Minnesota Department of Natural Resources
Division of Forestry

Anoka Sand Plain
Subsection Forest Resource Management Plan

April 2012

Division of Forestry Planning Document

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This document and additional information about the Division of Forestry Subsection Resource Management Plan (SFRMP) process can be found on the Internet at:
http://www.dnr.state.mn.us/forestry/subsection/anoka/index.html
This information is available in an alternative format upon request.

Maps in this document depict information for an area within a "planning boundary." This boundary closely approximates the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

Anoka Sand Plain
Subsection Forest Resource Management Plan

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Executive Summary

This Subsection Forest Resource Management Plan (SFRMP) process considers state forest lands administered by the Department of Natural Resources (DNR), Divisions of Forestry and Fish and Wildlife, Section of Wildlife in the *Anoka Sand Plain* subsection landscape unit. This landscape unit covers approximately 1.3 million acres in an area generally north of the Mississippi River from near Brainerd on the north trending southeastward to the confluence of the Mississippi and Minnesota Rivers. The subsection is generally located in east central Minnesota (*See Map 2.1*). Although the Ecological Classification System (ECS) subsection includes parts of twelve counties (Crow Wing, Morrison, Stearns, Benton, Wright, Sherburne, Mille Lacs, Isanti, Anoka, Chisago, Ramsey and Hennepin), the majority of timberlands subject to this SFRMP are located in: Morrison, Sherburne, Anoka, Isanti and Chisago counties.

This subsection forest resource management plan (SFRMP) strategic direction and stand selection document includes management direction, goals and strategies, and a 10-Year Stand Examination List guiding vegetation management on state forestlands administered by the Department of Natural Resources (DNR), divisions of Forestry, Fish and Wildlife. The Anoka Sand Plain subsection landscape unit is approximately 1.3 million acres. DNR lands comprise 67,000 acres (5 percent) of the land ownership in this subsection. Of the DNR lands, approximately 19,000 acres (28%) are considered Managed Acres. Acres in state parks and Scientific and Natural Areas (SNAs) are beyond the scope of this management plan

This ASP SFRMP uses many Department directions, guidelines and policy to recommend a plan for vegetation management. In addition to Department directives, this plan is consistent with direction of the Minnesota Forest Resource Council (MFRC) Landscape Program; the East Central Regional Landscape Committee completed the East Central Landscape Management Plan in 2005, and a supplemental document the Strategic Policy Framework: East Central Landscape Plan in 2009. These documents included desired future forest conditions for all forest lands in the East Central Landscape Region, which includes Pine, Kanabec, Mille Lacs, Morrison, Stearns, Benton, Wright, Sherburne, Isanti, Chisago and Wright counties. The goals and strategies in the ASP SFRMP for state-administered forest lands are consistent with those recommended by the MFRC East Central Landscape Management Plan.

Old forest will be maintained on state lands. Goals for maintaining old forest in forest types typically managed using even-aged management regimes (aspen, birch, and jack pine) vary by subsection. In an effort to achieve this, the ASP SFRMP recommends that aspen and oak cover types maintain extended rotation forests. In this SFRMP prescribed aspen acres were recommended at 37 percent of the management pool acres and oak recommended at 38 percent. Old forest conditions will also be provided in uneven-age managed cover types (e.g., northern hardwoods), ecologically important lowland conifers (EILC), and designated old-growth stands. A total of 245 acres have been designated as old growth.

Young forest will be maintained on state lands. The 0-30 age classes of aspen, oak, birch, and jack pine cover types represent young, early succession forest in this plan. Currently, these four cover types comprise 60 percent of the timber land acres while the goal is to essentially maintain the same number of acres in these cover types with some increases.

This plan recommends that at the end of this plan implementation period (2022) white pine, red pine and oak cover-types increase in acres through conversions. Tamarack, birch and ash/lowland hardwoods acres will remain the same. Aspen, northern hardwoods (as a general cover type) and jack pine will be reduced in total acres. White pine and bur oak will be increased as a component in other cover types such as aspen or oak. An increase will be seen in more open landscapes, oak savanna, and prairie, as a significant direction in this SFRMP is to manage for the native plant community which in many cases was a more open landscape with periodic disturbance by fire. Over the longer term, the dominant cover types will be aspen, oak and oak savannas. Most cover type conversions will occur during the 10 years covered by this plan, and many will be “soft” conversions that take place gradually, often without the use of a final harvest. Some conversions and cover-type increases will take several decades before they can be seen on the state lands.

Stands will be managed to maintain or increase within-stand species and structural diversity. Some stands will be managed using techniques such as variable retention and variable density, and will retain some trees of species and sizes typically found in older growth stages.

Vegetation management will provide a broad range of habitats that meet the needs of game and nongame species (coarse filter approach) while providing specific habitat needs for individual species (fine filter approach) when needed. There are 42 game species and 184 nongame species found in the subsection. The goal is to provide healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species.

Riparian areas will be managed to provide habitat for fish, wildlife, and plant species. The MFRC Voluntary Site-Level Forest Management Guidelines will be applied on all state lands. Management of riparian areas adjacent to wetlands and streams is important from a wildlife perspective because the unique relationship of wildlife to the wetland complexes found in the ASP.

Minnesota County Biological Survey (MCBS) work is currently completed in the ASP subsection. MCBS sites with statewide biodiversity significance rankings of Outstanding, High, and preliminary survey of High were determined to be the greatest concern or importance in this SFRMP. Strategies have been developed to manage forest land in these MCBS sites while minimizing the loss to the biodiversity significance factors on which the MCBS sites were ranked. On all state lands, known locations of rare plants and animals and their habitats and rare native plant communities will be protected, maintained, or enhanced in these subsections. Currently proposed high conservation value forests have been identified in the planning dataset and will be considered as state level decisions are made.

The treatment level (i.e., harvest, etc.) recommended for the 10-year plan is approximately 5,068 cords per year, compared to an estimated 3,790 cords per year during the decade preceding this planning period. This increase reflects more oak harvest in an attempt to balance age classes in future decades and to manage stands to conserve biodiversity. Strategies such as intermediate treatments and harvests in younger age classes have been implemented to increase timber productivity and quality, and to increase the average harvestable volume per acre growing on state lands over time.

Other topics addressed in the plan include: limiting damage from insects, disease, and non-native invasive species; minimizing forest management impacts on visual quality; recognizing climate change effects on forest lands and attempting to manage; protecting cultural resources; manage to allow use of prescribed fire; evaluating disturbance events (e.g., fire and wind) and, recognizing the challenges of landscape level planning on a fragmented landscape.

Chapter 1 Planning Area Description and Scope of the Subsection Forest Management Plan

1.1 Planning Area Description

This Subsection Forest Resource Management Plan (SFRMP) process considers state forest lands administered by the Department of Natural Resources (DNR), Divisions of Forestry and Fish and Wildlife, Section of Wildlife in the *Anoka Sand Plain* subsection landscape unit. This landscape unit covers approximately 1.3 million acres in an area generally north of the Mississippi River from near Brainerd on the north trending southeastward to the confluence of the Mississippi and Minnesota Rivers. The subsection is generally located in east central Minnesota (*See Map 1.1*). Although the Ecological Classification System (ECS) subsection includes parts of twelve counties (Crow Wing, Morrison, Stearns, Benton, Wright, Sherburne, Mille Lacs, Isanti, Anoka, Chisago, Ramsey and Hennepin) the vast majority of timberlands subject to this SFRMP are located in: Morrison, Sherburne, Anoka, Isanti and Chisago counties.

For more detailed land descriptions, refer to the *Anoka Sand Plain Preliminary Issues and Assessment*, at http://www.dnr.state.mn.us/forestry/subsection/anoka/index.html

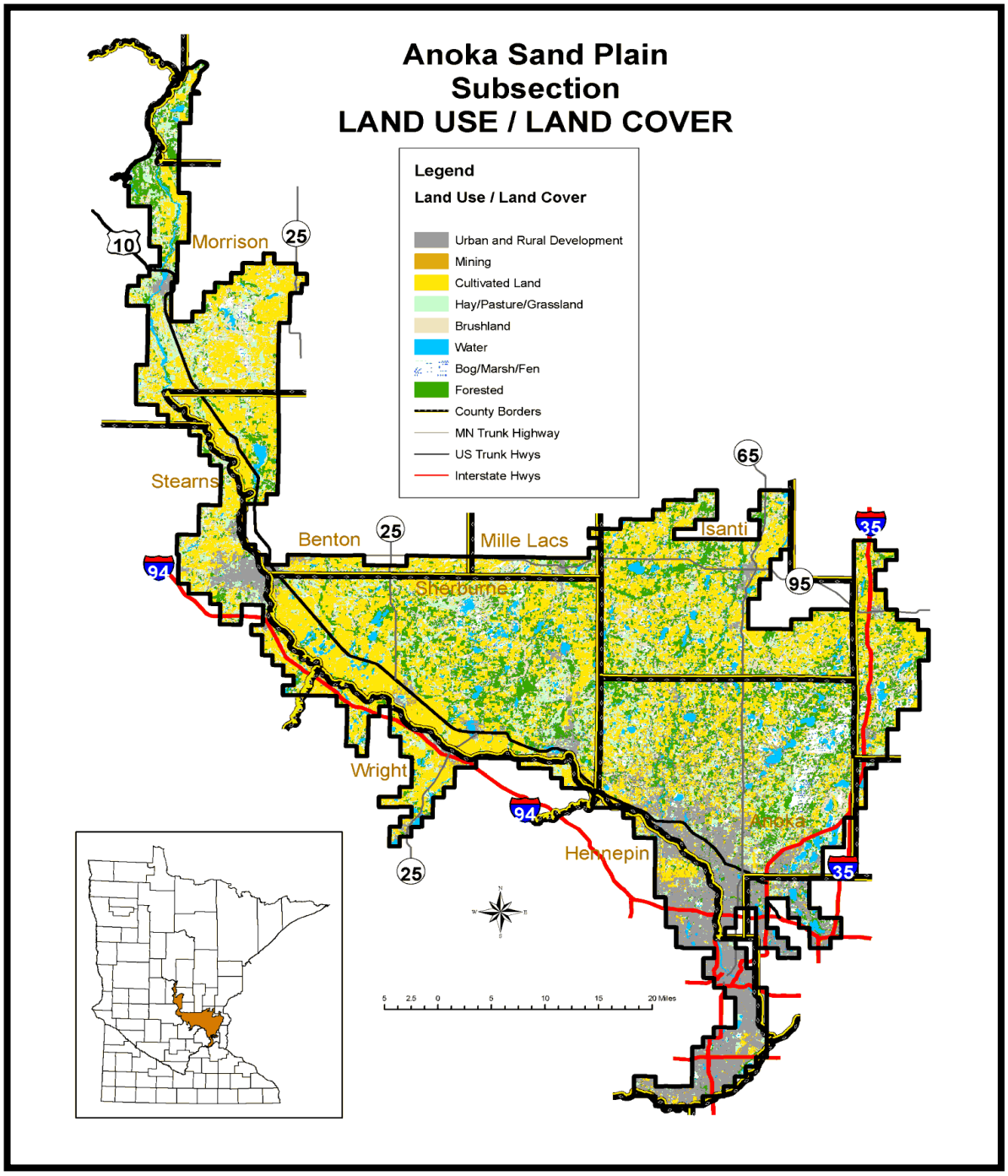
Map 1.1 (Anoka Sand Plain Land Use / Land Cover) identifies the overall land use pattern that exists in the ASP subsection. It shows the majority of lands are in urban lands uses, cultivated lands, hayland/pasture/grasslands, brushlands, and bog/marsh/fens. As shown only a minor portion of lands are identified as forested land uses. The limited public and state land ownership and of those public lands the limited forested land uses have implications for attempting to influence landscape level forest management directions. Goals and directions can be set for state administered lands and forest lands as outlined in this SFRMP, but their influence over the entire landscape can be minimal. These issues are identified in Chapter 2 (*SFRMP Issues)* and recommended directions in reflecting these limitations are outlined in Chapter 3 *(General Direction Statements and Strategies).*

1.2 Land Ownership

Structural development and agriculture are major uses of land in this subsection. Private lands total over 1.1 million acres or 88 percent. Public land ownership is minor in this subsection. Public agencies administer approximately 129,000 acres or 12 percent of the land. The DNR administered lands are approximately 67,000 acres or 5 percent of the total lands in the ASP subsection.

Table 1.1 identifies all land ownership within the Anoka Sand Plain subsection. The subsection totals about 1.3 million total acres. Private lands account for the vast majority of ownership at 88 percent, followed by State ownership at 5 percent. Federal lands within the subsection account for approximately 3 percent primarily Sherburne National Wildlife Refuge and Crane Meadows National Wildlife Refuge. This SFRMP addresses only DNR administered Forestry and Wildlife lands which total 44,000 acres or 66 percent of the total DNR ownership within in the ASP. Map 1.2 identifies the public land ownership in the ASP subsection.

Map 1.1 Anoka Sand Plain Land Use / Land Cover



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

Table 1.1 Land Ownership: Anoka Sand Plain (Acres)

Owner	Acres	Percent
Private[1]	1,128,014	88
State – All[2]	67,205	5
Forestry	7,134	<1
Wildlife	37,017	3
Federal	45,623	3
County	15,100	1
Private Industrial	10,849	<1
Private Non-Industrial	2.235	<1
Private Conservancy	496	<1
Total	**1,277,914**	**100**

Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.

[1] Includes all Private land categories

[2] Includes all lands administered by units of DNR including Forestry, Wildlife, Fisheries, Parks and Trails and Ecological and Water Resources. SFRMP only covers Forestry- and Wildlife-administered lands.

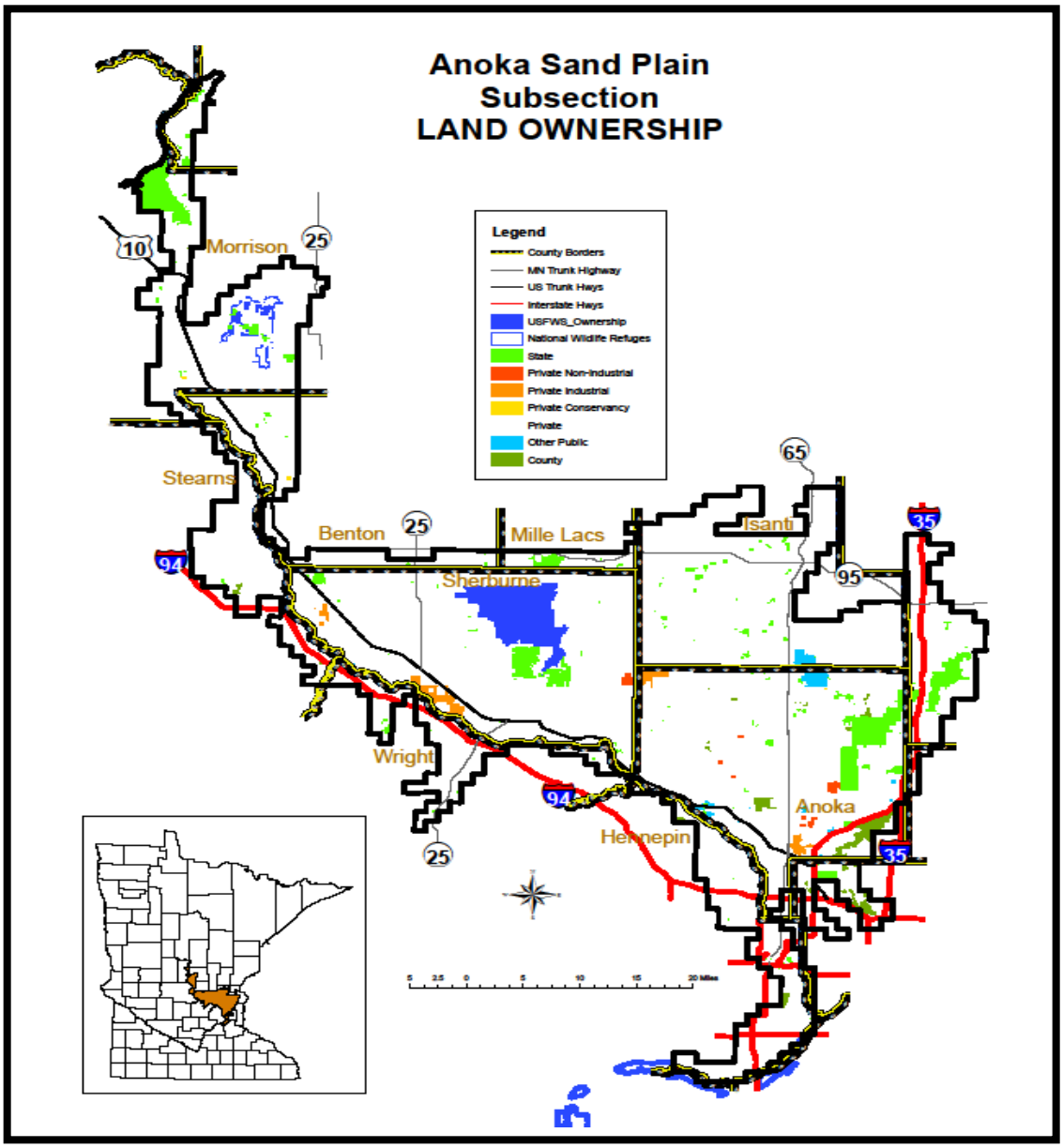
1.3 Scope of the Subsection Forest Resource Management Plan

A SFRMP is a DNR plan for vegetation management on forest lands administered by the DNR divisions of Forestry and Wildlife Section of the division of Wildlife. Vegetation management includes actions that affect the composition and structure of forest lands, such as timber harvesting, thinning, prescribed burning, and reforestation. The geographic area covered by these plans is defined by Ecological Classification System (ECS) subsections (Appendix A). Previous forest management plans were based on administrative boundaries (e.g., DNR forestry areas). The SFRMPs will also consider the condition and management of forest lands not owned by the DNR, but will only propose forest management direction and actions for DNR lands. The amount of DNR-administered forest lands within forested subsections will vary across the state. Examples of forest resource management planning activities that are beyond the scope of SFRMPs are: OHV trail system planning, comprehensive road access plans, state park land management planning, old growth forest designation, SNA establishment, wilderness designation, wildlife population goals, cumulative effects analysis at the watershed-level, fire management, and recreation facilities/systems planning.

Consistent with state policy (Minnesota Statutes 89A), the SFRMP process implements the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals.

The SFRMP process is divided into three steps. In Steps 1 and 2, the subsection team prepares information to assess the current forest resource conditions in the subsection and identify forest resource management *Issues* that will be addressed in the subsection plan. In Step 3, the subsection team finalizes the issues and develops *General Direction Statements* and *Strategies* to address these *Issues.* The *Strategies* will help in developing the cover type management recommendations, stand-selection criteria, and stand treatment levels. In this step, stands to be evaluated for treatment during the 10-year plan implementation period are selected and preliminary prescriptions are assigned. There are two opportunities for public input. The first is commenting on the *Preliminary Issues and Assessment document,* the second is formal stakeholder review of the *Draft Anoka Sand Plain Subsection Resource Management Plan.*

Map 1.2 Public Land Ownership in the Anoka Sand Plain Subsection



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

ECS Subsections
The DNR has developed an ECS as a tool to help identify, describe, and map ecosystems. ECS units are defined by climatic, geologic, hydrologic, topographic, soil, and vegetation data. The DNR ECS divides the state into six levels of ecological units, each level nested together within the next higher level. Subsections are the third level down in the ECS hierarchy in Minnesota. There are 17 forested subsections in the state, ranging in size from 339,285 to 3,657,011 acres.

Goals for the Planning Effort
While the planning process will produce many tangible "products," such as assessment information, issues, and strategies, the end result of the planning process will be two key products:

- **Desired Future Forest Composition (DFFC) goals:** The goals will include long-term (50 years or more) and short-term (10 years) desired changes in the structure and composition of DNR forest lands in the subsection. Composition goals could include the amount of various cover types, age-class distribution of cover types, and their geographic distribution across the subsection. DFFC goals for state forest lands will be developed from assessment information, issues, the general direction identified in response to the issues, and strategies to implement the desired management direction.

- **List of DNR forest stands to be treated over the next 10-year period.** SFRMPs will identify forest stands on DNR Forestry- and Fish and Wildlife-administered lands that are proposed for treatment (e.g., harvest, thinning, regeneration, and re-inventory) over the 10-year plan implementation period. Forest stands will be selected using criteria developed that begin to move DNR forest lands toward the long-term DFFCs. Many decisions and considerations go into developing these criteria and the list of stands proposed for treatment. Examples include 1) identifying areas to be managed as older forest or extended rotation forest (ERF); 2) identifying areas to be managed at normal rotation age; 3) identifying areas for management of unique or rare species or resources; 4) management of wildlife habitat; 5) age and cover type distributions; and 6) regeneration, thinning, and prescribed burning needs. Decisions will be made based upon the management activities (including no action) that will best move the forest landscape toward the DFFC goals for state forest lands.

Who Develops SFRMPs?
SFRMP team members include DNR forestry, wildlife, and ecological services staff. A list of SFRMP team members for the Anoka Sand Plain subsection is included at the beginning of this document. These teams have primary responsibility for the work and decision making involved with the subsection plans. Decision-making by the team is through an informed consent process. In addition to routine daily coordination, managers of adjacent county and federal lands are invited to provide formal comments on the draft SFRMP.

SFRMP and MFRC Regional Landscape Planning
The recommended desired outcomes, goals, and strategies developed for the East Central Landscape region by the regional landscape committee under the direction of the Minnesota Forest Resources Council (MFRC) Landscape Program were considered in developing this SFRMP. By considering the recommendations from the landscape region plan, the decisions for management of DNR-administered lands incorporate recommendations from a broader landscape perspective across all ownerships and assists in cooperation across ownerships in this larger landscape area.

1.4 SFRMP Process Overview
Table 1.2 outlines the steps in the DNR SFRMP process. Development and release for comment of the draft ASP SFRMP is in the third step of the process, i.e., the DNR interdisciplinary team has developed *General Direction Statements* and *Strategies* to address the final list of *Issues,* established desired future forest composition goals for DNR lands in the subsection, developed stand-selection criteria, and identified stands to treat over the 10-year plan implementation period.

Public involvement in the ASP SFRMP will occur primarily through:

- Distribution of the initial *Preliminary Assessment and Issues document* (mailings to stakeholders and publishing on the state's web site), with a public comment period to help identify key forest management *Issues* and solicit public input of preferred management direction;

- Distribution of the draft ASP SFRMP (general directions, forest management strategies, and DFFCs proposed by the DNR to address identified issues) along with the 10-year list of stands proposed for treatment with a 30-day public review period;
- Public review and comment on proposed plan revisions over the 10-year plan implementation period.

Table 1.2 SFRMP Process Overview

Step 1	**Initiating the Planning Process** • DNR forms interdisciplinary team for the subsection(s). • DNR staff assembles base assessment information. • Web page is established for the subsection on the DNR Web site. • DNR develops mailing list of public/stakeholders. • Public is informed that the planning process is beginning in the subsection, the estimated schedule for the planning process, and how and when they can be involved.
Step 2	**Preliminary Issues and Assessment document** • Subsection team adjusts and supplements the base resource assessment information for the subsection. • Team identifies the preliminary *Issues* to be addressed in the plan. • DNR distributes assessment information and the preliminary *Issues* for public information.
Step 3	**General Direction Statements, Strategies, and Stand Selection Criteria** • DNR finalizes the list of issues to be addressed in the plan based on public input from Step 2. • Subsection team develops *General Direction Statements* (GDSs) in response to the final list of *Issues.* • Subsection team develops *Strategies* and desired future forest composition (DFFC) goals consistent with the general direction. • Team develops stand-selection criteria to help identify DNR forest stands for treatment over the 10-year planning period to move toward the goals. • DNR distributes the Draft ASP SFRMP including: DFFCs, GDSs, Strategies, and 10-Year Stand Exam List for public review and comment.
Step 5	**Final Plan** • Subsection team summarizes public comments received on the Draft ASP SFRMP and develops DNR responses. • A summary of comments, responses, and plan revisions are presented to the department for management approval. • Commissioner approves final plan. • Final plan is distributed, including summary of public comments and DNR responses.

Contents of Document and Focus of Current Review

This document contains products developed by the SFRMP interdisciplinary team for public review as part of Step 3 in the planning process. Those products include the final list of *Issues* addressed in the plan, GDSs and *Strategies* to address the *Issues*, DFFC goals, stand-selection criteria, cover type management recommendations, and a draft 10-Year Stand Exam List.

In Step 2 of the process, the subsection team identified a preliminary list of *Issues* to be addressed in the plan. These *Issues* were developed based on the general field knowledge of department staff and forest resource information assembled by the subsection team in the *Preliminary Issues and Assessment*. The preliminary list of *Issues* and their descriptions were distributed for public review and comment in August 2011. The preliminary list of *Issues* was revised based on input from DNR staff and the public. This revised list of *Issues* is presented in Chapter 2 as the *Issues* to be addressed in the plan.

In Step 3, the subsection team developed *GDSs* and *Strategies* to address the final list of *Issues. Strategies* developed by the subsection team are based on existing DNR policies/mandates, technical expertise from

within and outside the subsection team, forest resource information from the *Preliminary Issues and Assessment* and other sources, and public input from Step 2 of the process. *Strategies* developed to address the various issues were then examined to ensure consistency with each other, to identify and group similar *Strategies*. The *Strategies* presented in this document are the product of this effort to develop a refined list of *Strategies* to address the final list of *Issues*.

The subsection team developed the DFFC goals based on current conditions on DNR forest lands in the subsection. DFFC goals are most commonly expressed in terms of desired changes in the age-class structure, the amount of various forest types within the subsection, and the geographic distribution of forest types and age-classes across the subsection.

GDSs, Strategies, and *DFFC* goals were used to define proposed criteria to select a pool of forest stands for treatment over the 10-year plan implementation period. Stand selection criteria can include: "normal" rotation ages (i.e., ages at which most forest stands will be harvested); extended rotation forest rotation ages (i.e., ages at which stands designated for older forest management will be harvested); potential productivity of the site for timber (i.e., site index); soil types; stand density, or stocking measures (e.g., basal area); tree species composition; brush and ground cover; stand size; stand location; insect and disease occurrence; and other specific criteria needed to address issues. Stand selection criteria presented in this document are those identified by the subsection team as best moving DNR forest lands toward the identified DFFC goals for this subsection.

The final plan includes an appendix of comments received during Step 2 of the process. Where appropriate, specific references are provided as to where and how comments and concerns were incorporated into the final *Issues, Strategies, DFFC* goals, or stand-selection criteria.

Chapter 2 SFRMP Issues

2.1 How SFRMP Issues Were Identified

Subsection Forest Resource Management Plans are organized by vegetation management issues. A key component in the planning process is to solicit stakeholder review of vegetation management issues to ensure that all key issues are addressed. Stakeholder review of the SFRMP issues is achieved through public review of the *Preliminary Issues and Assessment* document. The subsection team began with a common set of issues developed from previous SFRMPs. These common SFRMP *Issues* were refined and supplemented based on subsection-specific conditions and considerations and public comments. SFRMP teams used *Assessment* information[1], DNR policies and guidelines, local knowledge, existing plans, and public input to identify the final *Issues* relevant to the scope of this plan.

2.2 Issue Definition

From the issues identified in the *Preliminary Issue and Assessment* document, revised and more focused *Issues* evolved based on public comment and continued team discussions. Identified below are the revised and more focused *Issues.* Discussion and analysis of these more focused *Issues*, *General Direction Statements* (GDSs), desired future forest composition (DFFCs) and *Strategies* follows in Chapter 3.

What Is an SFRMP Issue?
A SFRMP issue is 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 Minnesota DNR Division of Forestry and Division of Fish and Wildlife. Relevant issues will likely be defined by current, anticipated, or desired forest vegetation conditions and trends, threats to forest vegetation, and vegetation management opportunities. The key factor in determining the importance of issues for SFRMP will be whether the issue can be addressed in whole or substantial part by vegetation management decisions on DNR-administered lands.

What Is Not a SFRMP Issue?
Issues that cannot be addressed in whole or substantial part by vegetation management decisions on DNR-administered lands are outside the scope of the SFRMP process. For example, SFRMP will not address recreation trails system issues or planning. However, aesthetic concerns along existing recreational trail corridors can be a consideration in determining forest stand management direction in these areas. Another example is wildlife populations; the plan will establish wildlife habitat goals but not goals for wildlife population levels.
Each issue needs to consider four pieces of information:

- What is the issue?
- Why is this an issue? (i.e., What is the specific threat, opportunity or concern?)
- What are the likely consequences of not addressing this issue?
- How can this issue be addressed by vegetation management decisions on DNR-administered lands?

2.3 Anoka Sand Plain SFRMP Issues

The following pages contain the *Issues* identified in the *Preliminary Issues and Assessment* document and brief discussion on why these are considered the key *Issues* to be considered in the SFRMP process. These *Issues* were developed based on the common issues from previous SFRMP plans, general field knowledge of department staff, by reviewing forest resource information for the subsection, and by considering stakeholder comments. It should be noted that the following issues are standard, generalized issues applied to all SFRMP processes during the Preliminary Issues and Assessment step. As noted at the end of this Chapter, not all these issues were determined to be significant to the ASP SFRMP process. Each SFRMP across the state is first subjected to a broader discussion of possible issues (*Preliminary Issues and Assessment document*), before the issues are narrowed to those significant to each individual SFRMP.

[1] Minn. DNR, August 2006, *Chippewa Plains – Pine Moraines and Outwash Plains Preliminary Issues and Assessment*, Subsection Forest Resource Management Plan.

A. How should the age classes of forest types be represented on lands managed by this process?

- **Why is this an issue?**
  Representation of all age classes and growth stages, including old-forest types, provides a variety of wildlife habitats, timber products, and ecological values over time.

- **How might DNR vegetation management address this issue?**
  Vegetation management can provide for a balance of all forest types and age classes.

- **What are possible consequences of not addressing this issue?**
  A forest without representation of all age classes and growth stages exposes itself to increased insect and disease problems, loss of species with age-specific habitat requirements, and loss of forest-wide diversity. Such a forest would also provide a boom-and-bust scenario for forest industries that depend on an even supply of forest products.

B. What are appropriate mixes of vegetation composition, structure, spatial arrangement, growth stages, and plant community distribution on state lands in this subsection?

- **Why is this an issue?**
  This is an issue because different users and stakeholders have differing opinions concerning what are the highest values within a forest and highest priority uses and management. This issue is particularly pronounced in the Anoka Sand Plain due to the population distribution relative to the amount of state forest lands which exist in the subsection. The development patterns and associated stakeholder comments will influence how forestry management is implemented in the Anoka Sand Plain subsection.

- **How might DNR vegetation management address this issue?**
  DNR can develop vegetation management strategies that produce effects similar to natural disturbances and can begin to restore certain species and conditions that were once more prevalent. Further the DNR can attempt to accommodate as many forest users as practical given the limited state land base in the subsection.

- **What are possible consequences of not addressing this issue?**
  1) Loss of wildlife habitat and associated species; 2) increase in invasive exotics; 3) loss of biodiversity; 4) simplification of stand and landscape communities; 5) loss of ecologically intact landscapes; 6) loss of the ability to produce a diversity of forest products, e.g., saw timber, and other nontimber products, and recreation users; 7) decrease resilience to climate change; and 8) continued and heightened user conflicts on the existing state lands within the subsection.

C. How can the Department address the impacts of forest management on riparian and aquatic areas including wetlands?

- **Why is this an issue?**
  Riparian and aquatic areas are critical to fish, wildlife, and certain forest resources. Vegetation management practices within riparian areas also have impacts on water quality.

- **How might DNR vegetation management address this issue?**
  The Minnesota Forest Resources Council (MFRC) site-level guidelines are the DNR's standard for vegetation management in riparian areas. At the site level, managers may want to exceed those guidelines. When planning vegetation management adjacent to aquatic and riparian areas, managers can consider specific conditions associated with each site such as soils, hydrology, desired vegetation, and considers enhancements to the MFRC guidelines.

- **What are possible consequences of not addressing this issue?**
  Failure to consider vegetation management that affects riparian and aquatic areas could result in increased run-off and erosion; more conspicuous run-off events; less stable stream flows; and negative impacts to water quality, fisheries, and wildlife habitat.

D. How might the Department maintain or enhance biodiversity and native plant community composition on actively managed stands where historic disturbance patterns, such as the frequency and intensity of fire, have been interrupted?

- **Why is this an issue?**
  This is an issue because we have historically lost and continue to lose significant areas of native plant communities historically maintained by fire. Many of these native plant communities, such as pin oak- burr oak woodland, oak savanna, prairie, and sedge meadow, are increasingly rare. In addition, they support important populations of rare species and serve as reference areas to help us evaluate the effects of management on biodiversity. Further, there is increased fire danger due to the build-up of fuels in some areas.

- **How might DNR vegetation management address this issue?**
  DNR will incorporate management techniques that maintain or enhance biological diversity and structural complexity into vegetation management plans, including increased use of prescribed burning.

- **What are possible consequences of not addressing this issue?**
  1) Degradation of existing biodiversity and ecosystem function; 2) fewer opportunities for maintaining or restoring ecological relationships; 3) reduction of species associated with declining habitat; 4) economic losses due to loss of site capability to maintain or restore ecological relationships; 5) reduction of species associated with declining habitat; 6) economic losses due to loss of site capability to maintain desired species, and 7) social and economic losses resulting from a decline in recreational activity associated with wildlife viewing and hunting.

E. How might the Department provide habitat for game and non-game wildlife and plant species as well as maintain opportunities for hunting, trapping, and nature observation?

- **Why is this an issue?**
  This is an issue because wildlife habitat is being lost. Forest wildlife species are important to Minnesotans. Many factors, ranging from timber harvest to land use development, influence wildlife species and populations.

- **How might DNR vegetation management address this issue?**
  DNR can select vegetation management techniques that provide a variety of wildlife habitats and ecosystem functions.

- **What are possible consequences of not addressing this issue?**
  1) Reduction of some types of wildlife habitat; 2) reductions of species associated with declining habitats; and 3) economic and social losses resulting from a decline in recreational activity associated with wildlife viewing, hunting, and aesthetics.

F. How might the Department address the impacts on forest ecosystems from forest insects and disease, invasive species, nuisance animals, herbivory, global climate change, and changes in natural disturbances such as fires and windthrow?

- **Why is this an issue?**
  This is an issue because insect and disease occurrences have significant impacts on vegetation in this subsection. Further, these non-native invasive and/or exotic species may displace native

species/communities. All of the above- mentioned processes can impact the amount of forest land harvested and regenerated during the 10-year plan implementation period. They can also influence the long-term desired future forest composition (DFFC) goals of the subsection plans.

- **How might DNR vegetation management address this issue?**
  To address some of these issues, DNR can design flexibility into the plan to deal with specific stands that are affected by some of these processes such as invasive species management or insects. For other issues a broader landscape level approach will be necessary such as to manage for global climate change.

- **What are possible consequences of not addressing this issue?**
  1) Reduced timber volume and recreational enjoyment of the forest;
  2) long-lasting change to native plant and animal communities; and
  3) Increased fire dangers.

G. What are sustainable levels of harvest for forest products?

- **Why is this an issue?**
  One primary goal of the SFRMP is to achieve a long-term sustainable harvest of forest products while considering and planning for all forest users and species that depend on the various forest growth stages. Determining the sustainable level of harvest requires consideration of the needs of all forest wildlife, plant, and recreational needs. Further, DNR managed forestlands have been certified by two third party certifiers: the Forest Stewardship Council and the Sustainable Forestry Initiative. Certification of the DNR's forest lands verifies that sustainable forest management is being practiced by the DNR.

- **How might DNR vegetation management address this issue?**
  The DNR can develop a 10-year harvest plan for state lands in this subsection that: promotes a balance of all age classes for all even-aged cover types; monitors nontimber species to ensure no over treatment; and, incorporates efforts to protect and consider all wildlife and plant species as well as cultural resources.

- **What are possible consequences of not addressing this issue?**
  1) Possible unsustainable harvests of these forest product resources;
  2) Adverse impacts to wildlife habitat and native plant communities; and
  3) unintended impacts to rare species.

H. How can the Department increase the quantity and quality of timber products on state lands?

- **Why is this an issue?**
  Although not a major contributor to the total state harvest levels, the demand for timber from this subsection is important to the area's timber industry. Assuring a continued supply of wood products while balancing with demands for other forest values is the goal of all forest management planning. The interests and needs of all forest users must be given consideration.

- **How might DNR vegetation management address this issue?**
  Vegetation management planning can identify forest stands for treatments that will increase timber productivity (e.g., harvesting at desired rotation ages, thinning, control of competing vegetation, and reforestation to desired species and stocking levels).

- **What are possible consequences of not addressing this issue?**

Timber supplies would become less predictable and/or unsustainable over time, with potential negative impacts ranging from over supplies to scarcities of forest products, higher procurement costs for industry, increased chemical treatments, and waste.

I. How can the Department implement forest management activities and minimize impacts on visual quality?

- **Why is this an issue?**
  Scenic beauty is one primary reason people choose to live near or use their recreation and leisure time in or near forested areas. As population growth continues within the Anoka Sand Plain subsection, additional pressures will be placed on the area's remaining forested, woodlands, grasslands and open lands.

- **How might DNR vegetation management address this issue?**
  DNR managers will continue to follow Best Management Practices (BMPs) for visual quality as forest lands are managed and identify areas that may need additional mitigation strategies**.**

- **What are possible consequences of not addressing this issue?**
  Not addressing this issue may result in negative impacts to residents of the area and users of the forest, woodlands, and grasslands in the subsection.

J. How will land managers achieve desired results and continue to uphold various state and federal statutes?

- **Why is this an issue?**
  There exist a wide range of legal mandates the divisions within the DNR must follow to guide timber, wildlife, recreation and cultural management on state lands, many can be conflicting, while fulfilling both department and division missions. For example, State Trust Fund lands must generate income for various trust accounts under state law, with timber sales the primary tool to achieve this directive. Conversely, wildlife habitat management and preservation, not necessarily timber sales, is the mandate for acquired Wildlife Management Area (WMA) lands. Further, unless efforts are made to consider land management of other public land managers in the subsection, conflicting objectives on adjacent lands could result.

- **How might DNR vegetation management address this issue?**
  Vegetation management will take administrative land status, relevant statutes and coordination with other land managers into consideration during the planning process.

- **What are possible consequences of not addressing this issue?**
  Failure to follow these mandates and legislative intent may be a violation of federal or state law. Opportunities for cooperative efforts may be lost.

K. How will cultural resources be protected during forest management activities on state-administered lands?

- **Why is this an issue?**
  Cultural resource sites possess spiritual, traditional, scientific, and educational values. Some types of sites are protected by federal and state statutes.

- **How might DNR vegetation management address this issue?**
  DNR managers will continue to have all vegetation management projects reviewed for known cultural resources. They will survey unidentified sites and if cultural resources are found, modify the project to protect the resource. If cultural resources are discovered in the course of the planning process, stand site visit or treatment, the project will be modified to protect the resource.

- **What are possible consequences of not addressing this issue?**
  Loss or damage to cultural resources.

L. How can the Department ensure that rare plants and animals, their habitats, and other rare features are protected in this subsection?

- **Why is this an issue?**
  Protecting rare features (endangered, threatened, and special concern species and their habitats) is a key component of ensuring species, community, and forest-level biodiversity in this subsection.

- **How might DNR vegetation management address this issue?**
  The Minnesota County Biological Survey (MCBS) has been completed in all counties in the Anoka Sand plain Subsection. DNR managers will check the Rare Species Database for the location of known rare features in this subsection. Identification and consideration of rare features will be addressed in two ways: identified in the management plan as part of stand selection criteria and considered as prescriptions are written prior to active management.

- **What are possible consequences of not addressing this issue?**
  Loss of rare species at the local and state level; 2) rare species declines leading to status changes; 3) rare habitat loss or degradation; and 4) loss of biodiversity at the species, community, and/or landscape level.

M. How can the Department manage natural resources in the face of increased human population and urbanization?

- **Why is this an issue?**
  This is an issue because increasing populations, urbanization and land use change adjacent to public lands hinders the DNR's ability to implement the full range of management options. Further, development pressures can result in conflicting land uses adjacent to public lands and fragments public land holdings, resulting in degradation of the resource. The development patterns and associated stakeholder comments will influence how forestry management is implemented in the Anoka Sand Plain subsection.

- **How might DNR vegetation management address this issue?**
  Seek opportunities for coordination with adjacent land owners and coordinate with other land managers in the subsection. Work with local governments to achieve more appropriate land uses adjacent to state land through land use management and land protection strategies, such as park designation and conservation easements.

- **What are possible consequences of not addressing this issue?**
  Continued conflicting land uses adjacent to public lands, isolation of natural areas, and loss of connectivity between state-managed forested lands.

N. How can the Department accommodate the full range of management goals and stakeholder recommendations given the limited public land ownership in the Anoka Sand Plain?

- **Why is this an issue?**
  This is an issue because state ownership is limited in this subsection. Further, accommodating the full range of forest resource management given the land base will prove to be a challenge due to the continued development pressures projected in the subsection. The development patterns and associated stakeholder comments will influence how forestry management is implemented in the Anoka Sand Plain subsection.

- **How might DNR vegetation management address this issue?**
  The DNR will continue to cooperate and coordinate with adjacent land owners (public and private). Continue efforts to seek stakeholder recommendations throughout the planning

process. Disseminate final plans to other land managers to use in their planning processes and use it to influence management on private lands through Private Forest Management efforts. Continue education efforts supporting the overall multiple use and enjoyment concept that applies to state administered lands.

- **What are possible consequences of not addressing this issue?**
  Further conflicts between users and the recommended management of state forested lands are possible. Missed opportunities for coordination among public and private forest land managers, resulting in not achieving the highest potentials for forest lands to accommodate the multiple goals required given the limited land base and increasing development pressures.

O. How should managers use prescribed fire as a management tool?

- **Why is this an issue?**
  This issue results from development pressures and conflicting adjacent land uses that limit the range of management options available to the forest land managers. Most of the native plant communities in the Anoka Sand Plain are fire dependent. Fire was a frequent natural disturbance on the pre-settlement landscape. The development patterns and associated stakeholder comments will influence how forestry management is implemented in the Anoka Sand Plain subsection.

- **How might DNR vegetation management address this issue?**
  Work with local planning and zoning to encourage the use of "conservation development" adjacent to high quality native plant communities that are best maintained with prescribed fire. Work with adjacent landowners to reduce the risk to their property from wildfire or escaped prescribed fire. Consider alternative techniques (e.g. herbicides, mechanical treatment, etc.) to accomplish resource management objectives where variables make prescribed fire inappropriate. Increase the understanding of the role of fire in natural communities among resource managers and the public.

- **What are possible consequences of not addressing this issue?**
  Loss of prescribed fire as a management option for this landscape resulting in yet further native plant community degradation.

2.4 From Preliminary Issues to General Direction Statements, DFFCs, and Strategies

Table 2.1 provides a summary of the final *Issues* together with the associated *General Direction Statements*, *DFFCs,* and *Strategies* as discussed in Chapter 3.

Table 2.1 SFRMP Issues, General Direction Statements and Strategies

	SFRMP Issue	General Direction Statements	Strategies
	3.1 Within Stand composition and Structure	**GDS-1A: Some stands on state lands will be managed to reflect the composition, structure, and function of native plant communities.**	a. Continue to use the Field Guide to the Native Plant Communities in Minnesota. b. Follow Strategies in GDS-3C and 3F
		GDS 1B: Species, age, and structural diversity within some stands will be maintained or increased.	a. Use selective harvesting to encourage diversity of species, ages, and stand structures. b. Implement the Site-Level Guidelines designed to maintain a diversity of tree species within a stand. c. Use the NPC Field Guide, site index, soils data, and ECS Silvicultural Interpretations to aid in determining the species composition and structure most appropriate for the site. d. Retain tree species, stand structure, and ground layer diversity within stands when prescribing timber stand improvement and thinning activities. e. Reserve seed trees in harvest areas and site preparation areas, where possible. f. Use the least intensive site preparation methods possible to ensure success. g. Use harvest systems or methods that protect advance regeneration. Retain conditions that favor regeneration and understory initiation. h. Identify some stands where succession is allowed to occur to encourage development of within-stand diversity. Movement to the next successional stage may be achieved with or without harvest. **i.** Increase and/or maintain by reserving from harvest, target species including white pine, burr/white oak, yellow birch, tamarack, and butternut as a component within appropriate cover types. Silvicultural practices that may add or increase the presence of these target species will include planting, inter-planting, and artificial or natural seeding.

	SFRMP Issue	General Direction Statements	Strategies
			j. Manage planted and seeded stands to represent the array of plant diversity. k. Use ERF in some even-age managed stands to encourage greater structural diversity. j. Encourage native fruit and mast-producing species.
	3.2 Harvest Levels	**GDS-2A: 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.**	a follow Strategies in GDS 1B, 3C and 3F
		GDS-2B: The harvest of nontimber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity.	a. Consider known traditional gathering areas when managing other forest resources. b. Consider the known locations of important wildlife habitats, rare native plant communities or species, and the possible impacts of nontimber forest products harvest practices before issuing special product permits. c. Forest managers should proceed judiciously when issuing special products permits for species where limited knowledge and understanding constrains our ability to know if we are managing these groups of species sustainably.
	3.3 Biological Diversity, Forest Composition, and Spatial Distribution	**GDS-3A: Old forest in this subsection is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity.**	a. Determine the desired level of effective extended rotation forest for even-age managed cover types. b. Prescribe ERF stands in even-age managed cover types so that adequate old forest is maintained at the end of the plan implementation period c. Manage some riparian management zones to reflect old forest conditions. d. Allow some stands to naturally succeed to long-lived cover types with, or without the use of harvest. e. Manage designated old-growth stands and old forest management complexes according to DNR policy.

	SFRMP Issue	General Direction Statements	Strategies
			f. Manage ecologically important lowland conifers according to department direction. g. Follow the MFRC Voluntary Site-Level Forest Management Guidelines (Site-Level Guidelines) to retain components of old forest in even-age managed cover types. h. Use silvicultural treatments that retain old forest components in some stands. i. Consider the status of old forest within the subsection when making decisions to add and offer unplanned wood for harvest.
		GDS-3B: Species of Greatest Conservation Need and Key Habitats are maintained or enhanced in the subsection.	a. Provide current SGCN and Key Habitat data to DNR staff upon request. b. Incorporate new SGCN and Key Habitat locations and data as they are collected in these subsections. c. Select some ERF, OFMC, EILC, and SMA stands based on their association with SGCNs and Key Habitats. d. Stand-level management accounts for SGCN and Key Habitats.
	DFFC **The DFFC of cover types on the landscape will be as shown on Table xxx. The ASP Plan will move the subsection toward more oak savanna acreage in upland areas. Cover type increases over the next 10 years will occur in oak savanna, low density oak** **Cover type decreases will occur in** **The cover type acreages of** **will be maintained over the 10-year planning period.**	**GDS-3C: 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.**	a. **I**ncrease the acres of white pine oak savanna, and prairie b. Increase mixed-forest conditions in some stands in all cover types. c. Forest composition goals and objectives are consistent with the MFRC Landscape plans.

	SFRMP Issue	General Direction Statements	Strategies
		GDS-3D: 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	a. Determine which MCBS sites are of greatest concern or importance for SFRMP over the 10-year plan implementation period. b. Consider the broader context and significance of the MCBS site as a whole when assigning management objectives and designing silvicultural prescriptions. c. Determine location and composition of stand conversions based on NPCs. d. Allow some stands to succeed to the next native plant community growth stage, with or without harvest. e. Emulate the within-stand composition, structure, and function of NPC growth stages when managing stands in MCBS sites. f. Apply variable density thinning during harvest or reforestation. g. Apply variable retention harvest techniques during harvest. h. Designate some stands as ERF to provide old forest conditions. i. Increase the use of prescribed fire as a silvicultural technique in managing fire-dependent NPCs. j. Locate roads to minimize impacts to MCBS sites. k. Emulate natural disturbance conditions of native plant communities in MCBS sites. l. Apply special management recommendations for known rare features, Species of Greatest Conservation Concern, and Key Habitats. m. Defer management of some stands that have been identified as having high conservation value for further assessment (e.g., EILC and nominated natural areas, and rare or representative ecosystems). n. Consider timber productivity, trust responsibilities, and other forest management priorities when managing stands in these MCBS sites. o. Forestry, Wildlife, and Ecological and Water Resources personnel will communicate with other landowners, as opportunities arise, to inform them of the significance of these MCBS sites and management options that could be implemented to address the biodiversity objectives of these MCBS sites.

