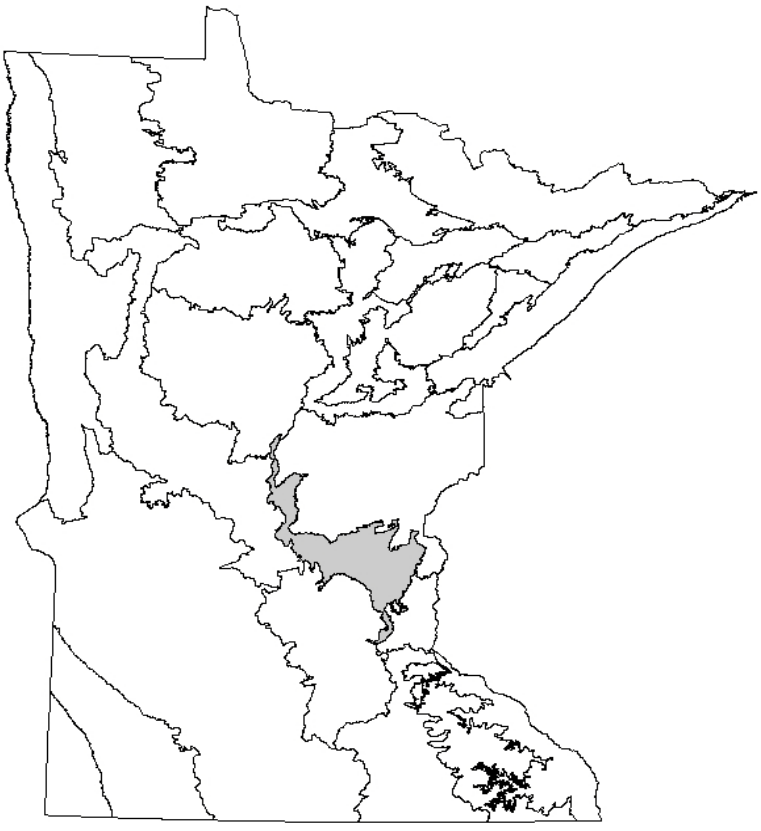
Anoka Sand Plain

Subsection Forest Resource Management Plan

Preliminary Issues and Assessment



Minnesota Department of Natural Resources
August 2011

Division of Forestry Planning Document

Prepared August 2011

Notes relating to this document:
This Preliminary Issues and Assessment document and color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at:
www.dnr.state.mn.us/forestry/subsection/anoka/index.html

Information about the Division of Forestry Subsection Resource Management Plan (SFRMP) process can be found at:
http://www.dnr.state.mn.us/forestry/subsection/index.html

This information is available in an alternative format on request.

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

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CHAPTER 1

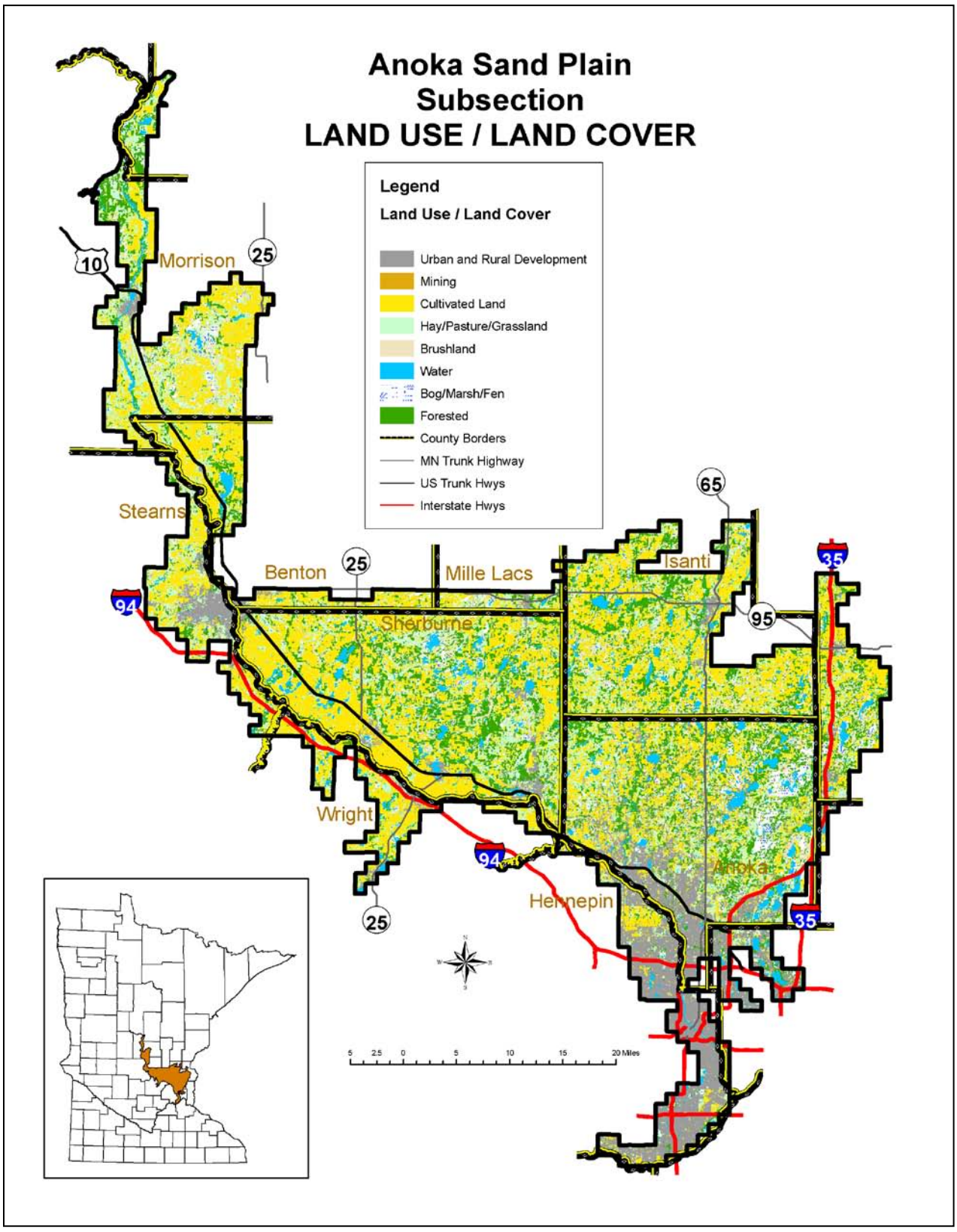
Background and Preliminary Issues

1.1 Background: Description of the Planning Area

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 eleven counties (Crow Wing, Morrison, Stearns, Benton, Wright, Sherburne, Mille Lacs, Isanti, Anoka, Chisago and Hennepin) the vast majority of timberlands subject to this SFRMP are located in: Morrison, Sherburne, Anoka, Isanti and Chisago counties.

Land development in this subsection is characterized by the northern area of the Twin Cities Metropolitan Area, combining with the growth and development associated with the St. Cloud metropolitan area. Primary land uses consist of developed land (urban, residential, commercial uses) associated with these growing metropolitan areas. Public agencies administer approximately 10 percent of the land area. State administered lands total approximately 67,000 acres or 5 percent of the total land area. Of this, approximately 14,300 acres (1 percent) of the total land area is classed as timberland that will be considered for wood products production and other resource management objectives in this Anoka Sand Plain SFRMP. The federal government administers approximately 46,000 acres (3.5 percent). These federal lands are primarily made up of the Sherburne National Wildlife Refuge and the Crane Meadows National Wildlife Refuge, both managed by the U.S. Fish and Wildlife Service. Other public lands such as state parks, lands managed by the University of Minnesota (Cedar Creek Natural History Area), county administered lands (county parks) and other federal lands are not considered in this SFRMP for purposes of vegetation management.

Map 1.1 Anoka Sand Plain Land Use / Land Cover



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

1.2 Subsection Forest Resource Management Planning

1. Introduction

Traditionally, the Minnesota Department of Natural Resources (DNR) directed timber harvesting on lands it administered through 5-year to 10-year forest resource management plans developed for each of its administrative forestry areas. Opportunities for public involvement were limited in the development and review of these timber management plans.

In response to growing public interest in DNR timber management planning, the DNR Subsection Forest Resource Management Plan (SFRMP) process was designed to provide a more standardized, formal process and opportunities for increased public involvement. In addition, it is based at the subsection level of the DNR's ecological classification system (ECS) rather than DNR administrative areas as in the past (i.e., DNR area forestry boundaries).

The SFRMP process is divided into two phases. In Phase I, the subsection team will identify important forest resource management *issues* that need to be addressed in the subsection plan and *assess* the current forest resource conditions in the subsection. In Phase II, the subsection team will develop recommended strategies to address these issues and help shape the desired future forest composition goals and stand-selection criteria. The DNR will seek public input during each phase.

2. Goals for the Planning Effort

SFRMP will constitute DNR planning for *vegetation management* on state forest lands administered in the subsections by the Divisions of Forestry and Management Section of Wildlife. The focus of this effort will be:

- **Identifying a desired future forest composition (DFFC)** for 50 years or more. Composition could include the amount of various cover types, age-class distribution of cover types, and their geographic distribution across the subsection. The desired future forest composition goals for state forest lands in the subsection will be guided by assessment information, key issues, general future direction in response to issues, and strategies to implement the general future direction.

- **Identifying forest stands to be treated over the next 10-year period.** SFRMPs will identify forest stands on DNR Forestry- and Wildlife- administered lands that are proposed for treatment (e.g., harvest, thinning, regeneration, and re-inventory) over the 10-year planning period. Forest stands will be selected using criteria developed to begin moving DNR forest lands toward the long-term DFFC goals. Examples of possible criteria include stand age and location, soils, site productivity, and size, number, and species of trees. 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 various sizes of patch management; 4) management of riparian areas and visually sensitive travel corridors; 5) age and cover-type distributions; and 6) regeneration, thinning, and prescribed burning needs. The DNR will select management activities (including "no action") that best move the forest landscape toward the DFFC goals for state forest lands.

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

3. Process

The objectives of the DNR SFRMP process are:

- To effectively inform and involve the public and stakeholders.

- To complete the process in each ecological classification system (ECS) subsection within a reasonable amount of time (the target is to complete a SFRMP plan in 12 months).
- To conduct a process that is reasonable and feasible within current staffing levels and workloads.
- To develop plans that are credible to stakeholders and enables good forest management.

Experience, new information, new issues, changing conditions, and the desire to broaden the focus of SFRMP in the future will demand a flexible and adaptable process. The plans will need to be flexible to reflect changing conditions. The SFRMP process will provide for annual reviews by DNR planning teams for the purpose of monitoring implementation and determining whether plans need to be updated to respond to unforeseen substantial changes in forest conditions.

DNR subsection teams will include staff from the DNR Divisions of Forestry and Fish and Wildlife, as well as the section of Ecological Services and other agency staff as needed. These subsection teams will have primary responsibility for the work and decision-making involved in crafting subsection plans.

The subsection team considers and coordinates with forest management plans of other agencies and levels of government that may affect management on state lands to be included in the ASP SFRMP. This information will help the DNR make better decisions on the forest lands it administers. In the Anoka Sand Plain subsection, the goals, strategies, and coordination efforts of the Minnesota Forest Resources Council (MFRC) East Central Landscape Committee will be considered and incorporated into the ASP SFRMP.

In the first phase of the SFRMP process, the subsection team will 1) identify important forest resource management issues that will need to be addressed in the subsection plan and 2) develop an assessment of the current forest resource conditions in the subsection. The assessment document developed by the team will consider at least eight basic elements (i.e., chapters in this document):

- Land ownership and administration
- Land use and cover
- Forest composition and structure
- Timber harvests
- Ecological information
- Stand damage and mortality
- Wildlife species

In Phase II of the SFRMP process, the subsection team will 1) finalize the issues, 2) determine general future direction in response to the issues, 3) identify DFFC goals, 4) develop strategies to implement the general future direction, and 5) develop the stand-selection criteria for determining the stands and acres to be treated over the next 10 years.

4. Relationship of SFRMP to Other Landscape-Level Planning Efforts.

1. Minnesota Forest Resource Council (MFRC) Landscape Planning Efforts

The 1995 Sustainable Forest Resources Act (Minn. Stat. Chapter 89A) directed the MFRC to establish a landscape-level forest resources planning and coordination program to assess and promote forest resource sustainability across ownership boundaries in large forested landscapes.

Volunteer, citizen-based regional forest resource committees are central to carrying out the general planning process. Within each landscape region, committees of citizens and representatives of various organizations work to:

- Gather and assess information on a region's current and future ecological, economic, and social characteristics;
- Use information about a region to identify that region's key forest resource issues;
- Plan ways to address key issues in order to promote sustainable forest management within the region; and,
- Coordinate various forest management activities and plans among a region's forest landowners and managers in order to promote sustainable forest management.

The MFRC East Central Regional Landscape encompasses much of the Anoka Sand Plain subsection. Recommended "desired outcomes, goals, and strategies" for the East Central Landscape were completed in March 2005. These recommendations will be considered and incorporated into the SFRMP process. This information will help the DNR make better decisions on DNR administered lands and assist in cooperating with management in the larger landscape.

For more information on the MFRC landscape planning and coordination program, visit the MFRC Web site at: http://www.frc.state.mn.us

2. Sherburne National Wildlife Refuge Comprehensive Conservation Plan
This plan articulates the management direction for the Sherburne NWR for future years. Through the development of goals, objectives, and strategies, this plan describes how the Refuge contributes to the overall mission of the National Wildlife Refuge System. Several legislative mandates within the National Wildlife Refuge System Improvement Act of 1997, and principles identified in "Fulfilling the Promise" (a strategic vision document for the Refuge System) have guided the development of this plan. These mandates and principles include:

- Wildlife has first priority in the management of refuges.
- Wildlife-dependent recreation activities, namely hunting, fishing, wildlife observation, wildlife, photography, environmental education and interpretation are priority public uses of refuges. The US Fish and Wildlife Service will facilitate these activities when they do not interfere with our ability to fulfill the Refuge's purpose or the mission of the Refuge System.

3. Restoration/Enhancement in the Anoka Sand Plain
The Anoka Sand Plain Habitat Partnership draws on the expertise, resources, and connections of a broad community of conservation stakeholders with the goal to restore and enhance oak savannas, woodlands and forests on public lands across the Anoka Sand Plain region. This planning and restoration effort will be considered as the Anoka Sand Plain SFRMP is developed and implemented.

5. Relationship of SFRMP to Other DNR Planning Efforts

While the SRFMP process focuses on developing vegetation management plans for state-administered forest lands within the subsection, it does not operate in a vacuum. SFRMP teams do their best to stay connected to other state, federal, and even local planning efforts affecting the subsection, particularly as they relate to management direction, decisions, and products that can assist in determining appropriate vegetation management direction on DNR lands. The following sections highlight a number of efforts that that SFRMP teams need to be aware of in order to incorporate relevant information, management direction, and products in the SFRMP process.

1. Off-Highway Vehicle (OHV) Planning Process
The DNR has completed a major OHV planning process. The process began with a statewide road and trail inventory effort on DNR and county lands in the state. This inventory process was completed in 2005 and the resulting road/trail inventory maps are available for consideration in the SFRMP process. This road/trail inventory is most useful when SFRMP teams work to identify new access needs for proposed vegetation management.

The remaining work to be done in the OHV planning process is the OHV Forest Classification and Road/Trail Designation process. These OHV system plans are being developed for each state forest within DNR Division of Forestry administrative areas. During the OHV system planning process, area OHV system planning teams classify state forests for OHV use and identify roads, trails, and areas open to OHV use. Area planning teams are responsible for leading a separate public input process for each OHV system plan.

While the SFMRP process does not include OHV system planning, SFRMP teams need to consider existing OHV trails and OHV system plans (where available), as well as other recreational trails and facilities, in making decisions on forest stand management next to these facilities and in determining new access needs. Likewise, OHV system plans should consider management direction and the results of stand selection (e.g., large patch areas, areas where temporary access is preferred, areas where new access is needed) developed through the SFRMP process.

For more information about the OHV planning process, visit the DNR Web site at http://www.dnr.state.mn.us/input/mgmtplans/ohv/designation/index.html.

2. Minnesota State Park Unit Planning Process

The SFRMP process will not address the management of DNR forest lands within the boundaries of state parks. The management of state parks (i.e., facilities and natural resources) is established via a separate state park planning process. Individual state park management plans address a park's ecological and recreational role in the context of the surrounding ecological community subsection(s) and its role in furthering Conservation Connection objectives. Park plans document existing natural and cultural resource conditions, and future management objectives. Existing recreational use and recreation trends are assessed, and a balance of sustainable recreational opportunities is recommended.

State park plans are developed through an open public process. The plan recommendations are developed through extensive involvement by interested citizens, recreation, and resource management professionals, and elected officials with local, regional, and statewide responsibilities. Usually this involvement is coordinated through a series of advisory committee meetings, area team meetings, public open houses, news releases, Internet Web site information, and review opportunities.

The SFRMP process should consider state park plans in making decisions on forest stand management adjacent to state parks. Likewise, state park plans need to consider the vegetation management direction and objectives in SFRMPs. Additionally, the SFRMP process should consider the role of state parks in the subsection in meeting desired future compositions and associated goals (e.g., biodiversity, wildlife habitat, community types, etc.).

3. Incorporating Biodiversity Considerations in SFRMP

Biological diversity is defined in statute as the "variety and abundance of species, their genetic composition, and the communities and landscapes in which they occur, including the ecological structure, function, and processes occurring at all of these levels." Protecting areas of significant biodiversity is consistent with state policy (Minnesota Statutes 89A) to pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals.

The DNR SFRMP process provides an immediate opportunity to incorporate biodiversity considerations in planning for forest systems on DNR lands. Ecological and Water Resources staff provides ecological information pertinent to managing for biodiversity to each of the subsection forest management teams (e.g. Minnesota County Biological Survey data, Natural Heritage information, Scientific and Natural Area biodiversity management techniques experience). SFRMP direction in addressing issues and developing strategies, desired future forest compositions, and ten-year lists of stands to be treated will reflect consideration of this information and the current, best understanding of how to manage for biodiversity.

In the future, the DNR will enhance and expand in partnership with affected stakeholders, biodiversity management planning efforts. However, the DNR's immediate focus is to incorporate biodiversity consideration into the SFRMP process.

4. Wildlife Plans and Goals

SFRMP plans are not wildlife habitat plans. Their implementation, however, affects forest habitats and consequently, wildlife distribution and abundance. Because state forest management under a multiple-use policy requires the consideration of wildlife habitat, several wildlife plans are considered during the SFRMP process.

a) Division of Fish and Wildlife Strategic Plan

The Minnesota DNR's Division of Fish and Wildlife Strategic Plan has recently established population and or harvest objectives for many of the state's wildlife species that are hunted and trapped. These objectives have been determined by a variety of processes that involve some level of stakeholder involvement and public review. Population objectives consider both biological and social carrying capacities tempered by economic needs or constraints (e.g., crop depredation). Among other tools, the division establishes annual harvest levels to meet desired population goals. During SFRMP, wildlife managers work toward the development of a plan that facilitates achievement of the wildlife population and/or harvest goals for key wildlife species outlined in the division's strategic plan.

b) Division of Fish and Wildlife "Fall Use Plan"

The Division of Fish and Wildlife's *Restoring Minnesota's Wetland and Waterfowl Heritage Plan*, also known as the Fall Use Plan, identifies harvest goals for waterfowl. This plan was consulted for determining extended forest management (ERF) needs with these subsections, as the amount of ERF influences cavity-nesting waterfowl populations.

c) Bird Plans

Several bird plans under the umbrella of the North American Bird Conservation Initiative provide a continental synthesis of priorities and objectives that can guide bird conservation actions. These plans identify species of continental importance, give a continental population objective, identify issues, and recommend actions. Similarly, the North American Waterfowl Management Plan provides long-term trend information and population objectives for waterfowl species. Wildlife managers involved in SFRMP use this information to form their planning recommendations and decisions, particularly as they relate to desired future forest conditions and age-class composition.

d) Comprehensive Wildlife Conservation Strategy

The Minnesota Comprehensive Wildlife Conservation Strategy (CWCS) plan identifies wildlife species that are considered "species in greatest conservation need" because they are rare, their populations are declining, or they face serious threats of decline. The federal government has mandated that partnerships within states develop a CWCS to manage their "species in greatest conservation need."

This plan identifies problems, threats, and opportunities that face the species; it develops 10-year objectives for species populations, habitats, and priority research and information needs, and develops conservation actions that address the 10-year objectives. Wildlife managers use this information to form SFRMP recommendations and decisions.

e) Wildlife Management Area Master Plans (Comprehensive Management Plans)

The Department of Natural Resources prepared comprehensive management plans for the state wildlife management areas having resident managers. The plans include present and projected regional perspectives, resource inventories, and demand and

use analyses, as well as acquisition and development plans, cost estimates, and resource management programs. These are ten-year management plans, and will be revised as new management practices develop, new resource philosophies evolve, and new problems are encountered. Under a cooperative agreement with the former State Planning Agency, the Department of Natural Resources completed plans for the Whitewater, Carlos Avery, and Mille Lacs Wildlife Management Areas during the 1976-77 biennium.

f) Management Guidance Documents – Individual Wildlife Management Areas
The intent of Management Guidance Documents is to describe the purpose of individual Wildlife Management Areas (WMAs) and provide basic information to resource managers within the Minnesota Department of Natural Resources (MNDNR). These documents are developed by consolidating several Geographic Information Systems (GIS) and other databases along with input from MNDNR Area Wildlife Staff. These administrative documents include purpose and history of acquisition, habitat emphasis, natural and cultural feature information, facility development, and public access.

6. DNR Direction Documents and relationship to SFRMP

The following sections highlight several of the more prominent direction documents and their relation to the SFRMP process.

1. DNR Strategic Conservation Agenda 2009–2013 and DNR Directions 2000.
The department's strategic planning documents, *DNR Strategic Conservation Agenda 2009– 2013* and *DNR Directions 2000*, provide broad goals, strategies, and performance indicators for forest resources in Minnesota (see DNR Directions 2000, Forest Resources Section in Appendix A and DNR Strategic Conservation Agenda, Forests Section at:
http://www.dnr.state.mn.us/conservationagenda/index.html.
This broad statewide direction will be used as a platform from which to develop additional complementary/supplemental goals and strategies specific to each subsection.

2. Old-Growth Forest Guidelines
The 1994 DNR Old-Growth Forest Guideline was developed via a stakeholder involvement process that led to consensus on old-growth forest goals by forest type by ECS subsection for DNR lands. Following the completion of the guideline, the DNR undertook and completed an old-growth nomination, evaluation and designation process for DNR lands. The latest information on old-growth forest policy and results can be found at:
http://www.dnr.state.mn.us/forests_types/oldgrowth/index.html.

Old-growth stand designation has been completed statewide and additional old-growth designation is not part of the SFRMP process. The primary significance of old growth in the SFRMP process is determining how DNR forest stands adjacent to and connecting adjacent old growth stands will be managed (e.g., as extended rotation forests, part of large patches, scheduling of harvest, conversion to other forest types, etc.). If not done prior to the SFRMP process, old forest management complexes (see Old-Growth Guideline Amendment #5) will be identified in conjunction with the SFRMP process.

3. Extended Rotation Forest Guideline
The 1994 DNR Extended Rotation Forest (ERF) Guideline was developed through a previous public and stakeholder input process. The primary purpose of the ERF Guideline is to provide adequate acreages of forest older than its normal rotation age to provide for species and ecological processes requiring older forests. During the SFRMP process, the ERF Guideline is to be applied to landscapes by designating particular areas of forest or stands for ERF management. An area

designated for ERF management will include all cover types and age classes within that designated ERF area.

Normal rotation ages will be established for each forest type managed primarily under even-aged silvicultural systems within the subsection based on site-quality characteristics related primarily to timber production (e.g., site index, growth rates, soils, insect and diseases, etc.). Maximum rotation ages for these forest types will also be established based on the maximum age at which a stand will retain its biological ability to regenerate to the same forest type and remain commercially viable as a marketable timber sale. Final harvest of an ERF stand will occur sometime between the normal rotation age for the cover type and the maximum rotation age. A forest stand is considered to be old forest whenever its age exceeds the normal rotation age for that cover type and is considered "effective ERF."

According to the statewide ERF Guideline, a minimum of 10 percent of the DNR Forestry- and Wildlife-administered timberlands within a subsection are to be managed as ERF. No maximum amount is identified in the guideline, although the guideline states it may be appropriate to designate 50 percent or more of DNR timberlands as ERF in some subsections. Determining the amount of DNR timberlands to be managed as ERF within each subsection involves consideration of wildlife habitat needs, visual and riparian corridors, and implications for timber production (both quantity and quality). The condition and future management of other forest lands in the subsection (i.e., other DNR and non-DNR lands) are considered to the extent possible in determining the amount of designated ERF on DNR timberlands.

4. Minnesota Forest Resource Council's (MFRC) Voluntary Site-level Forest Management Guidelines

The MFRC's *Voluntary Site-Level Forest Management Guideline*s establish integrated forest resource management practices intended to provide cultural resource, soil productivity, riparian, visual, water quality, wetlands, and wildlife habitat protections in a balanced approach. These guidelines were developed through a collaborative statewide effort and received extensive input during development from stakeholders, DNR staff, and other agency staff. The DNR adopted and strongly endorses the *Voluntary Site-Level Forest Management Guidelines* developed through that collaborative process. These guidelines are the standard in managing DNR lands, i.e., they are not voluntary on DNR-administered lands. As the department standard, departures from the guidelines will not be proposed in SFRMPs for entire subsections or geographic areas within subsections. There is flexibility and various options are available in application of the guidelines, but departures from the guideline standards need to be documented on a site-by-site basis. If departures above or below guideline recommendations (e.g., recommended minimums for riparian management zone [RMZ] width and residual basal area in the RMZ) are made, they will be documented during the timber sale appraisal and forest development processes.

