent road connecting the most remote parts of the forest to existing public roads. Forest roads provide access to forestlands for timber management, fish and wildlife habitat improvement, fire control, and a variety of recreational activities. Also, see *Forest road*.

Age class: An interval, commonly 10 years, into which the age range of trees or forest stands is divided for classification or use.

Age-class distribution: The proportionate amount of various age classes of a forest or forest cover-type within a defined geographic area (e.g., ecological classification system subsection).

All-aged: An uneven-aged stand that represents all ages or age classes from seedlings to mature trees.

Animal aggregations: A concentration of animals (of rare or common species or a mixture of rare and common) that occurs during part or all the species life cycle, such that when these animals are in these aggregations, they are highly vulnerable to disturbance. Examples are colonial water bird nesting sites, bat hibernacula, and mussel beds.

Annual stand examination list: List of stands to be considered for treatment in a particular year that was selected from the 10-year stand examination list. Treatment may include harvest, thinning, regeneration, prescribed burning, re-inventory, etc.

Annual work plan: The annual work responsibilities at the area (i.e., Division of Forestry administrative boundary) documented for the fiscal year.

Artificial regeneration: Renewal of a forest stand by planting seedlings or sowing seeds.

Assessment: A compilation of information about the trends and conditions related to natural and socio-economic resources and factors. The initial round of Subsection Forest Resource Management Plans (SFRMP) will focus primarily on trends and conditions of forest resources. Standard core assessment information sources and products have been defined.

Basal area: The cross-sectional area of a tree taken at the base of the tree (i.e., measured at 4.5 feet above the ground). Basal area is often used to measure and describe the density of trees within a geographic area using an estimate of the sum of the basal area of all trees cross-sectional expressed per unit of land area (e.g., basal area per acre).

Biodiversity (biological diversity): The variety and abundance of species, their genetic composition, and the communities and landscapes in which they occur, including the ecological structures, functions, and processes occurring at all of these levels.

Biodiversity Significance: The relative value, in terms of size, condition and quality, of native biological diversity for a given area of land or water. *(Adapted from: Guidelines for MCBS Statewide Biodiversity Significance Rank):* The Minnesota County Biological Survey uses a statewide ranking system to evaluate and communicate the biodiversity significance of surveyed areas (MCBS Sites) to natural resource professional, state and local government officials, and the public. MCBS Sites are ranked

according to several factors, including the quality and types of *Element Occurrences*, the size and quality of native plant communities, and the size and condition of the landscape within the Site. Areas are ranked as *Outstanding, High, Moderate, or Below the Minimum Threshold* for statewide biodiversity significance. (*Draft definition 3/24/2004*)

> ***Outstanding Sites:*** Those containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state.
> ***High Sites:*** Those containing the Best of the rest@, such as sites with very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes.
> ***Moderate Sites:*** Those containing significant occurrences of rare species, and/or moderately disturbed native plant communities and landscapes that have a strong potential for recovery.
> ***Sites Below the Minimum Threshold:*** Those lacking significant populations of rare species and/or natural features that meet MCBS minimum standards for size and condition. These include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movements, buffers surrounding higher quality natural areas, and open space areas.

Board foot: A unit of measuring wood volumes equaling 144 cubic inches. A board foot is commonly used to measure and express the amount of wood in a tree, sawlog, veneer log, or individual piece of lumber. For example, a 16-inch diameter at breast height (DBH) standing tree that is 80 feet tall contains approximately 250 board feet of wood and a tree with a 30-inch DBH and 80 feet tall contains about 1000 board feet or one metric board foot (MBF). A piece of lumber one cubic foot (1 foot x 1 foot x 1 inch) contains one board foot of lumber.

Browse: (n) Portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer and rabbits. (v) To feed on leaves, young shoots, and other vegetation.

Carr: Deciduous woodland or scrub on a permanently wet, organic soil. A carr develops from a bog, fen or swamp.

Clearcut: The removal of all or most trees during harvest to permit the re-establishment of an even-aged forest. A harvest method used to regenerate shade-intolerant species, such as aspen and jack pine.

Coarse woody debris: Stumps and fallen tree trunks or limbs of more than 6-inch diameter at the large end.

Coarse filter: Management of lands from a local to landscape scale that addresses the needs of all or most species, communities, environments, and ecological processes. In using a coarse filter approach (Hunter, 1990), it assumes that a broad range of habitats encompassing the needs of most species needs will be met, and their populations will remain viable on the landscape.

Cohort: a group of trees developing after a single disturbance, commonly consisting of trees of similar age.

Collaboration: A group in which members identify with the group and seriously consider the group's overall charge. Group members assume collective responsibility for outcomes, are interdependent, and have a joint ownership of decisions.

Common forest inventory: Also, known as CCSA (Common Cooperative Stand Assessment). Forest inventory stand data compiled by the Minnesota Interagency Information Cooperative from public agencies including the Minnesota DNR, Superior and Chippewa National Forests, and county land departments (2001). The common format contains the common attributes found in the state, federal, and counties forest inventories.

Competition: The struggle between trees to obtain sunlight, nutrients, water and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

Comprehensive DNR subsection plans: Address Minnesota Department of Natural Resources (DNR) programs and activities within the subsection. Involves programs and activities of multiple DNR divisions, not just the Division of Forestry.

Comprehensive Division of Forestry SFRMPs: Address other aspects of forest resource management on DNR Forestry lands (e.g., recreation, land acquisition/sales, fire management, and private forest management).

Connectivity: An element of spatial patterning where patches of vegetation such as, forest types, native plant communities or wildlife habitats are connected to allow the flow of organisms and processes between them.

Conversion: A change through forest management from one tree species to another within a forest stand or site.

Cooperative stand assessment (CSA): The forest stand mapping and information system used by the DNR to inventory the approximately five million acres (7,800 square miles) owned and administered by the state. The spatial information and stand attributes are now maintained in the Forest Inventory Module (FIM).

Cord: A pile of wood 4 feet high, 4 feet wide, and 8 feet long, measuring 128 cubic feet, including bark and air space. Actual volume of solid wood may vary from 60 to 100 cubic feet, depending on size of individual pieces and how tight the wood is stacked. In the lake states, pulpwood cords are usually four feet x four feet x 100 feet and contain 133 cubic feet. Pulpwood volume of standing trees is estimated in cords. For example, a 10-inch DBH tree, which is 70 feet tall, is about 0.20 cords; or five trees of this size would equal one cord of wood.

Corridor: A defined tract of land connecting two or more areas of similar habitat type through which wildlife species can travel.

Cover-type: Expressed as the tree species having the greatest presence (i.e., in terms of volume for older stands or number of trees for younger stands) in a forest stand. A stand where the major species is aspen would be called an aspen cover type.