	SFRMP Issue	General Direction Statements	Strategies
		GDS-3E: Rare plants and animals and their habitats are protected, maintained, or enhanced in these subsections.	a. Provide current rare features database (Natural Heritage Information System) to DNR staff through the DNR Quick Layers Themes in ArcGIS. b. Select some ERF, OFMC, SMA and EILC stands based on their association with rare features. c During the development of the 10-year stand examination list and annual stand examination lists, land managers check the rare features database and flag for follow-up consultation those stands proposed for treatment that includes a rare feature. d. Harvest prescriptions, and other management proposals identify and implement measures that protect rare features.
		GDS-3F: Rare native plant communities are protected, maintained, or enhanced in these subsections.	a. Manage known locations of critically imperiled (S1) or imperiled (S2) NPCs and those NPCs that are rare statewide or with limited occurrences in these subsections to maintain their ecological integrity. b. Ecological and Water Resources staff identified stands that are high quality examples of rare native plant communities. Those stands were removed from consideration for placement on the 10-year stand exam list.
		GDS- 3G: Even-age managed cover types will be managed to move toward a balanced age-class structure.	a. Target the selection of stand treatment acres to the appropriate age classes.
	DFFC Statement Prescribed ERF and effective ERF stands will be identified and will have silvicultural treatments prescribed to enhance the older forest features.	**GDS-3H: 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**	a. Prescribe ERF stands within even-age managed cover types so that each age class will be represented to produce a sustainable amount of old forest over time. b. Target ERF treatment acres to the appropriate age classes to move toward the declining age-class structure after normal rotation age.

	SFRMP Issue	General Direction Statements	Strategies
		GDS-3I: State lands will include representation of each of the Native Plant Community growth stages that historically occurred in these subsections.	a. Determine the growth stage stands selected for treatment in these Subsection. b. Strive to emulate the within-stand composition, structure, and function of NPC growth stages when managing stands. c. Consider the contribution of non-timber land cover types (e.g., stagnant conifer types), inoperable stands, and reserved areas (e.g., old growth, SNAs, state parks, Sherburne National Wildlife Refuge, and Cedar Creek Ecosystem Science Reserve) in providing representations of growth stages when developing prescriptions. d. Consider the contribution of non-timber land cover types (e.g., stagnant conifer types), inoperable stands, and reserved areas (e.g., old growth, SNAs, state parks, Sherburne National Wildlife Refuge, and Cedar Creek Ecosystem Science Reserve) in providing representations of growth stages when developing prescriptions. e. Manage the Designated Representative Sample Areas (RSAs) and High Conservation Value Forests (HCVF) consistent with forthcoming DNR direction to achieve distributions of native plant communities., f. Apply ECS Silvicultural Interpretations when proposing stand management prescriptions.
	3.4 Wildlife Habitat	**GDS-4A: Adequate habitat and habitat components exist, simultaneously at multiple scales, to provide for nongame species found in these subsections.**	a. Provide old forest distributed across the landscape. b. Provide young forest distributed across the landscape. c. Provide a variety of cover types and age classes across the landscape that better reflect patterns produced by natural disturbances. d. Manage to retain the integrity of riparian areas and provide protection for seasonal and permanent wetlands. e. Provide for the needs of species that depend on perches, cavity trees, bark foraging sites, and downed-woody debris. f. Provide for the needs of species associated with important native plant communities in this subsection. g. Provide for creation and maintenance of within-stand diversity. h. Manage to favor native plant communities and retain elements of biodiversity significance.

	SFRMP Issue	General Direction Statements	Strategies
			i. Consider Natural Heritage Program data and other rare species information during development of both the 10-year and annual stand examination lists. j. Apply the DNR management recommendations for habitats of nongame species as described in DNR guidelines and policies. k. Provide a range of habitats for short distance and long-distance (neo-tropical) migratory birds.
		GDS-4B: Adequate habitat and habitat elements exist, simultaneously at multiple scales, to provide for game species found in these subsections.	a. Provide young forest distributed across the landscape. b. Provide old forest distributed across the landscape. c. Provide a balanced age-class structure in cover types managed with even-age silvicultural systems. d. Increase the productivity and maintain the health of even-age managed cover-type stands. e. Provide for creation and maintenance of within-stand diversity. f. Continue to manage wildlife management areas for the benefit of game species. g. Manage priority open landscape areas (OLAs) for the benefit of wildlife species.
	3.5 Riparian and Aquatic Areas	**GDS-5A: Riparian areas are managed to provide critical[2] habitat for fish, wildlife, and plant species.**	a. Apply the Site-Level Guidelines relating to riparian areas. b. Manage to maintain or increase old forest in riparian areas. c. Using the NPC Field Guide and associated ECS Silvicultural Interpretations, manage for a species appropriate for the site. d. Discourage reed canary grass where feasible. e. Follow recommendations in Tomorrow's Habitat for the Wild and Rare. f. Consider recommendations of local governments and water resource management agencies when applying stand treatments within areas subject to water related and land use management plans.

	SFRMP Issue	General Direction Statements	Strategies
		GDS-5B: Forest management on state lands adequately protects wetlands and seasonal ponds.	a. Apply the Site-Level Guidelines when treating stands near wetlands and seasonal ponds. b. Consider landforms (e.g., end moraines) that have seasonal ponds and small open-water wetlands, and address those features in site-specific prescriptions that are developed during the stand examination field visit.
	3.6 Timber Productivity	**GDS-6A: Timber productivity and quality on state timber lands is increased.**	a. Move toward harvesting even-age managed non-ERF stands at their normal rotation age. b. Examine all stands over maximum rotation age in even-age managed cover types. c. Thin or selectively harvest in some stands. d. Include silvicultural treatments such as site preparation, inter-planting, release from competition (e.g., herbicide application or hand release), and timely thinning in plantation management, to increase productivity. e. Apply and supervise the implementation of the Site-Level Guidelines on treatment sites. f. Continue to implement, supervise, and enforce current DNR timber sale regulations to protect and minimize damages to sites or residual trees from treatment activities. g. Manage some ERF stands for large diameter, high-quality sawtimber products by retaining adequate stocking and basal area. h. Respond to insect and disease problems, as appropriate.
	3.7 Forest Pest, Pathogens and Exotic Species	**GDS-7A: Limit damage to forests from native and introduced insects and diseases to acceptable levels where feasible.**	a. Identify and monitor insect and disease species populations as part of the Forest Health Monitoring Program and document their occurrence on state-managed lands. b. Manage existing forest insect and disease problems, as appropriate within the constraints of budgets. c. Implement intervention plans developed by regional and statewide committees *before* pest outbreaks. d. Manage stands to reduce the potential impact of insects and diseases. e. In ERF stands, a higher level of impact from native insect and disease infestations may be accepted as long as it does not jeopardize the ability to regenerate the stand to the desired forest cover type or the management goals of the surrounding stands.

	SFRMP Issue	General Direction Statements	Strategies
		GDS-7B: Reduce the negative impacts caused by exotic species on forest vegetation on state forest lands.	a. Identify and monitor harmful exotic species populations as part of the Forest Health Monitoring Program and document their occurrence on state-managed lands. b. Adhere to the Minnesota DNR 2010 Invasive Species Program Directive c. Follow Minnesota DNR Operational Order 113 (Invasive Species) to minimize the spread of invasive exotic species during forest management activities. d. Manage exotic species, as appropriate, within the constraints of budgets . e. Manage non native invasive exotic species, as appropriate, within the constraints of budgets.
		GDS-7C: Reduce the negative impacts caused by wildlife species on forest vegetation on state forest lands.	a. Monitor state lands for damage caused by wildlife. b. During plantation establishment , control gophers as per current policy.
	3.8 Climate Change	**GDS-8A: 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.**	a. Maintain or increase species diversity across the subsection. b. Maintain or increase structural diversity across the subsection. c. Maintain connectivity that permits the migration of plants and animals as climate changes the landscape. d. Evaluate site conditions with respect to climate change when selecting tree species for regeneration. e. Use the concept of carbon sequestration to remove carbon dioxide (the most significant anthropogenic greenhouse gas) from the atmosphere. f. Apply the *Site-Level Guidelines* for tree species at the edge of their range.
	3.9 Cultural Resources	**GDS-9A: Cultural Resources will be protected on state-administered lands.**	a. Annual Stand Exam lists are reviewed by DNR archeologists; recommendations for mitigation are implemented as part of sale design.

	SFRMP Issue	General Direction Statements	Strategies
	3.10 Natural Disturbance Events	**GDS-10A: 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.**	a. The subsection planning team will evaluate large-scale (100's to 1000's of acres) disturbance events to determine appropriate action. b. Local land managers will evaluate and determine appropriate actions for small-scale (10s of acres) disturbance events.
	3.11 Prescribed Fire as a Management Tool	**GDS 11A: Continue to use prescribed fire as a forest vegetation management tool in the Anoka Sand Plain subsection.**	a. Work with local planning and zoning to encourage the use of "conservation development" adjacent to high quality native plant communities that are best maintained with prescribed fire. b. Work with adjacent landowners to reduce the risk to their property from wildfire or escaped prescribed fire. Implement "Fire Wise" concepts to prevent fire from coming onto state lands and leaving state lands noted in the Structural Development and Urbanization section 3.13. c. 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. d. Increase the understanding of the role of fire in fire dependent natural plant communities among resource managers and the public. e. Utilize the MN DNR prescribed fire forms and documents web page. f. Address smoke management concerns to allow continued use of prescribed fire to maintain fire dependent natural plant communities. g. Mimic historical pre-settlement fire frequency and intensity of forested, oak savanna, and open landscape fire dependent natural plant communities. h. When known rare plant and animal species are present in a fire dependent community, land managers will give consideration on how to minimize localized short term population declines caused by prescribed fire for specific listed species as much as practical.

	SFRMP Issue	General Direction Statements	Strategies
			Consider alternative techniques to accomplish resource management objectives where variables make prescribed fire inappropriate. i. Recognize infrastructure needs to implement prescribed fires, include maintenance and creation of fire breaks, obtaining fire equipment, and staff funding needs.
	3.12 Structural Development and Urbanization	**GDS-12A: The changing structural development and urbanization pattern will be considered as forest management is implemented in the subsection**.	a. Inform adjacent landowners when management activities will occur on the state land next to them and, when feasible, mitigate management activities to address landowners concerns. b. Encourage private landowners, local governments and other land managers to implement compatible land uses adjacent to state land through land use management actions. c. Work with other divisions to mitigate the impacts of forest management on recreational users. d. Inform adjacent landowners, local governments and stakeholders of forest management planning processes. e. Implement "*Fire Wise*" concepts to prevent fire from migrating onto state lands, from adjacent lands, and from escaping state lands.
	3.13 Limited Public Land Ownership	**GDS 13A : 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.**	a. influence management on private lands through stewardship planning efforts. b. Disseminate final plans to other land managers to use in their planning processes. c. Strategically purchase lands with conservation values.

Chapter 3 General Direction Statements and Strategies

Introduction

In response to the final list of Issues identified in Chapter 2, the ASP team developed General Direction Statements (GDSs) to address the issues, Strategies to achieve the general directions, and desired future forest composition goals. General Direction Statements take into account the direction provided in State statutes and rules, Department policies, guidelines, and directions (e.g., *A Strategic Conservation Agenda 2009-2013), and management that will sustain the forest resources on state-administered forest lands in the subsection*. GDSs provide general direction such as: increase, decrease, maintain, or protect a certain condition, output, or quality. Strategies were developed for each of the GDSs to achieve the general direction. To a major extent the GDSs and Strategies in this ASP SFRMP are guided by vegetation management directions established in the *Sand Dunes State Forest Operational Pl*an (see Appendix C. The directions contained in the *Operational Plan* result from guidance provided by Department management.

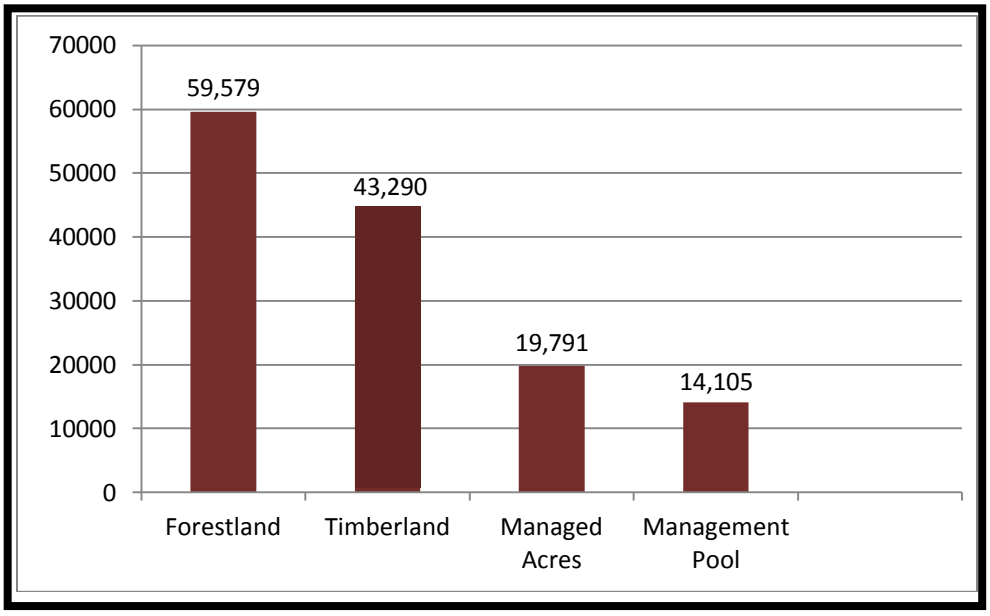
In situations where there is currently an ability to measure and quantify progress, goals were identified. Examples of goals are: cover-type acres, age-class distribution, and cover-type treatment levels (e.g., harvest levels). Goals, General Direction Statements and Strategies (Chapter 3), were used to develop stand selection criteria to identify a pool of stands from which to select stands to be treated during this 10-year plan. Selection and treatment of stands from this pool is expected to move State-administered forests in this subsection toward the goals. The GDSs, Strategies, and goals presented in this Chapter guided the selection of stands and the application of treatments to stands selected for treatment during the 10-year plan implementation period (fiscal years 2013 to 2022).

For most even-age managed cover-types, recommendations assume that balancing the distribution of the 10-year age classes is a long-term goal, even though it may take more than one rotation to achieve for most cover-types. In some cover-types (e.g., aspen and oak), this will be very difficult to achieve, due to existing age class distribution, species characteristics, changing disturbance regimes, markets and actual sales vs. stands offered.

The goals, GDSs and Strategies in the Anoka Sand Plain Subsection Forest Resource Management Plan (ASP SFRMP) for state-administered forest lands are consistent with those recommended by the regional landscape committees organized under the direction of the Minnesota Forest Resource Council (MFRC) Landscape Program. The ASP SFRMP is consistent with the East Central Regional Landscape report that includes desired future forest conditions and strategies for consideration across all ownerships.

This ASP SFRMP directs vegetation management over the 10-year plan implementation period of state administered lands managed by the divisions of Forestry and Fish and Wildlife. The figure below shows the state land acres administered by these divisions in the Anoka Sand Plain (ASP) subsection.

Chart 3.1
Forestlands, Timberlands, Managed Acres and Management Pool in the Anoka Sand Plain Subsection in Acres

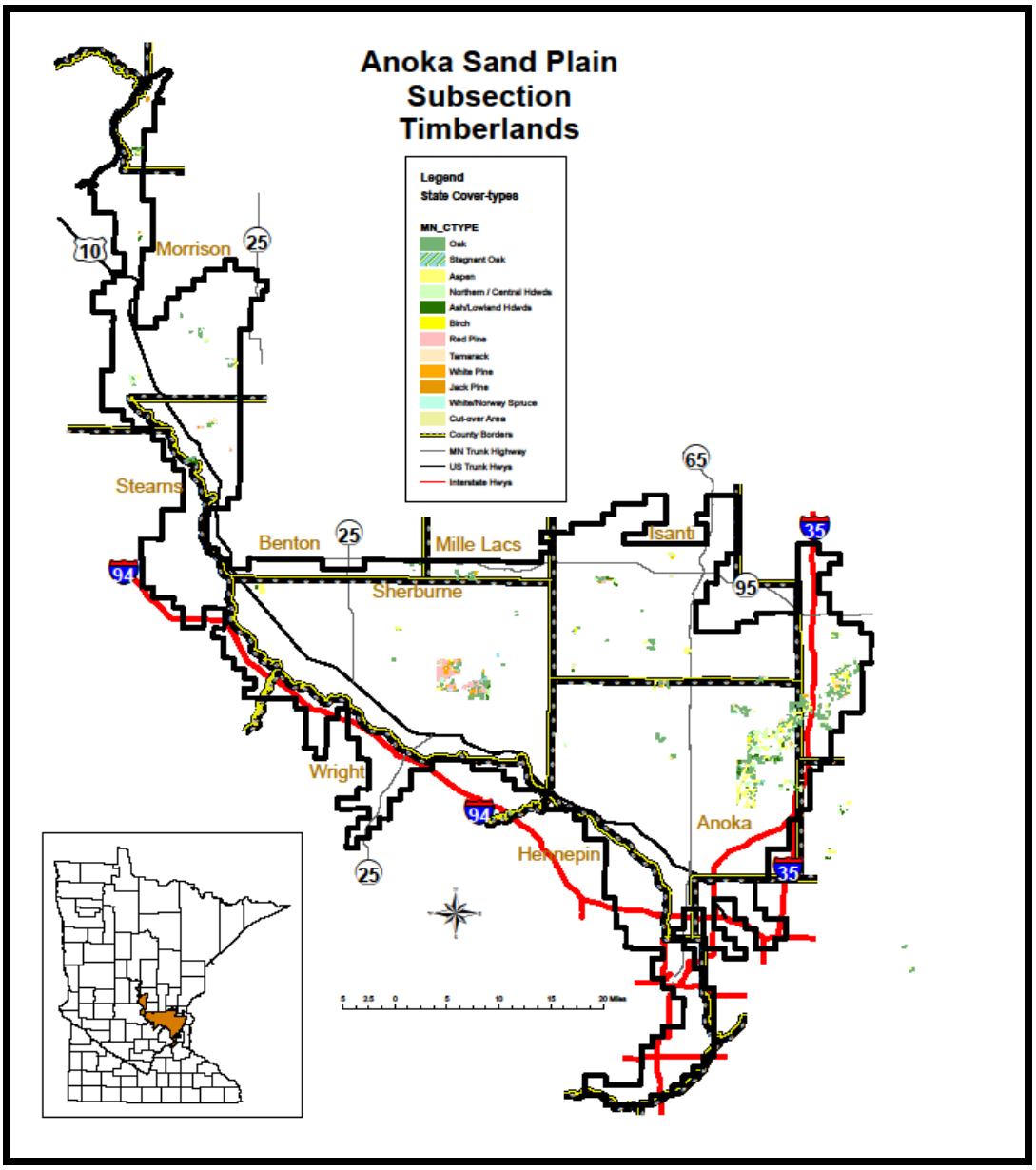


Forestland (59,579 acres) consists of all lands included in the DNR forest stand inventory (i.e., Cooperative Stand Assessment, or CSA), including cover-types from aspen to stagnant conifers, muskeg, lowland brush, and other wetlands. These are basically Department administered lands. As a category *forestland* in this subsection includes many acres of non-forested cover-type such as grasslands, prairie, and brush. *Timberland* (43,290 acres) is forestland *capable* of producing timber of a marketable size and volume, but may not contain forested lands. It does not include lands withdrawn from timber utilization by statute or administrative regulation such as state parks. In this plan, *Managed* Acres are those timberland acres available for timber management purposes (i.e., excludes timberlands reserved as old growth, SNAs; inoperable stands, etc.). These *Managed Acres* equal approximately 19,791 acres. The *Management Pool* acres are those *Managed Acres* minus grasslands and lands in the inventory classed as agricultural, and reflect lands that are currently identified with a cover-type. The *Management Pool* acres (14,105) represent only 24 percent of the total Department administered lands of the ASP subsection, indicating that the majority of Department administered lands are not capable of producing timber products or not subject to the SFRMP process.

Note: Due to updates to the forest inventory and other data sources during the planning process, there may be differences in acreages shown between various tables and figures in this planning document. These differences will not have a significant effect on the recommendations in this plan.

Map 3.1 below identifies the timberlands in the ASP subsection by cover-type. The majority of state administered timberlands are located within the Sand Dunes State Forest (Sherburne County) and the Carlos Avery Wildlife Management Area (Anoka and Chisago Counties). In addition, some acres within the St. Paul-Baldwin Plains and Moraines subsection (southeast of the ASP) were given consideration in the ASP SFRMP. These acres were included because no SFRMP will be prepared for this minor subsection. A total of 1,410 acres administered by the Section of Wildlife were considered as the 10-Year Stand Exam List was developed but none of these acres met the stand selection criteria.

Map 3.1 Anoka Sand Plain Timberlands



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

Role of Department guidance documents, policy and management recommendations.

In addition to DFFCs, General Direction Statements, Strategies and Stand Selection Criteria identified in this SFRMP, vegetation management is directed by an array of planning documents, guidelines, policies, objectives and initiatives adopted and implemented by the Department. Vegetation management implemented by the Department must consider this wide range of directives as they apply to individual site-level decisions.

In this chapter, the GDSs and associated Strategies are grouped under thirteen forest resource management Issue areas. These Issue areas evolved from discussion by the subsection planning Team and were

published for public review (the *Anoka Sand Plain Preliminary Issues and Assessment document,* September, 2011). This ASP SFRMP is organized around responding to the Issues through DFFCs, GDSs and Strategies.

3.1 Within-Stand Composition and Structure

Major Cover-types found in the ASP Subsection

Analysis and discussion of within-stand composition and structure is based on the current and future conditions of the cover-types found in the subsection. Following is a summary of the current and desired future condition of the cover-types found in the subsection.

Aspen

Current Conditions

Cover-type Acres

Mature aspen stands are typically comprised of a mixture of species, with aspen being the major component as measured by volume. There exist approximately 1,819 aspen timberland acres in this subsection. The aspen cover-type accounts for approximately 13 percent of the total management pool acres in the subsection.

Age-Class Distribution:

The current aspen age-class distribution does not reflect the desired balanced age-class structure for even-age managed cover-types.

As shown below the aspen cover-type is not a balanced age class distribution. Much of the 1-10 age class is the result of the Carlos Edge fire. Other factors which contribute to the current imbalance include uneven markets and the fact that 300 acres were cut in Carlos Avery under contract in 1979-1980 to regenerate old stands when there was no market for aspen. The 11 acres of 111-120 aged aspen is likely an inventory error.

Stand Composition:

A mixture of species comprises the typical mature aspen stand, with aspen being the major component as measured by volume. In this subsection, typical secondary cover-types in aspen are: northern hardwoods, white pine and black ash. Understory species in aspen are more likely to be aspen, white pine and black ash.

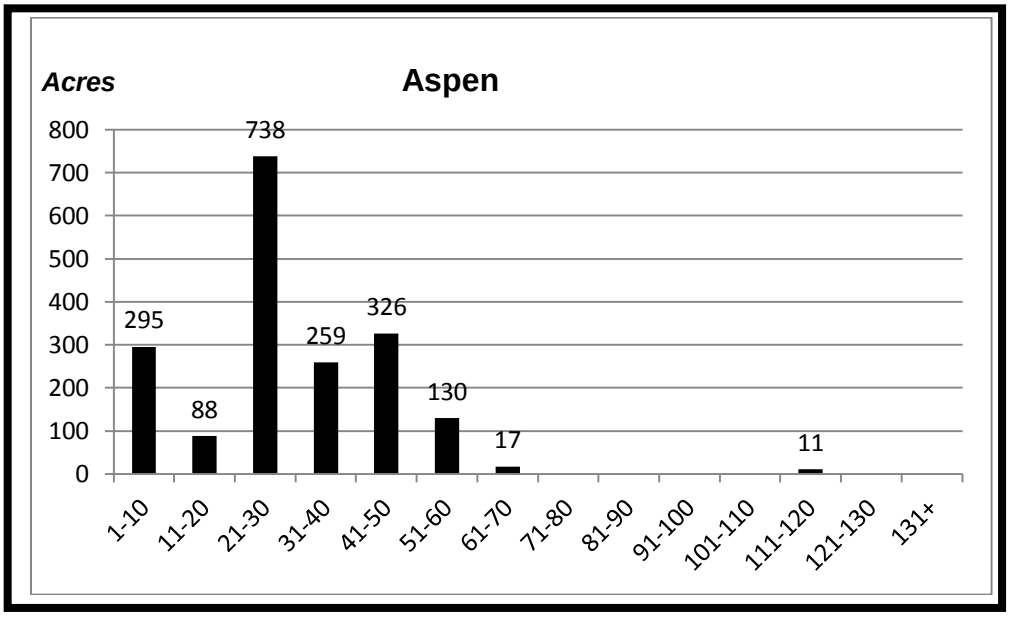
Native Plant Communities:

Typical native plant community where the aspen cover-type is found include:

- MHc26 CENTRAL DRY-MESIC OAK-ASPEN FOREST
- FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND

Chart 3.2 identifies the current age class distribution of aspen acres in the ASP subsection.

Chart 3.2 Aspen Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Future Direction

Cover-type Management Directions:
The direction for aspen over the 10-year plan implementation period is a reduction of 102 acres (6 percent) of the cover-type.

Approximately 102 acres of aspen are identified to be converted or allow a component to increase, primarily to white pine and oak over the 10-year plan implementation period. The decision whether or not to convert a stand to another cover-type will be determined when the stand is field visited. The outcome of a NPC-ECS field evaluation will determine the appropriate species conversions. Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes. Identifying rotation ages for the aspen cover-type and selecting stands to be site visited and treated that are at or over the rotation age, and applying similar stand selection criteria over future planning periods will have a positive effect on bringing the current age class imbalance more into balance over the long term .

Special Concerns or Limiting Factors:
A significant portion of the aspen cover-type consists of relatively small “aspen islands” distributed among lowland grasses, low areas and sedge meadows, particularly in the Carlos Avery WMA. The relatively small size of these islands together with difficulty accessing them during the winter poses a challenge to creating economically viable timber sales.

Establishment of gypsy moth seems likely in Minnesota during the 10-year plan implementation period. Oak and aspen are preferred hosts for gypsy moth, and early-season defoliation can place additional stress on trees. Decline and mortality from secondary causes may become a factor in mature or over-mature oak and aspen stands that have been defoliated repeatedly by gypsy moth. Silvicultural strategies for dealing with gypsy moth include managing for younger age classes that are more resilient to defoliation and

Oak

Current Conditions

Cover-type Acres:
In 2011, the oak cover-type comprised the majority of timberland acres in the ASP subsection accounting for 44 percent (6,260 acres) of total management pool acres in the ASP.

Age-Class Distribution:
As shown below, the oak cover-type does not represent a balanced age class distribution. Oak age class distribution reflects a change in land management and land ownership that occurred in the 1920's through the 1940's. The state acquired land through direct purchase and tax forfeiture. Agricultural grazing and crop production ceased on many acres, and oak seedlings and stump sprouts had an opportunity to get established. As agriculture decreased, the use of fire for land clearing also decreased. During the drought years of the 1930's fire from any source was more likely to have a significant impact on the landscape. As weather returned to normal patterns and fire suppression techniques improved, large scale fires became less frequent which allowed oak woodlands to expand. The spike in the 1-10 age class is partly the result of the Carlos Edge fire in 2000 and the subsequent mortality and regeneration of large areas of oak. Five hundred and forty acres of this age class are the results of timber harvest on Forestry land conducted to regenerate oak in an attempt to get a more balanced age class distribution. The 61-90 age class spikes are likely due to the discontinuation of widespread burning for vegetation management and the fire suppression efforts that followed resulting in regenerating stands being allowed to grow instead of continually being set back. In the 1920's and 1930's there were many farms abandoned and those fields subsequently converted back to woodlands, primarily oak. Due to the poor soils in the ASP, this is likely a contributing factor in the establishment of stands that are now 70-90 years old in the Sand Dunes State Forest.

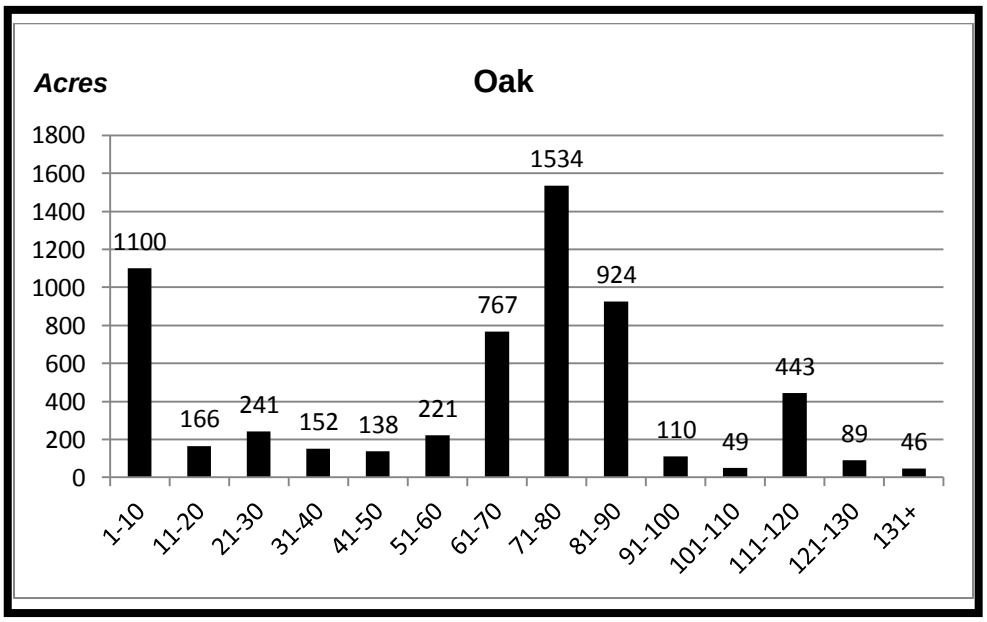
Stand Composition:
The oak cover-type in the ASP includes northern red oak, bur oak, northern pin oak and white oak. Oak species are commonly found as a component of other cover-types such as aspen and northern hardwoods, but sometimes are pure stands. Natural, mature oak stands range from nearly pure oak to mixed stands. Secondary species in the oak cover-type are most often aspen, paper birch, sugar maple, and red maple. Some oak stands are oak savanna native plant communities that have become more like woodlands in the absence of fire.

For purposes of identifying the oak treatment levels, the oak species found in the subsection (white, bur, red and pin) have been included as just one cover-type: oak. The exception to treating all oak species the same in this plan is the application of rotation ages. See Table 3.2 for the recommended rotation ages for the several oak species. As site visits are made to oak stands identified on the 10-Year Stand Exam List, the rotation age specific to the preferred oak species will be used to determine final stand management objectives and final prescriptions.

Of the 6,260 acres typed as oak or off-site oak, Bur or white oak were the dominant species on 934 acres (15% of the total oak acres). Red or pin oak is the dominant species on 5,326 acres (85% of the total oak acres).

Chart 3.3 identifies the current age class distribution of oak acres in the ASP subsection.

Chart 3.3 Oak Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Native Plant Communities:

Typical native plant communities where the oak cover-type is found include:

- FDc25 CENTRAL DRY OAK-ASPEN (PINE) WOODLAND
- MHs37 SOUTHERN DRY-MESIC OAK FOREST
- FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND

Future Direction

Cover-type Management Direction:

The 10 year direction for the oak cover-type is to maintain the approximate same number of oak acres on the landscape. A slight increase in the total acres by approximately 116 acres through conversions primarily from aspen, red cedar, jack pine and upland grass and brush will occur. Fifty-eight of the 116 acres of oak conversion will occur emphasizing conversion to oak savanna. Further, approximately 313 acres of the current oak cover- type will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. Of these 313 acres many oak stands will be reduced in canopy density by enhancing and restoring the native plant community, primarily oak savanna. Reduction in the density of some oak stands will be seen due to the convert to and increase in the white pine component.

The decision to convert, increase a component or conserve biodiversity of an oak stand to another cover-type or stand density will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate management.
Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:

After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes. Identifying rotation ages for the oak cover-type and selecting stands to be site visited and treated that are at or over the rotation age, and applying similar stand selection criteria over

future planning periods will have a positive effect on bringing the current age class imbalance more into balance over the long term .

Stand Composition:
Many of the oak to oak conversions identified on Table 3.1 are likely converting one oak species to another oak species. In these conversions, the challenge will be to reduce pin oak while maintaining the bur oak component.

This reflects a management goal in portions of the Sand Dunes State Forest to reduce the density of some oak woodlands and restore native plant communities as oak savannas dominated by bur oak.

Special Concerns or Limiting Factors:
Special concerns include the ability to maintain stands in the presence of oak wilt. Further, non-native invasive species such as honeysuckle, buckthorn, and black locust must be considered and managed. Another concern is the native species ironwood which can dominate the understory of some stands.

In addition, because much of the future direction for the oak cover-type includes managing for the native plant community and using prescribed fire as a treatment tool, the challenges associated with prescribed fire are limiting factors including maintaining fire control, confining fire to the site, and reducing smoke impacts on adjacent lands.

Establishment of gypsy moth seems likely in Minnesota during the 10-year plan implementation period. Oak and aspen are preferred hosts for gypsy moth, and early-season defoliation can place additional stress on trees. Decline and mortality from secondary causes may become a factor in mature or over-mature oak and aspen stands that have been defoliated repeatedly by gypsy moth. Silvicultural strategies for dealing with gypsy moth include managing for younger age classes that are more resilient to defoliation and maintaining species diversity within stands. Efforts to change the age class distribution in the ASP should also improve the ability of those stands to withstand gypsy moth defoliation.

Red Pine

Current Conditions

Cover-type Acres:
Red pine is a major cover-type in the ASP subsection with approximately 2,402 acres which represents approximately 17 percent of the management pool acres.

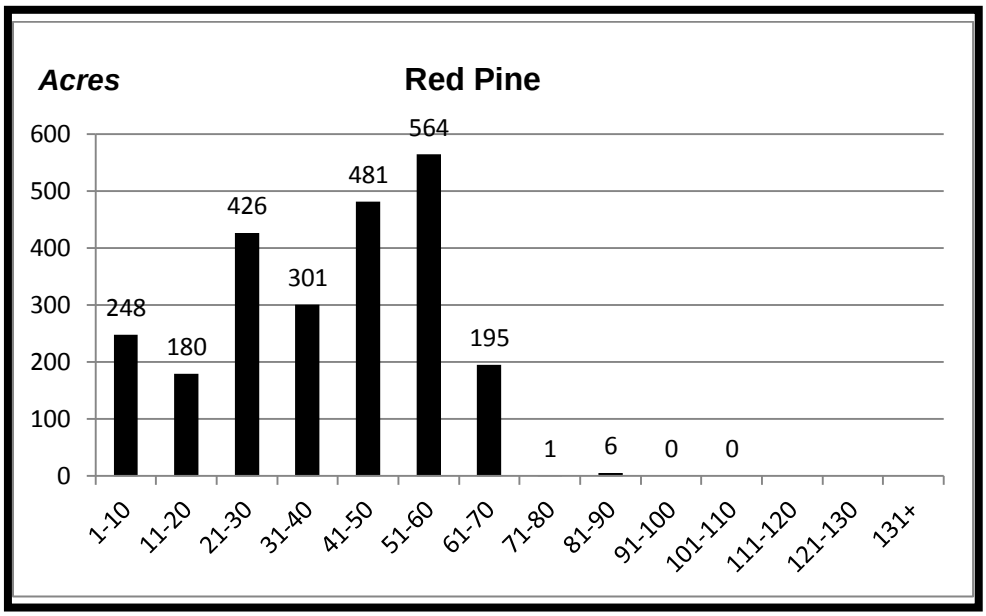
The ASP is on the western edge of the red pine range. Red pine did not occur at the time of initial European settlement except in the northern edge of the subsection. Most current stands were planted or have seeded in from nearby plantings. The percentage breakdown of red pine for this subsection is 85% on forestry lands and 15% on wildlife lands. As with white pine, it was planted in the Sand Dunes State Forest as lands were acquired. On wildlife lands it was planted as a “thermal cover” for wintering wildlife. Initially these acquired agriculture fields were planted purely to red pine and at fairly dense spacing. At that time, the demand for wood posts was high and these stands were thinned at an early age. In more recent years, as the post markets waned, the spacing was increased and white pine was mixed with the red pine during planting.

Age-Class Distribution:
The distribution of ages for red pine is reflected by the acquisition of forest lands, with the first plantings occurring 60-70 years ago. Site indexes for red pine on ASP soils are very high. There are multiple thinning entries during the life of the stand with each progressive entry yielding a higher value product.

Stand Composition:
Natural, mature red pine stands are typically mixed stands. Secondary species in the red pine cover-type are: white pine, jack pine, balsam fir, aspen, birch, white spruce, and possibly a scattering of red maple.

Chart 3.4 identifies the current age class distribution of red pine acres in the ASP subsection.

Chart 3.4 Red Pine Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Native Plant Communities:
A typical native plant community where the red pine cover-type is found includes:

- FDc34 CENTRAL DRY MESIC PINE-HARDWOOD FOREST

Future Direction

Cover-type Management Directions:
The 10-year direction for red pine includes the following: approximately 34 acres will be converted into red pine from upland larch and aspen; 18 acres of red pine will allow the white pine component to increase; and 317 acres will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. The decision whether or not to convert a stand to another cover-type will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate species conversions. Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
Although red pine will be reduced as a commercial cover-type, those red pine acres in the ASP not identified for specific management to convert, enhance and or restore to a native plant community will be managed for timber productivity. At the end of the 10-year plan implementation period the age class distribution is expected to more closely approach the desired balance among age classes.

Stand Composition:
Stand composition of red pine in the ASP predominately results from plantations and natural seeding from plantations.

Special Concerns or Limiting Factors:
During droughts, red pine are susceptible to bark beetle infestations (more so than white pine) so cutting regulations have to be adjusted accordingly. Loggers pay a premium for pine on the ASP because of its summer accessibility.

Northern Hardwoods

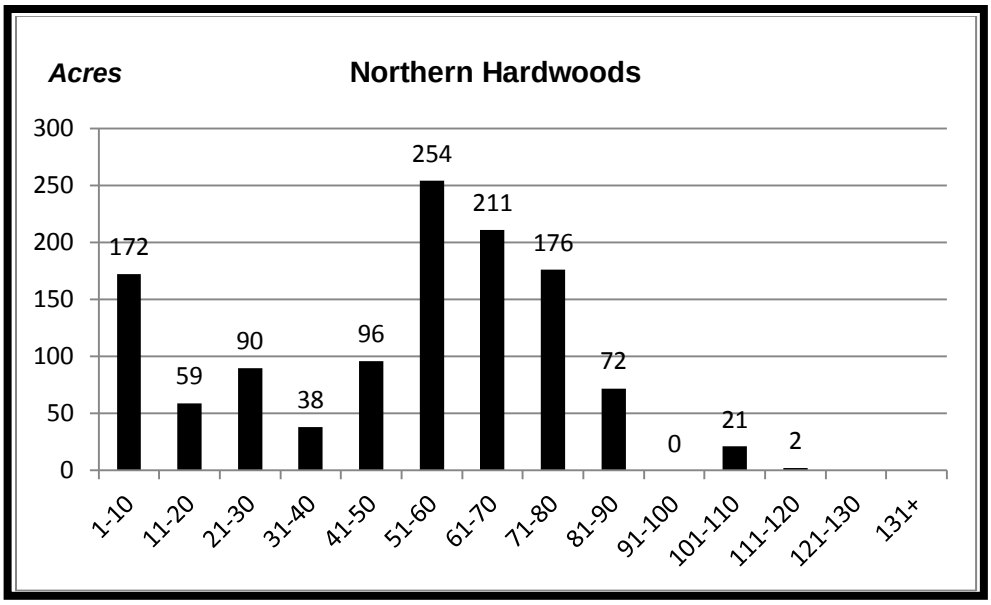
Current Conditions

Cover-type Acres:
In 2011, northern hardwoods cover-type comprised 8 percent (1176 acres) of the management pool acres in the ASP subsection.

Age-Class Distribution:
The current age-class distribution of northern hardwoods stands in the ASP subsection shows some slight over representations in the 0-10 and 51-90 age classes.

Chart 3.5 identifies the current age class distribution of northern hardwood acres in the ASP subsection.

Chart 3.5 Northern Hardwoods Age – Class distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

The increase in northern and central hardwoods reflects the change in land ownership and land management that occurred in the 1920's and 1930's. As the state acquired land through purchase and tax forfeiture, the amount of large-scale burning decreased. During the same period wildfire suppression techniques improved and agricultural grazing decreased. Hardwood forests filled-in along with oak woodlands. In more recent years, as oak woodlands declined due to age, fire and disease, some have succeeded to northern and central hardwood types. This trend is likely to continue unless declining oak stands are regenerated or use of prescribed fire increases. In particular, the spike in the 1-10 age class is likely the result of stands affected by the Carlos Edge Fire. The remaining imbalance is partially due to the poor markets for these stands since many are primarily basswoods with various percentages of other species. Demand for basswood has historically been low and only the stands with other desirable species sell well. Also, the majority of these stands are now just approaching their rotation age so they would not have been cut on Wildlife Management Areas prior to reaching their rotation age.

Stand Composition:
Natural, mature northern hardwood stands are mixed stands. Species in the northern hardwood cover-type are: oak, maple, basswood, ash, aspen and birch.

Native Plant Communities:
Typical native plant community where the northern hardwoods cover-type is found include:

- MHs49 SOUTHERN WET-MESIC HARDWOOD FOREST
- WFn55 NORTHERN WET ASH SWAMP
- FDS37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND

Northern hardwood cover-type occurs across a wide range of native plant communities in the ASP subsection.

Future Direction

Cover-type Management Directions:
The direction for the northern hardwoods cover-type for the ASP subsection is to slightly reduce the number of northern hardwood acres. Of the existing northern hardwoods type the direction is to convert 5 acres to oak and increase the oak component on an additional 92 acres. This represents an 8 percent decrease in the mixed northern hardwoods cover-type from 2011 acres.

In addition, 29 acres of northern hardwoods will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
In the ASP subsection, northern hardwoods are managed as an uneven-aged cover-type so balancing age-classes is not a priority of this plan.

Stand Composition:
Future directions for the northern hardwoods cover-type include transitioning some acres to oak woodlands and oak savannas.

Special Concerns or Limiting Factors:
When implementing the conversions, increases and or restorations in the northern hardwoods cover-type, non-native invasive species such as honeysuckle, buckthorn, and black locust must be considered and managed. Another concern is the native species ironwood which can dominate the understory of some stands.

Tamarack

Current Conditions

Cover-type Acres:
There are approximately 729 acres of tamarack on state-administered lands in the ASP subsection. This represents approximately 5 percent of management pool acres in the subsection.

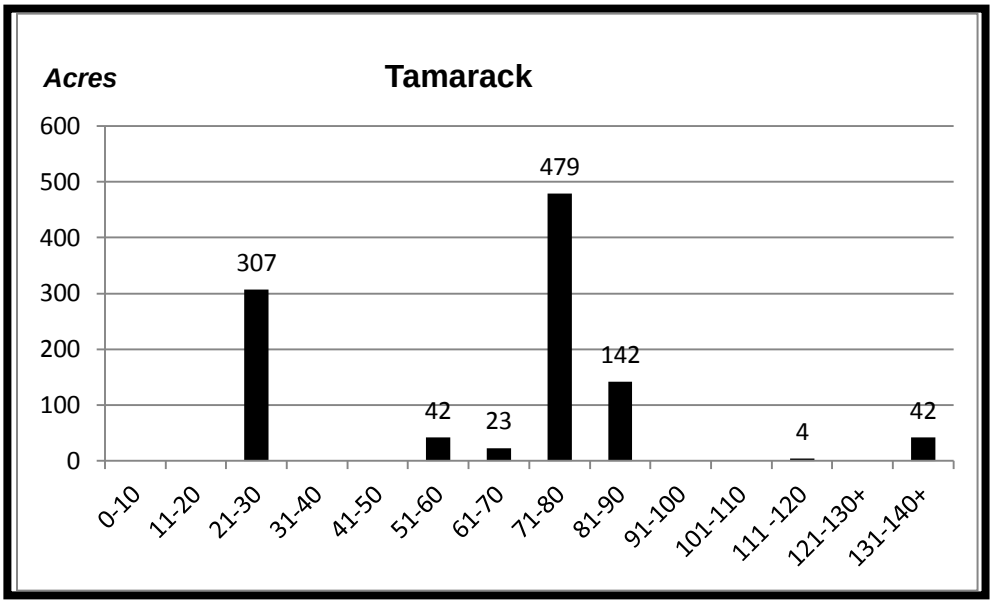
The ASP is near the southern edge of the tamarack range. The percentage break down of tamarack for this subsection is 21% forestry and 79% wildlife. Most of the stands occur in wetlands. These stands occur in relatively large blocks. Of the Wildlife administered tamarack, 65% (388 acres) occur in one complex just east of Sunrise Pool #1 of the Carlos Avery WMA. These stands are susceptible to variations in water tables and whole stands can be lost due to changes in drainage or fluctuations in the water table.

These acres also include a small amount (30 acres) of European larch that was planted in the Sand Dunes State Forest. This is non-native to the ASP and was planted as an experiment to see how it would perform in the sand. Some of it has since been inter-planted with pine and some of it has pine seeding into it. Upon maturity it will be harvested and converted to pine or managed to conserve biodiversity.

Age-Class Distribution:
The distribution of age classes of tamarack is skewed by the one large complex noted above, all being given the same age, creating the "spike". Also, much of the inventory on these tamarack stands is almost 20 years old with relatively low volumes to start with (less than 10 cords/acre). Additional tamarack stands will be revisited to confirm their vigor and volumes during the 10-year plan implementation period.

Chart 3.6 identifies the current age class distribution of tamarack and larch acres in the ASP subsection.

Chart 3.6 Tamarack Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Stand Composition:
Natural, mature tamarack stands range from pure or nearly pure stands to mixed stands. Secondary species in the cover-type include aspen, birch, maple and white pine.

Native Plant Communities:
A typical native plant community where the tamarack cover-type is found includes:

- APn81 NORTHERN POOR CONIFER SWAMP
- FPs63 SOUTHERN RICH CONIFER SWAMP

Future Direction

Cover-Type Management Directions:
The direction for the ASP SFRMP is to maintain the current acreage of tamarack. No concerted effort will be made to convert or increase components of this cover-type. One 4 acre stand will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. Management Objective from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes.

Special Concerns or Limiting Factors:
The standard method to regenerate tamarack is not generally available to the ASP. Strip cutting to encourage regeneration is practiced in tamarack stands. Few tamarack stands of sufficient size exist in the ASP to implement this regeneration method. Tamarack is prone to a number of pests and environmental factors. Reed canary grass as a non-native invasive species also impacts tamarack management.

White Pine

Current Conditions

Cover-type Acres:
The white pine cover-type consists of approximately 692 acres or 5 percent of the total management pool acres in the ASP subsection. White pine historically occurred uncommonly, and only in places where lakes and wetlands stopped or slowed the spread of fire. White pine can be found as pure stands and also as a component of many other upland cover-types in this subsection. Most stands were planted or have seeded in from nearby plantations. The naturally occurring mature white pine stands quite often show a strong oak component.

Age-Class Distribution:

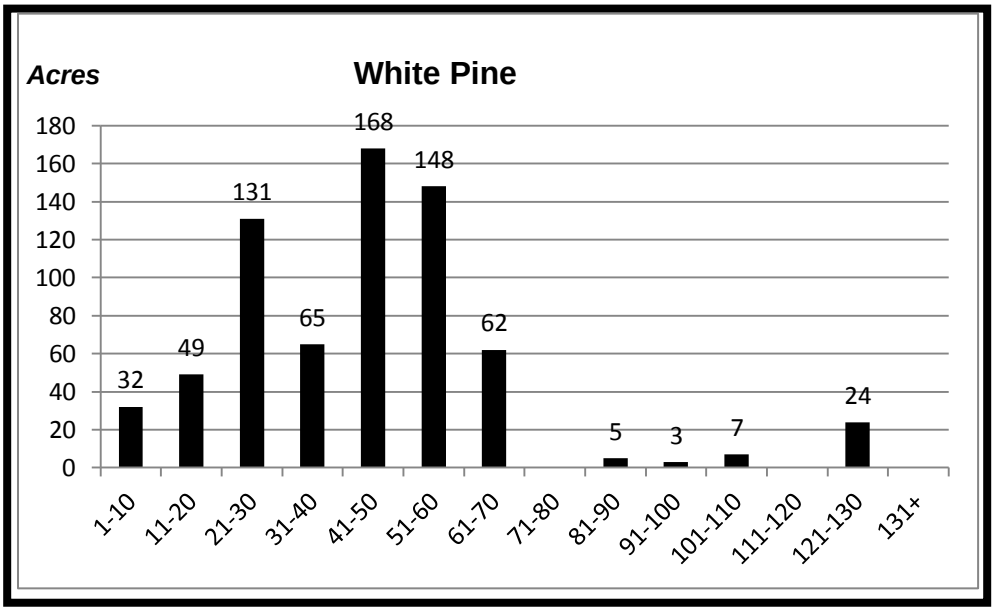
The age class distribution of white pine in this subsection is the result of planting white pine as lands were acquired in the Sand Dunes State Forest. White pine was a highly sought after tree by the early timber industry in Minnesota. Commercial logging of white pine began in 1839 at Marine on St Croix. Over the next couple of decades logging of white pine moved up the St Croix and Mississippi rivers into the ASP.

