Chapter 3. Focused Issues, General Direction Statements, DFFCs, and Strategies

3.0 Background

In response to the final list of Issues identified in Chapter 2, the CP-PMOP Planning Team developed general direction statements (GDSs) to address the Issues, strategies to achieve the general directions, and desired future forest composition (DFFC) goals. General direction statements consider direction provided in state statues and rules; Department policies, guidelines, and direction (e.g., *Directions 2000, The Strategic Plan* or *A Strategic Conservation Agenda 2003-2007)*; and management that will sustain forest resource on state-administered forest lands in the subsections. GDSs provide general direction such as: increase, decrease, maintain, or protect a certain condition, output, or quality. Strategies were developed for each of the GDSs to move toward the general direction as specified. Where possible (i.e., current ability to measure and quantify), DFFC goals were identified. DFFC goals are expressed both in short term (during the 10-year SFRMP plan implementation period) and long-term (50+ years) goals for the ultimate desired condition of DNR forest lands in the subsections. Examples of DFFC goals are: cover type acres, age-class distribution, amount of young and old forest, and cover type treatment levels (e.g., harvest level).

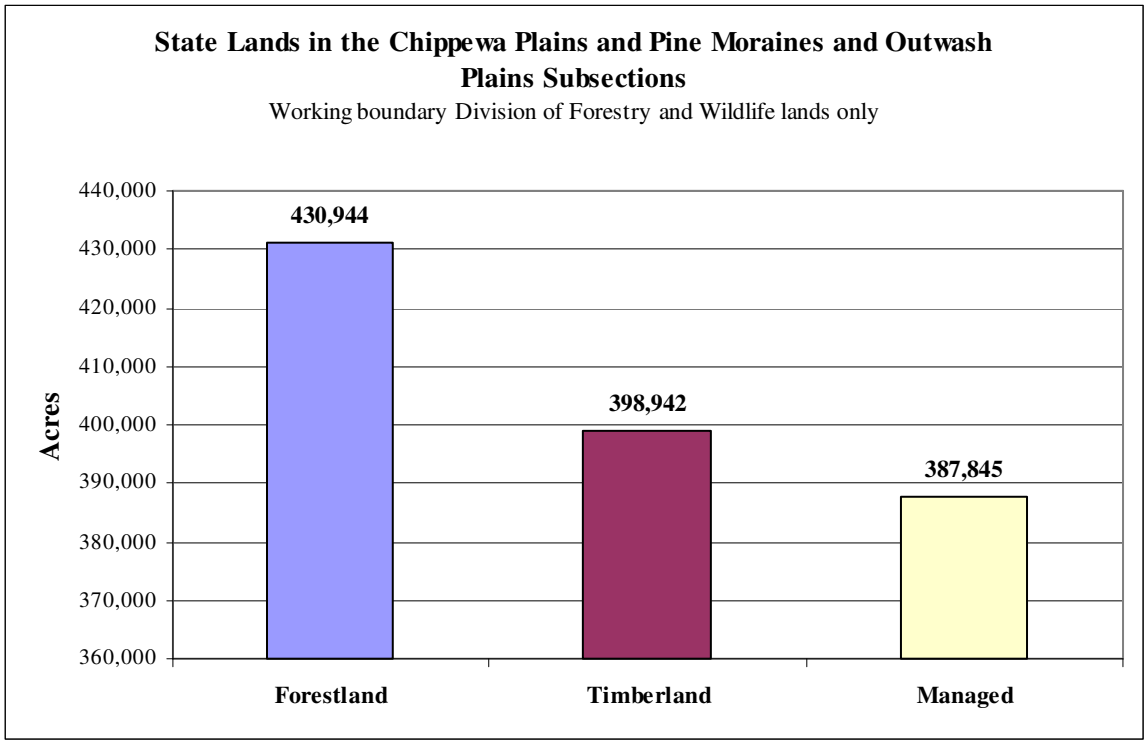
DFFC goals, general direction statements, strategies, as identified in this Chapter, and Cover type Management Recommendations as identified in Chapter 4, were used to determine stand treatment levels and define stand selection criteria to identify a pool of stands from which to select stands to be treated during this 10-year plan. This plan recommends treatment levels by cover type to move toward the DFFC goals and establishes the 10-year Stand Exam List that identifies specific forest stands selected for site-visit and possible treatment. The GDSs, strategies, and DFFC goals presented in this chapter have been used to guide the selection of the 10-Year Stand Exam List for the CP-PMOP SFRMP.

The following summarizes the sequence from Issues to Strategies:

1. 14 forest management Preliminary Issue Areas were identified in the *Preliminary Issues and Assessment document*; from these,
2. 29 more Focused Issue statements were drafted; from these,
3. 31 General Direction Statements and DFFCs were developed, relating to each Issue; then,
4. 168 Strategies were drafted to implement the GDSs and DFFCs.

As background to this chapter, Figure 3.0a shows the state land acres administered by the Division of Forestry and the Management Section of Wildlife in the two subsections. The state park lands within the CP-PMOP are not addressed in this plan. "*Forest land"* consists of all lands included in the forest inventory from aspen and pine cover types to stagnant conifers, and lowland brush. "*Timberland* " includes those cover types that are capable of producing merchantable timber. In this plan, "*managed"* acres are those acres available for timber management purposes. These managed acres make up approximately 90 percent of the total forest land (both divisions) in the two subsections. State lands reserved from harvest such as designated old-growth stands and scientific and natural areas (SNAs) are not included in managed acres, meaning they are not available for harvest.

Figure 3.0a Forest land, Timberland, and Managed Acres



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

Relationship of the CP-PMOP SFRMP with other forestry planning efforts

While the SFRMP process focuses on developing vegetation management plans for state-administered forestlands within the subsection, other department planning efforts, policy and guidelines also guide vegetative management. All of these directions have been considered by the CP-PMOP Planning Team in developing this plan. In addition, the CP-PMOP Plan has also, when possible, taken into consideration and coordinated with other state, federal, and local resource management planning efforts affecting the subsections.

The following sections highlight the more prominent directions, documents and processes that influence the SFRMP process.

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:

1. gather and assess information on a region's current and future ecological, economic, and social characteristics;
2. use information about a region to identify that region's key forest resource issues;
3. plan ways to address key issues in order to promote sustainable forest management within the region; and,
4. coordinate various forest management activities and plans among a region's forest landowners and managers in order to promote sustainable forest management.

The MFRC north central landscape encompasses much of the Chippewa Plains and Pine Moraines and Outwash Plains subsections. Recommended "desired outcomes, goals, and strategies" for the North Central Landscape Regional Plan were completed in March 2003. These recommendations have been considered and are incorporated into the CP-PMOP SFRMP planning process.

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

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

The MFRC's *Voluntary Site-Level Forest Management Guideline*s June 2005 as amended, including 2007 amendments addressing biomass harvest, 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 *Voluntary Site-Level Forest Management Guidelines* developed through that collaborative process have been adopted and are implemented as the DNR practices forest management. These *guidelines* are the standard in managing DNR lands, (i.e., they are not voluntary but are required practices on DNR-administered lands. However, as recognized in the *guidelines*, deviation is allowed on a case by case basis, where written documentation is provided of the need to meet other goals or strategies that conflict with the strict application of the *guidelines*.

DNR Strategic Conservation Agenda 2003–2007 and DNR *Directions 2000, The Strategic Plan.*

The department's strategic planning documents, *DNR Strategic Conservation Agenda 2003–2007* and *Directions 2000*, *The Strategic Plan* provide broad goals, strategies, and performance indicators for forest resources in Minnesota (see DNR *Directions 2000, The Strategic Plan* Forest Resources Section in Appendix A and DNR *Strategic Conservation Agenda*, *2003-2007* Forests Section at http://www.dnr.state.mn.us/conservationagenda/index.html). This broad statewide direction is used as a platform from which to develop additional complementary/supplemental goals and strategies specific to each subsection.

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 Ecological Classification System (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

Extended Rotation Forest Guideline

The 1994 DNR *Extended Rotation Forest (ERF) Guideline* was developed through a public and stakeholder input process. The primary purpose of the *ERF guideline* is to provide adequate acreages of forest cover types older than their normal rotation ages to provide for species and ecological processes that require older forest characteristics. During the SFRMP process for all subsection planning, 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 are 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 are also 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.

The statewide *ERF guideline* requires that a minimum of 10 percent of the DNR Forestry- and Wildlife-administered timberlands within a subsection be managed as ERF. Determining the amount of DNR

timberlands to be managed as ERF within each subsection involves many considerations including wildlife habitat needs, visual and riparian corridors, and implications for timber production (both quantity and quality).

Incorporating Biodiversity Considerations in SFRMP

Biological diversity is defined in Minnesota 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."* (Minnesota Statutes 89A). Protecting areas of significant biodiversity is consistent with state policy that seeks to pursue the sustainable management, use, and protection of the state's forest resources to achieve economic, environmental, and social goals.

The SFRMP process incorporates biodiversity considerations in planning for forest systems on DNR lands. The Ecological Resources Division has provided ecological information pertinent to managing for biodiversity within the two subsections (e.g. *Minnesota's Comprehensive Wildlife Conservation Strategy; An Action Plan for Minnesota Wildlife, 2006;* Minnesota County Biological Survey data; Natural Heritage information; and, Scientific and Natural Area biodiversity management techniques experience). SFRMP direction in addressing issues and developing GDSs, Strategies, DFFCs, and the 10-Year Stand Exam List and New Access Needs List reflect vegetative management to maintain biodiversity.

Interdisciplinary Forest Management Coordination Framework

The purpose of the *Interdisciplinary Forest Management Coordination Framework*, December 2007, is to ensure effective coordination between the divisions of Forestry, Fish and Wildlife, and Ecological Resources to improve decision-making and achieve sustainable forest management. The *framework* applies primarily to planning and implementing forestry and fish and wildlife management practices on land administered by the divisions of Forestry, and Fish and Wildlife. While each division has different mandates and functions, they have mutual responsibility for sustainable forest management. Interdisciplinary cooperation is designed to ensure integrated decision-making necessary to comprehensively manage forest ecosystems and their interrelated resources.

Although adopted near the completion of the CP-PMOP Plan, many of the coordination policies of the *Interdisciplinary Forest Management Coordinating Framework* have been implemented as the CP-PMOP Plan was developed. The *framework* will serve as the process to guide interdisciplinary coordination among the DNR divisions.

DNR *Forest-Wildlife Habitat Management Guidelines*

DNR *Forest-Wildlife Habitat Management Guidelines* provide direction to DNR wildlife and forestry staff for integrated forest / wildlife management on state-administered lands. Some areas of the guideline overlap with the MFRC *Voluntary Site-Level Forest Management Guidelines*. MFRC *guidelines* will prevail if overlaps are found in the field. Relevant species-specific sections of the *Forest-Wildlife Habitat Management Guidelines* have been applied to 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.).

Management Section of Wildlife Plans, Goals and Guidelines

SFRMP plans are not wildlife habitat plans, however, forest management efforts affect forest habitats and consequently wildlife distribution and abundance. Because state forest management, under a multiple-use policy, requires consideration of wildlife habitat, wildlife plans have been consulted during the SFRMP process including:

1. The Division of Fish and Wildlife's *Strategic Plan* that establishes population and or harvest objectives for many of the state's wildlife species that are hunted and trapped;
2. Division of Fish and Wildlife's *Restoring Minnesota's Wetland and Waterfowl Heritage Plan*; and,
3. Management Guidance Documents for Wildlife Management Areas.

