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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DNR Personnel Involved in Developing the SFRMP

Anoka Sand Plain SFRMP Team Members

Division of Forestry

Lance Sorensen, Timber Program Staff, Central Region
Don Mueller, Cambridge Forestry Area Supervisor
Robert Quady, Forester, State Land Program Forester, Cambridge Area

Division of Fish and Wildlife

Bryan Lueth, North Metro Wildlife Supervisor
Dan Rhode, Manager Carlos Avery Wildlife Management Area
Nicholas Snavely, Assistant Area Wildlife Manager, Sauk Rapids Area

Division of Ecological and Water Resources

Hannah Texler, Regional Plant Ecologist, Central Region

Field Participants

Beau Liddell, Little Falls Wildlife Area Supervisor
David Pauly, Cambridge Wildlife Area Supervisor
John Korzeniowski, Little Falls Forestry Area Supervisor
Erica Hoaglund, Central Region Non-Game Specialist
Curtis Vanderschaaf, Forest Modeler
Kate Drewry, Area Hydrologist, Central Region

Geographic Information Systems support

Tom Engel, Project Consultant, Northeast Region

Planning support

Robert Pulford, SFRMP Planner, Brainerd

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 website for ASP SFRMP

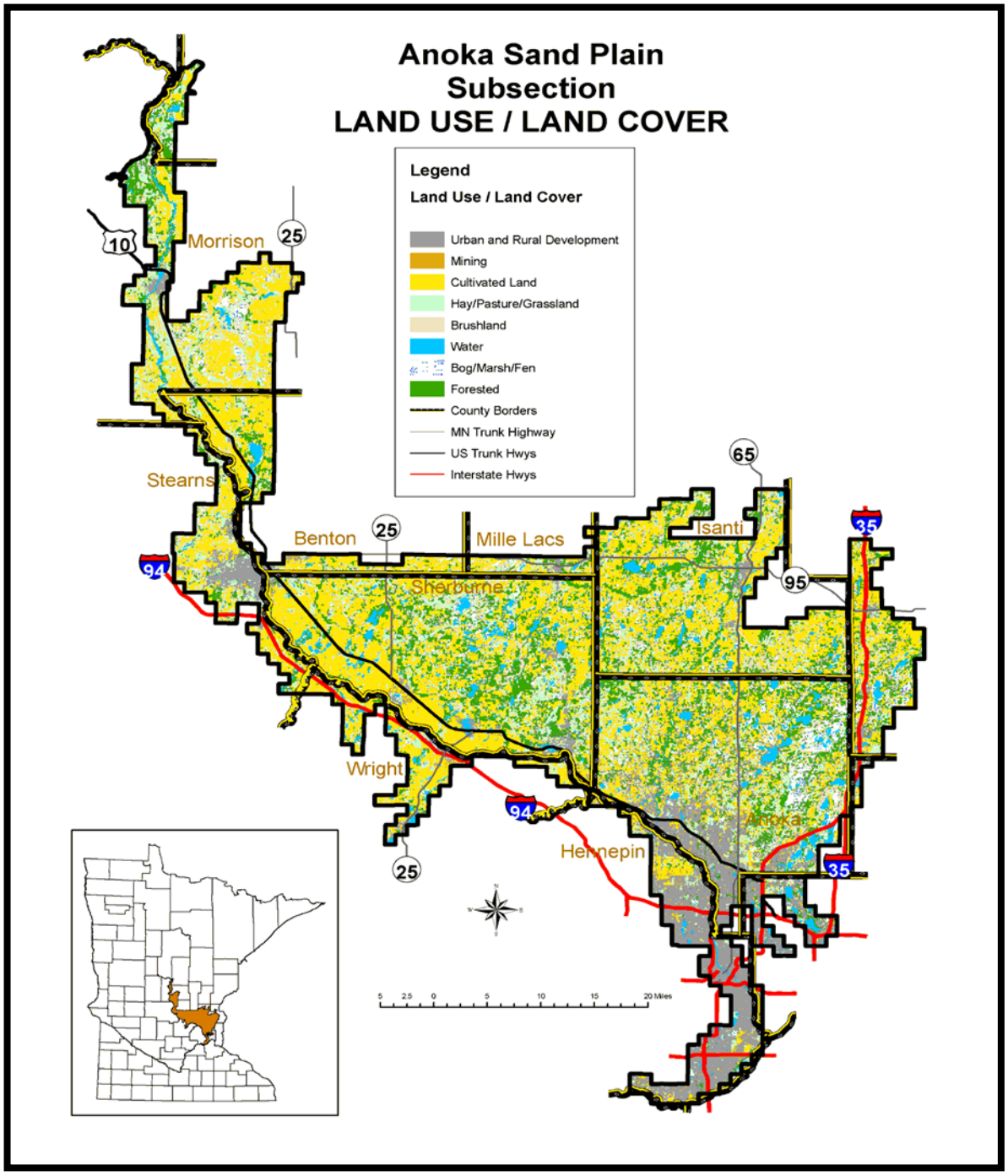
Map 1.1 (Anoka Sand Plain Land Use / Land Cover) identifies the overall land use pattern that exists in the ASP subsection. It shows the majority of lands are in urban lands uses, cultivated lands, hayland/pasture/grasslands, brushlands, and bog/marsh/fens. As shown only a minor portion of lands are 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: website for ASP SFRMP.

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.