Starting in the 1940's, white pine was planted to a mix of white pine and Norway pine. Some of the oldest stands (120+ years) would have regenerated after the original logging boom. In the 1990's Minnesotans were concerned about the loss of white pine stands across the state. To address this concern a committee was convened and the result was a *1998 White Pine Management Policy.* The basic goal of the policy was to increase the presence of white pine on the landscape. The policy also calls for white pine to be treated as ERF (extended rotation forest). See Appendix F for a list of stands on the 10-Year Stand Exam List with a white pine component.

The ASP subsection is on the western edge of the white pine range. The percentage breakdown of white pine for this subsection is 85% on Forestry lands and 15% on Wildlife lands. It is an aggressive seeder and is easily regenerated by seed trees. It will move into the understory of the oak and other hardwoods if there is a seed source in the area. The sands of the ASP are well suited to growing white pine because not only does it regenerate easily it has very high site indexes with 100 year old white pine reaching 3 feet in diameter. While other parts of the state struggle with deer depredation and white pine blister rust, losses from these causes are not significant on the ASP.

Chart 3.7 identifies the current age class distribution of white pine acres in the ASP subsection.

Chart 3.7 White Pine Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Stand Composition:
Natural, mature white pine stands are typically mixed stands. Secondary species in the white pine cover-type typically include oak species.

Native Plant Communities:
Typical native plant communities where the white pine cover-type is found include:

- FDc25 CENTRAL DRY OAK-ASPEN (PINE) WOODLAND
- FDc34 CENTRAL DRY MESIC PINE-HARDWOOD FOREST

Future Direction

Cover-type Management Direction:
The cover type direction calls for an increase of white pine as mixed pine stands, aspen and hardwood stands shift to more white pine. A total of 59 acres of primarily jack pine and white spruce will be converted into white pine.

Approximately 190 acres will be managed to increase the white pine component (1 percent of all management pool acres) primarily from aspen and oak types. This leads to an increase in total white pine acreage across the subsection. It may take several decades however to fully change some stands to be classed as white pine stands.

In addition 122 acres will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. The decision whether to convert a stand to another cover-type will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate species management. Management Objectives from one cover-type to another can be found on Table 3.1.

In addition and not accounted for here, over future decades, white pine acres will increase as it continues to establish itself on the edges of old agricultural fields and grasslands in the ASP subsection. These stands will be managed to encourage white pine.

Age-Class Distribution:
White pine is not managed as an even-aged cover-type, therefore balancing age classes is not a priority for this cover-type.

Ash/Lowland Hardwoods

Current Conditions

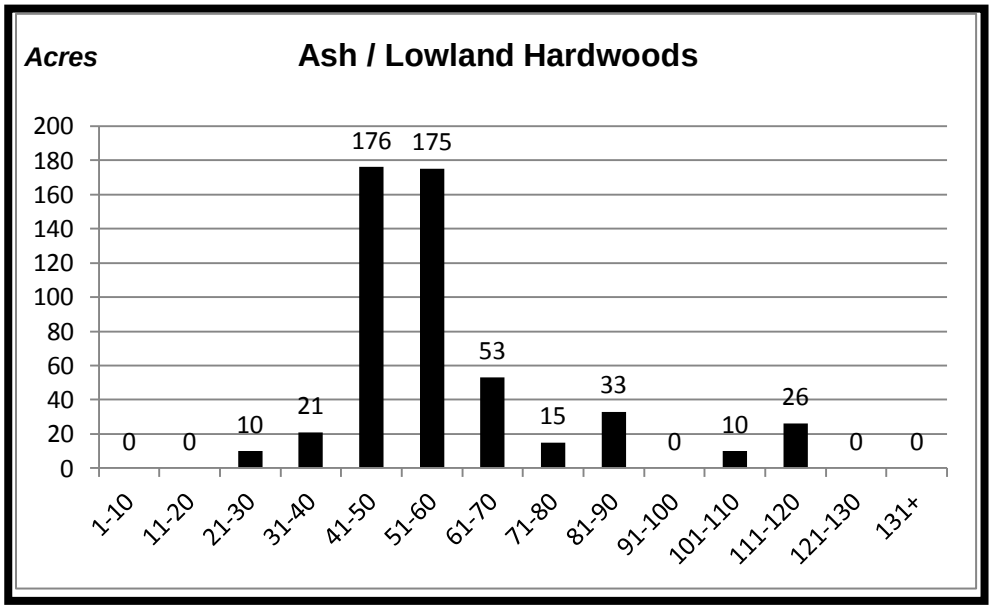
Cover-type Acres:
These cover-types are combined into one management category because they are managed under the same management prescriptions. Ash/lowland hardwoods (Ash/LH) make up approximately 568 acres or 4 percent of the total timberland acres in the ASP subsection.

Age-Class Distribution:
The current age-class distribution of the Ash/LH cover-type shows no acres in the 1-10 and 11-20 age classes. Some younger age classes of Ash/LH do exist, but are a component or secondary species of other cover-types, primarily aspen.

The age class distribution for black ash and lowland hardwoods is very unbalanced. The large increase in lowland hardwoods during the 1950's and 1960's (41-60 year age class) likely reflects a change in land ownership and management at Carlos Avery Wildlife Management Area which included installing infrastructure to stabilize water levels, perhaps creating habitats more conducive to these forest types.

Stand Composition:
Windthrow is a dominant natural disturbance in Ash/LH stands, resulting in large downed logs, hummocks, and hollows that promote tree seedling establishment and create diverse sites for wet and mesic forest herbs. Secondary tree species typically include elm, aspen, basswood or oaks (depending on site NPC). Chart 3.8 identifies the current age class distribution of Ash/LH acres in the ASP subsection.

Chart 3.8 Ash/Lowland Hardwoods Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Native Plant Communities:
Typical native plant community where the Ash/LH cover-type is found include:

- WFn55 NORTHERN WET ASH SWAMP
- WFn64 NORTHERN VERY WET ASH SWAMP
- MHs49 SOUTHERN WET-MESIC HARDWOOD FOREST
- FFs68 SOUTHERN FLOODPLAIN FOREST

Future Direction

Cover-type Management Direction
The 10 year direction for the ASP subsection essentially is to maintain the acres of the Ash/LH cover-type. Twenty-three acres will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. Management Objectives from one cover-type to another can be found on Table 3.1.

Field staff will follow Department guidance on management of Ash/LH in the face of the Emerald Ash Borer invasion. See ash management guidance at:
http://files.dnr.state.mn.us/forestry/ecssilviculture/policies/guidelinesManagingAshMinnesotaForestryLands-100723.pdf

Age-Class Distribution:
In the ASP Ash/LH is not managed as an even-aged cover-type, balancing age classes is not a priority.

Special Concerns or Limiting Factors:
Emerald ash borer was discovered in Minnesota in 2009; the extent to which Minnesota ash populations will be affected is yet to be determined, as is the extent to which this pest will affect the acreage of ash and lowland hardwoods in the ASP subsection or the State. Ash will continue to be managed consistent with Department guidelines for dealing with the emerald ash borer.

Reed canary grass invasions are also a concern for the ash cover-type. Reed canary grass can become established when seeds are brought in by floodwaters and when canopies are opened up.

Jack Pine

Current Conditions

Cover-type Acres:
Jack pine cover-type totals 223 acres representing less than 2 percent of the management pool acres in the ASP subsection, The ASP is at the southern edge of the jack pine range. Jack pine occurs naturally in native plant communities in the ASP only at the northern edge of the subsection. The jack pine acres are evenly distributed between forestry and wildlife and have mostly been planted or seeded in from nearby plantings. Jack pine easily regenerates on the ASP soils. While areas of older jack pine with 8-10 inch diameters can be found, much of the jack pine only lives to 30 years old before it is killed by bark beetles and other factors. It was planted as parcels were acquired, however because of health issues it was replaced with longer lived pines over time. Currently, where it is found as mixed pine stands, the jack pine is removed at the first thinning in favor of longer lived pine and to prevent the chance of bark beetle damage to the stand.

Age-Class Distribution:
The distribution of age classes in jack pine shows a rapid decline after ages 30 to 40. The current age class distribution reflects the difficulty of maintaining jack pine, past 40 years in age. Due to the very few acres and being on the southern edge of its range, no concerted effort will be made to attempt to balance age classes over the decades.

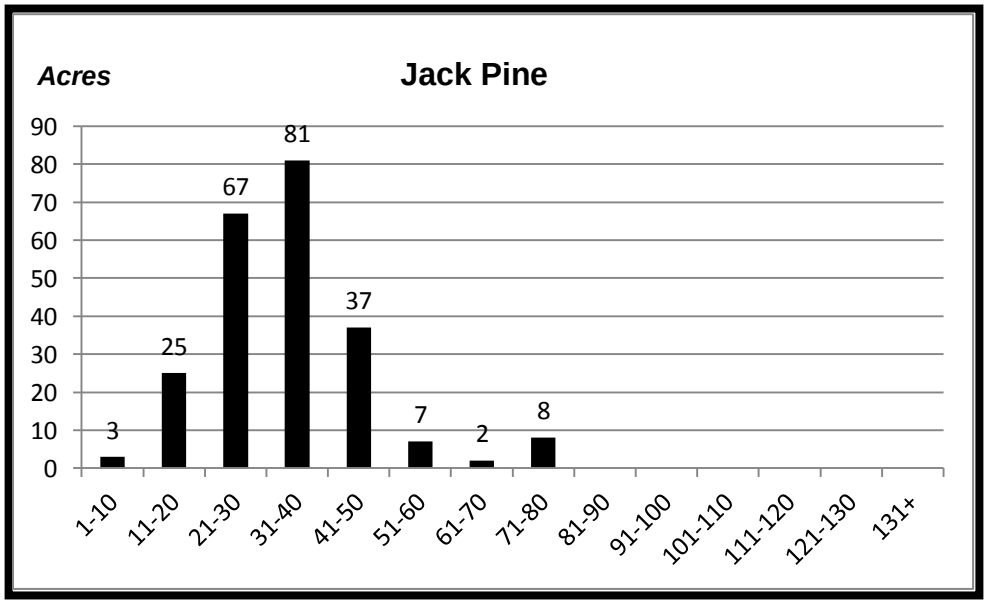
Stand Composition:
The majority of jack pine stands result from plantations or natural seeding from plantations. The exception is found in the northern portions of the ASP (Crow Wing County) where natural stands of jack pine can be found. Typical secondary species in jack pine plantations are: red pine, birch, and possibly a scattering of red maple.

Native Plant Communities:
Typical native plant community where the white pine cover-type is found include:

- FDc23 CENTRAL DRY PINE WOODLAND
- FDc34 CENTRAL DRY-MESIC PINE-HARDWOOD FOREST

Chart 3.9 identifies the current age class distribution of jack pine acres in the ASP subsection.

Chart 3.9 Jack Pine Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Future Direction

Cover-type Management Direction:
The direction of the ASP SFRMP is to reduce acres of jack pin. Approximately 49 acres of jack pine will be converted or a component increased to primarily oak and white pine. This represents a 22 percent reduction in jack pine acres. In addition 54 acres will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied.

The decision whether convert a stand to another cover-type will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate species management. Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
Jack pine is not a major cover-type in the ASP subsection, therefore balancing age classes of jack pine is not a priority of the plan.

Paper Birch

Current Conditions

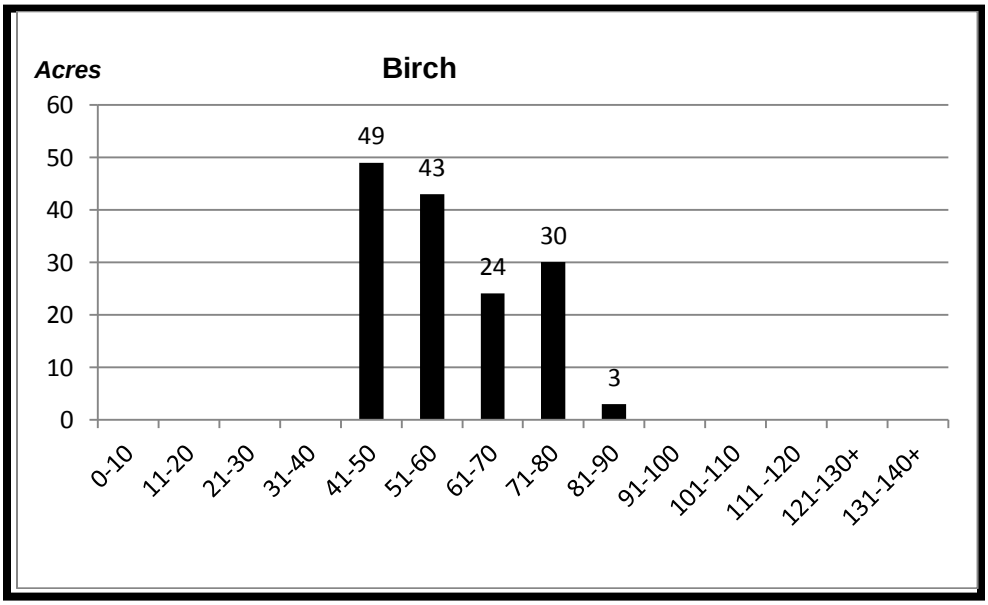
Cover-type Acres
The birch cover-type most often refers to stands of paper and yellow birch within the planning area. Birch accounts for a very minor portion of the management pool (149 acres) within the ASP subsection.

Age-Class Distribution:
It does remain a goal to improve the balance of age classes in the birch cover-type to the extent it is practicable given the small amount of birch acres, markets and logger interest. Currently very little birch is found on the landscape in the 0-40 age classes. Efforts will be made to include some birch stands over rotation ages with adjacent aspen, oak or northern hardwood stands to make sales.

Birch is a relatively small component of the forest on the Anoka Sand Plain, but the increase in the number of stands dominated by birch may be attributed to the change in land ownership and land management of the 1920's and 1930"s. As the frequency and severity of fires decreased, birch had an opportunity to occupy more acres along with oak and other upland hardwoods. In addition, the imbalance in birch ages may also result from the state acquiring Carlos Avery WMA and leaving many of the old farm fields fallow and allowing them to regenerate to forest types. Birch, being a pioneering species, was likely to take advantage of these fields, especially along the edges.

Chart 3.10 identifies the current age class distribution of birch acres in the ASP subsection.

Chart 3.10 Birch Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Stand Composition:
Within-stand species composition of mature birch stands (40+ years old) in the subsection typically includes species such as aspen and oak. The stand history (both natural and anthropogenic) and the NPC of the site account for most of the species variation within the birch cover-type.

Native Plant Communities:
Although birch as a cover-type is rare in this subsection a typical native plant community where the birch cover-type is found includes:

- FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND

Future Direction

Cover-type Management Directions:
The direction for the birch cover-type is to maintain the approximate same number of acres on the landscape.

There are no goals to actively convert or increase the birch cover-type. Some birch acres have been identified for harvest with the management objective of maintaining the species. Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes. Identifying rotation ages for the birch cover-type and selecting stands to be site visited and treated that are at or over the rotation age, and applying similar stand selection criteria over future planning periods will have a positive effect on bringing the current age class imbalance more into balance over the long term . In addition to the birch stands selected on the 10-Year Stand Exam List, birch over rotation age will be considered to be offered for sale as a component of other adjacent sales.

Minor Cover-types found in the ASP Subsection

The following minor cover-types are found in the ASP subsection. Although some minor cover type stands are identified on the ASP 10-Year Stand Exam List, none of these are considered commercial cover-types. Most management on these cover-types over the 10-year plan implementation period aims at converting to oak, white pine or managing for the native plant community.

White Spruce / Norway spruce

Current Conditions

Cover-type Acres:
White and Norway spruce is a minor cover-type, totaling 87 acres and less than 1 percent of the management pool acres in the ASP subsection. White and Norway spruce will be treated the same in this plan.

The ASP is at the southern edge of the white spruce range. The percentage breakdown of white spruce for this subsection is 85% forestry and 15% wildlife. On forestry lands spruce were planted periodically as a trial to see how they would do on these sands. In the past, industry would desire certain species and there were initiatives to plant those species. While spruce does moderately well on the ASP soils it does have some disease (canker) issues, however its' performance pales in comparison to pine.

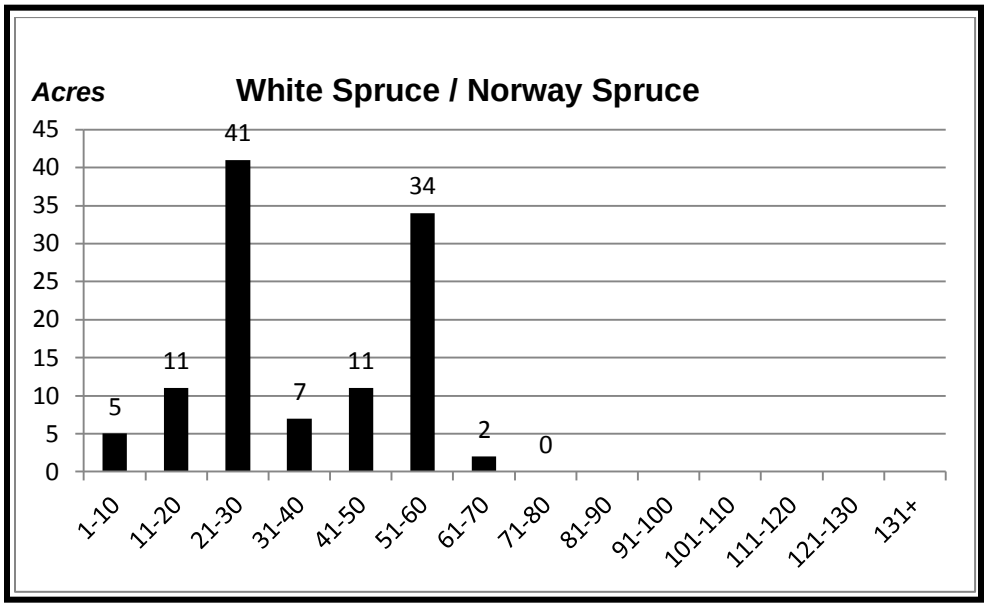
Age-Class Distribution:
The age-class distribution on the chart reflects these various planting periods, noted also in the red pine discussion above. The spikes are exacerbated by the relatively small amount of acreage and represent a few plantations. Upon maturity these pure stands will be converted to pine and where pine is a component of a white spruce stand, the pine will be favored.

Stand Composition:
The white spruce which does exist on state lands were planted, so it primarily occurs as pure stands. Some stands however do have red pine as a secondary species.

Native Plant Communities:
Because the ASP subsection is at the southern edge of the white spruce range, this cover-type is not typically found in any of the native plant communities represented on the landscape.

Chart 3.11 identifies the current age class distribution of white and Norway spruce acres in the ASP subsection.

Chart 3.11 White Spruce / Norway spruce Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

Future Direction

Cover-type Management Direction:
The direction of the ASP SFRMP is to maintain approximately 58 acres of this cover-type at the end of the plan implementation period. Eighteen acres are to be converted to white pine and 11 acres will be managed to restore the native plant community with the *Conserve Biodiversity Management Objective* applied. Over the longer term, the direction is to maintain these remaining acres until they reach rotation age and then convert to red pine.

Management Objectives from one cover-type to another can be found on Table 3.1.

Age-Class Distribution:
There is no long-term goal to move this cover-type toward a more balanced age-class structure.

Red Cedar

Current Conditions

Cover-type Acres:
Red cedar is a minor cover-type in the ASP subsection. Balancing age classes is not a priority for this cover-type in the ASP SFRMP.

Stand Composition:

The few red cedar stands range from nearly pure to mixed stands. Secondary species includes aspen, and bur oak. Red cedar is typically an uncommon shrub or small tree in fire-dependent forests, woodlands, and oak savannas in the ASP. In the absence of fire, it can become abundant.

Native Plant Communities:
Typical native plant communities where the red cedar cover-type is found when fire has been excluded include:

- FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND
- UPs14 SOUTHERN DRY SAVANNA

Future Direction

Cover-Type Management Directions:
The direction for red cedar is basically to maintain the current acres; one 20 acre stand is identified to be converted to oak.

Age-Class Distribution:
A balanced age-class distribution is not a goal for this cover-type.

Table 3.1 shows the 10-Year Stand Exam List by Management Objective. This Table does not include MA1 (Maintain the Cover type) Management Objectives. A description of each Management Objective is included below the table.

Essentially this table identifies acres to be converted, cover-type to be increased and stands to be managed to *Conserve Biodiversity* (harvest, convert, enhance, and or restored to the native plant community. As noted elsewhere in this plan, some stands on the 10-Year Stand Exam List are identified with two or more Management Objectives because the final management can only be determined following site visits. If a stand had multiple objectives it is included in Table 3.1 under the objective other than *Conserve Biodiversity (CON) Management Objective.*

Table 3.1 10-Year Stand Exam List by Management Objectives

	Convert into					Increase component				
Existing Cover-type	**oak[1]**	**white pine[2]**	**red pine[3]**	**low brush[4]**	**up brush[5]**	**oak[6]**	**bur oak[7]**	**white pine[8]**	**Conserve Biodiversity[9]**	**10-year Totals**
Ash/LLhws										23
Aspen	17						21	64		102
Nhwds	5				2	92			29	128
Oak. Ox	58	2		4				100	313	477
W Pine									122[10]	122
R Pine								18	317[10]	335
J Pine	4	32				4		9	54	103
S Pine		7								7
W Spruce		18							11	29
Up Larch			21							21
Tamarack									4	4
Red Cedar	20									20
Up Grass	4									4
Up Brush	9									9
Marsh					13					13
Hy poplar			13							13
Totals	116	59	34	4	15	96	21	190	849	1410

Source: 10-Year Stand Exam List Final.

Footnotes

[1] COV30 includes stand management to convert to oak savanna or woodland.
[2] COV51 includes stand management to convert white pine.
[3] COV52 includes stand management to convert to red pine.
[4] COV85 includes stand management to convert to lowland brush.
[5] COV86 includes stand management to convert to upland brush.
[6] INC30 includes stand management to increase oak cover-type.
[7] INC35 includes stand management to increase the bur oak component.
[8] INC51 includes stand management to enhance, and or restore the white pine component.
[9] CON includes management to harvest, convert, enhance, and or restored to the native plant community.
[10] these stands will be thinned and managed thru rotation age prior to implementing its management objective to Conserve Biodiversity

Total stand site visits and possible treatments (meaning conversions or cover-type increases together with stands identified on the 10-year list primarily for timber production) are shown on Table 3.8.

GDS 1A Some stands on state lands will be managed to reflect the composition, structure, and function of native plant communities.

A *native plant community* (NPC) is a group of native plants that interact with each other and the surrounding environment in ways not greatly altered by humans or by introduced plant or animal species. These groups of native plants form recognizable communities (e.g., Southern Dry-Mesic Oak (Maple) Woodland, Southern Rich Conifer Swamp, Southern Floodplain Forest) that tend to repeat across the landscape and over time. The goal is to retain NPC characteristics in some managed stands. Since most native plant communities in the Anoka Sand Plain were maintained in part through frequent fire, originating from lightning or set

intentionally by Native Americans and other early residents, natural resource managers often need to actively manage native plant communities in this subsection to maintain them.

GDS 1A Strategies

a. Continue to use the *Field Guide to the Native Plant Communities in Minnesota: the Eastern Broadleaf Forest Province* and associated ECS Silvicultural Interpretations to classify stands to NPC and prepare silvicultural prescriptions.

Identified below are the Native Plant Communities found in the ASP subsection.

FIRE-DEPENDENT FOREST/WOODLAND SYSTEM

FDc23 CENTRAL DRY PINE WOODLAND
- FDc23a Jack Pine-(Yarrow) Woodland
- FDc23a2 Bur Oak-Aspen Subtype

FDc25 CENTRAL DRY OAK-ASPEN (PINE) WOODLAND
- FDc25b Oak – Aspen Woodland

FDc34 CENTRAL DRY MESIC PINE-HARDWOOD FOREST
- FDc34a Red Pine-White Pine Forest

FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND
- FDs37a Oak – (Red Maple) Woodland
- FDs37b Pin Oak – Bur Oak Woodland

MESIC HARDWOOD FOREST SYSTEM

MHc26 CENTRAL DRY-MESIC OAK-ASPEN FOREST
- MHc26a Oak – Aspen – Red Maple Forest
- MHc26b Red Oak – Sugar Maple – Basswood – (Large-Flowered Trillium) Forest

MHc36 CENTRAL MESIC HARDWOOD FOREST (EASTERN)
- MHc36a Red Oak-Basswood Forest (Noncalcareous Till)
- MHc36b Red Oak-Basswood Forest (Calcareous Till)

MHc47 CENTRAL WET-MESIC HARDWOOD FOREST
- MHc47a Basswood – Black Ash Forest

MHs37 SOUTHERN DRY-MESIC OAK FOREST
- MHs37a Red Oak – White Oak Forest
- MHs37b Red Oak – White Oak – (Sugar Maple) Forest

MHs38 SOUTHERN MESIC OAK-BASSWOOD FOREST
- MHs38c Red Oak – Sugar Maple – Basswood – (Bitternut Hickory) Forest

MHs39 SOUTHERN MESIC MAPLE-BASSWOOD FOREST
- MHs39a Sugar Maple – Basswood-(Bitternut Hickory) Forest
- MHs39c Sugar Maple Forest (Big Woods)

MHs49 SOUTHERN WET-MESIC HARDWOOD FOREST
- MHs49a Elm – Basswood – Black Ash – (Hackberry) Forest

FLOODPLAIN FOREST SYSTEM

FFn57 NORTHERN TERRACE FOREST
- FFn57a Black Ash-Silver Maple Terrace Forest

FFn67 NORTHERN FLOODPLAIN FOREST
- FFn67a Silver Maple-(Sensitive Fern) Floodplain Forest

FFs59 SOUTHERN TERRACE FOREST
- FFs59a Silver Maple – Green Ash – Cottonwood Terrace Forest
- FFs59c Elm – Ash – Basswood Terrace Forest

FFs68 SOUTHERN FLOODPLAIN FOREST
- FFs68a Silver Maple – (Virginia Creeper) Floodplain Forest

WET FOREST SYSTEM

WFn53 NORTHERN WET CEDAR FOREST

WFn53b Lowland White Cedar Forest (Northern)
WFn55 NORTHERN WET ASH SWAMP
WFn55a Black Ash-Aspen-Balsam Poplar Swamp (Northeastern)
WFn55b Black Ash-Yellow Birch – Red Maple – Basswood Swamp (Eastcentral)
WFn64 NORTHERN VERY WET ASH SWAMP
WFn64b Black Ash-Yellow Birch – Red Maple – Alder Swamp (Eastcentral)
WFn74 NORTHERN WET ALDER SWAMP
WFn74a Alder – (Red Currant-Meadow Rue) Swamp

FORESTED RICH PEATLAND SYSTEM
FPn73 NORTHERN RICH ALDER SWAMP
FPn73a Alder – (Maple-Loosestrife) Swamp
FPs63 SOUTHERN RICH CONIFER SWAMP
FPs63a Tamarack Swamp (Southern)

ACID PEATLAND SYSTEM
APn81 NORTHERN POOR CONIFER SWAMP
APn81b Poor Tamarack-Black Spruce Swamp
APn81b1 Poor Tamarack-Black Spruce Swamp, Black Spruce Subtype
APn81b2 Poor Tamarack-Black Spruce Swamp, Tamarack Subtype
APn91 NORTHERN POOR FEN
APn91a Low Shrub Poor Fen
APn91b Graminoid Poor Fen (Basin)

UPLAND PRAIRIE SYSTEM
UPs14 SOUTHERN DRY SAVANNA
UPs14aDry Barrens Oak Savanna (Southern)
UPs14a2 Dry Barrens Oak Savanna (Southern): Oak Subtype
UPs14b Dry Sand – Gravel Oak Savanna (Southern)
UPs24 SOUTHERN MESIC SAVANNA
UPs24a Mesic Oak Savanna (Southern)
UPs13 SOUTHERN DRY PRAIRIE
UPs13a Dry Barrens Prairie (Southern)
UPs13b Dry Sand - Gravel Prairie (Southern)
UPs23 SOUTHERN MESIC PRAIRIE
UPs23a Mesic Prairie (Southern)

MARSH SYSTEM
MRn83 NORTHERN MIXED CATTAIL MARSH
MRn83a Cattail - Sedge Marsh (Northern)
MRn93 NORTHERN BULRUSH-SPIKERUSH MARSH
MRn93a Bulrush Marsh (Northern)
MRn93b Spikerush - Bur Reed Marsh (Northern)

OPEN RICH PEATLAND SYSTEM
OPn92 NORTHERN RICH FEN (BASIN)
OPn92a Graminoid Rich Fen (Basin)
OPn92b Graminoid - Sphagnum Rich Fen (Basin)

WET MEADOW/CARR SYSTEM
WMn82 NORTHERN WET MEADOW/CARR
WMn82a Willow - Dogwood Shrub Swamp
WMn82b Sedge Meadow
WMn82b2 Sedge Meadow: Tussock Sedge Subtype
WMn82b4 Sedge Meadow: Lake Sedge Subtype
WMs83 SOUTHERN SEEPAGE MEADOW/CARR

WMs83a Seepage Meadow/Carr

WETLAND PRAIRIE SYSTEM

WPs54 SOUTHERN WET PRAIRIE

WPs54b Wet Prairie (Southern)

CLIFF/TALUS SYSTEM

CTS12 SOUTHERN DRY CLIFF

CTs12a Dry Sandstone Cliff (Southern)

ROCK OUTCROP SYSTEM

ROs12 SOUTHERN BEDROCK OUTCROP

ROs12b Crystalline Bedrock Outcrop (Transition)

LAKESHORE SYSTEM

LKi32 INLAND LAKE SAND/GRAVEL/COBBLE SHORE

LKi32a Sand Beach (Inland Lake)

To learn more about NPCs typically found in this subsection, refer to the *Field Guide to Native Plant Communities of Minnesota: Eastern Broadleaf Forest Province.*

GDS 1B Species, age, and structural diversity within some stands will be maintained or increased.

This GDS differs from GDS-1A (above) in that it emphasizes managing for the suite of species, growth stages, and disturbance regimes appropriate to the NPC class or type identified using the NPC *Field Guide*, whereas GDS-1B emphasizes species, age, and structural diversity in and of itself without direct connection to the native plant community. Further, this GDS represents a broad general direction, and applies to only *some* stands identified on the ASP 10-Year Stand Exam List. It's important to note that while *some* stands will be managed to maintain or increase the species, age and structural diversity, other stands will not be managed for this general direction.

Diverse forest stands are more resilient to perturbations than less diverse forest stands. A forest stand with a mix of tree species and ages provides habitat for a wider variety of associated species while providing a diversity of forest products. The net economic, social, and ecological values and functions of most forest stands are related to the composition of trees, shrubs, ground flora, and structural characteristics. Structural characteristics include the sizes (diameter and height), abundance, and distribution of overstory trees; understory vegetation; and the arrangement (scattered or clumped) of vegetation in the stand. Structural characteristics also include the presence or absence of snags and coarse woody debris and how these features are distributed through space. Retaining large-diameter structures provides micro-sites for seed germination, cavities for nesting and den sites, and important escape and nesting cover within stands.

GDS-1B Strategies

a. Use selective harvesting to encourage diversity of species, ages, and stand structures.

As noted forest management is directed by a wide range of Department policy, guidelines and directives too numerous to identify here. In implementing this Strategy, field staff refers to forest management direction documents maintained by the Department on the following website:

http://intranet.dnr.state.mn.us/forest_mgmt_direction/index.html

b. Implement the *Site-Level Guidelines* designed to maintain a diversity of tree species within a stand.

The MFRC *Site-Level Guidelines* provide direction on retaining leave trees and snags, conifer retention and regeneration, and timber stand improvement (TSI) activities, among others. These *Guidelines* can be found at:

http://www.frc.state.mn.us/documents/council/site-level/MFRC_FMG&Biomass_

c. Use the *NPC Field Guide,*[3] site index, soils data, and ECS Silvicultural Interpretations to aid in determining the species composition and structure most appropriate for the site.

d. Retain tree species, stand structure, and ground layer diversity within stands when prescribing timber stand improvement and thinning activities.

The following techniques can be used to implement this Strategy:

- Rather than managing for one tree species when thinning or performing TSI, manage for the variety of species found in the stand.
- Based on current stand composition and other considerations (e.g., insect and disease concerns or wildlife habitat), take advantage of opportunities to diversify stands when prescribing thinning. Thinning intensities in stands may vary depending on current stand condition, such as trees per acre, tree size, and species composition, or the future desired within-stand composition.

e. Reserve seed trees in harvest areas and site preparation areas, where possible.

Resistance to windthrow, insect and disease risks, and the quality, number, and distribution of seed trees must all be considered when selecting seed trees.

The following techniques can be used to implement this Strategy:

- Timber harvesting techniques and site preparation methods that expose mineral soil may be used on some sites to facilitate natural seeding.
- Select seed trees that have the potential to survive to produce seeds.

f. Use the least intensive site preparation methods possible to ensure success.

Site preparation can create conditions favorable to invasive species and alter structural diversity in the ground layer. Striving to minimize site preparation intensity will minimize these threats.

g. Use harvest systems or methods that protect advance regeneration. Retain conditions that favor regeneration and understory initiation.

When it is desirable to protect the existing seedlings and saplings in a stand, timber sale regulations will specify outcomes to protect these regenerating trees. In some cases, portions of the stand will be delineated to protect regeneration by restricting harvest activity in those areas. To enhance seedling recruitment of some species, a partial canopy may be retained to meet needed moisture and light requirements of the seedlings.

h. Identify some stands where succession is allowed to occur to encourage development of within-stand diversity. Movement to the next successional stage may be achieved with or without harvest.

Use field evaluation of stands to determine if a stand should be allowed to succeed to the understory species. This Strategy will meet some of the forest composition changes recommended by this plan. Consult the *NPC Field Guide* and *ECS Silvicultural Interpretations* for help in reaching these decisions.

[3] Minn. DNR, 2003, *Field Guide to Native Plant Communities of Minnesota: Eastern Broadleaf Forest Province* Ecological Land Classification Program, Minnesota County Biological Survey, Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources St. Paul, MN 55155.

i. Increase and/or maintain by reserving from harvest, target species including white pine, bur/white oak, yellow birch, tamarack, and butternut as a component within appropriate cover-types. Silvicultural practices that may add or increase the presence of these target species will include planting, inter-planting, and artificial or natural seeding.

The target species identified above are important to wildlife and maintaining biodiversity. In implementing this Strategy, the *NPC Field Guide*, site index, soils data, and *ECS Silvicultural Interpretations*, and observations that the species is now naturally occurring and doing well on the site, can aid in determining the appropriate species for the site.

j. Manage planted and seeded stands to represent the array of plant diversity.

Planted and seeded stands will be managed to meet aesthetic and biodiversity goals. This may be accomplished by:

- Accepting lower stocking levels of planted species in younger plantations if other desirable species are present.
- Planting or seeding mixed species appropriate to the site.
- Using intermediate harvests to enhance age, species, and structural diversity.
- Use the least intensive site preparation necessary to successfully regenerate the site, while favoring retention of the existing ground-layer plant species.

Some plant communities can naturally exhibit low species diversity. Low species diversity can be natural and has occurred historically in some peatlands.

k. Use ERF in some even-age managed stands to encourage greater structural diversity.

l. Encourage native fruit and mast-producing species.

Follow the *Site-Level Guidelines* for retaining and enhancing hard and soft mast (fruit) production.

3.2 Harvest Levels

GDS-2A: 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 ASP SFRMP treatment levels are reflected in the number of acres that will be divided into annual stand examination lists and field visited over the 10-year period. After field visits, treatments may include timber harvest, inventory alteration (i.e., correcting or updating forest inventory data), forest development without harvest, or deferring treatment (treat in a future planning period).

Treatment levels were developed for this plan by considering all appropriate DFFCs, General Direction Statements (GDSs), and specifically the factors that contribute to the present age-class imbalances, primarily:

- historic land use practices prior to state ownership are the main cause and were discussed in section 3.1 above; and,
- Wildfire in the Carlos Avery WMA over the last 10 years has also caused disruption in the age class structure.

The even-aged cover-types for the Anoka Sand Plain SFRMP include; aspen, birch, oak and red pine and will be managed through even-aged silvicultural strategies. The uneven-aged cover-types for the Anoka

Sand Plain SFRMP include ash/lowland hardwood, northern hardwoods, white pine and tamarack and will be managed using uneven aged silvicultural techniques.

Table 3.2 identifies the rotation ages for even aged managed cover-types used in the ASP SFRMP leading to development of the 10-Year Stand Exam List.

Table 3.2 Rotation Ages for Even-Age Managed Forest Cover-types

Cover-type	Management Pool	Site Index	Merchantable Age	Normal Rotation Age	Maximum Rotation Age
Aspen	1,819	All	30	40	50
Birch	149	All	30	40	50
Red/Pin Oak	5,326	All	30	80	120
White/Bur Oak	934	All	50	120	200
Red Pine	2,402	All	25	80	100
Jack pine	223	All	30	30	45
Tamarack	729	All	60	100	140

To determine treatment levels for this plan all oak species are grouped together. Red/pin oak is the primary oak species in the ASP accounting for 85 percent of the overall oak cover-type acres. Different rotation ages are identified for the two oak species and will be applied appropriately as site visits are made.

Factors contributing to the identified treatment levels in the ASP subsection
The following factors contributed to establishing the treatment levels recommended in the ASP SFRMP.

a. Treating Stands at or Older than Normal Rotation Age
The primary stand selection criteria to select stands to be placed on the 10-Year Stand Exam List was establishing rotation ages for commercial cover-types and treating stands at or over the identified rotation age.

Table 3.3 below shows the cover-types; rotation class; rotation age; total acres and percent over rotation age for 2011. This Table also shows the projected acres over rotation age following implementation of this plan (2022). This information is taken from the FIM dataset prepared in 2011 and used as the planning data for the ASP SFRMP.

This table shows that birch (96%), jack pine (61%), aspen (18%) and oak (12%) have the highest percentages over their identified rotation ages for 2011. The oak cover-types combined have 12 percent of their total acres over the rotation age but only one percent is over the extended rotation age. In the ASP, the wildlife managers prefer to allow a significant portion of the cover-type to grow beyond extended rotation to allow for maximum mast production and wildlife benefit. Management is different for bur and white oak as the rotation age is much longer than for the red/pin oak. Bur and white oak rotation age is 120 years. The appropriate rotation age will be applied by field staff as site visits occur.

Following the 10-year plan implementation period, acres over their rotation age found on the ASP landscape can be summarized as follows:

For the even-aged managed cover-types
- Total acres of aspen remains similar to 2011 levels, but the percentage over rotation ages increases, the aspen forest is getting older;
- Total birch acres remains the same, but percentage over rotation age declines, the birch forest is getting younger;
- The acreage of oak (all species combined) remains the same, but the percentage of all oak species over their rotation ages increases, meaning there is more older oak on the landscape;
- Red pine acres remains essentially the same

- The acreage of jack pine decreases and the percentage over rotation age increases; so there will be less total acres but more older jack pine than at present;
- The acreage of tamarack remains the same, and the percentage over rotation age decreases slightly.

Considering the uneven-aged cover-types:

- The acreage of ash/LLhws remains the same, but the acres and percentage over rotation age decreases slightly;
- The acreage of northern hardwoods remains the same with the total acres and percentage over rotation age increasing; and,
- The total acres of white pine increases by 9 percent and more acres are over 100 years

A significant future direction of the ASP SFRMP is conversion, enhancement and restoration from current cover-types to oak savanna, oak woodlands and native plant community. Several assumptions must be made to project future ages for stands to be managed to restore the native plant community with the *Conserve Biodiversity Management Objective.* See Appendix B, *Notes for Age Class Structure 2022 Projections* for a summary of these assumptions. The final decisions about conversions, enhancements and restorations will only be made following site visits.

Table 3.3 Current and Future Acres and Acres Over Rotation Age by Cover-type

Cover-type	Rotation Class	Rotation Age	2011			2022		
			Acres	Acres over RA	% over	Acres	Acres Over RA	% over
Aspen	Normal	40	1,250	344	28	1,233	310	25
	Maximum (ERF)	50	569	33	6	569	28	5
Birch	Normal	40	149	143	96	149	104	70
Red/Pin Oak & Ox	Normal	80	3,761	659	18	3,758	1,182	31
	Maximum (ERF)	120	1,550	78	5	1,550	321	21
Bur/White Oak & Ox	Normal	120	449	6	<1	452	23	5
	Maximum (ERF)	200	430	0		430	0	
Red Pine	Normal	80	2,402	6	<1	2,436	6	<1
Jack Pine	Normal	30	223	135	61	188	165	88
Tamarack	Normal	100	729	46	6	729	0	
Ash/LLhw	Normal	80	568	70	12	568	56	10
NH/CH	Normal	80	1,176	80	7	1,171	123	11
White Pine	Normal	100	692	30	4	750	9	1

Footnote: Oak totals don't sum 6260 because MN_SPP is not oak on 4 stands (68 acres), and was not categorized as either white or red oak.

Of the primary commercial cover-types in the ASP subsection (aspen, oak and red pine) only aspen and oak were designated extended rotation cover-types. Red pine has only 6 acres over the maximum rotation age of 100 years so no ERF was identified for red pine.

Table 3.4 below, identifies the average stand treatment age for the stands selected and placed on the 10-Year Stand Exam List.

Table 3.4 Average Stand Treatment Age and Average Age of Acres to be Site Visited

Cover-type	Acres over Rotation Age	Average Stand Age	Average Age of Acres Treated (Weighted average)
Aspen	367	42	46*
Oak	743	78	83*
Red Pine	5.7	40	40
Jack Pine	135	40	25
Tamarack	45.9	132	134
Northern Hw	80.2	67	70

** stands categorized in FIM as underdevelopment were not considered to determine average age of stands*

The Average Age of Acres Treated is a "weighted average" which reflects the average of all acres being site visited for each of the identified cover-types. Put another way if the larger stands are older, the weighted average is higher.

b. Maintaining Old Forest

A forest stand of any particular even-age managed forest cover-type is considered old forest whenever its age exceeds the normal rotation age for that cover-type. In 2011 there were 1,630 acres of the ten cover-types shown on Table 3.3 that are over their rotation age. Following implementation of this plan a total of 2,572 acres of these ten cover-types will be over their rotation age. This represents a 43 percent increase in the number of acres over their rotation age within the lands managed through the SFRMP process. Acres over rotation age found on lands not managed as part of the SFRMP process can also be considered "old forest" in the subsection. For example old forest on Camp Ripley Military Reservation, Uncas Dunes SNA or other state administered lands outside the lands managed by SFRMPs can be considered as contributing to the Department's old forest guidelines.

Maintaining old forest areas in this subsection is difficult because:

- past land use history and the time when this land came into state ownership (development for agricultural and urban uses tended to remove forested acres);
- the recent fire history occurring on the Carlos Avery WMA (which impacted some older forested stands). The age-class imbalance found in the Carlos Avery WMA is partially explained by these reasons;
- some wildlife management areas have stands that are slated for conversion from oak woodland to a more open landscape. This prescription may allow stands on the exam list which would allow a treatment by removing a percentage of the tree cover but leaving a predetermined percentage of crown cover. These stands, however, would then be taken out of the pool for later treatments because they would no longer be classified as timberlands for production of wood. The remaining trees would stay on the site for a significantly longer time than identified by the extended rotation age.

Table 3.5 below provides information on the 1994 old growth goals and the designated acres in the Anoka Sand Plain subsection. From a candidate pool of 1,595 acres, 245 acres were designated as old growth. These specific acres are reserved from harvest.

Table 3.5 Designated Old-Growth Acres

Cover-type	Old-growth 1994 Acreage Goal	Old-Growth Acres Designated
Lowland Hardwoods	80	24
Northern Hardwoods	115	150
Oak	40	48
Birch		15
White Pine	135	8
Total	370	245

c. Stands Reserved or Deferred for Further Evaluation

In the ASP subsection, one tamarack stand has been identified as an ecologically important lowland conifer stand (EILC). This stand is reserved from evaluation due to uncertainty of inventory; difficulty of regenerating tamarack; and, pending Department standards for designating old growth in lowland conifer cover-types. In addition to the EILC stand the designated old growth discussed above make up the stands reserved from treatment during this plan implementation period.

d. Maintaining young forest

Moving toward and eventually maintaining a balanced age-class distribution will ensure that young forest (0-30 years old) exists on the landscape over time. In the ASP subsection the age class structure is out of

balance for most cover-types and by treating stands over rotation age, over several planning periods, the treatment schedule will attempt to balance out the age class structure and add more young forest.

e. Planned Increases/Decreases in Cover-type Acres

Planned increases and decreases in cover-type acres in the ASP SFRMP are referred to as conversions, cover-type increases, or Conserve Biodiversity. These cover-type changes will have an impact on harvest levels over the 10-year plan implementation period as well as over the longer term (50-year) and are identified by Management Objective on Table 3.1.

A goal is to manage timberlands consistent with the native plant community. A total of 849 acres are identified with a Management Objective of Conserve Biodiversity as shown on Table 3.1 and can be summarized as follows:

- In some stands (approximately 228 acres) conversions will translate into conversions from one cover-type to another (e.g. aspen to oak or one oak species to another);
- On approximately 307 acres, a component of the cover-type will be increased (e.g. white pine will be favored in some mixed white pine / oak stands);
- On approximately 849 acres the stands will be managed to:
    - consider a rare species or habitat;
    - protect a rare native plant community; and or
    - use prescribed fire as a treatment tool.

  On these acres the final Management Objective and final prescription can only be determined following site visit. Final treatment can include thinning or harvest. The preliminary prescription for all acres on the 10-Year Stand Exam List is shown on Table 3.8

Examples of planned increases and decreases in cover type acres include:

- Low density oak conversions are planned on several wildlife management areas in the subsection. These are converting oak woodlands to more open type oak savanna which will be managed and kept open using prescribed fire as a management tool.
- Stands with a component of white pine will naturally transition to white pine cover types. Some planting of conifers will continue in the Sand Dunes State Forest (refer to Appendix C, *Sand Dunes State Forest Operational Plan)*.
- Jack pine will also be mostly eliminated from the subsection as it is now found in the designated "Immediate Area" of Sand Dunes State Forest and will be harvested during the planning period. No regeneration of this type is planned. These actions are planned to enhance the "fire dependent" plant communities.

In many instances the final decisions on conversions, increases and Conserve Biodiversity will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate action.

2. Supply of Timber

After accounting for the factors which affect the overall supply of timber (listed above), the volumes anticipated to result from the 10-Year Stand Exam List can be projected. The supply of timber from the ASP is not significant to the statewide timber supply goals. The ASP represents about 1 percent of the total timber offered by the Division of Forestry for its annual goal. Timber offered will not fluctuate significantly over the planning period (with the exception of FY2012 and FY2013 due to the Sandstone Area blowdown timber salvage, some sales from the ASP subsection may be delayed).

General observations characterizing the supply of timber from the ASP subsection include the following:

- The main importance of timber in the Sand Dunes State Forest is the availability of accessible wood during the spring break up period.

- Oak harvests are primarily for fuel wood, although some small sawlogs are harvested. Many oak wilt pockets are added to stand exam lists and moved ahead in order to remove another infection center.

- Markets for pine fluctuate and some timber is processed for pulp markets and some for sawing into framing lumber and boards. Some also is used for treated landscape timbers. Over the last several years unsold tracts have not been a problem in the Anoka Sand Plain. On larger wildlife management areas, access is sometimes a challenge although most the timber is sold for winter access on frozen ground only.

a. Even and Uneven-age Management and Thinning

Even-aged managed cover-types include aspen, birch, oak, red pine, jack pine, and white/Norway spruce. Some oak stands are managed as uneven aged, and some northern hardwood stands will be managed as even-aged stands. The uneven-age managed cover-types include ash/lowland hardwoods, northern hardwoods, white pine and tamarack. All uneven-age and some even-age managed cover-types will be managed using selective harvest treatments.

Treatment levels for the commercial cover types are not driven by timber values in the ASP subsection. Treatment levels will focus on the DFFC that recognizes the native plant community and recommends treatments that enhance and restore those communities. Secondary non-timber or non-traditional timber values is the primary DFFC in this subsection. As shown on Table 3.8 approximately 3,883 acres are identified to be site visited and treated during the 10-year plan implementation period. Some of these acres will be thinned or harvested with the management objective of restoring or enhancing the biodiversity of the stand. Of the 3,883 acres to be site visited, 2,394 acres or 62 percent will be managed to maintain the cover-type with timber production as the primary focus.

b. Biomass Harvesting

Although there is no target or DFFC for biomass harvest at this time, the ASP SFRMP estimates that 15,000 green tons of biomass would be available as tops and limbs from roundwood harvests proposed in this plan. This is an emerging market in response to demand for alternative energy production. Minnesota DNR policy is changing in response to this changing market.