Off-Highway Vehicle (OHV) Planning Process

SFRMP planning is not a recreational vehicle planning process. During development of the CP-PMOP Plan, the DNR was involved in a significant OHV planning process that has impacts and intersects with forest resource management. This OHV planning process has been used in the CP-PMOP planning

process primarily as a tool to identify New Access Needs as part of the 10-Year Stand Exam List (Chapter 7 of this plan). For more information about the OHV planning process, see the DNR Web site at http://www.dnr.state.mn.us/input/mgmtplans/ohv/designation/index.html.

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 through a separate state park planning process.

The SFRMP process has considered state park plans in making decisions on forest stand management adjacent to state parks. Likewise, as future state park plans are developed they will consider the vegetation management direction and objectives in CP-PMOP SFRMP. Additionally, the SFRMP process has considered the role of state parks in the subsection for meeting desired future compositions and associated goals (e.g., biodiversity, wildlife habitat, community types, etc.).

Summary

As discussed, the DNR uses a variety of written vehicles (e.g., policies, guidelines, recommendations, memos, operational orders, agreements) to communicate vegetative management policy direction to DNR staff. This policy direction covers the broadest range of issues practical including: forest productivity, old-growth management, ecologically important lowland conifers, coordination among all DNR divisions, site-level mitigation, rare habitats and species, and extended rotation forest management. All of these plans, guidelines and processes have been used to develop the CP-PMOP SFRMP.

General Direction Statements, Strategies and Desired Future Forest Condition

Identified below are the Issues, general direction statements (GDSs), desired future forest conditions (DFFCs) and strategies developed to guide forest vegetation management on state forest lands. Each Issue, GDS, DFFC, and Strategy has been developed from specific Issue areas as first identified in the *Preliminary Issues and Assessment document, August 2006* prepared for the CP-PMOP. These GDSs, Strategies, and DFFCs together with the specific Cover Type Management Recommendations (Chapter 4) provide the guidance and direction as the 10-Year Stand Exam List and New Access Needs List were developed.

3.1 Primary Issue Area: Age Classes

Focused Issue A1 What is the desired age-class and growth-stage distribution for forest types across the landscape?

GDS A1a Forest resources will continue to represent multiple age classes, distributed across the landscape.

Forests will be managed to provide a representation of forest age classes that are sustainable over time, balanced with the need to provide a stable timber supply and increased timber productivity, with both old forests and early successional forest habitat represented within the landscapes. One goal is to minimize large fluctuations in harvest levels to the extent possible. Over time, age-classes for each cover type will approach a balanced condition, with approximately equal amounts in each 10-year age class up to normal rotation ages.

The current age-class distributions of the aspen, balm of Gilead, birch, balsam fir, black spruce, jack pine, and tamarack cover types show imbalance in age structure. This imbalance is a result of broad-scale harvest and subsequent fires in the early 1900s. This, coupled with a lack of markets and low harvest rates for many years continued to skew the age class distributions. As second growth forests have evolved and moved beyond normal rotation age, together with increased timber demand in recent years has provided opportunities to create more younger age classes and move these cover types toward a more balanced age structure. The amount of forest above maximum rotation age is decreasing due to harvest, insects and disease, and succession to other cover types such as from the in-growth of secondary species (e.g, balsam fir understory in a declining aspen stand.) Table 3.1a identifies the total cover type acres by age-class for the CP-PMOP subsections.

Table 3.1a reflects the forest cover type dataset as included in the CP-PMOP *Preliminary Issues and Assessment document* and is included here to provide continuity from the *Preliminary Issues and Assessment document* to the CP-PMOP Plan.

It is the DNR's objective to use the best available information as forest management plans and plan components are developed. As information concerning forest cover types, age classes and condition etc, is improved, this information is used to provide the most up-to-date information upon which to make forest management decisions. During development of the CP-PMOP SFRMP the following three databases came into consideration:

1. 2004 databases as shown on Table 3.1a was used in development of the *Preliminary Issues and Assessment document* and development of the GDSs, DFFCs and strategies;
2. January 2007 database (update and improvement to the 2004 dataset) was used to develop treatment levels and conversion targets; and,
3. July 2007 database was used to develop the 10-Year Stand Exam List and New Access Needs List.

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

Table 3.1a Chippewa Plains/Pine Moraines and Outwash Plains State[1] Timberland[2] Cover Type Acres by Age-Class (2004)

Cover type	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121 +	TOTAL
Ash/Lowland Hdwds.	90	191	507	280	355	426	1,210	2,366	2,852	2,795	3,176	2,279	16,520
Aspen/Balm	36,419	47,127	28,309	14,755	6,413	11,867	19,624	15,803	4,514	45	39	321	181,231
Balsam Fir	213	232	819	1,232	1,261	1,032	1,367	1,529	420	333	57	0	8,494
Birch	236	177	176	177	342	1,210	3,906	3,197	1,671	616	225	170	12,102
Black Spruce Upland	0	66	28	0	0	0	12	0	0	0	0	0	106
Black Spruce Lowland	1,081	1,618	1,952	3,250	1,121	1,088	1,450	2,129	3,020	2,845	5,643	2,527	27,721
Cutover Area[3]	3,044	721	200	7	24	11	0	0	0	0	0	19	4,025
Jack Pine[4]	1,483	1,546	1,750	662	2,902	5,453	2,403	1,477	375	27	9	0	18,088
Northern White Cedar	4	90	119	85	203	76	213	390	959	1,796	4,644	3,909	12,487
Northern Hardwoods[5]	308	615	508	726	131	720	3,040	3,983	2,287	2,626	839	1,029	16,809
Red (Norway) Pine	4,533	5,478	7,500	5,081	1,748	1,017	1,099	715	1,739	2,466	1,923	1,428	34,726
Oak	125	155	294	180	148	540	4,827	4,891	2,592	945	469	435	15,598
Tamarack	1,354	713	3,806	3,256	4,712	2,839	2,371	2,843	4,015	4,517	9,774	3,691	43,889
White Pine	572	86	38	106	215	185	844	51	113	75	254	144	2,683
White Spruce	664	2,035	1,966	1,028	480	146	278	60	5	9	13	0	6,681
Total	50,126	60,850	47,972	30,825	20,055	26,610	42,644	39,434	24,562	19,095	27,065	15,952	401,160

[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 V: *Glossary*). However, 4,427 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.

[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] Contains 13 acres of Scotch pine forest that will be planned and managed along with the jack pine type.

[5] Contains six acres of Central Hardwoods forest that will be planned and managed along with the northern hardwoods type.

In addition to planning for early successional forests, old forest considerations in subsection planning will ensure adequate representation of older growth stages in even-aged cover types to address visual goals and recreation needs, help maintain the integrity of forested riparian areas, complement or connect old-growth stands and other old patches, provide habitat for wildlife species associated with old forest, and provide for older growth stages of native plant communities.

Forest stand is considered to be old forest whenever its age exceeds the normal rotation age. Generally *old forest conditions* refers to 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.

Sites best suited for various age classes can be determined from ECS classifications and other tools that identify a site's capabilities. Determining the appropriate extent and locations of old forest to be sustained requires balancing landscape level factors including: timber productivity, economic impacts, historical forest conditions and habitat requirements, as well as site level considerations such as proximity to existing old growth stands, proximity within visual corridors, steep terrain, or in riparian areas, etc.

Strategies

A1a. 1 Consider ECS characteristics and other indicators when deciding where old forest and younger age classes are best suited.

This strategy can be implemented by identifying ECS classifications, and locating major disturbance regimes, bearing tree information and native plant communities to help categorize land type associations (LTAs) by their ability to develop and maintain various aged forests. This information can then be used to identify locations best suited to support old forest characteristics and young age classes.

A1a. 2 Provide representations of desired age-classes through forest composition goals.

This strategy can be implemented by:

1. Maintaining young, early successional forest in a variety of patch sizes to provide habitat for associated species.
2. Managing riparian management zones (RMZs) primarily to reflect old forest conditions.
3. Allowing some stands to naturally succeed to other cover types.
4. Using silvicultural treatments that retain old forest components in some stands, striving to emulate the within-stand composition, structure and function of older growth stages.
5. Taking into account the contributions of non-timberland cover types (e.g., stagnant conifers), inaccessible or inoperable stands, and reserved areas (old growth, SNAs, state parks) in providing representations of growth stages on the landscape.
6. Increasing mixed forest conditions in some stands.

A1a. 3 Develop and apply criteria to identify stands that are over rotation age but can be carried into subsequent 10-year plan implementation periods to reduce age-class imbalances.

One primary goal of the CP-PMOP SFRMP planning effort is to target the selection of stand treatment acres to the appropriate age classes to achieve DFFCs. Stands found to be over rotation age can be identified, re-evaluated and deferred for treatment to the next planning cycle in an effort to balance age classes over decades. Chapter 4, Cover type Management Recommendations, identifies each cover type, the current age-class distribution by cover type acres and the future stand management for that particular cover type.

Table 3.1b identifies total cover type acres that are either under normal rotation age or over normal rotation age. This table identifies that several cover types (ash, lowland hardwoods, northern

hardwoods) have an excess of acres over the normal rotation age, meaning that in past decades less than optimal harvest (to maintain balanced age classes) in these cover types has occurred. This results in imbalances in age class distributions that the CP-PMOP Plan addresses through the recommended treatment levels.

Table 3.1b Cover Type Acres by Under Normal Rotation and Over Rotation Age

Covertype	Acres less than or equal to normal rotation age	Acres over normal rotation age
Ash	80	13,968
Lowland Hardwoods	12	2,622
Aspen	152,434	25,704
Birch	4,629	4,925
Balm of Gilead	1,780	873
Northern Hardwoods	727	15,465
Oak	7,669	8,194
Central Hardwoods	0	6
White Pine	873	2,267
Red (Norway) Pine	29,927	5,929
Jack Pine	11,484	6,202
White Spruce	5,825	1,414
Balsam Fir	3,709	3,933
Lowland Black Spruce	16,916	10,869
Tamarack	23,037	21,762
Cedar	154	13,398
Upland Black Spruce	0	76

The desired future age class distributions will be achieved by reducing the imbalances of under normal rotation age and over normal rotation age for particular cover types as shown in Table 3.1b.

DFFC Statement

A range of age classes will be implemented, eventually moving the cover types toward a more balanced age structure. Harvest plans will be guided by the established rotation ages and acreage goals for each cover type as identified in the figures from Chapter 4 (Cover Type Management Recommendations) that portray the 2017 through 2057 Desired Age-Class Distributions.

Focused Issue A2 What is the appropriate amount, type and distribution of old forests?

GDS A2a Forest managed for old forest characteristics will be distributed across the landscape.

A forest stand of any particular even-aged managed forest cover type is considered old forest whenever its age exceeds the normal rotation age for that cover type. "Old forest" includes extended rotation forest (ERF), old growth forest (OG), ecologically important lowland conifers (EILC) and old forest management complexes (OFMCs). Historically, forests were not evenly distributed by age throughout these two subsections, but were clustered or dispersed according to site characteristics and environmental influences. The western portions of these subsections were likely dominated by younger forests, where regular burning influenced vegetation, while older forests may have been concentrated on the eastern side of the subsections, particularly on the east side of large lakes, where they may have had more favorable micro-site conditions and protection from fires.

Determining the amount of old forest to be sustained in these subsections required balancing several factors: timber productivity, economic impacts, forest conditions representative of natural disturbance regimes, and habitat requirements. The goal is to provide a representation of old forest that is sustainable over time, balanced with the need to provide a stable timber supply, increased timber productivity, and also maintaining adequate early successional forest habitat.

As background to develop the CP-PMOP SFRMP, selection of ERF, OG, EILC and OFMCs was completed with input from all department disciplines as reflected on the CP-PMOP Planning Team and input from field staff (meaning including forestry, fisheries, ecological resources and wildlife staff) from across the subsections. The overall goal is to maximize old forest habitat values while minimizing potential economic impacts. If all appropriate factors are not adequately considered, allocation of ERF, for example, among DNR Forestry Areas could affect timber harvest levels and possibly local economies. Failure to determine the most appropriate distribution of old forest and ERF in the CP-PMOP subsections could result in less than optimal economic, ecological and social benefits being derived from state forest lands.