Cover type distribution: The location and/or proportionate representation of cover types in a forest or a given geographic area.

Critical habitat: habitat or habitat elements that must be present and properly functioning to assure the continued existence of the species in question.

Crop tree: any tree selected or retained to be a component of a future commercial harvest.

Cruise: (v) A survey of forestland to locate timber and estimate its quantity by species, products, size, quality, or other characteristics. (n) An estimate derived from such a survey.

Cubic foot: A wood volume measurement containing 1,728 cubic inches, such as a piece of wood measuring one foot on a side. A cubic foot of wood contains approximately six to 10 usable board feet of wood. A cord of wood equals 128 cubic feet.

Cultural resource: An archaeological site, cemetery, historic structure, historic area, or traditional use area that is of cultural or scientific value.

Desired future forest composition (DFFC) goals: Broad vision of landscape vegetation conditions in the long-term future. For the purposes of the initial round of subsection planning, DFFC goals will focus on future desired forest composition looking ahead 50 years. DFFC goals may include aspects like 1) the amount of various forest cover types within the subsection, 2) age-class distribution of forest cover types, 3) the geographic distribution of these across the subsection, and the related level of management for even-aged forest, 4) extended rotation forest, etc.

Disturbance: Any event, either natural or human induced, that alter the structure, composition, or functions of an ecosystem. Examples include forest fires, insect infestation, windstorms, and timber harvesting.

Disturbance regime: Natural or human-caused pattern of periodic disturbances, such as fire, wind, insect infestations, or timber harvest.

Dominant trees: Trees that are in the upper layer of the forest canopy, larger than the average trees in the stand.

Early successional forest: The forest community that develops immediately following a removal or destruction of vegetation in an area. Plant succession is the progression of plants from bare ground (e.g., after a forest fire or timber harvest) to mature forest consisting primarily of long-lived species such as sugar maple and white pine. Succession consists of a gradual change of plant and animal communities over time. Early succession forests commonly depend on and develop first following disturbance events (e.g., fire, windstorms, or timber harvest). Examples of *early successional forest* tree species are aspen, paper birch, and jack pine. Each stage of succession provides different benefits for a variety of species.

Ecological classification system (ECS): A method to identify, describe, and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil, and vegetation data. (See Appendix A.)

Ecological evaluation: A concise report containing descriptions of the significant natural features of a site, such as the flora, fauna, rare features, geology, soils, and any other factors that provide interpretation of the site's history, present state, and biodiversity significance. Management and protection recommendations are often included in these reports. Evaluations are produced by the MCBS at the completion of work in a given county or ECS subsection, and are generally reserved for those sites with the highest biodiversity significance in a geographic region, regardless of ownership.

Ecological integrity: In general, ecological integrity refers to the degree to which the elements of biodiversity and the processes that link them together and sustain the entire system are complete and capable of performing desired functions. Exact definitions of integrity are relative and may differ depending on the type of ecosystem being described.

Ecologically important lowland conifers (EILC): includes stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands, that are examples of high quality native plant communities (NPC) that are representative of lowland conifer NPC's found in the subsections. The designated EILC stands will be reserved from treatment during this 10-year planning period. Future management/designation of these stands is yet to be determined.

Ecosystem based management: The collaborative process of sustaining the integrity of ecosystems through partnerships and interdisciplinary teamwork. Ecosystem based management seeks to sustain ecological health while meeting social and economic needs.

Element Occurrence (EO): An area of land and/or water where a rare feature (plant, animal, natural community, geologic feature, animal aggregation) is, or was present. An Element Occurrence Rank provides a succinct assessment of estimated viability or probability of persistence (based on condition, size, and landscape context) of occurrences of a given Element. An Element Occurrence Record is the locational and supporting data associated with a particular Element Occurrence. Element Occurrence

Records for the State of Minnesota are managed as part of the rare features database by the Natural Heritage and Nongame Research Program. (Draft definition 3/24/2004, Adapted from Biotics EO Standards: Chapter 2)

Endangered species: A plant or animal species that is threatened with extinction throughout all or a significant portion of its range in Minnesota.

Even-aged: A forest stand composed of trees of primarily the same age or age class. A stand is considered even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years).

Evenflow: Providing a relatively consistent amount of timber (or other products) in successive management periods.

Exotic species: Any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, which is not native to that ecosystem, and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Extended rotation forests (ERF): Forest stands for which the harvest age is extended beyond the normal or economic harvest age. ERF provides larger trees, old forest wildlife habitat, and other nontimber values. Additional details regarding management of ERF on DNR-administered lands is contained in the DNR Extended Rotation Forest Guidelines (1994). **Prescribed ERF** is the cover type acreage designated for management as ERF. Stands designated as ERF will be held beyond the recommended normal rotation (harvest) age out to the established ERF rotation age(s). A stand of any age can be prescribed as ERF. **Effective ERF** is defined as the portion of the prescribed ERF acreage that is actually over the normal rotation age for the cover type at any one time.

Extirpated: The species is no longer found in this portion of its historical range.

Fine filter: Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem. For example, individual nests, colonies, and habitats are emphasized. A *fine filter* approach (Hunter, 1990) considers the specific habitat needs of selected individual species that may not be met by the broader coarse filter approach.

Forest inventory and analysis (FIA): A statewide forest survey of timber lands jointly conducted by the DNR and the U.S. Department of Agriculture—Forest Service that periodically, through a system of permanent plots, assesses the current status of, and monitors recent trends in, forest area, volume, growth, and removals.

Forest Inventory Module (FIM): The FIM provides a database and application through which field foresters can maintain an integrated and centralized inventory of the forests on publicly owned lands managed by the Division of Forestry and other divisions. In the field, foresters collect raw plot and tree data. Those data are summarized in stand level data that are linked to a spatial representation of stand boundaries. Part of the DNR's **FOR**estry **I**nformation **S**ys**T**em (FORIST).

Forest land: Consists of all lands included in the forest inventory from aspen and pine cover types to stagnant conifers, muskeg, lowland brush, and lakes.

Forest management: the practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest. Note: forest management includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, and other forest resource values.
From: The Dictionary of Forestry. 1998. The Society of American Foresters. J.A. Helms, ed.