5. DNR Forest-Wildlife Habitat Management Guidelines

DNR forest-wildlife habitat management guidelines provide direction to DNR wildlife and forestry staff for integrated management on state-administered lands. The guidelines were last revised in 1985. As such, some portions of the guidelines are out-of-date. Some areas of the guideline overlap with the MFRC site-level forest management guidelines. MFRC site-level guidelines will prevail when they overlap with DNR forest-wildlife habitat management guidelines. Species-specific sections of the guidelines that are still considered current are relevant in the SFRMP process in determining management around known species locations (i.e., eagles nests) or in the management of areas for particular types of habitat (e.g., open landscapes, ruffed grouse management areas, deer yards, etc.). The DNR forestry/wildlife/ecological services coordination policy is currently in the process of being revised. Following revision of the coordination policy, the forest wildlife habitat management guidelines will be reviewed and updated as needed.

6. DNR Interdisciplinary Forest Management Coordination Framework

The DNR Interdisciplinary Forest Management Coordination Framework is a policy to ensure effective and timely coordination between the Divisions of Forestry, Fish and Wildlife and Ecological Resources as a means to improve decision-making and achieve sustainable forest management.

The scope of the framework is focused on the coordination of the planning and implementation of fish and wildlife, and forestry management practices primarily on lands administered by the divisions of Forestry, and Fish and Wildlife.

7. High Conservation Value Forests

The DNR, as a function of maintaining forest certification is required to develop an interim approach to identify and appropriately manage high concentration value forests (HCVFs) to ensure the maintenance or enhancement of high conservation values (HCVs). The interim period will conclude when the Department formally defines HCVs and demonstrates which sites, or portions of sites, will be managed as HCVFs. The Department's HCVF Framework report identifies MCBS sites of *outstanding* and *high* biodiversity significance as candidates to manage as HCVFs. At this time, as an interim approach, the Department will:

1) Manage all MCBS *Outstanding* Sites as HCVFs;
2) Manage all MCBS *High* Sites as HCVFs until the Department identifies a subset of *high* sites to manage as HCVFs; and
3) Conduct an analysis to identify which *high* sites will be treated as HCVFs.

8. White Pine Initiative

In 1996 a White Pine Regeneration Strategies Work Group was formed to prepare recommendations for white pine management on state lands. The primary white pine harvest objectives recommended by that Work Group include: white pine harvesting will be restricted to thinnings, selective harvests, or shelterwood harvests; adequate seed producing white pine will be retained and treatments carried out to increase white pine natural regeneration; reserve the better white pine trees that occur as scattered individuals or in small groups for their seed producing, aesthetic, wildlife and ecological benefit; and, manage all white pine under extended rotation forest guidelines to increase the acreage and distribution of older white pine stands and trees on the landscape.

9. Permanent School Trust Fund

The Minnesota Constitution established the Permanent School Fund to ensure a long-term source of funds for public education in the state. The goal of the permanent school fund is to secure the maximum long-term economic return from the school trust lands consistent with the fiduciary responsibilities imposed by the trust relationship established in the Minnesota Constitution, with sound natural resource conservation and management principles, and with other specific policy provided in state law.

10. Grouping of DNR Direction Documents by 3-Level Hierarchy

The DNR uses a variety of written vehicles (e.g., policies, guidelines, recommendations, memos, operational orders, agreements) to communicate direction to DNR staff on a range of forest management issues including old-growth forests, inter-divisional coordination, site-level mitigation, rare habitats and species, and accelerated management. Interdisciplinary and external involvement has varied in the development of these direction documents, as have the expectations for their implementation (i.e., must follow, follow in most cases, follow when possible). Chart 1.2 places a number of DNR direction documents within a defined policy hierarchy that clarifies decision authority and expected actions. This can serve as a useful reference for the public in understanding the array of forest management guidance available to staff and serve as a starting place for DNR staff to help provide more consistent application across the state.

Chart 1.1 *grouping* of DNR Direction Documents by 3-level Hierarchy

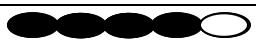
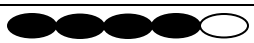
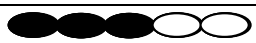
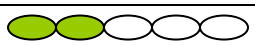
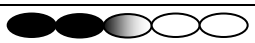
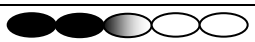
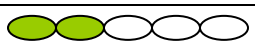
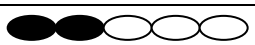
Nomenclature	Developed by	Level of Review	Expectations	Departure Authority
Policies				
Old Growth Forest Guideline	DNR			No departures allowed
ERF Guideline	DNR			No departures allowed
Forest/Wildlife Coordination Policy	DNR			No departures allowed
WMA Policy	Wildlife			Region - Interdisciplinary
SNA Est. & Admin. Op. Order	Eco Services			No departures allowed
MFRC Site-Level Guidelines	MFRC			Field appraiser w/ documentation
ID and Mgmt of EILC	CO/FRIT			Region - Interdisciplinary
Guidelines				
Rare Species Guides	Eco Services			Known locations: Area ID Otherwise: field appraiser w/ doc.
Covertype Mgmt. Recommendations	SFRMP Teams			Field appraiser w/ documentation
NE Region Wood Turtle	NE Region (For, Wild, Trails)			Region - Interdisciplinary
Decorative Tree Harvest Guidelines	Forestry			Area - Interdisciplinary
Accelerated Management	Forestry			Area - Interdisciplinary
Gypsy Moth Mgmt. Guidelines	Forestry/ Dept. of Ag.			Field appraiser w/ documentation
For/Wild Habitat Guidelines	Wildlife/Forestry			Area - Interdisciplinary
Integrated Pest Management	Forestry			Field appraiser w/ documentation
Silvicultural Mgrs. Handbooks	NCES, Forestry			Field appraiser w/ documentation
NE R. Grouse Mgmt. Areas	Wildlife			Area - Interdisciplinary

Chart 1.1 *(continued)*

Recommendations				
Goshawk Considerations	Eco & Water Res			Known locations: Area - Interdisciplinary Otherwise, document use
MCBS H/O Biodiversity	Eco & Water Res			Consider if site ditions differ from
ECS Field Guide Interps.	Eco & Water Res			Field appraiser w/ umentation
MCBS Rare NPC	Eco & Water Res			Known locations: a - Interdisciplinary erwise, document
Red-Shouldered Hawk	Eco & Water Res			Known locations: a - Interdisciplinary erwise, document
Four-toed Salamander	Eco & Water Res			Known locations: Area - Interdisciplinary Otherwise, document use
Black-throated Blue warblers	Eco & Water Res			Document use
Seasonal ponds	Eco & Water Res			Document use
Boreal owl guidelines	Eco & Water Res			Known locations: Area - Interdisciplinary Otherwise, document use
Botrychium guidelines	Eco & Water Res			Known locations: Area - Interdisciplinary Otherwise, document use

Chart 1.1 *(continued)*

KEY	
	Must follow; no departures
	Expected to follow; documented & approved departures OK
	Expected to follow to the degree possible
	Recommended in usual circumstances; departures OK based on site conditions
	Recommended when opportunities and conditions suitable
	Incorporate if possible
	Broad external technical & public
	Broad public/stakeholder
	Limited public/stakeholder
	Department ID review
	Local ID team review
	Division review w/ peer technical input
	Division review

8. Public Involvement

Public involvement in SFRMP occurs at two points:

1. The public review of the Preliminary Issues and Assessment document. This document will be posted and notice sent to stakeholders to review and forward questions throughout the SFRMP planning process; and
2. A formal public review and comment period on the Draft Anoka Sand Plain SFRMP which includes the 10 –year Stand Exam List.

The SFRMP draft plan document will be available at DNR area forestry offices, DNR regional and division offices and the DNR Web site:

http://www.dnr.state.mn.us/forestry/subsection/anoka

9. Future Directions

While the initial focus of SFRMPs is on forest composition and vegetation management, the intention is for its scope to broaden in the future. Changes in this direction will likely be incremental as the process becomes more familiar to DNR staff and the public. The likely progression in future years will be to include other aspects of forest land management on DNR lands (e.g., recreation facilities/systems, land acquisition/sales) and other DNR Forestry programs including private forest management and fire management. A subsequent step may be to include lands administered by other units of DNR (i.e., Trails and Waterways, Parks, etc.), making this a department-wide plan that is not limited to Forestry and Wildlife land.

10. SFRMP Process

The Anoka Sand Plain subsection team is in the initial stages of the SFRMP process. The team has developed the preliminary issues and assessment information and is now requesting public input, the first of two opportunities in the SFRMP process.

Chart 1.2 Public Involvement and Process Timelines ASP SFRMP

SFRMP Task	Public Notification/Participation	Public Comment Period	Target completion
I. Preparation of the Planning Process • Assemble initial assessment information and data sets.	• DNR develops mailing list of public/ stakeholders. • Establish web-site for subsection.	n/a	prior to start of process
II. Preliminary Issues and Assessment Document • Background information • Preliminary Issues	• Inform the public of planning efforts, schedule, and how and when they can be involved. • Provide the Preliminary Issue and Assessment document on DNR website • Notice to Stakeholders	on going	9-1-11
III. Prepare Draft Plan • Strategic Direction (GDSs, • Strategies, • Desired Future Conditions • 10-Year Stand Examination List and New Access Needs	• Mail summary to mailing list. • Provide documents to stakeholders on request and post DNR web site • Identify SFRMP contacts for questions. • Offer meetings by appointment	30 days	11-1-11
IV. Prepare Final Plan • Respond to public comments • Present revised plan for approval. • Notice to stakeholders	• Inform public of final plan. • Provide summary of public comments and how DNR responded. • Provide final plans in key locations and on Web/CD and in Area offices. • Mail plan summaries to mailing list.	n/a	12-15-11

1.3 Preliminary Issue Identification

One of the first steps in the SFRMP process is to identify issues that the plans will address. SFRMP teams will use assessment information; local knowledge; existing plans, policies, and guidelines; and public input to help identify issues relevant to the scope of the plans. Subsection teams will begin with the common set of issues developed from previous SFRMP plans. These common SFRMP issues will then be refined and supplemented based on subsection-specific conditions and considerations.

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?

1.4 Preliminary Issues

The following pages contain the preliminary issues identified by the subsection team. These issues were developed based on the common issues from previous SFRMP plans, general field knowledge of department staff, and by reviewing forest resource information for the subsections. The next step of the SFRMP process will determine how vegetation management on DNR-administered lands will address these issues.

The Anoka Sand Plain (ASP) team has begun identifying important issues in these subsections that should guide forest planning. A preliminary issues list was developed to stimulate thought on issues that may impact forest planning in this subsection.

This plan will provide guidance for forest management on state lands for the next 10 years and establish goals for the next 50 to 100 years. The ASP team is looking for additional issues that affect our forests that could be mitigated or avoided by forest planning and vegetation management.

For any of these issues there is no one correct answer, direction or response from the Department in terms of the "correct" method of vegetation management. How the ASP SFRMP ultimately addresses these issues will depend on many factors including: condition of the forest resources today; forest management goals for the future; the judgment and expertise of Department professionals; existing Department vegetation management directives and statutes; and recommendations from the public and stakeholders.

A. How should the age classes of forest types be represented across the landscape?

- **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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

B. What are appropriate mixes of vegetation composition, structure, spatial arrangement, growth stages, and plant community distribution on state lands across the landscape?

- **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 tourism; 7) decrease resilience to climate change; and 8) continued and heightened user conflicts on the existing state lands within the subsection.

- **Other considerations?**
  What other factors ought to be considered with this issue?

C. How can we 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.

- **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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

D. How might we 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-bur 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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

E. How might we 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, influences 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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

F. How might we 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 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 planning 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?**
  DNR can design flexibility into the plan to deal with specific stands that are affected by these processes.

- **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 danger.

- **Other considerations?**
  What other factors ought to be considered with this issue?

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 these subsections that promotes a balance of all age classes for all even-aged cover types, monitor nontimber species to ensure no over treatment while incorporating efforts in the process to protect and consider all wildlife and plant species and 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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

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

- **Why is this an issue?**
  The demand for timber remains significant, while demand for other forest values has also increased. Minnesota's forest industry requires a sustainable and predictable supply of wood.

- **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. Increased management costs. Alternatively, wood and wood product

- **Other considerations?**
  What other factors ought to be considered with this issue?

I. How can we 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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

L. How can we 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 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?**
  1) 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.

- **Other considerations?**
  What other factors ought to be considered with this issue?

M. How do we 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.

- **Other considerations?**

N. Can we 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 relatively 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.

- **Other considerations?**

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

- **Other considerations?**

CHAPTER 2

Land Ownership and Administration

Anoka Sand Plain Subsection

2.1 Land Ownership

Table 2.1 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. Of the total state ownership, the ASP SFRMP addresses only Forestry and Wildlife lands which total less than 4 percent of the State ownership.

Table 2.1 Land Ownership: Anoka Sand Plain (Acres)

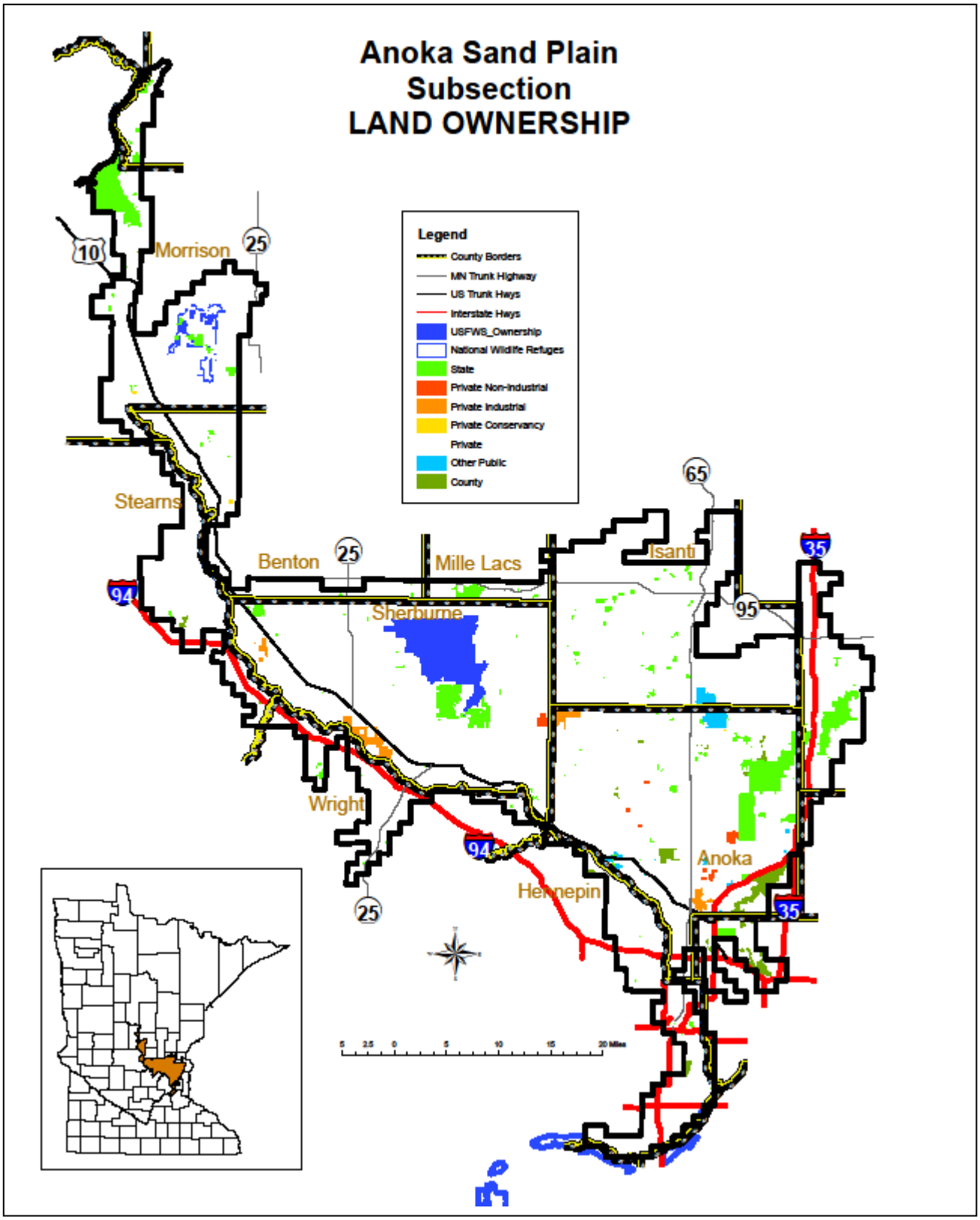
Owner	Acres	Percent
Private[1]	1,128,014	88
State – All[2]	67,205	5
Forestry	7,134	<1
Wildlife	37,017	3
Federal	45,623	3
County	15,100	1
Private Industrial	10,849	<1
Private Non-Industrial	2.235	<1
Private Conservancy	496	<1
Total	**1,277,914**	**100**

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.

Map 2.1 Public Land Ownership in the Anoka Sand Plain Subsection

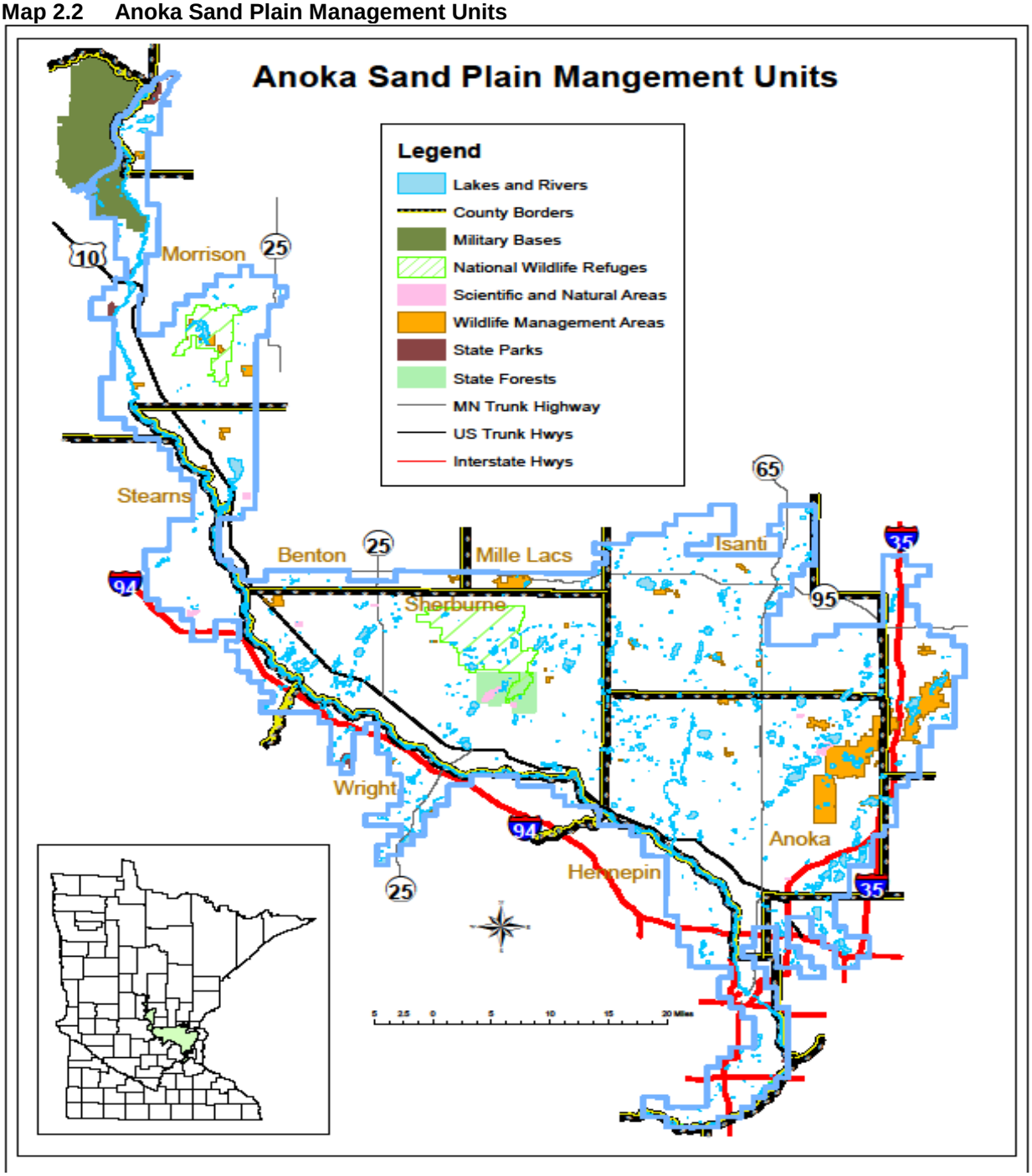


Color maps may be viewed as PDF files on the Anoka Sand Plain Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/anoka/index.html.

2.2 Public Ownership: Management Units

Map 2.2 identifies the primary public land ownership units within the Anoka Sand Plain subsection. The Anoka Sand Plain SFRMP plans for vegetative management on lands identified as State Forests and Wildlife Management Areas (administered by the Fish and Wildlife Division, Section of Wildlife).

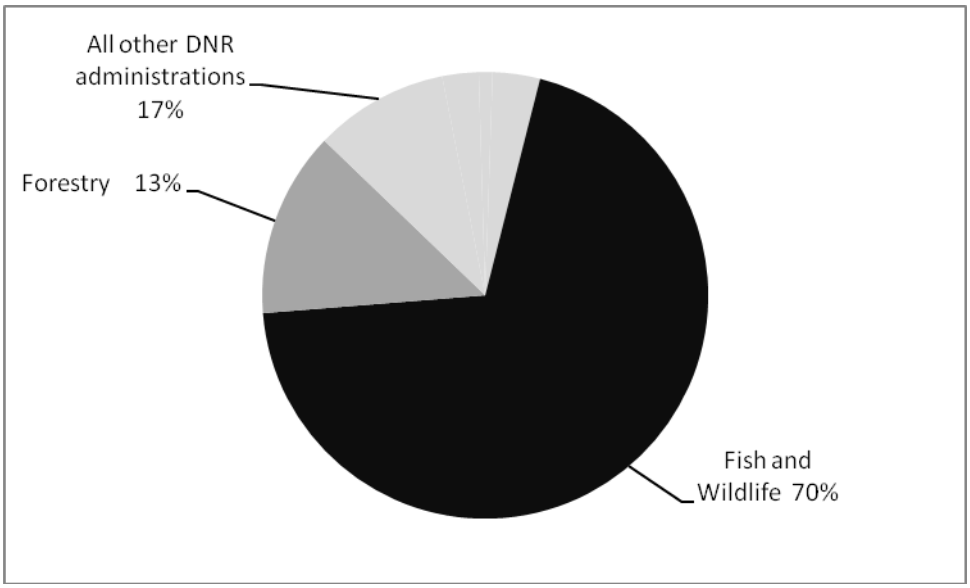
Map 2.2 Anoka Sand Plain Management Units



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

Chart 2.1 identifies the percentage of DNR lands owned and administered within the Anoka Sand Plain subsection. This chart shows that Forestry makes up 13 percent and Fish/Wildlife lands make up 70 percent of the total lands subject to this plan.

Chart 2.1 DNR Administered Lands in Anoka Sand Plain subsection



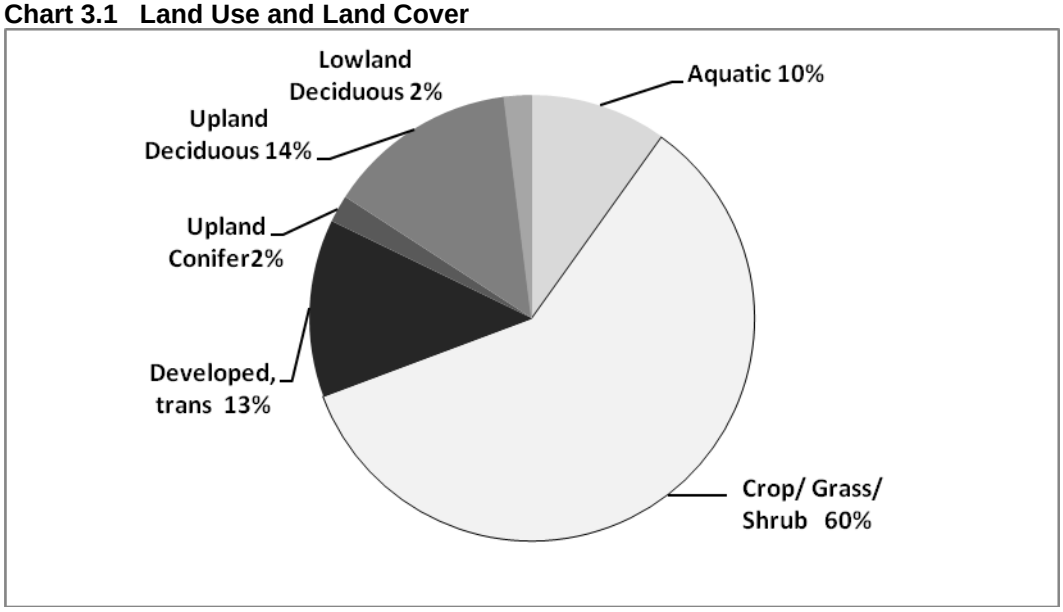
CHAPTER 3
Land Use and Cover

Anoka Sand Plain Subsection

3.1 Land Use and Land Cover

Chart 3.1 shows land uses and land cover for the Anoka Sand Plains subsection. The primary land uses are Crop/Grass/Shrub covering 60% of the landscape, "Developed, trans" uses which includes all "developed" lands, roads, railroads, urban, suburban and commercial/industrial uses accounts for 13%; and Upland Deciduous cover types which covers 14% of the subsection.