Following are examples of factors that assisted in balancing old forest characteristics with other management objectives. Some advantages of managing for old forest characteristics include:

1. ensures an adequate representation of older growth stages in even-aged cover-types;
2. addresses visual concerns and recreation desires;
3. helps maintain the integrity of forested riparian areas;
4. complements or connects old-growth stands and other old patches;
5. provides habitat for wildlife species associated with old forest;
6. provides for older growth stages of natural community types; and,
7. provides large-diameter timber products.

Uneven-aged managed stands and other state lands (e.g., state parks and SNAs) also contribute to old forest conditions. In addition, compositional changes to more long-lived conifers will provide more forest with longer rotations in the future.

Strategies

A2a. 4 Designate ERF stands in the amounts and percentages prescribed by the Statewide ERF Work Group.

In order to designate ERF, a series of management ages first needed to be established that were unique to each cover type. To assist in this effort, a Statewide Rotation Age Workgroup developed and provided to the planning team normal rotation ages, maximum rotation ages, and merchantable ages for each of the even-aged managed cover types as shown in Table 3.1c.

Table 3.1c Division of Forestry Recommended Rotation Ages for Forest Stands in the CP-PMOP Subsections

Cover type	Chippewa Plains				Pine Moraines-Outwash Plains			
	Site Index Class	Merchantable Age	Normal Rotation Age	Maximum Rotation Age	Site Index Class	Merchantable Age	Normal Rotation Age	Maximum Rotation Age
Aspen	All	30	45	80	All	30	40	75
Balsam Fir	All	30	45	60	All	30	45	60
Balm of Gilead	All	30	40	60	All	30	40	60
Birch	All	30	50	65	All	30	50	60
Black Spruce	40+	30	65	95	40+	30	65	95
	23-39	50	95	130	23-39	50	95	130
Jack pine	All	30	40	65	All	30	40	65
Oak	60+	35	80	120	60+	30	80	120
	< 60	35	50	80	<60	30	50	80
Red (Norway) Pine	All	30	100	170	All	30	100	170
Tamarack	All	30	60	105	All	30	70	105
White Cedar		None						
White Spruce	Natural Planted	30 30	60 50	90 60	Natural Planted	30 30	60 50	90 60

In addition to normal, maximum and merchantable ages for each cover type, extended rotation forest age-class distribution must also be established as well as percentage goals of ERF by cover type. Extended rotation DFFC goals for each cover type were developed by a Statewide ERF Workgroup and provided to the CP-PMOP Planning Team as shown in Table 3.1d (expressed as Effective ERF Percent Goal). This table shows the total timberland cover type acres, the Prescribed ERF percentage, Prescribed Acres, Effective ERF Goal percentage, Effective ERF Acres and the current acres percentage over normal rotation ages by cover type.

Table 3.1d State Timberland ERF by Cover Type

Cover Type	Timberland[1] Acres	Prescribed ERF %[2]	Prescribed ERF Acres[3]	Effective ERF % Goal[4]	Effective ERF Acres	Current Acres % > NRA[5]
Aspen/balm of Gilead	182,505	30.45	54,820	13.50	24,671	27.8
Birch	9,450	56.25	5,711	12.50	1206	90.1
Red (Norway) Pine	34,198	63.25	21,672	25.00	8786	10.0
Jack Pine	14,339	42.00	6,071	15.00	2163	62.1
White Spruce (Natural)	1,061	68.00	727	17.00	180	62.9
White Spruce (Planted)	6,028	60.00	3,064	10.00	603	6.3
Balsam Fir	7,690	56.21	4,278	14.00	1085	63.8
Oak (<60)	9,468	70.00	5,952	20.00	1920	93.4
Oak (>=60)	6,458	44.20	2,807	13.00	839	15.2
BSL (SI 29-39)	23,461	53.90	12,930	14.00	3285	37.4
BSL (SI >=40)	4,217	43.18	2,343	11.00	434	65.2
Tamarack	44,269	37.24	16,107	14.00	6198	31.2

[1] Timberland Acres: Forestry and Wildlife lands considered available for timber harvest.
[2] Prescribed ERF %: percentage goal of the timberland acres in designated as ERF.
[3] Prescribed ERF Acres: acres designated as ERF.
[4] Effective ERF % Goal: Percent goal of cover type timberland acreage to be managed beyond the normal rotation. Effective ERF is the percent of the timberland acreage that is above the normal rotation age.
[5] Percent of timberland acreage older than the normal rotation age(s) established for the cover type.

The Effective ERF Percent Goals as identified in Table 3.1d, were used as a guide during treatment level modeling of each cover type to maintain acceptable amounts of old forest and effective ERF through time. Using the effective ERF percent goals, Table 31e identifies effective ERF percentages resulting over the five-decade plan implementation period.

Table 3.1e Effective ERF Percent 2007 – 2057

Cover Type	2007	2017	2027	2037	2047	2057	DFFC Goal*
Aspen/Balm of Gilead	9.7%	9.0%	10.2%	13.3%	14.9%	14.6%	13.5%
Birch	54.3%	37.5%	24.2%	13.0%	5.6%	4.0%	12.5%
Red (Norway) Pine	6.3%	10.1%	11.3%	11.9%	12.6%	10.0%	25.0%
Jack Pine	28.5%	16.5%	11.1%	7.1%	7.7%	13.6%	15.0%
White Spruce Planted	4.1%	6.7%	5.5%	10.7%	8.3%	10.8%	10.0%
White Spruce Natural	12.6%	12.2%	15.0%	25.2%	21.5%	19.1%	17.0%
Balsam Fir	34.6%	27.8%	21.3%	14.7%	7.4%	11.4%	14.0%
BSL (SI 40+)	34.9%	32.6%	26.0%	20.4%	17.4%	14.7%	11.0%
BSL (SI 29-39)	22.0%	19.4%	20.1%	15.4%	12.4%	8.4%	14.0%
Oak <60	57.8%	44.6%	29.3%	22.2%	12.7%	4.9%	20.0%
Oak >60	6.6%	26.1%	27.2%	27.0%	19.2%	13.8%	13.0%
Tamarack	22.2%	21.8%	14.6%	13.8%	12.2%	7.8%	14.0%

*DFFC Goal provided by Statewide ERF Workgroup

A2a. 5 Distribute ERF stands across the landscape consistent with ERF policy.

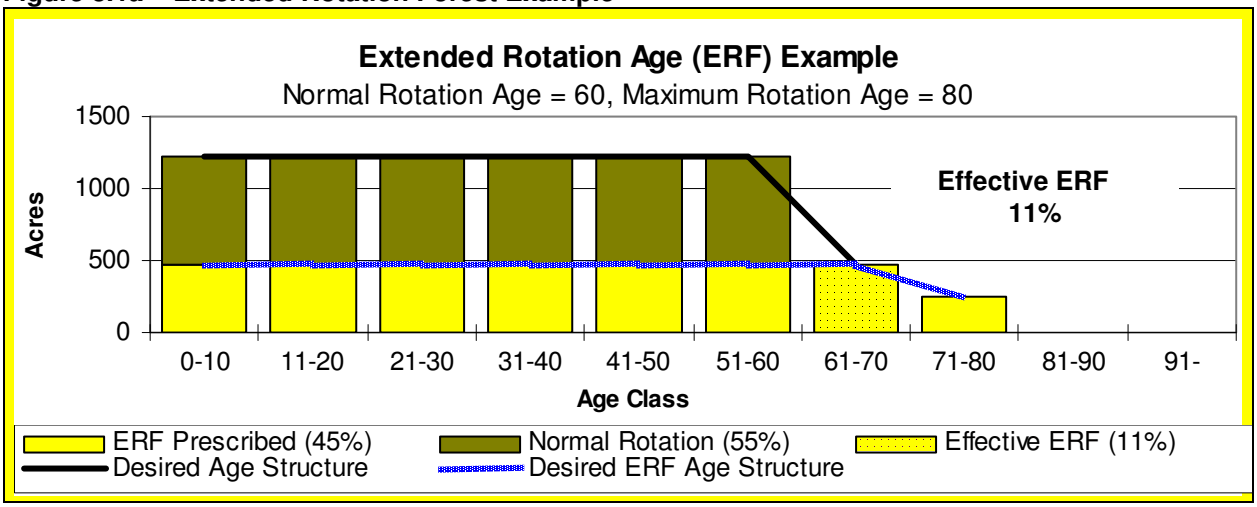
In identifying ERF on the landscape, the CP-PMOP Planning Team used the ERF goals by cover type as provided by the Statewide ERF Workgroup. In distributing ERF across the landscape the ERF percentage goals were allocated to each Forestry Area based on the cover type percentages of each individual Forestry Area to total cover type acreage within the two subsections.

A2a. 6 Prescribe ERF stands across all age classes to maintain a constant supply of effective ERF.

The amount of prescribed ERF was determined by modeling to provide the desired amount of effective ERF by cover type as the DFFC age-class distribution is achieved. Table 3.1d shows the percentage of prescribed ERF necessary to achieve the effective ERF, and the current acreage, by percent, over the normal rotation by cover type. Designation of ERF stands included strategies to maintain similar acreages in each age class over time and to provide for a sustainable supply of old forest and old forest benefits. Fluctuations in the amount of effective ERF will be seen until a balanced age-class distribution is reached, after which, fluctuations may occur periodically due to major disturbances such as wind or fire. See the Figures in Chapter 4, Cover type Management Recommendations that portray the ERF acreage by age-class distributions for each decade from 2017 through 2057, resulting from application of the treatment levels.

In describing and understanding ERF levels, two terms are used: Prescribed ERF and Effective ERF. 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 appropriate age at or before maximum rotation age(s). A stand at 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. Figure 3.1a illustrates an Extended Rotation Forest Example showing prescribed ERF and effective ERF for a cover type that has an even-aged class distribution with a declining acreage from normal rotation age to the maximum rotation age.

Figure 3.1a Extended Rotation Forest Example



A2a. 7 Manage ERF stands in even-aged cover types to achieve a declining age-class structure from normal rotation age to maximum rotation age.

Extended rotation forests are representative of old forest characteristics. In implementing this strategy, ERF levels in an age class will be adjusted through specific stand treatments over time. Planning for desired amounts of old forest was a factor in treatment level considerations. Holding non-ERF stands past the established normal rotation age ensures higher levels of old forest on the landscape, as well as helps to balance the age classes. In some cover types, because stands will not be held past their established maximum rotation age, a temporary drop below desired levels will occur for one or two

decades. Some cover types exceed the ERF DFFC because of the need to hold some stands past normal rotation age to move more quickly toward meeting the goal of balancing the age classes.

Table 3.1f identifies the projected old forest percentage by cover type resulting from application of the treatment model spreadsheets to each even-aged managed cover type.

At the end of the CP-PMOP 10-year plan implementation period (FY2018), the percentage of acres over normal rotation age will be reduced for all cover types except oak (high site index), red pine and white spruce planted. This acreage provides old forest conditions. For most cover types the percentage of old forest remains higher out through the decades than the DFFC goal because of the large acreages currently over the normal rotation ages.