Forest road: A temporary or permanent road connecting the remote parts of the forest to existing public roads. Forest roads provide access to public land for timber management, fish and wildlife habitat improvement, fire control, and a variety of recreational activities. The Division of Forestry has three classifications for roads and access routes:

> ***System roads*** - These roads are the major roads in the forest that provide forest management access, recreational access and may be connected to the state, county, or township public road systems. These roads are used at least on a weekly basis and often used on a daily basis. The roads should be graveled and maintained to allow travel by highway vehicles, and road bonding money can be used to fund construction and reconstruction of these types of roads. The level and frequency of maintenance will be at the discretion of the Area Forester and as budgets allow.
>
> ***Minimum maintenance roads*** - These roads are used for forest management access on an intermittent, as-need basis. Recreational users may use them, but the roads are not promoted or maintained for recreation. The roads will be open to all motorized vehicles but not maintained to the level where low clearance licensed highway vehicles can travel routinely on them. The roads will be graded and graveled as needed for forest management purposes. Major damage such as culvert washouts or other conditions that may pose a safety hazard to the public will be repaired as reported and budgets allow.
>
> ***Temporary access*** – If the access route does not fit into one of the first two options, the access route has to be abandoned and the site reclaimed so that evidence of a travel route is minimized. The level of effort to effectively abandon temporary accesses will vary from site to site depending on location of the access (e.g., swamp/winter vs. upland route), remoteness, and existing recreational use pressures.

Forest stand: A group of trees occupying a given area and sufficiently uniform in species composition, age, structure, site quality, and condition so as to be distinguishable from the forest on adjoining areas.

FORIST: The **FOR**estry **I**nformation **S**ys**T**em (FORIST) is a collection of integrated spatial applications and datasets supporting day-to-day operations across the Division of Forestry. The first two parts of the system are in operation: Forest Inventory Module (FIM) and Silviculture and Roads Module (SRM). A Timber Sales Module is scheduled to be operational in 2006.

Fragmentation: Breaking up of large and contiguous ecosystems into patches separated from each other by different ecosystem types. Breaking up a contiguous or homogeneous natural habitat through conversion to different vegetation types, age classes, or uses. *Forest fragmentation* occurs in landscapes with distinct contrasts between land uses, such as between woodlots and farms. *Habitat fragmentation* occurs where a contiguous or homogeneous forest area of a similar cover type and age is broken up into smaller dissimilar units. For example, a conifer-dominated forest (or portion of it) is fragmented by clearcutting if it is converted to another type, such as an aspen-dominated forest.

Fully-stocked stand: A forest stand in which all growing space is effectively occupied but having ample space for development of the crop trees.

Game Species: In this plan, *game* species include those terrestrial species that are hunted and trapped.

Gap: the space occurring in forest stands due to individual tree or groups of trees mortality or blowdown. *Gap management* uses timber harvest methods to emulate this type of forest spatial pattern.

Geographic information system (GIS): Computer software used to manipulate, analyze, and visually display inventory and other data, and prepare maps of the same data.

Group selection: A process of harvesting patches of selected trees to create openings in the forest canopy and to encourage reproduction of uneven-aged stands.

Growth stage: Growth stages of native plant communities as presented in the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* are periods of stand maturation where the mixture of trees in the canopy is stable. Growth stages are separated by periods of transition where tree mortality is high and different among the species, usually involving the death of early successional species and replacement by shade-tolerant species or longer-lived species.

Habitat: An area in which a specific plant or animal normally lives, grows and reproduces; the area that provides a plant or animal with adequate food, water, shelter and living space.

Herbivory: Plant communities resulting from the browsing and grazing of wildlife. A plant-animal interaction whereby an organism eats some or all of a plant and the plant responds immediately (stress, decline, or death) or over time (evolutionary adaptation). Herbivory occurs both above and below ground. As defined for the issues concerned with herbivory in the plan; the influence by dominant herbivores on forest composition, structure, forest dynamics and spatial patterns. Dominant herbivores include beaver, deer, moose, hares, rabbits, small mammals, and forest tent caterpillars.

High risk low volume (HRLV): HRLV stands are identified based on one or more of the following: 1) stands coded as high risk in FIM forest inventory, 2) significant insect or disease damage to the main species in the stand, 3) stands over normal rotation age at time of survey with total stand volume eight cords per acre (low volume), or 4) very old stand, e.g., aspen over than 80 years old.

High-quality native plant community: A community that has experienced relatively little human disturbance, has few exotic species, and supports the appropriate mix of native plant species for that community. A high quality native plant community may be unique or have a limited occurrence in the subsection, have a known association with rare species, or is an exemplary representative of the native plant community diversity prior to European settlement.

Intensive management: Intensity of management refers to the degree of disturbance associated with silvicultural treatments. In this plan, references to it range from less intensive to more intensive management. Examples of more intensive management are: 1) Site preparation techniques such as rock-raking that disrupts the soil profile and leaves coarse woody debris in piles; 2) broadcast herbicide use that eliminates or dramatically reduces herbaceous plant and shrub diversity; 3) Conversions of mixed forest stands through clear-cutting and/or site preparation that result in the establishment of a more simplified monotypic stand such as mostly pure aspen regeneration or high-density pine plantations. Examples where more intensive management may be needed are: to regenerate a site successfully to a desired species, control of insect or disease problems, and wildlife habitat management (e.g., maintenance of wildlife openings).

Intermediate cut: The removal of immature trees from the forest sometime between establishment and major harvest with the primary objective of improving the quality of the remaining forest stand.

Issue: A natural resource-related concern or conflict that is directly affected by, or directly affects, decisions about the management of vegetation on lands administered by the DNR divisions of Forestry and Fish and Wildlife. Relevant issues will likely be defined by current, anticipated, or desired resource conditions and trends, threats to resources, and vegetation management opportunities. The key factor in determining the importance of issues for SFRMP is whether vegetation management issues can address the issue in whole or substantial part on DNR-administered lands.

Landform: Any physical, recognizable form or feature of the earth's surface, having a characteristic shape, and produced by natural causes. Examples of major landforms are plains, plateaus, and mountains. Examples of minor landforms are hills, valleys, slopes, eskers, and dunes. Together, landforms make up the surface configuration of the earth. The "landform" concept involves both empirical description of a terrain (land-surface form) class and interpretation of genetic factors ("natural causes"). (An Ecological Land Classification Framework for the United States, 1984, p. 40).

Landscape: A general term referring to geographic areas that are usually based on some sort of natural feature or combination of natural features. They can range in scale from very large to very small. Examples include watersheds (from large to small), the many levels of the ECS, and Minnesota Forest Resources Council (MFRC) regional landscapes. The issue being addressed usually defines the type and size of landscape to be used.

Landscape region: A geographic region that is defined by similar landforms, soils, climatic factors, and potential native vegetation. The landscape region used for this planning effort is the subsection level of the ECS.