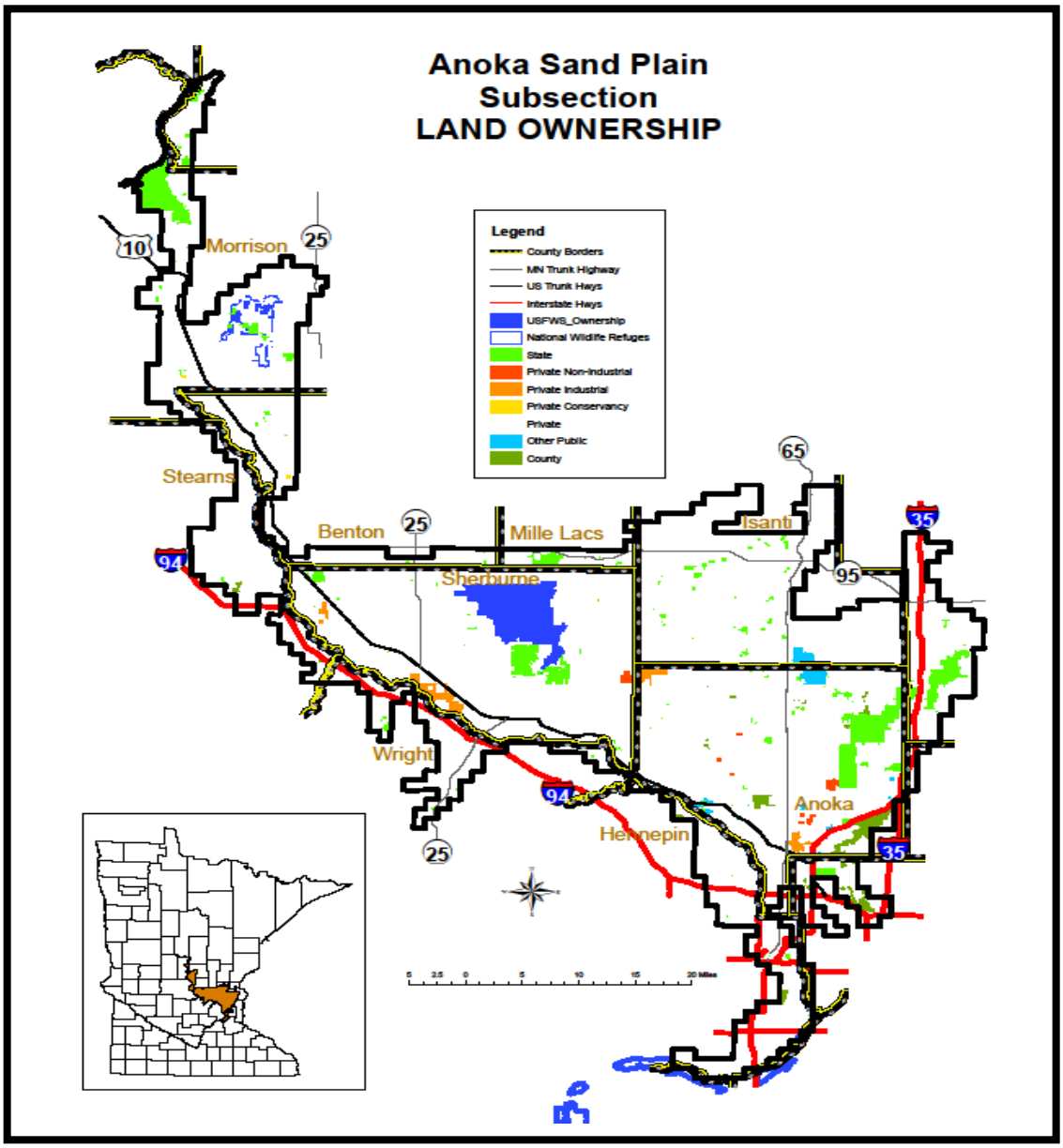
1.3 Scope of the Subsection Forest Resource Management Plan

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: website for ASP SFRMP.

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 T**he 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

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.

	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.

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.

	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**	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

	subsection.	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 Pla*n (see Appendix C. The directions contained in the *Operational Plan* result from guidance provided by Department management.

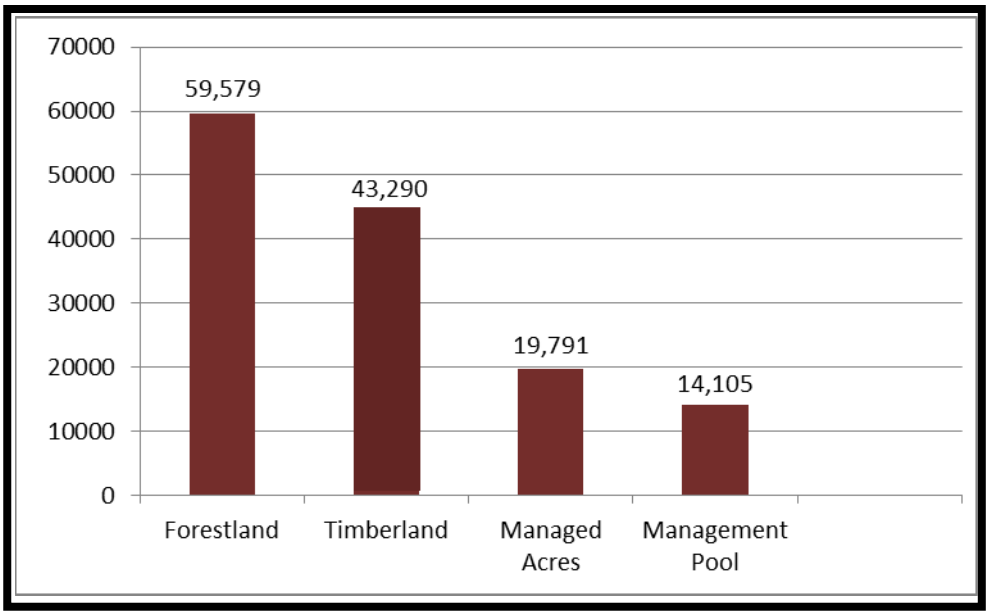
In situations where there is currently an ability to measure and quantify progress, goals were identified. Examples of goals are: cover-type acres, age-class distribution, and cover-type treatment levels (e.g., harvest levels). Goals, General Direction Statements and Strategies (Chapter 3), were used 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