Table 3.1f Old Forest: Percent of Managed Acres Over Normal Rotation Age

Cover type	Percent at start of Decade						
	2007	2017	2027	2037	2047	2057	DFFC Goal*
Aspen/BG	27.8	15.8	14.9	18.0	17.3	18.4	13.5%
Birch	88.0	65.0	38.8	19.9	8.2	5.6	12.5%
Jack Pine	62.1	33.8	17.9	12.4	11.7	27.5	25.0%
Balsam Fir	63.8	44.9	28.8	17.0	9.1	16.8	15.0%
Tamarack	61.2	43.9	30.9	30.1	26.2	20.9	10.0%
Oak <60	92.0	61.6	35.2	25.8	15.4	6.2	17.0%
Oak >60	15.2	44.1	48.8	39.7	24.6	13.8	14.0%
BSL 23-39	37.2	33.9	30.2	23.4	19.4	15.1	11.0%
BSL >40	62.3	53.6	41.6	30.0	24.0	18.8	14.0%
Red (Norway) Pine	8.7	12.0	12.1	11.9	12.6	10.1	20.0%
White Spruce Natural	16.7	12.9	15.0	25.2	30.5	19.1	13.0%
White Spruce Planted	6.3	6.7	5.5	17.3	15.5	17.9	14.0%

*Provided by the Statewide ERF Workgroup

A2a. 8 Maintain the current acreage of designated Old Growth stands.

The old growth stands that were designated as a result of the *Old Growth Forest Guidelines* process, completed in 2003 will generally be retained. In addition, a process has been identified in the *Old-growth Guideline Amendment # 2* by which acres of old growth that meet accepted criteria may be added, or acres deleted based on ongoing planning and discussions among DNR divisions throughout the 10-year plan implementation period. The goal is to maintain the acreage and previously identified stands of old growth forest statewide. Management of designated old growth stands and the surrounding special management zones (SMZs) and old forest management complexes (OFMCs) will be implemented consistent with all *Old Growth Forest Guidelines* and *Amendments*. Consideration to designate additional stands or remove currently designated old growth stands will also follow policies outlined in the *Old Growth Forest Guidelines and Amendments*.

Table 3.1g identifies the old growth stands and total acres by cover type as designated in the CP-PMOP. These stands are designated acres and reserved from harvest during this plan implementation period.

Table 3.1g Designated Old Growth for the CP-PMOP Subsections

Old Growth Type	Total Cover Type Acres on State Lands in these Subsections	Number of Stands Designated Old Growth	Total Designated Old Growth Acres	Percent of Cover type Designated as Old Growth
Ash	14,202	21	390	3%
Cedar	12,578	14	967	8%
Lowland Hardwoods	2,657	14	293	11%
Northern Hardwoods	16,141	59	1,726	11%
Red (Norway) Pine	35,144	59	956	3%
Oak	16,058	8	112	1%
White Pine	2,002	21	453	23%
Total Designated Old Growth	**98,782**	**196**	**4,896**	**5%**

In addition to designating old growth stands, OFMCs are also delineated. OFMCs were required under Department policy directives adopted prior to development of the CP-PMOP SFRMP. OFMCs include stands adjacent to designated old growth stands and are managed to complement and protect the old growth attributes of the designated stands. This includes managing for the unique goals of a SMZ, and extended rotation forest (ERF) in the vicinity of designated old-growth stands.

Table 3.1h identifies total stands and acres associated with OFMCs by cover type in the CP-PMOP.

Table 3.1h Acres by Cover Type of stands affected by an OFMC

Inventory Cover Type	Total Cover Type Acres on State Lands in these Subsections	Number of Stands in OFMC	Total Acres in OFMC	Percent of Cover Type
Ash	14,202	21	571	4.0%
Lowland Hardwoods	2,657	8	96	3.6%
Aspen	180,606	168	2,633	1.5%
Birch	9,653	16	290	3.0%
Balm of Gilead	2,662	2	12	0.5%
Northern Hardwoods	16,163	43	720	4.5%
Oak	16,103	21	259	1.6%
White Pine	2,027	5	37	1.8%
Red Pine	35,128	46	754	2.1%
Jack Pine	14,458	21	283	2.0%
White Spruce	7,080	4	107	1.5%
Balsam Fir	7,752	19	302	3.9%
Lowland Black Spruce	27,786	16	168	0.6%
Tamarack	44,275	20	572	1.3%
Cedar	13,195	47	674	5.1%
Stagnant Tamarack	4,209	3	455	10.8%
Stagnant Cedar	10,142	15	272	2.7%
Cut over area	4,781	5	57	1.2%
Lowland Grass	13,249	8	148	1.1%
Upland Grass	3,483	2	58	1.7%
Lowland Brush	54,746	60	1,345	2.5%
Upland Brush	1,129	1	7	0.6%
Industrial Development	1,340	2	13	1.0%
Recreational Development	333	3	10	3.0%
Roads	1,327	4	27	2.0%
Permanent Water	13,070	27	371	2.8%
Non-permanent Water	10,370	12	200	1.9%
Marsh	47,665	45	1,154	2.4%
Muskeg	4,632	3	29	0.6%

A2a. 9 Manage designated old-growth stands and OFMCs according to individual OFMC plans and DNR *Old Growth Management Guidelines.*

OFMCs were designated consistent with the process outlined in Appendix D (*Process Used to Determine Old Forest Management Complexes).* Designating OFMCs was a preliminary step to the CP-PMOP SFRMP planning process, (required under prior Department policy). The OFMCs as designated, are summarized on Table 3.1h. In addition, acres of EILC were also identified as a preliminary step to the SFRMP planning process (See Appendix F, *Ecologically Important Lowland Conifers: Stand Designation Process*). These EILC acres will be evaluated for their potential as "old growth". Approximately twice as much EILC acreage was identified compared to what is expected to be designated old growth because currently designated old growth stands do not include the lowland conifer types such as black spruce,

tamarack and cedar. Once old growth is identified from the EILC inventory, non-old growth EILC will be returned to the forest timberlands inventory.

Where OFMC plans have been completed, forest management will follow the management plans for designated old-growth stands and the surrounding acres. Foresters will use the *DNR Old-Growth Forest Guidelines, Amendments #5 and #6* as guides.

A2a. 10 Continue to prescribe ERF stands adjacent to old growth to create OFMCs consistent with DNR OFMC policy.

A2a. 11 Prescribe ERF stands in steep areas, inaccessible terrain, riparian areas, habitat areas, travel corridors, and visual corridors to achieve desired old forest attributes consistent with DNR OFMC policy.

As ERF stands were selected by DNR staff, stands were frequently designated in blocks to protect and enhance old growth and riparian corridors. Also, ERF facilitates patch management by maintaining some old patches now and ensuring that some patches will be held beyond normal rotation age in the future. During the selection of ERF stands, even-aged stands in riparian areas and adjacent to designated old growth were given priority for ERF designation. Site-level forest management guidelines recommend managing for longer-lived conifers throughout the landscape. In many cases, however, stands located in inaccessible terrain were tagged "inoperable" and excluded from designation as prescribed ERF.

A2a. 12 Consider ECS and range of natural variation (RNV) when identifying sites capable of growing older stands and/or providing winter cover and food sources for wildlife.

A2a. 13 Give priority to designating ERF in areas of the landscape that have historically supported the oldest forests and highest proportion of older forests.

In designating ERF by Forestry Areas, department staff (including Ecological Resources and Wildlife) had the opportunity to consider the historical and spatial distribution of old forests. Special consideration was given to designating ERF stands adjacent to designated old growth forests to further the objectives of OFMCs.

DFFC Statement
ERF will be achieved in the amounts identified on Table 3.1e.

Focused Issue A3 What is the appropriate amount, type and distribution of young early-successional forest?

GDS A3a Forests managed for young early-successional stages will be distributed across the landscape.

In the context of this GDS, "young early-successional forest" is represented by aspen, balm of Gilead, birch, and jack pine cover types in the 0-30 year age group. The amount of young forest to be sustained over time will be determined by desired long-term cover type acres and a balanced age-class distribution for these cover types. These four cover types comprise 53 percent of the total timberland acres in the CP-PMOP landscape. The 0-30 age group of aspen, balm of Gilead, birch, and jack pine cover types comprises 55 percent of the timberland acres in these cover types. Historically, younger forests may have been more prevalent along the western portions of these subsections, where they were subjected to frequent fires.

Young early-successional forest will be adequately represented over time using regulated harvesting in the aspen, balm of Gilead, birch, and jack pine cover types. Jack pine stands in the central floristic region generally don't originate as fully stocked stands (see Appendix R *Potential Pine Woodlands Areas*). Most harvest will occur through even-aged treatment. In appropriate areas, harvest prescriptions will attempt to mimic the intense wildfires and wind events that occurred naturally to initiate fully stocked, early successional forest. Silvicultural treatments which result in perpetuation of forest floor flora and

native plant community features will be favored when possible, particularly in the jack pine cover type. A variety of harvest sizes will be used while maintaining existing large patches and creating opportunities for large patches in the future by grouping of harvest activities.
For aspen, balm of Gilead, and jack pine, emphasis will be on maintaining an adequate amount of young age classes on the landscape through regulated harvest. For birch, the focus will be on increasing regeneration of birch stands back to birch, during this 10-year plan implementation period. Existing birch stands are being lost to natural conversion due to the over mature nature of many of these stands.

Moving toward and eventually maintaining a balanced age-class distribution will ensure that young forest (0-30 years old) exists on the landscape over time. The percentage of young forest per decade was considered when the 10-year treatment levels were determined. This ensured that there would be adequate young forest over the 50-year plan implementation period. In some cover types, higher levels of young forest will occur in the initial decades due to the accelerated treatment of the acres currently over the rotation ages. Table 3.1i summarizes the projected percentage of young forest by decade by cover type. This table shows that at the end of the 10-year plan implementation period there will be more young forest in all cover types except red pine and white spruce.

Table: 3.1i Young Forest Summary: Projected Percent of Cover type 0-30 Years Old

Cover Type	DFFC %	2007	2017	2027	2037	2047	2057
Aspen/BG	64	62	63	58	61	60	59
Birch	53	6	32	57	75	61	50
Jack Pine	65	32	58	75	77	58	49
Balsam Fir	57	14	37	63	80	57	42
Black Spruce Lowland 23-39	27	14	23	30	37	32	29
Black Spruce Lowland >40	41	19	26	32	47	46	44
Oak <60	48	4	34	61	73	47	34
Oak >60	33	3	23	41	57	52	47
Red (Norway) Pine	23	50	27	20	15	17	18
Tamarack	43	12	32	50	55	40	29
White Spruce Natural	42	40	32	36	35	38	45
White Spruce Planted	54	68	51	48	44	50	55

Strategies

A3a. 14 Consider ECS characteristics when locating sites capable of supporting young early-successional forests.

As field foresters site-visit stands during the 10-year plan implementation period, a *Silvicultural Prescription Worksheet* will be prepared. The purpose of the *worksheet* is to provide a process by which foresters can assess all site factors that may affect stand management. Those factors include ECS information such as land type association (LTA); the NPC; and, growth stage of the dominate species. As field foresters determine stands capable of supporting young forests, these ECS characteristics will be considered.

In implementing this strategy, priority will be given to cover types where acreage is declining on these landscapes. Of the four cover types associated with young, early successional forests (aspen, balm of Gilead, birch, and jack pine), jack pine and birch cover types are declining in total acres.

A3a. 15 Move aspen/balm of Gilead, paper birch, and jack pine cover types toward a balanced age-class structure**.**

A3a. 16 Maintain the amount of the birch cover type and the percent of birch as a stand component during the initial10-year plan implementation period.

This strategy will be implemented by increasing the treatment level for the birch cover type, with the goal to regenerate most birch harvest sites to well-stocked young birch stands, and monitor the success of these tactics.

A3a. 17 Decrease the amount of birch as a cover type and stand component during subsequent 10-year planning periods (through five decades).

A3a. 18 Include areas of young, early-successional forest, adjacent to areas of extensive or expansive old forest (i.e., ERF, old growth, or OFMC).