Landscape study area (LSA): A large geographic area identified by the MCBS as a core area for the MCBS survey process in northern Minnesota. The LSA is intended to represent some of the landscapes within an ecological subsection (a unit in Minnesota's ECS. A LSA 1) generally captures the range of environmental gradients and ecological conditions found in large landscapes, 2) generally encompasses the range of native plant community complexes that exhibit repeatable patterns at the landform or ecological land-type association (LTA) scale, 3) exhibits the potential for intact landscape level processes to occur, 4) contains representative native plant communities functioning under relatively undisturbed conditions, and 5) often contains habitat for rare species. An LSA area is typically thousands of acres and contains two to several MCBS sites. A LSA may encompass portions of one or more ecological LTAs and lie in more than one county. LSAs are identified prior to MCBS field surveys and boundaries are modified during the survey process. At the completion of the MCBS surveys, a LSA becomes a macro site, two or more sites, or a combination of macro sites and sites. In some cases a LSA is eliminated from further survey consideration during the MCBS survey process.

Leave trees: Live trees selected to remain on a site to provide present and future benefits, such as shelter, resting sites, cavities, perches, nest sites, foraging sites, mast, and coarse woody debris.

Legacy patch: An area within a harvest unit that is excluded from harvest; this area is representative of the site and is to maintain a source area for recolonization, gene pool maintenance, and establishment of microhabitats for organisms that can persist in small patches of mature forest.

Macrosite: A large area, generally thousands of acres, containing two or more sites that have some geographical and ecological connection relevant to conservation planning. MCBS sites within a macrosite are generally close to one another but are not necessarily contiguous. Thus, macrosites may contain some disturbed areas. In northern Minnesota, MCBS macrosites correspond to the final (post field-evaluation) boundaries of LSAs. (Areas less than 2,000 acres formerly labeled "preserve designs" are also macrosites).

Managed acres: Timberland acres that are available for timber management purposes.

Mast: Nuts, seeds, catkins, flower buds, and fruits of woody plants that provide food for wildlife.

Marketable timber: Merchantable timber that is accessible now.

Mature tree: A tree that has reached the desired size or age for its intended use. Size or age will vary considerably depending on the species and the intended use.

Maximum rotation age: In this plan, the maximum age at which a forest covers type will retain its biological ability to regenerate to the same cover type and remain commercially viable as a marketable timber sale.

Mean annual increment (MAI): Average annual growth of a stand up to a particular age. It is calculated by dividing yield at that age by the age itself (e.g., the mean annual increment for a stand at age 50 with 25 cords per acre total volume: 25) 50 years = 0.5 cords per year).

Merchantable timber: Trees or stands having the size, quality, and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging.

Mesic: Moderately moist.

MCBS Sites: Areas of land identified by Minnesota County Biological Survey (MCBS) staff, ranging from tens to thousands of acres in size, selected for survey because they are likely to contain relatively undisturbed native plant communities, large populations and/or concentrations of rare species, and/or critical animal habitat. The site provides a geographic framework for recording and storing data and compiling descriptive summaries.

Minnesota forest resources plan (MFRP): Statewide DNR strategic forest resources plan. Includes statewide vision, mission, preferred future, goals, strategies and objectives. For each of the division's programs, it includes goals, statewide direction, and major strategies and objectives.

Minnesota TAXA: Minnesota Taxonomy Database maintained by the DNR Division of Ecological Services.

Minnesota Wildlife Resource Assessment Project (MNWRAP): A wildlife species database and related information system that provides the overall data management, framework, analysis functions, and long-term support for statewide, landscape, and site level wildlife resource assessment efforts. It will cover the total spectrum of wildlife diversity and habitat associations in Minnesota.

Mixed forest or stand: A forest or stand composed of two or more prominent species.

Mixed forest conditions: In this plan, refers to vegetative composition and structure that is moving toward the mix and relative proportion (e.g., dominated by, common, occasional, or scattered) of species found in the native plant community for that site. Tree species mix and proportion depends not only on the targeted growth stage (based on the rotation age for the desired cover type) but also species found in older growth stages.

Mortality: Death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire, or other factors.

Multi-aged stand: A stand with two or more age classes.

Multiple use: Using and managing a forested area to provide more than one benefit simultaneously. Common uses may include wildlife, timber, recreation, and water.

Native plant community: A group of native plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms. These groups of native plants form recognizable units, such as an oak forest, prairie, or marsh, that tend to reoccur over space and time. Native plant communities are classified and described by physiognomy, hydrology, landforms, soils, and natural disturbance regimes (e.g., wild fires, wind storms, normal flood cycles).

Natural Area: An area of land, with significant native biodiversity, where a primary goal is to protect, enhance or restore ecological processes and Native Plant Community composition and structure. An MCBS *Site* of Outstanding or High biodiversity significance is often recommended for nomination as a natural area. For these Sites, an MCBS *Ecological Evaluation* is written to characterize the ecological significance of the Site as a whole and to serve as a guide for conservation action by the various landowners. Sites (or portions of Sites) that are recommended as natural areas may be identified by the landowner or land management agency for conservation activities such as designation as a (city, county, state, private) park, non-motorized recreation area, scientific and natural area, reserve, special vegetation management (e.g. natural disturbance based forest management for maintenance of mature growth stage), etc. (*Draft definition 3/24/2004*)

Natural Area Registry (NAR) Agreement: a memorandum of understanding between the Ecological Services Division and another governmental unit. The other governmental unit can be Division of Forestry, Wildlife, or Parks, depending on who the land administrator is for the parcel in question. It can also be city, county, tribal, or federal government. The NAR generally identifies the site, explains its significance, sets a proposed management direction, and states that before any management contrary to that direction occurs, the parties will get together and talk about it first. It is not a binding agreement. Examples of NAR's: an old growth yellow birch stand in Crosby-Manitou State Park; the South Fowl Lake cliff community on Division of Forestry land in Cook County; and a ram's-head orchid site on Hubbard County land.

Natural disturbances: Disruption of existing conditions by natural events such as wildfires, windstorms, drought, flooding, insects, and disease. May range in scale from one tree to thousands of acres.

Natural regeneration: The growth of new trees from one of the following ways: (a) from seeds naturally dropped from trees or carried by wind or animals, (b) from seeds stored on the forest floor, or (c) from stumps that sprout or roots that sucker.

Natural spatial patterns: refers to the size, shape, and arrangement of patches in forested landscapes as determined primarily by natural disturbance and physical factors.

No forest land: Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses such as crops, improved pasture, residential areas, city parks, improved roads, and power line clearings.

Nongame species: In this plan, *non-game species* include amphibians, reptiles, and those mammal and bird species that are not hunted or trapped.

Nontimber forest products: Foods, herbs, medicinals, decoratives and specialty items also known as special forest products. Special forest products might include berries, mushrooms, boughs, bark, Christmas trees, lycopodium, rose hips and blossoms, diamond willow, birch tops, highbush cranberries, burls, conks, Laborador tea, seedlings, cones, nuts, aromatic oils, extractives.