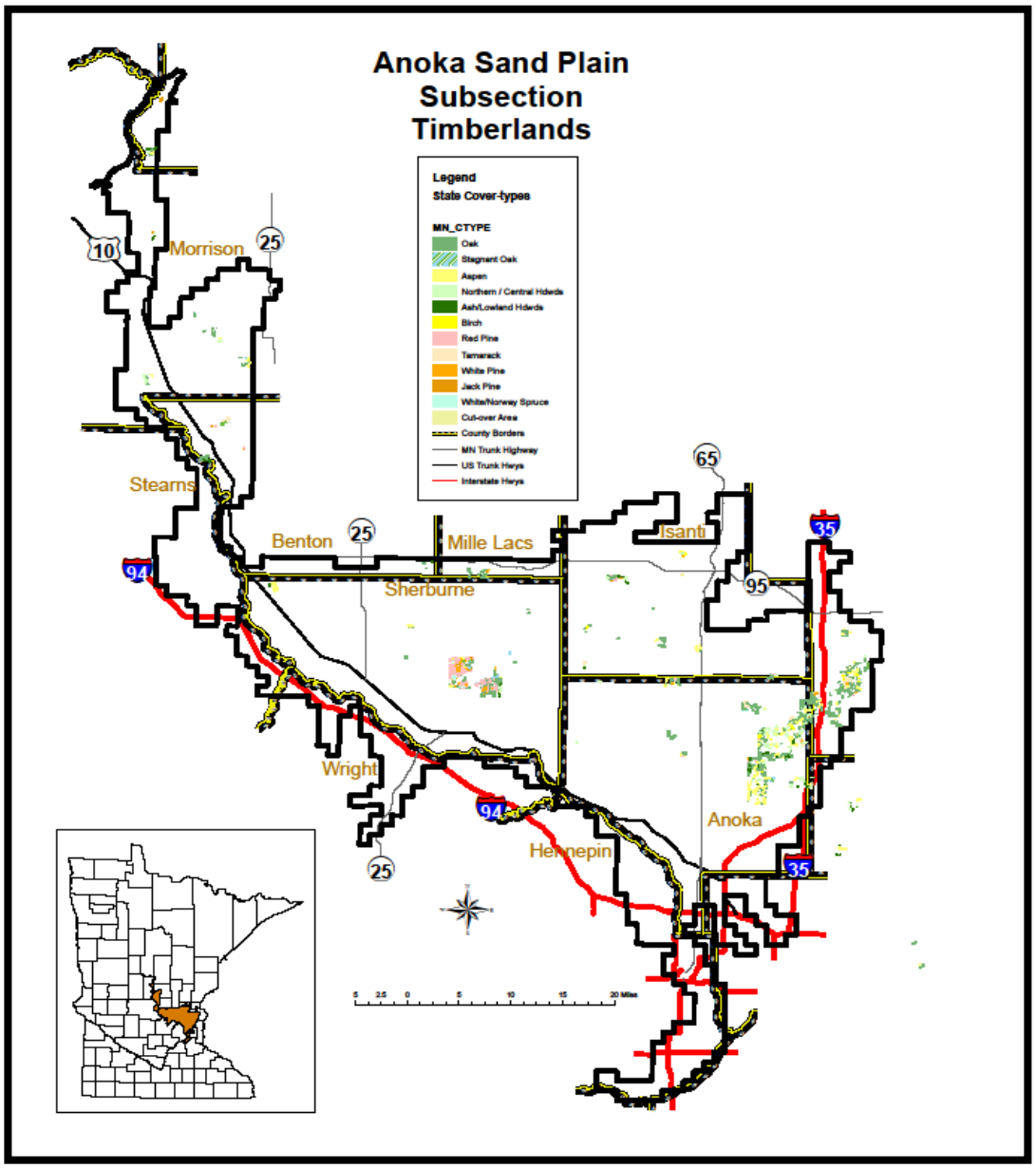


Forestland (59,579 acres) consists of all lands included in the DNR forest stand inventory (i.e., Cooperative Stand Assessment, or CSA), including cover-types from aspen to stagnant conifers, muskeg, lowland brush, and other wetlands. These are basically Department administered lands. As a category *forestland* 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: website for ASP SFRMP.

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.

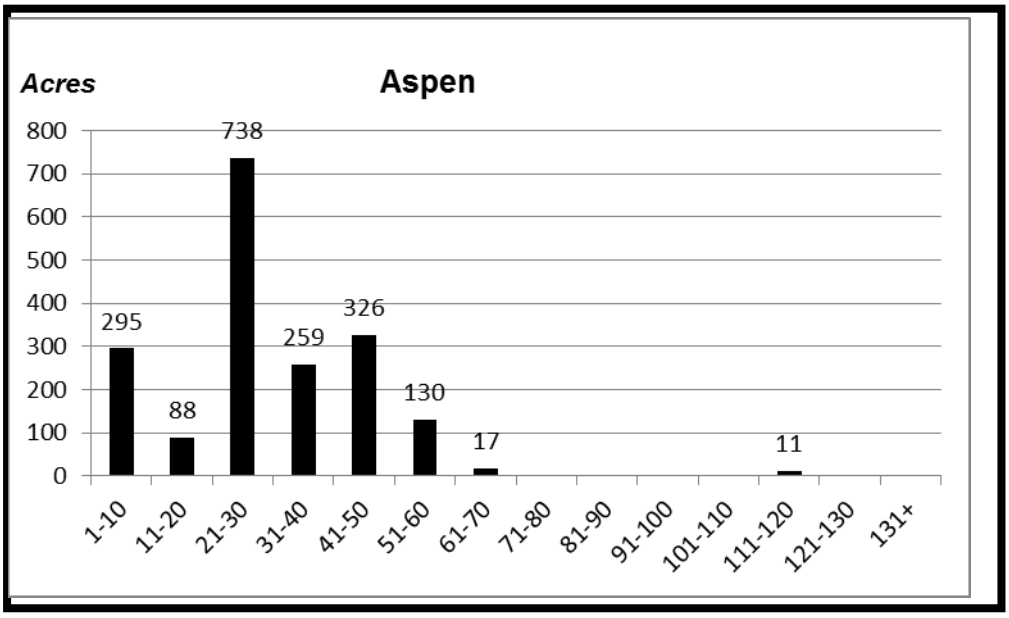
Native Plant Communities:

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.

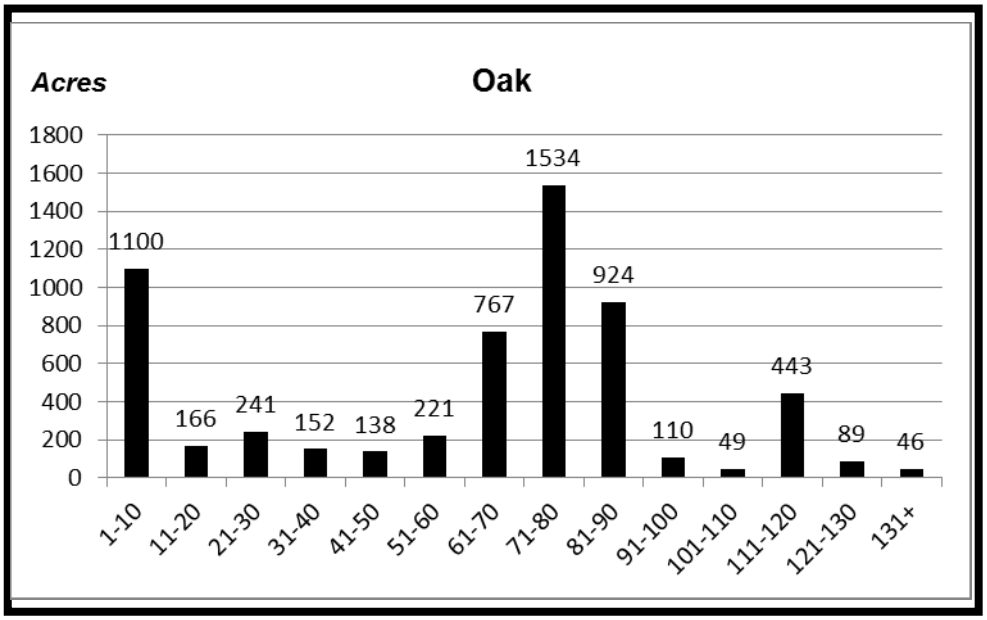
Stand Composition:
The oak cover-type in the ASP includes northern red oak, bur oak, northern pin oak and white oak. Oak species are commonly found as a component of other cover-types such as aspen and northern hardwoods, but sometimes are pure stands. Natural, mature oak stands range from nearly pure 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