A3a. 19 Maintain young, early-successional forest, in a variety of patch sizes to provide habitat for associated species.

DFFC Statement
Young forests will be distributed across the subsections in the cover types and percentages consistent with Table 3.1i.

3.2 Primary Issue Area: Forest Composition

Focused Issue B1 What is the appropriate forest composition at the landscape level and how will the important tree species that have declined, be restored?

GDS B1 Forest composition will be managed according to ecological classifications to more closely reflect vegetation that developed under natural disturbance regimes.

Ecologic, economic, and social considerations used in developing the vegetation change goals for these subsections included information on current and historic forest composition, natural disturbance regimes, ecological classifications, wildlife habitat, forest insects and disease, forest productivity, recreational values, and aesthetics.

Within the CP-PMOP subsections, forest information was compiled for cover type/tree species and spatial summaries for multiple land ownerships (see Appendix N, *Land Type Association Assessment and Analysis Documents*). These *documents* allowed DNR staff to evaluate and compare forests in these subsections with the conditions consistent with those found under natural disturbance regimes. The CP-PMOP Planning Team reviewed and approved the forest composition goals, targets, and strategies that were recommended through the DFFC setting process (see Appendix G, *Process Used to Determine Forest Composition Goals*).

The CP-PMOP Plan identifies 10 and 50-year cover type DFFC acreage goals that balance acreage increases and decreases within subsections. Projected cover type treatment levels and cover type change goals will be used over the 10 and 50 year plan implementation periods to achieve the DFFCs (See Appendix H, *Ten and Fifty-Year Cover Type Conversion Goals*).

The proposed cover type change goals reflect increases of the acreage of cover types that have declined, generally longer-lived conifers, from hardwood cover types that are currently over represented. These DFFCs were designed to be aggressive but achievable and appropriate to the landscape. These increases will be implemented while maintaining or enhancing important wildlife habitats and plant communities, and providing a sustainable level of forest products.

Table 3.2a identifies the desired cover type acreage changes over 10-years and 50-years reflecting the DFFCs as applied to the forest cover types in the CP-PMOP.

Table 3.2a Desired Cover type Acreage Changes – 10-years and 50 Years

CP-PMOP		DFFC - 2017			DFFC - 2057		
Cover type	**Existing Acres**	**Acres**	**+/- Acres**	**(+/-)% Change**	**Acres**	**+/- Acres**	**(+/-)% Change**
Aspen/balm of Gilead	182,745	179,945	-2,800	-2%	168,376	-14,369	-8%
Ash/Lowland Hardwoods	16,856	16,256	-600	-4%	15,056	-1,800	-11%
Tamarack	44,269	45,069	+800	+2%	46,669	+2,400	+5%
Birch	9,645	9,645	0	0%	9,145	-500	-5%
Balsam Fir	7,750	7,550	-200	-3%	7,494	-256	-3%
White Pine	2,002	2,452	+450	+23%	4,252	+2,250	+112%
Red (Norway) Pine	35,144	35,144	0	0%	41,159	+6,015	+17%
Jack Pine	14,419	19,919	+5,500	+38%	26,588	+12,169	+84%
Black Spruce Lowland	27,678	27,678	0	0%	27,678	0	0%
White Spruce	7,088	7,038	-50	-1%	7,233	+145	+2%
Cedar	12,578	12,878	+300	+2%	13,239	+661	+5%
Northern Hardwoods	16,141	15,891	-250	-2%	14,391	-1,750	-11%
Oak	16,058	15,308	-750	-5%	14,308	-1,750	-11%
Total Acres	**392,373**	**394,773**	**2,400**		**395,588**	**3,215**	

In determining sites most conducive to cover type changes, foresters will use the following resources:

1. Preliminary stand-level direction recorded during development of the 10-Year Stand Exam Lists (e.g., preliminary stand prescriptions, preliminary management objectives, comments and the associated stand management recommendations and considerations);
2. Potential conversion sites and associated scores for cover types with planned increases (see Appendix K, *Stand Scoring System*);
3. ECS/NPC evaluations and considerations;
4. Conversion acreage allocations by Forestry Area;
5. CP-PMOP Plan GDS and strategies (Chapter 3 of the CP-PMOP Plan;
6. Cover type Management Recommendations (Chapter 4 of the CP-PMOP Plan);
7. Priority LTA for cover type increase (See Appendix N, Land Type Association *Assessment and Analysis Documents*);
8. Minnesota County Biological Survey (MCBS) site management recommendations;
9. Designated patch areas (See Appendix Q, *Patch Management in the CP-PMOP* and Appendix R, *Potential Pine Woodland Areas*); and,
10. *Silvicultural Prescription Worksheet* (see Appendix E).

Methods to change stand overstory composition will range from intensive site preparation to managing for the understory species. As stand prescriptions are applied, field foresters will favor less intensive efforts and more natural approaches including the following:

1. Allow natural succession of some aspen/balm of Gilead, birch and hardwood stands to conifers;
2. Use uneven-aged management to develop multi-aged conifer stands;
3. Manage plantations to resemble natural stands;

4. Use prescribed fire to maintain forest communities dependent on fire;
5. Use methods that favor natural regeneration, such as seed trees, harvest timing, slash management, etc.;
6. Increase mixed forest conditions in some stands in all cover types;
7. Utilize timber harvest systems or methods that protect advanced regeneration;
8. Seed or plant sites that don't contain an adequate natural seed source;
9. Vary silvicultural treatments across the landscape to promote the development of diverse stands; and,
10. Prescribe ERF in some stands to allow advanced conifer regeneration to develop.

Strategies

B1a. 20 Consider the MFRC's *North Central Landscape Region Plan* forest composition goals and objectives**.**

DNR staff routinely considers and have incorporated MFRC's north central landscape planning efforts, and also have incorporated the Recommended Desired Outcomes, Goals and strategies included in the *North Central Landscape Region Plan* dated January 27, 2004 in this CP-PMOP Plan. The GDSs, strategies and DFFCs identified in this CP-PMOP Plan are consistent with those recommended in the MFRC's *North Central Landscape Region Plan*.

The following identifies the desired future forest conditions from the MFRC's *North Central Landscape Region Plan:*

1. There will be an increased component of red, white and jack pine, cedar, tamarack, spruce and fir.
2. The forest will have a range of species, patch sizes, and classes that more closely resemble natural patterns and functions within this landscape.
3. The amount of forest land and timberland will not decrease using FIA definitions for timberland and forest land. Large blocks of contiguous forest land that have minimal inclusion of conflicting land uses will be created and/or retained for natural resource and ecological benefits, and to minimize land use conflicts (hereafter referred to as "natural resource emphasis areas).
4. In large blocks of contiguous forest land retain critical natural shoreline on lakes for scenic, wildlife, water quality, and other natural resource values.

Consistency with the above MFRC's desired future forest conditions can be found throughout the GDSs, strategies and DFFCs of the CP-PMOP Plan.

B1a. 21 Increase mixed forest conditions in most stands in selected cover types.

Mixed forest conditions in this plan refer 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 NPC for that site.[1] Currently, many stands are composed of a mixture of species, but the proportion of the ecologically dominant species has declined. The lack of fire in some forests has led to an altered forest composition (such as more balsam in fire-dependent sites). Therefore, a key strategy in moving forest composition that considers range of natural variation (RNV) is the promotion of mixed-forest conditions while managing and maintaining cover types. 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.

Mixed forests that are managed toward the NPC composition, structure, and natural disturbance regimes provide the range of conditions to which native organisms have adapted. Mixed forests are more likely to provide the variations in moisture, light, and nutrients necessary for the development of diverse microsites, and the compositional and structural components necessary for the development of niches.

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

Mixed forests increase the likelihood that natural successional pathways will develop toward desired NPC composition and growth stages. A mixed forest may ameliorate damage from wind, fire, drought, and flood. The increased tree species diversity provided in mixed forests also increases the likelihood that forests will persist in the face of global climate change. Mixed forests are preferred because they offer social, economic, and ecological benefits not found in single species forests.

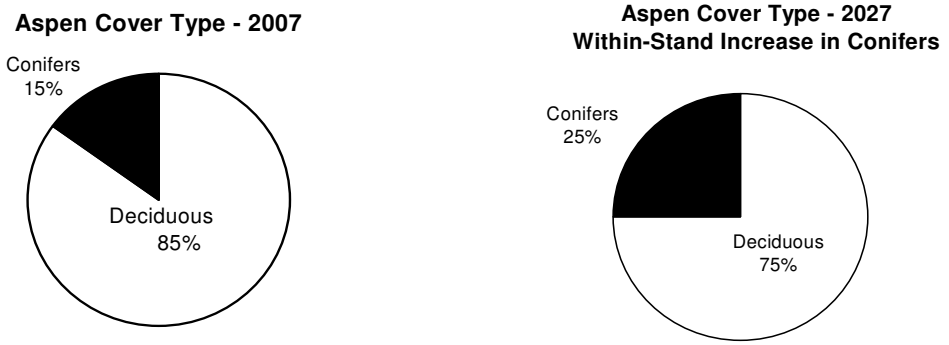
Mixed forests can buffer outbreaks of insect or disease infestations. Some examples of pest problems that can affect single-species stands more than mixed stands are jack pine budworm, spruce budworm, yellow-headed spruce sawfly, pine and tamarack bark beetles, forest tent caterpillar, hypoxylon canker, dwarf mistletoe, and blister rust. In other cases, certain mixtures of tree species may increase insect and disease damage (e.g., a balsam fir component in a white spruce stand will increase the risk of spruce budworm damage to the spruce). When managing for a mixed forest, the effects of insect or disease infestations on the stand will be considered.

While clearcutting for even-aged management will continue, in both single- and mixed-species stands, mixed forests provide additional silvicultural treatment options. More specific management recommendations by cover type to promote mixed forest conditions are provided in Chapter 4, Cover type Management Recommendations.

Implementation of this strategy may range from application of the MFRC's *Voluntary Site-Level Forest Management Guidelines* (e.g., legacy patches and conifer retention) in harvest operations to other management such as mechanical site preparation, prescribed burning, seeding, and planting within-stand. The strategy to increase mixed forest conditions is to favor species found in NPCs appropriate to the site, especially tree species that have significantly declined from past levels such as white pine, red pine, jack pine, white cedar (lowland and upland), white spruce, tamarack (lowland and upland) and birch.

Figure 3.2a illustrates an example of an increase in mixed forest conditions within an aspen stand. In this example, in 2007, the deciduous species are primarily aspen (e.g., 60 percent) with paper birch and other hardwoods present. Conifer species are primarily white spruce, balsam fir, white pine, and red pine. Through the application of appropriate strategies as identified in this plan, by 2027 an increase in conifers within the aspen stand (from 15 percent to 25 percent) occurs, but the stand remains primarily comprised of aspen and inventoried as an aspen cover type. Desired species composition would vary with NPC.

Figure 3.2a Generalized Example of an Increase in Mixed Forest Conditions



B1a. 22 Decrease the acres of aspen, northern hardwoods, oak, ash, and lowland hardwoods to favor conifer cover types.

Evaluation and understanding of cover type trends is important to determine the appropriate cover type changes to be included in this plan. The cover type change information has been evaluated as both recent trends and historic trends. Specific observations for general cover types is difficult as many factors will influence the trend such as: same cover type found in both upland and lowland sites; land ownership; trends across subsections or across LTAs may not be consistent; and within any one general cover type, several tree species are grouped, some of which may be increasing while others may be deceasing.

Beyond these complicating factors, the following general observations concerning the trends of cover types in these subsections can be made:

Considering recent trends:

1. The following cover types are increasing: red pine, white pine, white spruce, northern hardwoods, oak, tamarack, ash, and lowland hardwoods.
2. The following cover types are decreasing: balsam fir, jack pine, aspen, birch, black spruce, and cedar.