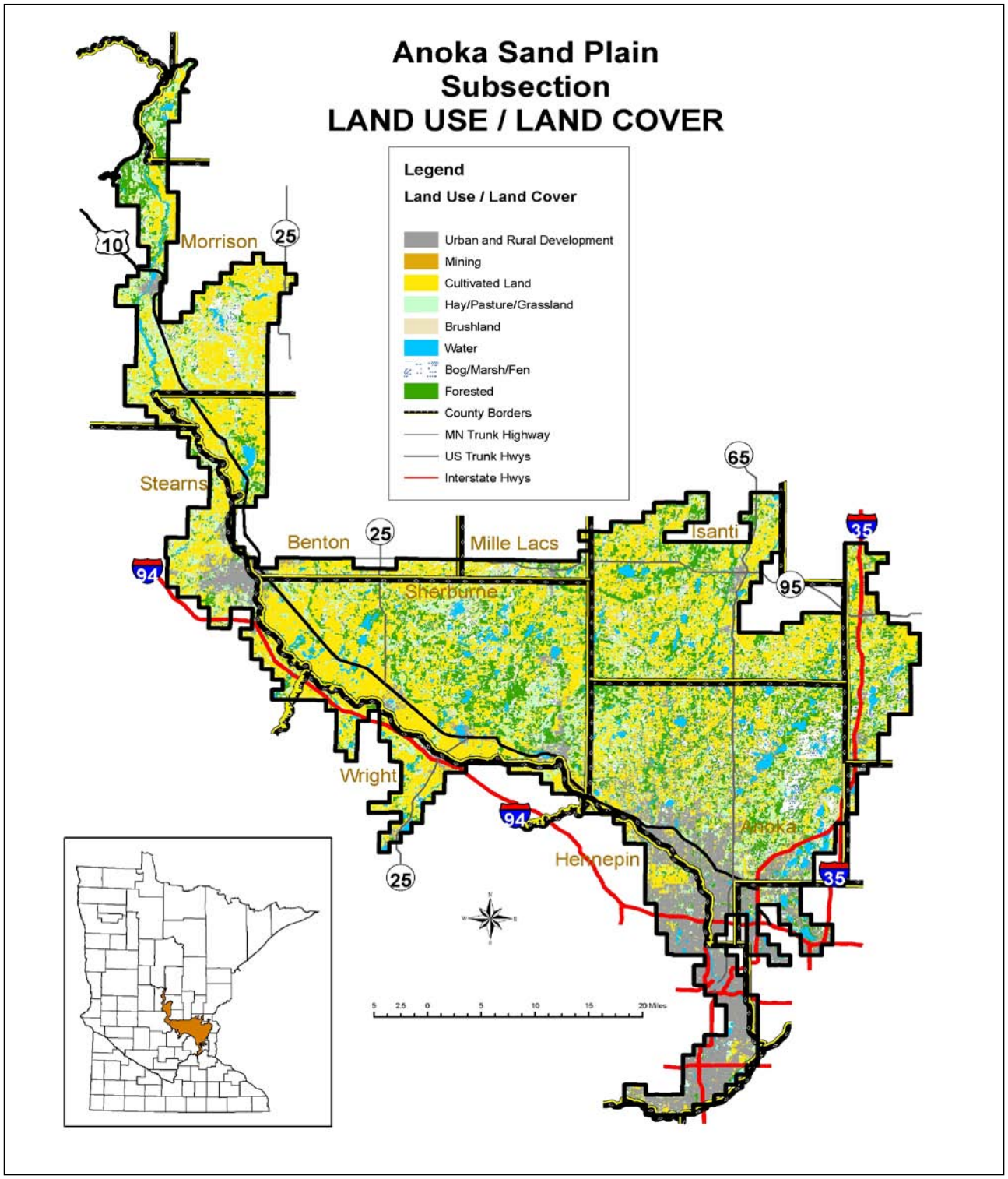
Chart 3.1 Land Use and Land Cover



Source: *Land cover data set derived from classified 30-meter resolution Thematic Mapper satellite imagery. Landsat images between 1991 and 1996 were classified by Manitoba Remote Sensing Centre. Detailed metadata can be found at the Interagency Information Cooperative's Web site at: www.iic.state.mn.us.*

Map 3.1 identifies the land uses and land cover for the Anoka Sand Plain. It shows the majority of lands within the urban and rural land uses; cultivated lands; hay/pasture/grassland; and brush lands.

Map 3.1 Land Use / Land Cover: Anoka Sand Plain Subsection



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

3.2 Land Use and Cover Classification Descriptions

Forested: Areas with at least two-thirds of the total canopy cover composed of deciduous forest, coniferous forest, or mixed deciduous/conifer forest. Forest stands may be either natural origin or planted.

Cultivated land: Areas under intensive cropping or rotation, fallow fields, and fields seeded with forage and cover crops. Fields exhibit linear or other patterns associated with current or recent tillage.

Hay/pasture/grassland: Areas covered by grasslands and herbaceous plants. May contain up to one-third shrubs and/or tree cover. Areas range in size (small to extensive) and shape (regular to irregular). These areas often exist between agricultural land and more heavily wooded areas, and along rights-of-way and drains. Some areas may be used as pastures or mowed or grazed, and range in appearance from smooth to mottled. Included are fields that show evidence of past tillage but are retired and planted to a cover crop or appear abandoned and occupied by native vegetation.

Water: Areas of permanent water bodies—such as lakes, rivers, reservoirs, stock ponds, ditches, and permanent and intermittently exposed palustrine (marshy) open water areas—where photo evidence indicates that water covers the area most of the time.

Urban-rural development: Areas that are used for urban and industrial purposes (e.g., cities).

Bog/marsh/fen: Peat-covered or peat-filled depressions with a high water table. Bogs are carpeted with sphagnum moss and ericaceous (heath) shrubs and may be treeless or tree-covered with black spruce and/or tamarack. Bogs, marshes, and fens may be grassy and contain standing or slowly moving water. Vegetation consists of grass, sedge sods, or common hydrophytic (i.e., water-loving) vegetation such as cattail and rushes. Areas are often interspersed with channels or pools of open water.

Brushland: Areas with combinations of grass, shrubs, and trees in which deciduous and/or coniferous tree cover comprises one-third to two-thirds of the area, and/or the shrub cover comprises more than one-third of the area. This complex often exists next to grassland or forested areas but may be found alone. Brushland areas vary in shape (i.e., irregular) and size.

Mining: Areas stripped of topsoil revealing exposed substrate such as sand/gravel. Included are gravel quarry operations, mine tailings, borrow pits, rock quarries, and natural beaches/sand dunes.

3.3 GAP Classification of the Anoka Sand Plain subsection

What Is a GAP Classification?

The Gap Analysis Program (GAP) was project sponsored and coordinated by the Biological Resources Division of the U.S. Geological Survey. The Minnesota DNR participated in this nationwide project. Coordination of GAP activities with neighboring states is done to ensure the development of regionally compatible information.

The GAP Web site defines the project as "… a scientific method for identifying the degree to which native animal species and natural communities are represented in our present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation 'gaps.'" The purpose of GAP is to provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists, and policy makers with the information they need to make better-informed decisions.

The basic statewide geographic information systems (GIS) datasets of GAP include land cover, distributions of native vertebrate species, major land-ownership patterns, and land management. Gap analysis is conducted by overlaying vegetation and species richness maps with ownership and management maps so that gaps in the management for biodiversity can be identified. The data layers are developed, displayed, and analyzed using GIS techniques.

Land-Cover Classification
The GAP classification of current vegetation (land cover map), which is a part of the larger project, was produced by computer classification of satellite imagery (Landsat 5 Thematic Mapper imagery [draft} by the Resource Assessment Unit of the DNR Division of Forestry. Units of analysis are divided by Ecological Classification System (ECS) subsections. The minimum mapping unit is one acre.

The following table, chart and map show the GAP land-cover classification of the subsection in this plan. Chapter Two of this document contains the land ownership and land management information classification of the subsection in this plan.

Table 3.1 Gap Classifications for the Anoka Sand Plain Subsection

Cover type	Acres	Acres	% All Classes	% Vegetated Classes	% Forested Classes
Aquatic Environments		**122390**	9.6		
Water	64207				
Floating Aquatic	1264				
Broadleaf Sedge/Cattail	31191				
Sedge Meadow	25728				
Crop / Grass / Shrub		**769829**	60.3	77.4	
Grassland	22712				
Barren	4722				
Cropland	45372				
Upland Shrub	10271				
Lowland Deciduous Shrub	73983				
Non-vegetated		**160278**	12.5		
High Intensity Urban	40355				
Low intensity urban	11989				
Mixed Developed	1				
Transportation	32				
Lowland Conifer		**3065**	<.01	.3	1.4
Lowland Black Spruce	29				
Lowland Northern White	1				
Lowland Evergreen Shrub	91				
Tamarack	2944				
Lowland Stagnant		**17**	<.01	<.01	<.01
Stagnant Black Spruce	8				
Stagnant Tamarack	9				
Upland Conifer		**19411**	1.5	2.0	8.6

Cover type	Acres	Acres	% All Classes	% Vegetated Classes	% Forested Classes
Red Pine	17412				
White Pine Mix	947				
White Spruce	29				
Jack Pine	1007				
Balsam Fir mix	16				
Upland Deciduous		**179568**	14.1	18.1	79.9
Aspen/White Birch	29969				
Bur/White Oak	25775				
Northern Pin Oak	57108				
Red Oak	55429				
Black Ash	4531				
Silver Maple	3262				
Maple/Basswood	3256				
Cottonwood	94				
Other Upland Deciduous	144				
Lowland Deciduous		**22676**	1.8	2.3	10.1
Total		**127723**	100	100	100

Footnotes:
Forested Classes: Lowland Conifer; Lowland Stagnant; Upland Conifer; Upland Deciduous; Lowland Deciduous
Vegetated Classes: all Forested Class and Crop/Grass/Shrub

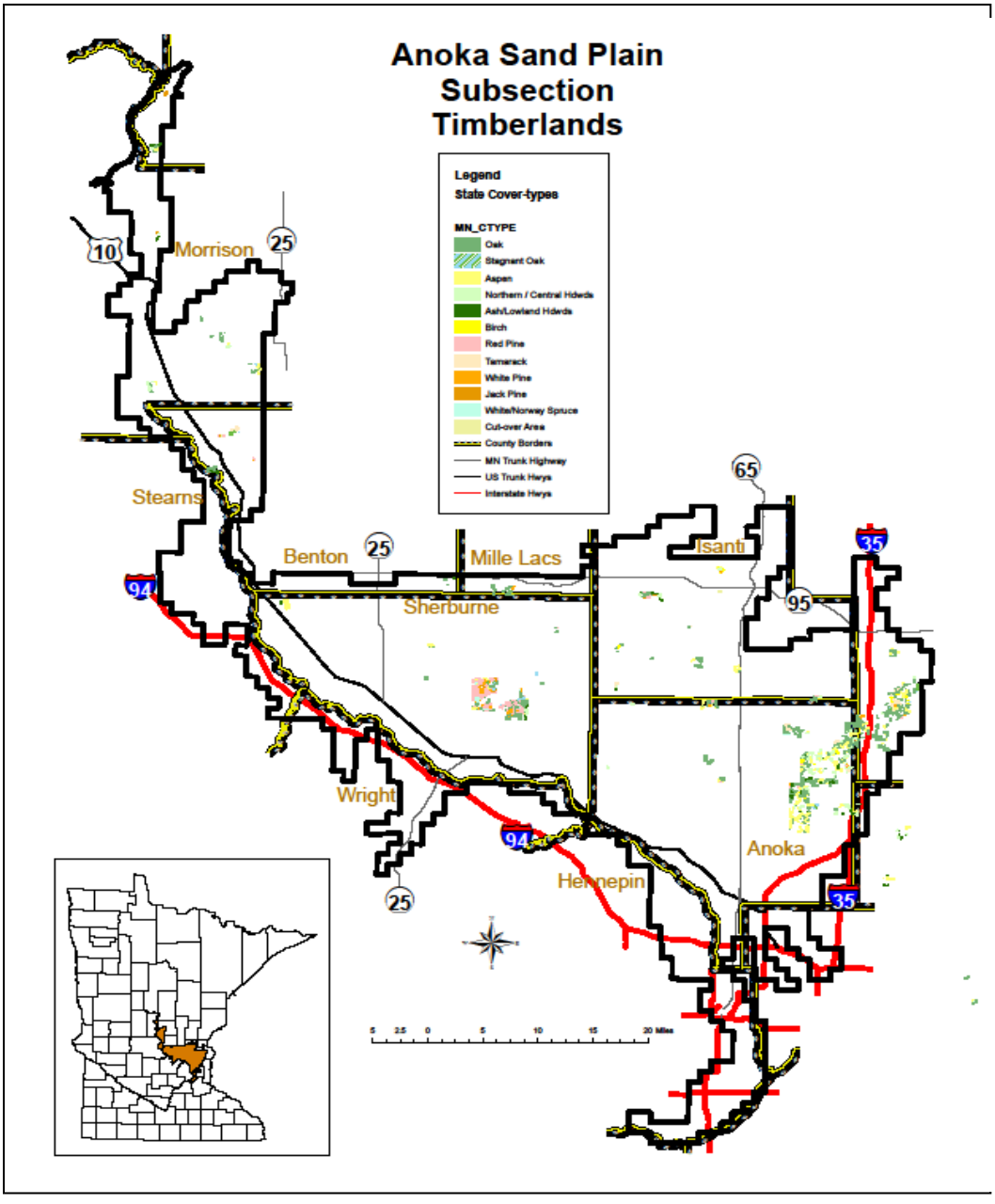
CHAPTER 4

Forest Composition and Structure

4.1 Timberlands by Cover Type

Map 4.1 identifies the timberlands by cover type found in the Anoka Sand Plain Subsection.

Map 4.1 Timberland by Cover Types on lands administered by DNR Forestry and Section of Wildlife



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

Table 4.1 Anoka Sand Plain State[1] Timberland[2] Cover-Type Acres by Age-Class (2011)

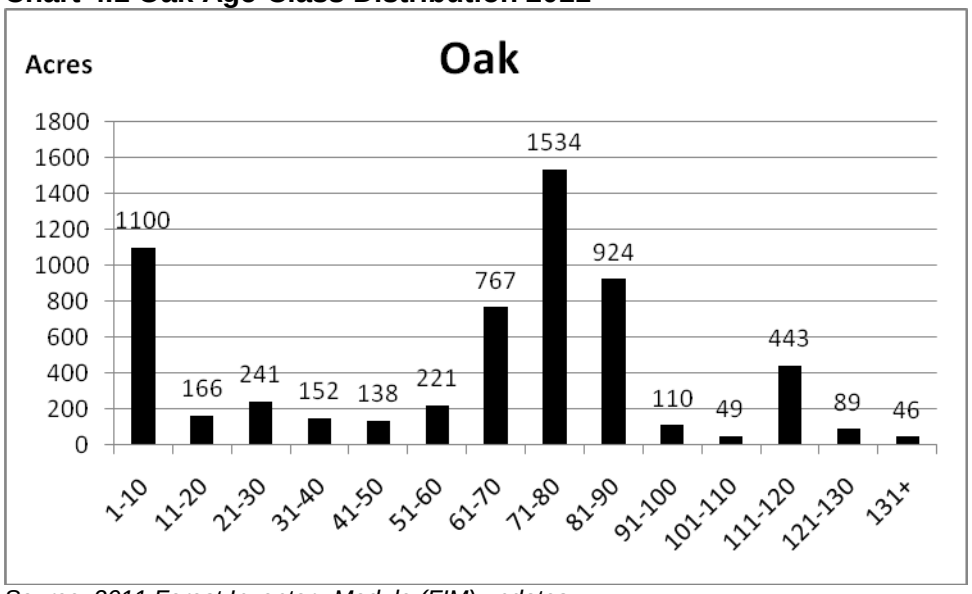
Cover Type	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111 -120	121-130+	131-140+	TOTAL
Oak	1100	166	241	152	138	221	767	1534	924	110	49	443	89	46	5980
OX (79)	97		10			111	22		27	43	64	24		10	408
Aspen	295	88	738	259	326	130	17					11			1864
NH / CH	172	59	90	38	96	254	211	176[5]	72		21	2			1191
Ash/LHd			10	21	176	175	53	15	33		10				568[8]
Birch	7				49	43	17	30	3						149
Red Pine	248	180	426	301	481	564	195	1	6						2402
Tamarack			30[7]			42	23	479	142			4		42	762
White Pine	32	49	131	65	168	148	62		5	3	7		24		694
Jack Pine	3	25[4]	67	81	37	7	2	8							230
WS / NS	5	11	41[6]	7	11	34	2								111
COA[3]	42														42
Total	2001	578	1784	926	1482	1729	1371	2243	1212	156	151	510	113	98	14403

[1] Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 Cooperative Stand Assessment (CSA) forest inventory.
[2] Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix C: Glossary).
[3] Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually, the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.
[4] Includes 7 acres of Scotch pine that will be managed consistent with jack pine.
[5] Includes 10 acres of central hardwoods forest that will be planned and managed consistent with northern hardwoods.
[6] includes 23 acres of Norway spruce that will be managed consistent with white spruce
[7] includes 30 acres of upland larch that will be managed consistent with tamarack
[8] includes 49 acres of unknown age

4.2 Cover type Age-Class Distributions

Charts 4.1 through 4.10 identify the current age-class distribution of the primary cover types found in the Anoka Sand Plain subsection for state administered lands. The cover types identified on these charts are generally considered the potential commercial cover types in the ASP subsection.

Chart 4.1 Oak Age-Class Distribution 2011



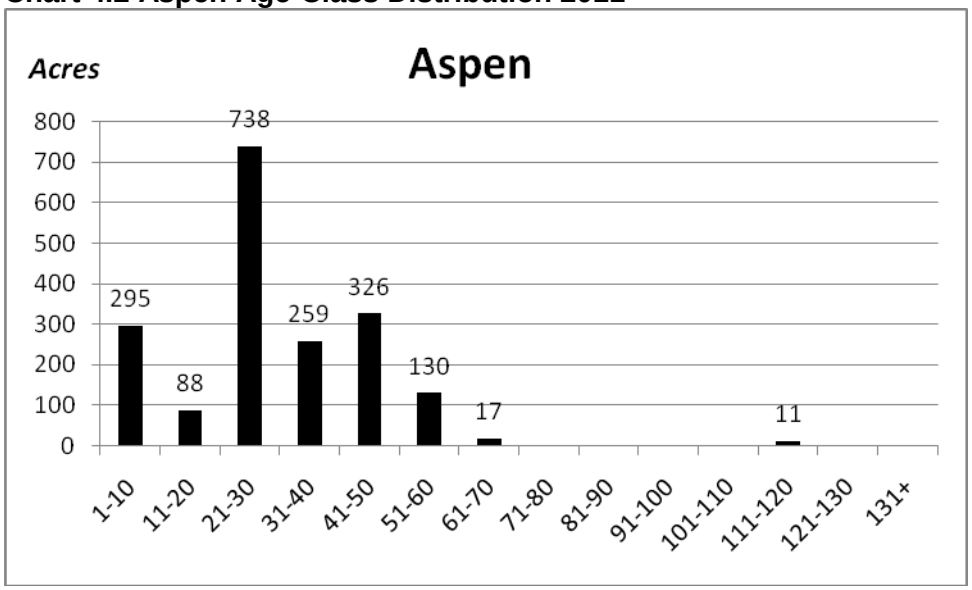
Source: 2011 Forest Inventory Module (FIM) updates

As shown above, 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 agricultural management 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 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 Anoka Sand Plain this is likely a contributing factor in the establishment of stands that are now 70-90 years old in the Sand Dunes State Forest.

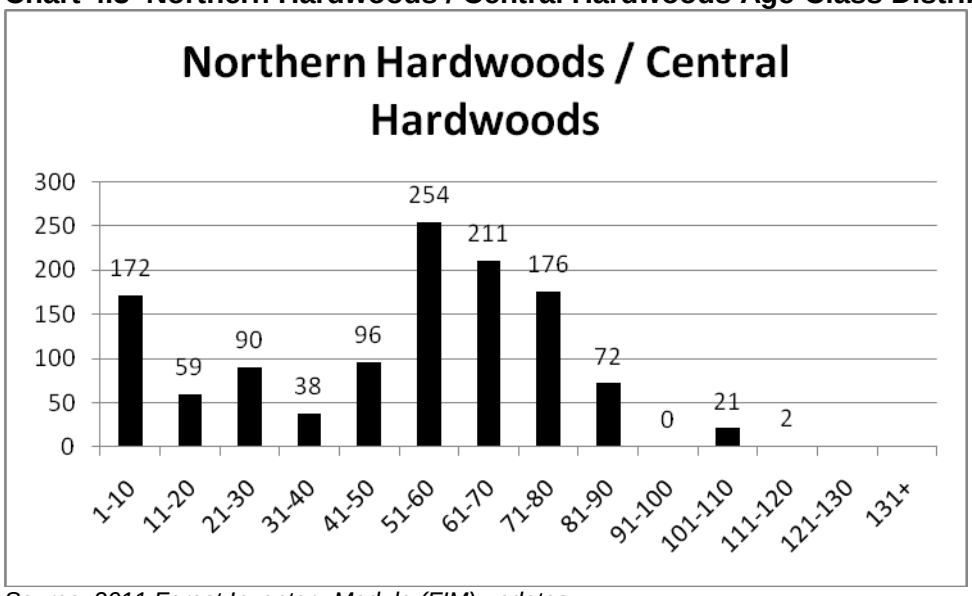
Chart 4.2 Aspen Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

As shown above 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.

Chart 4.3 Northern Hardwoods / Central Hardwoods Age-Class Distribution 2011



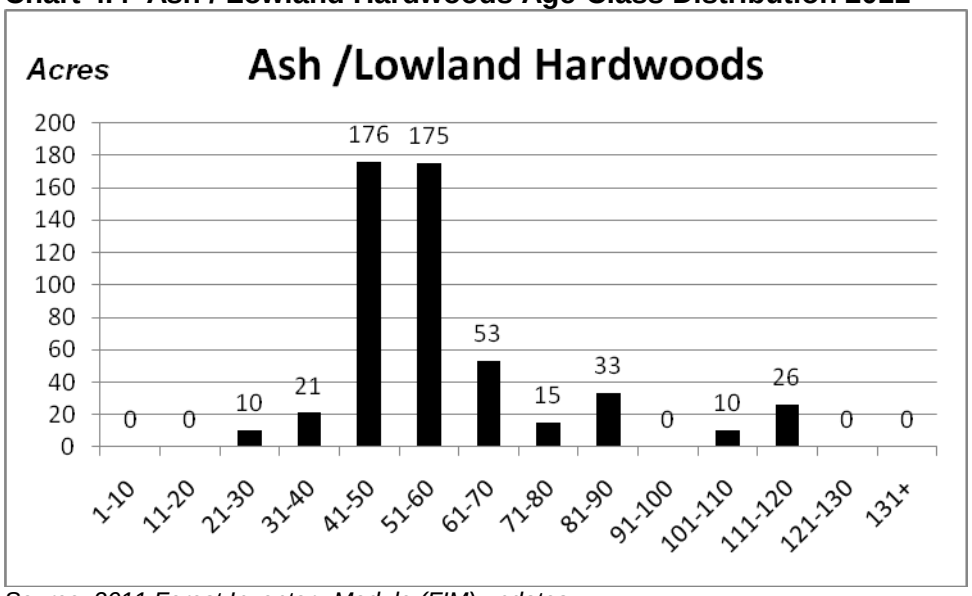
Source: 2011 Forest Inventory Module (FIM) updates

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.

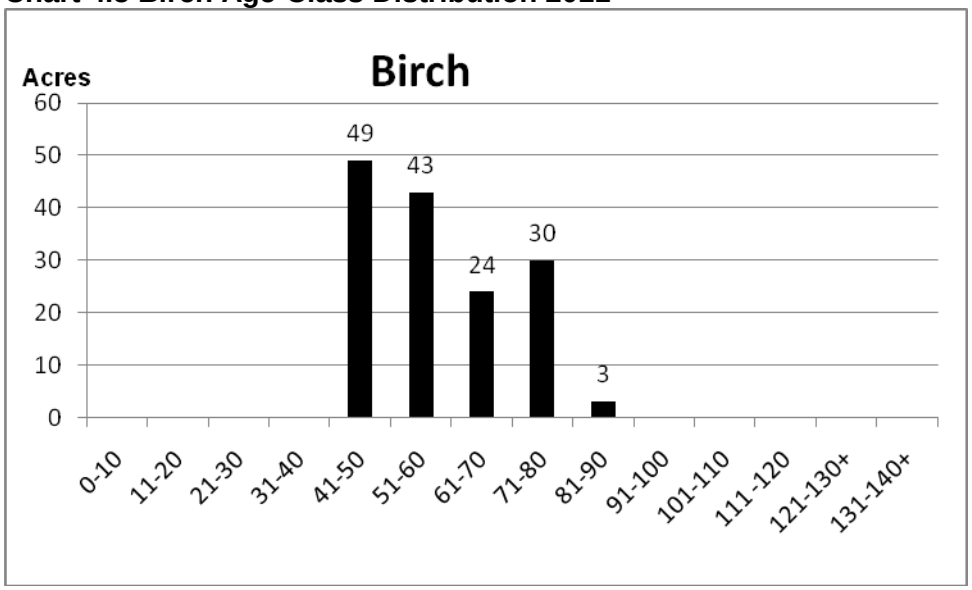
Chart 4.4 Ash / Lowland Hardwoods Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

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 Management Area which included installing infrastructure to stabilize water levels, perhaps creating habitats more conducive to these forest types..