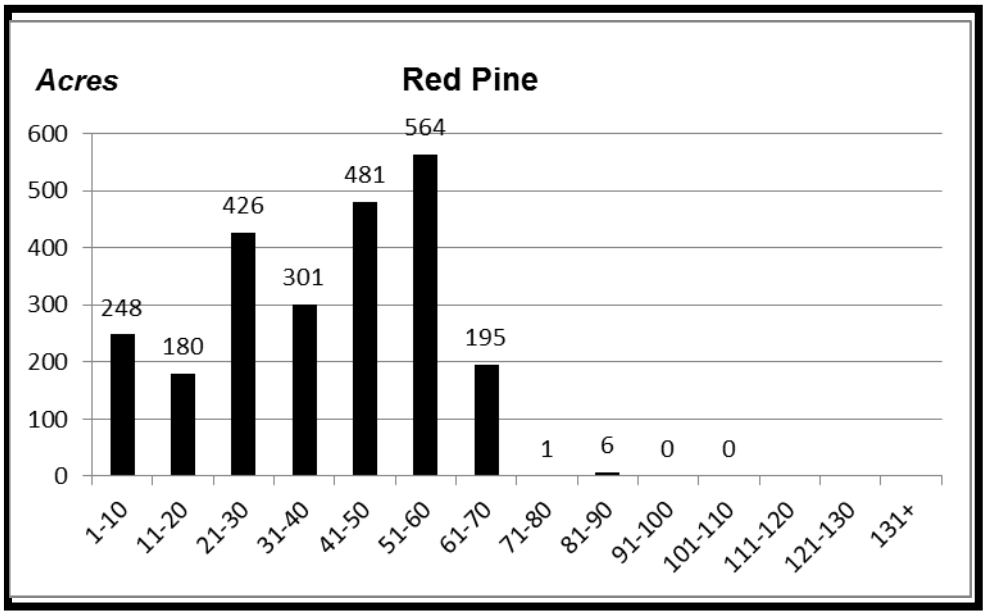
Cover-type Acres:
Red pine is a major cover-type in the ASP subsection with approximately 2,402 acres which represents approximately 17 percent of the management pool acres.

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

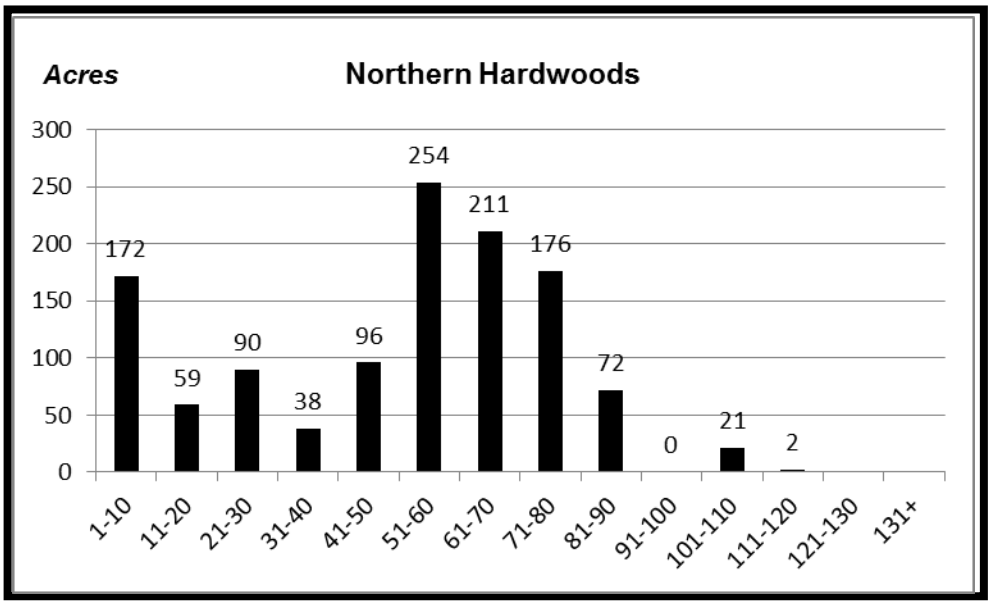
Current Conditions

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.

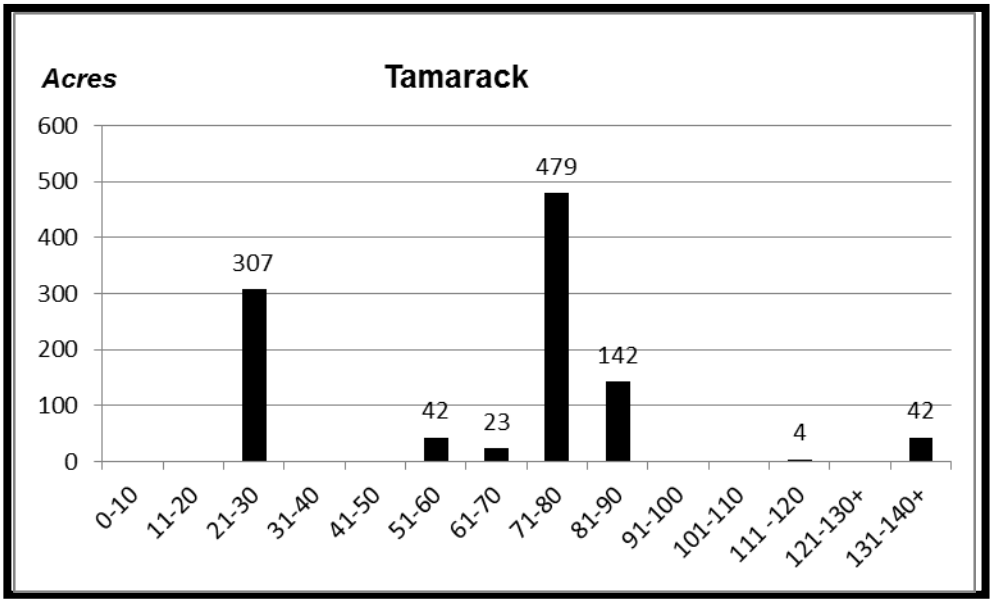
These acres also include a small amount (30 acres) of European larch that was planted in the Sand Dunes State Forest. This is non-native to the ASP and was planted as an experiment to see how it would perform in the sand. Some of it has since been inter-planted with pine and some of it has pine seeding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