Normal rotation age: For even-aged managed cover types, the rotation age set by the SFRMP Team for non-ERF timberland acres. It is based on the culmination of mean annual increment (CMAI), other available data related to forest productivity that also considers wood quality, and local knowledge.

Old-growth forests: Forests defined by age, structural characteristics, and relative lack of human disturbance. These forests are essentially free from catastrophic disturbances, contain old trees (generally over 120 years old), large snags, and downed trees. Additional details on the management of old-growth forests on DNR-administered lands are contained in Old-Growth Guidelines (1994).

Old forest: A forest stand of any particular forest cover type is considered old forest whenever its age exceeds the normal rotation age established by the landscape team for that cover type. In this plan, it does not include designated old growth, state park lands, etc.

Old forest conditions: forest that has the age and structural conditions typically found in mature to very old forests, such as large diameter trees, large snags, downed logs, mixed species composition, and greater structural diversity. These older forest conditions typically develop at stand ages greater than the normal rotation ages identified for even-aged managed forest cover types.

Old forest management complex: Represents an area of land, made up of several too many stands that are managed for old-growth, special management zone (SMZ), and extended rotation forest (ERF) in the vicinity of designated old growth stands.

Operational planning: What specifically will happen. The specific actions (i.e., projects, programs, etc.) that will be taken to move towards the desired future established by the various sources of strategic direction. Examples include stand examination lists, road projects, recreational trail/facilities projects, staffing, annual work plan targets, etc. Operational planning is also referred to as tactical planning.

Overmature: A tree or even-aged stand that has reached an age where it is declining in vigor and health and reaching the end of its natural life span resulting in a reduced commercial value because of size, age, decay, and other factors.

Overstocked: The situation in which trees are so closely spaced that they are competing for resources, resulting in less than full-growth potential for individual trees.

Overstory: The canopy in a stand of trees.

Partial cut: A cutting or harvest of trees where only some of the trees in a stand are removed.

Patch: An area of forest that is relatively homogenous in structure, primarily in height and stand density, and differs from the surrounding forest. It may be one stand or a group of stands.

Plantation: A stand composed primarily of trees established by planting or artificial seeding.

Prescribed burn: To deliberately burn wildlands (e.g., forests, prairie, or savanna) in either their natural or modified state and under specified conditions within a predetermined area to meet management objectives for the site. A fire ignited under known conditions of fuel, weather, and topography to achieve specific objectives.

Prescription: A planned treatment (clear-cut, selective harvest, thin, reforest, reserve, etc.) designed to change current stand structure to one that meets management goals. A written statement that specifies the practices to be implemented in a forest stand to meet management objectives. These specifications reflect the desired future condition at the site and landscape level and incorporate knowledge of the special attributes of the site.

Pulpwood: Wood cut or prepared primarily for manufacture into wood pulp or chips, for subsequent manufacture into paper, fiber board, or chip board. Generally, trees 5- to-12 inches diameters at breast height are used.

Pure forest or stand is defined as composed principally of one species, conventionally at least 80 percent based on numbers, basal areas, or volumes.

Range of natural variation (RNV): Refers to the expected range of conditions (ecosystem structure and composition) to be found under naturally functioning ecosystem processes (natural climatic fluctuations and disturbance cycles such as fire and windstorms). RNV provides a benchmark (range of reference conditions) to compare with current and potential future ecosystem conditions.

Rare Features Database is maintained by the Natural Heritage and Nongame Research Program and is comprised of locational records of the following features:

- **Rare plants.** Rare plants tracked are all species that are listed as Federally endangered, threatened or as candidates for Federal listing; all species that are State listed as endangered, threatened or special concern. Several rare species are also tracked which currently have no legal status but need further monitoring to determine their status.
- **Rare animals.** All animal species that are listed as Federally endangered or threatened (except the gray wolf) are tracked, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened or special concern.
- **Natural communities**. Natural communities are functional units of landscape that are characterized and defined by their most prominent habitat features - a combination of vegetation, hydrology, landform, soil, and natural disturbance cycles. Although natural

communities have no legal protection in Minnesota, the Natural Heritage and Nongame Research Program and the Minnesota County Biological Survey have evaluated and ranked community types according to their relative rarity and endangerment throughout their range. Locations of high quality examples are tracked in the Rare Features Database.

- **Geologic features**. Noteworthy examples of geologic features throughout Minnesota are tracked if they are unique or rare, extraordinarily well preserved, widely documented, highly representative of a certain period of geologic history, or very useful in regional geologic correlation.
- **Animal aggregations**. Certain types of animal aggregations, such as nesting colonies of waterbirds (herons, egrets, grebes, gulls and terns), bat hibernacula, prairie chicken booming grounds, and winter bald eagle roosts are tracked regardless of the legal status of the species that comprise them. The tendency to aggregate makes these species vulnerable because a single catastrophic event could result in the loss of many individuals.

Rare species: A plant or animal species designated as **endangered, threatened,** or of **special concern** by the state of Minnesota (this includes all species designated as endangered or threatened at the federal level), or an uncommon species that does not (yet) have an official designation, but whose distribution and abundance need to be better understood.

Refuge/refugia: Area(s) where plants and animals can persist through a wind and/or fire event.

Regeneration: The act of renewing tree cover by establishing young trees naturally (e.g., stump sprouts, root suckers, natural seeding) or artificially (e.g., tree planting, seeding).

Regional landscapes: MFRC established eight regional landscapes covering Minnesota based on ecological, socio-economic, and administrative factors. These landscapes were established to undertake landscape-based planning and coordination across all forest ownerships. The subsections included in this plan are in the Northeast Landscape Region.

Release: Freeing a tree, or group of trees, from competition that is overtopping or closely surrounding them.

Relevéϑs: Vegetation survey plot data.

Research natural areas (RNAs): Areas within national forests that the U.S. Forest Service has designated to be permanently protected and maintained in natural condition (e.g., unique ecosystems or ecological features, rare or sensitive species of plants and animals and their habitat, and high quality examples of widespread ecosystems).

Reserved forestland: Forestland withdrawn from timber utilization through statute, administrative regulation, or designation.

Riparian area The area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands.

Riparian management zone (RMZ): That portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. It is the area where riparian guidelines apply.

Rotation age: The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors.

Salvage cut: A harvest made to remove trees killed or damaged by fire, wind, insects, disease, or other injurious agents. The purpose of salvage cuts is to use available wood fiber before further deterioration occurs to recover value that otherwise would be lost.

Sanitation cut: A cutting made to remove trees killed or injured by fire, insects, disease, or other injurious agents (and sometimes trees susceptible to such injuries) for the purpose of preventing the spread of insects or disease.