Chart 4.5 Birch Age-Class Distribution 2011

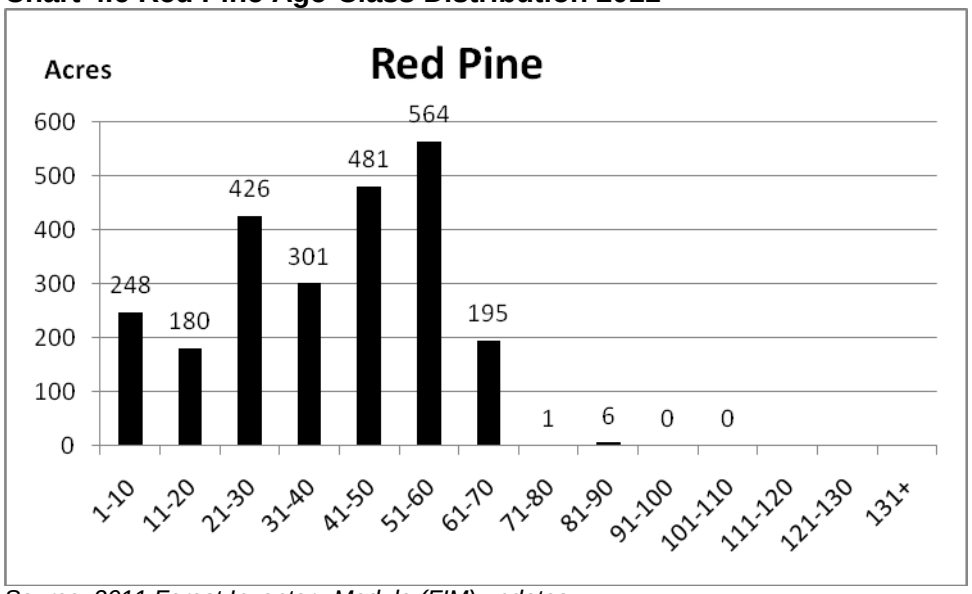


Source: 2011 Forest Inventory Module (FIM) updates

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 hand 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 field 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 4.6 Red Pine Age-Class Distribution 2011



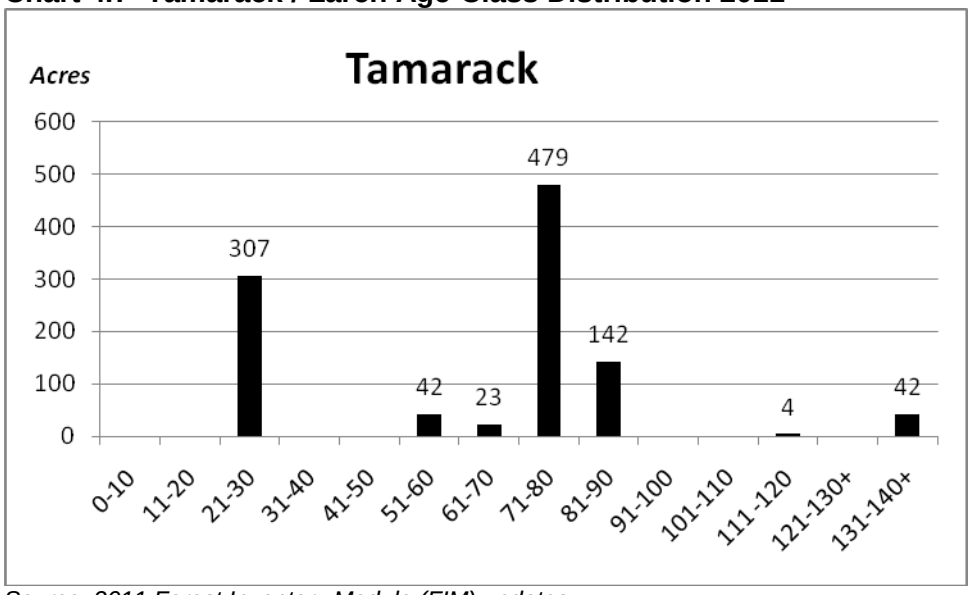
Source: 2011 Forest Inventory Module (FIM) updates

The ASP is on the western edge of the Red Pine range. 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.

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. 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 it summer accessibility.

In the long term there will be a loss of Red Pine when 608 acres (25%) that are currently typed as Red Pine are converted to oak savanna and prairie. Additionally, the majority of the 321 acres (13%) that were planted on wildlife lands will be phased out as they reach maturity.

Chart 4.7 Tamarack / Larch Age-Class Distribution 2011



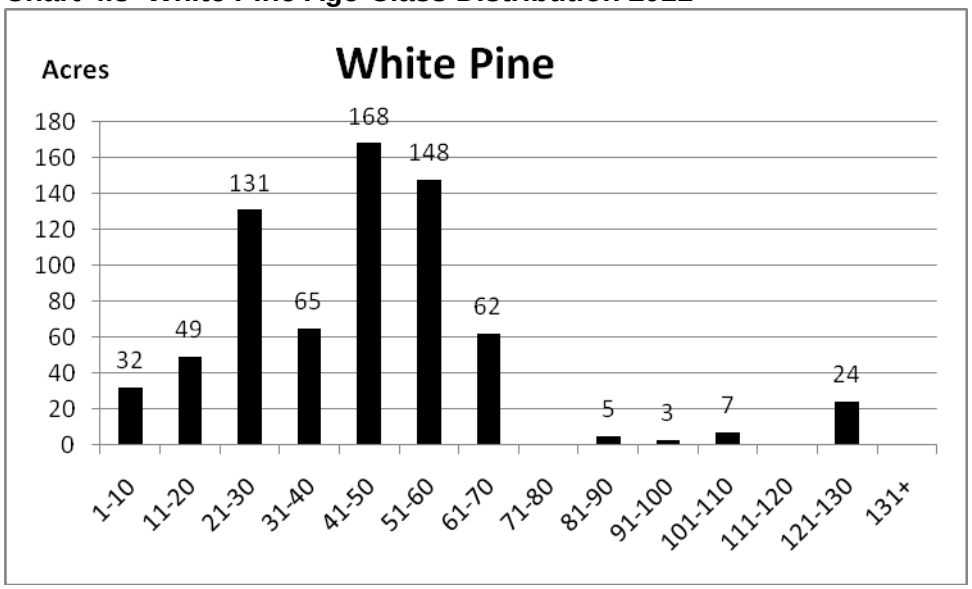
Source: 2011 Forest Inventory Module (FIM) updates

The ASP is at 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 tamarack, 65% (388 acres) occur in one complex just east of Sunrise Pool #1. 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.

The distribution of age classes appears somewhat skewed by this one large complex, 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). They should be revisited to confirm their vigor and volumes.

This chart also includes a small amount (30 acres) of European larch that was planted in the Sand Dunes State Forest. This is non-native to the ASP. It 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.

Chart 4.8 White Pine Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

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.

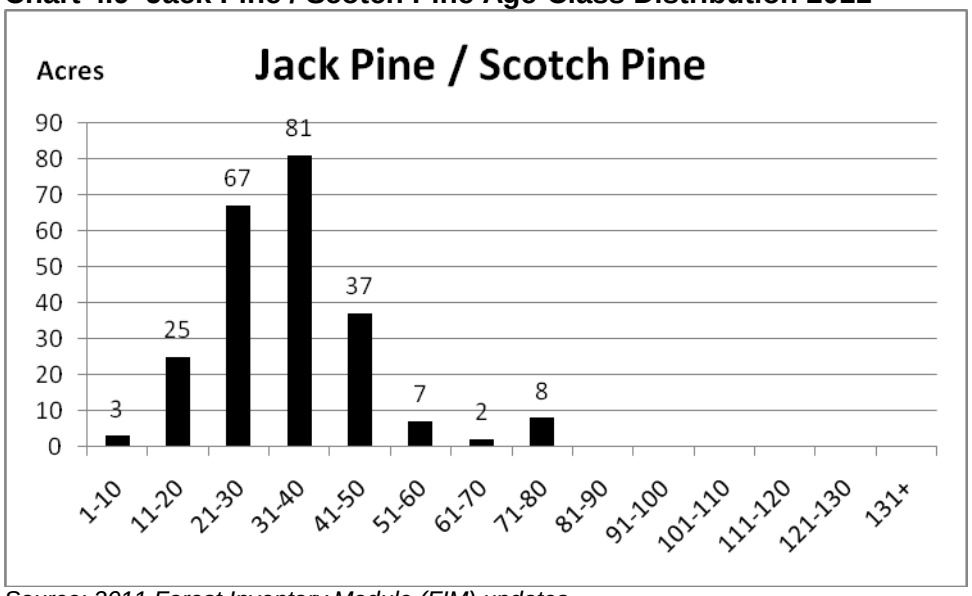
The Anoka Sand Plain (ASP) is on eastern edge of the white pine range. The percentage breakdown of white pine for this subsection is 85% on Forestry lands and 15% on Wildlife lands. It is an aggressive seeder and is easily regenerated by seed trees. It will move into the understory of the oak and other 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.

The distribution of ages of white pine in this subsection are mostly due to as land was acquired in the Sand Dunes State Forest, starting in the 1940's, it 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 citizens of the state were concerned about the loss of white pine stands in the state. Because of that 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. Since that time forestry has made an effort to increase the presence of white pine on the stands. The policy also calls for white pine stands to be at treated as ERF (extended rotation forest).

In the short term there will be an increase of white pine as mixed pine stands or hardwoods stands with white pine (as a component) become dominated by white pine. In

the long term there will be a loss of white pine with 169 acres (24%) that are currently typed as white pine are converted to oak savanna or prairie.

Chart 4.9 Jack Pine / Scotch Pine Age-Class Distribution 2011



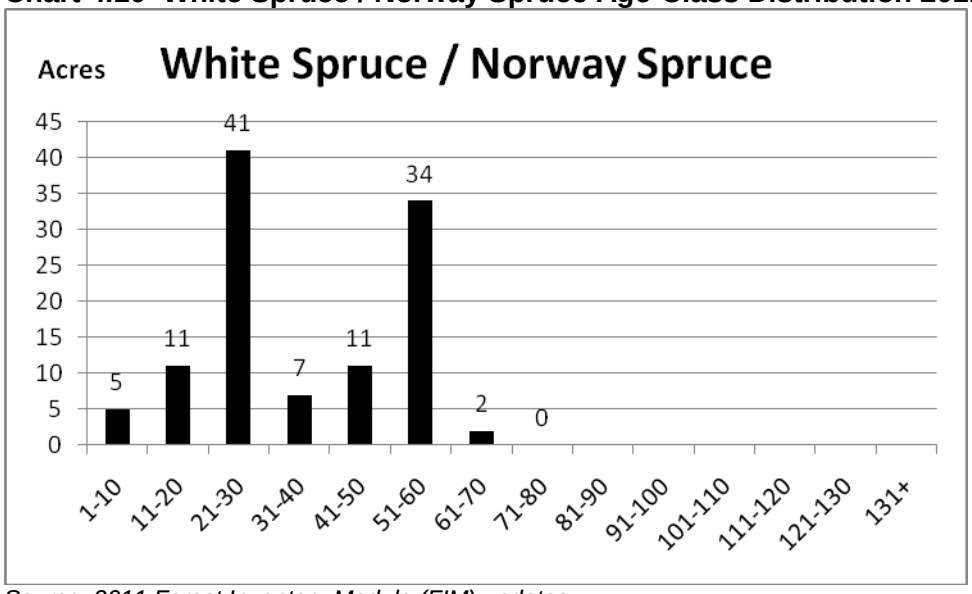
Source: 2011 Forest Inventory Module (FIM) updates

The ASP is at the southern edge of the jack pine range. The Jack pine acres, for this subsection are evenly distributed between forestry and wildlife. Jack pine easily regenerates on the ASP soils. While areas of older jack pine with 8-10´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.

The distribution of age classes in Jack pine shows this rapid decline after ages 30 – 40. In the future there will be fewer acres of jack pine on forestry lands when 45 acres (40%) that are currently typed as jack pine are converted to oak savanna and prairie.

Scotch pine is a non-native to the ASP. Some of the stands that were acquired in the SDSF were Christmas tree plantations. Unfortunately, the plan was to let these trees mature and take them out at rotation age. These trees are prolific seeders and have spread from these original plantations to other parts of the forest. While there are only few acres of pure scotch pine (less than 10) it is a component of many stands. Because the original stock was for Christmas tree they genetically are of poor form for timber. Loggers have said that since there is no grade stamp for Scotch pine, even those that reach larger diameter, this species can only be used for pulp. Like jack pine, these trees are generally short lived and are often attacked by bark beetles. When possible the Department will work to eliminate Scotch pine from the forest.

Chart 4.10 White Spruce / Norway Spruce Age-Class Distribution 2011



Source: 2011 Forest Inventory Module (FIM) updates

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 it's performance pales in comparison to pine.

The age distribution on the chart reflects these various planting periods. 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 current stand, we will select against the spruce.

This chart also represents a small amount (23 acres) of Norway spruce. It is a non-native to the ASP. It will be treated the same as white spruce.

4.3 Historical Forest Composition Compared to Today's Forest

Table 4.2 Historical Forest Composition Comparison - An Estimate

Anoka Sand Plain Historical Forest Composition Comparison for Extant Forests			
Species	**BT**	**FIA**	**Magnitude of Change**
Ash	0.8	4.8	6.1
Aspen	2.9	9.5	3.3
Basswood	1.0	2.3	2.3
Box Elder	0.0	0.7	NA
Bur Oak	41.9	14.6	-2.9
Cherry	0.0	1.3	28.7
Cottonwood/Willow	0.2	0.6	2.8
Elm	2.3	6.8	2.9
Ironwood	0.4	0.4	1.1
Jack Pine	0.4	1.2	2.9
Paper Birch	1.0	1.9	1.9
Pin Oak	29.5	7.5	-4.0
Red Maple	0.0	1.6	NA
Red Oak	6.8	33.5	4.9
Red Pine	0.7	8.3	12.3
Sugar Maple	0.6	0.8	1.4
Tamarack	10.2	1.1	-9.7
White Pine	0.8	1.3	1.7
White Spruce	0.0	0.7	NA

Table Explanation

This table shows the relative abundance of public land survey (PLS) bearing tree (BT) species marked as witness trees in the mid-1800s compared to 1990 Forest Inventory and Analysis (FIA) tree species for extant forests in the subsection. Extant forests in this context are defined as areas that were initially forest at the time of the original public land survey and still were forest in the early 1990s. It provides an estimate of the abundance of certain kinds of tree species before the land was logged and settled, compared to today's forest. Magnitude of change was calculated by comparing FIA data to original bearing trees. For example, a -2.0 in this column represents a 2-fold decline of that tree species since the original public land survey was conducted, while 4.5 would represent a 4.5-fold increase.

Methodology

Relative abundance of BT trees is the percent by tree species identified as BTs in the original land survey records in the subsection. Any general BT trees were apportioned based on known species proportions within the subsection then assigned to a specific species. FIA data were modified to mimic the establishment of a survey corner by recording only one tree in each quadrant of the FIA sampling point similar to the selection of BT trees in the past. The relative abundance of FIA tree species is based on this estimate. Relative abundance data have been produced at subsection and the LTA (land type association) levels. This assessment includes only the subsection data. The LTA level data can provide land managers more detailed information on where in the larger subsection the composition changes are greater. LTA data can be used to assist in determining where it would be appropriate to attempt restoration of a species, if that is desired, within a subsection.

Summary of Table 4.2
Subsection-level data for the Anoka Sand Plain should be interpreted with the understanding the data applies only to extant forests. Based on the available data, important species showing a significant increase were aspen, elm, red oak, and red pine. Bur oak, pin oak, and tamarack were the only important tree species showing a significant decline. Some of these cover type changes may be explained by identification interpretations of the surveyors. *Note: Where a species is rare in the BT data, the data may not be as reliable.*

4.4 Old-Growth Forests

DNR's old-growth management goal is to identify and protect the highest quality remaining natural old-growth forest communities on state-administered lands. Old-growth forest stands are defined by age, structural characteristics, and relative lack of human disturbance. These forests are essentially free from catastrophic disturbances and contain old trees (generally more than 120 years old), large snags, and downed trees.

Old-growth forest represents the latter stages of succession in forested ecosystems. Remaining old-growth forests are important for their scientific and educational values, as well as their aesthetic and spiritual appeal. Old-growth forests provide special habitats for native plants, important habitat features for wildlife, and examples of the maximum limits of individual tree and stand production. Because old-growth ecosystems developed for a long time without large-scale disturbance, the study of plants, animals, soils, and ecosystem processes in old-growth stands provides important insights into the natural function of forest ecosystems. Such insights can be crucial for future forest management and for maintenance of biological diversity.

Old-growth designations are based on the 1994 DNR Old-Growth Guidelines. Designation of old-growth stands in the Anoka Sand Plain subsection was completed in 2011.

The 1994 goals for acreage and number of sites may be adjusted in the future. If new information becomes available on the extent, quality, and distribution of potential old-growth stands meeting prescribed selection criteria, the goals may be adjusted. If individual stands that appear to meet requirements are discovered on state land during the SFRMP process or in subsequent years, they may be evaluated and given official old-growth status if they qualify.

Table 4.3 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 (i.e., given official protection) and 1,350 acres were released from candidacy.

Table 4.3 Designated old-growth acres in the Anoka Sand Plain Subsection

Forest 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

CHAPTER 5

Timber Harvest

5.1 Acres of Timber Sold on DNR Lands in the ASP

The annual harvest on DNR lands is allocated and tracked in acres. Table 5.1 shows relatively significant differences over the last ten years. One reason for differences in the yearly harvest level is the variation in timber markets and the resulting amount sold each fiscal year (i.e., July 1–June 30).

Table 5.1 Acres of State timber sales offered 2001-2010: Anoka Sand Plain

Fiscal Year	Total Acres
2001	517
2002	400
2003	124
2004	353
2005	434
2006	321
2007	358
2008	231
2009	240
2010	315

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul

5.2 Volume and Value of Timber Sold From DNR Lands in the ASP

The annual harvest on DNR lands is allocated and tracked in acres. The following charts show the total *volume* sold per year in cords for the subsection.

Table 5.2 Annual Harvest on DNR lands Anoka Sand Plain

Year	Cords	Value $	Average Price /Cord	Biomass-ton	Value $	Price/ Ton
2001	2154	58,304.60	26.53			
2002	3891	93,755.30	24.09			
2003	No data	no data	no data			
2004	1614	23,321.40	14.45			
2005	1425	38,499.45	27.02			
2006	1386	39,152.00	28.25			
2007	2609	36,897.00	16.6			
2008	2792	52,982.29	18.98	841	1398.62	1.66
2009	3105	76,771.30	24.72	2058	1780.9	0.43
2010	4371	117,842.20	26.96	554	663.9	0.6

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul.

Table 5.3 Timber Scaled by product and species - Fiscal Year 2007

Species	Product	Volume	Value	Value/Cord
Norway pine	Pulp & Bolts	1202	23,559.20	19.60
Scotch pine	Pulp & Bolts	59	661.92	11.20
White pine	Pulp	59.1	1261.79	21.35
White spruce	Pulp	6.4	121.60	19.00
Mixed species – all	Biomass	437.4	787.32	1.80

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul

Table 5.4 Timber Scaled by product and species – Fiscal Year 2008

Species	Product	Volume	Value	Value/Cord
Ash	Sawtimber	0.9	61.88	68.
Aspen Species	Pulp & Bolts	38.0	1083.00	28.50
Trembling Aspen	Pulp and Bolts	1657.0	53,412.95	32.25
Northern Hardwoods	Cordwood/Pulp	438.1	1967.57	4.49
Basswood	Sawtimber	0.2	14.58	81.00
Oak Species	All Products	962.2	10,800.15	11.24
Norway pine	All Products	1646.6	41,893.64	25.44
Scotch pine	All products	37	356.20	9.58
White pine	All Products	105	2,917.45	27.79
White spruce	Pulpwood	4	64.00	16.00
Jack pine	All products	67	1,116.75	16.67
All species	Biomass	705. tons	1269.9	1.80/ton

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul.

Table 5.5 Timber Scaled by Product and species – Fiscal Year 2009

Species	Product	Volume	Value	Value/ Cord
Trembling Aspen	Pulp and Bolts	11.1	167.8	15.12
Northern Hardwoods	All products	145	3,333.75	22.99
Oak Species	All products	1320	33,090	25.07
Norway pine	Pulp & Bolts	363.8	10,015.97	27.53
Scotch pine	All products	101	1414	14.00
White Pine	All products	49	1363	27.82
White Spruce	All products	62.5	1401.72	22.43
Jack Pine	All products	79.7	1690.39	21.21
All Species	Biomass – TONS	1092.9	894.72	0.82/ton

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul.

Table 5.6 Timber Scaled by product and species – Fiscal Year 2010

Species	Product	Volume	Value	Value/Cord
Trembling Aspen	All products	301.2	9,527.79	31.63
Northern Hardwoods	All products	127.0	835.30	6.58
Oak Species	All products	1079.8	13,168.32	12.19
Northern Pin Oak	All products	247	10,825.80	43.83
Bur Oak	All products	22.0	268	12.18
Misc Hardwoods	All Products	45.4	765.7	16.22
Norway pine	All products	1220.3	29,015.28	23.78
Scotch pine	All products	143.3	2793.86	19.5
White Pine	All products	133.8	3391.30	25.35
White Spruce	Al l products	110.0	2530.00	23.00
Jack pine	All products	119.1	2680.12	22.50
Eastern Red Cedar	All products	17.2	79.15	4.59
All Species	Biomass - tons	644.85	494.10	1.13/ton

Source: Timber Sales Historical Records database, Timber Sales Module, Minnesota DNR, St. Paul.

CHAPTER 6

Ecological Information

6.1 Ecological Description of the Subsection

Anoka Sand Plain

This subsection encompasses the Anoka Sand Plain and sandy valley trains along the Mississippi River in Central Minnesota (Dept. of Soil Science, Univ. of Minn., 1980b). The Mississippi River and its valley forms the western boundary. The boundary of the Anoka Sand Plain forms the eastern and northern edges.

This subsection consists of a flat, sandy lake plain and terraces along the Mississippi River. Recent mapping suggests that much of the sand plain, once thought to be fluvial, is probably lacustrine in origin (Lehr, in progress). Low moraines are locally exposed above the outwash and there are small dune features (Wright 1972). There are also ice block depressions and southwest trending tunnel valleys on the sand plain (Albert 1993).

Landform

The major landform is a broad sandy lake plain, which contains small dunes, kettle lakes, and tunnel valleys. Topography is level to gently rolling. There are small inclusions of ground moraine and end moraine (Wright 1972). The other important landform is a series of sandy terraces associated with historic levels of the Mississippi River. Terraces are also associated with major tributaries of the Mississippi.

Bedrock geology

Bedrock is locally exposed in the St. Cloud area. Surface glacial deposits are usually less than 200 feet thick (Olsen and Mossler 1982). The subsection is underlain by Cambrian and Ordovician dolomite, sandstone, and shale (Morey 1976).

Soils

Soils are derived primarily from fine sands of the sandy plain. Most of these sandy soils are droughty, upland soils (Psamments), but there are organic soils (Hemists) in the ice block depressions and tunnel valleys, and poorly drained prairie soils (Aquolls) along the Mississippi River (Cummins and Grigal 1981). Seventy to 80% of the soils are excessively well drained sands and another 20% are very poorly drained (Dept. of Soil Science, Univ. of Minnesota 1980b).

Climate

Total annual precipitation ranges from 27 inches in the west to 29 inches in the east, with growing-season precipitation ranging from 12 to 13 inches. The growing season length ranges from approximately 136 to 156 days, with the longest growing season in the south.

Hydrology
Terraces associated with the Mississippi River form part of the western boundary of the subsection. Most rivers and streams are tributaries of the Mississippi, although some flow east to the St. Croix River, which eventually flows into the Mississippi. Many rivers, streams, and lakes are located in old glacial tunnel valleys. There are 38 lakes larger than 160 acres in area; about 3% of the subsection's surface is covered by water. Peatlands occupy linear depressions of many tunnel valleys (Albert 1993).

Pre-settlement vegetation
The predominant vegetation on the droughty uplands was oak barrens and openings. Characteristic trees included small and misformed bur oak and northern pin oak (Kratz and Jensen 1983). Jack pine was present locally along the northern edge of the subsection. Brushland characterized large areas of the sand plain. Upland prairie formed a narrow band along the Mississippi River, as did areas of floodplain forest (Marschner 1974).

Present vegetation and land use
Sod and vegetable crops are extensively grown on drained peat and muck areas (Dept. of Soil Science, Univ. of Minnesota 1980). Urban development is rapidly expanding into the subsection. Wheeler et al. (1985) found species associated with oak openings and oak barrens to be abundant in the sand plain although large areas of openings and barrens are uncommon on today's landscape.

Natural disturbance
Fire and drought were important factors impacting the vegetation of the sand plain. Drought caused mortality of two of the dominant species of the oak barrens and savannas, northern pin oak and bur oak. During severe periods of drought, vegetation cover was greatly reduced on portions of the sand plain, resulting in eolian erosion and sand dune movement (Keen and Shane 1990).