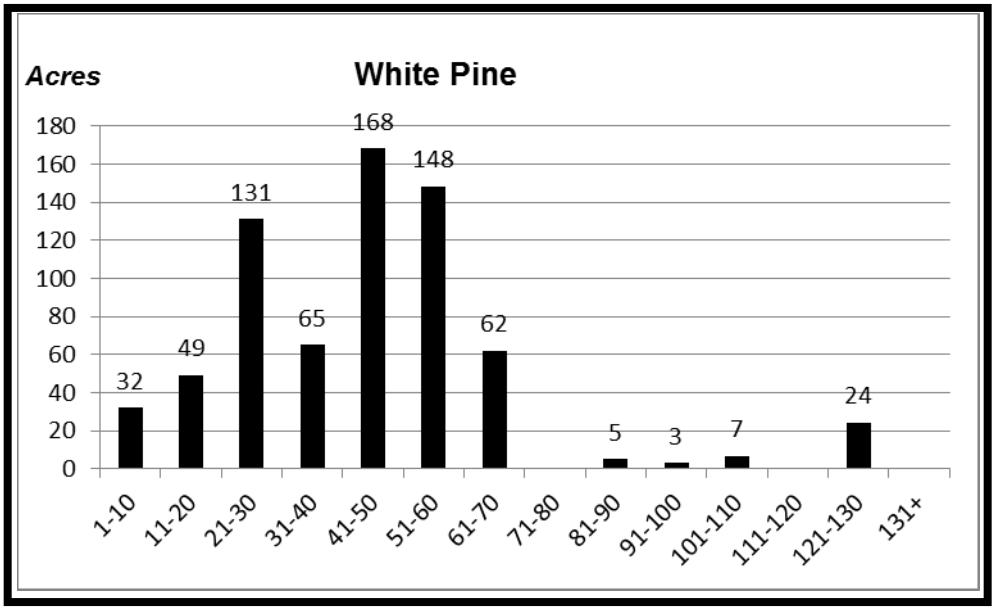
The age class distribution of white pine in this subsection is the result of planting white pine as lands were acquired in the Sand Dunes State Forest. White pine was a highly sought after tree by the early timber industry in Minnesota. Commercial logging of white pine began in 1839 at Marine on St Croix.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

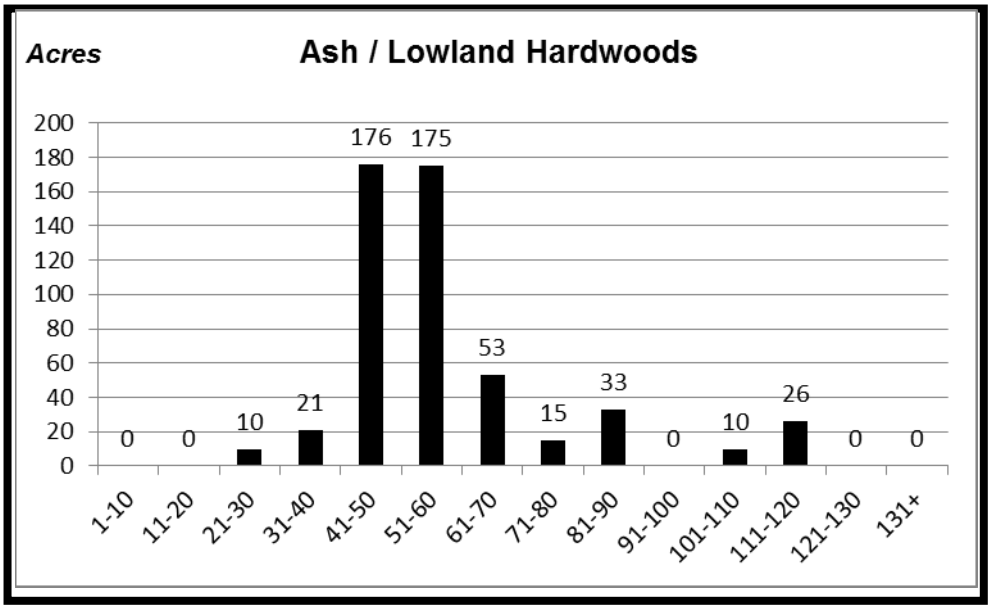
Cover-type Acres:
These cover-types are combined into one management category because they are managed under the same management prescriptions. Ash/lowland hardwoods (Ash/LH) make up approximately 568 acres or 4 percent of the total timberland acres in the ASP subsection.

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:
website to find ash management guidelines

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.

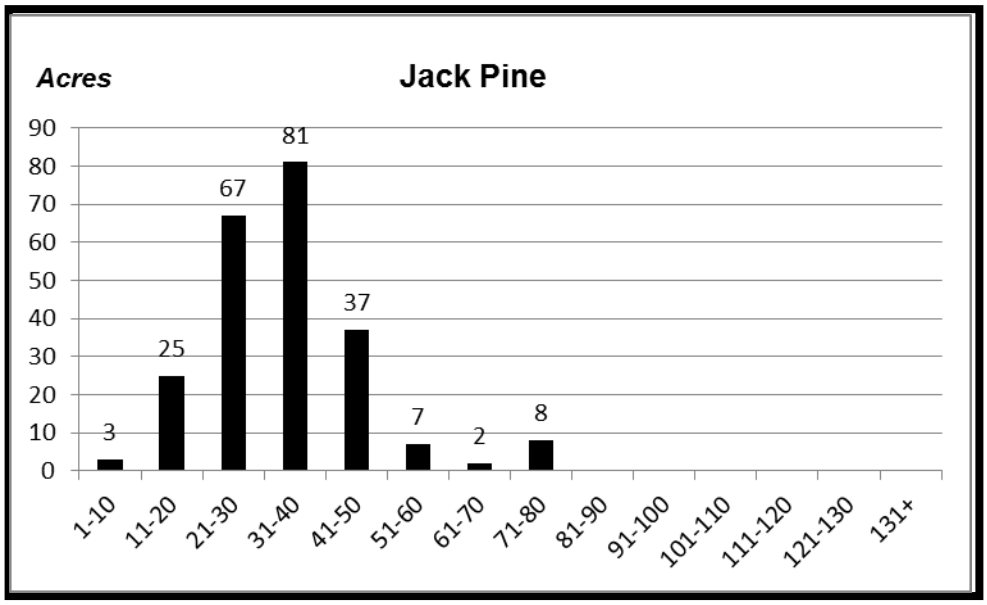
Stand Composition:
The majority of jack pine stands result from plantations or natural seeding from plantations. The exception is found in the northern portions of the ASP (Crow Wing County) where natural stands of jack pine can be found. Typical secondary species in jack pine plantations are: red pine,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

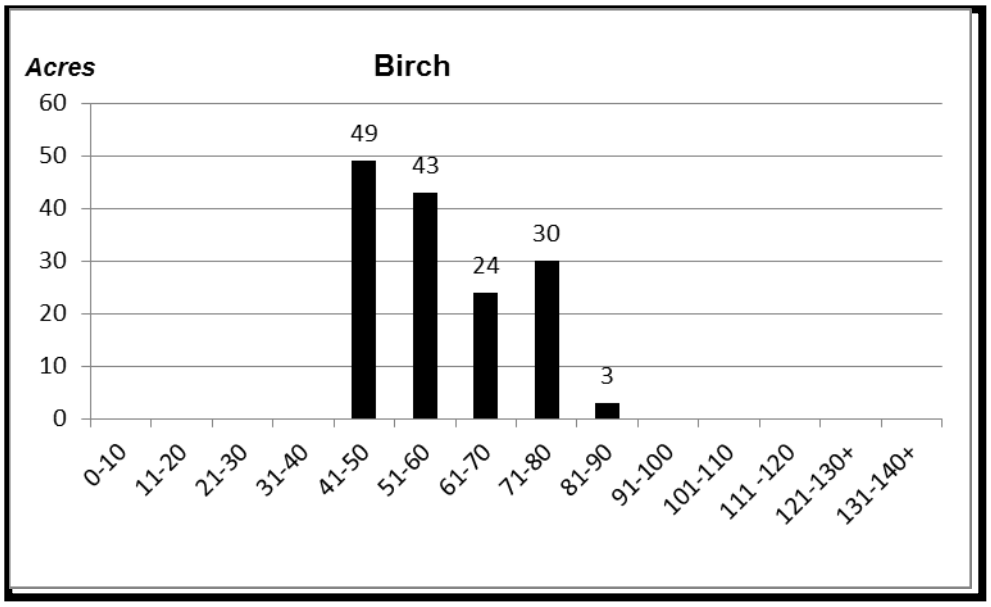
Cover-type Acres
The birch cover-type most often refers to stands of paper and yellow birch within the planning area. Birch accounts for a very minor portion of the management pool (149 acres) within the ASP subsection.