Sapling: A tree that is 1 inch to 5 inches in diameter at breast height.

Sawlog: A log large enough to produce lumber or other products that can be sawed. Its size and quality vary with the utilization practices of the region.

Sawtimber: Trees that yield logs suitable in size and quality for the production of lumber.

Scarify: To break up the forest floor and topsoil preparatory to natural regeneration or direct seeding.

Scientific and natural areas (SNAs): Areas established by the DNR, Division of Ecological Services to preserve natural features and rare resources of exceptional scientific and educational value.

Seedbed: The soil or forest floor on which seed falls.

Seed tree: Any tree, which bears seed; specifically, a tree left standing to provide the seed for natural regeneration.

Selective harvest: Removal of single scattered trees or small groups of trees at relatively short intervals. The continuous establishment of reproduction is encouraged and an all-aged stand is maintained. A management option used for shade-tolerant species.

Shade tolerance: Relative ability of a tree species to reproduce and grow under shade. The capacity to withstand low light intensities caused by shading from surrounding vegetation. Tolerant species tolerate shade, while intolerant species require full sunlight.

Shelterwood harvest: A harvest cutting in which trees on the harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of new seedlings under partial shade and protection of older trees. Produces an even-aged forest.

Silviculture: The art and science of establishing, growing, and tending stands of trees. The theory and practice of controlling the establishment, composition, growth, and quality of forest stands to achieve certain desired conditions or management objectives.

Silviculture and Roads Module (SRM): The SRM provides a database and application through which field foresters can record planned and actual forest development prescriptions (e.g., site preparation, tree planting projects, timber harvest, road maintenance, etc.) and follow-up surveys. SRM supports the geographic description of the extent of a development project separate from FIM stand boundaries. A variety of maps and other reports can be generated by the development system. SRM will also produce maps and reports that roll up forestry area data to the regional or statewide level. Part of the DNR's **FOR**estry **I**nformation **S**ys**T**em (FORIST).

Site index (SI): A species-specific measure of actual or potential forest productivity or site quality, expressed in terms of the average height of dominant trees at specific key ages, usually 50 years in the eastern U.S.

Site preparation: Treatment of a site (e.g., hand or mechanical clearing, prescribed burning, or herbicide application), to prepare it for planting or seeding and to enhance the success of regeneration.

Site productivity: The relative capacity of a site to sustain a production level over time. The rate at which biomass is produced per unit area. For example, cords per acre growth of timber.

Size class: A category of trees based on diameter class. The DNR's forest inventory has size classes such as Size Class *1* = 0 - 0.9 inch diameter; *2* = 1 - 2.9 inches diameter; *3* = 3 – 4.9 inches; *4* = 5 – 8.9 inches; *5* = 9 – 14.9 inches, etc. Also, size class may be referred to as seedling, sapling, pole timber, and saw timber.

Slash: The non-utilized and generally unmarketable accumulation of woody material in the forest, such as limbs, tops, cull logs, and stumps, that remain in the forest as residue after timber harvesting.

Snag: A standing dead tree.

Soil productivity: The capacity of soils, in its normal environment, to support plant growth.

Special concern species: A plant or animal species that is extremely uncommon in Minnesota, or has a unique or highly specific habitat requirements, and deserves careful monitoring. Species on the periphery of their ranges may be included in this category, as well as species that were once threatened or endangered but now have increasing, or stable and protected, populations.

Special management zone (SMZ): a buffer immediately surrounding designated old-growth forest stands. It is intended to minimize edge effects and windthrow damage to old-growth stands. Minimum width is 330-feet from the edge of the old-growth stand. Timber harvest is allowed in the SMZ, but there are limitations on how much can be clearcut at any given time.

Stand: A contiguous group of trees similar in age, species composition, and structure, and growing on a site of similar quality, to be a distinguishable forest unit. A forest is comprised of many stands. A ***pure stand*** is composed of essentially a single species, such as a red pine plantation. A ***mixed stand*** is composed of a mixture of species, such as a northern hardwood stand consisting of maple, birch, basswood, and oak. An ***even-aged stand*** is one in which all of the trees present are essentially the same age, usually within 10 years of age for aspen and jack pine stands. An ***uneven-aged stand*** is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

Stand age: The average age of the main species within a stand.

Stand density: The quantity of trees per unit area. Density usually is evaluated in terms of basal area, numbers of trees, volume, or percent crown cover.

Stand examination list: DNR forest stands to be considered for treatment (e.g., harvest, thinning, regeneration, prescribed burning, reinventory, etc.) over the planning period based on established criteria (e.g., rotation age, site index, basal area, desired future cover-type composition, etc.). These stands will be assigned preliminary prescriptions and most will receive the prescribed treatment. However, based on field appraisal visit, prescriptions may change for some stands because of new information on the stand or its condition.

Stand-selection criteria: Criteria used to help identify stands to be treated as determined by the subsection team. Criteria will likely be based on include rotation ages, site index, basal area, cover-type composition, understory composition, location, etc. Factors considered in developing stand-selection criteria will include: 1) desired forest composition goals, 2) timber growth and harvesting, 3) old-growth forests, 4) extended and normal rotation forests, 5) riparian areas, 6) wildlife habitat, 7) age and cover-type distributions, 8) regeneration, 9) thinning and 10) prescribed burning needs.

State forest road: Any permanent road constructed, maintained, or administered by the DNR for the purposes of accessing or traversing state forest lands.

Stocking: An indication of the number of trees in a stand as compared to the desirable number for best growth and management, such as well-stocked, overstocked, and partially-stocked. A measure of the proportion of an area actually occupied by trees.

Strategic planning: A process to plan for desired future states. Includes aspects of a plan or planning process that provide statements and guides for future direction. The geographic, programmatic, and policy focus can range from very broad and general to more specific in providing tiers/levels of direction. Strategic planning is usually long term (i.e., at least five years, often longer). It usually includes an assessment of current trends and conditions (e.g., social, natural resource, etc.), opportunities, and threats; identification of key issues; and the resulting development of goals (e.g., desired future conditions), strategies, and objectives. Vision and mission statements may also be included.

Stumpage: The value of a tree as it stands in the forest uncut. Uncut trees standing in the forest.

Stumpage price: The value that a timber appraiser assigns to standing trees or the price a logger or other purchaser is willing to pay for timber as it is in the forest.

Subsection: A subsection is one level within the ECS. From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province → Section → Subsection→ Land Type Association → Land Type→Land Type Phase. Subsections areas are generally one to four million acres in Minnesota, with the average being 2.25 million acres. Seventeen subsections are scheduled for the SFRMP process.