6.2 Land Type Associations of the Subsection

There are five Land Type Associations (LTAs) in the Anoka Sand Plain Subsection. Most of the state lands covered by this plan, including all of the Sand Dunes State Forest and all of Carlos Avery Wildlife Management Area, are in the Anoka Lake Plain LTA (see Map 6.1).

Mc01 Anoka Lake Plain 679,189 acres

A nearly level to gently rolling lake plain formed by melt water from the Grantsburg Sublobe. Some areas have been reworked by wind to form dunes. Uplands occupy 73%, wetlands occupy 22%, and lakes occupy 5% of the LTA (MNDNR, 1998). Soil parent material is fine sand. Pre-European settlement vegetation was predominantly a complex of oak savannas with wet prairies.

Mc02 Burns Till Plain 52,998 acres

A steep stagnation moraine formed by the Grantsburg Sublobe. Soils have formed under forest vegetation in coarse loams, sands, and gravel parent materials. Pre-European settlement vegetation was a mix of big woods, aspen-oak forest, and some oak savanna.

Mc03 Elk River Moraine 27,073 acres

A rolling to steep pitted outwash plain formed by the Superior Lobe glacier. Soils have formed under forest vegetation in sandy and gravelly parent material. Pre-European settlement vegetation was a mix of aspen-oak forest and some oak savanna.

Mc04 Agram Sand Plain 108,886 acres

A rolling outwash plain formed by the Superior Lobe glacier. Soils have formed under prairie vegetation in sandy parent material with a coarse loamy surface mantle. Pre-European settlement vegetation was a mix of oak savanna, wet prairie, and brush prairies.

Mc05 Mississippi Sand Plain 332,055 acres

A nearly level to rolling landscape formed by outwash channels and post-glacial river terraces. Uplands occupy 88%, wetlands occupy 9%, and lakes occupy 3% of the LTA (MN DNR, 1998). Soils have formed in sandy parent material under prairie or oak savanna vegetation. Vegetation prior to European settlement was a mix of oak savanna, prairie, and wet prairie (Marschner, 1974).

6.3 Native Plant Communities of the Subsection

Minnesota's Native Plant Community Classification

The process of revising the Minnesota Department of Natural Resources' native plant community classification began in 1996 as a collaborative project among the Division of Ecological Services' Natural Heritage and Nongame Research Program (NHNRP), the Minnesota County Biological Survey (MCBS), and the Division of Forestry's Ecological Land Classification Program (ELCP). The revised community classification is integrated with the ECLP's ecological land classification of Minnesota and is based on extensive analyses of vegetation plot data. The new classification replaces the plant community classification presented in *Minnesota's Native Vegetation: A Key to Natural Communities, Version 1.5*. The second volume of the new classification*, Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province,* was published in 2005 and includes the Anoka Sand plain Subsection. The field keys to Minnesota's forested plant communities contained within this field guide are being used with other ECS and native plant community (NPC) information to provide another tool to use in making forest management decisions on state lands.

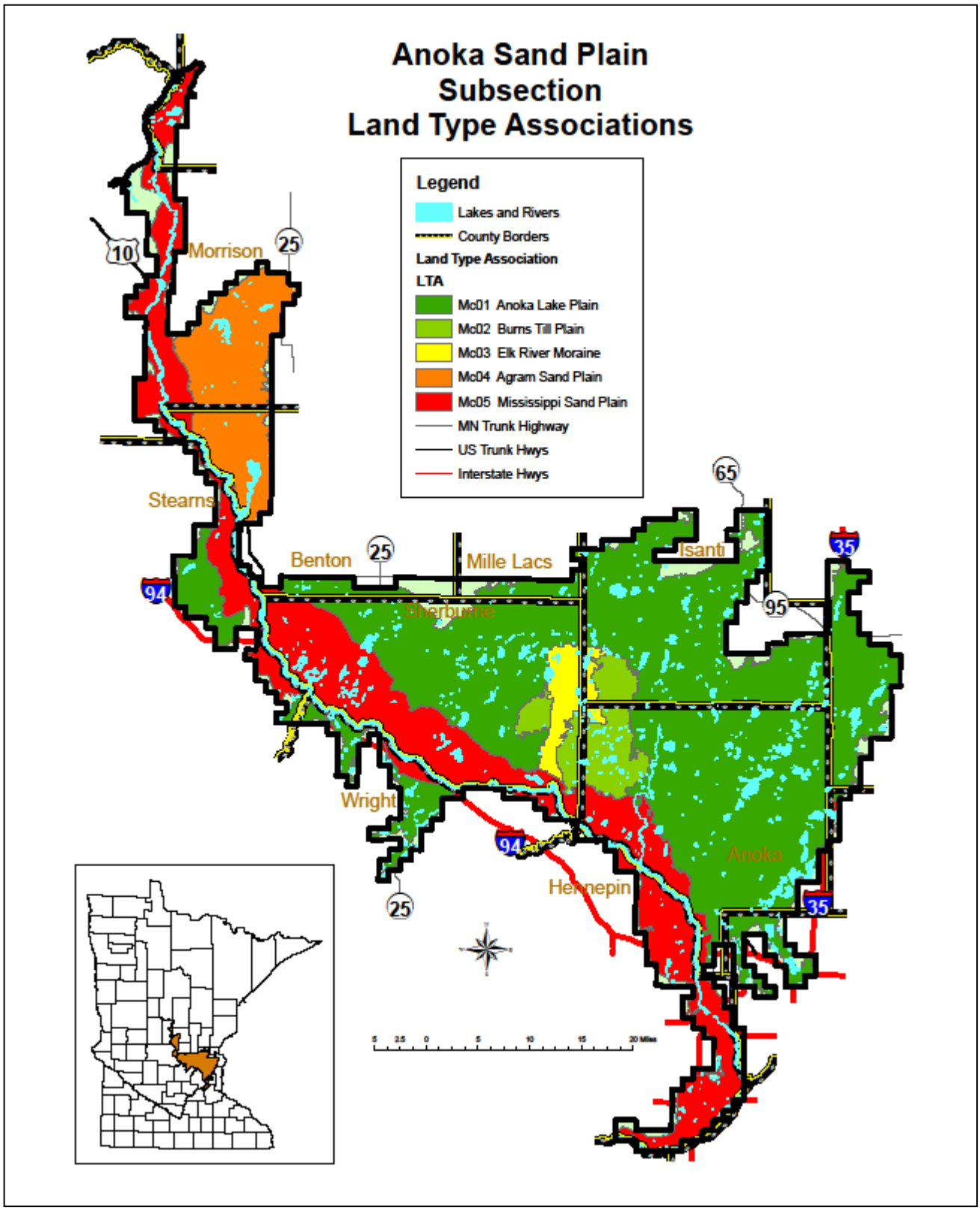
Results of the Classification Revision Project

1. ELCP will have a plant community classification integrated with its statewide land classification system. ELCP will use the community classification to develop ecosystem management tools for field managers that enable rapid identification of the vegetation potential of sites and identification of options for sustainable forest management.

2. MCBS and NHNRP will have a statewide classification that is more useful than the current classification for biodiversity surveys, research, and conservation work in Minnesota.

3. All three programs will be better able to communicate to land managers the role of major ecological processes in plant communities and landscapes.

Map 6.1 Land Type Associations



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

Classification of Native Plant Communities

The delineation of native plant communities in the new classification is based on statistical analyses of vegetation plot data, or relevés, which are housed in the DNR's Natural Heritage Information System Relevés Database. Most of these relevés were done by ecologists with the MCBS and NHNRP or by contractors working with ELCP in the Chippewa National Forest. During the classification project, relevés were also acquired from other sources, including research projects, environmental review projects, and conservation inventories. A total of 2,756 relevés were analyzed to develop the classification of wooded communities. These plot data reflect much of the variation in wooded plant communities across Minnesota, although there are some areas of the state for which few relevés exist.

Analyses of the vegetation plot data were organized within the framework of ecologically defined land units developed by ELCP (see Ecological Classification System map of Minnesota in Appendix A). The result is a classification of wooded plant communities that relates more deliberately to variation in physical features of the landscape than the previous classification and has an ecologically based hierarchy. The hierarchy of Minnesota's wooded plant community classification is:

Ecological System (such as Fire-Dependent Forest/Woodland System)
Floristic Region (such as Northern Floristic Region)
Native Plant Community Class (such as Dry-Sand Pine Woodland)
Native Plant Community Type (such as Dry-Sand Jack Pine Woodland) (Sometimes with subtypes)

Native plant community classifications differ from forest cover types (such as those used in cooperative stand assessment forest inventory) in that they are based on all vascular plant species, not just the dominant tree species.

The following list includes the native plant communities that contain trees and are found in the Anoka Sand Plain, then lists their associated codes and gives a brief description. Much more detailed information about the plant communities, including distribution maps, can be found *in Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province.* A copy of this publication will be available at sites where hard copies of this Issues and Assessment document are available for public viewing. In addition, the field guide is available through the Minnesota Bookstore at http://www.comm.media.state.mn.us/bookstore.

Native Plant Communities that Include Trees in the Anoka Sand Plain – Systems, Classes, Types, and Codes -

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

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 (East central)

WFn64 NORTHERN VERY WET ASH SWAMP

WFn64b Black Ash-Yellow Birch – Red Maple – Alder Swamp (East central)

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

UPLAND PRAIRIE SYSTEM

UPs14 SOUTHERN DRY SAVANNA
UPs14a Dry Barrens Oak Savanna (Southern)
UPs14a2 Dry Barrens Oak Savanna (Southern): Oak Subtype
UPs14b Dry Sand – Gravel Oak Savanna (Southern)

UPs24 SOUTHERN MESIC SAVANNA
UPs24a Mesic Oak Savanna (Southern)

6.4 Minnesota's List of Endangered, Threatened, and Special Concern Species Rare Features Information

Purpose, Scope, and Relationships to Federal Laws

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota DNR to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern (ETS). The resulting List of Endangered, Threatened, and Special Concern Species (http://www.dnr.state.mn.us/ets/index.html) is codified as Minnesota Rules, Chapter 6134. The Endangered Species Statute also authorizes the DNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300.

Minnesota's Endangered Species Statute and the associated rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. A person may not take, import, transport, or sell any portion of an endangered or threatened species. However, these acts 1) may be allowed by permit issued by the DNR, 2) exempt plants on certain agricultural lands and plants destroyed in consequence of certain agricultural practices, and 3) exempt the accidental, unknowing destruction of designated plants. Minnesota's Endangered Species Statute or the associated rules do not protect species of special concern. Persons are advised to read the full text of the statute and rules in order to understand all regulations pertaining to species that are designated as endangered, threatened, or species of special concern.

Note that the federal Endangered Species Act of 1973, as amended (16 USC 1531 _ 1544) requires the U.S. Department of the Interior to identify species as endangered or threatened according to a separate set of definitions, and imposes a separate set of restrictions for those species. Two species on the federal list of endangered or threatened species (see http://www.fws.gov/midwest/endangered/lists/minnesot-spp.html) occur in the Anoka Sand plain: Higgin's eye mussel and Karner blue butterfly.

For more information on listed species, contact:

Natural Heritage and Nongame Research Program
Minnesota Department of Natural Resources
500 Lafayette Rd, Box 25
St. Paul, MN 55155
651-259-5090
1-888-646-6367

Minnesota Natural Heritage Information System

Records of known locations of listed species are maintained in the Natural Heritage Information System. All DNR offices have this information available for review prior to forest management activities to determine if a known location of a rare species is in the vicinity of a stand. When reviewing forest stands for management activities during the planning process, this information will be available when assigning stand prescriptions. If an ETS species is known to exist or found on a site, management activities are modified to protect, promote, or enhance the ETS species on the site.

Survey Methods

Much of the information about rare features in the Natural Heritage Information System is the result of systematic rare features survey work done since the 1970s by the MCBS and the Natural Heritage Program, and contained within historic records and collections. While survey process and protocols for plants and animals are necessarily different in some ways, methods common to both include:

- Review of existing information
- Selection of targeted species and survey sites

- Field survey using techniques appropriate to the species
- Information management

A more detailed description of rare plant and animal survey procedures can be found in the MCBS page of the Minnesota DNR Web site at: http://www.dnr.state.mn.us/eco/mcbs/procedures/index.html.

Minnesota Listed Species

The rare feature products prepared for the Anoka Sand plain subsection plan include information on species of plants and animals listed as endangered, threatened, and special concern (ETS). *Minnesota's List of Endangered, Threatened, and Special Concern Species* was created in 1984 and was last revised in 1996. The List, created under Minnesota's Endangered and Threatened Species Statute, draws attention to species that are at greatest risk of extinction within the state and applies special regulations to 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 flora and fauna. Because the list influences 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 periodic revisions to the list.

Rare Features Codes

Minnesota Status

END—Endangered. A species is considered **endangered** if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.

THR—Threatened. A species is considered **threatened** if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.

SPC—Special Concern. A species is considered a species of **special concern** if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range not listed as threatened may be included in this category, along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

NON—Plant or animal species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories:

- The species is being considered for addition to the state list.
- The species was removed from the state list but records for the species are still entered and maintained as a precautionary measure.
- The species has been recently discovered in the state; the species is presumed to be extirpated from the state.

NPC (Native Plant Community) System (adapted from native plant community systems in *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*; the aquatic systems listed here, as well as the U and code, were created for this SFRMP process and are not a part of the field guide).

AL – Aquatic (lake)
AR – Aquatic (river)
CL – Cliff
FD – Fire dependent forest
FF – Floodplain forest

LK – Lakeshore
MR – Marsh
MH – Mesic hardwood forest
FP – Forested/treed peatland (includes both rich and acid forested/treed peatlands)
OP – Open rich peatland (includes rich fens)
AP – Acid peatland (includes open bogs)
RV – River shore
WF – Wet forest
WM – Wet meadow/carr
UP – Upland Prairie
U – Wide-ranging and/or associated with a wide variety of habitats

Table 6.1 – Animals MINNESOTA LISTED SPECIES – Anoka Sand Plain

Scientific Name	Common Name	Name Category	MN Status	NPC System
Acipenser fulvescens	Lake Sturgeon	Vertebrate Animal	SPC	AL, AR
Actinonaias ligamentina	Mucket	Invertebrate Animal	THR	AR
Agapetus tomus	A Caddisfly	Invertebrate Animal	SPC	AR
Alasmidonta marginata	Elktoe	Invertebrate Animal	THR	AR
Ammodramus nelsoni	Nelson's Sparrow	Vertebrate Animal	SPC	AP, WM, OP
Arcidens confragosus	Rock Pocketbook	Invertebrate Animal	END	AR
Buteo lineatus	Red-shouldered Hawk	Vertebrate Animal	SPC	MH, FF, MR
Cicindela lepida	Little White Tiger Beetle	Invertebrate Animal	THR	UP
Cicindela patruela patruela	Northern Barrens Tiger Beetle	Invertebrate Animal	SPC	UP
Clemmys insculpta	Wood Turtle	Vertebrate Animal	THR	MH, FF, AR, RV
Cycleptus elongatus	Blue Sucker	Vertebrate Animal	SPC	AR

Scientific Name	Common Name	Name Category	MN Status	NPC System
Cyclonaias tuberculata	Purple Wartyback	Invertebrate Animal	THR	AR
Cygnus buccinator	Trumpeter Swan	Vertebrate Animal	THR	AL, AR
Dendroica cerulea	Cerulean Warbler	Vertebrate Animal	SPC	MH, FF
Ellipsaria lineolata	Butterfly	Invertebrate Animal	THR	AR
Elliptio dilatata	Spike	Invertebrate Animal	SPC	AR
Empidonax virescens	Acadian Flycatcher	Vertebrate Animal	SPC	MH, FF
Emydoidea blandingii	Blanding's Turtle	Vertebrate Animal	THR	AR, UP, MR
Etheostoma microperca	Least Darter	Vertebrate Animal	SPC	AR, AL
Falco peregrinus	Peregrine Falcon	Vertebrate Animal	THR	CL
Gallinula chloropus	Common Moorhen	Vertebrate Animal	SPC	MR, AR, AL
Haliaeetus leucocephalus	Bald Eagle	Vertebrate Animal	SPC	U
Hesperia leonardus leonardus	Leonard's Skipper	Invertebrate Animal	SPC	UP
Hesperia uncas	Uncas Skipper	Invertebrate Animal	END	UP
Heterodon nasicus	Plains Hog-nosed Snake	Vertebrate Animal	SPC	UP
Lampsilis higginsi	Higgins Eye	Invertebrate Animal	END	AR
Lanius ludovicianus	Loggerhead Shrike	Vertebrate Animal	THR	UP
Lasmigona compressa	Creek Heelsplitter	Invertebrate Animal	SPC	AR
Lasmigona costata	Fluted-shell	Invertebrate Animal	SPC	AR
Ligumia recta	Black Sandshell	Invertebrate Animal	SPC	AR
Lycaeides melissa samuelis	Karner Blue	Invertebrate Animal	END	UP
Marpissa grata	A Jumping Spider	Invertebrate Animal	SPC	UP
Metaphidippus arizonensis	A Jumping Spider	Invertebrate Animal	SPC	UP
Microtus ochrogaster	Prairie Vole	Vertebrate Animal	SPC	UP
Myotis septentrionalis	Northern Myotis	Vertebrate Animal	SPC	FD, MH
Notropis anogenus	Pugnose Shiner	Vertebrate Animal	SPC	AR, AL
Paradamoetas	A Jumping	Invertebrate	SPC	UP, FP,

Scientific Name	Common Name	Name Category	MN Status	NPC System
fontana	Spider	Animal		MR
Perognathus flavescens	Plains Pocket Mouse	Vertebrate Animal	SPC	UP
Phalaropus tricolor	Wilson's Phalarope	Vertebrate Animal	THR	AL, AR, WM, UP, MR
Pipistrellus subflavus	Tricolored Bat	Vertebrate Animal	SPC	MH, FD
Pituophis catenifer	Gophersnake	Vertebrate Animal	SPC	UP
Pleurobema coccineum	Round Pigtoe	Invertebrate Animal	THR	AR
Quadrula nodulata	Wartyback	Invertebrate Animal	END	AR
Seiurus motacilla	Louisiana Waterthrush	Vertebrate Animal	SPC	MH, FF
Speyeria idalia	Regal Fritillary	Invertebrate Animal	SPC	UP
Sterna forsteri	Forster's Tern	Vertebrate Animal	SPC	AL, LK
Truncilla donaciformis	Fawnsfoot	Invertebrate Animal		AR
Tutelina formicaria	A Jumping Spider	Invertebrate Animal	SPC	UP
Tympanuchus cupido	Greater Prairie-chicken	Vertebrate Animal	SPC	UP
Wilsonia citrina	Hooded Warbler	Vertebrate Animal	SPC	MH, FF, WF

Table 6.2 – Plants and Fungi: MINNESOTA LISTED SPECIES

Scientific Name	Common Name	Name Category	MN Status	NPC System
Antennaria parvifolia	Small-leaved Pussytoes	Vascular Plant	SPC	UP
Aristida tuberculosa	Sea-beach Needlegrass	Vascular Plant	SPC	UP
Baptisia alba	White Wild Indigo	Vascular Plant	SPC	UP
Bartonia virginica	Virginia Bartonia	Vascular Plant	END	FP, WM
Besseya bullii	Kitten-tails	Vascular Plant	THR	UP
Botrychium oneidense	Blunt-lobed Grapefern	Vascular Plant	END	MH
Botrychium rugulosum	St. Lawrence Grapefern	Vascular Plant	THR	FD
Botrychium simplex	Least Moonwort	Vascular Plant	SPC	U
Carex formosa	Handsome Sedge	Vascular Plant	END	MH
Carex obtusata	Blunt Sedge	Vascular Plant	SPC	UP
Carex plantaginea	Plantain-leaved Sedge	Vascular Plant	END	MH
Cirsium hillii	Hill's Thistle	Vascular Plant	SPC	UP
Cypripedium arietinum	Ram's-head Lady's-slipper	Vascular Plant	THR	FP, FD
Decodon verticillatus	Waterwillow	Vascular Plant	SPC	MR, LK, RV
Fimbristylis autumnalis	Autumn Fimbristylis	Vascular Plant	SPC	LK, WM
Hudsonia tomentosa	Beach-heather	Vascular Plant	SPC	UP
Huperzia porophila	Rock Clubmoss	Vascular Plant	THR	CL
Hydrocotyle americana	American Water-pennywort	Vascular Plant	SPC	WF
Juglans cinerea	Butternut	Vascular Plant	SPC	MH
Juncus marginatus	Marginated Rush	Vascular Plant	SPC	WP, WM
Juniperus horizontalis	Creeping Juniper	Vascular Plant	SPC	UP
Laccaria trullisata	Sandy Laccaria	Fungus	SPC	UP
Lactarius fuliginellus	A Species of Fungus	Fungus	SPC	UP
Minuartia dawsonensis	Rock Sandwort	Vascular Plant	SPC	UP
Najas gracillima	Thread-like Naiad	Vascular Plant	SPC	AL
Oenothera rhombipetala	Rhombic-petaled Evening Primrose	Vascular Plant	SPC	UP
Orobanche uniflora	One-flowered Broomrape	Vascular Plant	SPC	UP
Panax quinquefolius	American Ginseng	Vascular Plant	SPC	MH
Platanthera clavellata	Club-spur Orchid	Vascular Plant	SPC	AP, OP
Platanthera flava var. herbiola	Tubercled Rein-orchid	Vascular Plant	END	WM
Poa paludigena	Bog Bluegrass	Vascular Plant	THR	WF
Polygala cruciata	Cross-leaved Milkwort	Vascular Plant	END	WM
Potamogeton bicupulatus	Snailseed Pondweed	Vascular Plant	END	AL
Potamogeton diversifolius	Diverse-leaved Pondweed	Vascular Plant	END	AL
Psathyrella rhodospora	A Species of Fungus	Fungus	END	MH, FF
Rotala ramosior	Tooth-cup	Vascular Plant	THR	LK
Scirpus clintonii	Clinton's Bulrush	Vascular Plant	SPC	WM
Scleria triglomerata	Tall Nut-rush	Vascular Plant	END	UP, WP, WM
Shinnersoseris rostrata	Annual Skeletonweed	Vascular Plant	THR	UP

Scientific Name	Common Name	Name Category	MN Status	NPC System
Silene drummondii	Drummond's Campion	Vascular Plant	SPC	UP
Trillium nivale	Snow Trillium	Vascular Plant	SPC	MH
Triplasis purpurea	Purple Sand-grass	Vascular Plant	SPC	UP
Viola lanceolata	Lance-leaved Violet	Vascular Plant	THR	WM
Xyris torta	Twisted Yellow-eyed Grass	Vascular Plant	END	WM

Additional Species Data

In addition to information on listed species, the Anoka Sand Plain subsection plan includes information on species labeled as "NONs." "NONs" are defined as a plant or animal species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories:

- The species is being considered for addition to the state list.
- The species was removed from the state list but records for the species are still entered and maintained as a precautionary measure.
- The species has been recently discovered in the state or the species is presumed to be extirpated from the state.

Table 6.3 "NONs"-Plants *MINNESOTA "NONs" –*

Scientific Name	Common Name	Name Category	MN Status	NPC System
Bartramia longicauda	Upland Sandpiper	Vertebrate Animal	NON	UP
Botaurus lentiginosus	American Bittern	Vertebrate Animal	NON	MR, FP, WM
Elaphe vulpina	Western Fox Snake	Vertebrate Animal	NON	UP, FD
Grus canadensis	Sandhill Crane	Vertebrate Animal	NON	MR, UP
Heterodon platirhinos	Eastern Hognose Snake	Vertebrate Animal	NON	FD, UP
Lycaena epixanthe michiganensis	Bog Copper	Invertebrate Animal	NON	FP, AP
Agalinis purpurea	Purple Gerardia	Vascular Plant	NON	WM
Aristida longespica var. geniculata	Spiked Needlegrass	Vascular Plant	NON	UP, WP
Carex grayi	Gray's Sedge	Vascular Plant	NON	FF
Echinochloa walteri	Walter's Barnyard Grass	Vascular Plant	NON	FF, MR
Gaura biennis	Biennial Gaura	Vascular Plant	NON	UP, FD
Hieracium longipilum	Long-bearded Hawkweed	Vascular Plant	NON	UP
Linaria canadensis	Old Field Toadflax	Vascular Plant	NON	UP
Lycopus virginicus	Virginia Water Horehound	Vascular Plant	NON	FF, WF, WM, MR
Myriophyllum tenellum	Leafless Water Milfoil	Vascular Plant	NON	LK
Oenothera laciniata	Slashed Evening Primrose	Vascular Plant	NON	UP
Oxypolis rigidior	Cowbane	Vascular Plant	NON	WM
Polygonum arifolium	Halberd-leaved Tearthumb	Vascular Plant	NON	MR, WM, WF
Rubus semisetosus	Half Bristly Bramble	Vascular Plant	NON	WM
Sagittaria graminea	Grass-like Arrowhead	Vascular Plant	NON	WM, LK
Utricularia gibba	Humped Bladderwort	Vascular Plant	NON	OP, LK, AL

Listed Species Status Sheets

The Ecological and Water Resources Division has posted information about listed species on the Rare Species Guide, a web resource on the DNR website at: http://www.dnr.state.mn.us/rsg/index.html. This guide includes information about each species, including habitat and conservation/management information. The rare species tables list the ecological systems each species occurs in. Additional habitat information for animals can be found in the list of Species in Greatest Conservation Need by Habitat found in the Wildlife chapter of this document.

A supplemental document, *Statement of Need and Reasonableness (SONAR) and Species Status Sheets,* is available by contacting the DNR. This document addresses listed species in the state for which a change in status was proposed during the last list revision in 1996. The *Species Status Sheets* provide some information on the species and describe the rationale for the proposed change in Minnesota Status in 1996.