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.

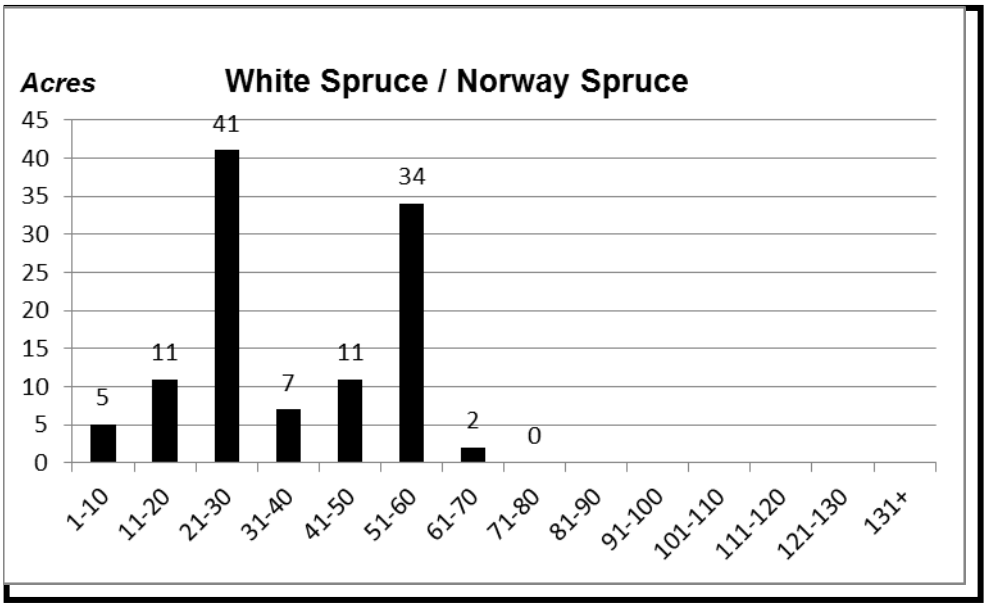
Age-Class Distribution:
The age-class distribution on the chart reflects these various planting periods, noted also in the red pine discussion above. The spikes are exacerbated by the relatively small amount of acreage and represent a few plantations. Upon maturity these pure stands will be converted 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: website to find forest management direction and policy

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.

[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.

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.

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] MFRC biomass harvesting guidelines

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:

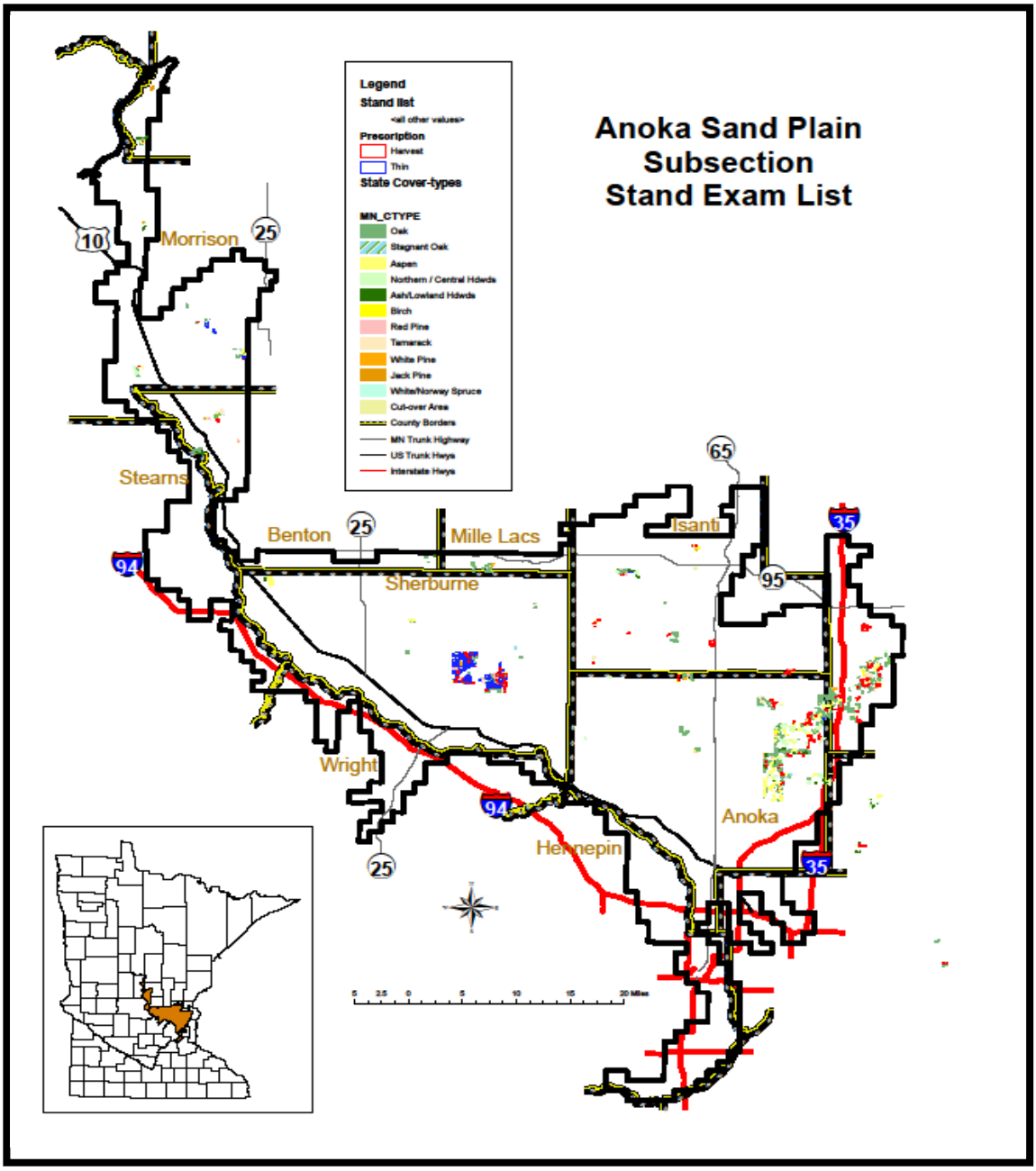
- 1100 - Even-Aged Regen Harvest
- 1110 - Clearcut Removal or Felling
- 1111 - Clearcut with Reserves
- 1116 - Clearcut-Natural Seeding Removal or felling
- 1117 - Clearcut with Reserves Natural Seeding
- 1120 - Clearcut with Seed Trees
- 1212 - Clearcut with Reserves Sprouting
- 1810 - Commercial Thinning
- 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: website for ASP SFRMP.