Biomass as tops and limbs will be available for purchase on most timber sale sites where roundwood is harvested. Sites not available for biomass harvest are defined in the *MFRC Biomass Harvesting Guidelines*[4]. In addition some non-commercial forest sites are available for biomass harvest consistent with biomass harvesting guidelines as markets demand. Some areas have been identified by wildlife managers within the ASP with potential for biomass harvest from brushlands. Treatment of some non-native invasive species (buckthorn), are also counted in this biomass estimate.

c. Volume Comparison between past Harvest Levels and the Recommended SFRMP Treatment Levels

Table 3.6 identifies the volume of wood sold by the Cambridge Forestry Area and Little Falls Forestry Area for the past decade (2001 – 2010) and is provided as a comparison with the volumes projected based on implementation of this ASP SFRMP. The Cambridge Forestry Area volumes result from actual timber sales. The wood sold from the Little Falls Forestry Area is estimated to be approximately 1,750 cords over the ten year period (2001 to 2010), or 150 to 200 cords per year. The Little Falls Forestry Area has minor state lands lying within the ASP subsection.

Considering both Forestry Areas a total of approximately 37,900 cords including biomass or 3,790 cords per year on average are sold per year from the ASP subsection.

4 http://www.frc.state.mn.us/FMgdline/Final_Draft_for_MFRC_Approval_Forest_BiomassHarvest_Guidelines.pdf

Table 3.6 Anoka Sand Plain Wood Sold[1] in cords FY 2001-2010

	Cambridge Forestry Area		Little Falls Forestry Area	
Species	**Wildlife**	**Forestry**		**Totals**
Aspen	657	1,003		1,660
Birch	127	0		127
Ash/LH	0	35		35
Northern Hardwoods	581	1374		1,955
Oak	3,120	11,798		14,918
Jack Pine	20	280		300
Red Pine	413	8,096		8,509
Scotch Pine	100	747		847
White Pine	59	1,231		1,290
Spruce	13	206		219
Tamarack	0	650		650
Misc (Red Cedar)	0	61		61
Total	5,090	25,481	1,750[3]	30,591
Biomass	261	1,319		1,580
Fuelwood totals[2]	1250	2,750		4,000
Total	6,601	29,550	1,750[3]	37,901

Source: Cambridge and Little Falls Forestry Area sales records

Footnotes:

[1] These volumes do not include those cords offered but not purchased on the initial sale. If they were reoffered and sold in a subsequent year they were included in that FY's total.

[2] Fuelwood – 80% oak- 20% northern hardwoods

[3] Little Falls Forestry Area estimate of 150-200 cords per year from the ASP portion of the Area.

In SFRMPs the MNDNR develops annual planned treatment levels on a cover-type acreage basis. To determine the volume expected to result from the planned treatment acres, the acres must be converted into cords based on cover-type and preliminary prescription. The projected volume of wood resulting from the acres on the 10-Year Stand Exam List is provided in Table 3.7. The harvest volume is a projection generated by applying the Walters / Ek yield and density equations[1], based on forest inventory data, treatment acres, and treatment method. It is a rough projection because not all treatment acres are suitable, or will result in timber sales; the treatment method (prescription) may change after the field visit of the stand; and the volume estimates from the combination of forest inventory data and yield tables typically are not as accurate as the more intensive appraisals that are completed for timber sales.

[1] Walters, David K., and Alan R. Ek. 1993. Whole stand yield and density equations for fourteen forest types in Minnesota. Northern Journal of Applied Forestry 10: 75-85.

Table 3.7 Projected Volume (cords) to be Site Visited and Potentially Offered for Sale over the 10-Year Plan Implementation Period

Cover-type	Treated Acres	Number of Stands	Total Cords	Cords Per Acre
Ash	50	4	878	18
Lowland Hdwds	16	2	387	24
Aspen	390	40	6,963	18
Birch	39	8	832	21
Hybrid Poplar	13	1	35	3
Northern Hdwds	154	16	3,631	24
Oak	888	49	19,434	22
Offsite Oak	65	5	698	11
White pine	300	24	2,674	9
Norway pine	1,734	88	13,003	7
Jack pine	132	12	700	5
Scotch pine	7	1	7	1
White spruce	65	6	472	7
Norway spruce	23	2	71	3
Upland Larch	21	1	129	6
Tamarack	46	5	722	16
Red cedar	20	1	40	2
Lowland Brush	4	1	0	0
Upland Brush	9	1	0	0
Marsh	13	1	0	0
Total	3,989	268	50,675	13

Source: 10-Year Stand Exam List applied to Walters / Ek yield and density equations

Table 3.8 compares historical and projected cords. Total cords sold for the ASP subsection is approximately 37,900 cords or an average of 3,790 cords per year. It is projected the total cords resulting from site visits and possibly offered for sale from the 10-Year Stand Exam List will equal approximately 50,675 cords or an average of 5,068 cords per year.

Table 3.8 Comparison of Historical and Projected Volume from ASP All Cover types

Historical Cords	10-Year Stand Exam List
Average Cords Sold per year (2001 - 2010)	**Projected Cords per year (2013 – 2022)**
3,790	5,068

Table 3.9 summarizes total acres of even-age and uneven-age managed cover-types in the stand exam pool selected for treatment during the 10-year plan implementation period.

Table 3.9 Managed Cover-type Treatment Pool Summary for the Anoka Sand Plain

Cover-Type	Management Pool Acres	Rotation Class	Rotation Age	Management Pool Acres	Total Plan Treatment Acres		
					clearcut[1]	thin[2]	Total
Aspen	1819	Normal	40	1250	270	17	287
		ERF Max	50	569	103		103
Red Pine	2402	Normal	80	2402	26	1708	1734
Oak [3]	6260	Normal	80/120	4279	745	59	804
		ERF Max	120 200	1981	149		149
Tamarack	729	Normal	100	729	46		46
Birch	149	Normal	40	149	38		38
Jack Pine	223	Normal	30	223	9	104	113
White Pine	692	Uneven-Age	NA	692	24	277	301
White/Norway Spruce	111	Uneven-Age	NA	111	18	70	88
Ash/Lowland Hardwoods	568	Uneven-Age	NA	568	66		66
Northern/Central Hdwds	1176	Uneven-Age	NA	1176	139	15	154
Totals	14,105			14,105	1,633	2,250	3,883

Footnotes:

[1] *All prescriptions with clearcut*

[2] *All prescriptions with thin*

[3] *Red and white oak groups have the two groups added together for total management pool and treatment acres.*

Table 3.10 below, identifies the preliminary prescriptions for all acres on the 10-Year Stand Exam List. The complete 10-Year Stand Exam List is included as Appendix D. This table identifies all acres to be site visited and possibly treated during the 10-year plan implementation period.

Table 3.10 10-Year Stand Exam List by Preliminary Prescription in Acres

	Preliminary Prescription										
Cover-type	**1100**	**1110**	**1111**	**1116**	**1117**	**1118**	**1120**	**1212**	**1810**	**9100**	**Totals**
Aspen	40	207	94				26	7	17		391
Oak	55	481	354	4					59		953
Red Pine		26							1,708		1734
Northern Hdwds	16	54				2	67		15		154
Jack Pine	7				2				104	19	132
W/N Spruce		18							70		88
Tamarack			4		42						46
Hybrid Poplar									13		13
White Pine		24							277		301
Birch			39								39
Ash / LLhw		66									66
Up Larch		21									21
Marsh						13					13
Upland Brush									9		9
totals	118	897	491	4	44	15	93	7	2,272	19	3960

Source: 10-Year Stand Exam List
Note: the more accurate preliminary prescription for oak and aspen is 1113 (Even-aged Management with Clearcut and Sprouting) but in many cases above more general prescription codes were used.

For Table 3.10:

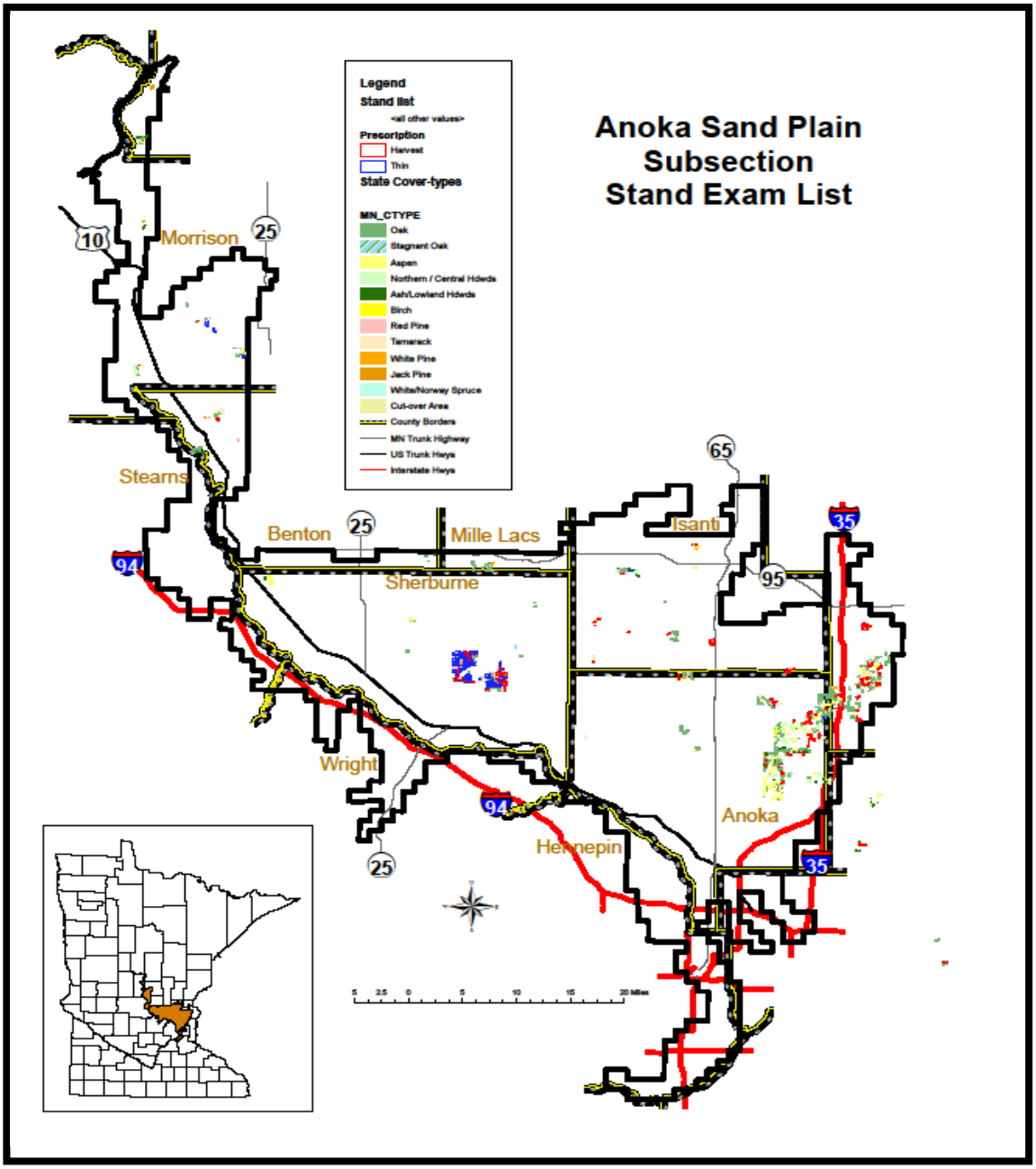
- 1100 - Even-Aged Regen Harvest
- 1110 - Clearcut Removal or Felling
- 1111 - Clearcut with Reserves
- 1116 - Clearcut-Natural Seeding Removal or felling
- 1117 - Clearcut with Reserves Natural Seeding
- 1120 - Clearcut with Seed Trees
- 1212 - Clearcut with Reserves Sprouting
- 1810 - Commercial Thinning
- 9100 - On-site Visit

Comparing Table 3.9 with 3.10 shows a difference in Total Acres treated. The differences can be explained as follows. Table 3.10:

- includes prescription of 9100 (site visit) Table 3.9 does not.
- treatment of Upland Brush, Table 3.9 does not.
- treatment of Marsh, Table 3.9 does not.

Map 3.2 below identifies all stands placed on the 10-Year Stand Exam List. This map shows stands to be site visited and possibly treated. Although final decisions on treatment can only be made following the site visit, each stand on the 10-Year List received a "preliminary prescription" as shown on Table 3.10. See Appendix D for the *10-Year Stand Exam List.*

Map 3.2 10-Year Stand Exam List



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

GDS 2A Strategies

a. follow Strategies in GDS 1B, 3C and 3F

GDS 2B The harvest of nontimber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity.

Nontimber forest products, also known as special forest products, can be categorized into five general areas: decorative materials, foods, herbs, medicinal materials, and specialty items. Currently in the ASP subsection, special product permits or informal timber sales are issued for some nontimber forest products including: Permits are issued to ensure that harvest operations do not damage the site's potential for future production and comply with management guidelines established by the Division of Forestry. Harvest of nontimber forest products may be restricted on some state administered forest lands such as WMAs, aquatic management areas (AMAs), and SNAs.

The following Strategies will be used to protect the long-term availability of these forest resources.

GDS 2B Strategies

a. Consider known traditional gathering areas when managing other forest resources.

b. Consider the known locations of important wildlife habitats, rare native plant communities or species, and the possible impacts of nontimber forest products harvest practices before issuing special product permits.

c. Forest managers should proceed judiciously when issuing special products permits for species where limited knowledge and understanding constrains our ability to know if we are managing these groups of species sustainably.

To implement these Strategies, field staff should check the link to the Timber Sale Manual, Section F4: Special Forest Products for specific specifications and restrictions, and can be found at http://filesintranet.dnr.state.mn.us/user_files/2203/forest_products_and_utlization_standards.

3.3 Biological Diversity, Forest Composition, and Spatial Distribution

GDS 3A Old forest in this subsection is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity.

Consideration of old forest during planning was done to:

- Ensure an adequate representation of older stands and old forest components within even-age cover-types.
- Address visual quality concerns and recreation desires.
- Help maintain the integrity of forested riparian areas.
- Complement or connect old-growth stands.
- Provide habitat for wildlife species associated with old forest.
- Provide for older growth stages of NPC types.
- Provide large-diameter timber products.
- Help contribute to carbon sequestration on state forest lands.

A forest stand of any particular even-age managed forest cover-type is considered old forest whenever its age exceeds the normal rotation age agreed on by the landscape rotation age work group for that cover-type. Determining the amount of old forest to be sustained in this subsection required balancing many

factors: timber productivity, economic impacts, historical forest conditions, habitat requirements, forest health, and timber quality. The goal is to provide a representation of older forest stands and old forest components that is sustainable over time, balanced with the need to provide a stable timber supply, increased timber productivity, and early successional forest habitat. Information about Minnesota's old-growth forest policy can be found at http://www.dnr.state.mn.us/forests_types/oldgrowth/index.html

The cover-type and acreage of designated old-growth forests in the ASP subsection is identified on Table 3.5 above.

Providing for adequate and sustainable amounts of old forest across the landscape over time requires:

- Designating some current old forest to be maintained as old over time (e.g., as done in the old-growth designation process).
- Designating forest that is held to an older forest condition (i.e., extended rotation forest).
- Specifying situations under which forest managers will create or maintain old forest components within treated stands, based on site factors found there (e.g., management within Minnesota County Biological Survey (MCBS) sites of biodiversity significance).

In addition to old forest conditions identified in even-aged managed cover-types, uneven-age managed stands and other state lands (e.g., state parks and SNAs) also can contribute to old forest conditions. In addition, on some DNR Wildlife and Forestry lands, compositional changes to more long-lived conifer stands will provide more forest with longer rotations in the future.

GDS-3A Strategies

a. Determine the desired level of effective extended rotation forest for even-age managed cover-types.

The acreage and age of DNR timber lands to be managed as extended rotation forest (ERF) was provided to the ASP SFRMP team by an interdisciplinary statewide ERF workgroup. Forests managed as ERF are key to maintaining some forest within the subsection with old forest conditions. ERF contributes to providing "old forest" conditions, as the portion of ERF acreage that is over the normal rotation age (NRA) for the cover-type at a given time. Because forest stands designated as ERF can (and should) be in any age class, there are cases where large numbers of acres must be designated ERF (referred to as prescribed ERF) to achieve the identified old forest goal, due to the current cover-type age-class distribution. Cover-types typically managed under even-age regimes are the focus of ERF designation – such a management designation is unnecessary for cover-types managed under uneven-age regimes.

Designated ERF stands are harvested in stages between normal rotation age and maximum rotation age to help achieve the desired tapering distribution in older age classes.

For this planning process, all Wildlife Management Areas and Forestry Areas submitted stands to be prescribed as ERF stands. These prescribed ERF stands were identified in the ASP SFRMP Dataset as the ERF management pool. From this pool only a portion of prescribed ERF stands were selected and placed on the 10-Year Stand Exam List, allowing acres of ERF to remain on the landscape. ERF is prescribed for aspen and oak cover-types. A total of 569 acres of aspen is prescribed in the ASP Implementation Dataset. Of these 569 acres 103 acres are identified to be site visited on the 10-Year Stand Exam List, A total of 1,981 acres of oak cover-types is prescribed as ERF in the ASP Implementation Dataset. Of these acres 148 are identified on the 10-Year Stand Exam List for site visit and possible treatment. This process enabled the team to meet, or very closely meet, the acreage goals provided to them by the Statewide ERF Workgroup.

b. Prescribe ERF stands in even-age managed cover-types so that adequate old forest is maintained at the end of the plan implementation period.

Due primarily to existing imbalances in age classes in some cover-types, there will be fluctuations in the amount of effective ERF until a balanced age-class distribution is reached. After this, fluctuations may occur periodically because of major disturbances such as wind or fire. ERF has been designated for aspen and oak cover-types.

c. Manage some riparian management zones to reflect old forest conditions.

Site-level forest management guidelines recommend managing for longer-lived species within riparian management zones (RMZs). In the ASP subsection however, some portions of RMZs will continue to be managed for early successional species such as grasslands and oak savanna.

d. Allow some stands to naturally succeed to long-lived cover-types with, or without the use of harvest.

These site-level evaluations will be made following the site visit. Field evaluation tools include use of the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province*[5] *(Native Plant Community (NPC) Field Guide),* and associated Silvicultural Interpretations.

e. Manage designated old-growth stands and old forest management complexes according to DNR policy.

Old Growth has been designated in oak, birch, white pine, ash/lowland hardwoods and northern hardwoods. One old forest management complex has been identified surrounding designated old growth northern hardwoods. Complete and follow long-term management plans for designated old-growth stands and the surrounding acres in the old forest management complexes (OFMCs) that are to be managed for old forest characteristics. Use the *DNR Old-Growth Forest Guidelines, Amendments 5 and 6* as a guide. High-quality native plant communities (NPCs) and other stands that meet old-growth criteria can be nominated for designation as old growth following the *DNR Old-Growth Forest Guidelines*.

f. Manage ecologically important lowland conifers according to department direction.

Ecologically important lowland conifers (EILC) can include stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands that are representative examples of high quality lowland conifer NPCs found in the ASP subsection. Lowland conifers are not a significant cover-type in the ASP. One 47 acre tamarack stand was identified as EILC. This designated EILC stand will be reserved from treatment during this 10-year plan implementation period, or until such time as designation or release decisions are made by the Department. *(DNR Memorandum, July 3, 2000, Old-Growth Forest Guidelines and Protection of Important Lowland Conifer Sites)*

The designated tamarack stand will not cause a reduction in the treatment level in the tamarack cover-type.

g. Follow the MFRC *Voluntary Site-Level Forest Management Guidelines* to retain components of old forest in even-age managed cover-types.

Examples of retention of old forest components include retaining leave trees, legacy patches, snags, and coarse woody debris.

h. Use silvicultural treatments that retain old forest components in some stands.

Examples of silvicultural treatments that can retain old forest components include:

- Selective harvest (i.e., group selection and single tree selection)
- Intermediate harvest (i.e., thinning)

[5]Minn. DNR, 2005, *Field Guide to Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province*. Ecological Land Classification Program, Minnesota County Biological Survey, Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources St. Paul, MN 55155.

- Shelterwood harvest with reserves
- Seed tree harvest with reserves
- Variable retention harvest
- Variable density thinning

Field staff will consult *DNR Forest Management Direction Documents* found at:
http://intranet.dnr.state.mn.us/forest_mgmt_direction/index.html

i. Consider the status of old forest within the subsection when making decisions to add and offer unplanned wood for harvest.

GDS-3B Species of Greatest Conservation Need and Key Habitats are maintained or enhanced in the subsection.

Minnesota DNR participates in the State Wildlife Grants Program (SWG), created by the US Congress in 2001. Congress mandated that to participate in the SWG Program, states, in partnership with other conservation agencies and organizations must develop a Comprehensive Wildlife Conservation Strategy (CWCS) to identify and manage *Species of Greatest Conservation Need* (SGCN) and associated *Key Habitats*.

SGCN are defined as native animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Minnesota's SGCN list includes 292 native animal species. Key Habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Minnesota's CWCS identifies Key Habitats in terms of the DNR's three-volume *Field Guide to Native Plant Communities. Tomorrow's Habitat for the Wild and Rare* contains a listing of SGCNs and Key Habitats known to occur in the Anoka Sand Plain subsection. By alerting resource managers and the public to SGCN and Key Habitats, activities can be reviewed and prioritized to complement Minnesota's CWCS. (See Appendix E, *Species of Greatest Conservation Need – Anoka Sand Plain)*

GDS-3B Strategies

a. Provide current SGCN and Key Habitat data to DNR staff upon request.

DNR staff from all divisions will have access to the most up-to-date SGCN and Key Habitat locations by coordinating with the Division of Ecological and Water Resources. The Key Habitats for the ASP subsection are oak savanna, prairie, grassland, wetland-nonforest, shoreline-dunes-cliff/talus (dune habitat), lake-shallow, and river-headwater to large.

b. Incorporate new SGCN and Key Habitat locations and data as they are collected in the ASP subsection.

SGCN and Key Habitat data are collected to various degrees by MCBS, Natural Heritage & Nongame Research Program, and various other sources. As these new data are compiled they will be made available to DNR staff and applied to management decisions per the *Interdisciplinary Forest Management Coordination Framework*[6] *(Coordination Framework).*

c. Select some ERF, OFMC, EILC, and SMA stands based on their association with SGCNs and Key Habitats.

SGCNs and Key Habitats were considered during the selection of stands in ERF, OFMCs, EILC, and SMA areas.

[6] DNR Divisions of Forestry, Fish and Wildlife, and Ecological Resources: *Interdisciplinary Forest Management Coordination Framework*. St. Paul, Minnesota. December 2007.

d. Stand-level management accounts for SGCN and Key Habitats.

SGCN and Key Habitat datasets are made available to area staff by Ecological and Water Resources upon request. Resource managers will use the *Coordination Framework* process to ensure that SGCNs and Key Habitats are considered as stand treatments are discussed. Ecological and Water Resources will deliver SGCN and/or Key Habitat management considerations to forest managers for use in making forest management decisions for stands selected for treatment, access routes, and other management or development activities consistent with the process outlined in the *Coordination Framework*.

GDS 3C Forest cover-type composition on state lands moves closer to the range of cover-type composition that occurred historically (prior to European settlement) within the ecosystems found in the subsection.

The proposed cover-type change directions increase the acreage of cover-types that have declined historically, while maintaining or enhancing important wildlife habitats and plant communities, and providing a sustainable level of forest products. The ecologic, economic, and social considerations used in developing the cover-type change directions for the subsection include:

- Historic forest composition
- Historic disturbance regimes
- Range of natural variation
- Wildlife habitat
- Forest insects and diseases
- Forest productivity (e.g., match the species to the site using NPC Field Guide)
- Increase availability of certain forest products (e.g., sawtimber)
- Recreational values

The primary cover-type changes recommended include efforts to convert and or increase the cover-types to more open oak woodlands and oak savanna.

GDS 3C Strategies

a. Increase the acres of white pine, oak savanna, and prairie.

This Strategy will be implemented using the following techniques:

1. Use the *NPC Field Guide* as a tool to guide the on-site evaluation of stands for conversion from one cover-type to another or managing for mixed forest conditions (species composition and stand structure). Options available include:
   - Allow some stands to convert from grasslands through natural succession to long-lived conifer cover-types without harvest. Emphasize this in stands with adequate advance regeneration of long-lived conifer species.
   - Artificially convert some stands through mechanical site preparation, prescribed burning, planting, or seeding.
   - Selectively harvest some stands to move toward the desired cover-type and within-stand composition.
   - Allow some stands to convert from grasslands to forest cover-types through natural succession.

   Conversions can be immediate, or can take place over the span of a rotation period through thinning, partial cuts, and intermediate treatments.

2. Use accepted oak savanna and prairie restoration management tools, including timber harvest, prescribed burning, and invasive species control, to increase the amount of oak savanna and prairie in places where they historically occurred.

Vegetation throughout the ASP subsection has undergone a shift in structure and species composition in the last 100 years or so, as many areas of oak savanna, prairie, and oak openings have converted to more closed woodland and/or been planted to pine. On some state lands, some of these areas have management goals of restoring the more open native plant communities through a combination of timber harvest, invasive species control, and prescribed burning. Most of these areas are not considered conversions, because in many cases the cover types do not change, but a shift in species composition and cover will occur. In some cases, stands are considered conversions when there is a major shift, such as the removal of pines and the conversion from a pine cover-type to an oak or grassland cover-type.

3. Use the *Sand Dunes State Forest Operational Plan* to guide vegetation management in the Sand Dunes State Forest. The *Operational Plan* (included as Appendix C) was developed in 2011 as a stand level guide to desired future conditions of vegetation in various management zones in the state forest and to outline how these conditions will be achieved. In some portions of the forest, the *Operational Plan* outlines a shift in emphasis from managing a mixed hardwood/pine forest to managing for oak savanna, prairie, and oak woodland with a much reduced presence of pine (Zones 2, 3, and 4). In these areas, there will be a decrease in pine, an increase in oak oak savanna and prairie, and a management shift in oak woodlands to remove pine and increase the use of prescribed fire as a management tool. In other portions of the state forest, management will continue to emphasize a mixed hardwood/pine forest (Zone 1). The Bob Dunn Recreation Area (Zone 5) includes both types of management goals, and also emphasizes management for recreational use.

   The five zones in the Sand Dunes State Forest are as follows:

   - Zone 1 – Long-Term Forest Management (2,840 acres)

   - Zone 2 – Uncas Dunes Scientific and Natural Area (677 acres)
     The Uncas Dunes Scientific and Natural Area will continue to be managed for rare features by the Scientific and Natural Areas program

   - Zone 3 – Immediate Rare Features Management (513 acres)
     Effective immediately (starting 2011 and going out ten years) this zone will be managed for the native plant communities, including oak savanna, prairie, woodland, and wetland, and the rare species that occur there.

   - Zone 4 – Eventual Rare Features Management (1,348 acres)
     This zone in the South Unit of the Sand Dunes State Forest will be managed for the array of oak savanna, woodland, prairie, tamarack swamp, emergent marsh, and sedge meadow native plant communities and the rare species that occur there, but with a delay in the timeline for harvest of planted pine as rotation ages are achieved.

   - Zone 5 – Bob Dunn Recreation Area (353 acres)
     The Bob Dunn Recreation Area includes day use areas, the drive-in campground, and the horse camp. This area is managed in part by DNR Parks and Trails, along with Forestry. It includes important areas of oak savanna, prairie, and sedge meadow native plant communities and many rare species populations. This zone will be managed to enhance the rare features while taking into account recreational best management practices with input from DNR Forestry, Parks and Trails, Wildlife, and Ecological and Water Resources Division staff.

b. Forest composition goals and objectives are consistent with the MFRC Landscape plans.

Department personnel have been involved in the MFRC Regional Landscape planning efforts carried out in Minnesota for a number of years. Although the planning processes differ in scope and scale, they share a number of goals and the Department remains committed to maintaining close relationships. The ASP SFRMP is consistent with the recommendations contained in the MFRC Landscape plans.

There are intended differences in the scope of the two planning efforts. Some differences are:

- DNR manages state-administered forest lands by cover-type, with goals by 10-year planning periods, whereas MFRC Landscape Plan recommendations are based on ecosystem types and growth stages. There is no direct comparison between age-class distributions for cover-types and range of natural variation growth stages for ecosystem types. However, the landscape and subsection plans share goals with respect to maintaining the forest land base; managing forests by considering native plant communities, recognizing the challenges posed by the growing population within the subsection, protecting forest ecosystems, using ECS as a primary management guide, increasing forest land, improving water quality, and promoting sustainable timber production.
- MFRC Landscape plans address all ownerships, therefore they do not identify specific acreage goals for recommended cover-type conversions, enhancements or restorations. To coordinate the two planning efforts, Minnesota DNR provides MFRC staff with information regarding state land management, to assist them in monitoring accomplishments in the MFRC regional landscapes. Monitoring plan implementation is an integral part of the SFRMP process. Formal ASP SFRMP monitoring reports will be prepared at specific points during the 10-year plan implementation period. Appendix G of this plan includes the *ASP SFRMP Monitoring Plan* for state lands in the ASP subsection.

GDS 3D Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to sustain or enhance the biodiversity significance factors on which these MCBS sites were ranked.

Minnesota County Biological Survey sites range from 10s to 1,000s of acres in size and contain intact native plant communities, populations and/or concentrations of rare species, critical animal habitat, and/or functional landscapes representative of pre-European settlement Minnesota. The ASP subsection is subjected to significant development pressures from the Minneapolis/St. Paul metro area, the St, Cloud metro area and to some extent Brainerd. Development from these metro areas has and will continue to challenge the ability to achieve a pre-European landscape. The MCBS "site" provides a geographic framework for evaluating and communicating statewide and regional biodiversity significance.

In order to provide a relative measure of how Sites of Biodiversity compare to each other, MCBS sites are ranked according to the four levels described below. Important factors influencing MCBS site ranks include:

- Rare species occurrences;
- Native plant community quality, rarity, and size; and
- Landscape context and presence/absence of landscape-level functions.

Sites of biodiversity significance serve as ecological reference areas that help to: 1) improve our understanding of ecosystem form and function; 2) improve our understanding of Minnesota's native biodiversity; and, 3) evaluate the effects of management on biodiversity, rare species, native plant communities, and ecosystem form and function.

MCBS site boundaries are initially determined through aerial photo interpretation, a review of existing data, and/or remote sensing. These first drafts of MCBS sites are typically created before MCBS field survey initiation and are termed, "Survey Priority Areas." Survey Priority Areas provide a framework in which to organize and prioritize field surveys within the survey area. Survey Priority Areas are delineated at a coarse level (i.e., the boundaries are general) and ranked as either having high survey priority or moderate survey priority (see below for more detail).

O - OUTSTANDING. MCBS sites 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.

H - HIGH. MCBS sites containing the "best of the rest," such as MCBS sites with very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes.

M - MODERATE. MCBS sites containing significant occurrences of rare species and/or moderately disturbed native plant communities, and landscapes that have a strong potential for recovery.

B - BELOW MCBS MINIMUM BIODIVERSITY THRESHOLD FOR STATEWIDE SIGNIFICANCE. MCBS sites 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.

Hp - **Preliminary Survey Priority of HIGH.** An area exhibiting high potential for high quality and/or representative native plant communities, rare species occurrences and/or concentrations, and/or functional landscapes.

Mp - **Preliminary Survey Priority of MODERATE.** An area exhibiting moderate potential for high quality and/or representative native plant communities, rare species occurrences and/or concentrations, and/or functional landscapes.

Upon survey completion, MCBS Survey Priority Areas are revised (i.e., the boundaries are refined) resulting in MCBS sites of biodiversity significance that are ranked according to their statewide biodiversity significance. Sites of biodiversity significance may also be defined outside of Survey Priority Areas based on field survey results and final biodiversity significance interpretations for a survey area. The boundaries of MCBS sites are influenced by land-use history and/or notable differences in landforms, native plant communities, rare species occurrences, and/or Ecosystem Classification System (ECS) units (e.g., subsections).

Minnesota County Biological Survey biodiversity significance guidelines are applied statewide, but not all criteria may be applicable to all regions i.e., portions of the state are highly fragmented and completely lack significant components of functional landscapes whereas other portions of the state contain large, intact landscapes but lack rare species and/or rare native plant communities – yet both areas may share the same biodiversity significance rank based on the statewide significance of the features they each contain. Biodiversity significance rankings for some sites may need to be updated as survey work proceeds across the state to reflect new information and our growing understanding of Minnesota's native biodiversity.

MCBS surveys have been completed in nearly all of the ASP subsection. The one exception is Crow Wing County, which has only a small portion included in this plan. Field work has been completed in this county, and the mapping is expected to be completed and available in January 2012.

In 2009, the DNR began implementing the High Conservation Value Forest policy in response to a Forest Certification Corrective Action Request (CAR). This policy states that on certified state forestry and wildlife lands, all MCBS sites of outstanding biodiversity significance and a subset of MCBS sites of high biodiversity significance will be considered High Conservation Value Forests (HCVFs). These sites will be managed to maintain or enhance identified high conservation values. A process was put in place for designating HCVF sites, and the DNR is currently in the process of reviewing proposed sites. Final HCVF sites are expected to be designated by June 2012. A *Fact Sheet describing High Conservation Value Forests* is included as Appendix H. The stand exam list included as Appendix D includes a column for whether or not stands are within proposed HCVFs. Resource managers will consult the *ASP SFRMP Dataset* in preparation for field visits to ensure that HCVF information is considered.

Table 3.11 below identifies the total cover-type acres and acres by cover-type included on the 10-Year Stand Exam List that are identified as a *proposed* HCVF. This table shows that on the ASP subsection 1,339 acres (34 percent) of the stand exam list are included on *proposed* HCVF sites. As field visits to these stands are

made during the plan implementation period, the current inventory and Department guidelines on how to manage within HCVF will be implemented.

Table 3.11 Stands on the 10-Year Stand Exam List exhibiting a *proposed* High Conservation Value (HCVF)

Cover-type	Total Acres on 10-Year List	10-Year Stand Exam List stands located within proposed HCVF	
		Acres	Percent
Aspen	390	151	39
all Oaks	953	519	54
Northern Hw	154	129	84
Ash/LLhw	66	46	70
Jack pine	113	18	16
W / N Spruce	88	11	13
Tamarack	46	46	100
Birch	38	13	34
White pine	301	64	21
Red pine	1,734	342	20
Total	3,883	1,339	34

Source: ASP SFRMP Dataset

Forest management activities such as timber harvesting, site preparation, access route construction and maintenance, and tree planting will occur on Forestry- and Wildlife-administered lands within MCBS sites following the guidance and directions contained in this plan. Forest management activities carried out in those MCBS sites determined to be of greatest concern or importance for SFRMP will emphasize the following strategies to help minimize the loss of the factors on which the MCBS sites were ranked.

GDS 3D Strategies

a. Determine which MCBS sites are of greatest concern or importance for SFRMP over the 10-year plan implementation period.

MCBS sites of greatest concern or importance for SFRMP were determined to be those MCBS sites with state lands that have a biodiversity significance rank of Outstanding or High, or are in survey priority areas with a rank of High. These MCBS sites represent the best occurrences of existing biodiversity significance, so they provide the greatest opportunity to sustain or minimize the loss to native biodiversity. This will also be reflected in the designation of HCVF.

b. Consider the broader context and significance of the MCBS site as a whole when assigning management objectives and designing silvicultural prescriptions.

Management decisions should be made considering the broader context and factors that contribute to the significance of the MCBS site as a whole. Silvicultural prescriptions incorporate connections between stand-level actions and their effect on a site's biodiversity significance. Final management objectives will be carried out consistent with the *Coordination Framework*.

c. Determine location and composition of stand conversions based on desired NPCs.

Managers will determine the NPC Class for stands planned for site preparation and tree planting forest development activities using the *Field Guide to the Native Plant Communities of Minnesota: the Eastern*

Broadleaf Forest Province. NPC mapping by the Minnesota County Biological Survey is also available for nearly all of the subsection, and can be used to help inform identification of NPC class for each stand.

The NPC Field Guide and associated ECS Silvicultural Interpretations which can be viewed at:
http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Whenever possible and practical, manage stand cover-type conversions with less intensive site preparation or plantations with less intensive timber stand improvement (TSI).

d. Allow some stands to succeed to the next native plant community growth stage, with or without harvest.

Most likely candidates for succession would be stands that contain adequate regeneration stocking levels and structural characteristics for the site to convert to a later growth stage. Other candidates would include stands whose location, condition, or rare species occurrences are critical factors to a site's biodiversity significance, where later successional stages are the best habitat for those rare features.

e. Emulate the within-stand composition, structure, and function of NPC growth stages when managing stands in MCBS sites.

Determine which species to harvest and retain their spatial and temporal arrangement based on NPC tree succession and disturbance ecology. DNR Forestry's *ECS Silvicultural Interpretations* will be used to make the link between stand-level considerations and NPC ecology.

Examples include:

- The availability of coarse woody debris and snags – species, size class distribution, spatial distribution through time;
- Leave trees and legacy patch selection and design are influenced by how the NPC would have been disturbed under natural conditions;
- Include super-canopy trees as leave trees and in legacy patches;
- Diameter classes in uneven-age managed stands reflect the range and abundance expected for the NPC;
- Retain or create a legacy of species and structural features that are found in older growth stages, so that maintenance or movement of the stand towards other growth stages is an option. Natural disturbances rarely destroy all biological and physical features of the NPC, so older growth stage species and structures often persist in young stands regenerating from catastrophic disturbances;
- Use silvicultural techniques during forest management activities to recruit desired species through natural regeneration – leave trees that are likely to produce seeds, leave or remove trees that help create/maintain microclimate conditions favorable to seedling establishment and growth;
- Use gap management with varying gap sizes to encourage recruitment of desired species (e.g., red oak) in northern hardwood stands;
- Use silvicultural techniques that take advantage of opportunities to increase recruitment of desired species from native plant communities in adjacent stands; and,
- Manage stands based on NPC boundaries recognizing that a change in cover-type may or may not relate to a change in NPC.

f. Apply variable density thinning during harvest or reforestation.

Variable density techniques may be prescribed during the planning of timber sales and/or forest development activities. Using this approach, harvest (clear-cut or thinning) and planting (or seeding) would be accomplished in a pattern (clumped or dispersed) that more closely replicates patterns created after natural disturbance. For example, retain legacy patches versus scattered reserves in clear-cuts to retain islands of residual vegetation that include tree species present at older growth stages.

g. Apply variable retention harvest techniques during harvest.

The main objectives of variable retention are to retain the natural range of stand structure and forest functions. With retention systems, forest areas to be retained are determined before deciding which areas will be cut. The following are techniques to be considered:

- Standing trees are left in a dispersed or aggregate form to meet objectives such as retaining NPC form and function, old-growth structure, habitat protection, and visual qualities. Variable retention retains structural features (e.g., snags, large woody debris, and live trees of varying sizes and canopy levels) as habitat for a host of forest organisms.

- Consult the legacy patches recommendations in *MRFC Voluntary Site-level Forest Management Guidelines, Wildlife Habitat Section, pages 43-47.*

- During harvest, retain tree species and diameters present at older growth stages, in clumps or dispersed to more closely replicate the pattern after natural disturbance. Include retention of large, downed logs. For example: leave legacy patches throughout the stand; and leave islands of residual vegetation that include tree species present at older growth stages.

h. Designate some stands as ERF to provide old forest conditions.

ERF designated stands will help maintain old forest conditions within MCBS sites and will retain older growth stages on the landscape for longer periods of time than stands managed as normal rotation forests. When ERF stands are harvested within MCBS sites make efforts to retain the older forest components that are present in the stand or retain features that allow older forest components to continue developing. Within the ASP subsection there are 845 acres of ERF stands that are found in MCBS sites. This is an approximate acreage number as the shapefile of MCBS sites and FIM boundaries are not always identical.

i. Increase the use of prescribed fire as a silvicultural technique in managing fire- dependent NPCs.

Increasing the use of prescribed fire is a primary tool to be used to implement the management directions recommended in the ASP SFRMP. See Section 3.12 Use of Prescribed Fire as a Management Tool for more information.

j. Locate roads to minimize impacts to MCBS sites.

Roads contribute to a decrease in interior forest conditions and an increase in terrestrial invasive species abundance. Where forest interior habitat is present, all efforts should be taken to minimize new road construction and enlargement of existing roads and trails in MCBS sites. It is not anticipated that new access will be needed to treat the stands on the 10-Year Stand Exam List. Stands that don't already have access will likely be served by winter access only on frozen conditions across existing state lands. Where new access may be necessary, efforts will be made to minimize impacts by considering MCBS and HCVF factors. On state units where prescribed fire is being used as a management tool, roads can be carefully placed, if needed to serve as fire breaks.

k. Emulate natural disturbance conditions of native plant communities in MCBS sites.

Consider retaining more than the recommended number of leave trees in larger harvest sites (greater than 100 acres) because this would better mimic natural disturbances, such as fire and windstorm. *(See MFRC Site-level Forest Management Guidelines, Timber Harvesting, Page 39).*

Native plant communities in most of the Anoka Sand Plain are fire-dependent plant communities. The *Sand Dunes State Forest Operations Plan* (Appendix D) outlines how the use of prescribed fire, logging, and invasive species control will be used to mimic historic disturbance patterns in this area. Similarly, native plant communities in other MCBS mapped sites on state forestry and wildlife lands in the subsection will be

managed with a combination of prescribed fire, logging, and invasive species control to mimic historic fire and windstorm patterns.

l. Apply special management recommendations for known rare features, Species of Greatest Conservation Need (SGCN), and Key Habitats.

Rare features include rare native plant communities as well as rare plants, rare animals, and their habitats. Additional rare feature locations are likely to be discovered in this subsection. Management activities will be carried out in a manner that protects, maintains, or enhances rare features according to DNR policy and state statute.

Three Special Management Areas (SMAs) have been designated on lands in the ASP subsection to address special management needs of rare features, SGCNs, and Key Habitats. These three SMAs are described below and their locations shown on Map 3.3.

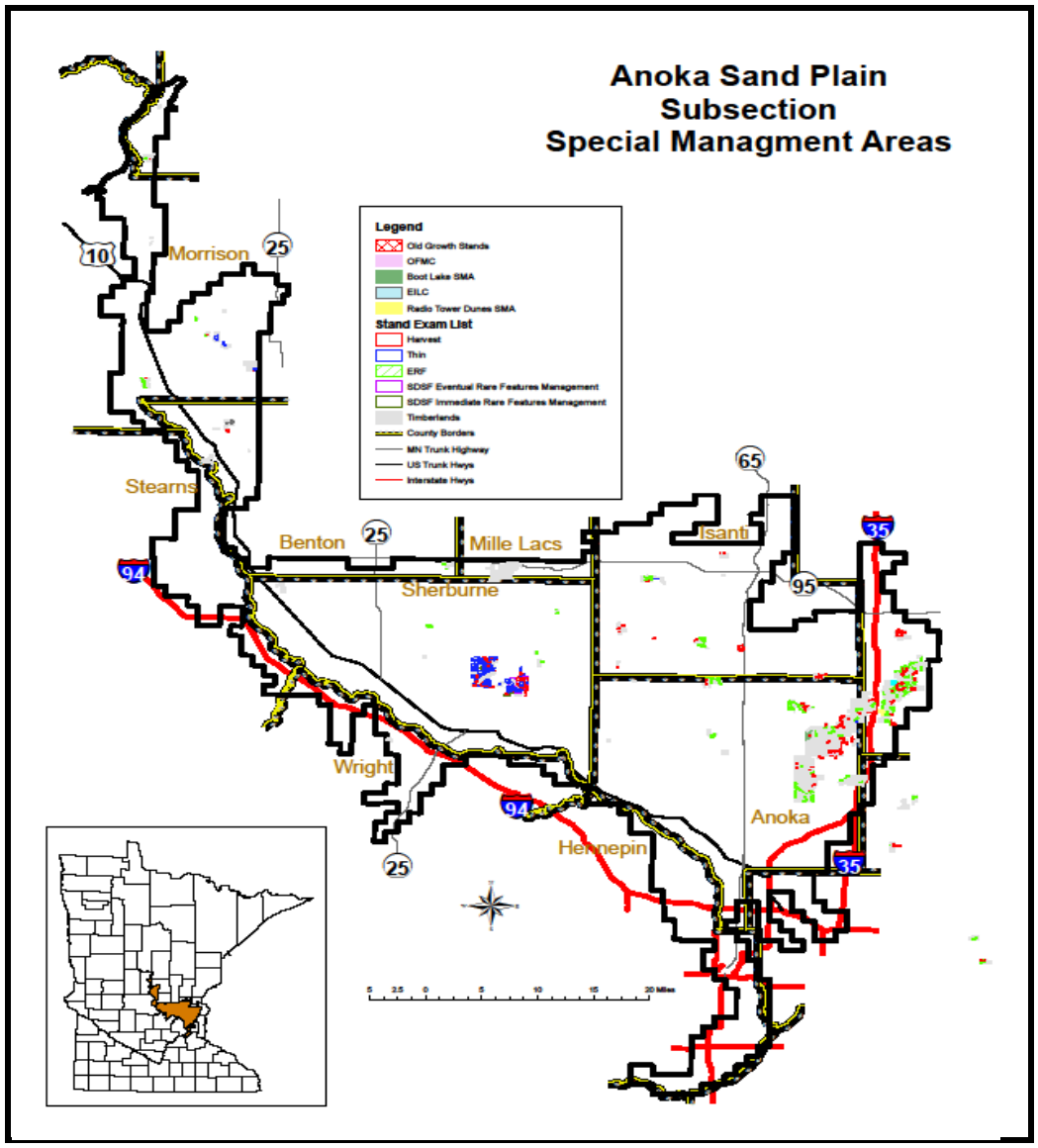
1. **Radio Dunes SMA** is located in the Carlos Avery Wildlife Management Area (WMA), east of a prominent radio tower. This SMA includes dune formations, Dry Barrens Oak Savanna, and two state-listed rare species: beach heather *(Hudsonia tomentosa)*, and the northern barrens tiger beetle *(Cincindela patruela patruela).* This area will be managed to sustain the oak savanna plant community and its component rare species.

2. **The Boot Lake SMA** is also in the Carlos Avery WMA. This SMA includes habitat for the red-shouldered hawk *(Buteo lineatus),* a state-listed rare bird that utilizes forest habitat with adjacent open wetlands. The red-shouldered hawks also occur in adjacent lands, including the Boot Lake Scientific and Natural Area. There are a number of MCBS-mapped native plant communities in this SMA, including Oak (Red Maple) Woodland, Black Ash- Yellow Birch – Red Maple – Basswood Swamp, Tamarack Swamp, Willow-Dogwood Shrub Swamp, and Sedge Meadow. These plant communities will be managed with an emphasis on maintaining the forest and wetland plant communities, and ensuring that habitat for red-shouldered hawks is sustained.

3. **The Sand Dunes State Forest SMA** includes the acres in the Immediate and Eventual Rare Feature Management Areas further detailed in the *Sand Dunes State Forest Operation Plan* (Appendix D). This SMA will be managed to protect the dunes, native plant communities, and fourteen state-listed rare plant and animal species that occur there.