Natural Heritage and Nongame Research Program Species Fact Sheets

The goal of the current species fact sheet project is to update and publish information on Minnesota's rare species. The database fields that will be used to describe habitats have not yet been finalized, but the database will consolidate and draw from existing databases wherever possible (such as the Natural Heritage Information System, Heritage Data Management System, Minnesota Taxonomy Database- MnTAXA, etc.). Species information will be presented using an interactive database approach that allows visitors to the Web site to search on selected fields from a relatively simple database and create customized reports. Users will also be able to perform alphabetical searches to obtain the information they need and generate standard printouts of rare species accounts.

The Heritage Program is aware of, and sensitive to the broader desire to use existing classification schemes, database fields, etc., and will be designing a rare species accounts database on that premise, hoping to complement and not complicate greater coordination efforts throughout the DNR and beyond.

The anticipated project schedule is over the next 18 to 24 months, during which time the content will likely be published in phases: about 200 accounts of endangered and threatened species will be published first, followed by approximately 240 accounts of species of special concern.

Information Resources

The Minnesota (DNR) Natural Heritage Information System rare features database and the Rare Species Guide were the sources for species occurrence information. Hannah Texler (Central Region Regional Plant Ecologist) and Krista Larson (Central Region Acting Nongame Specialist) assessed the native plant community (NPC) system association(s) for these species.

Sources for Additional Rare Species Information

1. The Nature Conservancy. *Element Occurrence Abstracts.*
2. NatureServe. A network connecting science with conservation that includes an online encyclopedia of rare plants and animals. http://www.natureserve.org/.
3. U.S. Department of Agriculture—Forest Service Region 9, Regional Forester *Sensitive Species Conservation Assessment Documents* (also on the Web at: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/index.htm).

6.5 Minnesota County Biological Survey

Process for Conducting Minnesota County Biological Survey (MCBS) Landscape Assessments

Minnesota County Biological Survey (MCBS) fieldwork has been completed in the Anoka Sand Plain subsection (http://www.dnr.state.mn.us/eco/mcbs/procedures/index.html). All MCBS data have been mapped and entered into the appropriate databases with the exception of Crow Wing County, which includes a very small portion of the subsection with little state land. For Crow Wing County, field surveys have been completed, but only preliminary MCBS site and native plant community data are available. This preliminary data from Crow Wing County will be used by the SFRMP team in its assessment process. For all counties, the SFRMP team will include in its assessment package MCBS survey information available in the DNR rare features database, the DNR data deli, and from other sources.

MCBS Site Delineation Process

MCBS ecologists analyze survey areas (a county or ECS subsection) using historic and current ecological information, including remotely sensed data, to identify and delineate areas that appear to have some level of biodiversity significance. These locations are considered MCBS sites. The site is the primary unit around which most MCBS data (such as field evaluations, native plant community records, and ecological evaluations) are organized.

Assessment products have been prepared by staff of the Natural Heritage and Nongame Research Program (NHNRP) and Minnesota County Biological Survey (MCBS), Minnesota Department of Natural Resources (DNR).

Additional information about rare features assessment products is available by contacting the Minnesota DNR.

Procedures—sites and native plant community surveys

1. Review of existing information

Within each county or ecological subsection, site and native plant community surveys begin with a review of existing records and information about areas of native vegetation. Among the sources consulted are:

- Climate, geomorphology, soils data.
- Museum and herbarium records.
- Existing records in the Natural Heritage Information System and other historical records such as the public land surveys Bearing Tree Data Base conducted in Minnesota from 1847 to 1907.
- Other inventories, such as timber stand inventories and the National Wetlands Inventory.
- Knowledgeable individuals.

2. Site selection

Sites that appear to contain important areas of native vegetation are digitized in a Geographic Information System (GIS) or delineated on topographic maps using aerial photography, satellite imagery, and other related resource maps and data. These sources of information are used to determine boundaries and provide a preliminary determination of the types of native plant communities that are present within each site.

MCBS has developed guidelines for determining which sites to map within each county or ecological unit. These include guidance for site evaluation based on size, current condition (including type and extent of human disturbance), landscape context, spatial distribution of native plant communities, and availability of critical rare plant or rare animal habitat. A site most often contains several different kinds of native plant communities (for example, oak forests, sedge meadows, and tamarack swamps); the boundaries of each community type are usually delineated within the site.

3. Field surveys of selected sites
For sites that appear to be of good quality with little evidence of disturbance, the ecologist conducts a field survey, recording notes about the type and structure of vegetation present, the most common plants, and evidence of disturbance such as cut stumps, soil erosion, and abundant weedy or exotic plant species.

If there are good quality examples of native plant communities at the site, the ecologist will often do a vegetation plot sample, or relevé, within one or more of the communities.

4. Information management
After site and native plant community surveys are completed, the ecologist determines which sites and locations of native plant communities meet minimum MCBS standards for size and quality. Poor-quality sites are eliminated from further consideration. For good-quality sites the ecologist enters data into the Natural Heritage Information System (NHIS) that includes:

- Descriptive summaries of the site (landforms, soils, hydrology, plant community types, kinds of disturbance, etc.)
- Descriptive records on good-quality plant community locations.
- Relevé samples.

The ecologist then:

- Refines the boundaries of the sites and native plant communities on topographic maps or digital files and the final boundaries and associated data reside in the NHIS that includes a GIS. The GIS is used to produce many different kinds of maps, including individual county maps of existing native plant communities.
- Prepares a site evaluation for selected high-quality sites. These are used to guide conservation activity, such as special vegetation management or acquisition as a park or natural area.

MCBS field biologists also conduct surveys for rare plants. See (http://www.dnr.state.mn.us/eco/mcbs/procedures_plants.html) and rare animals. See (http://www.dnr.state.mn.us/eco/mcbs/procedures_animals.html). Data gathered during these surveys lead to inform decisions about the biodiversity importance of MCBS sites in the survey area.

Assessment products have been prepared by staff of the Natural Heritage and Nongame Research Program (NHNRP) and Minnesota County Biological Survey (MCBS), Minnesota Department of Natural Resources (DNR).

CHAPTER 7

Stand Damage and Mortality

Anoka Sand Plain Subsection

7.1 Introduction

This an assessment of forest insects and diseases known to cause tree mortality, growth loss, and quality reduction in forest stands in the Anoka Sand Plain subsection. The presence of forest insect and disease agents, as well as animal and abiotic agents, have been documented in reports by the Minnesota Department of Natural Resources (MN DNR), Forest Health Team; University of Minnesota; USDA Forest Service, State and Private Forestry; and North Central Forest Experiment Station.

7.2 Role of Insects and Disease

Native forest insects and disease organisms influence forest ecosystem dynamics as pests and agents of stress, but also play a beneficial role in the natural processes. Many native insects and diseases are an essential natural component of healthy forests and may contribute to compositional, structural, and functional diversity. By selectively affecting tree growth and mortality rates, they alter forest composition, structure, and succession. They thin and prune host populations, reducing density and competition. They can slow or stall the process of succession, or they can accelerate it. Through decay and biomass decomposition, they contribute significantly to carbon cycling, nutrient cycling, and energy flow in forest ecosystems. Insect and disease organisms serve as food for many invertebrates and vertebrates. Of vertebrates, birds consume the most tree-feeding insects, but many mammals consume insects to some degree as well. Insects and diseases create structural habitat for shelter and nesting. Many species of woodpeckers are attracted to trees with decay where they excavate cavities for nesting. Many animals use dead wood to roost, nest, or forage.

These same native forest insect and diseases are perceived as problems or pests by some when occurring at a level or on a site where they interfere with human goals, plans, and desires for trees and forests. Native insects and diseases can reduce timber productivity, lumber grade, site aesthetics, wildlife habitat, and water quality, and can increase the hazard of falling trees and branches and the occurrence of fire hazards, etc. Data from the 1990 Forest Inventory and Analysis for Minnesota indicate that 37 percent of the wood volume produced by all tree species annually is lost due to mortality. Insects and disease organisms account for more than 53 percent of this loss or more than 143 million cubic feet of wood. (Miles, Chen, Leatherberry, 1995). Surveys conducted by the MN DNR, Division of Forestry of oak and birch mortality triggered by drought and attacks by boring insects and root rot organisms, found in excess of 300,000 oaks and 200 million birch dying during the late 1980s and early 1990s (Albers, 1998). More than 40 percent of the birch type in Minnesota was affected.

What is perceived to be beneficial from one perspective may be viewed as detrimental from another. A very low level of decay would be required on a site being managed for high timber productivity, a higher level of decay may be acceptable on a site being managed under extended rotation, while any level may be acceptable on an old-growth site. Some level of decay will occur on every site regardless of the level of management. A forest tent caterpillar outbreak might be viewed as both beneficial and detrimental. The outbreak may benefit some birds that eat them but, be detrimental to others by leaving nests exposed to predators and bright sunlight, which can overheat, dehydrate, and kill young birds in nests. A forest tent caterpillar outbreak may increase the growth of shade-tolerant understory trees due to increased nutrients from insect droppings and dead caterpillars, and due to increased sunlight getting through the defoliated overstory

canopy. The same outbreak is detrimental to the overstory aspen due to slower growth and increased mortality caused by the loss of leaves.

While native insect and disease organisms have co-evolved with native trees and forests, exotic insects and disease organisms have not. Exotics do not have a natural "role" in our native ecosystems and have and will continue to alter forest ecosystem diversity, function, and productivity. Exotics historically have caused intensive and severe disturbances over large areas. In extreme cases they have virtually eliminated their host species. The elm resource has been devastated by introduction of the Dutch elm disease fungus and its bark beetle vector. The white pine blister rust fungus, accidentally introduced near the start of the 20th century, has played an important role in reducing the amount of white pine in Minnesota. Gypsy moth, while not yet established in Minnesota, is established in Wisconsin and Michigan and will become established here. While future impacts of gypsy moth in Minnesota are difficult to predict, especially in the northern aspen-birch forest, the insect has the potential to cause widespread mortality and will alter the composition and structure of the forest.

An ecosystem perspective requires that strategies to maintain the health of individual stands consider the beneficial, as well as the detrimental effects of insects and disease organisms. Forests must be considered as an ecosystem and manipulation to one part of that ecosystem affects the other parts. Pests have long influenced forest management, but forest management also affects pest populations. Vigorous trees tend to suffer less damage from these agents. Forest management aims to promote stand vigor and productivity by matching tree species to the planting site; manipulating rotation age, stand density, and species composition; avoiding wounding and root damage during thinning and harvesting; removing diseased and infested trees during harvesting operations, etc. Forest management does not attempt to eliminate native insect and diseases or their processes, but rather to control their activity and impact to a level that allows goals for timber production, water quality, aesthetics, recreation, wildlife, etc. to be realized.

In contrast, a much more aggressive approach is needed with exotic (non-native) organisms that cause significant mortality. It is important to avoid the introduction of exotics and attempt to contain and eradicate them when first found. Often it is not possible to eradicate or contain exotics once they are established. Attempts to slow their spread and management techniques to minimize their damage are then needed. Dutch elm disease and white pine blister rust are exotics that have become permanent components of the ecosystem and must be considered during all management activities. This also applies to gypsy moth after it becomes established in Minnesota.

7.3 Damage and Mortality

Table 7.1 below summarizes acres affected and acres of mortality from the Cooperative Stand Assessment (CSA) inventory on state lands in these subsections.

Table 7. 1 Stand Damage and Mortality

	Anoka Sand Plain		
Cover Type	**Percent Affected**	**Percent Mortality**	**Acres**
Ash	28	19	536
Lowland Hardwoods	35.5	6.7	314
Aspen	21.2	10.9	635.9
Birch	25	25	25.5
Cottonwood	10.6	90	14.2
Northern Hardwoods	24.9	7.3	1880.6
Oak	18.2	5.3	3095.6
White Pine	13.7	3.5	328.8
Norway Pine	9.4	6.2	735.4
Jack Pine	9.9	17	79.5
White spruce	16.6	3.1	38.4
Tamarack	18.7	15.4	265.5
Offsite Oak	43.6	33.6	102.8

Notes:

1 Each stand is assessed for the presence or absence of damage. These numbers reflect the sums of all acres in a cover type that are damaged or have died. In reality, the number of damaged and dead trees per acre is usually very low.

2 Percent affected and percent mortality are not additive. A stand cannot have mortality unless it also is affected.

Table 7.2 below summarizes the insect and disease agents that are known to cause mortality or quality reductions in these subsections. In addition to insect and disease agents, environmental conditions may also affect the quality and vigor of many species. These include frost crack, wind-throw, fire, animal damage and wind damage.

Table 7.2 Insects and Diseases Known to Cause Quality Reductions or Mortality by Cover Type

Cover Type	Agents Known To Cause Mortality	Agents Known To Cause Quality Reductions
All cover types	Armillaria root rot	Stem decay fungi
Ash	Emerald ash borer	Heart Rot / Cankers
Lowland Hardwoods	Dutch Elm Disease	Heart Rot
Aspen	Hypoxylon canker	White trunk rot
	Phellinus	Forest tent caterpillar
		Poplar borer
Oak	Gypsy moth	Heart Rot
	Two-lined chestnut borer	
	Oak wilt	
Birch	Birch decline	
Tamarack	Larch beetle	
Jack pine	Jack pine budworm	Red rot
	Ips bark beetles	
White pine	White pine blister rust	
Red pine	Ips bark beetles	Diplodia shoot blight and canker
		Sirococcus shoot blight
White spruce	Spruce budworm	

Although there are many insect and disease agents that can affect state timberlands, two in particular will require special consideration in forest management in the Anoka Sand Plain: oak wilt and emerald ash borer.

Oak Wilt

Oak wilt is a caused by a nonnative fungus that was first described in Wisconsin in 1944. It was reported in Minnesota in 1950. It became well established on the Anoka Sand Plain because of the abundance of Northern Red Oak and Northern Pin Oak. In 1982 it was discovered in Sherburne County by Elk River and in 1984 there was an infection site in the Sand Dunes State Forest. Since that time it has continued to progress across most of the Anoka Sand Plain subsection.

Oak wilt is spread overland by insects carrying the fungus from a diseased tree to a wounded healthy tree. It is also spread by root grafts from a diseased tree to a healthy tree. It spreads rapidly in the red oak groups and less aggressively in the white oak group. Public agencies have had various oak wilt control programs mostly focused on educating the public on how to avoid spreading oak wilt and also cost sharing the costs of vibratory plowing to prevent root grafts spread.

In 1989 Forestry started vibratory plowing infection centers on state lands. Air photos and detection flights were used to find new infections centers. This practice continued for

twenty years until it became cost prohibitive. Currently, forestry is harvesting stands as they become infected and encouraging the diversification of these stands with other tree species. This disease will have a major impact on future oak management. Although oak will be a component of future stands, there will be fewer stands of pure oak. With the white oak group being less susceptible to the disease, presumably there will be a shift to a higher component of the white oak group in future stands.

Emerald Ash Borer (*Agrilus marcopoli)*

The ash genus (*Fraxinus*) in Minnesota comprises some 900 million trees and is the second most common hardwood tree genus in the state. EAB was discovered in the United States in 2002 and is now present in 13 states and 2 Canadian Provinces. It was found in Minnesota in 2009; currently EAB's only known occurrence within Minnesota is within Houston County and the cities of St. Paul and Minneapolis. New infestation was discovered in Shoreview in July 2011. EAB populations can spread rapidly in infested firewood, logs, and ash nursery stock. Therefore, it is assumed that EAB will soon infest Minnesota's forested areas and cause significant impact to the ash resource. Experience from other states has shown that EAB kills 99%+ of the ash in a stand once that stand becomes infested. This level of impact is greater than what occurred with American elm following the introduction of Dutch elm disease in Minnesota.

To date there has been no evidence of resistance to EAB within any North American ash species. Resistance does exist in some Asian ash species. Subtle differences in susceptibility to EAB between white, green, and black ash have been reported, but those differences are minor and should not influence management options. All three ash species in Minnesota will likely succumb to EAB attack.

The Anoka Sand Plain subsection does not have a large prevalence of ash cover types. Some exists in Carlos Avery WMA and other WMA's for a total of 568 acres of ash and other mixed lowland hardwoods. The age classes of these cover types 70 years old. Much of the ash resource is mixed with other lowland and bottomland species.
Management Guidelines for EAB have been developed and released in December 2010.

To find the complete document look for Op Order #119, which outlines the Department's guidance on invasive species see:
http://filesintranet.dnr.state.mn.us/user_files/1920/oporder_119_ashmanagement.pdf

or on the main DNR website
http://files.dnr.state.mn.us/forestry/ecssilviculture/policies/guidelinesManagingAshMinnesotaForestryLands-100723.pdf

The Minnesota Department of Agriculture is the lead agency for policy and procedure development for Emerald Ash Borer.

For further information see this general informational website,
http://www.emeraldashborer.info/

CHAPTER 8

Wildlife Species Status

Anoka Sand Plain subsection

Table 8.1 provides information on the occurrence and legal status of wildlife species in the Anoka Sand Plain subsections. The species in this table are surveyed annually by the DNR.

A DNR initiative: Minnesota's Comprehensive Wildlife Conservation Strategy includes a publication entitled Minnesota's State Wildlife Action Plan: Tomorrow's Habitat for the Wild and Rare. This document provides additional information and summaries about wildlife species and habitats in greatest need of conservation. Information is presented on their distribution and abundance including low and declining populations and wildlife-related issues.

Minnesota's State Wildlife Action Plan: Tomorrow's Habitat for the Wild and Rare can be found at:
http://www.dnr.state.mn.us/cwcs/index.html

Table 8.1 Terrestrial, Vertebrate Species List Anoka Sand Plain ECS Subsection

Information Source: The following information has been summarized from ongoing efforts of the Minnesota Gap Analysis Project (MN-GAP), a project to provide a statewide assessment on the conservation status of native vertebrate species and natural land cover types.

Species Selection Criteria: Species selection criteria for MN-GAP includes the following: 1) Be known to breed in Minnesota (evidence of breeding 5 of the past 10 years) and be a regularly occurring non-accidental, 2) Be listed as state endangered, threatened, or special concern or as federally endangered or threatened, 3) Be listed as a furbearer, big game, small game, or migratory bird in Minnesota, and, 4) be an exotic species in Minnesota that impacts native species or is of management interest.

Species Group: Notes one of four major species groups - Birds, Mammals, Amphibians, and, Reptiles.

[a] **Species Common and Scientific Name:** Notes MN-GAP naming protocol based on a plant, animal and ecological database called NatureServe Explorer located at www.natureserve.org.

[b] **Resident Status: R**=Regular resident as Breeding, Nesting, or Migratory (acceptable record exists in at least eight of the past ten years); **PR=**Permanent Resident (exists year-round).

[c] **State Legal Status: E**=State Endangered; **T**=State Threatened; **SC**=State Species of Special Concern; **BG=**Big Game; **SG=**Small Game; **F**=Furbearer; **MW**=Migratory Waterfowl; **UB**=Unprotected Bird; **PB=**Protected Bird; **PWA**=Protected Wild Animal; **UWA**=Unprotected Wild Animal.

[d] **Federal Legal Status: T**=Federal Threatened; **E**=Federal Endangered; **P**=Federal Protection by Migratory Bird Treaty Act and/or Bald Eagle Protection Act and/or CITES.

[e]**SGCN Species: (Species of Greatest Conservation Need):** X = yes

DISCLAIMER: This species list is a representation of the current occurrence of these species based upon Minnesota Ecological Classification System Subsections. The species may not occur everywhere within the Subsection. Animal distributions are dynamic and occurrence revisions may be made as new information becomes available.

Common Name[a]	Scientific Name[a]	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	SGCN Species[e]
BIRDS					
Common Loon	*Gavia immer*	R	PB	P	X
Pied-billed Grebe	*Podilymbus podiceps*	R	PB	P	
Red-necked Grebe	*Podiceps grisegena*	R	PB	P	X
Eared Grebe	*Podiceps nigricollis*	R	PB	P	X
Double-crested	*Phalacrocorax auritus*	R	UB	P	
American Bittern	*Botaurus lentiginosus*	R	PB	P	X
Least Bittern	*Ixobrychus exilis*	R	PB	P	X
Great Blue Heron	*Ardea herodias*	R	PB	P	
Great Egret	*Ardea albus*	R	PB	P	
Green Heron	*Butorides virescens*	R	PB	P	
Black-crowned Night-Heron	*Nycticorax* **nycticorax**	R	PB	P	X
Trumpeter Swan	*Cygnus buccinator*	R	PB, MW,	P	X
Canada Goose	*Branta canadensis*	R	PB, MW	P	
Wood Duck	*Aix sponsa*	R	PB, MW	P	
Green-winged Teal	*Anas crecca*	R	PB, MW	P	
Mallard	*Anas platyrhynchos*	R	PB, MW	P	
Northern Pintail	*Anas acuta*	R	PB, MW	P	X
Blue-winged Teal	*Anas discors*	R	PB, MW	P	
Northern Shoveler	*Anas clypeata*	R	PB, MW	P	
Canvasback	*Aythya valisineria*	R	PB, MW	P	
Redhead	*Aythya americana*	R	PB, MW	P	
Ring-necked Duck	*Aythya collaris*	R	PB, MW	P	
Hooded Merganser	*Lophodytes cucullatus*	R	PB, MW	P	
Ruddy Duck	*Oxyura jamaicensis*	R	PB, MW	P	
Turkey Vulture	*Cathartes aura*	R	PB	P	
Osprey	*Pandion haliaetus*	R	PB	P	
Bald Eagle	*Haliaeetus*	R	PB, SC	P/T	X
Northern Harrier	*Circus cyaneus*	R	PB	P	X
Cooper's Hawk	*Accipiter cooperii*	R	PB	P	
Red-shouldered Hawk	*Buteo lineatus*	R	PB, SC	P	X
Broad-winged Hawk	*Buteo platypterus*	R	PB	P	
Red-tailed Hawk	*Buteo jamaicensis*	R	PB	P	
American Kestrel	*Falco sparverius*	R	PB	P	
Peregrine Falcon	*Falco peregrinus*	R	PB, T	P	X
Gray Partridge	*Perdix perdix*	PR	PB, SG		
Ruffed Grouse	*Bonasa umbellus*	PR	PB, SG		
Wild Turkey	*Meleagris gallopavo*	PR	PB, SG		
Virginia Rail	*Rallus limicola*	R	PB, SG	P	X
Sora	*Porzana carolina*	R	PB, SG	P	
Common Moorhen	*Gallinula chloropus*	R	PB, SG,	P	X
American Coot	*Fulica americana*	R	PB, SG	P	

Common Name[a]	Scientific Name[a]	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	SGCN Species[e]
Sandhill Crane	*Grus canadensis*	R	PB	P	
Killdeer	*Charadrius vociferus*	R	PB	P	
Spotted Sandpiper	*Actitis macularia*	R	PB	P	
Upland Sandpiper	*Bartramia longicauda*	R	PB	P	X
Wilson's Snipe	*Capella delicate*	R	PB, SG	P	
American Woodcock	*Scolopax minor*	R	PB, SG	P	X
Wilson's Phalarope	*Phalaropus tricolor*	R	PB, T	P	X
Ring-billed Gull	*Larus delawarensis*	R	PB	P	
Black Tern	*Chlidonias niger*	R	PB	P	X
Rock Dove	*Columba livia*	R	PB	P	
Mourning Dove	*Zenaida macroura*	R	PB	P	
Black-billed Cuckoo	*Coccyzus*	R	PB	P	X
Yellow-billed Cuckoo	*Coccyzus americanus*	R	PB	P	
Eastern Screech-Owl	*Otus asio*	PR	PB	P	
Great Horned Owl	*Bubo virginianus*	PR	UB	P	
Barred Owl	*Strix varia*	PR	PB	P	
Common Nighthawk	*Chordeiles minor*	R	PB	P	X
Whip-poor-will	*Caprimulgus vociferus*	R	PB	P	X
Chimney Swift	*Chaetura pelagica*	R	PB	P	
Ruby-throated Hummingbird	*Archilochus colubris*	R	PB	P	
Belted Kingfisher	*Ceryle alcyon*	R	PB	P	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	R	PB	P	X
Red-bellied Woodpecker	*Melanerpes carolinus*	PR	PB	P	
Yellow-bellied Sapsucker	*Sphyrapicus varius*	R	PB	P	X
Downy Woodpecker	*Picoides pubescens*	PR	PB	P	
Hairy Woodpecker	*Picoides villosus*	PR	PB	P	
Northern Flicker	*Colaptes auratus*	R	PB	P	
Pileated Woodpecker	*Dryocopus pileatus*	PR	PB	P	
Eastern Wood-Pewee	*Contopus virens*	R	PB	P	X
Willow Flycatcher	*Empidonax traillii*	R	PB	P	X
Least Flycatcher	*Empidonax minimus*	R	PB	P	X
Eastern Phoebe	*Sayornis phoebe*	R	PB	P	
Great Crested Flycatcher	*Myiarchus crinitus*	R	PB	P	
Western Kingbird	*Tyrannus verticalis*	R	PB	P	
Eastern Kingbird	*Tyrannus tyrannus*	R	PB	P	
Horned Lark	*Eremophila alpestris*	R	PB	P	
Purple Martin	*Progne subis*	R	PB	P	
Tree Swallow	*Tachycineta bicolor*	R	PB	P	