Considering historic trends:

1. The following cover types have increased: balsam fir, aspen, birch, northern hardwoods, oak, ash, and lowland hardwoods.
2. The following cover types have decreased: jack pine, red pine, white pine, white spruce, black spruce, cedar, and tamarack.

B1a. 23 Increase the acres of the white pine, jack pine, tamarack and northern white cedar cover types.

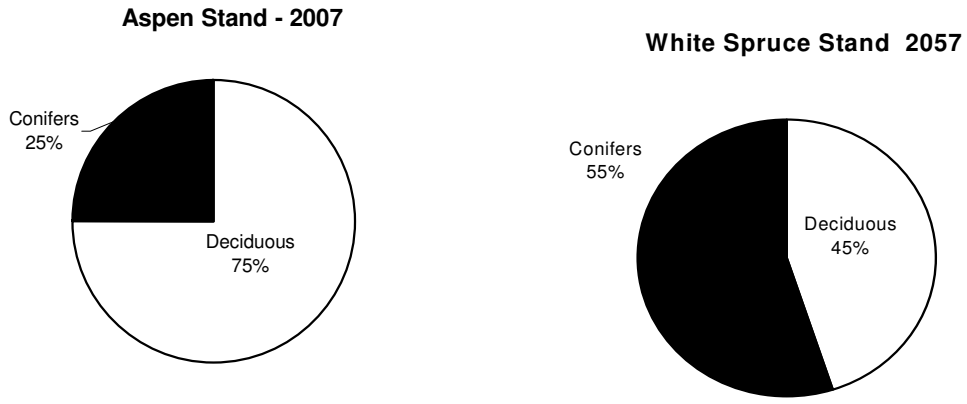
From the stands identified on the 10-Year Stand Exam List, this strategy will be implemented by using available tools and resources to guide the on-site evaluation of stands for conversion from one cover type to another or managing for mixed forest conditions (species composition and stand structure). Appendix S, *Stands with a White Pine Component*, identifies stands included on the 10-Year Stand Exam List that include white pine as the primary or as a secondary cover type component.

To meet these goals, foresters are advised to follow the specific cover type management recommendations as identified in Chapter 4, *Cover type Management Recommendations* such as:

1. Allow some stands to convert through natural succession to long-lived conifer cover-types without harvest. Emphasize this in stands with adequate advanced regeneration of long-lived conifer species.
2. Artificially convert some stands through mechanical site preparation, prescribed burning, planting, or seeding.
3. Selectively harvest some stands to move toward the desired cover type and within-stand composition.

Figure 3.2b illustrates an example of an aspen stand being converted to a white spruce stand over time. In 2007, the aspen stand is 60 percent aspen and 15 percent other hardwoods. Conifer species comprise 25 percent of the stand, consisting primarily of white spruce with some balsam fir, white pine, and red pine. Through stand treatments between 2007 and 2057, such as clearcut with reserves, selective harvest, site preparation, or tree planting, the stand has converted to become primarily conifers. In 2057, aspen comprises 30 percent of the stand and white spruce is 35 percent of the stand. With conifers becoming the predominant species group (55 percent) in the stand and white spruce comprising the largest portion, the cover type is now classified as white spruce. Species composition would vary with NPC for the site. Note that the stand retains a significant component (45 percent) of deciduous species such as aspen.

Figure 3.2b Generalized Example of an Increase in Conifer Cover type Acres: Aspen Stand Converts to a White Spruce Stand



B1a. 24 Increase the acres of the cedar and tamarack cover types on both upland and lowland sites.

Data from the CP-PMOP planning area suggests a long-term decline in lowland cedar and tamarack acreage. The MFRC *North Central Landscape Region Plan* recommends an increased component of upland cedar in Boreal Hardwood-Conifer Plant Communities and an increased component of upland tamarack in Boreal Hardwood-Conifer and Dry-Mesic Pine Plant Communities.

B1a. 25 Maintain the acres of the black spruce cover type on both upland and lowland sites. Despite both recent and historic black spruce declines in these subsections, the 10- and 50-year goal is to maintain current black spruce acreage on upland and lowland sites.

As shown on Table 3.2b, the acreage of the following cover types will increase during the 10-year period:

- tamarack
- white spruce (natural)
- northern white cedar (mostly lowland but some upland)
- white pine
- jack pine

The total acreage of the following cover types will decrease during the 10-year period:

- white spruce (net decrease, decreases from white spruce plantations on FD sites)
- balsam fir
- oak (on drier sites in PMOP)
- aspen
- northern hardwoods
- ash/lowland hardwoods

The acreage of the following cover types will be maintained during the 10-year period;

- birch
- lowland black spruce
- red (Norway) pine (no net change)
- balm of Gilead (generally managed with aspen)

Table 3.2b Cover Type Change Goals (DFFC) and Projected Increases and Decreases

Cover Type	10-year DFFC	50-year DFFC
Upland Conifers		
Jack Pine	38% increase	84% increase
White Pine	23% increase	112% increase
Red (Norway) Pine	maintain	17% increase
Lowland Conifers		
White Spruce	1% decrease	2% increase
Balsam Fir	3% decrease	3% decrease
Tamarack	2% increase	5% increase
Northern White Cedar	2% increase	5% increase
Lowland Black Spruce	maintain	maintain
Other Cover types		
Oak	5% decrease	11% decrease
Paper Birch	maintain	5% decrease
Aspen	2% decrease	8% decrease
Northern Hardwoods	2% decrease	11% decrease
Ash/Lowland Hardwoods	4% decrease	11% decrease

DFFC Statement

The DFFC of cover types on the landscape will be as shown on Table 3.2a. The CP-PMOP Plan will move these subsections toward more conifer cover type acreage in upland areas. Cover type increases over the next 10 years will occur in jack pine, white pine, tamarack, and white cedar. Cover type decreases will occur in the aspen, balsam fir, oak, white spruce, northern hardwoods and ash/lowland hardwoods cover types. The cover type acreages of red pine, birch and black spruce lowland will be maintained over the 10-year plan implementation period.

Focused Issue B2 What is the appropriate mix of patch sizes and forest condition on the landscape considering the impacts of fragmentation?

GDS B2a Minimize forest fragmentation and manage habitat fragmentation to provide an ecologically appropriate variety of patch sizes distributed across the landscape.

Forest fragmentation is defined as distinct contrasts between land uses, such as between heavily forested lands and agricultural lands or residential development. Forest fragmentation is more significant in the PMOP than in the CP.

Habitat fragmentation occurs where a contiguous or homogeneous forest area of a similar cover type and age is broken up into smaller, dissimilar units and is a concern in both of these subsections. Habitat fragmentation has the potential to interfere with species seasonal migration and dispersal, negatively affects survival requirements, and reduces habitat patch size to a level smaller than some animal species require. In some cases however, habitat fragmentation can be beneficial for species that thrive in forested areas with small patches and abundant edge habitats.

Forest landscapes that have evolved from traditional vegetation management practices are more fragmented and contain fewer large patches than landscapes where spatial patterns are determined primarily by natural disturbance and landform. The average overall patch size has declined nearly 50

percent since the 1930s in the north central Minnesota Drift and Lakes Plains section[1]. Incorporating spatial considerations into the CP-PMOP stand selection process and coordinating stand treatments through the life of this plan can reduce forest habitat fragmentation and maintain and promote larger patches over time.

Although the CP-PMOP Plan considered management activities of other ownerships, patch management is primarily focused on identifying opportunities that exist on large blocks of state land. To guide patch management on state lands, *a patch is defined as one or more adjoining stands that is relatively homogenous in structure, primarily in height and density, and is similar in vegetation cover and age*. Patch sizes (Table 3.2c) range from small (less than 40 acres) to large (greater than 640 acres). Patches may have smaller areas (e.g., 10-15 percent of the patch area) within them that are not in the same patch category as the main patch, such as inclusion pockets or stands, residual islands, corridors, and buffers.

Using Cooperative Stand Assessment (CSA) forest inventory data, an initial patch assessment was conducted for state lands in these subsections[2]. Patches were created in a GIS data layer by dissolving common stand boundaries between stands of the same cover type group and age-class. As part of the initial patch assessment, all stands were classified by size down to Class 5. Information on all forested patches from this assessment was then summarized and analyzed. As a result, the CP-PMOP Planning Team identified a general need for more larger and older forest patches on state lands within these landscapes. DNR staff then selected a pool of certain large patches to be considered for patch management. During meetings within Forestry Areas, designated patches were chosen from the pool. Stands within certain designated patches were assigned an ERF prescription if the patch goals included management on a longer rotation to generate an older age patch. These designated patches will be maintained or enhanced over time and their management should help ensure that a variety of large patches are retained in these subsections.

For purposes of identifying patches for patch management in the CP-PMOP Plan, designated forest patches included patch size classes 1-3 (101 acres and larger).

Table 3.2c Patch Size Classes for Patch Management in SFRMP

Size Class	Acre Range
Class 1	Greater than 640 acres
Class 2	251 - 640 acres
Class 3	101 - 250 acres
Class 4	41 - 100 acres
Class 5 - Small	Less than 40 acres

The result of this effort was identification of 146 patches that were then tagged in the forest inventory dataset and available to the Forestry Areas as the 10-Year Stand Exam Lists were prepared. Appendix Q (*Patch Management in CP-PMOP*) identifies the patches alphabetically by patch name for the CP-PMOP subsections. Coordinated management within these designated forest patches and application of the strategies below, to other forested areas, should reduce forest habitat fragmentation on state lands.

[1] Manolis, J. December 2003. *Project Summary: Results from the Minnesota Spatial Analysis and Modeling Project*. Minnesota Forest Resources Council (MFRC) and Minn. DNR.
[2] Minn. DNR. July 17,2007 Addressing Patch Management in SFRMP. SFRMP Process Guidebook IV .

Tables 3.2d and 3.2e summarize the patch designations for the CP-PMOP subsections.

Table 3.2d Designated Patch Summary by Age Class and General Forest Type (CP-PMOP Subsections)

Patch Summary by Age Class			Total Acres by General Forest Type			
Age Class	**Size Class**	**Number**	**Average Size**	**Deciduous**	**Conifers**	**Total Acres**
Old	Class 1	10	1808	3882	14197	18078
Old	Class 2	24	406	1301	8448	9749
Old	Class 3	27	154	1349	2807	4157
Total Old		**61**		**6532**	**25452**	**31984**
Intermediate	Class 1	2	2408	4815	0	4815
Intermediate	Class 2	12	410	1290	3632	4921
Intermediate	Class 3	22	156	1166	2270	3436
Total Intermediate		**36**		**7271**	**5902**	**13173**
Young	Class 1	8	2028	14950	1271	16222
Young	Class 2	16	404	4680	283	4963
Young	Class 3	25	150	1545	937	2481
Total Young		**49**		**21175**	**2491**	**23666**

Table 3.2e Designated Patch Summary by Size Class and General Forest Type (CP-PMOP Subsections)

Patch Summary by Size Class			Total Acres by General Forest Type			
Size Class	**Age Class**	**Number**	**Average Size**	**Deciduous**	**Conifers**	**Total Acres**
Class 1	Old	10	1808	3882	14197	18078
Class 1	Intermediate	2	2408	4815	0	4815
Class 1	Young	8	2028	14950	1271	16222
Total Class 1		**20**		**23648**	**15468**	**39115**
Class 2	Old	24	406	1301	8448	9749
Class 2	Intermediate	12	410	1290	3632	4921
Class 2	Young	16	404	4680	283	4963
Total Class 2		**52**		**7271**	**12363**	**19634**
Class 3	Old	27	154	1349	2807	4157
Class 3	Intermediate	22	156	1166	2270	3436
Class 3	Young	25	150	1545	937	2481
Total Class 3		**74**		**4060**	**6014**	**10074**

Strategies

B2a. 26 Inventory current and potential patches by subsection.