Species of Greatest Conservation Need and Key Habitats are identified as part of Minnesota's Comprehensive Wildlife Conservation Strategy (CWCS). Species of Greatest Conservation Need are defined as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Key Habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Minnesota DNR participates in the State Wildlife Grants Program (SWG), created by the US Congress in 2001. Congress mandated that to participate in the SWG Program, states, in partnership with other conservation agencies and organizations must develop a Comprehensive Wildlife Conservation Strategy (CWCS) to identify and manage their SGCN. Management activities will be carried out in a manner that complements Minnesota's CWCS. See web page at: http://www.dnr.state.mn.us/cwcs/index.html

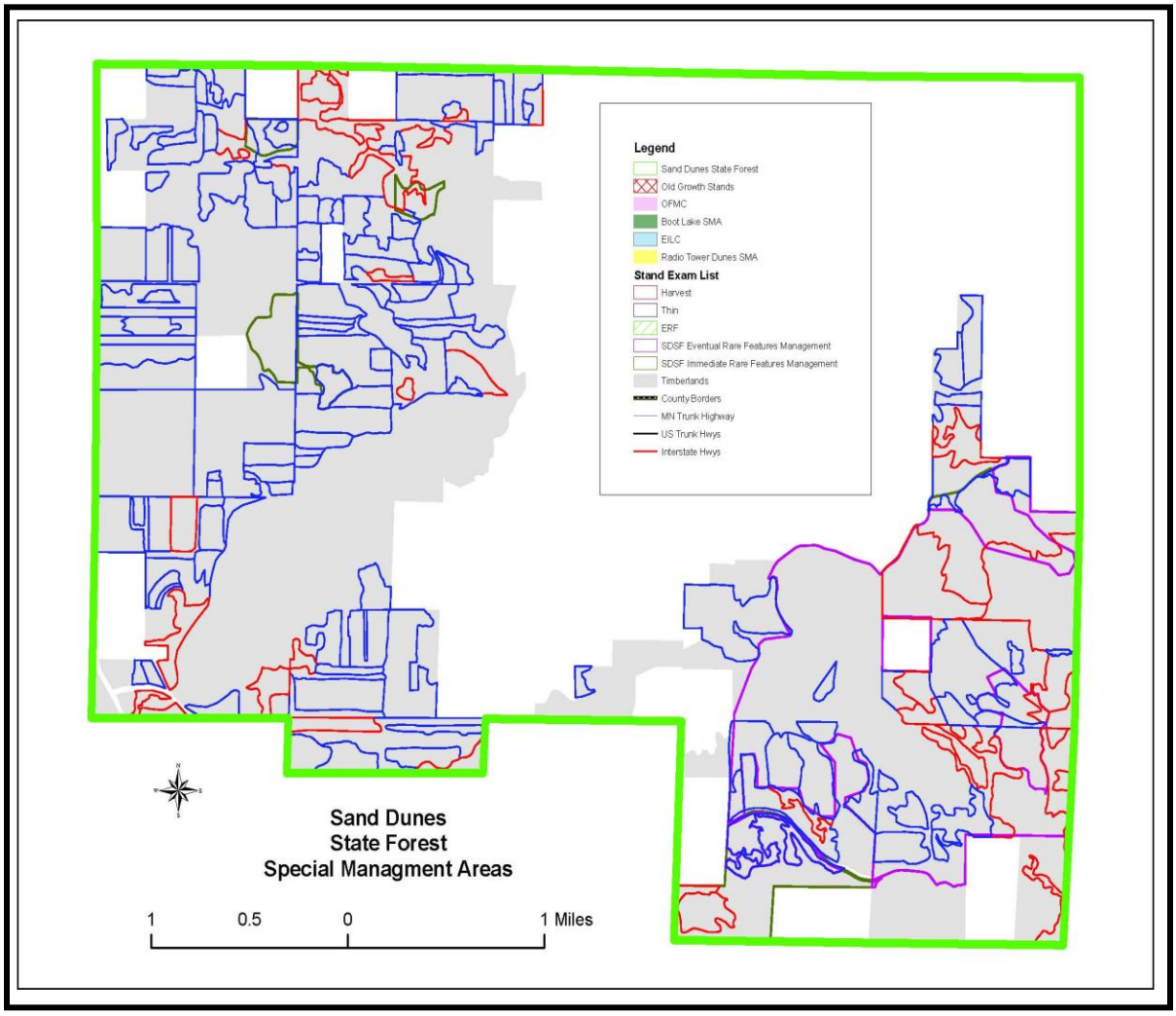
Map 3.3 Special Management Areas - Anoka Sand Plain



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

Map 3.4 identifies the Sand Dunes State Forest and the special management areas. This map is provided to better identify the special management areas of the SDSF which are the Immediate Rare Features Area and the Eventual Rare Features Areas. This map also shows stands to be harvested or thinned as identified on the 10-Year Stand Exam List.

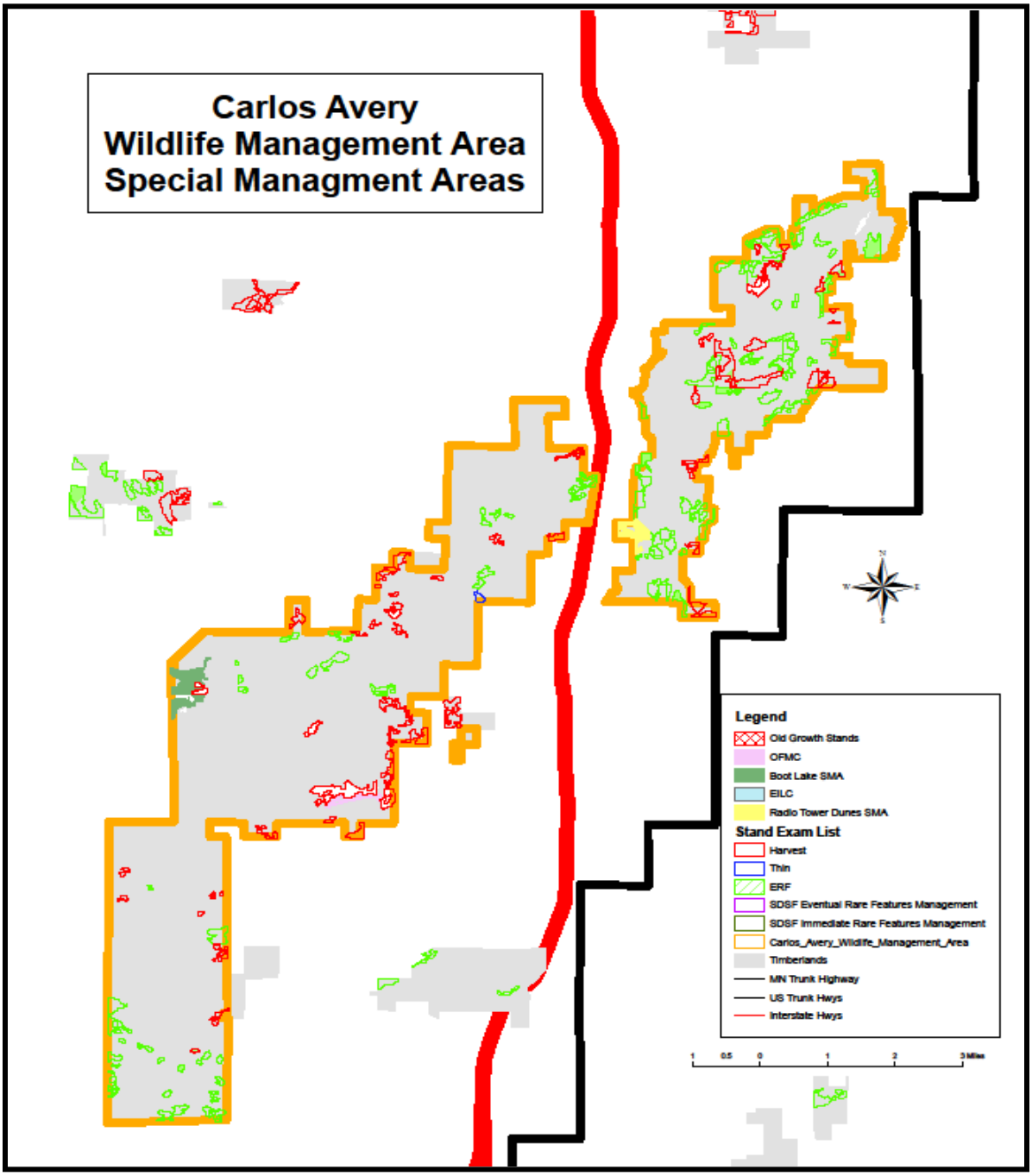
Map 3.4 Sand Dunes State Forest - Special Management Areas



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

Map 3.5 identifies the Carlos Avery WMA and the Special Management Areas. These SMAs include Boot Lake SMA and Radio Dunes SMA. This map also identifies designated old growth, the OFMC, EILC and ERF stands and stands to be thinned or harvested from the 10-Year Stand Exam List.

Map 3.5 Carlos Avery WMA - Special Management Areas



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

m. Defer management of EILC stands.

Reasons to defer some stands include:

- Designated EILC stands will be reserved from treatment during this 10-year plan implementation period or until old-growth guidelines or other EILC guidelines are in place. EILC acres will be included in cover-type treatment acres calculations for this 10-year plan. Therefore, EILC designations will not cause a reduction in the treatment level tamarack cover-type. One EILC stand is designated, however based on site visits, there may be additional stands added in the future.

n. Consider timber productivity, trust responsibilities, and other forest management priorities managing stands in these MCBS sites.

These considerations will include:

- Land status and timber productivity will be considered while implementing the other Strategies on stands identified for management.
- Areas will follow DNR policy regarding replacing stands that are deferred from treatment.

o. Forestry, Wildlife, and Ecological and Water Resources personnel will communicate with other landowners, as opportunities arise, to inform them of the significance of these MCBS sites and management options that could be implemented to address the biodiversity objectives of these MCBS sites.

This Strategy will be implemented by:

- The draft and final ASP SFRMP will be placed on the DNR's public web site; stakeholders and other land managers in the ASP subsection will be notified and copies distributed on request.
- DNR resource management staff will seek to implement stand-level management activities that achieve landscape-level biodiversity goals and objectives across ownerships.
- When assisting private landowners with woodland stewardship plans, information on the biodiversity significance of these MCBS sites will be provided.
- As the *Sand Dunes State Forest Operational Plan* process is complete, adjoining landowners will be notified.
- Ecological and Water Resourced Division personnel will communicate and deliver information about priority MCBS sites of biodiversity significance to other landowners within these MCBS sites.

The intent of this Strategy is to provide information on the MCBS sites and cooperate in forest land management across ownerships in the landscape when possible and agreed upon by the landowners affected. It is not meant to imply or mandate how other landowners should manage their lands.

GDS 3E Rare plants and animals and their habitats are protected, maintained, or enhanced in this subsection.

Minnesota's List of Endangered, Threatened, and Special Concern Species (ETS List) was created in 1984 and was last revised in 1996. Created under Minnesota's Endangered and Threatened Species Statute, the ETS List draws attention to species that are at greatest risk of extinction within the state with special regulations applied to those species listed as endangered or threatened. By alerting resource managers and the public to species in jeopardy, activities can be reviewed and prioritized to help preserve the diversity and abundance of Minnesota's native flora and fauna. Because of the importance of the ETS List in influencing resource use and management activities in Minnesota, it is critical that it reflect the most current information regarding the distribution, abundance, and security of species within the state. Consequently, Minnesota law requires the ETS List to be periodically revised. Proposed changes to the ETS List are currently being reviewed. The latest ETS list revision is currently in-progress with rule-making estimated to be completed within the early years of this plan.

Up to date information about rare plants and animals in the state is available to DNR staff and the public through the Rare Species Guide on the DNR website, available at:
http://www.dnr.state.mn.us/rsg/index.html

The DNR takes a leadership role in protecting and providing habitat for rare plants and animals in Minnesota by managing the listing of rare species in the state. Protecting rare plants and animals and their habitat is a key component of ensuring the continuance/long-term viability of Minnesota's species, community, and landscape- level biodiversity. Implementation of the Strategies below will assist the DNR's ability to protect rare species and their habitats in this subsection.

GDS 3E Strategies

a. Provide current rare features database (Natural Heritage Information System) to DNR staff through the DNR Quick Layers Themes in ArcGIS.

DNR staffs from all divisions will have access to the most up-to-date rare features locations.

b. Select some ERF, OFMC, SMA and EILC stands based on their association with rare features.

When extended rotation forests (ERF), old forest management complexes (OFMCs), special management areas (SMAs) and ecologically important lowland conifers (EILC) stands were selected in this subsection, locations of rare species populations and conditions for rare species and their habitats were considered in the stand selections.

c. During the development of the 10-Year Stand Examination List and Annual Stand Examination Lists, land managers check the rare features database and flag for follow-up consultation those stands proposed for treatment that includes a rare feature.

If rare feature locations occur in or near stands proposed for treatment, land managers confer with the appropriate Wildlife or Ecological and Water Resources staff to determine if adjustments to proposed treatments are needed to protect the rare plant or animal, its habitat, or other rare features. Joint site visits are often conducted to determine appropriate management.

Further clarifications to implement this Strategy include:

- The rare features database is regularly updated and available to area offices.
- Area staff is trained in the use of the Natural Heritage Information System and regularly consult the rare features database as management or development activities are planned and implemented.
- Stand selections or treatments are adjusted or stand prescriptions include mitigation measures to protect the rare plants or animals and their habitat within the stand. Often adjustments are deferred until the field visit.
- In the Sand Dunes State Forest, a variety of special management areas have been established to ensure rare species habitat is maintained or enhanced. Areas in Sand Dunes State Forest with special emphasis on rare features include SNAs, and the Immediate and Eventual Rare Features Management Areas. In addition, a number of concentrations of rare animal species have been documented in the portion of SDSF not within these special management areas. These have been designated Rare Species Persistence Corridors. Further details about these areas are included in GDS 3C #3 on page 3.44, and described in the Sand Dunes State Forest Operational Plan (Appendix C).

d. Harvest prescriptions, and other management proposals identify and implement measures that protect rare features.

Prescriptions for stands selected for treatment, access routes, and other management or development activities include mitigation measures that protect the rare feature(s) within the stand. Mitigation includes measures that reduce the likelihood of the introduction or spread of non-native invasive species (and the

impacts of the control measures for invasive species, e.g., effects on rare species and/or habitat from use of herbicides to eradicate non native invasive species).

GDS 3F Rare native plant communities are protected, maintained, or enhanced in this subsection.

Minnesota's NPCs have been evaluated and assigned an S-Rank based on the Heritage Conservation Status Rank (S-Rank) system developed by NatureServe[7]. The resulting S-Rank is a value (S1 to S5) assigned to a NPC type (or subtype) that best characterizes the relative rarity or endangerment of the NPC statewide (Table 3.12).

Table 3.12 Statewide Heritage Conservation Ranks (S-Ranks) for Native Plant Community Types

NPC Type S-Rank	Definition
S1	Critically imperiled.
S2	Imperiled.
S3	Rare or uncommon.
S4	Widespread, abundant, and apparently secure, but with cause for long-term concern.
S5	Demonstrably widespread, abundant, and secure.

Resource managers will consult the *Conservation Status Ranks for Minnesota Native Plant Communities (October 2008*) prepared by the Division of Ecological and Water Resources to determine those known or likely to occur in the subsection. Note*: As MCBS and native plant community interpretations progress across the state, S-ranks will be revisited and refined as justified.* A complete list of the Statewide S-Ranks for NPC types in Minnesota is available from the DNR Natural Heritage and Nongame Research Program.[8]

Locations of the rare NPC types or subtypes listed in the *Conservation Status Ranks* will be documented and may be assigned a relative rank for the quality of the NPC occurrence. Specifications for ranking the quality of NPCs are currently being revised by the MN DNR Division of Ecological and Water Resources to complement the MN DNR's three-volume *Field Guide to the Native Plant Communities of Minnesota* (version 2.0). Generally, NPCs are ranked for quality based on factors associated with size, condition, and landscape context. The relative quality of the NPC is assigned on a continuum from "A" through "D", with an "A" rank indicating an excellent quality NPC, and a "D" rank indicating a poor quality NPC. The Conservation Status Ranks for Minnesota do not address relative quality although it is generally true that "A" quality examples are rarer than lower quality examples for any given NPC type or subtype.

Because MCBS is a primary source for NPC data and MCBS prioritizes survey efforts within MCBS sites, most documented locations of rare NPCs are within MCBS sites. However, there may also be locations of rare NPCs documented in areas outside MCBS sites. This will become more common as NPC data collection is being completed by other DNR divisions and a growing number of cooperators.

The protection of many MCBS-mapped rare native plant communities will be addressed by considering how to maintain or enhance high conservation values (including native plant communities) in HCVF sites once they are designated.

[7] NatureServe - In cooperation with the Network of Natural Heritage Programs and Conservation Data Centers. 2002. Element Occurrence Data Standard. Arlington, VA.

[8] Minn. DNR 2008. Conservation Status Ranks for Minnesota Native Plant Communities (October 2008). Minnesota Department of Natural Resources – Division of Ecological Resources. St. Paul, MN 55155.

GDS 3F Strategies

a. Manage known locations of globally imperiled (G1G2) or state critically imperiled (S1) or imperiled (S2) NPCs and those NPCs that are rare statewide or with limited occurrences in this subsection to maintain their ecological integrity.

Native plant communities have been assigned global and statewide conservation status ranks by NatureServe. These status ranks include statewide ranks ranging from S1 (critically imperiled) to S5 (demonstrably widespread, abundant, and secure) [footnote 6], and global ranks ranging from G1 to G5. S ranks and G ranks for each native plant community can be found in the Natural Heritage Information System database. The list of S1-S2 and G1-G2-ranked native plant communities is included below.

Forest Certification has required the DNR to protect and appropriately manage some of the best examples of rare native plant communities on state wildlife and forestry lands through two designations: G1G2 Native Plant Communities and Representative Sample Areas (RSAs).

One RSA has been proposed for designation in the ASP subsection, located in the Sand Prairie WMA. This RSA would protect two rare native plant communities, the Dry Sand-Gravel Prairie and Wet Prairie. DNR policy states that native plant communities with G1G2 or Representative Sample Area designations will be managed to maintain or enhance those native plant communities. As of 2011, a Department regional team is in the process of drafting a Memorandum of Understanding that will designate a portion of the Sand Prairie WMA as a Natural Area Registry site and that will detail how the area will be managed.

The native plant communities in the ASP that are globally and/or state imperiled are:

FDc25b Oak – Aspen Woodland (S2)
FDc23a2 Jack Pine – (Yarrow) Woodland: Bur Oak – Aspen Subtype (G2, S2)
FDc34a Red Pine- White Pine Forest (S2)
FFs59c Elm – Ash – Basswood Terrace Forest (S2)
FPs63a Tamarack Swamp (Southern) (G2)
MHs38c Red Oak – Sugar Maple – Basswood – (Bitternut Hickory) Forest (S2)
UPs14a2 Dry Barrens Oak Savanna (Southern) (G2,S2)
UPs14b Dry Sand – Gravel Oak Savanna (Southern) (G2,S2)
UPs24a Mesic Oak Savanna (Southern) (G1,S1)
UPs13a Dry Barrens Prairie (Southern) (G2,S2)
UPs13b Dry Sand – Gravel Prairie (Southern) (G2,S2)
UPs23a Mesic Prairie (Southern) (G1-G2,S2)
WPs54b Wet Prairie (Southern) (S2)
LKi32a Sand Beach (Inland Lake) (S1)
MRp83a Cattail – Sedge Marsh (Prairie) (S2)

Where rare NPCs occur, vegetation management within and adjacent to these NPCs will protect, maintain, or enhance the ecological integrity of the NPCs. Some locations of NPCs of concern are best managed by avoidance, while other sites can either be maintained or enhanced by using the appropriate prescribed burning, harvesting or other forest management activities (e.g. application of ECS silvicultural interpretations).

DNR personnel have been trained in the use of the *Field Guide to the Native Plant Communities of Minnesota: Eastern Broadleaf Forest,* for identification of NPCs. Additional ECS products, such as silvicultural interpretations for management of NPCs, have been developed for use by field staff for implementing ECS-based management on state lands.

Management prescriptions that maintain or perpetuate rare native plant communities do not always fit neatly within the range of harvest prescription codes that are available to be used in DNR databases. For example, the restoration of oak savanna entails removing trees and shrubs that have invaded in the absence of fire, while leaving other trees and shrubs, and following up with prescribed burning. This does not fit neatly within

even- or uneven-aged management prescriptions. Therefore, the 10-Year Stand Exam List in this plan (Appendix D) includes some stands where native plant communities and rare species habitat are primary management objectives, and prescriptions are noted as “on-site visit” (9100), indicating that non-standard management prescriptions will be determined when the stands are visited by an inter-disciplinary group. Similarly, management objective codes do not always conform easily to standard forest codes. For example, a Norway pine stand that will be managed as oak savanna will likely be considered a conversion from Norway pine to oak, Upland Brush, or Grassland. However, an oak stand that is a mix of oak species and planted pines that will in the future be managed as an oak woodland native plant community may not be a conversion because it is still an oak cover-type following the prescribed management.

b. Ecological and Water Resources staff identified stands that are high quality examples of rare native plant communities. Those stands were placed on the list with management objectives that address biodiversity significance.

Subsequent coordination between divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources staff will determine if adjustments to proposed treatments are needed to protect, maintain, or enhance the ecological integrity of the rare NPCs.

GDS 3G Even-age managed cover-types will be managed to move toward a balanced age-class structure.

A balanced age-class structure has relatively equal acres in each 10-year age class out to the normal rotation age. A goal is to provide an even flow of wildlife habitat and timber harvest. A steady supply of these resources over time is important to wildlife, recreation, the forest products industry, and the local economies that depend on them. Many cover-types managed under even-age regimes (see above) do not currently display a balanced age class distribution.

The following Strategy will be implemented to move even-age managed cover-types toward a balanced age-class distribution.

GDS 3G Strategies

a. Target the selection of stand treatment acres to the appropriate age classes.

The ASP SFRMP attempts to balance age classes by selecting stands from specific age classes based on rotation age stand selection criteria developed during the planning process, including normal rotation age, maximum rotation age, and ERF percentage.

GDS 3H 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.

DNR guidance to SFRMP teams requires the development of a declining age-class structure from normal rotation age to the determined maximum rotation age for each even-age managed cover-type. ERF stands, when they are beyond the normal rotation age will provide old forest habitat, recreational opportunities of older forests, and opportunities for large-diameter timber product management. ERF stands were prescribed in aspen and oak cover types. A total of 1,981 acres of oak were prescribed ERF and a total of 569 of aspen were prescribed and tagged in the ASP SFRMP Implementation Dataset. Only a portion of these prescribed ERF acres were selected for inclusion on the 10-Year Stand Exam List, thus providing acres of ERF in the aspen and oak cover types.
The following Strategies will be used to achieve the desired declining age-class structure in aspen and oak cover-types:

GDS 3H Strategies

a. Prescribe ERF stands within even-age managed cover-types so that each age class will be represented to produce a sustainable amount of old forest over time.

b. Target ERF treatment acres to the appropriate age classes to move toward the declining age-class structure after normal rotation age.

The ASP SFRMP provides for old forest conditions by harvesting appropriate acreages from each age class of ERF over normal rotation age. The remaining un-harvested acres will contribute to old forest conditions until they reach the maximum rotation age.

GDS 3I State lands will include representation of each of the Native Plant Community growth stages that historically occurred (pre European settlement) in this subsection.

Growth stages incorporate both horizontal and vertical developmental stages (stand structure changes over time) and successional stages (species composition changes over time) that occur after a disturbance. For example, in the Southern Dry-Mesic Oak (Maple) Woodland, there are two growth stages. The first, 0-75 years, is a young growth stage of forests recovering from fire, dominated by bur oak with some northern red oak or white oak, and with minor components of quaking aspen, northern pin oak, and black cherry. The second, > 75 years, consists of mature forests dominated by a mixture of bur oak, white oak, northern pin oak, and some northern red oak. In the past, growth stages developed through natural disturbances such as wind and fire. Now, growth stages are emulated through forest management activities such as timber harvest, prescribed burns, and forest development activities.

These growth stages are important to the wildlife species that inhabit these plant communities. Wildlife habitat and the species occurrence can vary with growth stage, for example, old growth forest cavities support fisher den sites.

This SFRMP does not establish acreage goals for growth stages by ecosystem type or native plant community. The Strategies in this SFRMP will move toward representation of all NPC growth stages. Young and old growth stages are currently adequately represented on the landscape, but intermediate stages are lacking. Management strategies can provide some components of older growth stages in much younger stands by leaving coarse woody debris, snags, super canopy trees, and legacy patches.

Stands can also be managed to maintain the existing growth stage or assist in moving the stand to the next older growth stage. The Strategies identified below, the *Field Guide to Native Plant Communities*, and the Silvicultural Interpretations can provide options to field staff for accomplishing these goals.

GDS 3I Strategies

a. Determine the growth stage of stands selected for treatment in this subsection.

Stands identified on the 10-Year Stand Exam List for the ASP subsection will be classified to NPC consistent with DNR policy. Field staffs are encouraged to use growth-stage information in developing stand management prescriptions.

b. Strive to emulate the within-stand composition, structure, and function of NPC growth stages when managing stands.

c. Consider the contribution of non-timber land cover-types (e.g., oak savanna, inoperable stands, and reserved areas (e.g., old growth, SNAs, state parks, Sherburne National Wildlife Refuge, and Cedar Creek Ecosystem Science Reserve)) in providing representations of growth stages when developing prescriptions.

d. Manage the designated Representative Sample Area (RSAs) and High Conservation Value Forests (HCVF) consistent with forthcoming DNR direction to achieve distributions of native plant communities.

See Appendix H (*HCVF Factsheet*) for a discussion on the current status of the HCVF designation effort.

e. Apply *ECS Silvicultural Interpretations* when proposing stand management prescriptions

3.4 Wildlife Habitat

GDS 4A Adequate habitat and habitat components exist simultaneously, at multiple scales, to provide for nongame species found in this subsection.

Nongame[9] *species* are an important indicator of the biological health of the forest and are important to society for their inherent values. Legal statutes, public expectations and desires of interest groups, and Department of Natural Resources (DNR) internal policies require the consideration of nongame species in the management of state-administered lands. The DNR strategic plan *Directions 2000* (Minnesota DNR 2000) and the DNR's Conservation Agenda 2009-2013 calls for an objective of "healthy self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species, especially those species listed as threatened or endangered."

Many tourists appreciate and seek out opportunities to observe nongame species during their trips to this area, where they have a chance to see a number of species that are rare elsewhere. Carlos Avery and Lamprey Pass WMA, and the Sand Dunes State Forest and Uncas Dunes SNA are noted for their wildlife viewing opportunities by Watchable Wildlife, Inc.

There are 184 vertebrate nongame species [10] and 42 game species known or predicted to occur within this subsection. Each species has different habitat requirements, some of which conflict. Individual consideration of management needs for each species is therefore impossible to accomplish with a single approach across the planning area[11]. To ensure that the subsections are managed to maintain and enhance the habitat of game species, a number of management techniques will be considered using both a coarse filter approach and a fine filter approach.

Providing a variety of habitat patterns that reflect the patterns created by natural disturbance factors and efforts to reduce the effects of habitat fragmentation will help provide habitat for nongame species with different requirements. Several management techniques will be considered to ensure that the ASP subsection is managed to maintain and enhance the habitat of nongame species.

The three primary approaches are:
A ***coarse filter*** approach (Hunter, 1990[12]) emphasizes management of forests from a local to landscape scale to: maintain the integrity of ecosystem processes, maintain components of the range of historic habitats and age classes, and retain/enhance structural attributes within habitats. In using a coarse filter approach, it assumes that a broad range of habitats encompassing the needs of most species will be met,

[9] In this plan, *nongame species* include amphibians, reptiles, and those mammal and bird species that are not hunted or trapped.
[10] Minnesota DNR. 2011 *Anoka Sand Plain Subsection Preliminary Issues and Assessment*.
[11] 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.
[12] Hunter, M.L. 1990. *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biodiversity*. Prentice-Hall Inc., Englewood Cliffs, N.J.

and their populations will remain viable on the landscape. Habitat analysis and management emphasis in this plan were primarily done at this level.

A ***fine filter*** approach considers the specific habitat needs of selected individual species that may not be met by the broader coarse filter approach. Providing habitat at this level will be guided primarily by department policies and guidelines that provide recommendations for habitat management at this finer level for a number of species, such as state or federal listed species (e.g., bald eagle).

A ***meso filter*** focuses on conservation of critical ecosystem elements such as structures (logs, snags, pools, springs, streams, reefs, and hedgerows) and processes (fire, flooding) that would be missed by a coarse or fine filter. An example of how these three scales work would be that a meso filter would focus on coarse woody debris (CWD), the processes that created the CWD, and the features it provides to associated biodiversity; a coarse filter would focus on the ecosystem in which the CWD exists, while a fine filter would focus on a species that may use the CWD.[13]

GDS 4A Strategies

a. Provide old forest distributed across the state lands in this subsection.

Old forest includes stands that are beyond the normal rotation age established for the cover-type. There are many nongame species within the subsection that are associated with old forest and old forest conditions such as large-diameter trees and/or uneven-age successional stages. Examples of species are fisher, Pileated woodpecker, eastern chipmunk, and red-backed salamander. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time will ensure available habitat for many of these species. Extended rotation forests and designated old-growth forest are examples.

b. Provide young forest distributed across the state lands in this subsection.

Young forest in this plan refers to stands that are 0-30 years old. There are many nongame species within the subsection that are associated with young forest or young forest condition such as seedling and/or sapling successional stages. Examples of species are catbird, meadow vole and golden-winged warbler. Areas managed for young forest conditions (GDS-2A and 2D) will provide young forest habitat across the subsection.

c. Provide a variety of habitat patterns across the state lands in this subsection that better reflect patterns produced by natural disturbances, and attempt to maintain existing large habitat blocks.

In implementing this Strategy, field staff recognizes that the fragmented nature of state ownership and cover-types are not conducive to significant large block management in the ASP.

d. Manage to retain the integrity of riparian areas and provide protection for seasonal and permanent wetlands.

Many nongame species are associated with forested wetlands or the riparian forest interface. These areas also serve as movement corridors for additional species. Consideration for the health and integrity of riparian areas and protection or mitigation of other wetlands (GDS-5B) will serve to provide such needs. This Strategy will be implemented primarily by following the *MFRC Site Level Guidelines* pertaining to riparian areas.

e. Provide for the needs of species that depend on perches, cavity trees, bark foraging sites, and downed-woody debris.

[13] Hunter, Malcolm L. Jr. A Mesofilter Conservation Strategy to Complement Fine and Coarse Filters. Cons. Bio.
Vol.19, No. 4. August 2005.

A number of species rely on tree perches, existing tree cavities or available trees that can be excavated to provide a cavity, insect foraging sites on dead or dying trees, or downed trees or slash for roosting, nesting, or cover. Historically, natural processes provided these habitat needs. Today, the frequency and size of these processes have declined. This Strategy will be implemented primarily by following the *MFRC Site Level Guidelines.*

f. Provide for the needs of species associated with important native plant communities in this subsection.

A number of nongame species found within the subsections have some association or dependence on specific native plant communities.[14] (See Appendix I, *Wildlife Habitat Relationships*). Several open landscape wildlife species such as Blanding's turtle, gopher snake and red-headed woodpecker have declined significantly from historic levels in this subsection.

This Strategy will be implemented through the following techniques:

- Increase acres of oak woodland and oak savanna cover-types through active management including selective harvest and prescribed burning .
- Designate portions of the Sand Dunes State Forest for immediate conversion from pine to more open cover-type (see *Sand Dunes State Forest Operational Plan*, Appendix C).
- Manage invasive species.

g. Provide for creation and maintenance of within-stand diversity.

Managing for a mix of tree species and ages along with a diversity of structural characteristics (e.g., tree diameter, tree height, and scattered or clumped distribution) in some stands will provide conditions for species that require within-stand diversity.

h. Manage to favor native plant communities and retain elements of biodiversity significance.

Habitat for nongame species associated with highly diverse native plant communities will be provided by the following techniques:

- Identify and manage high-quality and/or rare native plant communities so they are maintained or enhanced.
- Use the *NPC Field Guide* and associated *Silvicultural Interpretations* to manage some stands to reflect the composition, structure, and function of native plant communities.
- Maintain or increase biodiversity, where ecologically appropriate, within areas of statewide biodiversity significance.

i. Consider Natural Heritage Program data and other rare species information during development of both the 10-year and annual stand examination lists.

Natural Heritage Program data will be available and considered during the 10-year and annual stand examination selection process. Before groundwork begins, field staff will check the database for known locations of rare nongame species in stands planned for treatment and, if present, will seek advice from appropriate staff or refer to established guidelines or considerations on avoiding negative impacts to these species.

j. Apply the DNR management recommendations for habitats of nongame species such as Blanding's turtle and red-headed woodpecker as described in DNR guidelines and policies.[15]

[14] Green, J.C. 1995. *Birds and Forests: A Management and Conservation Guide*. Minnesota Department of Natural Resources.

[15] Minnesota DNR. 2007*Anoka Sand Plain Subsection Preliminary Issues and Assessment.*

Follow recommendations in the *Forestry Wildlife Habitat Management Guidelines*[16] manual; apply considerations provided in Ecological Resources *Rare Species Fact Sheets* and *Tomorrow's Habitat for the Wild and Rare.*

k. Provide a range of habitats for short distance and long distance (neo-tropical) migratory birds.

According to breeding bird monitoring work in northern Minnesota (e.g., *NRRI Technical Report: NRRI/TR-2005/04*[17]; *USFWS Breeding Bird Survey*; *Audubon Christmas Bird Counts*; and DNR's *Tomorrow's Habitat for the Wild and Rare*, there have been significant declines in populations for some neo-tropical birds. Widespread declines have been reported for ground nesting birds and species found mainly in mature forest habitats. Strategies have been developed throughout this SFRMP that address the need to maintain or enhance habitat for both short distance and long-distance (neo-tropical) migratory birds, such as bobolink, swans, ducks, and hummingbirds. These Strategies include applying a coarse filter approach, designating ERF, providing a range of age-classes from young to old, managing for within-stand diversity, etc.; all provide a range a habitats for a variety of species, including neo-tropical songbirds. Implementation of the open landscape strategies in this SFRMP will benefit the species associated with open oak savanna.

GDS 4B Adequate habitat and habitat elements exist, simultaneously, at multiple scales, to provide for game species found in this subsection.

Game[18] species are an important indicator of the biological health of the forest and are important to society for their recreational, economic, and inherent values. Legal statutes, public expectations, the desires of interest groups, and DNR internal policies require the consideration of game species in the management of state-administered forest lands. The DNR strategic plan, *Directions 2000,* states that an "objective is healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species," and for "populations of fish, wildlife and plant species to sustain recreational opportunities." [19]

The presence of public forest land in the subsections draws many hunters and trappers to the area each fall. The proximity of public lands to the Twin Cities and St. Cloud urban areas are especially important for outdoor recreation opportunities in the ASP and likely contribute to local economies.

The report "*An Assessment of Open Landscapes for Management of Brushland Wildlife Habitat in Northern and Central Minnesota, 2002"* prepared by the MNDNR, Division of Wildlife identified the Anoka Lake Plain Land Type Association (LTA) as a priority open landscape LTA within the ASP subsection planning area. Reclaiming areas to more historic oak savanna and prairie has been identified as a management goal in the ASP SFRMP which is consistent with the recommendations contained in the *Assessment.*

Ecologically, there have been both historic and more recent changes to this subsection that have affected game species and their habitat:

- Changes in the abundance of tree species, age structure of the forest, and structural and species diversity;
- Loss of larger patches and connections between such patches;
- Increased habitat fragmentation from roads, trails, and development;
- Alteration of natural fire disturbance events; and,
- Subdivision of parcels, increasing fragmentation of ownerships and habitat.

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[16] Minnesota DNR. 1985. *Forestry-Wildlife Guidelines to Habitat Management*.

[17] Lind, J., Danz, N., Hanowski, J, and Niemi, G. *Breeding Bird Monitoring in Great Lakes National Forests 1991-2004; 2004 Annual Update Report*. NRRI/TR-2005/04. Natural Resources Research Institute, Duluth, MN. 27p. PDF document at: www.nrri.umn.edu/mnbirds/

[18] In this plan, *game* species include those terrestrial species that are hunted and trapped.

[19] Minnesota DNR. 2000. *Directions 2000: The Strategic Plan.* St. Paul, MN.

Both natural events and forest vegetation management through stand treatments, have the potential to positively or negatively affect game species.

GDS 4B Strategies

g. Provide young forest distributed across the state lands in this subsection.

Young forest in this SFRMP refers to stands that are 0-30 years old. There are many game species within the ASP subsection that are associated with young forest or young forest conditions such as seedling and/or sapling successional stages (see Appendix I, *Wildlife Habitat Relationships)*. Some examples of these species are white-tailed deer and ruffed grouse.

Areas managed for young forest conditions will provide a distribution of young forest habitat across the ASP subsection.

h. **Provide old forest distributed across the state lands in this subsection.**

Old forest includes stands that are beyond the normal rotation age established for the cover-type. There are many game species within the ASP subsection that are associated with old forest and old forest conditions, such as large-diameter trees and uneven-age successional stages (see Appendix I, *Wildlife Habitat Relationships)*. Some examples of these species are gray squirrel and wood duck.

Designation and maintenance of areas to be managed for old forest conditions across the landscape over time will ensure available habitat for many of these species. Designated old-growth forest and ERF stands are examples of Strategies that provide old forest values across the landscape.

i. Provide a balanced age-class structure in cover-types managed with even-age silvicultural systems.

A balanced age-class structure leads to relatively equal acreages in each age class out to the normal rotation age. To provide an even flow of early successional forest habitat, it is necessary to avoid large fluctuations in harvest levels within the aspen and oak cover-types, By beginning now, to address current age-class imbalances by moving toward a future balanced age-class structure, future sustainability of game species habitat will be enhanced.

j. Increase the productivity and maintain the health of even-age managed cover-type stands.

There are many game species that rely on dense young seedling and/or sapling stage successional stages within even-age managed cover-types for food or cover. Managing to improve stocking levels in these stages and maintain health and vigor will help to ensure that density of young trees and shrubs will be suitable for game species. Managing prescribed ERF aspen and oak stands with a declining age-class structure from the normal to maximum rotation ages (GDS-2B) will ensure that stands are harvested before they become too old to be regenerated back to the same cover-type.

k. Provide for creation and maintenance of within-stand diversity.

Managing for a mix of tree species, ages, and structural characteristics (such as tree diameter and height, and scattered or clumped distribution) in some stands will provide conditions for species that require such diversity. This Strategy can be implemented by applying the *MFRC Site-Level Guidelines* for leave trees, snags, coarse woody debris, riparian management zones, conifer and mast species retention and regeneration, and road maintenance or closure.

l. Continue to manage wildlife management areas for the benefit of game species.

Most management benefiting game species in the ASP subsection will occur as a result of decisions designed to meet multiple objectives, the application of which will move across the landscape over time (coarse filter). In some cases, areas have been and will continue to be selected with the intent of maintaining these areas over time to provide specific game species benefits (fine filter).

Most State Wildlife Management Areas are managed for specific game species, and their forest types are managed to maximize wildlife production. Examples include retaining oak forests beyond normal rotation ages to maximize acorn production for wildlife.

g. Manage a portion of priority open landscape areas (OLAs) for the benefit of wildlife species.

In the ASP subsection, the Anoka Lake Plain is recommended as a priority open landscape. The Anoka Lake Plain covers a large portion of the ASP subsection including the primary state administered lands (Sand Dunes State Forest and the Carlos Avery Wildlife Management Area). A goal for the ASP identifies managing a significant portion of state lands to benefit wildlife and conserve the biodiversity of the native plant communities (see Appendix C, *Sand Dunes State Forest Operational Plan*) such as oak savanna, grasslands and prairie. Further, *Tomorrow's Habitat for Wild and Rare* identified oak savannah, prairie, wetland-nonforest, and grassland as key habitats for the SGCN species in the Anoka Sand Plain. Examples of game species that benefit from these key habitats include American badger, white-tailed deer, turkeys and red fox. Maintaining, enhancing and protecting these key habitats are listed as priority conservation actions.

Wildlife habitat in OLAs will be improved and managed by:

- Utilizing available information and review by field staff to identify and approve open landscape projects within the recommended OLAs (i.e., Anoka Lake Plain) in the planning area;
- Coordinate across divisions on management prescriptions for selected stands within OLAs in a manner that enhances open landscape habitat conditions (e.g., create larger blocks of even-age cover-types managed with a clearcut prescription, minimize snag and leave tree presence in the interior of harvest blocks, discourage conifer planting, prescribed burns, shearing or mowing of brush);

3.5 Riparian and Aquatic Areas

GDS 5A Riparian areas are managed to provide critical[20] habitat for fish, wildlife, and plant species.

Riparian areas encompass the transition zone between the terrestrial and aquatic habitats that occurs along lakes, streams, and open-water wetlands. A r*iparian management zone* (RMZ) is that portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. Riparian areas are among the richest habitats in found in any subsection. The management of riparian areas can influence water quality, water temperature, erosion rates, and deposition of woody debris in lakes and streams and the overall diversity of wildlife and plant species found in the watershed. Riparian areas provide corridors and connecting links of habitat for plant and wildlife species. Well-managed riparian areas are critical to protect, maintain, or enhance aquatic and wildlife habitats, aesthetics, recreation, water quality, and forest products.

In the ASP subsection there are two small sections of designated trout streams that run through state administered lands covered by this plan. These streams are found in NPC's that occurred naturally and will be managed as such. The remaining riparian areas are primarily associated with small lakes and open water wetlands. These areas are made up of a wide range of cover-types ranging from lowland grasses to

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

high dry forest types. These stands will be managed for the appropriate species for the site, which may include a range of age class and forest types within and adjacent to these riparian areas.

GDS 5A Strategies

a. Apply the *Site-Level Guidelines* relating to riparian areas.

As a part of timber sales supervision and inspections, DNR forestry staff will ensure application of MFRC Site Level Guidelines in riparian areas. Also, MFRC site-level monitoring will periodically sample sites in the ASP subsection as part of the monitoring program at the statewide level. The objective of this statewide monitoring program is to evaluate the implementation of the *Voluntary Site-Level Forest Management Guidelines* through field visits to randomly selected, recently harvested sites distributed across the various forest land ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.) in the state.

b. Manage to maintain or increase old forest in riparian areas.

As part of the ASP SFRMP process, Forestry and Wildlife Areas considered placing ERF in riparian areas prior to development of the 10-Year Stand Exam List. Old forests provide the best source of woody debris in aquatic systems and habitat for a wide variety of wildlife species. Longer rotation age reduces the frequency of future harvest activities and may provide opportunities for a wider variety of forest products.

c. Using the NPC Field Guide and associated ECS Silvicultural Interpretations, manage for a species appropriate for the site.

On wildlife management lands, strategies may include efforts to encourage beaver activity for the wildlife habitat benefits and recreational opportunities they provide.

d. Discourage reed canary grass where feasible.

In managing reed canary grass resource managers will consult the following technical guidelines:

- http://www.ipaw.org/invaders/reed_canary_grass/RCG-management.pdf
- http://www.ipaw.org/invaders/reed_canary_grass/index.aspx
- http://www.dnr.state.mn.us/invasives/terrestrialplants/grasses/reedcanarygrass.html
- http://www.michigan.gov/documents/deq/deq-ogl-ais-guide-PhragBook-Email_212418_7.pdf
- http://www.bwsr.state.mn.us/practices/whats_working-invasivespecies.html#commonreed

e. Follow recommendations in *Tomorrow's Habitat for the Wild and Rare*.

This document identifies Species in Greatest Conservation Need and associated Key Habitats. For a discussion of key habitats and species in greatest conservation need see Appendix E.

f. Consider recommendations of local governments and water resource management agencies when applying stand treatments within areas subject to water related and land use management plans.

Although only a limited amount of state lands are associated with river and stream environments in the ASP, a considerable amount of state wildlife lands are association with open-water pools in the Carlos Avery WMA. Forest land managers will consider the requirements of the Shoreland Management Act and MFRC Site-Level Guidelines relative to vegetation management, as stands are site visited for possible treatments.

This Strategy will be implemented through the following techniques:

- Local government land use ordinances will be appended to the *ASP SFRMP.* See Appendix J for a list of ordinances and plans implemented by local governments and water resource management agencies within the ASP subsection.

- Implementing *MFRC Site Level Guidelines* related to riparian zones, protection of water resources is furthered.

GDS 5B Forest management on state lands adequately protects wetlands and seasonal ponds.

Wetland areas include lowland forested areas (such as black ash, tamarack, and aspen cover-types), lowland brush and lowland grass cover-types, and seasonal ponds. These areas are protected using different site-level forest management guidelines than those required for riparian areas adjacent to lakes, streams, and rivers or permanent open water ponds. Due to the mixed wetland / forested nature of the Carlos Avery WMA (the largest state-administered unit in the ASP subsection), protecting wetlands and seasonal ponds is an important management direction.

GDS 5B Strategies

a. Apply the MFRC *Site-Level Guidelines* when treating stands near wetlands and seasonal ponds.

Some examples of recommendations from the *Guidelines* are:

- Maintain filter strips.
- Avoid disturbances such as ruts, soil compaction, excessive disturbance to litter layer, and addition of fill.
- Use timber sale planning and administration to ensure that skidding and other equipment operations in upland stands take place outside of small non-open water wetlands and seasonal ponds. Meet with permittee/operator on site before the start of the permit activities to review details of the wetlands and protection measures within the sale area, and periodically visit the site during the harvest operation.
- Leave-tree guidelines recommend selecting leave trees in clumps, islands, or strips centered around or that coincide with small non-open water wetlands and seasonal ponds.

DNR forestry personnel will ensure the application of wetlands and seasonal pond *Guidelines* as a part of their timber sales supervision and inspections.

b. Consider landforms (e.g., end moraines) that have seasonal ponds and small open-water wetlands, and address those features in site-specific prescriptions that are developed during the stand examination field visit.

End moraines have a high concentration of seasonal ponds that are easily missed if field evaluations occur outside of spring and early summer seasons. Identification of landforms associated with vernal pools, or seasonal wetlands, will help field staff to be aware of the potential for these pools year-round.

3.6 Timber Productivity

GDS 6A Timber productivity and quality on some state timber lands is increased.

The Department is required to practice multiple use forest management. Multiple use management includes several overall goals among them are: timber production, wildlife habitat, ecological resource management and recreation among many others. Timber production is only one of several DFFCs guiding forest management in the Anoka Sand Plain.

The ASP SFRMP is guided by several overall DFFCs including:

- manage consistent with the NPC;
  Much of the ASP landscape was historically subjected to fires which played a role in the evolving vegetation. In the absence of large fires, specific vegetation treatments will be employed on state lands in an effort to support the NPC. In the ASP subsection this can mean a transition from timberlands to more open landscapes, oak savannas and open woodlands. These treatments will not necessarily add to the timber productivity of those lands.

- manage for wildlife habitat;
  Because of the significant wildlife lands in the ASP subsection (wildlife administered lands account for 70 percent of the lands addressed in this plan), timber productivity and quality must be tempered with managing for other resource values such as wildlife habitat. Managing for timber production in many instances contributes to wildlife habitat, but maximum timber productivity is not a universal DFFC on all lands in the subsection. In many cases this is consistent with increasing timber productivity, but not universal.

- Manage for timber productivity and quality:
  Timber productivity and quality is the primary direction on a portion of the state-administered lands subject to this plan. See Appendix C, *Sand Dunes State Forest Operational Plan* for more detailed discussions.

Timber productivity in the ASP subsection has been variable over the years. In the Sand Dunes State Forest, pine species do well. White pine is longer lived than red pine in soil types found in the SDSF. Pine is being managed on some areas in the SDSF for fiber production, consistent with the Division of Forestry's mandate to provide wood fiber for industrial uses. White Pine regenerates well without active management intervention. Red pine will last to around 80 years on these sites.

Oak species on sandy soils, as generally found in the ASP are susceptible to oak wilt. This has caused some difficult management decisions to be made over the last two decades. Among these are attempting treatments resulting in considerable expenditure with little overall success and the need to treat stands that would not otherwise be scheduled for treatment. Treatment of oak wilt stands ranges from clear cutting an infection center to trench plowing when the infection is neighboring a private residential property. Within the last few years a new management scheme was developed to try to diversify the oak dominated woods but some stakeholders disagreed with this approach and many sites will revert to non pin oak dominated stands and some will become bur oak woodlands. Oak management on many of the Wildlife Management Areas is not being maintained as woodland but converted to a more open landscape that is fire dependent to remain open. In Carlos Avery management of oak includes holding it for a longer rotation for maximum mast and wildlife benefit. There are many high conservation value forests in Carlos Avery and these are considered when managing these stands. Timber productivity is not the primary goal for those lands, but harvest does play a significant role in their management. Wild fire has affected the WMA significantly over the last decade with two major fires that have altered the composition and character of the plant communities. The age class imbalance has been affected by the fire as well as past land use prior to state management. This plan and subsequent plans will address this issue over time.

Increasing the timber productivity of state forest lands is a way to continue to provide the current (or greater) harvest volume and improve timber quality, while managing some lands with less emphasis on timber productivity. Increases in timber productivity can be achieved during this 10-year plan by accelerating the rate at which the DNR addresses: the age-class imbalance over current levels; implementing intermediate stand treatments; converting to more productive species; and, continuing to protect soil productivity by applying the site-level guidelines.

GDS 6A Strategies

a. Move toward harvesting even-age managed non-ERF stands at their normal rotation age.

This is being addressed in the plan with careful planned harvest through the planning period. This is a small public land based area with relatively few acres that can be harvested sustainably. Through perhaps five planning periods (50 years), by harvesting at the NRA and older, the current age balance imbalance will gradually come more into balance. This presumes less impact from large incident wildfires. Climate change over the extended planning five decade period will require reassessment of the cover-types and quality of the standing timber and plant communities.

b. Examine all stands over rotation age in even-age managed cover-types.

During development of the 10-Year Stand Exam List, all even-aged managed stands over their rotation ages were evaluated for possible inclusion on the10-Year List. These cover-types included: aspen, oak, birch, white spruce, and jack pine. There are virtually no red pine stands over rotation age in the ASP.

The main even aged cover-type in the ASP is oak and many oak stands are included on the List to be treated when at and over rotation age in many instances for wildlife management goals stated above.

c. Thin or selectively harvest in some stands.