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 forest products and utilization 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 old growth policy

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.

[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.

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)
- 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: forest management direction and policy

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.

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

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

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:
ECS silviculture interpretations

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.

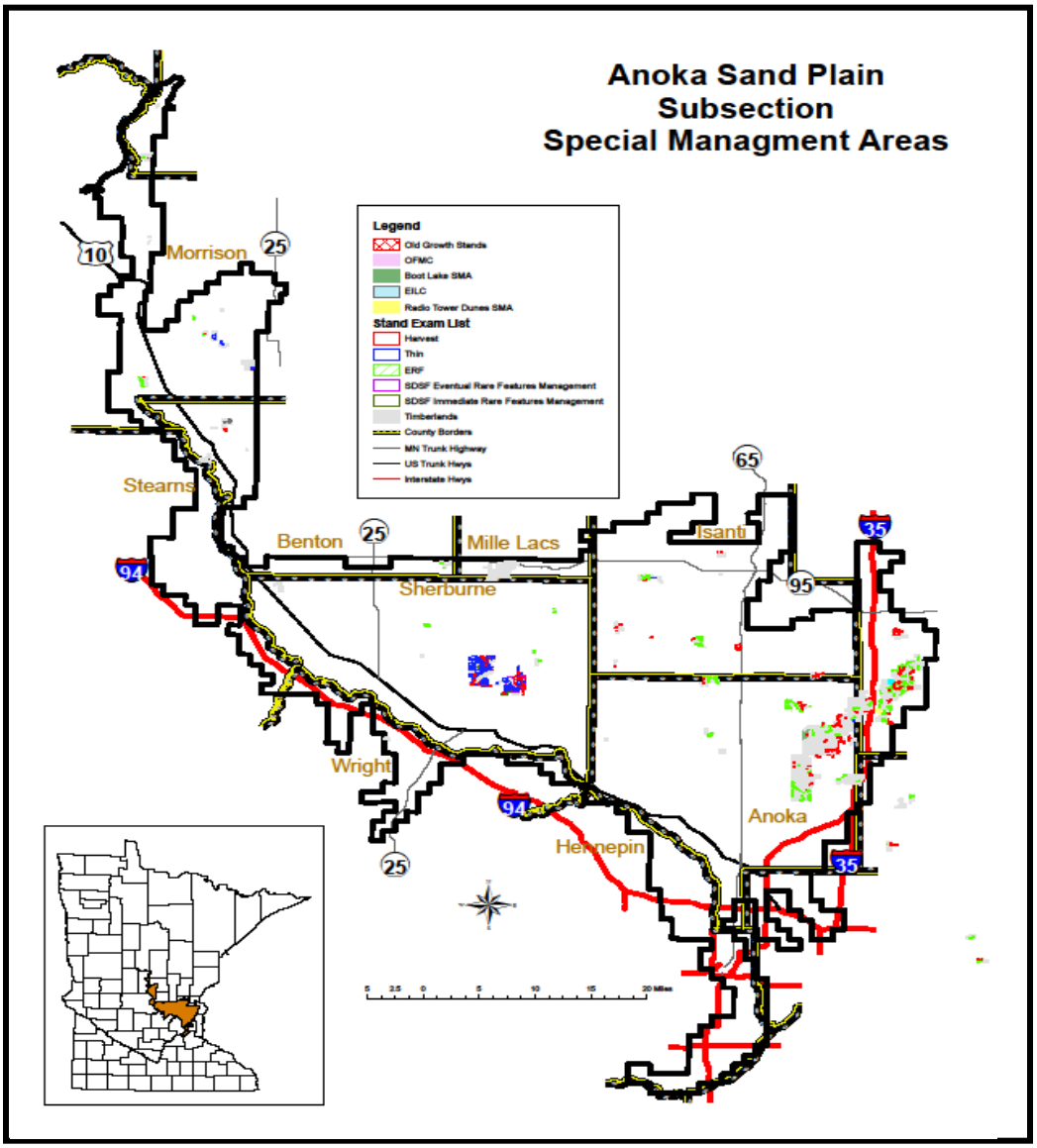
1. **Radio Dunes SMA** is located in the Carlos Avery Wildlife Management Area (WMA), east of a prominent radio tower. This SMA includes dune formations, Dry Barrens Oak Savanna, and two state-listed rare species: beach heather *(Hudsonia tomentosa)*, and the northern barrens tiger beetle *(Cincindela 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: Comprehensive Wildlife Conservation Strategy

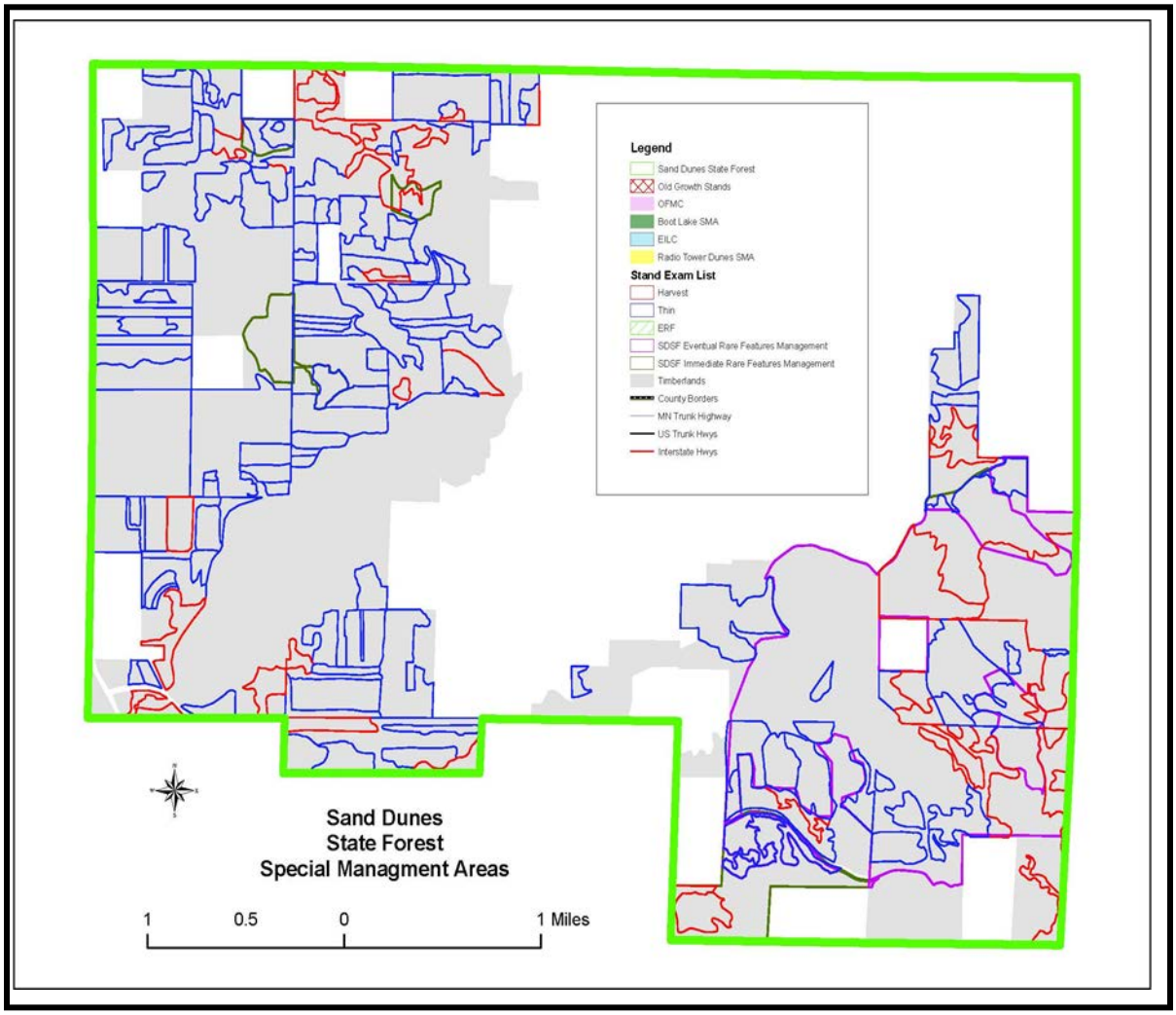
Map 3.3 Special Management Areas - Anoka Sand Plain