B2a. 27 Manage patch sizes to more closely resemble those created under natural disturbance regimes.

When implementing patch management strategies, foresters will give consideration to:

1. Harvest adjacent to other recently harvested sites to increase the size of young Patches;
2. Minimize the fragmenting of habitat with roads and forest access trails;
3. Leave live trees and snags within most even-aged managed timber harvests to mitigate the effects of habitat fragmentation; and,
4. Manage some patches as old forest, consistent with this GDS, as well as other departmental recommendations such as the Northern Goshawk Management Considerations.

B2a. 28 Retain and create larger patches, where conditions allow, through state management activities and cooperation with other landowners and forest managers**.**

B2a. 29 When applying silvicultural treatments in an area, give priority to management of whole stands, groups of stands, or entire native plant communities to further patch management goals.

B2a. 30 Coordinate plan implementation with large land managers including the U.S. Forest Service, county land departments, local governments, industrial forest land managers and nonprofit organizations to identify causes and mitigate impacts of fragmentation.

DFFC Statement

The average forest patch size on state lands and the patch size within designated forest patches will increase through implementation of this plan.

Focused Issue B3 How can landscape level connectivity between forest habitats be maintained?

GDS B3a Connectivity will be maintained between forest habitats using natural corridors and corridors maintained using forest management practices.

Because of the significant amount of public forest land in the Laurentian Mixed Forest Province, connectivity in this part of the state is likely adequate but needs to be specifically maintained as part of forest management activities. However, connectivity in some parts of these subsections, especially in the PMOP, has suffered due to forest fragmentation resulting from changes in ownership patterns, land use, and human population densities.

Maintaining habitat connectivity will allow diverse populations of wildlife to remain connected, so they can adapt and migrate in the future. Migration corridors are important because global warming will likely cause some animal species associated with the mixed coniferous-deciduous forests to move northward and others to enter the province from the south. Landscape level connectivity will also benefit biodiversity and help maintain ecologically intact landscapes.

Strategies

B3a. 31 Identify existing and potential corridors between significant forest areas and assess cooperation opportunities with other landowners.

B3a. 32 Maintain or improve important corridors between forest areas.

B3a. 33 Give priority to riparian corridors that connect significant forest areas.

Focused Issue B4 What is the appropriate mix of forest structure and growth stages for state lands within the subsections?

GDS B4a Representations of all growth stages with vertical and horizontal structural diversity will be distributed across the landscapes.

Harvest, reforestation, and protection strategies will guide management decision-making to reach a variety of objectives such as timber production, diversity of age classes, patch size distribution, native plant community retention (forest land, wetland, and open brush land communities), and connectivity (to provide habitat corridors and wildlife habitat).

Forest management prescriptions will be designed to emulate natural stand development patterns and to produce structural components found in natural stands, but will evolve in a shorter timeframe. By anticipating future patterns of forest development, foresters predict the potential for individual stands to produce specific characteristics such as a multi-layered canopy. Foresters can then develop appropriate silvicultural prescriptions and influence the rates of stand development and the types of structures, products, and habitats that forest stands actually produce. Individual stand management will vary greatly. Some stands will be managed to focus on timber production, with habitat structures such as snags and down wood incorporated. Others will be managed to produce stands that emulate habitat conditions normally associated with older forests. These stands are also expected to produce high volumes of timber.

Forests with a full range of growth stages and vertical and horizontal diversity across the landscape provide the range of conditions to which native organisms have adapted. A variety of growth stages are more likely to provide the variations in moisture, light, and nutrients necessary for the development of diverse microsites, as well as the compositional and structural components necessary for the development of niches.

Growth Stage Descriptions

1. **Young Forests and Woodlands-** are characterized as stands disturbed by timber harvest, fire, or wind where most or all of the larger trees have been killed or removed, or where brush fields have been cleared for planting; or where new trees, shrubs, and herbs no longer appear in the stand, and begin to die from shading and competition in a process called stem exclusion.

2. **Transition Forest-** This growth stage occurs after the stem exclusion process has created small openings in the canopy, when enough light and nutrients become available to allow herbs, shrubs, and new trees to grow again in the understory.

3. **Mature Forest and Woodlands-** This growth stage occurs as the process of understory re-initiation progresses where openings in the canopy persist. Shrub and herb communities are more diverse and vigorous, and two or more distinct layers of tree canopy appear.

4. **Old Forest-** This growth stage occurs when forest stands attain structural characteristics such as numerous large trees; multi-layered canopy; substantial number of large down logs; and large snags. It is not the same as old growth, although some of its structures are similar to old growth.

5. **Very Old Forests** / **Woodlands-** Typical characteristics of old growth include: moderate to high canopy closure; patchy, multi-layered, multi-species canopy with trees of several age classes, but dominated by large overstory trees with a high incidence of large living trees, some with broken tops and other indications of old and decaying wood;

numerous large, standing dead trees (snags); heavy accumulations of down woody debris; and the presence of species and functional processes that are representative of the potential natural community.

The present forest inventory for state lands does not monitor growth stages however, various growth stages can be observed in the field. The present inventory system does monitor some elements of growth stages but does not combine all the features needed into a model that can be readily monitored.

In the CP-PMOP landscapes forest cover types are managed as uneven-aged and even-aged types. The uneven-aged types can be managed to maintain old forest growth features. The even-aged cover types can be managed to include most of these growth stages, where appropriate with the LTA and other management objectives. Even-aged managed cover types that are subject to the normal rotation age harvest usually progress from the young forest stage through the mature stage at which time they are normally harvested to achieve the balanced age class objective. In the even-aged managed stands where prescribed ERF is planned, the stand will progress beyond the mature stage to the old forest structure stage and become effective ERF stands. Eventually some of the effective ERF stands may be retained to replace existing old growth stands that may not have retained their old growth functions due to catastrophic disturbance events. Old growth stands have been designated and receive management in accordance with objectives established to maintain the old-growth functions.

Strategies

Across the landscape and within the LTA's, the even-aged managed cover types will provide for a variety of growth stages important to wildlife habitat and ecological function. In addition, the cover types that are managed with an uneven aged prescription can, and do fill a valuable role in providing structural components associated with the older forest structure growth stage. These strategies will be applied to prescribed ERF and ERF stands, but if applied to all stands subjected to normal rotation management, the representation of all growth stages including vertical/horizontal structural diversity will be increased.

One primary goal from *Directions 2000, The Strategic Plan* indicates that all forest ecosystems will be healthy, resilient, and functioning. Forest ecosystem health and resilience ensures that forests can respond to disturbances and the demands society places on them. Measures of forest composition and ecosystem functions are useful in documenting forest health.

Examples of performance measures that focus on the distribution of forest plant communities, species, and ages are:

1. Acres of old growth forest by type; or,
2. Acres of forest by community or forest type and age class.

Examples of performance measures that focus on forest health are:

1. Number of species of plants and animals with significantly reduced;
2. geographic ranges or population sizes (compared to conditions resulting from natural disturbance regimes); or,
3. Tree growth rates.

B4a. 34 Retain structural components of old forest, when managing uneven-aged cover types and at the final harvest of even-aged cover types.

All stands designated for final harvest prescriptions including those subject to normal rotation age harvest and those at maximum rotations age will have live and dead trees retained that meet or exceed the MFRC *Voluntary Site-level Forest Management Guidelines*. These trees will form a population of legacy trees that will continue to provide some of the characteristics of old forest structures well into the early growth stages of the regenerating stand. The retention of these trees will not have densities high enough to have an impact on the productivity of the new stand and yet will continue to provide some of the benefits of the older forest.

The uneven age managed cover types have silvicultural treatments prescribed at intervals as the stand conditions change over time. Active management can be used to enhance and ensure the desired old-forest structures. Timeframes can be shortened to achieve those conditions. During the stand visit and

prior to setting up the harvest regulations, older and larger trees should be selected to be reserved to provide the vital functions of old-forest structures. These treatments will bring the stand to, and maintain it in the older forest structure.

B4a. 35 Use variable density techniques during intermediate stand treatment and variable retention techniques during final harvest to move selected stands toward desired growth stages and desired within-stand structure.

For a variety of forest health and economic reasons, intermediate silvicultural treatments are prescribed to stands younger than normal rotation age and ERF stands beyond normal rotation age. These intermediate treatments can be designed to manipulate the forest canopy to influence the amount of light and moisture available at the forest floor. Thinning prescriptions that allow significant light will stimulate the herb and shrub regeneration, the development of an understory, and layering in transition and mature stands. Use of variable density thinning will allow this development to be patchy in nature. The retention of a variety of the stand structures will move the stands toward the older forest structure growth stage. These treatments, applied throughout the landscape, will ensure a variety of stands of different growth stages to meet present and future forest needs.

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

The main objectives of variable retention are to retain the natural range of stand structure and forest functions. With retention systems, forest areas to be retained are determined before deciding which areas will be cut. Standing trees are left in a dispersed or aggregate form to meet objectives such as retaining old-growth structure, habitat protection, and visual qualities. Variable retention retains structural features (e.g., snags, large woody debris, and live trees of varying sizes and canopy levels) as habitat for a host of forest organisms. During harvest, foresters will retain tree species and diameters present at older growth stages, in clumps or dispersed, to more closely replicate patterns found after natural disturbance and include retention of large, downed logs. For example prescriptions may include leave legacy patches throughout the stand or leave islands of residual vegetation that include tree species present at older growth stages. In particular foresters will consider the legacy patch recommendations in *MRFC Voluntary Site-level Forest Management Guidelines*.

B4a. 36 Develop a methodology to measure growth stages, within-stand age diversity, plant species diversity and vertical/horizontal structure and use this methodology to quantify and monitor changes.

DFFC Statements

All silvicultural prescriptions for uneven-aged management cover types will ensure that all tree sizes, ages and species present in the stand at the time of the site-level visit will be well represented following the stand treatment.

All stands designated for final harvest prescriptions will have 15 or more scattered older live trees per acre or will have clumps that meet or exceed 5 percent of the sale acreage retained to provide future snags and cavity nesting trees.

Prescribed ERF and effective ERF stands will be assessed and if necessary will have silvicultural treatments prescribed to enhance the older forest features.

The forest inventory dataset will include a field to record the observed growth stage represented at the time of the site-level visit. All field personnel will receive the training necessary to consistently assess forest growth stages.

Cover type conversions to meet management objectives will use natural regeneration methods when possible, and minimal site preparation when artificial regeneration is necessary.

Focused Issue B5 How will native plant communities that developed under natural disturbance regimes be represented in the future?

GDS B5a The full range of common and uncommon native plant communities and the community viability that developed under natural disturbance regimes will be well represented in the future.

Thirty-four NPC classes are found in the CP-PMOP subsections. These plant communities are all well represented on state lands and include an array of community types from fire-dependent conifers to hardwoods, swamps, bogs and peatlands. The total extent of the natural community types has not been mapped, but releves do give ecologists information to map potential extent within the state for each of the various community types. The description of these NPCs and their extent within the state are found in the *Field Guide to the Native Plant Communities of Minnesota-The Laurentian Mixed Forest Province.*

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

Within the CP-PMOP subsections there exist eight NPCs with a status rank of S1 (Critically Imperiled) or S2 (Imperiled) and are listed in Appendix J (*Native Plant Communities)*. Where Minnesota County Biological Surveys have been published or field surveys completed, the known locations of these rare plant community types (S1 and S2) have been documented. Because MCBS prioritizes survey efforts within MCBS sites, most documented locations of rare NPCs are within MCBS sites. However, there may also be locations of rare NPCs documented in areas outside MCBS sites. Field foresters are advised to observe and record all occurrences of rare NPCs and consider potential impacts as treatments are prescribed.