In the ASP the stands identified to be thinned are mainly in the Sand Dunes State Forest. The pine cover-types are thinned on a regular time schedule. Northern hardwoods are thinned selectively to gradually capture the maturing timber quality and regenerate the stand. Oak, while an even-aged type is often thinned or patch cut to suppress oak wilt infections in stands. Oak wilt is a common disease problem. Attempts to manage and control the spread of oak wilt have met with varying success over the last twenty years.

Ash is another cover-type that is managed as an uneven-aged community. There are limited areas of ash within the ASP subsection. With the discovery of emerald ash borer in southern Minnesota and the Twin City metro area, some caution will be needed to detect and respond to any EAB outbreaks as soon as possible.

Thinning or selective harvest may be prescribed for both normal rotation stands and ERF stands. This SFRMP has developed a pool of stands that were volunteered by wildlife and forestry areas, for examination and treatment over the 10-year plan implementation period. Some of the stands will be listed as a conversion, increase and or managed to conserve biodiversity to a more open landscape community (e.g. oak savanna, oak woodlands or grasslands). The Sand Dunes State Forest will have areas designated as “immediate” conversion from one cover-type to another desired plant community. Other areas will be considered “eventual” and will be managed to the end of rotation as the current listed type. These management and treatment practices are mainly focused on the Sand Dunes and Bob Dunn Recreation Area within the Sand Dunes State Forest. (see Appendix C, *Sand Dunes State Forest Operational Plan).*

d. Include silvicultural treatments such as site preparation, inter-planting, release from competition (e.g., herbicide application or hand release), and timely thinning in plantation management, to increase productivity.

See Strategy, for techniques to maintain plant diversity within plantations.

The use of pesticides (herbicides, insecticides, etc.) will be minimized. When they must be used to control competing vegetation or forest insects and diseases on state lands, the following operational standards will be followed:

- DNR Operational Order No. 59 - Pesticides and Pest Control
- Division of Forestry - Pesticide Use Guidelines
- Pesticide Labels
- Material Safety and Data Sheets for each pesticide and adjuvant being used or recommended
- *MFRC Site-Level Guidelines* relating to pesticide use

e. Apply and supervise the implementation of the MFRC *Site-Level Guidelines* on treatment sites.

f. Continue to implement, supervise, and enforce current DNR timber sale regulations to protect and minimize damages to sites or residual trees from treatment activities.

Much of the Sand Dunes State Forest is accessible during spring break-up periods making the timber offered in the area more desirable. There are restrictions due to oak wilt season (April 15 through July 15) and also restrictions and management practices to suppress pine bark beetle outbreaks requiring that products harvested during this period must be removed with no slash larger than 3 inches in diameter be left on the ground.

g. Manage some ERF stands for large diameter, high-quality sawtimber products by retaining adequate stocking and basal area.

h. Respond to insect and disease problems, as appropriate.

3.7 Forest Pests, Pathogens and Non-native invasive Species

GDS 7A Limit damage to forests from native and introduced insects and diseases to acceptable levels where feasible.

Forest insects and disease organisms influence forest ecosystem dynamics. At acceptable levels, they promote diversity of tree species and generate important elements of forest structure that are important as habitat and in nutrient cycling, such as snags and coarse (large) woody debris. However, epidemic populations of insect pests can cause high levels of tree mortality, and can have significant ecological and economic consequences. Native and introduced diseases can cause significant species-specific losses in volume and mortality. Forest management will not attempt to eliminate native insects and diseases or their processes from the landscape, but rather to limit their impact on individual sites to a level that allows goals for timber production, water quality, aesthetics, recreation, wildlife, and biodiversity to be realized.

Natural resource managers are concerned about the introduction and establishment of non-native invasive insects and diseases on public land. Examples of non native invasive insects and diseases with known adverse effects on Minnesota forest resources include: emerald ash borer, white pine blister rust, gypsy moth, and oak wilt. There is potential for significant adverse impacts from other species present in the ASP subsection, such as: Bur oak blight. Management will seek to minimize impacts from these species, limit the introduction of new non-native invasive species, and minimize the impact of control measures on vulnerable native species.

Local introductions and spread of harmful non-native invasive plants can happen through several activities. Global warming effects and a variety of insect and disease concerns (e.g. oak wilt, two-lined chestnut borer, gypsy moth, and armillaria root rot may impact oak management on some sites. Establishing and promoting practices that minimize these introductions will slow the spread of harmful non-native invasives and reduce the associated losses.

GDS 7A Strategies

a. Identify and monitor insect and disease species populations as part of the Forest Health Monitoring Program and document their occurrence on state-managed lands.

Early identification and risk assessment of new insect and disease introductions improve potential to develop and implement appropriate responses. Monitoring known insect and disease pests, and conditions conducive to outbreaks can provide useful information for predicting potential outbreaks. Mutually established protocols for data collection and information sharing among federal (U.S. Environmental

Protection Agency, U.S. Department of Agriculture) and state agencies improve capacity to respond to the spread of established non-native invasive species into new areas, new species introductions, and outbreaks of established pests and diseases.

b. Manage existing forest insect and disease problems, as appropriate within the constraints of budgets.

Much of managing insect and disease problems centers on managing the vector that spreads the insect or disease. The Department attempts to manage the vector to prevent the spread of a problem into new areas or, if populations are low, to keep them from building. These methods include quarantines (emerald ash borer) education of public (don't haul firewood) or regulations (limit harvest season). Once an insect or disease is established in an area it is often there to stay and the goal shifts to managing the insect or disease to minimize its impact. These prevention strategies are then used to help prevent it from spreading into new areas.

Oak wilt is an example of this on the ASP. In the early 80's, when it first arrived on the ASP, the emphasis on public and private lands was aggressive prevention and control. This included aerial surveys, public education, and cost sharing control methods on private lands, and carrying out control methods on state land. Over the next two decades, despite these efforts, the disease continued to spread across the ASP. The costs of controlling it became prohibitive on both state and private lands. The DNR has now shifted to more passive management techniques including forest diversification, harvest disease pockets and shifting to more disease resistant white oaks. The education efforts continue.

c. Implement intervention plans developed by regional and statewide committees *before* pest outbreaks (e.g., the strategic plan for the cooperative management of gypsy moth in Minnesota involving Minnesota DNR, Minnesota Department of Agriculture, USDA-APHIS, and USDA-FS).

These plans detail appropriate integrated pest management strategies, circumstances under which strategies can be appropriately and effectively used, responsibilities, and cost-sharing arrangements. Containment and eradication measures will seek to minimize impacts from these species, while minimizing the impact of control measures on vulnerable native species.

If pesticides are needed to control forest insects and diseases on state forest lands, the following operational standards will be used:

- DNR Operational Order No. 59 - Pesticides and Pest Control
- Divisions of Forestry and Fish and Wildlife - Pesticide Use Guidelines
- Pesticide Labels
- *MFRC Site-Level Guidelines* relating to pesticide use.
- Refer to Material Safety and Data Sheets for each pesticide and adjuvant being used or recommended.

d. Manage stands to reduce the potential impact of insects and diseases.

This Strategy can be implemented by:

- Develop management plans and stand treatment prescriptions using the DNR Forest Development Manual and other recognized insect and disease management sources, while considering ecological processes and functions and impacts to native species and habitats.
- Provide information and training via logger education programs to equipment operators and tree fellers regarding techniques that minimize damage to retained trees (e.g., leave trees or crop trees).
- Include regulations on timber sales and forest development proposals that recognize potential insect and disease problems and mitigate there impacts.

e. In ERF stands, a higher level of impact from native insect and disease infestations may be accepted as long as it does not jeopardize the ability to regenerate the stand to the desired forest cover-type or the management goals of the surrounding stands.

This will enhance old forest conditions within the ASP subsection. Retaining the potential to regenerate the stand will be the primary objective, except in stands where a conversion is planned to another type not at risk from a damaging agent.

GDS 7B Reduce the negative impacts caused by non-native invasive species on forest vegetation on state forest lands.

Invasion of forest ecosystems by non-native invasive species can cause significant economic losses and expenditures for control because they destroy or displace native plants and animals, degrade native species habitat, reduce productivity, pollute native gene pools, and disrupt forest ecosystem processes (e.g., hydrological patterns, soil chemistry, moisture-holding capability, susceptibility to erosion, and fire regimes). Forest management activities have significant potential as an avenue for unintentional introductions of non-native invasive plants, especially in less developed portions of the subsections.

Unlike insects and diseases concerns, non-native invasive plants and animals have little influence on the tree species of the forest. When they compete with timber types they can be treated the same as natural vegetation, which they are probably displacing. The main issue is that these non-native invasives displace the native plants thereby disrupting the native plant communities and the associated flora and fauna. Non-native invasive species include buckthorn, ginnala maple, Chinese elm and Scotch pine. Some of these were actually planted in the past for a variety of reasons.

GDS 7B Strategies

a. Identify and monitor harmful non-native invasive species populations as part of the Forest Health Monitoring Program and document their occurrence on state-managed lands.

b. Adhere to the Minnesota DNR 2010 Invasive Species Program Directive.
http://files-intranet.dnr.state.mn.us/forestry/manuals/roadManual/invasiveSpecies/rdman_invasivespeciesprogramdirective091201.pdf

c. Follow Minnesota DNR Operational Order 113 (Invasive Species) to minimize the spread of invasive non-native invasive species during forest management activities.

d. Manage non-native invasive species, as appropriate, within the constraints of budgets.

As with insect and disease issues, often times managing non-native invasive species issues centers around managing the vector that spreads the non-native invasives. The Department attempts to manage the vector to prevent the spread of a problem into new areas or if populations are low, to keep them from becoming well established. These methods include: enforcing local ordinances and state statutes, education of public, and regulations (timber sales). Once a non-native invasive is established in an area it is often there to stay and the goals shifts to managing its impact. The hope is that, over time, natural controls evolve to help control the non-native invasive. As with insect and disease problems prevention strategies are then used to help prevent it from spreading into new areas

An example of a non-native invasive of particular concern in the south part of the ASP is buckthorn. The main vector of buckthorn is birds eating the seeds and depositing them in previously un-infested areas. There is almost no opportunity to control this vector. Buckthorn is fairly shade tolerant so it easily dwells in the understory of stand. Once established, buckthorn is almost impossible, or at least very expensive, to control.

e. Manage non-native invasive species, as appropriate, within the constraints of budgets.

It's not practicable to control all non native invasives on all of the state lands within the subsection. With the limited budgets, the control efforts will have to be focused on those areas that are determined to be of highest concerns. An example would be areas that have rare features the invasion of a non-native invasive would destroy. These determinations will be made by interdisciplinary process that will weigh the various values.

GDS 7C Reduce the negative impacts caused by wildlife species on forest vegetation on state forest lands.

The ASP is unique from many other parts of the state in that wildlife has very limited negative impact on the forest vegetation. Many parts of the state struggle with establishing oak or white pine because of wildlife depredation. This has not been a problem on the state lands in the ASP. Oak and white pine establishes so prolifically and grows so quickly the impact of wildlife on them is minimal. It would be similar to aspen regeneration in other parts of the state.

The one exception is when pines are being planted on previously open grown fields. In these cases managers have struggled with losses from gophers. Once pines are established, especially white pine, they regenerate naturally through seeding and gophers are no longer an issue. The ASP does see limited beaver activity but this mostly occurs on wildlife lands where timber production is not the primary goal.

GDS 7C Strategies

e. **Monitor state lands for damage caused by wildlife.**

b. During plantation establishment, control gophers as per current policy.

The method of gopher control has evolved over the years. Initially it was done by subterranean bait. Once forestry lands became certified, using this type of bait was prohibited so trapping became the method of control. Using bait is still allowed on noncertified lands.

3.8 Climate Change

GDS 8A Forest management on state lands attempts to mitigate the effects of global climate change on forest lands. Management is based on our current knowledge and will be adjusted based on future research findings.

Minnesota DNR recognizes that climate change, also known as global warming, is occurring at a rate that exceeds historical levels, and that the rate is likely to continue to increase. A growing body of evidence concludes that climate change is real and will have serious implications for people and the natural world upon which we depend.

In an important step forward for Minnesota's environment, the Minnesota Climate Change Advisory Group in 2007 developed a comprehensive plan for reducing the state's greenhouse gas emissions. The DNR supports the Minnesota Climate Change Advisory Group's 2007 climate change initiatives with the following programs:

- Easements promoted by Minnesota Forests for the Future are a cost-effective tool for retaining forest lands in private ownership and maintaining important recreational opportunities, wood products production, fish and wildlife habitat, and climate change mitigation by capturing and storing carbon dioxide from the atmosphere. See webpage at: http://www.dnr.state.mn.us/forestlegacy/mff/index.html

- State funding will provide for easement acquisition or acquisition of interests in lands by fee title, gift, or donation. These efforts will prevent development and conversion of forest land, provide forest values in perpetuity, and allow landowners to continue to manage forests sustainably for timber and other products while retaining land in private ownership.

- Several climate models (e.g., atmospheric-ocean general circulation models[21]) in use around the world predict global climate change. The Intergovernmental Panel on Climate Change refers to climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The models agree that average temperatures are increasing and predict more variable changes in precipitation. This global warming will affect forests and wildlife in Minnesota.[22,23]

Scientists believe the predicted climate change will affect the size, frequency, and intensity of disturbances such as fires, windstorms, and insect outbreaks. It will affect the survival of existing plant and animal species and the distributions of plants and animals. Even at modest levels, independent studies find mounting evidence that the current climate change influences plant and animal ranges and behavior.[24] Some plant and animal species may not be able to adapt to the rate of change. Increases in the reproductive capability and survival of non-native invasive species, insect pests, and pathogens will impact forests and wildlife. Certain tree species, such as black spruce, balsam fir, birch, and jack pine will respond negatively to increased soil warming and decreased soil moisture. Carbon sequestration by forests and wetlands may be affected because of accelerated decomposition rates.

Most tree species in Minnesota reach the limit of their geographic range somewhere within the boundaries of the forested portion of the state. Predictions have been made on the potential future distributions of trees.[25] There is a need to facilitate species adaptation to change in response to possible rapid climatic changes.

Although there are uncertainties about the effects of climate change on forest vegetation at the subsection scale, the following Strategies will be used to help monitor and mitigate the predicted effects of climate change on vulnerable species and native plant communities.

GDS 8A Strategies

a. Maintain or increase species diversity across the subsection.

The forest composition and within-stand diversity goals of this SFRMP will provide a more diverse forest across the subsection. By maintaining a variety of species at the stand and landscape levels across the subsection, the forest will be more resilient, more genetically diverse, and will utilize a broader range of site conditions (i.e., niches). This variety promotes forest survival as well as to serve as a reproductive source for forest plant and animal migration in the face of accelerated climate change. Maintaining species diversity at multiple scales will minimize the risk of widespread, stand-replacing insect and disease outbreaks that could result from accelerated climatic change.

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[21] IPCC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). [Houghton, J.T., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 881pp.

[22] Weflen, K., *The Crossroads of Climate Change*. Minnesota Conservation Volunteer, January-February 2001, Minnesota Department of Natural Resources, St. Paul, MN.

[23] Pastor, John, personal communication at March 13, 2003 North Shore SFRMP meeting. Natural Resources Research Institute, University of Minnesota-Duluth.

[24] Root, T. et al., *Fingerprints of Global Warming on Wild Animals and Plants*, Stanford University, Nature-January 2, 2003; and Parmesan, Camille, A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems, University of Texas.

[25] Iverson, L, et al. 1999. *An Atlas of Current and Potential Future Distributions of Common Trees of the Eastern United States.* Gen. Tech. Rep. NE-265. Radnor, PA. USDA Forest Service. Northeastern Research Station. 245 p.

b. Maintain or increase structural diversity across the subsection.

Structural characteristics include the size (diameter and height), abundance and distribution of overstory trees, understory vegetation, and their arrangement (scattered or clumped) within the stand. Structural characteristics also include the presence or absence of snags and coarse woody debris and the way these features are distributed in space. Appropriate structural types, amounts, and arrangements vary by native plant community and growth stage. By maintaining or increasing structural diversity across the ASP subsection, the forest will provide habitat to a greater number of species than a forest with uniform structural diversity. For example, large-diameter structures, both standing and lying on the ground, provide micro-sites for seed germination, cavities for nesting and den sites, and important escape and nesting cover within stands. This variety will assist the forest to survive as well as serve as a reproductive source for forest plant and animal migration in the face of accelerated climate change.

c. Maintain connectivity that permits the migration of plants and animals as climate changes the landscape.

Maintaining NPC spatial patterns where patches of vegetation are connected will allow the flow of plants, animals, and processes (e.g., seed dispersal) between suitable habitats. The ability of species to move to a new more hospitable site is a critical survival tactic.

The following are some methods for addressing this Strategy during plan implementation:

- Where available, MCBS sites of biodiversity significance are used as a means to identify, quantify, compare, and monitor NPC spatial patterns as they relate to ASP SFRMP direction.
- Classification of stands to NPC and application of *ECS Silvicultural Interpretations* provide a means to maintain NPC spatial patterns on managed lands.
- Plan harvests to minimize road construction and landings.
- Stand management incorporates actions that minimize the potential for invasive species establishment.

d. Evaluate site conditions with respect to climate change when selecting tree species for regeneration.

Field staff will use the *NPC Field Guide*, associated silvicultural references, existing tree distributions, and modeled future tree distributions (when the model becomes available), when selecting the species most appropriate for the site.

e. Use the concept of carbon sequestration to remove carbon dioxide (the most significant anthropogenic greenhouse gas) from the atmosphere.

Climate models (e.g., *Hadley Centre for Climate Prediction and Research-UK, carbon cycle models*) predict that, as future atmospheric carbon dioxide concentrations increase, global temperatures will increase. Forests have the ability to remove carbon dioxide through photosynthesis and to store the carbon as woody material. Carbon is stored in all parts of the forest including living plants, dead plants, fallen leaves, and soil. The storage of carbon is called *carbon sequestration*. Carbon also remains stored in wood that is harvested and processed into wood products.[26] The carbon remains stored in wood until it is gradually released through slow decay or is released rapidly when it is burned.

Forest management activities, such as ensuring existing stands are adequately stocked and ensuring regeneration is adequate after harvest, sequester carbon. Basically, any activity that provides healthy and productive forests will increase carbon sequestration. In this plan, stands in a wide range of age-classes will be evaluated for treatment. Increasing the stocking and growth rate of timber will help in sequestering carbon. Stands will be field examined to determine if there is sufficient advance regeneration. If the site

[26] Heath, L. 2000. *Carbon Sequestration: Yet Another Benefit of Forests*. Forest Legacy Program. USDA Forest Service, Durham, NH.

lacks adequate regeneration, silvicultural techniques will be used that result in a more fully stocked stand. Stands that contain a variety of tree species are more likely to fully occupy a site, increasing the overall wood volume grown on the site. Increasing the woody biomass over what is currently on these under-stocked sites will help sequester carbon.

The following are some examples of forest management strategies in this SFRMP that will help in carbon sequestration:

- Examine stands for treatment from a wide range of age-classes.
- Balance the age-class distribution in even-age managed cover-types.
- Emphasize longer-lived species.
- Designate forest stands to be managed as extended rotation forest (ERF).
- Reserve and maintain old-growth forests.
- Increase timber productivity in managed stands.
- Retain leave trees, legacy patches, snags, and coarse woody debris on harvested sites.
- Minimize roads and landings.
- Minimize slash burning.
- Utilize biomass for alternative energy supplies.
- Manage for quality timber with lower defect levels that will be available for a wider range of uses and require less processing.

Because of the unique nature of the ASP subsection, not all DFFCs, GDSs and Strategies identified in this plan will achieve a net increase in carbon sequestration. As discussed several GDSs will result in an increase in use of prescribed fire for vegetation management including:

- the density of some stands in specific cover-types (oak) will be reduced to a woodland, oak savanna or grasses; and
- in some cases the cover-types will be removed (red pine) to provide for a more open landscape.

All of these directions are intended to promote vegetative management considering the native plant community.

f. Apply the *Site-Level Guidelines* for tree species at the edge of their range (*Rationale for Guidelines Section, Wildlife Habitat, pages 26-35*).

Implementation of this Strategy supports one of the Department's guides on reacting to climate change by encouraging species found at the edge of their ranges. This will foster forest diversity thereby establishing a more resilient forest in the face of possible climate change challenges.

3.9 Cultural Resources

GDS 9A Cultural Resources will be protected on state-administered lands.

A cultural resource is an archaeological site, cemetery, historic structure, historic area, or traditional use area that is of cultural or scientific value. Cultural resources are remaining evidence of past human activities. To be considered important, a cultural resource generally has to be at least 50 years old. A cultural resource may be the archaeological remains of a 2,000 year-old Indian village, an abandoned logging camp, a portage trail, a cemetery, food gathering sites such as ricing camps and sugarbushes, or a pioneer homestead. They often possess spiritual, traditional, scientific, and educational values. In addition to federal and state laws that protect certain types of cultural resources, the *MFRC Site-Level Guidelines* provide information and recommendations to assist private and public land managers in taking responsible actions when cultural resources are encountered.

GDS 9A Strategies

a. Annual Stand Exam lists are reviewed by DNR archeologists; recommendations for mitigation are implemented as part of sale design.

3.10 Natural Disturbance Events

GDS 10A Natural disturbance events that occur on state land within the subsection are promptly evaluated to determine the appropriate forest management needed to respond to the impact.

By promptly evaluating known disturbance events (e.g., fire, wind, or insects and disease), land managers will be able to quickly recommend what, if any, forest management activities are necessary to mitigate the impacts of the event. Depending on the scale of the event and potential positive or negative impacts, management recommendations will range from no action to salvage harvesting and/or prescribed burning. Where quick action is needed to salvage harvest timber from damaged stands, the annual plan addition process for public review will be used.

GDS 10A Strategies

a. The subsection planning team will evaluate large-scale (100's to 1000's of acres) disturbance events to determine appropriate action.

If large-scale disturbance events occur during the 10-year plan, the team will assess the extent and significance of the event on the structure and condition of forest lands in the subsections. The team will propose forest management actions to be implemented within the area impacted by the event and determine whether adjustments to the short-term harvest levels are needed.

When large-scale disturbance events involve multiple ownerships, the DNR will cooperate in assessment and implementation of management actions with other agencies and landowners, when possible. To better inform the public of planned large-scale salvage harvest, a press release will be completed that includes information on the disturbance and the planned management actions.

b. Local land managers will evaluate and determine appropriate actions for small- scale (10s of acres) disturbance events.

After small-scale disturbances, local forest and wildlife managers will do a timely evaluation of the disturbance area and take the appropriate action needed to address the situation.

3.11 Prescribed Fire as a Management Tool

GDS 11A Continue to use prescribed fire as a forest vegetation management tool in the Anoka Sand Plain subsection.

This issue results from development pressures and conflicting adjacent land uses that limit the range of management options available to the forest land managers. Most of the native plant communities in the Anoka Sand Plain are fire dependent. Fire was a frequent disturbance on the pre-settlement landscape. The development patterns and associated stakeholder comments will influence how forestry management is implemented in the ASP subsection.

Fire dependent native plant communities found within ASP subsection listed below can be referenced within the *Field Guide to Native Plant Communities of Minnesota: Eastern Broadleaf Province* for a better understand the role of fire in maintaining them within each community's natural history section.

Identified below are the fire dependent native plant communities:

FIRE-DEPENDENT FOREST/WOODLAND SYSTEM

FDc23 CENTRAL DRY PINE WOODLAND
- FDc23a Jack Pine-(Yarrow) Woodland
- FDc23a2 Bur Oak-Aspen Subtype

FDc25 CENTRAL DRY OAK-ASPEN (PINE) WOODLAND
- FDc25b Oak – Aspen Woodland

FDc34 CENTRAL DRY MESIC PINE-HARDWOOD FOREST
- FDc34a Red Pine-White Pine Forest

FDs37 SOUTHERN DRY-MESIC OAK (MAPLE) WOODLAND
- FDs37a Oak – (Red Maple) Woodland
- FDs37b Pin Oak – Bur Oak Woodland

FDw44 NORTHWESTERN WET-MESIC ASPEN WOODLAND
- FDw44a Aspen – (Cordgrass) Woodland

FIRE-DEPENDENT UPLAND PRAIRIE SYSTEM

UPs14 SOUTHERN DRY SAVANNA
- UPs14a Dry Barrens Oak Savanna (Southern)
- UPs14a2 Dry Barrens Oak Savanna (Southern): Oak Subtype
- UPs14b Dry Sand – Gravel Oak Savanna (Southern)

UPs24 SOUTHERN MESIC SAVANNA
- UPs24a Mesic Oak Savanna (Southern)

GDS 11A Strategies

a. Work with local planning and zoning to encourage the use of "conservation development" adjacent to high quality native plant communities that are best maintained with prescribed fire.

b. Work with adjacent landowners to reduce the risk to their property from wildfire or escaped prescribed fire. Implement "Fire Wise" concepts to prevent fire from coming onto state lands and leaving state lands noted in the Structural Development and Urbanization section 3.12.

c. 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.

d. Increase the understanding of the role of fire in fire dependent natural plant communities among resource managers and the public.

A research project focused on "Fire history and age structure analysis in the Sherburne National Wildlife Refuge: establishing reference conditions in a remnant oak savanna woodland" (Kipfmueller et al. 2007) was conducted within the ASP subsection and may provide additional guidance on historic fire frequency and intensity for this area. Additional resources for managing ASP subsection fire dependent communities utilizing prescribed fire to mimic historic fire regimes can be researched at the Fire Research and

Management Exchange System (FRAMES) web site located at http://www.frames.gov , which has made research papers like the one above available through their web page. "FRAMES provide a method of exchanging information and transferring technology among wild land fire researchers, managers, and other stakeholders in an online environment. The FRAMES portal, supported by USGS, provides essential searchable information, a platform for data sharing and storage, development of new tools, and support to federal wild land fire management agencies in the United States throughout the various stages of wildland fire, including planning, operation, and post-fire monitoring" (FRAMES 2011). FRAMES is part of the Wildland Fire Science Partnership, which is available at http://www.firesciencepartnership.org/index.html (2011).

Likewise, the Fire Research and Management Exchange System (FRAMES) web page at http://www.frames.gov provides additional specifics on several fire related subjects and is a partnership that "was created to develop and deliver knowledge and decision support tools to policymakers, wildland fire managers, and communities" (FRAMES 2011. FRAMES is the source of FFI, which is an interagency fire ecology "monitoring software tool designed to assist managers with collection, storage and analysis of ecological information. It was constructed through a complementary integration of the Fire Ecology Assessment Tool (FEAT) and FIREMON" (FFI 2011). Land managers are encouraged to employ this ecological monitoring utility to track implementation of prescribed fire. Similarly, the Lakes States Fire Science Consortium "is a network of fire managers and scientists interested in the fire-dependent forest ecosystems of the Lake States region" and has numerous links on their web page at: http://lakestatesfiresci.net/ of fire related subjects related to Minnesota (Lake States Fire Science Consortium 2011).

e. Utilize the MN DNR prescribed fire forms and documents web page at:
http://www.dnr.state.mn.us/rxfire/forms.html, which contains the:
- *Minnesota Department of Natural Resources Prescribed Burn Handbook* at: http://files.dnr.state.mn.us/forestry/wildfire/rxfire/prescribedBurn_Handbook2010.pdf and
- *Operational Order #47: Prescribed Burn Guidelines* at: http://files.dnr.state.mn.us/forestry/wildfire/rxfire/oporder47.pdf

to effectively implement prescribed fires to maintain fire dependent natural plant communities.

f. Address smoke management concerns to allow continued use of prescribed fire to maintain fire dependent natural plant communities.

This Strategy can be implemented by following guidelines in the *Minnesota Smoke Management Plan* (http://files.dnr.state.mn.us/forestry/wildfire/rxfire/minnesotasmokemanagementplan.pdf) to reduce potential impacts to smoke sensitive receptors (populations sensitive to smoke and associated health risks) and avoid visibility impacts.

g. Mimic historical pre-settlement fire frequency and intensity of forested, oak savanna, and open landscape fire dependent natural plant communities.

A two step process will be needed to implement prescribed fire at appropriate fire frequencies and intensities due to the past history of wildfire suppression and lack of prescribed fires within the Anoka Sand Plain subsection. First, over the first ten years in areas that will have more prescribed fires occurring, up to three prescribed fires may be needed to reduce the fuel loading that has built up over the years due to fire exclusion in fire dependent native plant communities, as well as address additional fire intensity concerns these fuels may present. Second, after these first ten years, the implementation of a fire regime schedule that mimics the historical patterns of low intensity fires would be maintained with the effort to rotate through all the designated prescribed burn management units over time and keep approximately the same number of acres burned each year. Descriptions of historical pre-settlement fire frequency and intensity can be found within the ASP subsection fire dependent native plant communities listed above and should mimic a rotation of fires based on the natural history section located in the *Field Guide to Native Plant Communities of Minnesota: Eastern Broadleaf Province* during the second phase. There may be times where more or less time between prescribed fires would be implemented to favor fire tolerant trees based on objectives within the adaptive management process or the very opposite to reduce the basal area or stem density of certain

tree species. Likewise, depending on the requirements for each rare species within these native plant communities, there may be a need to adjust the fire frequency and intensity accordingly to favor specific species within a specific prescribed burn area.

h. When known rare plant and animal species are present in a fire dependent community, land managers will give consideration on how to minimize localized short term population declines caused by prescribed fire for specific listed species as much as practical. Consider alternative techniques to accomplish resource management objectives where variables make prescribed fire inappropriate.

A list of some rare plant and animal species for which fire may be an issue include the following: Creeping Juniper (*Juniperus horizontalis*), Uncas Skipper (*Hesperia uncas*), Leonard's Skipper (*Hesperia leonardus leonardus*), Northern Barrens Tiger Beetle (*Cicindela patruela patruela*), a species of jumping spider (*Metaphidippus arizonensis*), Plains Pocket Mouse (*Perognathus flavescens*), Gopher Snake (*Pituophis catenifer*), Western Hognose Snake (*Heterodon nasicus*), *Emydoidea blandingii* (Blanding's Turtle) and potentially others. As an example, Creeping Juniper (*Juniperus horizontalis*) does not tolerate fire, therefore populations need to be identified and taken into account when planning prescribed burns to exclude these individual populations.

To encourage invertebrate populations, it is generally beneficial to remove any pine needles covering the ground layer as quickly as possible and prescribed burning can be an effective way to accomplish this objective. Likewise, other rare species considerations that need attention include utilizing the correct frequency and timing of prescribed burns during appropriate seasons, as well as ensuring the size of prescribed burn units are taken into account as native plant communities are maintained with fire, while at the same time being carried out in a fashion that is not detrimental to any rare features trying to be maintained or encouraged to expand utilizing adaptive management strategies. Prescribed burns should be limited to smaller areas to allow for sufficient invertebrate survival in unburned areas to help facilitate recolonization of burned areas, and with sufficient time for this to occur before burning additional areas. Likewise, the prescribed burn boss and other planners need to consult with other knowledgeable MN DNR staff and natural resources specialists who know invertebrate life cycle strategies when developing fire management units to ensure their long term survival.

The MN DNR Rare Species Guide web page, which is available at: http://www.dnr.state.mn.us/rsg/index.html should be consulted to obtain additional information on specific rare features within (MN DNR 2008). Minnesota's current list of endangered, threatened and special concern species can also be reached from this same web page or directly at http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf (MN DNR 2011 c).

Land managers need to give consideration on how to minimize localized short term population declines caused by prescribed fire for specific listed species as much as practical based off of species fire effects database and other resources. This will allow them to thrive in fire dependent communities as they had historically. Reference material on the effect of fire on specific and/or related flora and fauna, as well as soil, water and air can be found the Fire Effects Information System (2011) web page at http://www.fs.fed.us/database/feis. This web page should be reviewed to obtain specific guidance for land managers on how individual species respond to fire and the implications that will have on their management of this area. Likewise, on this web page, there are links to other fire effects reports including; "Wildland fire in ecosystems: effects of fire on fauna," (Smith 2000), "Wildland fire in ecosystems: effects of fire on flora," (Brown and Smith 2000), "Wildland fire in ecosystems: effects of fire on soils and water," (Neary et al. 2005), "Wildland fire in ecosystems: effects of fire on air" (Sandberg et al. 2002), and "Wildland fire in ecosystems: fire and nonnative invasive plants" (Zouhar *et al.* 2008).

i. Recognize infrastructure needs to implement prescribed fires, include maintenance and creation of fire breaks, obtaining fire equipment, and staff funding needs.

A balanced approach for harvesting stands over this 10 year plan implementation period is recommended to ensure that not too many stands come up on any one year, which could prevent the necessary pre- and/or

post-harvest invasive species treatment and prescribed fire management activities to take place. Preparation work should begin as soon as possible, following adoption of the ASP SFRMP in selected stands where it is possible to set the foundation for native plant community management; for example, burn breaks should be established and staff should begin planning the timeline for putting prescribed fire on the ground in fire dependent native plant communities prior to and after timber harvests. Existing fire breaks should be used as future FIM boundaries within the ASP subsection management sections to ease implementation of prescribed fire within these fire dependent communities. Any existing FIM boundaries should be double checked to see if they match with existing fire breaks and leave them as is if they do correspond. Stand prescriptions for future cuttings should be based on these new FIM boundaries established from existing fire breaks. If new fire breaks must be created to make long term management possible utilizing prescribed fire, then managers are encouraged to determine these new fire breaks and incorporate them into the updated FIM boundaries.

The Minnesota Department of Natural Resources (DNR) Division of Forestry's historical role as the primary contingency resource for most DNR division prescribed burns that are conducted, as well as their on-call status for wildland fire response during the fire season, has limited their ability to conduct prescribed burns, when compared to other divisions. Likewise, limitations in funding and staffing within the Division of Forestry, as well as a focused history of fire suppression have hampered past efforts to implement prescribed fires on state forest lands. In order to increase prescribed fire frequencies within the ASP subsection, additional Division of Forestry staff, as well as potentially other DNR divisions, contractors, and United States Fish and Wildlife Service (USFWS) staff could assist the Division of Forestry under a signed prescribed fire agreement, such as the *USFWS and MN DNR Local Agreement Statement* (See Appendix K).

3.12 Structural Development and Urbanization

GDS 12A The changing structural development and urbanization pattern will be considered as forest management is implemented in the subsection.

The ASP subsection lies just to the north of the Twin Cities and stretches up the Mississippi River to Brainerd. This area includes not only some of the fastest growing counties in Minnesota but some of the fastest growing counties in the United States. This trend has slowed down over the past few years but is expected to continue once economic conditions improve.

Public lands are an attraction for developers with housing development occurring adjacent. This has created a plethora of issues when trying to implement timber management on state land.

Some of these issues include:

- Aesthetic concerns when implementing forest management in neighboring "backyards".
- Concerns with the use of fire from both a threat to values and smoke impacts.
- Dust and noise issues when using road systems for forest management activities.
- close proximity (housing development and state lands) leads to a greater scrutiny of management actions.
- Increased populations increase the movement of non-native invasives with people as the vector.
- Relatively small parcels of state land are surrounded by many land owners makes it difficult for management continuity (control of non-native invasives, pesticide use, access issues).
- Potential conflicts with recreationists using the state lands with forest management activities.

GDS 12A Strategies

a. Inform adjacent landowners of nearby management activities on the state lands and, when feasible, mitigate any impacts.

Many of the Department's forest management activities include routine public notice processes. Examples include notification of draft SFRMPs for comment, stakeholder notice of additions to annual stand exam lists; timber sales, prescribed burns and pesticide projects. In these cases, if a landowner expresses concerns about a project and implementing an alternative action to address the concern does not significantly affect the management goals of the project, the Department will address those concerns in carrying out the project.

Other projects are carried out without notification. This would include things such as tree planting, fuelwood sales and dump site clean-up, and have less potential to raise concerns from adjacent landowners

b. Encourage private landowners, local governments and other land managers to implement compatible land uses adjacent to state land through land use management actions.

More compatible land uses adjacent to public lands will reduce the potential for conflicts resulting from professional forest management practices. Reduced conflicts will aid in forest management activities including invasive species control efforts, implementing prescribed fire actions and harvesting practices.

This Strategy can be implemented through land management strategies, such as park designation and conservation easements or lower density development adjacent to public lands.

c. Work with other divisions to mitigate the impacts of forest management on recreational users.

On wildlife lands this would include timing management activity so as not to coincide with heavy hunting activity. The existing campgrounds and day use areas will be considered when implementing forest management activities. Many forest management routes are used as recreational trails. Annual coordination with the Area trail managers is implemented to identify potential user conflicts and mitigations.

d. Inform adjacent landowners, local governments and stakeholders of forest management planning processes.

Both adjacent landowners and those in the vicinity of state lands have interest in the management plans for public lands. Decisions made in these plans can affect neighboring landowners both directly and indirectly. Periodically, during planning processes, the general public and stakeholders are given the opportunity to review and comment on draft plans such as with subsection plans, annual stand exam lists or when a change occurs in management direction such as the *Sand Dunes Operational Plan*. Over time many of these planning processes and the corresponding comment process have become internet based as opposed to actually holding public meetings. Advantages include: convenience for the public; availability around the clock; and, is in a format where managers at all levels can have access to and view the comments and public recommendations. The downside of internet based public review is that managers do not get the face to face interaction with the general public and in some cases stakeholders.

e. Implement "*Fire Wise*" concepts to prevent fire from migrating onto state lands, from adjacent lands, and from escaping state lands.

Most wildfires are cause by humans. As the number of people in an area increases so does the incidence of wildfire. The causes can be attributed to adjacent property owners or people using the state land. The lands of the ASP tend to be lighter soils that can be drought prone. Many of the timber types and grasslands, which thrive on these soils, will burn easily. Because of the development adjacent to the state lands, private property value threats are significant.

Fire Wise concept management includes:

- Maintaining access trails throughout the properties to aid in fire response.
- Discing fire breaks to slow ground fire spread.
- Encouraging the use of biomass to reduce the amount of ground fuels and fire intensity.
- Aggressive thinning in conifers to help reduce crown fire spread.
- Pruning in conifers to decrease ladder fuels and thereby decreasing the chance of crown fires.
- Maintain fire detection and suppression resources to respond quickly to wildfires.

- Work with local fire departments and other public agencies for a coordinated suppression response.
- Educating the public on *Fire Wise* concepts.

The ASP SFRMP identifies an increase in the use of prescribed burning on some of these state land parcels. Implementing these *Fire Wise* concepts will help in carrying those burns off safely and without incident.

GDS 12B Minimize forest management impacts on visual quality in sensitive areas.

Scenic beauty is a primary reason people choose to spend their recreation and vacation time in or near forested areas. Where forests are near recreational trails, lakes, waterways, public roads, and highways, consider impacts of forest management activities to the visual quality of the site during and after management activities.

GDS 12B Strategies

a. Consider aesthetics when carrying out forest management activities.

Due to the close proximity of the ASP subsection to metropolitan areas, state lands receive much scrutiny from the public in terms of management activities. The saying, "Beauty is in the eye of beholder" hold true for forest management. One person may see a pine plantation as a neat, efficient and uniform forest stand while another will see it as sterile and unnatural. One person may see a heavily burned area as destroyed while another will see it as regenerating fire dependant species. Pleasing all nearby residents' and stakeholders' aesthetic tastes is likely not possible, but strategies can be implemented to mitigate some of the perceived impacts of forest management. These include:

- Timber sale design to minimize visual impacts
- Encouraging the utilization of biomass.
- Selling fuelwood permits to clean up landings, timber sales and oak wilt pockets.
- Moving away from conifer monocultures.
- Encourage multi-aged stands with shade tolerant conifers.

b. Apply the *Site-Level Guideline*s pertaining to visual quality on all vegetative management activities.

The MFRC guidelines contain many recommended forest management techniques that will minimize the impacts of vegetative management activities on visual quality. *Directions 2000* (*Objective 3.3*)[27] states that the "DNR will apply the appropriate guidelines so that visual quality is not adversely impacted during forest management activities." Several examples of the recommended techniques included in the guidelines are listed below:

- Minimize visibility of harvest areas by limiting the apparent size of the harvest area.
- Avoid management operations during periods of peak recreational use whenever possible.
- Locate roads and trails to minimize visibility from nearby vantage points, such as scenic overlooks, streams, and lakes.
- Encourage long-lived species and other visually important species adjacent to or located in recreation areas. This will minimize the frequency of management activities. It will also provide larger-crowned, larger-diameter trees that improve forest aesthetics.
- Consult the S*and Dunes State Forest Operational Plan* (Appendix C) for specific recommendations for vegetation management near the Bob Dune Recreation Area.

DNR forestry staff applies the visual quality guidelines as a part of timber sales supervision and inspections.

[27] Minnesota Department of Natural Resources, *Directions 2000: The Strategic Plan*, Objective 3.3, p22.

3.13 Limited Public Land Ownership

State ownership is relatively limited in this subsection, compared with other more forested subsections in Minnesota. Accommodating the full range of forest resource management objectives given the limited state-administered lands and fragmented cover-types in the ASP subsection proves to be a challenge. This challenge is complicated by the continued development pressures projected in the subsection (limiting the interest in and ability of private forest lands to practice sustained forest management).

Subsection resource management planning as implemented through SFRMPs in Minnesota considers the wide range of resource management issues affecting vegetation on state administered lands. These issues include forest production, wildlife habitat management and ecological issues such as management for rare and unique species. Accommodating all issues adequately can be less of a challenge with a broader state administered land base to work with. For example achieving many forest management objectives relies on the private logging industry to harvest selected stands. Harvests are a key technique to affect age classes, convert cover-types, and respond to disease outbreaks and disturbance events. With a limited land base, the availability and interest of loggers due to markets and volumes offered, to buy timber sales is not as widespread as is found in more forested regions of the state. Without this harvest activity, many forest management strategies cannot be fully implemented.

The ASP SFRMP has identified forest management objectives recognizing that challenges exist that result from a relatively limited land base to work with. Because state-administered lands are limited, the roll private forest lands play in achieving landscape level DFFCs is elevated. Landscape level DFFCs are recommended in the *MFRC East Central Landscape Plan.* As identified earlier, the overall directions of the *ASP SFRMP* are consistent with the recommendations contained in the *MFRC East Central Landscape Plan* which includes recommendations on forest management across all land ownerships including privately held forest lands. Private forest land managers are encouraged to consider the desired future conditions recommended in both the *ASP SFRMP* and the *MFRC East Central Landscape Plan*

Because of the limited state land base, and subsequent challenges to implementing subsection goals, opportunities and coordination among public and private forest land managers, as well as among the divisions within the Department, designed to achieve the highest potentials for forest lands to accommodate the multiple goals required, must be a high priority.

GDS 13A 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.

GDS 13A Strategies

a. influence management on private lands through stewardship planning efforts.

b. Disseminate final plans to other land managers to use in their planning processes.

c. Strategically purchase lands with conservation values.

Appendices

Appendix	**A**	**Ecological Classification System (ECS)**
Appendix	**B**	**Notes for Age Class Structure 2022 Projections**
Appendix	**C**	**Draft Operational Plan for the Management of the Sand Dunes State Forest**
Appendix	**D**	**10-Year Stand Exam List**
Appendix	**E**	**Tomorrow's Habitat for the Wild and Rare Anoka Sand Plain – Subsection Profile**
Appendix	**F**	**Stands with a White Pine Component**
Appendix	**G**	**Anoka Sand Plain SFRMP Monitoring Plan**
Appendix	**H**	**HCVF Factsheet**
Appendix	**I**	**Wildlife Habitat Relationships**
Appendix	**J**	**Local Government Plans and Ordinances**
Appendix	**K**	**USFWS and MN DNR Local Agreement Statement**
Appendix	**L**	**Comments Received on the Draft ASP SFRMP and Responses to Comments Received**
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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

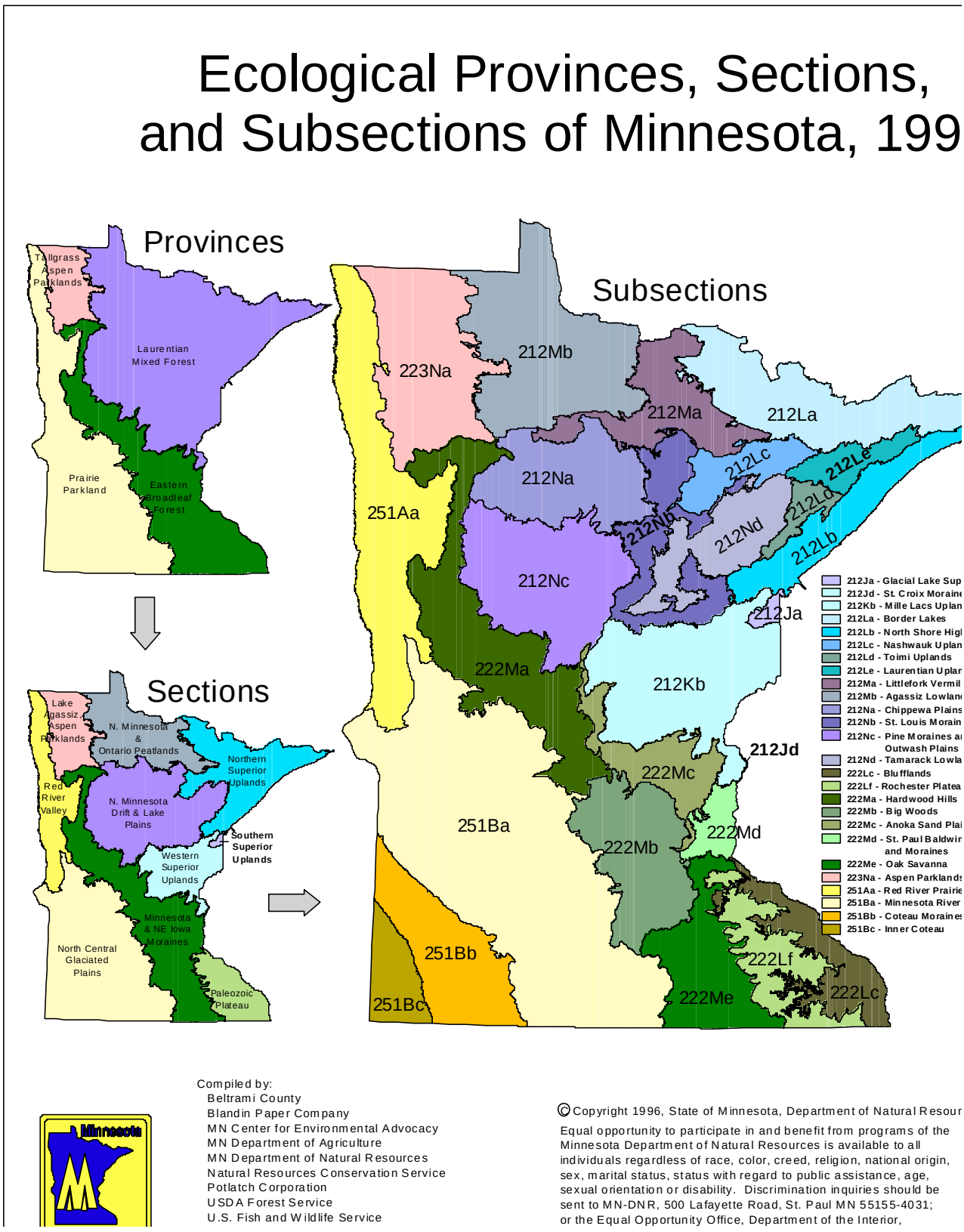
II. Purpose of an Ecological Classification System

- 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



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

DRAFT

Operational Plan for Management of Sand Dunes State Forest,

Sherburne County

Prepared By

Divisions of Forestry, Ecological and Water Resources, and Fish and Wildlife

Minnesota Department of Natural Resources

Draft Plan, September 7, 2011

Operational Plan for Management of Sand Dunes State Forest,

Sherburne County

Approved by:

_____ _____

XXXX, Title Date

Division of Forestry

_____ _____

XXXX, Title Date

Division of Ecological and Water Resources

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XXXX, Title Date

Division of Fish and Wildlife

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I. Background and Impetus for Plan

Sand Dunes State Forest (SDSF) is an 11,040 acre state forest in the Anoka Sand Plain (ASP) ecological subsection of central Minnesota, of which approximately 6,000 acres is owned by the Minnesota Department of Natural Resources. Minnesota's 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 other evergreens were planted in the state forest starting in the 1930's to stabilize the shifting dunes during time of drought, and planting has continued since this time to supply timber to economic markets. To date, over 2,400 acres of tree plantations have been established in Sand Dunes State Forest, the majority of which are pine.

In addition to timber production, Sand Dunes State Forest contains a number of rare geologically and ecologically significant features (reviewed in MN DNR 2009a; see supplement). 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.