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: webpage for ASP SFRMP.

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.

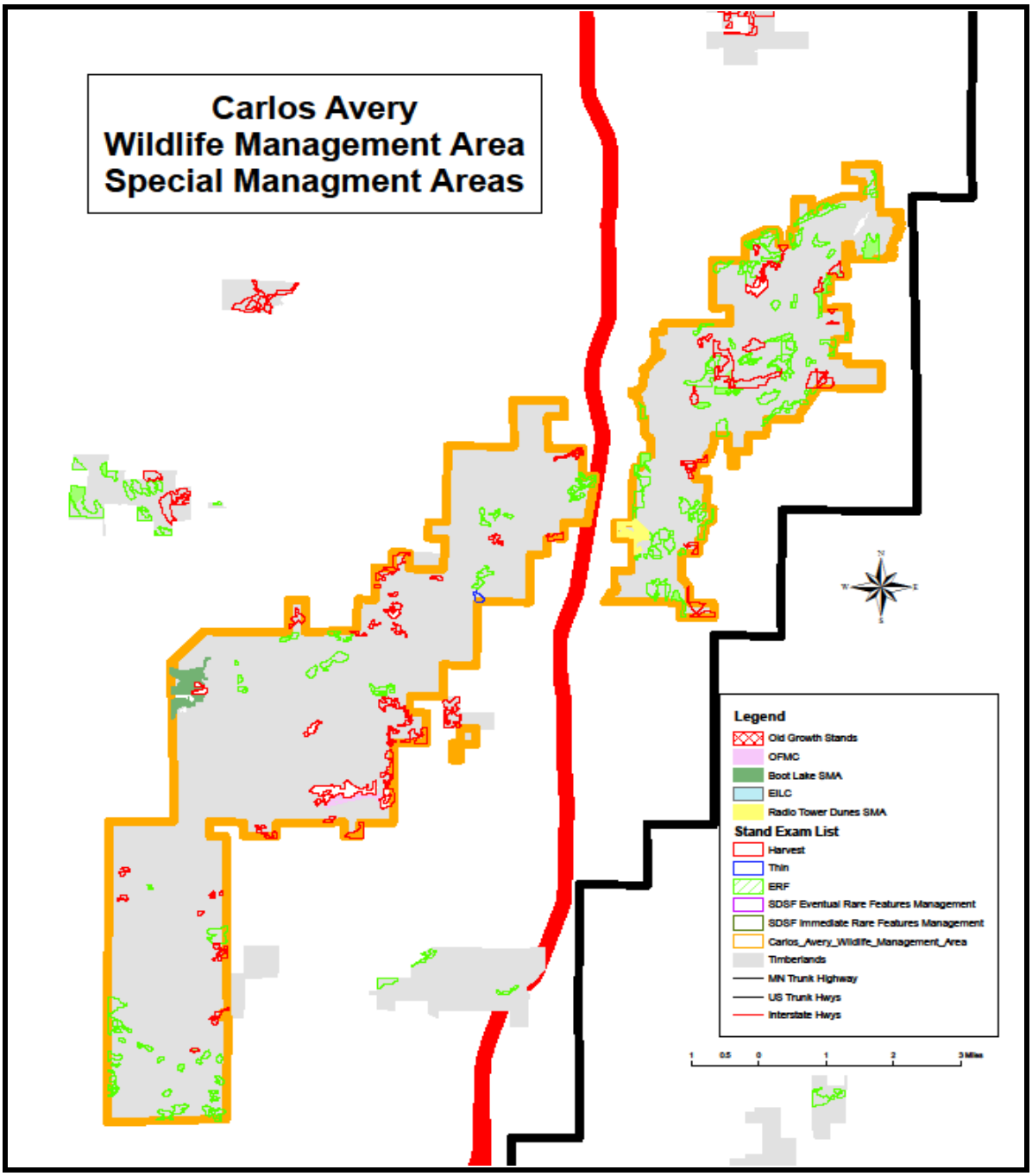
Map 3.4 Sand Dunes State Forest - Special Management Areas



Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: webpage for ASP SFRMP.

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: webpage for ASP SFRMP.

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: rare species guide

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: NRRI annual report

[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
- BWSR invasive species guides

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: MNDNR forest legacy

- 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 lacks adequate regeneration, silvicultural techniques will be used that result in a more fully stocked stand.

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

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
- UPs24aMesic 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, 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 (2011).

Likewise, the Fire Research and Management Exchange System (FRAMES) web page 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 lake states fire research 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:

- MNDNR prescription fire forms, which contains the:
- *Minnesota Department of Natural Resources Prescribed Burn Handbook* and
- *Operational Order #47: Prescribed Burn Guidelines*:

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* 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: rare species guide 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 Minnesota's endangered, threatened and special concern species (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). 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.

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-

[27] Minnesota Department of Natural Resources, *Directions 2000: The Strategic Plan*, Objective 3.3, p22.

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**	**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**
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Appendix	**L**	**Comments Received on the Draft ASP SFRMP and Responses to Comments Received**
Appendix	**M**	**Glossary**
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