Subsection forest resource management plan (SFRMP): A DNR plan for vegetation management on forest lands administered by DNR Divisions of Forestry and Fish and Wildlife that uses ECS subsections as the basic unit of delineation. Initial focus will be to identify forest stands and road access needs for the duration of the 10-year plan. There is potential to be more comprehensive in the future.

Succession: The natural replacement, over time, of one plant community with another.

Sucker: A shoot arising from below ground level from a root. Aspen regenerates from suckers.

Suppressed: The condition of a tree characterized by low growth rate and low vigor due to competition from overtopping trees or shrubs.

Sustainability: Protecting and restoring the natural environment while enhancing economic opportunity and community well-being. Sustainability addresses three related elements: the environment, the economy, and the community. The goal is to maintain all three elements in a healthy state indefinitely. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable treatment level: A treatment level (e.g., harvest acres per year) that can be sustained over time at a given intensity of management without damaging the forest resource base or compromising the ability of future generations to meet their own needs. Treatment levels may need to be varied above and/or below the sustainable treatment level until the desired age-class structure or stocking level is reached.

Tactical planning: See operational planning.

Temporary access: A temporary access route for short-term use that will not be needed for foreseeable future forest management activities. It is usually a short, temporary, dead-end access route.

Thermal cover: Habitat component (e.g., conifer stands such as white cedar, balsam fir, and jack pine) that provides wildlife protection from the cold in the winter and heat in the summer.
Vegetative cover used by animals against the weather.

Thinning: A silvicultural treatment made to reduce the density of trees within a forest stand primarily to improve growth, enhance forest health, or recover potential mortality. **Row thinning** is where selected rows are harvested, usually the first thinning, which provides equipment operating room for future

selective thinnings. **Selective thinning** is where individual trees are marked or specified (e.g., by diameter, spacing, or quality) for harvest. **Commercial thinning** is thinning after the trees are of merchantable size for timber markets. **Pre-commercial thinning** is done before the trees reach merchantable size, usually done in overstocked (very high stems per acre) stands to provide more growing space for crop trees that will be harvested in future years.

Threatened species: A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.

Timberland: Forestland capable of producing timber of a marketable size and volume at the normal harvest age for the cover-type. It does not include lands withdrawn from timber utilization by statute (e.g. Boundary Waters Canoe Area Wilderness) or administrative regulation such as designated old growth forest and state parks. On state forest lands this includes stands that can produce at least three cords per acre of merchantable timber at the normal harvest age for that cover-type. It does not include very low productivity sites such as those classified as stagnant spruce, tamarack, and cedar, offsite aspen, or nonforest land.

Timber management plan: The same thing as vegetation management if used with the SFRMP process.

Timber management planning (TMP): Successor to the TMP information system (TMPIS). Recognizes the entire timber management planning process as being more than just the computerized system. Incorporates GIS technology and an interactive process with other resource managers.

Timber management planning information system (TMPIS): Circa mid-1980s. Original computerized system for developing 10-year stand treatment prescriptions by area.

Timber productivity: The quantity and quality of timber produced on a site. The rate at which timber volume is produced per unit area over a period of time (e.g., cords per acre per year). The relative capacity of a site to sustain a level of timber production over time.

Timber stand improvement (TSI): A practice in which the quality of a residual forest stand is improved by removing less desirable trees and large shrubs to achieve the desired stocking of the best quality trees or to improve the reproduction, composition, structure, condition, and volume growth of a stand.

Tolerant: A plant cable of becoming established and growing beneath overtopping vegetation. A tree or seedling capable of growing in shaded conditions.

Two-aged stand: a stand with trees of two distinct age class separated in age by more than 20 percent of the rotation age.

Underplant: The planting of seedlings under an existing canopy or overstory.

Understocked: A stand of trees so widely spaced that even with full growth potential realized, crown closure will not occur.

Understory: The shorter vegetation (shrubs, seedlings, saplings, small trees) within a forest stand that forms a layer between the overstory and the herbaceous plants of the forest floor.

Uneven-aged stand: A stand of trees of a variety of ages and sizes growing together on a uniform site. A stand of trees with three or more distinct age classes.

Uneven-aged management: Forest management that results in forest stands comprised of intermingling trees or small groups that have three or more distinct age classes. Best suited for shade tolerant species.

Variable density: Thinning or planting in a clumped or dispersed pattern so that tree spacing more closely replicates patterns after natural disturbance (e.g., use gap management, vary the residual density within a stand when thinning, or plant seedlings at various densities within a plantation).

Variable retention: a harvest system based on the retention of structural elements or biological legacies (e.g., retain tree species and diameters present at older growth stages, snags, large downed logs, etc.) from the harvested stand for integration into the new stand to achieve various ecological objectives. *Aggregate retention* retains these structural elements in small patches or clumps within the harvest unit. *Dispersed retention* retains these structural elements as individual trees scattered throughout the harvest unit.

Vegetation growth stage: The vegetative condition of an ecosystem resulting from natural succession and natural disturbance, expressed as vegetative composition, structure and years since disturbance. The vegetation growth stage describes both the successional changes (i.e., the change in the presence of different tree species over time) and developmental changes (i.e., the change in stand structure overtime due to the regeneration, growth, and mortality of trees). Vegetation growth stages express themselves along the successional pathways for a particular ecosystem depending on the type and level of natural disturbance that has occurred. Forest tree and other vegetation composition, habitat features, and wildlife species use change with the various growth stages.

Vegetation management plan: In the process of developing the 10-year stand examination list, many decisions and considerations go beyond identifying what timber will be cut (i.e., broader than timber management). This includes designation of old growth, extended rotation forests, riparian areas, desired future forest composition, visually sensitive travel corridors, etc., all of which are intended to address wildlife habitat, biodiversity, and aesthetic and other concerns. Prescriptions assigned to stands reflect decisions based on these multiple considerations and are broader than decisions relative to final harvest (e.g., ERF designation, uneven-aged management, thinning, regeneration, underplanting, prescribed burning, etc.).

Viable populations: The number of individuals of a species sufficient to ensure the long-term existence of the species in natural, self-sustaining populations that are adequately distributed throughout their range.

Volume: The amount of wood in a tree or stand according to some unit of measurement (board feet, cubic feet, cords), or some standard of use (pulpwood, sawtimber, etc.).

Well-stocked: The situation in which a forest stand contains trees spaced widely enough to prevent competition yet closely enough to utilize the entire site.

Wildlife management area (WMA): Areas established by the DNR, Division of Fish and Wildlife, to manage, preserve and restore natural communities, perpetuate wildlife populations, and provide recreational and educational opportunities.

Windthrow: A tree pushed over by the wind. Windthrows are more common among shallow-rooted species.