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 reached a joint agreement on April 22, 2010 to protect and restore these unique natural features in selected areas of the state forest (Appendix 1). These areas will be restored to an approximation of pre-settlement vegetation and permanently managed for rare plant and animal species and the native plant communities including oak savanna, prairie, oak woodland, tamarack swamp, emergent marsh, and sedge meadow, on which they depend. The following operational plan describes how the agency will work together to implement this joint agreement and its goals, and will serve as a document to guide future management activities in the SDSF.

II. Desired Future Condition of Sand Dunes State Forest

The desired management objective of the Sand Dunes State Forest is broad ecosystem health that balances opportunities to enhance recreation, economic investments, water quality, biodiversity, and wildlife habitat. The management approach outlined in this operational plan divides the Sand Dunes

State Forest into five zones, each with a unique combination of management goals and timing. The zones are outlined in Appendix 2, which has a base layer showing 2010 color infrared photography. Under this approach, a total of 2,840 acres would focus on timber management and reforestation (zone 1), 2,538 acres would be managed permanently for rare natural features (zones 2, 3, and 4), and 353 acres would be managed for recreation in conjunction with rare natural features and timber (zone 5). A map of current cover types within the state forest as classified in the DNR's Forest Inventory Module (FIM) is shown in Appendix 3.

A. *Forestry Zone*

Zone 1: Long-Term Forest Management (2,840 acres)
This zone includes all of the Sand Dunes State Forest that is not included in any of the ecological and recreational management zones (zones 2-5) outlined in Appendix 2. Intensive forest management for pine, oak, and other species will continue in this zone. Most of it is former cropland that has been planted to conifers. Oak woodland was allowed to recover after agricultural grazing was discontinued in the middle of the 20th century, and fire was largely suppressed. Pine was inter-planted among the hardwoods or allowed to naturally seed itself into the understory and openings. There are a few areas that have been given a preliminary designation of High Conservation Value Forest (HCVF). Management activities within these areas will be compatible with maintaining or enhancing high conservation values including rare species and native plant communities.

The sands of the ASP are well suited to growing white pine because not only does it regenerate easily, it has a very high site index with 100 year old white pine reaching 3 feet in diameter. While other parts of the state struggle with deer depredation and white pine blister rust, losses from these causes are not significant on the ASP. White pine seedlings establish easily in the oak understory and will quickly fill a space in the canopy. It is native to the ASP although its distribution was significantly limited by grazing, fire frequency, and intensity.

Site indexes for Norway (red) pine are also very high on Anoka Sand Plain soils. This is a highly valuable timber species, and loggers pay a premium for Sand Dunes State Forest pine because of summer accessibility. Norway pine is somewhat more susceptible to drought and pine bark beetle mortality than white pine, so management must be adjusted accordingly.

Future management will trend toward a mixture of pine, oak, and other hardwoods. As pine plantations go through subsequent thinnings 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 the predominant species, pines will be encouraged to blend into the stand through artificial planting and natural seeding.

B. *Ecological Management Zones*

Zone 2: SNA – Currently Managed for Rare Features (tan outline on map, 677 acres)
The Uncas Dunes Scientific and Natural Area will continue to be managed for rare features by the Scientific and Natural Areas program.

Zone 3: Immediate Rare Features Management (green outline on map, 513 acres)
Effective immediately, this zone will be managed for the native plant communities, including oak savanna, prairie, woodland, and wetland, and the rare species that occur there. Historically areas within this zone had few pine plantings other than jack pine (some of which is deteriorating), and have concentrations of recently documented rare features. Between 2011-2022, pines will be removed through commercial logging where possible and through contract cutting in other situations, and habitat will be restored or enhanced to perpetuate native plant communities with a species composition and structure that resembles pre-settlement conditions (Supplement, Fig 2 – MN DNR 2009a). These areas will be actively managed with prescribed burning, non-native invasive species removal and control, and forest management practices when appropriate. There are currently 51 acres of Permanent School Trust Fund land within this zone, and Forestry is exploring opportunities to transfer the Trust Fund obligation to acres within the Long-Term Forest Management Zone. In addition, the Division of Ecological and Water Resources plans to reimburse bonding money that was recently used to plant pine seedlings west of the snowmobile trail and east of the fire break in T34N R27W Section 20.

The desired future condition of the immediate rare features management zone is a diverse mosaic of oak savanna, prairie, woodland, tamarack swamp, emergent marsh, and sedge meadow native plant communities that will support the rare ecological and geological features of the area, and an age class structure representative of pre-settlement conditions. Based on silvicultural interpretations and landscape-level public land survey data from the 1800's, 79% of the pre-settlement oak woodland (FDs37) landscape was in a young growth state (0-75 years old) and about 21% was in the mature growth stage (greater than 75 years old). Silvicultural prescriptions have not yet been developed for oak savanna (UPs14), but the desired age class structure should vary across the spectrum from young to mature trees. Pre-settlement vegetation described by Marschner (1975) would today be classified as oak savanna and/or dry prairie on south- and west-facing slopes, oak woodland on north- and east-facing slopes, and mesic prairie in shallow depressions.

In 2010, a GIS modeling project was conducted to compile an updated map of upland native plant communities in the state forest using information from MCBS native plant community polygons, rare features point data, relevés, aerial photos, 30m digital elevation information, the Ecological Evaluation for Sand Dunes Sate Forest (MN DNR 2009a), and ECS worksheets. Efforts focused on slope, aspect, and landforms to determine where oak savanna (UPs14) and oak woodland (FDs37) would occur. South to west-facing slopes were modeled as dry barrens oak

savanna, with the exception of some very steep south-facing open slopes that may support dry barrens prairie, and north to west-facing slopes were modeled as oak woodland. For the immediate rare features management areas in the north unit of SDSF, approximately 40% was classified as oak woodland, 19% as oak savanna, and 41% was unclassified due to flat topography. For the immediate rare features management areas in the south unit, approximately 49% was classified as oak woodland, 49% as oak savanna, and 2% was unclassified. Assuming that most flat areas will be considered oak savanna (unless field-checks determine otherwise), the proposed desired future condition of the immediate rare features management zone is to restore approximately 50-60% of the upland habitat to oak savanna and approximately 40-50% to oak woodland (Appendix 4). Results of this GIS native plant community modeling project will be verified through extensive field-checks during the summer of 2011, and the precise restoration direction and percent desired cover calculations will be modified accordingly.

Zone 4: Eventual Rare Features Management (red outline on map, 1,348 acres)
This zone in the South Unit of the Sand Dunes State Forest will be managed for the array of oak savanna, woodland, prairie, tamarack swamp, emergent marsh, and sedge meadow native plant communities and the rare species that occur there, but with a delay in the timeline for harvest of planted pine. This zone includes significant areas of dunes and rare features, but also includes significant pine plantations, notably commercially valuable red and white pine. Pines will be phased out as they reach rotation age as outlined Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) and are logged, and no new pines will be planted. This zone will be actively managed with prescribed burning, non-native invasive species control, and other forest management practices when appropriate.

The desired future condition of the eventual rare features management zone is similar to that of the immediate rare features zone described above with the exception of planted pine which will not be harvested until rotation age. This zone will also be restored to pre-settlement native plant communities including oak savanna, prairie, oak woodland, tamarack swamp, emergent marsh, and sedge meadow, will use the same landscape-level historical PLS data to obtain the desired age class structure, and will utilize output from the GIS native plant community mapping project to determine restoration direction. Based on slope, aspect, and landform data from the GIS model, approximately 47% of the upland habitat within this zone was classified as oak woodland, 49% as oak savanna, and 4% was unclassified due to flat topography. Therefore, assuming that most flat areas will be considered oak savanna, the proposed desired future condition of the eventual rare features management zone is to restore approximately 53% of the upland habitat to oak savanna and approximately 47% to oak woodland (Appendix 4). As stated above, field-verification of the results from this GIS mapping project will occur during the summer of 2011, and desired NPC cover classifications will be modified accordingly. In the interim between now the final harvest of the planted pine at rotation age, management activities should be consistent with the desired future conditions, particularly restoration and enhancement of oak savanna/prairie and oak woodland native plant communities.

C. Mixed Recreational, Ecological, and Forestry Management Zone

Zone 5: Bob Dunn Recreation Area (blue outline on map, 353 acres)
The Bob Dunn Recreation Area includes day use areas, the drive-in campground, and the horse camp. This area is managed in part by DNR Parks and Trails, along with Forestry. It includes important areas of oak savanna, prairie, and sedge meadow native plant communities and many rare species populations. This zone will be managed to enhance the rare features while taking into account recreational and economic needs with input from DNR Forestry, Parks and Trails, Wildlife, and Ecological and Water Resources Division staff. Recreational interests include campground and day use area, nature study, bird watching, hiking, skiing, horseback riding, hunting, and fishing. Appendix 5 breaks the Bob Dunn Recreational Area into three management areas: a long term forestry management area, an immediate rare features management area, and an eventual rare features management area.

The western half of the Bob Dunn Recreation Area contains large tracts of commercially valuable pine and will continue to be managed following site-level forestry management guidelines (Minnesota Forest Resources Council 2005). Much of the eastern half of the Bob Dunn Recreation Area (east of North Sand Dunes Forest Road) is mapped by the Minnesota County Biological Survey as having either high or outstanding biodiversity significance and has been given a preliminary designation of High Conservation Value Forest (HCVF). The southeastern portion of the recreation area that is ranked as outstanding biodiversity significance will be treated as an immediate rare features management area (as described above in Zone 3) and restored to pre-settlement native plant communities with special consideration for aesthetics, visitor uses, and other recreational needs. In the picnic and camping areas, native species should be used for visual screening where possible, and pines should be phased out of these areas by the year 2022 as it is economically feasible to remove them. The northeastern portion of the recreation area is ranked as high biodiversity significance and should be treated as an eventual rare features management area (as described above in Zone 4), provided that the preliminary designation of HCVF remains in place after review by the HCVF interdisciplinary team. If the HCVF designation remains in effect, pines should be removed as they reach rotation age and are logged, and no new pines should be planted. Active forest management techniques such as prescribed burning and non-native invasive species control should be implemented as appropriate within both of these immediate and eventual rare features areas.

Based on slope, aspect, and landform data from the GIS native plant community model, approximately 60% of the upland habitat within the Bob Dunn Recreation area was classified as oak savanna, 35% as oak woodland, and 5% was unclassified due to flat topography. Therefore, assuming that most flat areas will be considered oak savanna, the proposed desired future condition is to restore approximately 65% of the upland habitat to oak savanna and approximately 35% to oak woodland (Appendix 4). Desired NPC cover classifications will be

modified as needed upon field-verification of the GIS model. As implementation of this management approach proceeds, joint site visits will be arranged with Parks and Trails staff to design a work plan that minimizes trail closures and other impacts to recreational users. The addition of interpretive signage to kiosks at the north and south trailheads as well as the campground parking lot should be considered in order to help inform users about the restoration and enhancement process.

III. **Broad Adaptive Management Prescriptions**

The broad-scale adaptive management prescriptions below provide guidance on habitat management of stands within Sand Dunes State Forest to ensure active timber management, harvest, and reforestation, biological diversity, healthy and sustainable plant communities, age class diversity among various stands from mature to young regenerating stands, and habitat for nongame and game wildlife species and rare plants and animals. The ecological restoration prescriptions focus on oak savanna and oak woodland native plant communities; however, there are a number of other important native plant communities within Sand Dunes State Forest including dry barrens prairie, mesic prairie, emergent marsh, tamarack swamp, and sedge meadow. For simplification purposes in this plan, goals and methodology for restoration of dry barrens prairie and mesic prairie are treated as part of the oak savanna native plant community because rare species and management needs are similar. A summary table comparing and contrasting the desired characteristics of oak savanna and oak woodland native plant communities can be found in Appendix 6. More detailed information and species lists can be found in the Native Plant Communities of Minnesota field guide (MN DNR 2005). Specific goals for emergent marsh, tamarack swamp, and sedge meadow are not detailed in this plan.

A. *Oak savanna / prairie*

1. Goals for oak savanna conditions:

The goal for restoration of oak savanna within Sand Dunes State Forest is to return habitat conditions to the native plant community classification of UPs14a2: Dry Barrens Oak Savanna (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 in this section is also applicable to the two prairie native plant community classifications found in the state forest: UPs13a – Dry Barrens Prairie (Southern) and UPs23a – Mesic Prairie (Southern).

The desired tree cover for oak savanna in the state forest is between 5-50% with trees displaying an open-grown growth form and consisting of an overall patchy horizontal structure on the landscape. Stem density can vary widely between 17-200 trees per acre, and the 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 red cedars should be reduced in density to 1-3 scattered trees per acre that are at least 15 ft 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 graminoids and forbs typical of prairie and savanna habitat. Exposed areas of bare sand amongst the vegetation are of the utmost importance, especially on steep dune slopes.

2. Methods for oak savanna restoration:

To restore oak savanna in Sand Dunes State Forest, a number of different vegetation management activities will be employed including timber harvest, invasive species removal and control, and prescribed burning. All pines, spruces, and other conifers will be removed with the exception of eastern red cedar, bush juniper, and creeping juniper. While creeping juniper, a state-listed rare species, should not be disturbed, eastern red cedar will be removed when necessary to obtain the desired density of 1-3 trees per acre. Bush juniper is a low-growing native species that does not need to be removed by active cutting, but that may be impacted by prescribed burning. All hardwood trees less than 12 inches dbh will be removed with the exception of bur oak, northern pin oak, black cherry, and quaking aspen, which will be retained as needed to meet stem density goals. Similarly, bur oak, northern pin oak, black cherry, and quaking aspen greater than or equal to 12 inches dbh will be removed as needed to achieve canopy cover and basal area goals. Where possible, northern pin oak should be largely removed and bur oak should be retained. Stumps of the hardwood trees for which sprouting is not desirable should be treated with Garlon 4 Ultra. All non-native shrubs will also be removed either by cutting and treating stumps with herbicide or by direct herbicide application, with a special focus on controlling common buckthorn, non-native honeysuckle, and Amur maple. Staging areas are to be located in already disturbed sites that do not have rare species populations. Slash should be removed or burned to expose a maximal amount of bare sand for native species.

Fire is a critical component in restoring and maintaining oak savanna and will be used as a management tool to control invasive species and enhance native species habitat in the state forest. Burning is needed to maintain an open canopy via seedling reduction and mortality of fire-sensitive tree species, and may also reduce prevalence of invasives, particularly

through repeated fires early on in the restoration process. As a target goal for fire frequency in this initial restoration phase, each area should be burned three times in rotation within the first decade. After the first decade, areas should be burned approximately every 10 years with occasional longer time periods between burns to ensure retention of smaller oak size classes where needed; adaptive management techniques should be employed to determine whether this frequency is resulting in desired conditions and adjusted accordingly. Areas of mesic prairie (UPs23a) should be burned more frequently, approximately every 4 years. Fire breaks will need to be established and maintained to facilitate prescribed burning, and these breaks can also be used to access stands for management activities. Burn units must be planned to ensure that animals will have unburned habitat for refugia. This will be particularly essential for a number of rare invertebrates that can incur significant larval mortality as a result of spring and fall burns, or that otherwise have limited ability to disperse and recolonize sites after a burn. Timing of burns may vary depending on specific burn objectives. The use of alternate management techniques such as grazing or haying should also be investigated.

If seeding is done as part of the restoration, only locally-harvested seed should be used. Any dune slopes within the restoration areas that resemble those in Uncas Dunes SNA where herbaceous cover is fairly sparse and includes hairy grama grass (*Bouteloua hirsute*) should be the target of specific efforts to assure that this grass is established on the slopes, as it serves as the obligate larval host for the state-endangered Uncas skipper (*Hesperia uncas*). Establishment of other plants that are important in the life history of rare animal species include blazing star (*Liatris* spp.), large-flowered beard-tongue (*Penstemon grandiflorus*), round-headed bush clover (*Lespedeza capitata*), and leadplant (*Amorpha canescens*).

B. *Oak woodland*

1. Goals for oak woodland conditions:

The goal for restoration of oak woodland within Sand Dunes State Forest is to return habitat conditions to 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 the state forest is between 50-70% (up to 100% in some areas) with trees displaying an open-grown or moderately open-grown growth form. Stem density should fall within the range of 35 – 1,500 trees per acre, and 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. Subcanopy 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. Groundlayer 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.

2. Methods for oak woodland restoration:

To restore oak woodland in Sand Dunes State Forest, a number of different vegetation management activities will be employed including timber harvest, invasive species removal and control, and prescribed burning. All pines, spruces, and other conifers will be removed with the exception of bush juniper, creeping juniper, and eastern red cedar which are a native component of the FDs37 plant community. Eastern red cedar can be removed if desired, particularly from areas where they may become dense due to exclusion of fire. All non-native shrubs will also be removed either by cutting and treating stumps with herbicide or by direct herbicide application, with a special focus on controlling common buckthorn, non-native honeysuckle, and Amur maple. Staging areas are to be located in already disturbed sites that do not have rare species populations.

Individual stands will need to be identified for evaluation as potential old growth and as extended rotation forests. 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 nongame wildlife that utilize older forests such as red-shouldered hawks, and those that have native plant community ranks of B or higher. These stands would have non-native species control and in some cases limited small patch harvesting only (except in the case of old growth, where there would be no timber harvesting). In other stands, management will focus on oak regeneration to achieve canopy cover goals and to reduce fire-intolerant subcanopy species such as elm, red maple, ironwood, and green ash. While the most effective strategies for oak regeneration in these stands are still being determined, these objectives may be best achieved with large patch cuts or by clearcuts with reserves.

Fire will be used as a management tool to control invasive species and enhance native species habitat. Based on public land survey records for catastrophic and mild surface fires, the target burn frequency for oak woodland habitat in Sand Dunes State Forest should be approximately one prescribed burn every 9 years; adaptive management techniques should be employed to determine whether this frequency is resulting in desired conditions and adjusted accordingly. Fire breaks will need to be established and maintained to facilitate prescribed burning, and these breaks can also be used to access stands for management activities. Burn units must be planned to ensure that animals will have unburned habitat for refugia. Timing of burns may vary depending on specific burn objectives. 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.

C. *Mixed hardwood / pine forest (outside conversion areas)*

Mixed hardwood forests outside the immediate and eventual conversion areas will be managed for a variety of values including timber harvest, recreation, and wildlife habitat. Pin oak is the dominant species by far, but it is frequently mixed with bur oak, red maple, black cherry, elm, basswood, ash and aspen. Unless there is a significant disturbance (logging, wind, intense fire), pin oak will mature and decline sometime after age 70. Bur oak, maple and basswood will gradually occupy more of the canopy.

Management objectives in mixed hardwood forests outside the immediate and eventual conversion zones will focus on providing a balanced age structure of forest stands dominated by pin oak. Currently there is an abundance of mature and over-mature pin oak on the Anoka Sand Plain. Older, declining stands will be targeted for harvest while there is still enough vigor in the root systems to ensure adequate stump sprouting. Voluntary Site-Level Forest Management Guidelines call for mature trees to be reserved either singly or in clumps, and harvest regulations will be written to favor bur oak, white oak and black cherry. The reserved trees will continue to provide mast for wildlife as well as a seed source to supplement stump sprouting.

White pine, and to a lesser degree Norway pine, seed freely into hardwood forests from adjacent plantations. Pine seedlings tolerate shade longer than oak seedlings in mature hardwood forests and quickly occupy an opening in the canopy. The pines provide additional diversity in the stand and they offer greater economic return when the stand is harvested. After a hardwood stand has been harvested, pine seedlings may be planted at low density to supplement natural seeding to ensure they will be mixed into the next stand as the hardwoods regenerate from seed and stump sprouts.

Invasive exotic species are present in hardwood stands throughout the Sand Dunes State Forest to varying degrees. In stands that are lightly infested it may be possible to hold exotic species at minimal levels without significant expense. Stands that are heavily infested (or infested pockets within larger stands) may be problematic as existing control methods are prohibitively expensive. Outside the immediate or eventual conversion zones the primary objective is to regenerate a new forest before the old stand declines too far, and invasive exotic species control will be consistent with DNR Operational Order #113 (MN DNR 2007). As control techniques and strategies become better understood it may become more cost-effective to reduce the presence of exotic species in heavily infested stands.

Oak wilt contributes to the decline of oak woodlands dominated by pin oak. While the fungus does not specifically target trees that are stressed or declining, it seems to thrive in mature pin oak stands more than in younger stands. Bur and white oaks are far less susceptible to attack by oak wilt, but in areas where fungal innocculum is extensive bur and white oak will also show symptoms or mortality. Harvesting pin oak stands as oak wilt becomes established provides cost-effective passive oak wilt control. It does not prevent the fungus from spreading through inter-connected root systems, but it does reduce the amount of innocculum in the area and it allows seedlings an opportunity to get established. Where oak wilt is moving through oak stands on state land with the potential to move onto private land, managers may need to implement active control through vibratory plowing.

D. *Pine forest (outside conversion areas)*

The state began planting white and Norway pine on former cropland during the 1940s to stabilize drifting soil. Most plantations contained a single species, although more recent plantations contained a mix of white and Norway pine. Both species perform exceptionally well on the soils of the Anoka Sand Plain once they become established and plantations in the Sand Dunes State Forest represent a significant economic resource.

Seedlings are planted in rows at dense spacing initially. The first thinning usually occurs around 20 years and removes entire rows to provide access for future thinning. The plantation will be thinned periodically (every 7-10 years) until the final stocking is achieved. After the initial row thinning, subsequent thinning may take additional rows, individually selected trees, or a combination. Norway pine is typically thinned to approximately 90 square feet of basal area per acre; white pine will be maintained at a higher density. The purpose of thinning is to remove trees with defects that will not survive to full maturity and to provide optimal space for the remaining crop trees.

Small trees from the initial thinning may be chipped for energy or for the landscape market. Larger pines may be harvested for post and pole specialty markets. Larger pine logs will be sawn into dimensional lumber. Loggers tend to pay a premium for pine timber in the Sand Dunes because the sandy soils provide reliable access during the summer months.

Other conifers have been planted in the Sand Dunes State Forest. Jack pine is not productive on these soils and future planting is unlikely. White spruce and Norway spruce have done well in limited quantities, but future planting will probably remain limited.

As pine stands become more open through successive thinning, hardwood seedlings begin to encroach from surrounding stands. This creates an understory of hardwoods and pine underneath the main canopy of pine. When space opens up in the main canopy, pin oak or bur oak may move up to fill the space. As the pine plantations age, they tend to become

more diverse. Hardwoods present at the time of final harvest will provide stump sprouts to regenerate a mixed pine-hardwood forest on the next rotation.

IV. **Implementation**

A. DNR intra-agency roles and cooperation

Forestry staff will be responsible for all 6,000 acres of the state forest and will be accountable for managing this land for broad ecosystem health. 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 the five management zones and provide silvicultural and economic expertise balanced with technical assistance from Ecological and Water Resources. 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. Wildlife staff will partner in setting strategic direction and tactical implementation. The Scientific and Natural Areas program, with its goals of protection and restoration, manages Uncas Dunes SNA in consultation with Forestry. To facilitate the implementation of this plan, training on ecological classification systems (ECS), native plant communities (NPC), and use of silvicultural interpretations will be provided for area forestry staff with special guidance regarding the rare features and sensitive management strategies applicable to the state forest. This training will also be offered to staff in other divisions that provide technical guidance on SDSF management activities or assist with monitoring.

B. Timeline of implementation

To implement this operational plan, the first phase of management activities will focus on restoration and enhancement of native plant communities in the immediate rare features management sites and capturing opportunities such as timber harvest, woody biomass removal, invasive species control, and prescribed burning as they arise in the eventual rare features management sites.

All timber stands that fall within the 513 acre immediate rare features management zone will be harvested by FY2022 in accordance with the goals, methods, and desired future conditions outlined in this operational plan and with technical guidance from Ecological and Water Resources and Wildlife staff. Any stands within this zone that are already on an existing cut list, or are planned for thinning or other types of harvest between FY2012 and FY2022 (Appendix 7), should instead schedule a final cut at that time. Other stands that do

not have any harvest activities planned need to be added to 10 year stand exam list and harvested during this time. In order to accomplish this work within the specified time frame, approximately 51 acres will need to be harvested and treated each year. A balanced approach for harvesting stands over this 10 year window is recommended to ensure that not too many stands come up on any one year, which could prevent the necessary pre- and/or post-harvest invasive species treatment and prescribed fire management activities to take place. Staff are encouraged to utilize existing planned cut lists and combine adjacent stands that fall within the immediate rare features areas for harvest where possible to maximize efficiency.

Preparation work should also begin now in the eventual rare features management areas where possible to set the foundation for native plant community management once planted pine reaches rotation age; for example, burn breaks should be established and staff should begin putting prescribed fire on the ground prior to final harvest of pine to remove small pine seedlings and pine needle carpet.

C. Invasive species management

As outlined on the MN DNR's Operational Order #113 Information – Invasive Species web page (MN DNR 2011a), "Minnesota Department of Natural Resources (DNR) protects and manages the diverse natural resources of Minnesota. Because invasive species have the potential to adversely affect these natural resources, it is the DNR's policy to limit the introduction of invasive species onto DNR managed lands and waters, limit their rate of geographical spread, and reduce their impact on high value resources. Operational Order 113 (MN DNR 2007) sets forth DNR policy and procedures to:

- Prevent or limit the introduction, establishment and spread of invasive species
- Implement site-level management to limit the spread and impact of invasive species.

In order to carry out these policies, each division and bureau developed discipline guidelines which explain how they will carry out MN DNR Operational Order #113."

Sand Dunes State Forest site-level management recommendations stipulate that even though the Sand Dunes State Forest land is mainly administered by the Division of Forestry Invasive Species Guidelines (MN DNR 2008a), specific areas within it should have additional guidance as outlined in other division's invasive species guidelines. Specifically, areas designated as Immediate and Eventual Rare Features Management areas should also follow the Division of Ecological Resources Invasive Species Guidelines (MN DNR 2008b),including areas with this designation within the Bob Dunn Recreation Area. Also, areas within the Bob Dunn Recreation Area should follow the Division of Parks and Trails Division, Trails and Waterways Section Invasive Species Guidelines (MN DNR 2009b) and Division of Parks & Trails Invasive Species Guidelines on State Parks, State Recreation Areas & State Waysides (MN DNR 2009c).

An extensive list of additional guidance and information can be found at the MN DNR's Operational Order #113 Information – Invasive Species web page regarding the following topics:

- Educational Materials
- Pressure Washer Locations
- Contract, Grant, and Permit Language
- Invasive Species Identification and Info
- New Invasives to the Region
- Locations of Invasives in Minnesota
- Management Information
- Prevention
- Forestry Invasive Species Fact Sheets
- Funding Opportunities
- Op Order 113 Contacts
- Links

Reference material on the effect of fire on invasive species can be found in the publication, "Wildland fire in ecosystems: fire and nonnative invasive plants" (Zouhar *et al.* 2008). Likewise, the Fire Effects Information System (2011) web page should be reviewed to obtain specific guidance for Sand Dunes State Forest managers on how individual invasive species respond to fire and the implications that will have on their management of this area. For example, based on research investigating oak savanna restoration in Wisconsin, Willert (2000) found that the interaction of canopy thinning and prescribed burning were likely more successful at suppressing reinvasion of buckthorn and honey suckle after mechanical removal than thinning alone, and that thinning alone resulted in a higher percent cover of non-native invasive species than control sites with no active management due to the competitive advantage of invasive species in the canopy gaps. Burning also resulted in highest species cover, stimulating growth of grasses and forbs. Utilizing adaptive management and resources like the Fire Effects Information System to determine appropriate frequency of fire to manage invasive species within native plant communities with mechanical and chemical control when appropriate will provide feedback on how to better manage fire dependent communities within Sand Dunes State Forest.

Sand Dunes State Forest invasive species management should be addressed during any timber harvest as defined under MN DNR Operational Order #113 utilizing suitable MN DNR division invasive species guidelines for the area of interest as described above, while at the same time implementing best management practices like those outlined in "Sustaining Minnesota forest resources: voluntary site-level forest management guidelines for landowners, loggers and resource managers" (Minnesota Forest Resources Council 2005). Initially, frequent woody control treatments will likely be needed to set back well-

established stands of undesirable woody trees and shrubs. Biomass harvest, prescribed burning and grazing should all be considered by the manager depending on the location and type of invasive species infestation, or prevention thereof, within Sand Dunes State Forest. Biomass harvest guidelines can be found in the best management practices (BMPs) reference mentioned above. If prescribed grazing is utilized, it should be focused on smaller areas over a limited amount of time, otherwise known as flash grazing, with the ability to rotational graze an area for the specific time of the season needed to set back the invasive species of interest.

Management practices should focus on preventing or limiting the introduction, establishment and spread of invasive species throughout Sand Dunes State Forest. When invasive species infestations are discovered, mapping and reporting as outlined in Operational Order #113 should be followed. Time, money, and effort should first address new outlying infestations of invasive species surrounding earlier established infestations to limit their ability to overtake currently existing native flora of the area. Later, older infestations of invasive species that are well established should be addressed and treated with appropriate management techniques. Additionally, areas designated with highest ecological importance, such as immediate and rare features management areas, should receive a higher priority for invasive species monitoring, funding, and treatment, since invasive species management is highly dependent on funding. Integrated Pest Management (IPM) strategies should be utilized to effectively manage invasive species infestations. The following invasive species have been reported in Sand Dunes State Forest (see Appendix 8 for map of known locations): Hoary Alyssum (*Berteroa incana*), Common Buckthorn (*Rhamnus cathartica*), Glossy Buckthorn (*Frangula alnus*), Reed Canary Grass (*Phalaris arundinacea*), Exotic Honeysuckles (*Lonicera tartarica, L. morrowii, L. x bella*) , Spotted Knapweed (*Centaurea maculosa*), Black Locust (*Robinia pseudoacacia*), Purple Loosestrife (*Lythrum salicaria*), Amur Maple (*Acer ginnala*), Siberian Peashrub (*Caragana arborescens*), Leafy Spurge (*Euphorbia esula*), Common Tansy (*Tanacetum vulgare*), Perennial Sow Thistle (*Sonchus arvensis*), Cow Vetch (*Vicia cracca*) and Oak Wilt Fungus (*Ceratocystis fagacearum*). A description of these and other invasives can be found at http://www.dnr.state.mn.us/invasives/index.html, as well as more information on their ecological threat and various mechanical, chemical and biological control methods.

Forest harvest practices, such as conifer removal activities, must be done in a way that minimizes soil disturbance, thereby limiting opportunity for establishment of invasive exotic plants. Conducting these activities during the winter with snow coverage that is not too deep to ensure the ground is frozen is recommended to reduce the establishment or spread of invasive species. Some disturbance is inevitable, which may benefit some native flora, but extensive disturbance is likely to have undesirable effects that outweigh any such benefits.

D. Fire management – native plant communities (NPC) and prescribed fire

A description of the two major native plant communities found within Sand Dunes State Forest is needed to understand the role of fire in maintaining them:

Southern Dry-Mesic Oak (Maple) Woodland (FDs37)

"Natural History

In the past, fires were very common through the range of FDs37. An analysis of Public Land survey records indicates that the rotation of catastrophic fires on sites presently occupied by FDs37 was about 110 years, and the rotation of mild surface fires about 10 years. The rotation of all fires combined is estimated at 9 years. Windthrow was not common, with an estimated rotation exceeding 1,000 years. Based on the historic composition and age structure of these forests, FDs37 had two growth stages.

- 0 – 75 years: Young forests recovering from fire, dominated by bur oak with some northern red or white oak. Quaking aspen, northern pin oak, and black cherry are minor components.
- >75 years: Mature forests dominated by a mixture of bur oak, white oak, northern pin oak, and some northern red oak, with minor amounts of American Elm. (In the past, sites now occupied by FDs37 typically supported more open communities, including brushland prairie or savanna. Air photos from the 1930s show these sites to have scattered oaks rather than forest canopies. With the suppression of wildfires since the mid-1800s, these sites have developed denser tree canopies, and over time, herbs typically of mesic forests have become common in the understory. The current examples of FDs37 used in this classification are best described by mature forest growth stage described above)" (MN DNR 2005).

Dry Barrens Oak Savanna (Southern) (Ups14a2) Oak Subtype

"Natural History

Savannas form where fire recurs frequently enough to prevent trees and shrubs from dominating and shading out sun-loving herbaceous plants, but where frequency and severity are low enough to allow fire-tolerant trees to become established and sometimes reach maturity. Historically, savannas typically occurred in physical proximity to prairie, but where various factors provided some amelioration of the fire regime of the adjoining or surrounding prairie. These factors include streams, lakes, and steep topography, which limited the spread of fire and thus created conditions conducive to savanna than in typical prairies. All savannas are highly sensitive to fire-suppression, quickly succeeding to woodland and eventually to forest in the absence of fire. Seedling and saplings of a number of woodland trees are typically present in savanna today, reflecting reduced fire frequency and a general increase in these species in the landscape. Dry savannas are more resilient than mesic savannas because the xeric conditions and lower fertility of the soils inhibit tree and shrub growth and reproduction. These same factors also greatly influence herbaceous species composition, elimination species not adapted

to either frequent drought or low nutrient availability. On dune sands, blowout formation and migration produce dramatic local variation in species composition, from sparse stands of pioneer species in bare, sterile sand to a relative dense sod of grasses and forbs on long-stabilized, originally enriched sand. Before Euro-American settlement, browsing, grazing, and trampling by large ungulates were regular occurrences in dry savannas. The contribution of these activities to the composition and structure of the vegetation is not well understood, although it is known that confined grazing by domestic livestock can badly degrade dry savannas…"

- Ups14a2 Oak Subtype

  "Canopy is composed of oaks, with jack pine absent. Ups14a2 is documented in the MIM from numerous locations in the Anoka Sand Plain Subsection and one location in the Oak Savanna Subsection, and from scatter location in the PPL. Description is based on summary of vegetation data from 16 plots" (MN DNR 2005).

A research project focused on "Fire history and age structure analysis in the Sherburne National Wildlife Refuge: establishing reference conditions in a remnant oak savanna woodland" (Kipfmueller et al. 2007) was conducted directly north of Sand Dunes State Forest and may provide additional guidance on historic fire frequency and intensity for this area. Additional resources for managing Sand Dunes State Forest utilizing prescribed fire to mimic historic fire regimes of these fire dependent communities can be researched at the Fire Research and Management Exchange System (FRAMES) web site located at http://frames.nbii.gov/ which has made research papers like the one above available through their web page. "FRAMES provides a method of exchanging information and transferring technology among wildland fire researchers, managers, and other stakeholders in an online environment. The FRAMES portal, supported by USGS, provides essential searchable information, a platform for data sharing and storage, development of new tools, and support to federal wildland fire management agencies in the United States throughout the various stages of wildland fire, including planning, operation, and post-fire monitoring" (FRAMES 2011). FRAMES is part of the Wildland Fire Science Partnership, which is available at http://www.firesciencepartnership.org/index.html (2011).

A list of rare plant and animal species for which fire may be an issue include the following: Creeping Juniper (*Juniperus horizontalis*), Uncas Skipper (*Hesperia uncas*), Leonard's Skipper (*Hesperia leonardus leonardus*), Northern Barrens Tiger Beetle (*Cicindela patruela patruela*), a species of jumping spider (*Metaphidippus arizonensis*), Plains Pocket Mouse (*Perognathus flavescens*), Gopher Snake (*Pituophis catenifer*), Western Hognose Snake (*Heterodon nasicus*), *Emydoidea blandingii* (Blanding's Turtle) and potentially others. As an example, Creeping Juniper (*Juniperus horizontalis*) does not tolerate fire, therefore populations need to be identified and taken into account when planning Sand Dunes State Forest prescribed burns to exclude these individual populations. To encourage invertebrate populations, it is generally beneficial to remove any pine needles covering the ground layer as quickly as possible and prescribed burning can be an effective way to accomplish this objective. Likewise, other rare

species considerations need attention including utilizing the correct frequency and timing of prescribed burns during appropriate seasons, as well as ensuring the size of prescribed burn units are taken into account as native plant communities are maintained with fire, while at the same time being carried out in a fashion that is not detrimental to any rare features trying to be maintained or encouraged to expand utilizing adaptive management strategies. Prescribed burns should be limited to smaller areas to allow for sufficient invertebrate survival in unburned areas to help facilitate recolonization of burned areas, and with sufficient time for this to occur before burning the previously unburned areas at a later date. Likewise, the prescribed burn boss and other planners need to consult with other knowledgeable MN DNR staff and natural resources specialists who know invertebrate life cycle strategies when developing fire management units to ensure their long term survival. The MN DNR Rare Species Guide web page, which is available at http://www.dnr.state.mn.us/rsg/index.html should be consulted to obtain additional information on specific rare features within Sand Dunes State Forest (MN DNR 2008c). Minnesota's current list of endangered, threatened and special concern species can also be reached from this same web page or directly at http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf (MN DNR 2011b).

Sand Dunes State Forest managers need to give consideration on how to minimize localized short term population declines caused by prescribed fire for specific listed species as much as practical based off of species fire effects database and other resources. This will allow them to thrive in Sand Dunes State Forest's fire dependent communities as they had historically. Reference material on the effect of fire on specific and/or related flora and fauna, as well as soil, water and air can be found the Fire Effects Information System (2011) web page. This web page should be reviewed to obtain specific guidance for Sand Dunes State Forest managers on how individual species respond to fire and the implications that will have on their management of this area. Likewise, on this web page, there are links to other fire effects reports including; "Wildland fire in ecosystems: effects of fire on fauna," (Smith 2000), "Wildland fire in ecosystems: effects of fire on flora," (Brown and Smith 2000), "Wildland fire in ecosystems: effects of fire on soils and water," (Neary et al. 2005), "Wildland fire in ecosystems: effects of fire on air" (Sandberg et al. 2002), and "Wildland fire in ecosystems: fire and nonnative invasive plants" (Zouhar *et al.* 2008). Likewise, the Fire Research and Management Exchange System (FRAMES) web page at http://frames.nbii.gov/ provides additional specifics on several fire related subjects and is a partnership that "was created to develop and deliver knowledge and decision support tools to policymakers, wildland fire managers, and communities" (FRAMES 2011). FRAMES is the source of FFI, which is an interagency fire ecology "monitoring software tool designed to assist managers with collection, storage and analysis of ecological information. It was constructed through a complementary integration of the Fire Ecology Assessment Tool (FEAT) and FIREMON" (FFI 2011). Managers are encouraged to employ this ecological monitoring utility to track implementation of prescribed fire within Sand Dunes State Forest to restore selected areas back towards their native plant communities. Similarly, the Lakes States Fire Science Consortium "is a network of fire managers and scientists interested in the fire-dependent forest ecosystems of the Lake States region" and has numerous links on their web

page at http://lakestatesfiresci.net/ of fire related subjects related to Minnesota (Lake States Fire Science Consortium 2011).

A two step process will be needed to implement prescribed fire at appropriate fire frequencies and intensities due to the past history of fire suppression of wildfires and few prescribed fires implemented within Sand Dunes State Forest. First, over the first ten years in areas that will have more prescribed fires occurring, such as Immediate Rare Feature Management Areas, up to three prescribed fires may be needed to reduce the fuel loading that has built up over the years due to fire exclusion in these Sand Dunes State Forest native plant communities, as well as address additional fire intensity concerns these fuels may present. Second, after these first ten years, the implementation of a fire regime schedule that mimics the historical patterns of low intensity fires would be maintained with the effort to rotate through all the designated prescribed burn management units within Sand Dunes State Forest over time and keep approximately the same number of acres burned each year. Dry Barrens Oak Savanna (Southern) (Ups14a2) Oak Subtype and Southern Dry-Mesic Oak (Maple) Woodlands (FDs37) native plant communities would mimic a rotation of fires approximately every 9-10 years during this second phase. There may be times where more or less time between prescribed fires would be implemented to favor fire tolerant trees based on objectives within the adaptive management process or the very opposite to reduce the basal area or stem density of certain tree species. Likewise, depending on the requirements for each rare species within these native plant communities, there may be a need to adjust the fire frequency and intensity accordingly to favor specific species within a specific prescribed burn area.

The Division of Forestry's historical role as a contingency resource for most Department of Natural Resources division's prescribed burns that are conducted, as well as their on-call status for wildland fire response during the fire season, has limited their ability to conduct as many prescribed burns, when compared to other divisions. Likewise, limitations in funding and staffing within the Division of Forestry, as well as a focused history of fire suppression have hampered past efforts to implement prescribed fires on state forest lands. In order to increase prescribed fire frequencies within Sand Dunes State Forest, additional Division of Forestry staff, as well as potentially other Minnesota Department of Natural Resources divisions, contractors and/or even the United States Fish and Wildlife Service (USFWS) Sherburne National Wildlife Refuge staff could assist Forestry under a signed prescribed fire MN USFWS and MN DNR Local Agreement Statement (Appendix 9). To implement prescribed fires on and amongst the unique dunes of Sand Dunes State Forest, it would be beneficial for the manager to contact prescribed burn bosses from SE Minnesota where prescribed burns occur in bluffs on a regular basis, as well as contacting staff from locations like Itasca State Park to see what response their ecosystems have had in response to prescribed burns in the understory of red and white pine forests. Moreover, a review of the prescribed burning project in Cutfoot Experimental Forest may be beneficial to Sand Dunes State Forest managers in better understanding the role of seasonal timing and fire frequency, particularly when "several annual growing season burns appear to be conducive to establishment of an eastern white pine component under … red

pine, if a seed source is present after the last fire" (Palik & Kern 2009). This could be beneficial to forestry management practices within Sand Dunes State Forest with particularly application possibly more likely outside of rare features management areas in the long term as a potential white pine regeneration technique once it has been vetted through the adaptive management process.

Existing fire breaks should be used as future FIM boundaries within the immediate and eventual rare feature management sections to ease implementation of prescribed fire. Any existing FIM boundaries should be double checked to see if they match with existing fire breaks and leave them as is if they do correspond. Stand prescriptions for future cuttings should be based on these new FIM boundaries established from existing fire breaks. If new fire breaks must be created to make long term management possible utilizing prescribed fire, then managers are encouraged to determine these new fire breaks and incorporate them into the updated FIM boundaries.

The MN DNR prescribed fire forms and documents web page at http://www.dnr.state.mn.us/rxfire/forms.html (MN DNR 2011c) contains a variety of important information for implementing prescribed burns in Minnesota and a link to the MN DNR Prescribed Burn Handbook, which is directly available at http://files.dnr.state.mn.us/forestry/wildfire/rxfire/prescribedBurn_Handbook2010.pdf (MN DNR 2010a), as well as prescribed burn guidelines as outlined in MN DNR Operational Order 47, which is directly available at http://files.dnr.state.mn.us/forestry/wildfire/rxfire/oporder47.pdf (MN DNR 2010b). The MN DNR Prescribed Burn Handbook covers in detail to following subjects: prescribed burn responsibilities, prescribed burn planning, state and federal qualification and training requirements for prescribed burn personnel, obtaining prescribed burn supplies and equipment, obtaining prescribed burn personnel, contractor burning, safety, prescribed burn reviews, documentation, and prescribed burn restrictions (MN DNR 2010a). Getting prescribed burn experience is highly suggested for a career managing native plant communities with fire. Obtain the initial training needed to participate in prescribed burns by taking the following courses: I-100 Introduction to Incident Command System (ICS), S-130 Firefighter Training, S-190 Introduction to Wildland Fire Behavior, L-180 Human Factors on the Fireline and IS-700 An Introduction National Incident Management System (NIMS). The RT-130 Annual Fire Safety Refresher is needed every year after completing S-130, S-190 & L-180. Additional wildland and prescribed fire training required to become a certified prescribed burn boss is listed on the Minnesota Combined Fire Training Calendar, which is posted online at http://www.dnr.state.mn.us/forestry/fire/training/calendar.html (MN DNR 2011d).

E. Adaptive Management, monitoring and evaluation

As described by the U.S. Department of Interior, "Adaptive Management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals; increases scientific knowledge; and reduces tensions among stakeholders" (U.S. Department of the Interior 2008). In summary, "Adaptive Management is a structured approach to resource management. Through this iterative process, managers and scientists team together to improve resource management over time by learning from management outcomes.

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.

By repeating this cycle and increasing to the body of knowledge about the system in question, managers are able to refine their prescriptions to more closely meet the original objectives" (U.S. Department of the Interior 2010). Adaptive management implementation and guidance is published in "Adaptive Management: The U.S. Department of the Interior Technical Guide," available at http://www.doi.gov/initiatives/AdaptiveManagement/ and should be the technical basis for adaptive decision making by Sand Dunes State Forest managers in collaboration with various MN DNR department staff and stakeholders.

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. In an area such as the Sand Dunes State Forest that has undergone almost a century of wildland fire suppression with sporadic wildfire occurring over the years and few prescribed fires, adaptive management will provide the tools to continually manage habitat to meet various management objectives within its boundaries. The implementation of adaptive management within Sand Dunes State Forest will occur to plan management goals, set objectives to move towards those goals, implement management practices based on set objectives, monitor results of management practices, and evaluate results to ensure that the

next round of set objectives move the management of Sand Dunes State Forest closer to the intended long term management of each specific area. Adaptive management allows the constant reevaluation of results to ensure objectives are modified or maintained as needed to continually move towards long term management goals.

A structured decision making process has been started with the compilation of the Sand Dunes State Forest operational plan and the meetings that proceeded it, which have outlined specific management practices within Sand Dunes State Forest for the benefit of various natural resources users and inhabitants utilizing adaptive management as part of the conservation delivery, as well as monitoring and research phases of this strategic habitat conservation (U.S. Fish and Wildlife Service 2008).

Monitoring and evaluation shall occur on a three year cycle to ensure objectives are being meet, as well as the ability to reassess any new or evolving natural resources problems that have occurred that need to be addressed. Likewise, progress reviews shall be incorporated into or near annual stand exam meetings. Monitoring will follow the guidance and templates found in the ecological classification system (ECS) Case Studies in Ecological Silviculture manual found at http://www.dnr.state.mn.us/forestry/ecs_silv/monitoring.html (Almendinger 2010). Characteristics shall be developed indicative of achieving objectives through the standard monitoring techniques found in the manual that call for an assessment of regeneration and growth, monitoring plant diversity, and the utilization of photo monitoring with the following of procedures outlined for each. Additional special monitoring may be necessary as determined by those involved in the structured decision making process. Baseline monitoring should be completed early on to be able to compare against future management practices that should be able to show how much habitats have changed due to certain management practices to reach set habitat objectives. FRAMES, the source of FFI, which is an interagency fire ecology "monitoring software tool designed to assist managers with collection, storage and analysis of ecological information" may prove to be a useful tool in compiling monitoring data and analyzing results. It was constructed through a complementary integration of the Fire Ecology Assessment Tool (FEAT) and FIREMON" (FFI 2011). In the end, monitoring results should be used to learn, make decisions on management effectiveness and determine what needs to change to complete the adaptive management feedback loop. All outcomes shall be documented, as well as what decisions were made and why they were implemented in the field.

Monitoring techniques that should be considered during the structured decision making process include the frequency of timber cruising, the potential use of forest inventory module (FIM) and/or stand exam worksheets to track progress, the utilization of supervised classification and LiDAR (Light Detection And Ranging) to show differences before and after habitat cover type management is implemented, long-term monitoring of critical rare features, as well as other ways to monitor progress toward desired future conditions (DFC). Goals, objectives, variables, and metrics should be listed for measuring progress. For example, if the

goal is habitat restoration with objective of prescribed burning of a certain number of acres every three years, then the performance measure is number acres burned per year or the number acres within targeted burn interval. A ground cover assessment may be warranted to determine areas where timber harvest and/or burning is sufficient to recover native plant communities versus areas where timber harvest, fire, and/or invasive species control are needed. Invasive species monitoring should also continue utilizing the MN DNR's already established data entry system that currently uses Pendragon Forms 5.1 to create a point shape file database with multiple attributes for each sighting. The expansion of this invasive monitoring to include the actual spatial distribution which could be captured utilizing a polygon shape file to display the extent of the infestation is strongly encouraged to assist in follow up treatments, monitoring, and evaluations.

F. Financial issues – school trust fund, external funding sources for restoration

Approximately 350 acres of land within the immediate and eventual conversion zones are covered by financial obligations to the Permanent School Trust Fund. The DNR is charged with maximizing financial return from these acres. Some of the land is planted to pine which will be converted to native plant communities after the final harvest. The future earning potential of the land will be diminished and the Trust obligation may have to be compensated in some way. Some of the land is already being managed as oak woodland or it is permanent wetland, and the change in management objective may have little or no impact on future earning potential.

It may be possible to transfer the Trust obligation to other acres in the long-term forest management zone. This could satisfy the Trust obligation, but it works against the funding support for the Division of Forestry. In addition, transferring the Trust obligation involves complicated land appraisals that must be funded through some source. DNR is currently trying to resolve land-swap issues with the Trust in northern Minnesota and it could take several years before the issue in the Sand Dunes can be addressed.

Alternatives to transferring the Trust obligation may be found. There may be markets for native plant seed that can be collected on Trust land. Grazing leases could produce modest revenue and may help with invasive species control as well.