Common Name[a]	Scientific Name[a]	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	SGCN Species[e]
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	R	PB	P	X
Bank Swallow	*Riparia riparia*	R	PB	P	
Cliff Swallow	*Petrochelidon*	R	PB	P	
Barn Swallow	*Hirundo rustica*	R	PB	P	
Blue Jay	*Cyanocitta cristata*	PR	PB	P	
American Crow	*Corvus*	PR	PB	P	
Black-capped Chickadee	*Poecile atricapillus*	PR	PB	P	
Red-breasted Nuthatch	*Sitta canadensis*	PR	PB	P	
White-breasted Nuthatch	*Sitta carolinensis*	PR	PB	P	
Brown Creeper	*Certhia americana*	R	PB	P	
House Wren	*Troglodytes aedon*	R	PB	P	
Sedge Wren	*Cistothorus platensis*	R	PB	P	X
Marsh Wren	*Cistothorus palustris*	R	PB	P	X
Blue-gray Gnatcatcher	*Polioptila caerulea*	R	PB	P	
Eastern Bluebird	*Sialia sialis*	R	PB	P	
Veery	*Catharus fuscescens*	R	PB	P	X
Wood Thrush	*Hylocichla mustelina*	R	PB	P	X
American Robin	*Turdus migratorius*	R	PB	P	
Gray Catbird	*Dumetella*	R	PB	P	
Brown Thrasher	*Toxostoma rufum*	R	PB	P	X
European Starling	*Sturnus vulgaris*	PR	UB	P	
Cedar Waxwing	*Bombycilla cedrorum*	R	PB	P	
Loggerhead Shrike	*Lanius ludovicianus*	R	PB, T	P	X
Yellow-throated Vireo	*Vireo flavifrons*	R	PB	P	
Warbling Vireo	*Vireo gilvus*	R	PB	P	
Red-eyed Vireo	*Vireo olivaceus*	R	PB	P	
Blue-winged Warbler	*Vermivora pinus*	R	PB	P	
Nashville Warbler	*Vermivora ruficapilla*	R	PB	P	
Yellow Warbler	*Dendroica petechia*	R	PB	P	
Chestnut-sided Warbler	*Dendroica pensylvanica*	R	PB	P	
Cerulean Warbler	*Dendroica cerulea*	R	PB, SC	P	X
Black-and-white	*Mniotilta varia*	R	PB	P	
American Redstart	*Setophaga ruticilla*	R	PB	P	
Ovenbird	*Seiurus aurocapillus*	R	PB	P	X
Northern Waterthrush	*Seiurus noveboracensis*	R	PB	P	
Louisiana Waterthrush	*Seiurus motacilla*	R	PB, SC	P	X
Mourning Warbler	*Oporornis philadelphia*	R	PB	P	
Common Yellowthroat	*Geothlypis trichas*	R	PB	P	
Hooded Warbler	*Wilsonia citrina*	R	PB, SC	P	

Common Name[a]	Scientific Name[a]	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	SGCN Species[e]
Scarlet Tanager	*Piranga olivacea*	R	PB	P	
Northern Cardinal	*Cardinalis cardinalis*	PR	PB	P	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	R	PB	P	X
Indigo Bunting	*Passerina cyanea*	R	PB	P	
Dickcissel	*Spiza americana*	R	PB	P	X
Eastern Towhee	*Pipilo erythrophthalmus*	R	PB	P	
Chipping Sparrow	*Spizella passerina*	R	PB	P	
Clay-colored Sparrow	*Spizella pallida*	R	PB	P	
Field Sparrow	*Spizella pusilla*	R	PB	P	X
Vesper Sparrow	*Pooecetes gramineus*	R	PB	P	
Lark Sparrow	*Chondestes*	R	PB	P	
Savannah Sparrow	*Passerculus sandwichensis*	R	PB	P	
Grasshopper Sparrow	*Ammodramus*	R	PB	P	X
Le Conte's Sparrow	*Ammodramus leconteii*	R	PB	P	X
Song Sparrow	*Melospiza melodia*	R	PB	P	
Swamp Sparrow	*Melospiza georgiana*	R	PB	P	X
Bobolink	*Dolichonyx oryzivorus*	R	PB	P	X
Red-winged Blackbird	*Agelaius phoeniceus*	R	UB	P	
Eastern Meadowlark	*Sturnella magna*	R	PB	P	X
Western Meadowlark	*Sturnella neglecta*	R	PB	P	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	R	UB	P	
Brewer's Blackbird	*Euphagus cyanocephalus*	R	UB	P	
Common Grackle	*Quiscalus quiscula*	R	UB	P	
Brown-headed	*Molothrus ater*	R	PB	P	
Orchard Oriole	*Icterus spurius*	R	PB	P	
Baltimore Oriole	*Icterus galbula*	R	PB	P	
House Finch	*Carpodacus mexicanus*	PR	PB	P	
Pine Siskin	*Carduelis pinus*	R	PB	P	
American Goldfinch	*Carduelis tristis*	R	PB	P	
House Sparrow	*Passer domesticus*	PR	UB	P	
MAMMALS					
Virginia Opossum	*Didelphis virginiana*	PR	PWA, SG, F		
Cinereus Shrew	*Sorex cinereus*	PR			
Water Shrew	*Sorex palustris*	PR			
Arctic Shrew	*Sorex arcticus*	PR			
Pygmy Shrew	*Sorex hoyi*	PR			

Common Name[a]	Scientific Name[a]	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	SGCN Species[e]
Northern Short-tailed	*Blarina brevicauda*	PR			
Eastern Mole	*Scalopus aquaticus*	PR			
Star-nosed Mole	*Condylura cristata*	PR			
Little Brown Bat	*Myotis lucifugus*	PR			
Northern Myotis	*Myotis septentrionali*	PR	SC		X
Silver-haired Bat	*Lasionycteris noctivagans*	R			
Eastern Pipistrelle	*Pipistrellus subflavus*	R	SC		
Big Brown Bat	*Eptesicus fuscus*	PR			
Eastern Red Bat	*Lasiurus borealis*	R			
Hoary Bat	*Lasiurus cinereus*	R			
Eastern Cottontail	*Sylvilagus floridanus*	PR	PWA, SG		
White-tailed Jackrabbit	*Lepus townsendii*	PR	PWA, SG		
Eastern Chipmunk	*Tamias striatus*	PR			
Woodchuck	*Marmota monax*	PR			
Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*	PR			
Franklin's Ground Squirrel	*Spermophilus franklinii*	PR			X
Eastern Gray Squirrel	*Sciurus carolinensis*	PR	PWA, SG		
Eastern Fox Squirrel	*Sciurus niger*	PR	PWA, SG		
Red Squirrel	*Tamiasciurus hudsonicus*	PR			
Southern Flying Squirrel	*Glaucomys volans*	PR			
Plains Pocket Gopher	*Geomys bursarius*	PR	UWA		
American Beaver	*Castor canadensis*	PR	PWA, SG,		
Western Harvest Mouse	*Reithrodontomys megalotis*	PR			X
Prairie Deer Mouse	*Peromyscus maniculatus bairdii*	PR			
White-footed Mouse	*Peromyscus leucopus*	PR			
Southern Red-backed Vole	*Clethrionomys gapperi*	PR			
Meadow Vole	*Microtus*	PR			
Prairie Vole	*Microtus ochrogaster*	PR	SC		X
Muskrat	*Ondatra zibethicus*	PR	PWA, SG,		
Meadow Jumping Mouse	*Zapus hudsonius*	PR			
North American Porcupine	*Erethizon dorsatum*	PR	UWA		
Coyote	*Canis latrans*	PR	UWA		
Gray Wolf	*Canis lupus*	PR	SC	T/	
Red Fox	*Vulpes vulpes*	PR	PWA, SG,		

Common Name[a]	*Scientific Name*[a]	*Resident Status*[b]	*State Legal Status*[c]	*Federal Legal Status*[d]	*SGCN Species*[e]
Gray Fox	*Urocyon cinereoargenteus*	PR	PWA, SG, F		
American Black Bear	*Ursus americanus*	PR	PWA, BG	P	
Northern Raccoon	*Procyon lotor*	PR	PWA, SG,		
Ermine	*Mustela erminea*	PR	UWA		
Long-tailed Weasel	*Mustela frenata*	PR	UWA		
American Mink	*Mustela vison*	PR	PWA, SG,		
American Badger	*Taxidea taxus*	PR	PWA, SG,		X
Striped Skunk	*Mephitis mephitis*	PR	UWA		
Fisher	*Martes pennanti*	PR	PWA, SG,		
Northern River Otter	*Lontra canadensis*	PR	PWA, SG,		
Bobcat	*Lynx rufus*	PR	PWA, SG,	P	
White-tailed Deer	*Odocoileus*	PR	PWA, BG		
AMPHIBIANS					
Blue-spotted Salamander	*Ambystoma laterale*	PR			
Tiger Salamander	*Ambystoma tigrinum*	PR			
Mudpuppy	*Necturus maculosus*	PR			X
Eastern Newt	*Notophthalmus viridescens*	PR			
American Toad	*Bufo americanus*	PR	PWA		
Cope's Gray Treefrog	*Hyla chrysoscelis*	PR	PWA		
Gray Treefrog	*Hyla versicolor*	PR	PWA		
Western Chorus Frog	*Pseudacris triseriata*	PR	PWA		
Spring Peeper	*Pseudacris crucifer*	PR	PWA		
Green Frog	*Rana clamitans*	PR	PWA		
Northern Leopard	*Rana pipiens*	PR	PWA		
Mink Frog	*Rana septentrionalis*	PR	PWA		
Wood Frog	*Rana sylvatica*	PR	PWA		
REPTILES					
Snapping Turtle	*Chelydra serpentina*	PR	PWA, SC		X
Painted Turtle	*Chrysemys picta*	PR	PWA		
Wood Turtle	*Clemmys insculpta*	PR	PWA, T		X
Blanding's Turtle	*Emydoidea blandingii*	PR	PWA, T		X
Prairie Skink	*Eumeces septentrionalis*	PR			
Western Hognose Snake	*Heterodon nasicus*	PR	SC		X
Eastern Hognose Snake	*Heterodon platyrhinos*	PR			X
Northern Water Snake	*Nerodia sipedon*	PR			
Gopher Snake	*Pituophis catenifer*	PR	SC		X
Brown Snake	*Storeria dekayi*	PR			

Common Name[a]	*Scientific Name*[a]	*Resident Status*[b]	*State Legal Status*[c]	*Federal Legal Status*[d]	*SGCN Species*[e]
Redbelly Snake	*Storeria occipitomaculata*	PR			
Plains Garter Snake	*Thamnophis radix*	PR			
Common Garter Snake	*Thamnophis sirtalis*	PR			
Smooth Green Snake	*Liochlorophis vernalis*	PR			X

Table 8.2 Species of Greatest Conservation Need by Habitat – Anoka Sand Plain

Taxa	Scientific Name	Common Name	State Legal	Fed Legal	# of subsections	# of occurrences	# of habitats	Cropland	Developed	Forest- Lowland Conifer	Forest- Lowland Deciduous	Forest- Upland Conifer	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous (Hardwood)	Grassland	Lake- Deep	Lake- Shallow	Prairie	River- Headwater to large	River- Very Large	Shoreline-dunes-cliff/talus	Shrub- Lowland	Shrub/woodland- Upland	Wetland- Non-forest
AM	Necturus maculosus	Common Mudpuppy	NL	NL	14	0	3									x			x	x				
BI	Ammodramus leconteii	Le Conte's Sparrow	NL	NL	17	0	4								x			x				x		x
BI	Ammodramus savannarum	Grasshopper Sparrow	NL	NL	14	28	3								x			x					x	
BI	Anas acuta	Northern Pintail	NL	NL	9	0	5	x							x		x	x						x
BI	Arenaria interpres	Ruddy Turnstone	NL	NL	20	0	2														x			x
BI	Bartramia longicauda	Upland Sandpiper	NL	NL	19	7	6	x							x			x				x	x	x
BI	Botaurus lentiginosus	American Bittern	NL	NL	21	18	5			x					x			x				x		x
BI	Buteo lineatus	Red-shouldered Hawk	SPC	NL	12	31	3				x		x	x										
BI	Calidris alpina	Dunlin	NL	NL	24	0	2														x			x
BI	Calidris fuscicollis	White-rumped Sandpiper	NL	NL	20	0	2														x			x
BI	Calidris pusilla	Semipalmated Sandpiper	NL	NL	25	0	2														x			x
BI	Caprimulgus vociferus	Whip-poor-will	NL	NL	21	0	2					x		x										
BI	Catharus fuscescens	Veery	NL	NL	22	44	5			x	x	x	x	x										
BI	Chlidonias niger	Black Tern	NL	NL	18	21	2										x							x
BI	Chordeiles minor	Common Nighthawk	NL	NL	25	2	2		x												x			
BI	Circus cyaneus	Northern Harrier	NL	NL	25	4	6			x					x			x				x	x	x
BI	Cistothorus palustris	Marsh Wren	NL	NL	20	18	4			x							x					x		x
BI	Cistothorus platensis	Sedge Wren	NL	NL	25	39	5			x					x			x				x		x
BI	Coccyzus erythropthalmus	Black-billed Cuckoo	NL	NL	25	15	6				x	x	x	x								x	x	

Coccyzus erythropthalmus	**Black-billed Cuckoo**	**NL**	**NL**	**25**	**15**	**6**				**x**	**x**	**x**	**x**									**x**	**x**	
Contopus virens	Eastern Wood-pewee	NL	NL	25	54	5				x	x	x	x				x							
Cygnus buccinator	Trumpeter Swan	THR	NL	14	0	2										x								x
Dendroica cerulea	Cerulean Warbler	SPC	NL	10	2	2				x			x											
Dolichonyx oryzivorus	Bobolink	NL	NL	25	13	6	x							x			x					x	x	x
Empidonax minimus	Least Flycatcher	NL	NL	25	15	4				x	x	x	x											
Empidonax traillii	Willow Flycatcher	NL	NL	13	11	3																x	x	x
Falco peregrinus	Peregrine Falcon	THR	NL	6	10	10		x	x					x		x	x		x	x	x	x	x	x
Gallinula chloropus	Common Moorhen	SPC	NL	7	2	2										x								x
Gavia immer	Common Loon	NL	NL	18	13	1									x									
Haliaeetus leucocephalus	Bald Eagle	SPC	THR	21	55	7				x	x	x	x		x			x					x	
Hylocichla mustelina	Wood Thrush	NL	NL	20	5	3					x	x	x											
Ixobrychus exilis	Least Bittern	NL	NL	16	3	3										x						x		x
Lanius ludovicianus	Loggerhead Shrike	THR	NL	10	11	3								x			x						x	
Limnodromus griseus	Short-billed Dowitcher	NL	NL	22	0	1																		x
Limosa haemastica	Hudsonian Godwit	NL	NL	18	0	1																		x
Melanerpes erythrocephalus	Red-headed Woodpecker	NL	NL	22	1	8	x	x		x		x	x	x			x						x	
Melospiza georgiana	Swamp Sparrow	NL	NL	25	57	3			x													x		x
Numenius phaeopus	Whimbrel	NL	NL	13	0	1															x			
Nycticorax nycticorax	Black-crowned Night-heron	NL	NL	8	3	3				x						x								x
Phalaropus tricolor	Wilson's Phalarope	THR	NL	9	4	2										x								x
Pheucticus ludovicianus	Rose-breasted Grosbeak	NL	NL	25	26	5				x	x	x	x				x							
Pluvialis dominica	American Golden-plover	NL	NL	24	0	2															x			x
Podiceps grisegena	Red-necked Grebe	NL	NL	17	0	2										x								x
Podiceps nigricollis	Eared Grebe	NL	NL	9	0	1										x								
Rallus limicola	Virginia Rail	NL	NL	23	2	3										x						x		x
Recurvirostra americana	American Avocet	NL	NL	16	0	2															x			x
Scolopax minor	American Woodcock	NL	NL	22	3	4						x		x								x	x	
Seiurus aurocapillus	Ovenbird	NL	NL	22	28	4				x	x	x	x											

BI	**Seiurus motacilla**	**Louisiana Waterthrush**	**SPC**	**NL**	**5**	**4**	**2**				**x**							**x**					
BI	Sphyrapicus varius	Yellow-bellied Sapsucker	NL	NL	23	1	4				x	x	x	x									
BI	Spiza americana	Dickcissel	NL	NL	11	0	4	x							x		x				x		
BI	Spizella pusilla	Field Sparrow	NL	NL	13	48	3								x		x				x		
BI	Stelgidopteryx serripennis	Northern Rough-winged Swallow	NL	NL	25	4	3								x			x		x			
BI	Sturnella magna	Eastern Meadowlark	NL	NL	20	16	2								x		x						
BI	Toxostoma rufum	Brown Thrasher	NL	NL	25	6	2		x												x		
BI	Tringa melanoleuca	Greater Yellowlegs	NL	NL	25	0	2													x			x
BI	Tryngites subruficollis	Buff-breasted Sandpiper	NL	NL	23	0	4	x	x						x		x						
BI	Vermivora pinus	Blue-winged Warbler	NL	NL	6	0	4						x	x			x				x		
FI	Acipenser fulvescens	Lake Sturgeon	SPC	NL	14	1	2									x			x				
FI	Moxostoma valenciennesi	Greater Redhorse	NL	NL	11	28	1											x					
FI	Notropis anogenus	Pugnose Shiner	SPC	NL	9	0	2									x		x					
IN	Agapetus tomus	A Caddisfly	SPC	NL	2	1	1											x					
IN	Cicindela patruela patruela	A Tiger Beetle	SPC	NL	5	2	4		x			x		x							x		
IN	Epidemia epixanthe michiganensis	Bog Copper	NL	NL	13	0	2			x										x			
IN	Erynnis persius	Persius Duskywing	END	NL	5	0	1														x		
IN	Euphyes bimacula illinois	Two-spotted Skipper	NL	NL	7	0	1																x
IN	Hesperia leonardus leonardus	Leonard's Skipper	SPC	NL	7	1	2										x				x		
IN	Hesperia uncas	Uncas Skipper	END	NL	2	0	2										x				x		
IN	Lycaeides melissa samuelis	Karner Blue	END	END	3	0	3					x		x							x		
IN	Speyeria idalia	Regal Fritillary	SPC	NL	11	0	1										x						
MA	Microtus ochrogaster	Prairie Vole	SPC	NL	12	2	4	x							x		x				x		
MA	Mustela nivalis	Least Weasel	SPC	NL	12	0	8	x				x		x	x		x			x		x	x
MA	Myotis septentrionalis	Northern Myotis	SPC	NL	5	0	9		x	x	x	x	x	x	x						x	x	x
MA	Perognathus flavescens	Plains Pocket Mouse	SPC	NL	5	7	3								x		x			x			
MA	Reithrodontomys megalotis	Western Harvest Mouse	NL	NL	10	0	4	x							x		x				x		

MA	**Spermophilus franklinii**	**Franklin's Ground Squirrel**	**NL**	**NL**	**23**	**0**	**5**							**x**			**x**				**x**	**x**	**x**
MA	Spilogale putorius	Eastern Spotted Skunk	THR	NL	19	0	8		x		x		x	x	x			x				x	x	
MA	Taxidea taxus	American Badger	NL	NL	24	1	7	x	x			x		x	x			x					x	
MO	Actinonaias ligamentina	Mucket mussel	THR	NL	11	4	2												x	x				
MO	Alasmidonta marginata	Elktoe	THR	NL	7	3	2												x	x				
MO	Cyclonaias tuberculata	Purple Wartyback	THR	NL	5	1	1													x				
MO	Elliptio dilatata	Spike	SPC	NL	10	5	2												x	x				
MO	Lasmigona compressa	Creek Heelsplitter	SPC	NL	24	39	1												x					
MO	Ligumia recta	Black Sandshell	SPC	NL	25	112	2												x	x				
MO	Quadrula metanevra	Monkeyface	THR	NL	10	0	2												x	x				
MO	Quadrula nodulata	Wartyback	END	NL	5	20	1													x				
MO	Truncilla donaciformis	Fawnsfoot	NL	NL	5	13	1													x				
RE	Chelydra serpentina	Common Snapping Turtle	SPC	NL	25	15	5									x	x		x	x				x
RE	Clemmys insculpta	Wood Turtle	THR	NL	11	2	1												x					
RE	Elaphe vulpina	Eastern Fox Snake	NL	NL	9	2	6	x			x			x	x			x					x	
RE	Emydoidea blandingii	Blanding's Turtle	THR	NL	13	207	7								x		x	x	x	x		x		x
RE	Heterodon nasicus	Western Hognose Snake	SPC	NL	9	12	2								x			x						
RE	Heterodon platirhinos	Eastern Hognose Snake	NL	NL	6	6	7				x	x		x	x			x			x		x	
RE	Liochlorophis vernalis	Smooth Green Snake	NL	NL	15	0	3								x			x					x	
RE	Pituophis catenifer	Gopher Snake	SPC	NL	7	29	4								x			x			x		x	
SP	Metaphidippus arizonensis	A Jumping Spider	SPC	NL	4	1	1											x						
SP	Paradamoetas fontana	A Jumping Spider	SPC	NL	5	0	3			x								x						x
SP	Tutelina formicaria	A Jumping Spider	SPC	NL	1	0	1											x						

APPENDICES

A. Background on DNR Forest Inventory and Data Currency

B. Ecological Classification System

C. Glossary

D. Acronyms

APPENDIX A

Background on DNR Forest Inventory and Data Currency

The Minnesota Department of Natural Resources (DNR) uses a forest stand mapping and information system to classify the approximately 5 million acres (7,800 sq. mi.) owned and administered by the state. The system is designed to be a course classification of forest stands adequate to guide management decisions. It is commonly referred to as the "forest inventory."

The forest inventory system maps the boundaries and tabulates the contents of all forest stands five acres and larger on state-owned land. A forest stand is a group of trees uniform enough in composition to be managed as a unit. Boundaries are drawn by interpretation of aerial photographs. All other stand data are collected in the field on plots within each stand and boundaries may be adjusted at the time of the field visit.

The general descriptive term for the content of a stand is "cover-type." Although cover-types commonly bear the name of the primary tree species, they are usually an association of multiple tree species along with shrubbery and herbaceous plants. When it originated in 1952, the forest inventory was managed with "land use cards" containing a series of notches designed to identify specific attributes. Over the years this method evolved into the Cooperative Stand Assessment (CSA) and was based on pencil-drawn maps with a computer punch-card database. More recently, the system has matured into a geographic information system (GIS) database accessible to DNR forest managers online. Forest inventory is now managed using a computer program called the Forest Inventory Module (FIM). Consequently, the inventory is now referred to as "FIM" rather than "CSA."

FIM data are not compatible with the previous CSA layers. FIM data follows an internal DNR Division of Forestry classification and attribute-coding scheme not used by CSA. Also, comparisons between past inventory data (CSA) and current conditions (FIM) encounter some difficulty due to CSA stands being limited by section lines. This limitation does not exist with FIM data and stand boundaries can extend all the way to a township line if the stand characteristics warrant it.

The accuracy of forest inventory is limited by the method used to establish stand boundaries. Features are digitized on screen over standard electronic topographical maps [24k Digital Raster Graphic (DRG) images] and electronic aerial photography [USGS Digital Orthophoto Quads (DOQs)] and inherit the horizontal positional accuracy of these products.

FIM allows foresters to update data as changes to stands occur due to the passage of time, natural events, or management activities. However, many stands do not receive field visits or re-measurement for 20 years or more if they are established but not approaching maturity. These stands have their age brought up-to-date by computer calculation, but other attributes such as volume, disease, and understory composition are not updated until a field visit. Attempts to model these attributes forward have met with some success, but they have not become standard practice.

A synopsis of the currency of field inventory is shown in the attached table. It is important to keep in mind that only selected stands are scheduled for a visit depending on a number of factors. These include the years since inventory, known natural factors that may have impacted the stand, potential merchantability, potential for treatment, etc.

All these factors must be taken into consideration when looking at inventory data, using it in analysis, and making management decisions.

Years Since Inventory	Number of Stands	Total Acres
1	12	168
2	31	575
3	34	636
4	87	1200
5	38	539
6	150	2189
7	27	507
8	10	127
9	12	221
10	7	59
11	7	133
12	61	1142
13	9	281
14	6	120
15	4	156
16	75	939
17	214	2645
18	97	924
19	50	469
20	1	13
27	7	82
28	3	33
29	24	334
Unk	23	514
Total	989	14006

Footnotes:

Forested cover types only (Forest inventory covertype codes 1-74, 82).

Weighted average age of inventory = 11.3 years old.

APPENDIX B

Ecological Classification System (ECS)

I. Definition

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

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

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

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

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

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

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

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

Community: Unique combinations of plants and soils within land types, defined by characteristic trees, shrubs and forbs, elevation, and soil moisture (e.g., sugar maple-basswood forest).