APPENDIX N

Acronyms

AFRMP	Area Forest Resource Management Plan
BT	Bearing Tree
CMAI	Culmination of Mean Annual Increment
CMT	Commissioner's Management Team
CP	Chippewa Plains
CPPM	Chippewa Plains/Pine Moraines and Outwash Plains
CSA	Cooperative Stand Assessment
CWCS	Comprehensive Wildlife Conservation Strategy
DBH	Diameter at Breast Height
DFC	Desired Future Condition
DFFC	Desired Future Forest Composition
DMT	Division Management Team
DNR	Department of Natural Resources
DOQ	Digital Orthophoto Quadrangle
DRG	Digital Raster Graphics
ECS	Ecological Classification System
EILC	Ecologically Important Lowland Conifers
ELCP	Ecological Land Classification Program
ERF	Extended Rotation Forestry
ETS	Endangered, Threatened, or Special Concern
FIA	Forest Inventory and Analysis
FIM	Forest Inventory Module
FORIST	Forest Information System
FRIT	Forest Resource Issues Team
FTC	Forest Tent Caterpillar
FY	Fiscal Year
GAP	Gap Analysis Program
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GM	Gypsy Moth
HCVF	High Conservation Value Forest
HRLV	High Risk/Low Volume
HWDs	Hardwoods
LSA	Landscape Study Area
LSL	Laminated Strand Lumber
LTA	Land Type Association
MACLC	Minnesota Association of County Land Commissioners
MAI	Mean Annual Increment
MBF	Thousand Board Feet
MCBS	Minnesota County Biological Survey
MFRC	Minnesota Forest Resources Council
MFRP	Minnesota Forest Resources Plan
MnTAXA	Minnesota Taxonomy Database
MnWRAP	Minnesota Wildlife Resource Assessment Project
NAPP	National Aerial Photography Program
NAR	Natural Area Registry Agreement
NCFES	North Central Forest Experiment Station
NHIS	Natural Heritage Information System
NHNRP	Natural Heritage & Nongame Research Program
NPC	Native Plant Community
NRCS	Natural Resource Conservation Service
OFMC	Old Forest Management Complex
OHV	Off-Highway Vehicles

OSB	Oriented Strand Board
PM	Pine Moraines and Outwash Plains
RMT	Regional Management Team
RMZ	Riparian Management Zone
RNAs	Research Natural Areas
RNV	Range of Natural Variability
SFRMP	Subsection Forest Resource Management Plan
SGCN	Species in Greatest Conservation Need
SI	Site Index
SMC	Special Management Complex
SMZ	Special Management Area
SNA	Scientific and Natural Area
SNN	Shipstead-Newton-Nolan Act
SONAR	Statement of Need and Reasonableness
SPP	Species
SRM	Silviculture and Roads Module
TMP	Timber Management Plan
TMPIS	Timber Management Plan Information System
TNC	The Nature Conservancy
WMA	Wildlife Management Area

Appendix O

School Trust lands in Anoka Sand Plains (ASP) Subsection

DNR Lands included in the Anoka Sand Plains SFRMP	Total DNR Acres in the ASP SFRMP	School Trust Acres	% School Trust
Total	44,151	2,161	5%

ASP SFRMP Designation	[A] Total Acres Designated in the Subsection	% of Total Acres ([A]/44,151)	[B] School Trust Acres Designated in the Subsection	% of School Trust Acres Designated ([B]/2,161)
EILC	47	0.1%	0	0%
Old growth	245	0.6%	0	0%
Proposed RSA	0	0	0	0%
Total reserved acres[1]	292	0.7%	0	0%
ERF prescribed	2,550	5.8%	0	0%
HCVF acres[2]	19,427	44.0%	242	11.2%
SDSF Immediate Area	531	1.2%	85	3.9%
SDSF Eventual Area	1348	3.1%	398	18.4%
Managed acres[3]	19,791	44.8%	1404	65.0%
10-year stand exam acres	3,883	8.8%	490	22.7%

[1] Includes EILC, old growth, and RSA designated stands (with overlap removed).

[2] Excludes acres within HCVFs also designated as EILC, old growth, SDSF Immediate, or SDSF Eventual. Includes 698 acres that are also designated to be managed as ERF, of which none are school trust lands.

[3] Total acres of productive (i.e., commercially viable) forest stands available for management in this planning period. Excludes non-productive forest, non-forest, and acres with designations that generally prohibit commercial development (i.e., old growth, RSA and EILC).

High Conservation Value Forests (HCVF) - There are 242 acres of trust lands within proposed HCVF areas in the ASP subsection, excluding those HCVF trust acres also identified with a more restrictive designation (e.g., old growth, EILC, SDSF Immediate, SDSF Eventual). Of these acres, 35% (84 acres) are productive timberlands (i.e., capable of growing timber for commercial markets). Final HCVFs on DNR lands are still in the process of being identified and finalized. The numbers presented in the above table represent acres included in current proposed HCVF areas in the ASP subsection. It is unknown at this time specifically how HCVF designation will affect long-term revenue production on trust lands. For some high conservation values, there may be little or no effect. For other HCVs the effect may be significant. DNR will better understand the effect on long-term revenue production once more site-specific management direction is developed for each HCVF area. If DNR determines that management for HCVs restricts or prohibits long-term revenue generation on school trust lands in a way that conflicts with its Trust obligations, the DNR will seek a way to compensate the school trust via exchange, purchase or other acceptable method.

Sand Dunes State Forest (SDSF) Immediate Conversion Area

1. There are 85 acres of trust lands in the Immediate conversion area. Of these acres, 65% (55 acres) are productive timberlands (i.e., capable of growing timber for commercial markets).
2. Where there is marketable timber, on these sites, it will be harvested generating a financial return to help meet the trust fiduciary obligation.
3. After the existing timber is harvested, these lands will then be managed for rare feature values which will convert them to non forest (and hence non-revenue producing) uses in the near-term.
4. Where long-term revenue production is restricted, the DNR will work to transfer the trust status to other lands with a stronger long-term revenue producing potential. There may also be other compensation options considered to meet trust obligations.

SDSF Eventual Conversion Area

1. There are 400 acres of trust land in the Eventual conversion area. Of these acres, 90% (360 acres) are productive timberlands.
2. Where there is marketable timber, on these sites, it will be harvest generating a financial return to help meet the school trust fiduciary obligation.
3. Once these forest stands reach maturity, a "final" timber harvest will occur. After this "final" harvest, these lands will then be managed for rare feature values which will convert them to non forest (and hence non-revenue producing) uses over a longer period of time compared to the Immediate conversion areas. In some stands this will take up to 70 years before the "final" harvest occurs.
4. Where long-term revenue production is restricted, the DNR will work to transfer the trust status to other lands with a stronger long-term revenue producing potential. There may also be other compensation options considered to meet trust obligations.