Restoration of native plant communities will require sources of funding outside Forestry's normal channels. Grant funds may be available through the Lessard-Sams Outdoor Heritage Commission, the Legislative-Citizens' Commission on Minnesota Resources, fuel reduction grants and other sources.

G. Public relations

In the fall of 2011, an informational letter will be mailed to external partners, stakeholders, and neighboring landowners of the immediate and eventual rare features management zones as well as the Bob Dunn Recreational Area to explain the shift in future management strategy within these three zones of the state forest (Appendix 10). Following this mailing, public informational meetings may be scheduled if needed based on the level of feedback received. Opportunities for public input on forest management issues and management direction will occur through the DNR Subsection Forest Resource Management Planning (SFRMP) process for the Anoka Sand Plain that is currently underway.

Additional public outreach efforts should be developed over the next decade to garner support from stakeholders and engage partners in the native plant community restoration process as active management activities proceed. Ideas for outreach include:

- Developing a Sand Dunes State Forest informational brochure
- 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 to highlight active forest management techniques, native plant communities, rare species, and unique geological features
- Working with adjacent private landowners to coordinate oak wilt treatments
- Offering annual environmental education programs to the public or partnering with other entities to co-sponsor such events

H. Next Steps for Implementation / Further Considerations

- Place all stands within immediate rare features management zone on 10-year stand exam list for harvest by FY2022
- Incorporate active management practices into agenda of annual stand exam meetings to determine specific prescribed fire and invasive species management prescriptions for those stands in the immediate and eventual rare feature areas
- Create or utilize an existing project database to document and track site-level management decisions
- Develop suggested timelines and seasonality for burning, invasive species control, and harvest based on current habitat, desired future conditions, and types and locations of rare features
- Develop a burn plan for SDSF; create a map of fire units and establish fire breaks
- Conduct invasive species mapping project; apply for grant money to control invasives, particularly in immediate/eventual rare features areas
- Complete field checks of GIS NPC model; update with LiDAR data when available

- Submit request to transfer trust fund obligation within immediate/eventual rare features management zones to long-term forest management zone; if request fails, pursue alternative revenue options such as prairie seed collection
- Develop detailed plan for management of the Bob Dunn Recreation Area in consultation with Parks and Trails staff
- Implement outreach and education efforts in cooperation with area partners
- Develop guidelines for management of oak in eventual areas based on desired age structure, native plant communities, etc.
- Determine how to deal with oak wilt in a stand

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VI. **Appendices**

Appendix 1. Sand Dunes State Forest management decision, April 22, 2010.

April 22, 2010

Sand Dunes State Forest decision

Goals

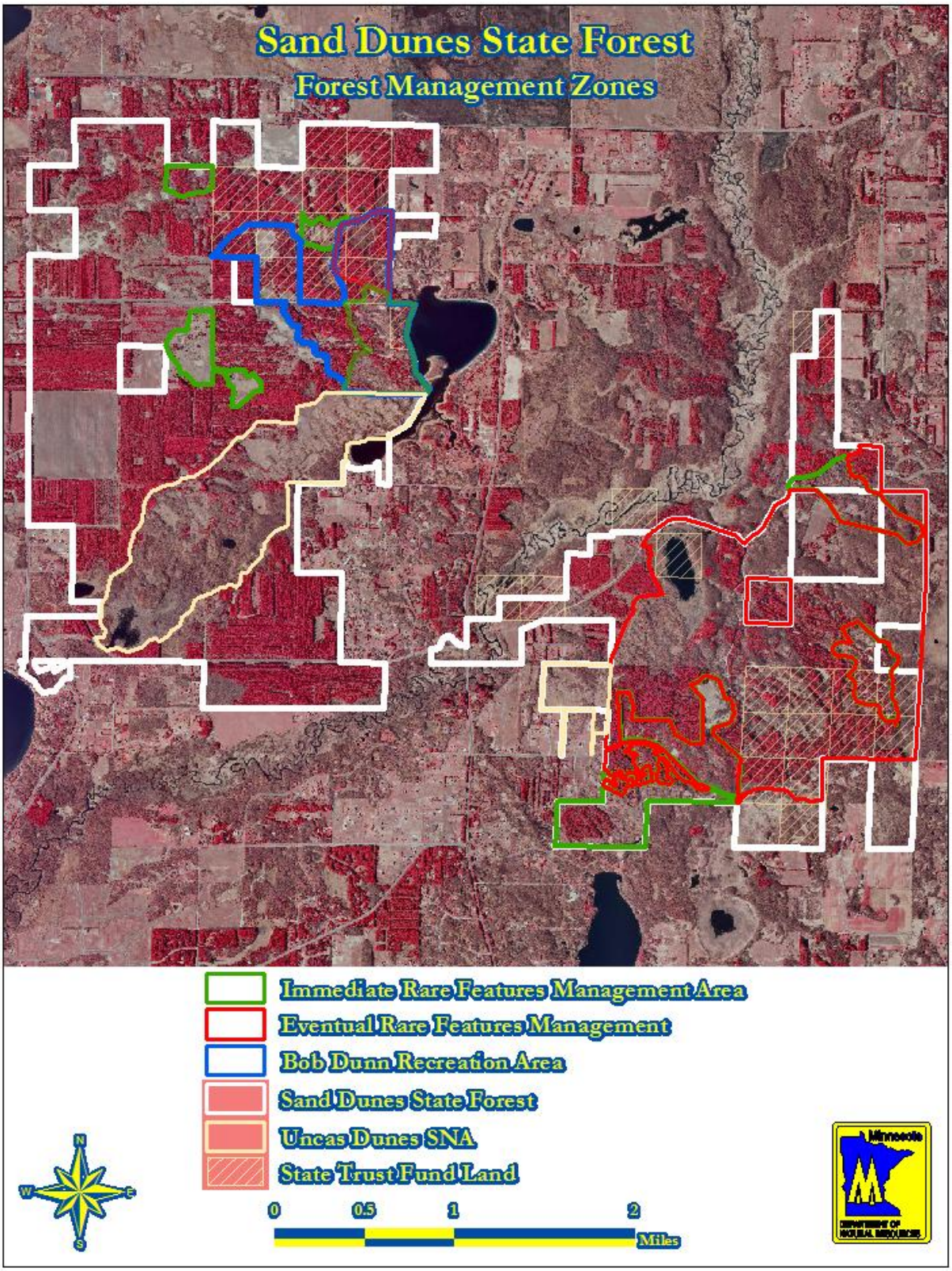
I. Achieve broad natural resources health through rare features protection, native habitat enhancement and restoration, and active timber management and harvest and reforestation.
II. Provide clear direction for staff that will enable them to move forward.
III. Enable a successful SFRMP process

Prescription
Manage so that we protect and restore the rare and distinct geological and ecological features, addressing the land and timber management investment that the state has made and the ecological opportunity that is presented in the Sand Dunes.

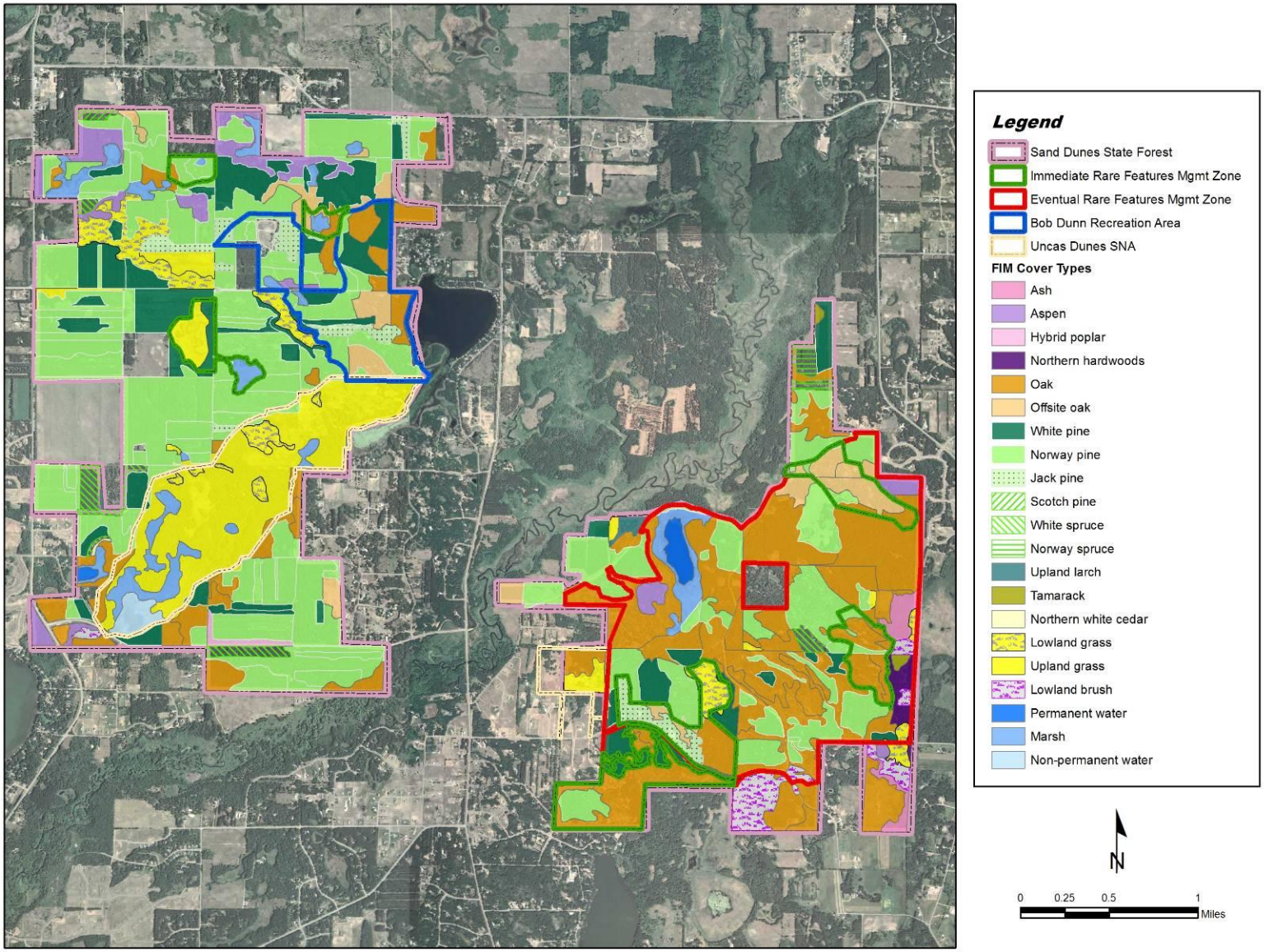
Concepts that create the framework of an agreement

1. Forestry becomes the lead for the entire 6,000 acres, managing for broad ecosystem health. This includes protection and restoration of the rare features (dunes/oak savanna) as well as harvest and reforestation of pine. Ecological Resources provides technical assistance. Forestry management and accountability includes the SNA and its goals of protection and restoration.
2. Trust land remains trust, unless exchanged or compensated, and is to be managed to achieve strong financial return.
3. Given the rare dune resource, Ecological Resources proposal to "eventually" return the southern unit acres to oak savanna is the agreed new management prescription. The prescription will be managed and implemented by Forestry providing silvicultural and economic expertise balanced with technical assistance from Ecological Resources.
4. Given the rare dunes and other natural resource occurrences, Ecological Resources proposal to "immediately" restore areas in the southern unit is agreed to with the following caveats:
    a. All Trust lands are excluded in accordance with point 2 above.
    b. Make economic use of all existing pine. Harvests can balance need for immediacy with market recovery. The goal is to optimize timber value with taking action soon. Look for all market options.
    c. Take steps to provide for public understanding and acceptance of these actions.
5. Regional Managers from Forestry and Ecological Resources must create a transition plan that will specify the steps necessary to move from the current situation to implementation of this agreement. This includes a required training component and a written process that describes how the two divisions will work together to accomplish this agreement and its goals.

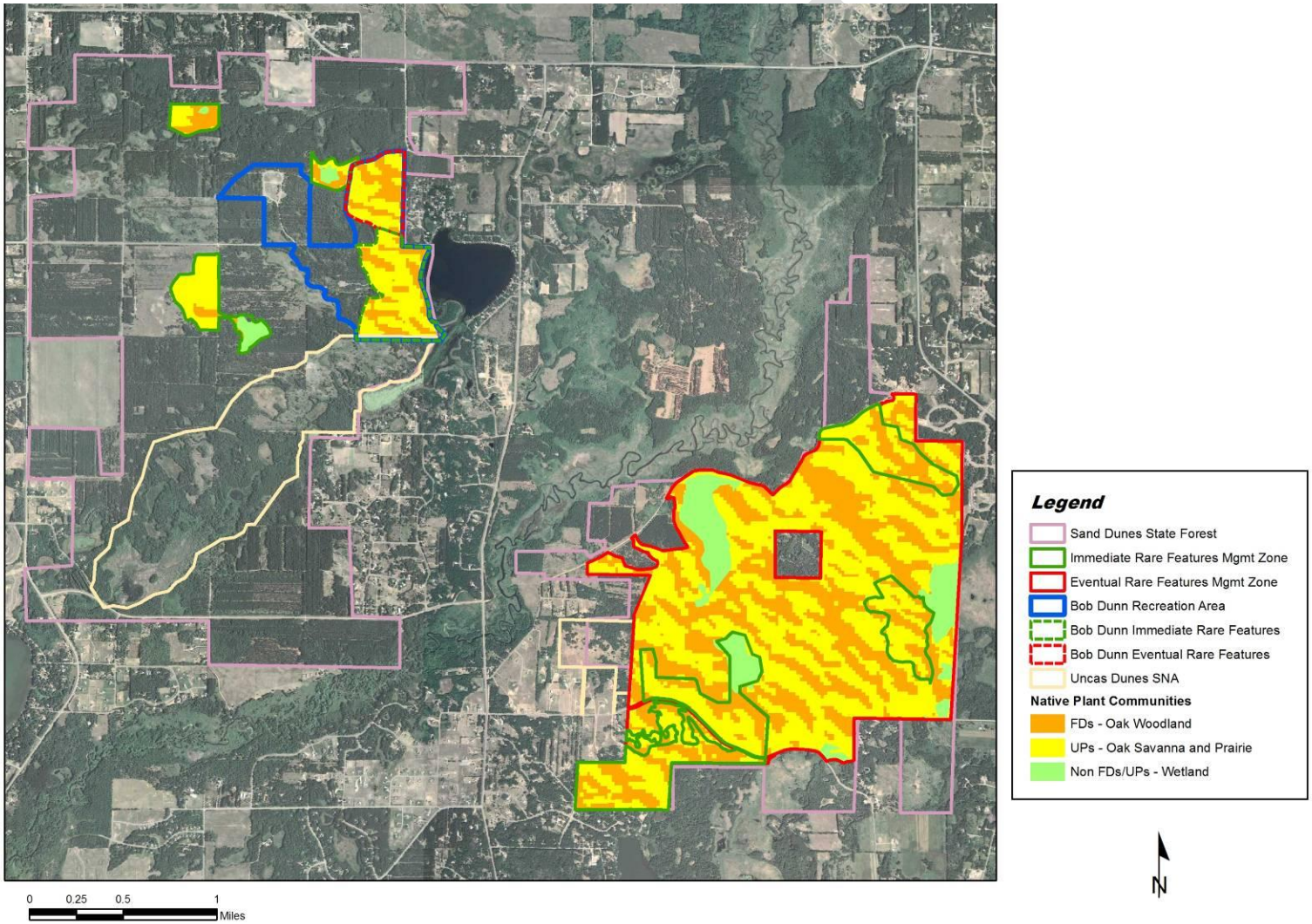
Appendix 2. Sand Dunes State Forest Management Zones.



Appendix 3. Current FIM Cover Types in Sand Dunes State Forest.

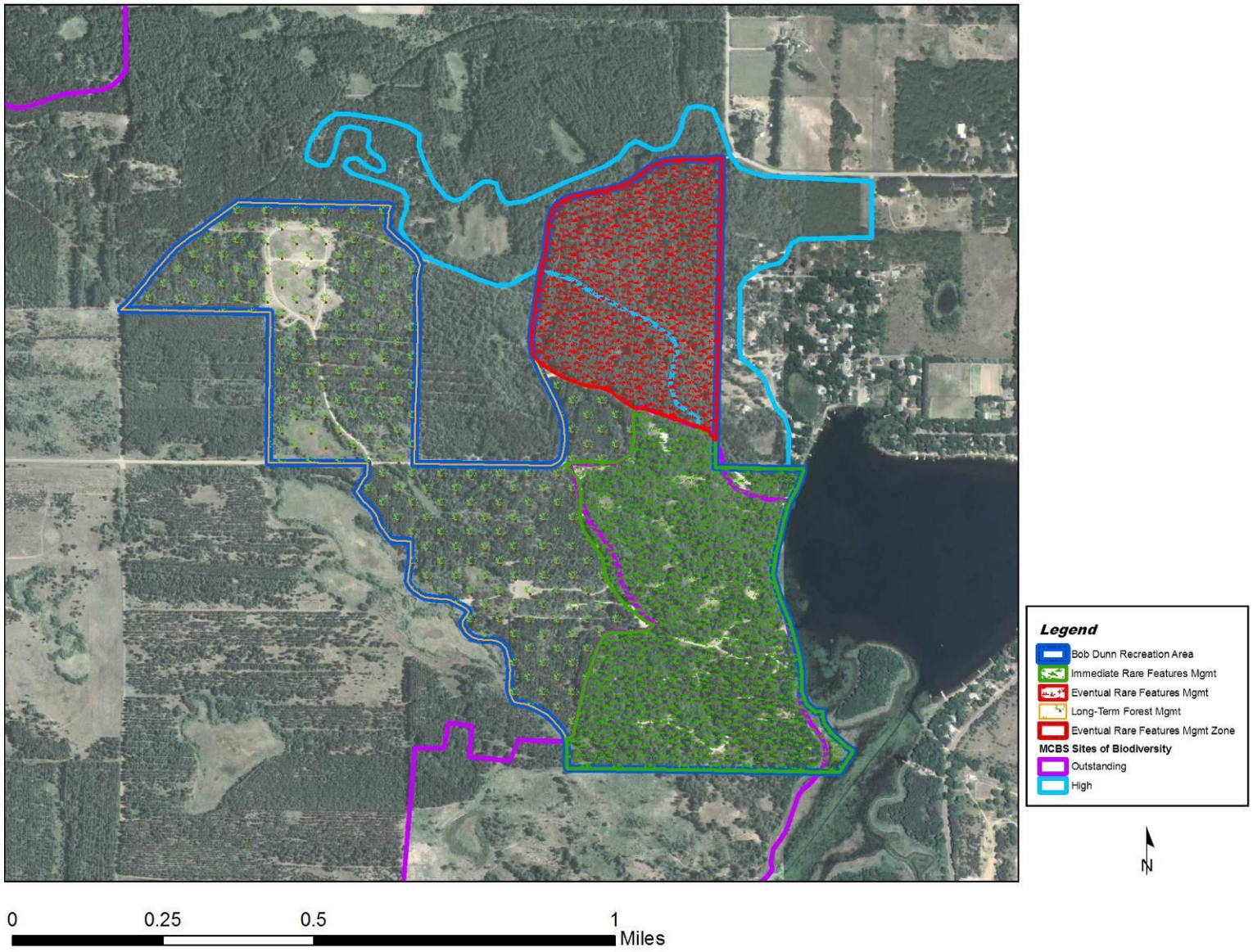


Appendix 4. Desired Future Condition* (DFC) of Rare Features Management Zones in Sand Dunes State Forest: Oak Savanna/Prairie, Oak Woodland, and Wetland Communities



***Note: DFC's shown above are based on a 2010 Native Plant Community GIS model and will be modified upon field verification**

Appendix 5. Bob Dunn Recreation Area Management Zones.

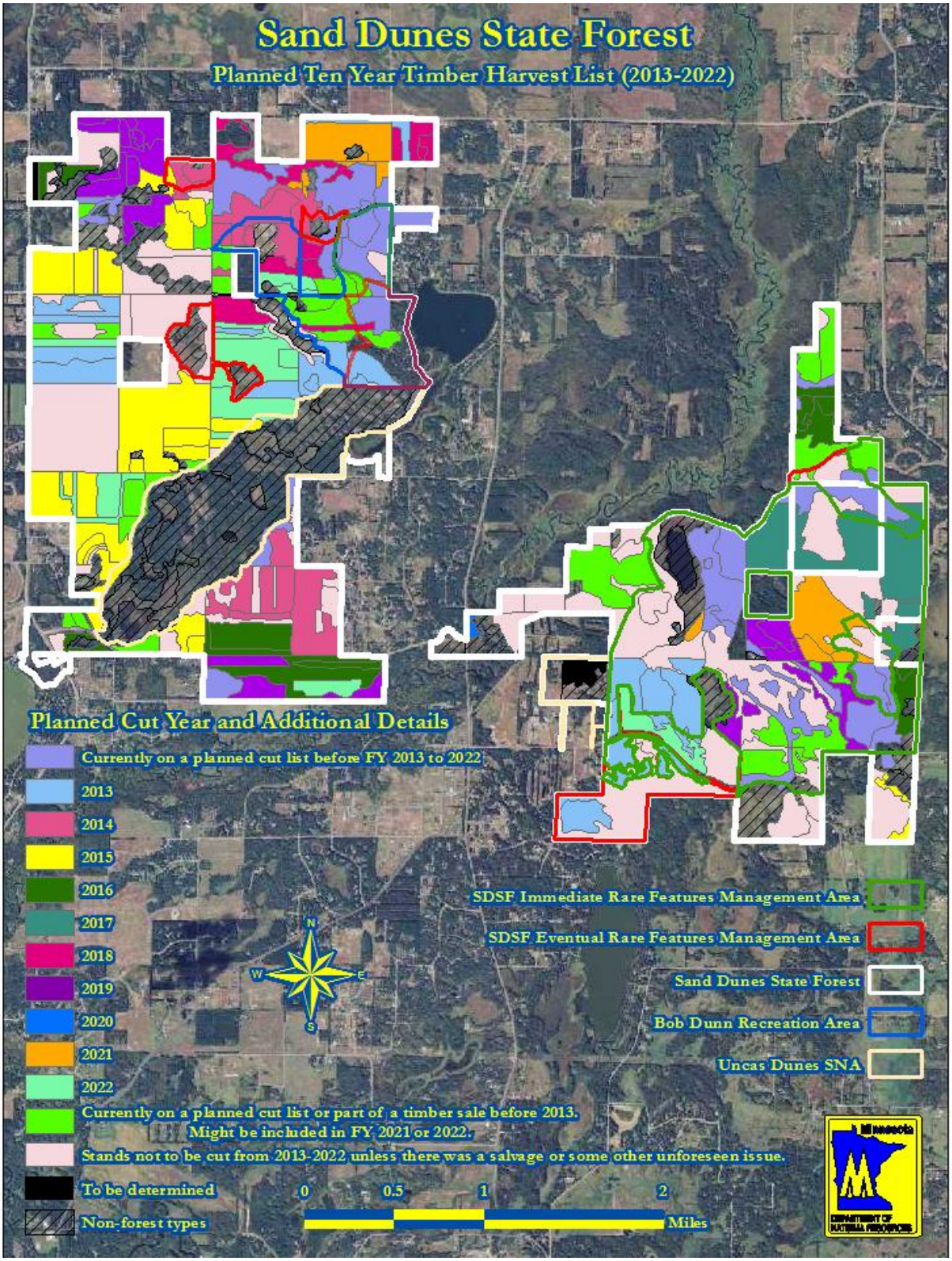


Appendix 6. Desired characteristics of oak woodland and oak savanna native plant communities.

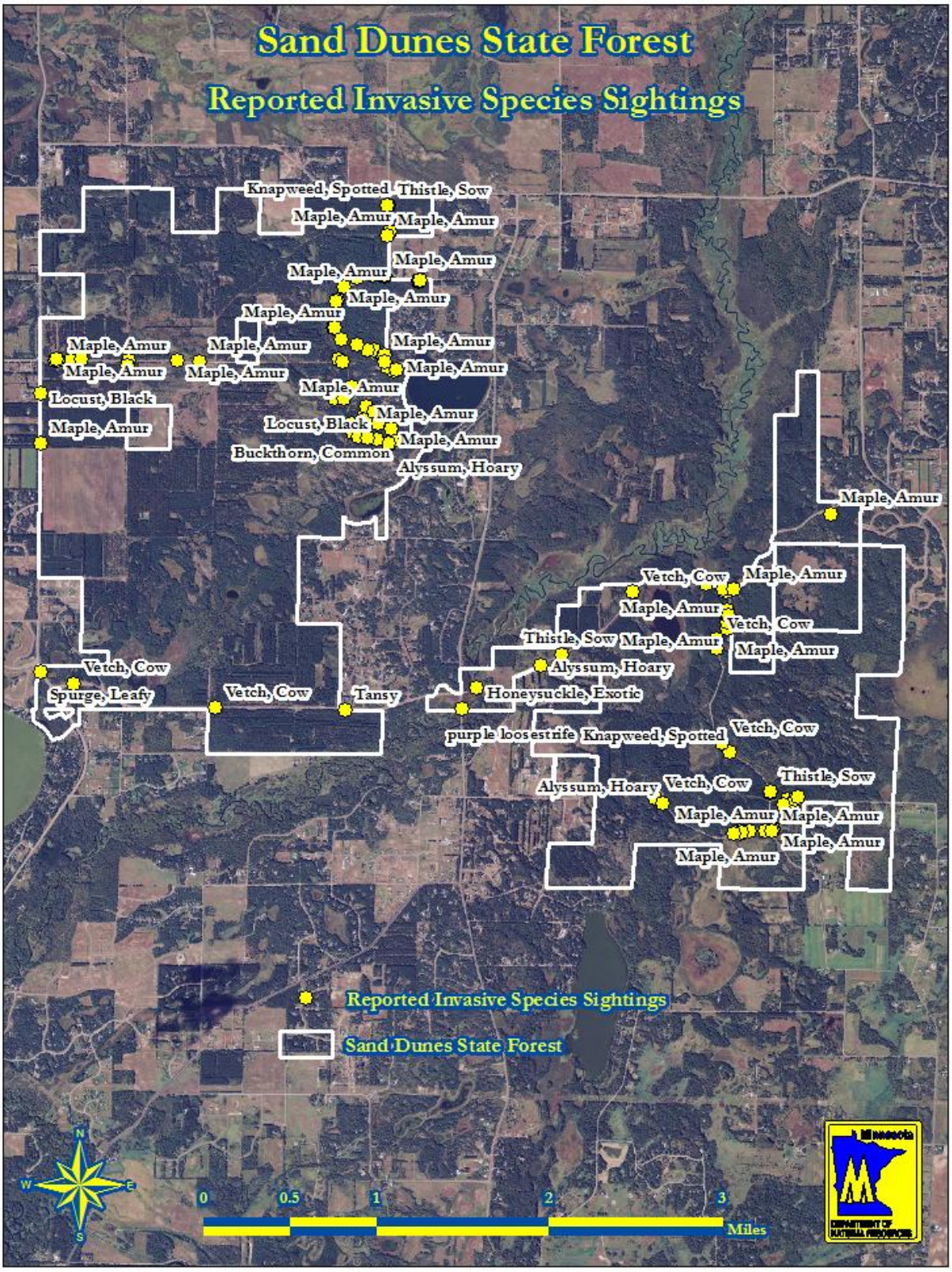
Desired Characteristic*	Oak Woodland	Oak Savanna
NPC Classification	FDs37	UPs14a2
Tree Cover	50-70% canopy cover 25-70% sub-canopy cover 25-70% shrub cover	5-50% tree cover (lowest on south- to west-facing slopes) Less than 30% shrub cover
Growth Form	Open- or moderately open-grown	Open-grown
Stem Density	35 – 1500 trees/acre	17 – 200 trees/acre
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 red cedar 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
Fire Breaks	To facilitate prescribed burning	To facilitate prescribed burning

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

Appendix 7. Planned ten-year timber harvest list for Sand Dunes State Forest (2013-2022).



Appendix 8. Sand Dunes State Forest Reported Invasive Species Sightings



Appendix 9. 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:

Local FWS Project Leader Signature: Date:

Local DNR discipline supervisor or designee: Date:

Appendix 10. Public informational letter.

Date, 2012

To Sand Dunes State Forest adjacent property owners,

The Minnesota Department of Natural Resources 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 these rare features in some designated areas in the state forest, DNR land management will shift away from pine plantations to restoration and management of native plant communities. On the attached map you will see an *Immediate Rare Features Management Zone* in which restoration work will begin over the next 5-10 years; the *Eventual Rare Features Management Zone* that surrounds it will be phased 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 Management Zone* all of the pine and spruce will be harvested. Work will begin to convert this zone to 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 brushland, 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 carefully prescribed burning to restore fire-dependant plant communities and targeted application of herbicides to reduce invasive/exotic plant species.

A slightly different approach will be used in the *Eventual Conversion 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 *Eventual Rare Features Management Zone* in the southeastern unit of the state forest and throughout much of the northwestern unit of the Sand Dunes State Forest, 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, and 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. Please review the attached map and if you have any questions or concerns, contact the Cambridge Area Forestry Supervisor.

Best Regards,

Don Mueller
Cambridge Area Forestry Supervisor
800 Oak Savanna Parkway SW
Cambridge, MN 55008
763.689.7109

VII. **Supplement** - An evaluation of the ecological significance of the Sand Dunes State Forest, Sherburne County, Minnesota (MN DNR 2009a).

(see attached .pdf)

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

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	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

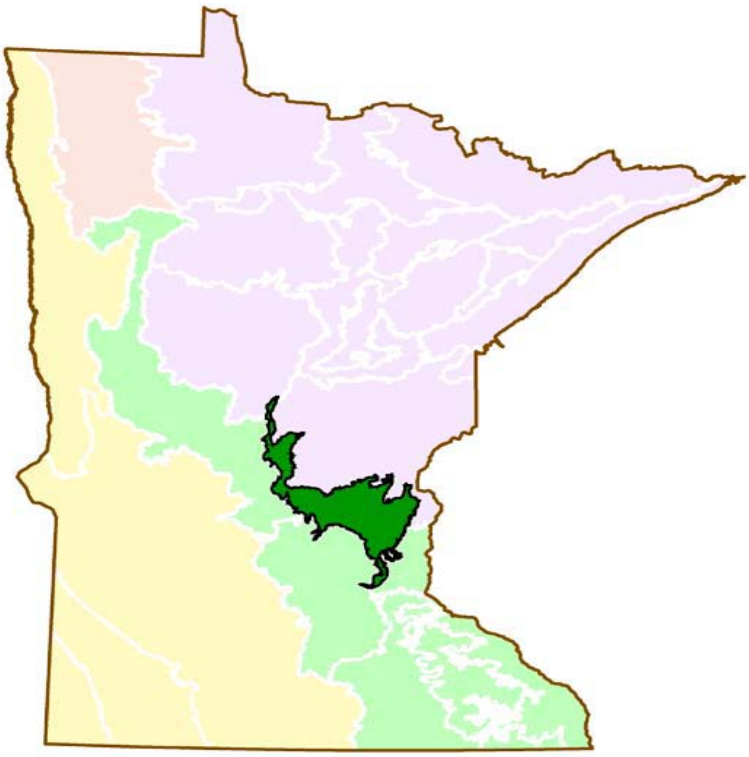
	A	B	C	D	E	F	G	H	I	J	K
260	N. Metro Wildlife	t03424w1260005	5 A51	29	5.4	1100	MA1	2014			0
261	N. Metro Wildlife	t03322w1070403	403 O55	70	10.0	1100	MA1	2013			1
262	N. Metro Wildlife	t03322w1050402	402 O54	79	10.0	1100	MA1	2013			1
263	N. Metro Wildlife	t03322w1060409	409 O53	84	24.0	1100	MA1	2013			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

Appendix E

TOMORROW'S HABITAT FOR THE WILD & RARE

Anoka Sand Plain

Subsection Profile

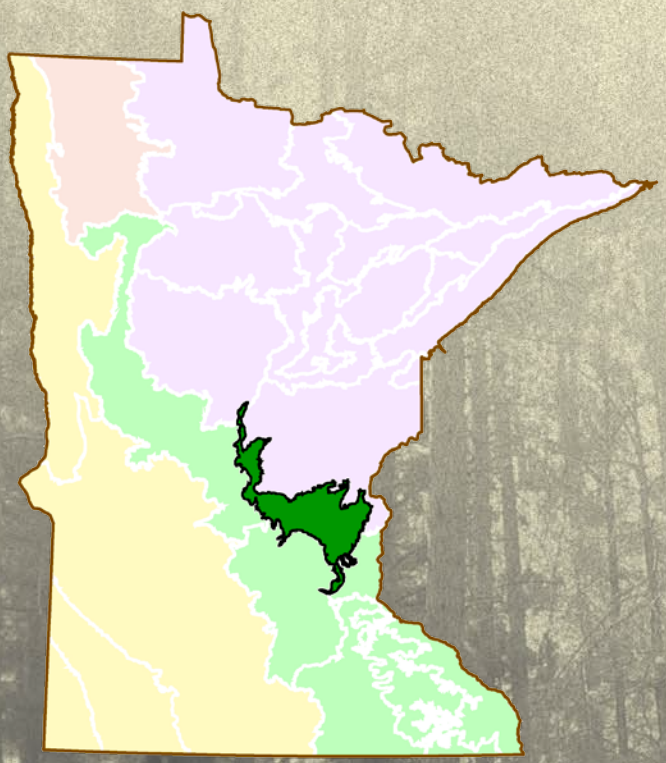


Tomorrow's Habitat for the Wild & Rare

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

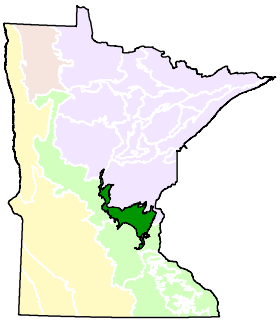
Acres: 1,199,711 (2.2% of state)

Ownership

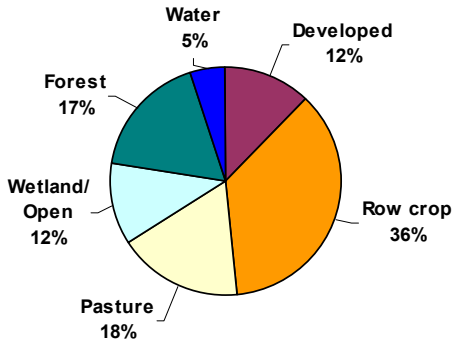
Public	Private	Tribal
9.7%	90.3%	0.0%

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.

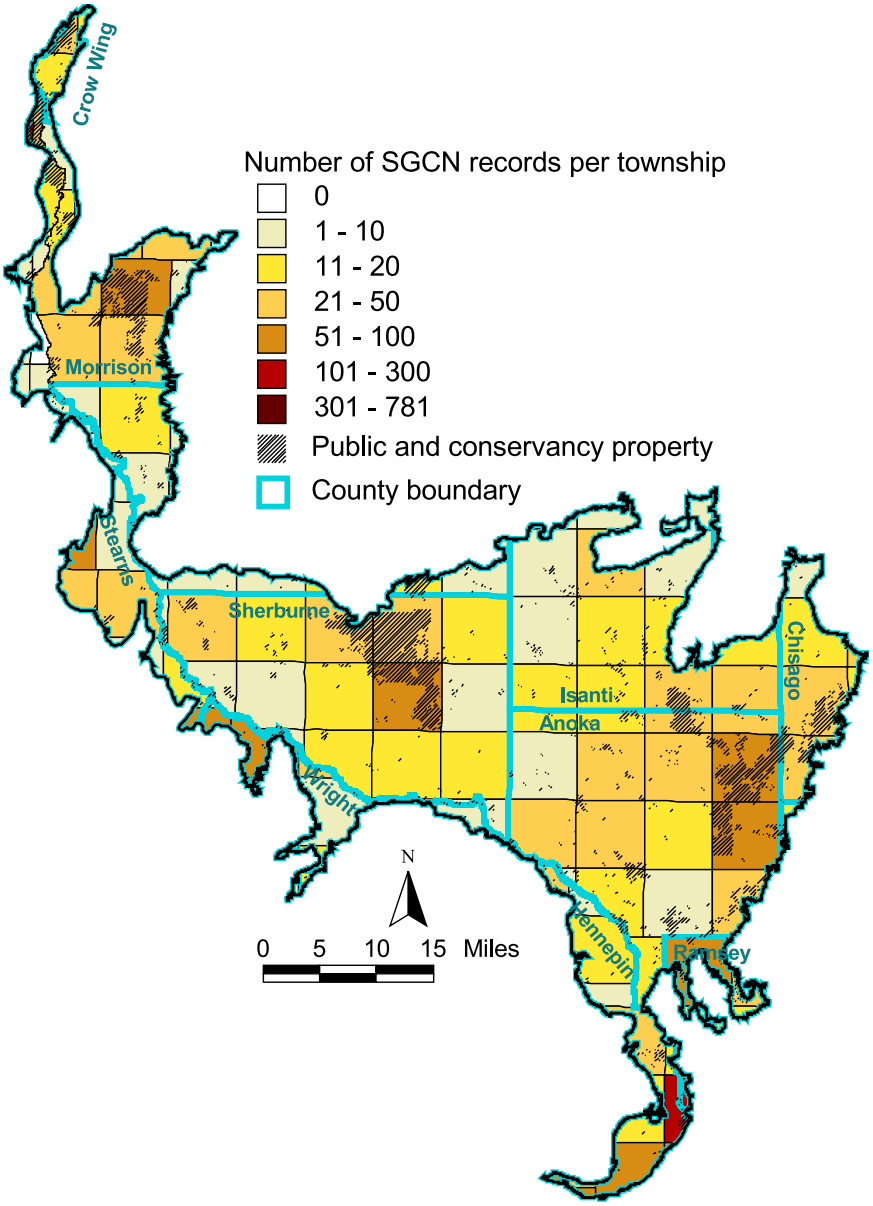
Abundance Abundant in some localized areas of SE MN, but also regularly encountered in the Anoka Sand Plain and recently found to be more common than previously known along small streams adjacent to prairies and grasslands of SW MN. Reasons for decline include changes due to land use, urban sprawl into 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 $p<0.01$.

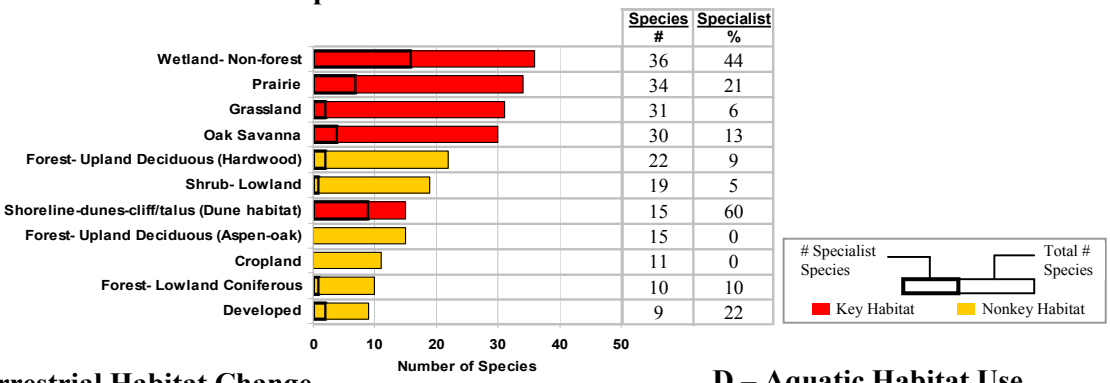
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

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).

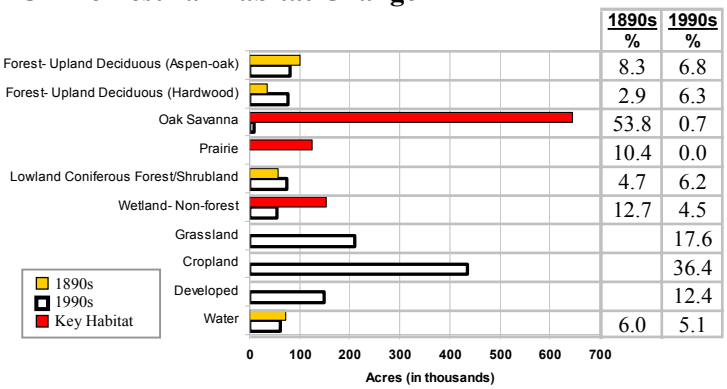
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with $p<0.01$ of all subsections.

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).

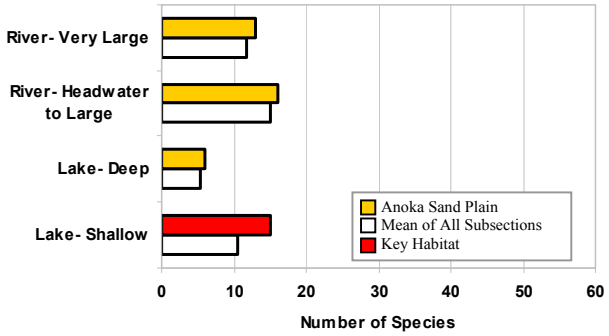
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



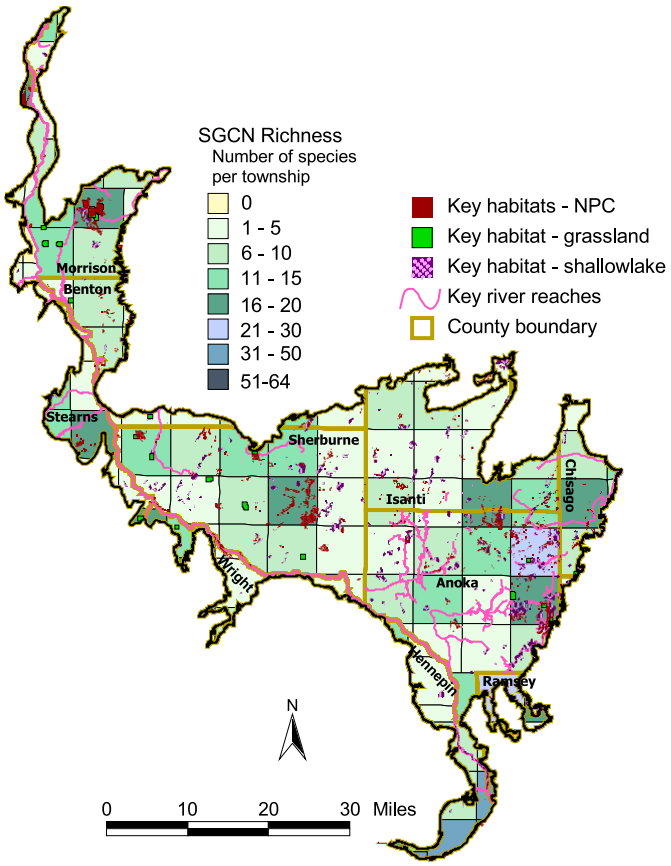
D – Aquatic Habitat Use



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

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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.

Appendix H
High Conservation Value Forest Fact Sheet

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.

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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.

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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).

APPENDIX I
Wildlife Habitat Relationships

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>>>																															
				Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores								Up. coniferous/deciduous mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mi		Forest type size class				
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
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/Catte	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 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	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>>

Non-Forested 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	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	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				
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 sh	Lowland evergreen sh	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>>> | 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 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 mi	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 m		Seedling	Sapling	Pole timber	Saw timber	Uneven
				Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores									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>>>

SPECIES GROUP Species Common Name	Habitat feature	Barren	Urban/			Ag./Gra			Shrub			Aquatic			Upland Coniferous Fores								Lowland Coniferous							Upland					Lowland				Forest size				
			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
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>>> | 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
NUTHATCHES																																														
Red-breasted Nuthatch	CS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
White-breasted Nuthatch	CS																															Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
CREEPERS																																														
Brown Creeper	CS																																				Y	Y		Y	Y			Y	Y	Y
WRENS																																														
House Wren	CS			Y					Y	Y																						Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			
Sedge Wren							Y	Y		Y				Y	Y											Y		Y		Y	Y															
Marsh Wren	R									Y		Y		Y	Y																															
KINGLETS																																														
Golden-crowned Kinglet																Y	Y	Y	Y	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										Y			Y	Y	Y
Blue-gray Gnatcatcher																																Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
THRUSHES																																														
Eastern Bluebird	CS			Y			Y	Y	Y	Y																						Y	Y	Y	Y	Y						Y				
Veery	M															Y								Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Swainson's Thrush	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y									Y			Y	Y	
Hermit Thrush	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Wood Thrush	M			Y																				Y								Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y
American Robin	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
MIMICS AND THRASHERS																																														
Gray Catbird	MR			Y					Y	Y	Y															Y		Y		Y	Y	Y	Y	Y	Y	Y						Y	Y			
Brown Thrasher	M			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	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		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	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>>>

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
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				
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		
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	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>>>																															
				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 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 mi	Low. deciduous/coniferous mi		Seedling	Sapling	Pole timber	Saw timber	Uneven
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
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	Y
Plains Pocket Gopher							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
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	
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				Y	Y	Y	Y	Y												

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:

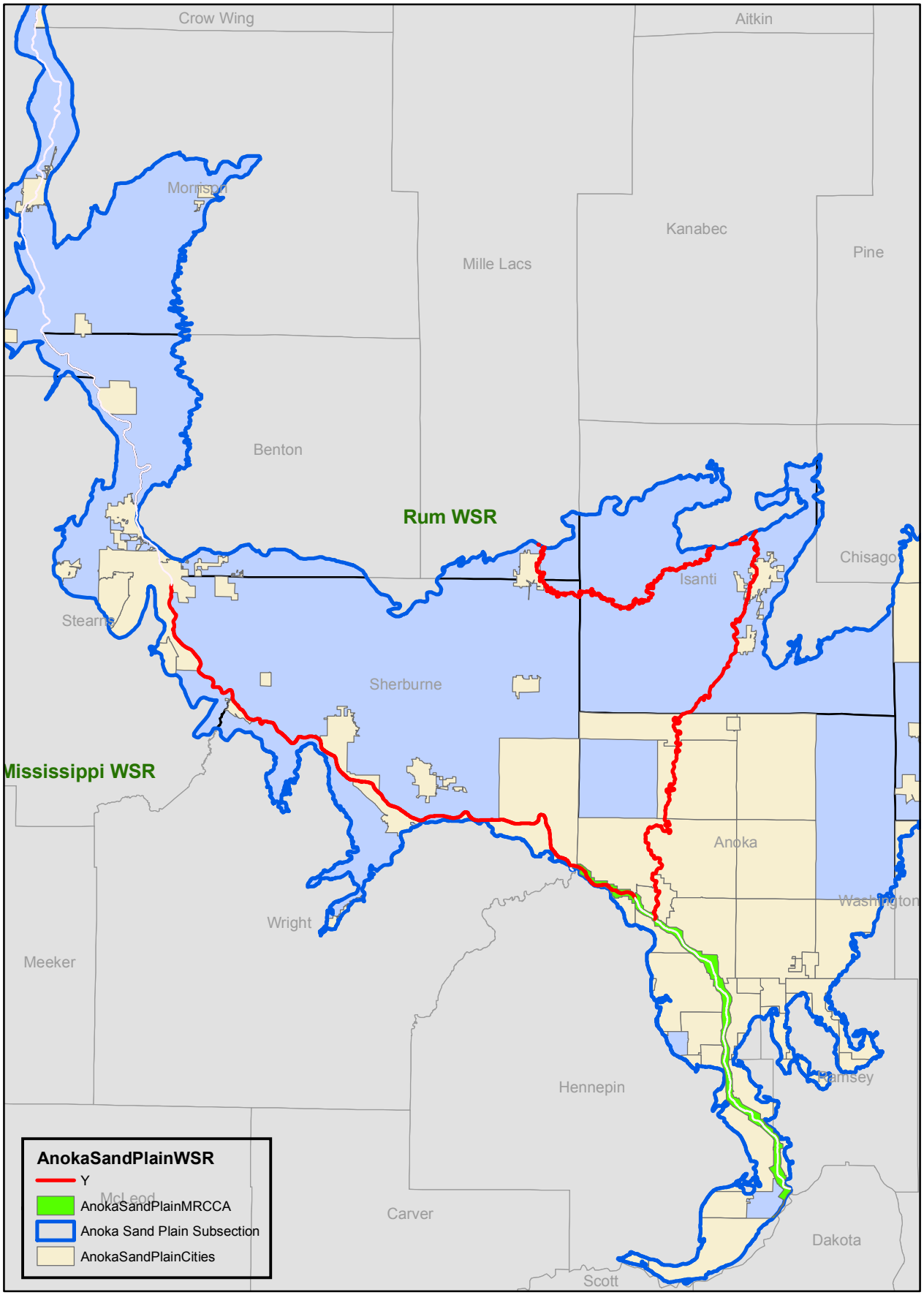
1. Zoning Ordinance (overlay districts): http://library.municode.com/index.aspx?clientId=11490&stateId=23&stateName=minnesota&ds=zoning

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.

Relevé϶s: 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.