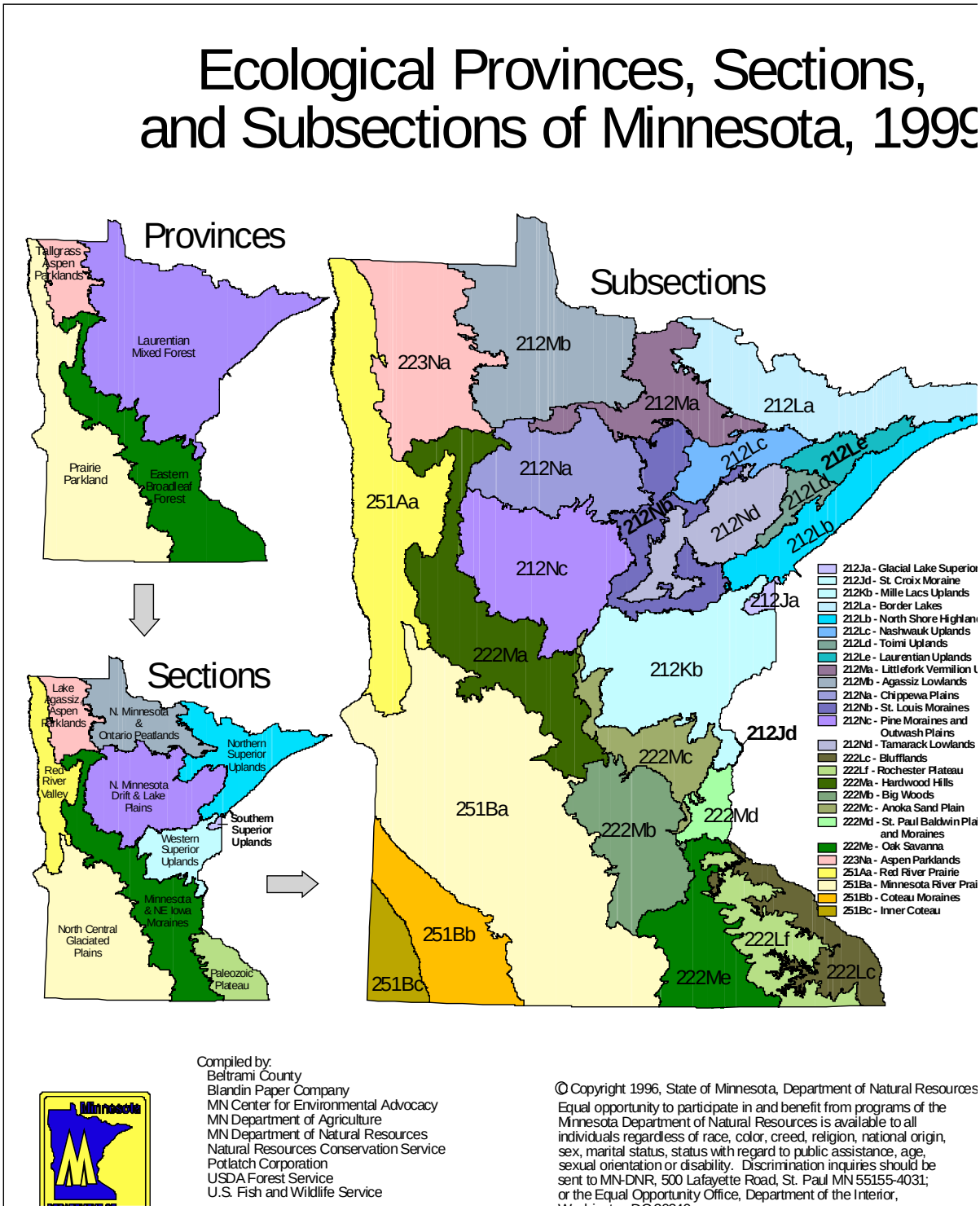
II. Purpose of an Ecological Classification System

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

III. End Products

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

Ecological Provinces, Sections, and Subsections of Minnesota, 1999



APPENDIX C
Glossary

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Desired future forest composition (DFFC) goals: Broad vision of landscape vegetation conditions in the long-term future. For the purposes of the initial round of subsection planning, DFFC goals will focus on future desired forest composition looking ahead 50 years. DFFC goals may include aspects like 1) the amount of various forest cover types within the subsection, 2) age-class distribution of forest cover types,

3) the geographic distribution of these across the subsection, and the related level of management for even-aged forest, 4) extended rotation forest, etc.

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

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

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

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

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

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

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

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

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

Element Occurrence (EO): An area of land and/or water where a rare feature (plant, animal, natural community, geologic feature, animal aggregation) is, or was present. An Element Occurrence Rank provides a succinct assessment of estimated viability or probability of persistence (based on condition, size, and landscape context) of occurrences of a given Element. An Element Occurrence Record is the locational and supporting data associated with a particular Element Occurrence. Element Occurrence Records for the State of Minnesota are managed as part of the rare features database by the Natural Heritage and Nongame Research Program. (Draft definition 3/24/2004, Adapted from Biotics EO Standards: Chapter 2)

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

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

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

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

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

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

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

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

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

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

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

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

System roads - These roads are the major roads in the forest that provide forest management access, recreational access and may be connected to the state, county, or township public road systems. These roads are used at least on a weekly basis and often used on a daily basis. The roads should be graveled and maintained to allow travel by highway vehicles, and road bonding money can be used to fund construction and reconstruction of these types of roads. The level and frequency of maintenance will be at the discretion of the Area Forester and as budgets allow.

Minimum maintenance roads - These roads are used for forest management access on an intermittent, as-need basis. Recreational users may use them, but the roads are not promoted or maintained for recreation. The roads will be open to all motorized vehicles but not maintained to the level where low clearance licensed highway vehicles can travel routinely on them. The roads will be graded and graveled as needed for forest management purposes. Major damage such as culvert washouts or other conditions that may pose a safety hazard to the public will be repaired as reported and budgets allow.

Temporary access – If the access route does not fit into one of the first two options, the access route has to be abandoned and the site reclaimed so that evidence of a travel route is minimized. The level of effort to effectively abandon temporary accesses will vary from site to site depending on location of the access (e.g., swamp/winter vs. upland route), remoteness, and existing recreational use pressures.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Management pool: In this plan, the acres available for timber management purposes.

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

Marketable timber: Merchantable timber that is accessible now.

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

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

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

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

Mesic: Moderately moist.

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

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

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

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

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

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

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

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

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

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

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

Natural Area Registry (NAR) Agreement: a memorandum of understanding between the Ecological Services Division and another governmental unit. The other governmental unit can be Division of Forestry, Wildlife, or Parks, depending on who the land administrator is for the parcel in question. It can also be city, county, tribal, or federal government. The NAR generally identifies the site, explains its significance, sets a proposed management direction, and states that before any management contrary to

that direction occurs, the parties will get together and talk about it first. It is not a binding agreement. Examples of NAR's: an old growth yellow birch stand in Crosby-Manitou State Park; the South Fowl Lake cliff community on Division of Forestry land in Cook County; and a ram's-head orchid site on Hubbard County land.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Overstory: The canopy in a stand of trees.

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

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

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

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

Prescription: A planned treatment (clear-cut, selective harvest, thin, reforest, reserve, etc.) designed to change current stand structure to one that meets management goals. A written statement that specifies the practices to be implemented in a forest stand to meet management objectives. These specifications reflect the desired future condition at the site and landscape level and incorporate knowledge of the special attributes of the site.

Pulpwood: Wood cut or prepared primarily for manufacture into wood pulp or chips, for subsequent manufacture into paper, fiber board, or chip board. Generally, trees 5- to-12 inches diameters at breast height are used.

Pure forest or stand is defined as composed principally of one species, conventionally at least 80 percent based on numbers, basal areas, or volumes.

Range of natural variation (RNV): Refers to the expected range of conditions (ecosystem structure and composition) to be found under naturally functioning ecosystem processes (natural climatic fluctuations and disturbance cycles such as fire and windstorms). RNV provides a benchmark (range of reference conditions) to compare with current and potential future ecosystem conditions.

Rare Features Database is maintained by the Natural Heritage and Nongame Research Program and is comprised of locational records of the following features:

- **Rare plants.** Rare plants tracked are all species that are listed as Federally endangered, threatened or as candidates for Federal listing; all species that are State listed as endangered, threatened or special concern. Several rare species are also tracked which currently have no legal status but need further monitoring to determine their status.
- **Rare animals.** All animal species that are listed as Federally endangered or threatened (except the gray wolf) are tracked, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened or special concern.
- **Natural communities**. Natural communities are functional units of landscape that are characterized and defined by their most prominent habitat features - a combination of vegetation, hydrology, landform, soil, and natural disturbance cycles. Although natural communities have no legal protection in Minnesota, the Natural Heritage and Nongame Research Program and the Minnesota County Biological Survey have evaluated and ranked community types according to their relative rarity and endangerment throughout their range. Locations of high quality examples are tracked in the Rare Features Database.
- **Geologic features**. Noteworthy examples of geologic features throughout Minnesota are tracked if they are unique or rare, extraordinarily well preserved, widely documented, highly representative of a certain period of geologic history, or very useful in regional geologic correlation.
- **Animal aggregations**. Certain types of animal aggregations, such as nesting colonies of

waterbirds (herons, egrets, grebes, gulls and terns), bat hibernacula, prairie chicken booming grounds, and winter bald eagle roosts are tracked regardless of the legal status of the species that comprise them. The tendency to aggregate makes these species vulnerable because a single catastrophic event could result in the loss of many individuals.

Rare species: A plant or animal species designated as **endangered, threatened,** or of **special concern** by the state of Minnesota (this includes all species designated as endangered or threatened at the federal level), or an uncommon species that does not (yet) have an official designation, but whose distribution and abundance need to be better understood.

Refuge/refugia: Area(s) where plants and animals can persist through a wind and/or fire event.

Regeneration: The act of renewing tree cover by establishing young trees naturally (e.g., stump sprouts, root suckers, natural seeding) or artificially (e.g., tree planting, seeding).

Regional landscapes: MFRC established eight regional landscapes covering Minnesota based on ecological, socio-economic, and administrative factors. These landscapes were established to undertake landscape-based planning and coordination across all forest ownerships. The subsections included in this plan are in the Northeast Landscape Region.

Release: Freeing a tree, or group of trees, from competition that is overtopping or closely surrounding them.

Relevéϑs: Vegetation survey plot data.

Research natural areas (RNAs): Areas within national forests that the U.S. Forest Service has designated to be permanently protected and maintained in natural condition (e.g., unique ecosystems or ecological features, rare or sensitive species of plants and animals and their habitat, and high quality examples of widespread ecosystems).

Reserved forestland: Forestland withdrawn from timber utilization through statute, administrative regulation, or designation.

Riparian area The area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands.

Riparian management zone (RMZ): That portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. It is the area where riparian guidelines apply.

Rotation age: The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors.

Salvage cut: A harvest made to remove trees killed or damaged by fire, wind, insects, disease, or other injurious agents. The purpose of salvage cuts is to use available wood fiber before further deterioration occurs to recover value that otherwise would be lost.

Sanitation cut: A cutting made to remove trees killed or injured by fire, insects, disease, or other injurious agents (and sometimes trees susceptible to such injuries) for the purpose of preventing the spread of insects or disease.

Sapling: A tree that is 1 inch to 5 inches in diameter at breast height.

Sawlog: A log large enough to produce lumber or other products that can be sawed. Its size and quality vary with the utilization practices of the region.

Sawtimber: Trees that yield logs suitable in size and quality for the production of lumber.

Scarify: To break up the forest floor and topsoil preparatory to natural regeneration or direct seeding.

Scientific and natural areas (SNAs): Areas established by the DNR, Division of Ecological Services to preserve natural features and rare resources of exceptional scientific and educational value.

Seedbed: The soil or forest floor on which seed falls.

Seed tree: Any tree, which bears seed; specifically, a tree left standing to provide the seed for natural regeneration.

Selective harvest: Removal of single scattered trees or small groups of trees at relatively short intervals. The continuous establishment of reproduction is encouraged and an all-aged stand is maintained. A management option used for shade-tolerant species.

Shade tolerance: Relative ability of a tree species to reproduce and grow under shade. The capacity to withstand low light intensities caused by shading from surrounding vegetation. Tolerant species tolerate shade, while intolerant species require full sunlight.

Shelterwood harvest: A harvest cutting in which trees on the harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of new seedlings under partial shade and protection of older trees. Produces an even-aged forest.

Silviculture: The art and science of establishing, growing, and tending stands of trees. The theory and practice of controlling the establishment, composition, growth, and quality of forest stands to achieve certain desired conditions or management objectives.

Silviculture and Roads Module (SRM): The SRM provides a database and application through which field foresters can record planned and actual forest development prescriptions (e.g., site preparation, tree planting projects, timber harvest, road maintenance, etc.) and follow-up surveys. SRM supports the geographic description of the extent of a development project separate from FIM stand boundaries. A variety of maps and other reports can be generated by the development system. SRM will also produce maps and reports that roll up forestry area data to the regional or statewide level. Part of the DNR's **FOR**estry **I**nformation **S**ys**T**em (FORIST).

Site index (SI): A species-specific measure of actual or potential forest productivity or site quality, expressed in terms of the average height of dominant trees at specific key ages, usually 50 years in the eastern U.S.

Site preparation: Treatment of a site (e.g., hand or mechanical clearing, prescribed burning, or herbicide application), to prepare it for planting or seeding and to enhance the success of regeneration.

Site productivity: The relative capacity of a site to sustain a production level over time. The rate at which biomass is produced per unit area. For example, cords per acre growth of timber.

Size class: A category of trees based on diameter class. The DNR's forest inventory has size classes such as Size Class *1* = 0 - 0.9 inch diameter; *2* = 1 - 2.9 inches diameter; *3* = 3 – 4.9 inches; *4* = 5 – 8.9 inches; *5* = 9 – 14.9 inches, etc. Also, size class may be referred to as seedling, sapling, pole timber, and saw timber.

Slash: The non-utilized and generally unmarketable accumulation of woody material in the forest, such as limbs, tops, cull logs, and stumps, that remain in the forest as residue after timber harvesting.

Snag: A standing dead tree.

Soil productivity: The capacity of soils, in its normal environment, to support plant growth.

Special concern species: A plant or animal species that is extremely uncommon in Minnesota, or has a unique or highly specific habitat requirements, and deserves careful monitoring. Species on the periphery of their ranges may be included in this category, as well as species that were once threatened or endangered but now have increasing, or stable and protected, populations.

Special management zone (SMZ): a buffer immediately surrounding designated old-growth forest stands. It is intended to minimize edge effects and windthrow damage to old-growth stands. Minimum width is 330-feet from the edge of the old-growth stand. Timber harvest is allowed in the SMZ, but there are limitations on how much can be clearcut at any given time.

Stand: A contiguous group of trees similar in age, species composition, and structure, and growing on a site of similar quality, to be a distinguishable forest unit. A forest is comprised of many stands. A ***pure stand*** is composed of essentially a single species, such as a red pine plantation. A ***mixed stand*** is composed of a mixture of species, such as a northern hardwood stand consisting of maple, birch, basswood, and oak. An ***even-aged stand*** is one in which all of the trees present are essentially the same age, usually within 10 years of age for aspen and jack pine stands. An ***uneven-aged stand*** is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

Stand age: The average age of the main species within a stand.

Stand density: The quantity of trees per unit area. Density usually is evaluated in terms of basal area, numbers of trees, volume, or percent crown cover.

Stand examination list: DNR forest stands to be considered for treatment (e.g., harvest, thinning, regeneration, prescribed burning, reinventory, etc.) over the planning period based on established criteria (e.g., rotation age, site index, basal area, desired future cover-type composition, etc.). These stands will be assigned preliminary prescriptions and most will receive the prescribed treatment. However, based on field appraisal visit, prescriptions may change for some stands because of new information on the stand or its condition.

Stand-selection criteria: Criteria used to help identify stands to be treated as determined by the subsection team. Criteria will likely be based on include rotation ages, site index, basal area, cover-type composition, understory composition, location, etc. Factors considered in developing stand-selection criteria will include: 1) desired forest composition goals, 2) timber growth and harvesting, 3) old-growth forests, 4) extended and normal rotation forests, 5) riparian areas, 6) wildlife habitat, 7) age and cover-type distributions, 8) regeneration, 9) thinning and 10) prescribed burning needs.

State forest road: Any permanent road constructed, maintained, or administered by the DNR for the purposes of accessing or traversing state forest lands.

Stocking: An indication of the number of trees in a stand as compared to the desirable number for best growth and management, such as well-stocked, overstocked, and partially-stocked. A measure of the proportion of an area actually occupied by trees.

Strategic planning: A process to plan for desired future states. Includes aspects of a plan or planning process that provide statements and guides for future direction. The geographic, programmatic, and policy focus can range from very broad and general to more specific in providing tiers/levels of direction. Strategic planning is usually long term (i.e., at least five years, often longer). It usually includes an assessment of current trends and conditions (e.g., social, natural resource, etc.), opportunities, and threats; identification of key issues; and the resulting development of goals (e.g., desired future conditions), strategies, and objectives. Vision and mission statements may also be included.

Stumpage: The value of a tree as it stands in the forest uncut. Uncut trees standing in the forest.

Stumpage price: The value that a timber appraiser assigns to standing trees or the price a logger or other purchaser is willing to pay for timber as it is in the forest.

Subsection: A subsection is one level within the ECS. From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province → Section → Subsection→ Land Type Association → Land Type→Land Type Phase. Subsections areas are generally one to four million acres in Minnesota, with the average being 2.25 million acres. Seventeen subsections are scheduled for the SFRMP process.

Subsection forest resource management plan (SFRMP): A DNR plan for vegetation management on forest lands administered by DNR Divisions of Forestry and Fish and Wildlife that uses ECS subsections as the basic unit of delineation. Initial focus will be to identify forest stands and road access needs for the duration of the 10-year plan. There is potential to be more comprehensive in the future.

Succession: The natural replacement, over time, of one plant community with another.

Sucker: A shoot arising from below ground level from a root. Aspen regenerates from suckers.

Suppressed: The condition of a tree characterized by low growth rate and low vigor due to competition from overtopping trees or shrubs.

Sustainability: Protecting and restoring the natural environment while enhancing economic opportunity and community well-being. Sustainability addresses three related elements: the environment, the economy, and the community. The goal is to maintain all three elements in a healthy state indefinitely. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable treatment level: A treatment level (e.g., harvest acres per year) that can be sustained over time at a given intensity of management without damaging the forest resource base or compromising the ability of future generations to meet their own needs. Treatment levels may need to be varied above and/or below the sustainable treatment level until the desired age-class structure or stocking level is reached.

Tactical planning: See operational planning.

Temporary access: A temporary access route for short-term use that will not be needed for foreseeable future forest management activities. It is usually a short, temporary, dead-end access route.

Thermal cover: Habitat component (e.g., conifer stands such as white cedar, balsam fir, and jack pine) that provides wildlife protection from the cold in the winter and heat in the summer.
Vegetative cover used by animals against the weather.

Thinning: A silvicultural treatment made to reduce the density of trees within a forest stand primarily to improve growth, enhance forest health, or recover potential mortality. **Row thinning** is where selected rows are harvested, usually the first thinning, which provides equipment operating room for future selective thinnings. **Selective thinning** is where individual trees are marked or specified (e.g., by diameter, spacing, or quality) for harvest. **Commercial thinning** is thinning after the trees are of merchantable size for timber markets. **Pre-commercial thinning** is done before the trees reach merchantable size, usually done in overstocked (very high stems per acre) stands to provide more growing space for crop trees that will be harvested in future years.

Threatened species: A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.

Timberland: Forestland capable of producing timber of a marketable size and volume at the normal harvest age for the cover-type. It does not include lands withdrawn from timber utilization by statute (e.g. Boundary Waters Canoe Area Wilderness) or administrative regulation such as designated old growth

forest and state parks. On state forest lands this includes stands that can produce at least three cords per acre of merchantable timber at the normal harvest age for that cover-type. It does not include very low productivity sites such as those classified as stagnant spruce, tamarack, and cedar, offsite aspen, or nonforest land.

Timber management plan: The same thing as vegetation management if used with the SFRMP process.

Timber management planning (TMP): Successor to the TMP information system (TMPIS). Recognizes the entire timber management planning process as being more than just the computerized system. Incorporates GIS technology and an interactive process with other resource managers.

Timber management planning information system (TMPIS): Circa mid-1980s. Original computerized system for developing 10-year stand treatment prescriptions by area.

Timber productivity: The quantity and quality of timber produced on a site. The rate at which timber volume is produced per unit area over a period of time (e.g., cords per acre per year). The relative capacity of a site to sustain a level of timber production over time.

Timber stand improvement (TSI): A practice in which the quality of a residual forest stand is improved by removing less desirable trees and large shrubs to achieve the desired stocking of the best quality trees or to improve the reproduction, composition, structure, condition, and volume growth of a stand.

Tolerant: A plant cable of becoming established and growing beneath overtopping vegetation. A tree or seedling capable of growing in shaded conditions.

Two-aged stand: a stand with trees of two distinct age class separated in age by more than 20 percent of the rotation age.

Underplant: The planting of seedlings under an existing canopy or overstory.

Understocked: A stand of trees so widely spaced that even with full growth potential realized, crown closure will not occur.

Understory: The shorter vegetation (shrubs, seedlings, saplings, small trees) within a forest stand that forms a layer between the overstory and the herbaceous plants of the forest floor.

Uneven-aged stand: A stand of trees of a variety of ages and sizes growing together on a uniform site. A stand of trees with three or more distinct age classes.

Uneven-aged management: Forest management that results in forest stands comprised of intermingling trees or small groups that have three or more distinct age classes. Best suited for shade tolerant species.

Variable density: Thinning or planting in a clumped or dispersed pattern so that tree spacing more closely replicates patterns after natural disturbance (e.g., use gap management, vary the residual density within a stand when thinning, or plant seedlings at various densities within a plantation).

Variable retention: a harvest system based on the retention of structural elements or biological legacies (e.g., retain tree species and diameters present at older growth stages, snags, large downed logs, etc.) from the harvested stand for integration into the new stand to achieve various ecological objectives. *Aggregate retention* retains these structural elements in small patches or clumps within the harvest unit. *Dispersed retention* retains these structural elements as individual trees scattered throughout the harvest unit.

Vegetation growth stage: The vegetative condition of an ecosystem resulting from natural succession and natural disturbance, expressed as vegetative composition, structure and years since disturbance. The vegetation growth stage describes both the successional changes (i.e., the change in the presence

of different tree species over time) and developmental changes (i.e., the change in stand structure overtime due to the regeneration, growth, and mortality of trees). Vegetation growth stages express themselves along the successional pathways for a particular ecosystem depending on the type and level of natural disturbance that has occurred. Forest tree and other vegetation composition, habitat features, and wildlife species use change with the various growth stages.

Vegetation management plan: In the process of developing the 10-year stand examination list, many decisions and considerations go beyond identifying what timber will be cut (i.e., broader than timber management). This includes designation of old growth, extended rotation forests, riparian areas, desired future forest composition, visually sensitive travel corridors, etc., all of which are intended to address wildlife habitat, biodiversity, and aesthetic and other concerns. Prescriptions assigned to stands reflect decisions based on these multiple considerations and are broader than decisions relative to final harvest (e.g., ERF designation, uneven-aged management, thinning, regeneration, underplanting, prescribed burning, etc.).

Viable populations: The number of individuals of a species sufficient to ensure the long-term existence of the species in natural, self-sustaining populations that are adequately distributed throughout their range.

Volume: The amount of wood in a tree or stand according to some unit of measurement (board feet, cubic feet, cords), or some standard of use (pulpwood, sawtimber, etc.).

Well-stocked: The situation in which a forest stand contains trees spaced widely enough to prevent competition yet closely enough to utilize the entire site.

Wildlife management area (WMA): Areas established by the DNR, Division of Fish and Wildlife, to manage, preserve and restore natural communities, perpetuate wildlife populations, and provide recreational and educational opportunities.

Windthrow: A tree pushed over by the wind. Windthrows are more common among shallow-rooted species.

APPENDIX D

Acronyms

AFRMP	Area Forest Resource Management Plan
BT	Bearing Tree
CMAI	Culmination of Mean Annual Increment
CMT	Commissioner's Management Team
CP	Chippewa Plains
CPPM	Chippewa Plains/Pine Moraines and Outwash Plains
CSA	Cooperative Stand Assessment
CWCS	Comprehensive Wildlife Conservation Strategy
DBH	Diameter at Breast Height
DFC	Desired Future Condition
DFFC	Desired Future Forest Composition
DMT	Division Management Team
DNR	Department of Natural Resources
DOQ	Digital Orthophoto Quadrangle
DRG	Digital Raster Graphics
ECS	Ecological Classification System
EILC	Ecologically Important Lowland Conifers
ELCP	Ecological Land Classification Program
ERF	Extended Rotation Forestry
ETS	Endangered, Threatened, or Special Concern
FIA	Forest Inventory and Analysis
FIM	Forest Inventory Module
FORIST	Forest Information System
FRIT	Forest Resource Issues Team
FTC	Forest Tent Caterpillar
FY	Fiscal Year
GAP	Gap Analysis Program
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GM	Gypsy Moth
HRLV	High Risk/Low Volume
HWDs	Hardwoods
LSA	Landscape Study Area
LSL	Laminated Strand Lumber
LTA	Land Type Association
MACLC	Minnesota Association of County Land Commissioners
MAI	Mean Annual Increment
MBF	Thousand Board Feet
MCBS	Minnesota County Biological Survey
MFRC	Minnesota Forest Resources Council
MFRP	Minnesota Forest Resources Plan
MnTAXA	Minnesota Taxonomy Database
MnWRA	Minnesota Wildlife Resource Assessment Project
P	
NAPP	National Aerial Photography Program
NAR	Natural Area Registry Agreement
NCFES	North Central Forest Experiment Station
NHIS	Natural Heritage Information System
NHNRP	Natural Heritage & Nongame Research Program
NPC	Native Plant Community
NRCS	Natural Resource Conservation Service
OFMC	Old Forest Management Complex
OHV	Off-Highway Vehicles

OSB	Oriented Strand Board
PM	Pine Moraines and Outwash Plains
RMT	Regional Management Team
RMZ	Riparian Management Zone
RNAs	Research Natural Areas
RNV	Range of Natural Variability
SFRMP	Subsection Forest Resource Management Plan
SGCN	Species in Greatest Conservation Need
SI	Site Index
SMC	Special Management Complex
SMZ	Special Management Area
SNA	Scientific and Natural Area
SNN	Shipstead-Newton-Nolan Act
SONAR	Statement of Need and Reasonableness
SPP	Species
SRM	Silviculture and Roads Module
TMP	Timber Management Plan
TMPIS	Timber Management Plan Information System
TNC	The Nature Conservancy
WMA	Wildlife Management Area