Strategies

B5a. 37 Use ECS information to assist in determining management direction for stands on state lands.

B5a. 38 Protect significant plant communities as they are identified.

B5a. 39 Encourage initiation of the Minnesota County Biological Survey in Beltrami, Itasca and Koochiching counties and completion of the survey in all other counties in the CP-PMOP.

B5a. 40 Delineate and manage ecologically important lowland conifer sites to enhance their unique characteristics.

B5a. 41 Document and manage known locations of NPCs with a statewide rank of Critically Imperiled (S1), or Imperiled (S2), and other plant communities that are rare in the landscape to maintain their ecological integrity.

These rare NPCs can be located outside of cover types managed as state timberland (e.g., swamp, marsh, or bogs). Where rare NPCs occur associated with a timberland cover type, vegetation management within and adjacent to these NPCs will protect, maintain, or enhance the ecological integrity of NPCs. Some locations of NPCs of concern are best managed by avoidance, while other sites can either be maintained or enhanced by using the appropriate harvesting or other forest management activities.

DNR staff is trained in the use of the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* for identification of NPCs. Additional ECS products, such as silvicultural interpretations for management of NPCs, have been developed for use by field staff for implementing ECS-based management on state lands. The *Silvicultural Prescription Worksheet* will also provide direction on ECS considerations as stand prescriptions are developed.

B5a. 42 Identify stands with known locations of Critically Imperiled (S1) or Imperiled (S2) NPCs and monitor those stands during Annual Stand Exam List review.
To ensure that rare NPCs are taken into consideration, review by all divisions (Forestry, Management Section of Wildlife and Ecological Resources) occurs at the following points:

1. during development of the 10-year Stand Exam List;
2. before the 10-year Stand Exam List is published to seek public review as stated in the *Interdisciplinary Coordinating Framework;* and,
3. during review of Forestry Area Annual Stand Exam Lists.

Following any of these reviews, staff may determine if adjustments to proposed treatments are needed to protect, maintain, or enhance the ecological integrity of rare NPCs.

3.3 Primary Issue Area: Riparian / Aquatic Areas

Focused Issue C1 How can the impacts of forest management on permanent wetlands, wetland inclusions, and seasonal ponds be addressed?

GDS C1a Forest management on state lands will protect permanent wetlands and seasonal ponds.

Wetland areas include lowland forested areas (such as black ash, black spruce, tamarack, and white cedar cover types), lowland brush and lowland grass cover types, and seasonal ponds. When applying stand treatments these areas will be protected using site-level forest management guidelines different than those required for riparian areas (i.e., adjacent to lakes, streams, and rivers or permanent open water ponds). The intent of these site-level guidelines is to protect the resource and maintain its ecological function.

An overall objective is to meet or exceed the Forest Stewardship Council (FSC) and the Sustainable Forest Initiative (SFI) certification standards by avoiding impact to riparian and aquatic areas potentially affected from forest management practices.

Strategies

C1a. 43 Implement the MFRC *Voluntary Site-level Forest Management Guidelines*.

Representative *Guidelines* specific to seasonal ponds and wetlands include the following:

1. Identify, establish, and protect filter strips;
2. Avoid disturbances such as ruts, soil compaction, excessive disturbance to litter layer, and addition of fill;
3. Ensure, through timber sale planning and administration, that skidding and other equipment operation in upland stands takes place outside of wetland inclusions and seasonal ponds;
4. Ensure recommended leave tree guidelines are implemented, including leave trees in clumps, islands or strips centered around or that coincide with wetland inclusions and seasonal ponds;
5. Develop and implement prescriptions that consider site-specific conditions such as soils, topography, hydrology, past management, and existing and desired vegetation that reduce negative impacts;
6. Use routes with least impact when creating freeze-down winter crossings when they are necessary;
7. Employ measures to maintain normal seasonal flows within wetland inclusions and seasonal ponds. Use slash distribution, dips, and water-bars as appropriate to more evenly distribute concentration of water flow;
8. Site and design access routes to minimize interruption of water flow;

9. Distribute age diversity across the sub-watershed to promote consistent variability of water flow across the landscape; and,
10. Ensure adequate vegetation to intercept precipitation in RMZ as appropriate for the hydrology of a particular seasonal basin.

C1a. 44 Protect non-target species from pesticide translocation by following the division's *Pesticide and Pest Control Operational Order #59.*

In particular, field foresters will implement the following to reduce drift:

1. Use low-volatility formulations;
2. Use the proper size nozzle for the job, preferably the largest practical nozzle;
3. Operate at the lower end of the rated pressure range for the nozzle;
4. Release spray near the crop or soil surface;
5. Avoid spraying at high temperatures (at or above 85 degrees F); and,
6. Spray when the wind is low and blowing away from sensitive crops or areas. (5 mph or less).

Field foresters will implement the following guidelines to prevent surface or groundwater contamination:

1. Implement non-chemical pest management strategies when practical.
2. Select pesticides with low runoff and leaching potentials.
3. Use the lowest effective rates and frequency.
4. Implement appropriate setbacks to keep safe distances from water bodies when making applications.

C1a. 45 Reduce negative impacts by selecting and implementing treatments that consider site-specific conditions such as soils, topography, hydrology, past management, existing vegetation, and desired vegetation.

Site-specific prescriptions will be identified and implemented during the stand field visit. The *Silviculture Prescription Worksheet* will be used to guide foresters through on-site decisions concerning stand treatments.

C1a. 46 Employ measures that maintain normal seasonal flows within wetland inclusions and seasonal ponds.

C1a. 47 Use access routes with the least impact when necessary to freeze-down winter crossings.

Focused Issue C2 How will the appropriate width of the riparian management zone (RMZ) be determined and what vegetation management activities will be allowed to take place?

Forest management activities carried out within the RMZ can negatively affect the natural functions of riparian areas. RMZs are areas of special concern along streams, lakes, and open water wetlands and are among the most important and diverse components of the forest ecosystem. As vegetation management is implemented, RMZs will be identified and managed to retain a relatively continuous forest cover for the conservation and maintenance of aquatic and wildlife habitat, aesthetics, water quality, recreation, and forest products.

GDS C2a Management activities will protect or enhance riparian areas.

Vegetation management adjacent to surface waters has an impact on water quality and subsequently wildlife and aquatic habitat. Failure to implement appropriate standards can have negative impacts on water quality, water temperatures, visual qualities and aquatic and terrestrial habitat. Vegetation management practices will be implemented that serve to maintain the environmental qualities of surface waters.
Historically, some streams in these subsections maintained cold-water temperatures, but over the last 100 years the vegetation has changed dramatically due to several factors including logging with subsequent fires, and changes in land use (agricultural, commercial and residential development near or impacting lakes and streams). These changes can lead to impacts including increases in stream temperatures, siltation, and flooding events that affect water quality. Implementation of the following strategies will protect and enhance the qualities of riparian areas.

Strategies

C2a. 48 Establish widths of RMZs consistent with MFRC Voluntary *Site-Level Forest Management Guidelines*.

A RMZ is that portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. The extent of each RMZ is unique and the MFRC *guidelines* allow flexibility to determine the most appropriate RMZ based on all land and water characteristics including the hydrology, topography, and existing vegetation of the site.

C2a. 49 Field identify the boundaries of RMZs prior to applying treatments.

During development of both the 10-Year Stand Exam Lists and the Forestry Area's Annual Stand Exam Lists, staff from all divisions have the opportunity review and identify, for joint site visit, the stands that fall within RMZs. The purpose of the joint site visit is to ensure that the interests of Wildlife, Ecological Resources and Forestry are reflected as stand treatments are applied.

C2a. 50 Maintain a filter strip between aquatic resources and treatment areas consistent with MFRC *Voluntary Site-level Forest Management Guidelines*.

C2a. 51 Implement treatments within identified RMZs consistent with MFRC *Voluntary Site-level Forest Management Guidelines.*

DNR forestry staff will apply riparian guidelines as a part of timber sales supervision and inspections. Also, the MFRC site-level monitoring program will periodically sample sites in these subsections. The objective of this monitoring program is to evaluate the implementation of the *MFRC Voluntary Site-Level Forest Management Guidelines* through field visits to randomly selected, recently treated sites.

C2a. 52 Distribute slash evenly within RMZs to adequately protect soils and provide nutrient retention.

C2a. 53 Retain a selection of live and dead trees in a variety of sizes and species adequate to provide a mixed age structure when conducting management within an RMZ.

Focused Issue C3 How can the cumulative impacts to aquatic resources of forest management on a watershed/sub-watershed level be addressed?

GDS C3a The management and administration of state land will minimize negative cumulative impacts on aquatic resources.

The CP-PMOP Plan contains forest vegetation management goals and objectives for both the relative short term (10-year plan implementation period) and the long term (50 years or more). Over long periods of time, land use activities, including recurring forest management practices, can have significant cumulative impacts on natural resources.

All MFRC *Voluntary Site-Level Forest Management Guidelines* will be implemented as they apply to managing potential impacts on aquatic resources. In addition, other relevant guidelines and policy will be implemented in an effort to minimize cumulative impacts including *Directions 2000, The Strategic Plan: Water Resources. Goal 1. Objective 1.5: "Pollution in aquatic systems will be reduced".*

The Department will continue efforts to monitor, coordinate with other agencies, and take a proactive approach to address potential water quality impacts to water resources through the Clean Water Legacy Program.

The following specific strategies will be implemented as stand management prescriptions are identified.

Strategies

C3a. 54 Continue to implement all MFRC *Voluntary Site-level Forest Management Guidelines* directing forest management practices that pose potential impacts to surface waters.

C3a. 55 Collect baseline ecological data on surface water quality across the subsection.

C3a. 56 Implement ongoing surface water quality monitoring.

C3a. 57 Coordinate and cooperate with other landowners and water resource managers to establish guidelines that determine and minimize cumulative impacts.

C3a. 58 Implement site level surface water quality monitoring on water that may be impacted by logging activities when there is cause for concern.

These strategies will be implemented as described below:

1. Complete stream surveys, including physical habitat inventory such as stream cross section, bottom substrate, and other stream survey parameters;
2. Complete lake surveys, to include nursery ponds and shallow lakes;
3. Complete the Minnesota County Biological Survey to include an inventory of flora, fauna, and plant communities;
4. Monitor ecological conditions including those identified in *Directions 2000, The Strategic Plan, Environmental Indicators Initiative; and Natural Resources Stewardship 2001;*
5. Implement the CP-PMOP monitoring function of SFRMPs; and,
6. Implement forest certification monitoring.

Focused Issue C4 How can adequate safeguards be implemented to provide old-forest characteristics, including nesting cavities, in riparian areas?

GDS C4a Forest management activities will provide old-forest characteristics in defined riparian areas.

Old forests provide the best source of woody debris in aquatic systems and habitat for a wide variety of wildlife species. Within riparian areas, extended rotation age forests reduce the frequency of harvest activities, thereby reducing the potential for water quality impacts. Old forest management complexes (OFMCs) and ecologically important lowland conifers (EILC) stands within riparian areas will be managed to maintain or increase old forest conditions. During the selection of ERF, even-aged stands in riparian areas received a high priority for ERF designation.

In addition, managing for OFMC, EILC and ERF adjacent to riparian areas furthers recreational, visual, wildlife habitat and water quality management objectives. Maintaining old forest characteristics in riparian areas furthers goals of the MFRC's *North Central Landscape Region Plan*, and is consistent with MFRC's *Voluntary Site-Level Forest Management Guidelines*. Further direction is provided in DNR's *Forestry-Wildlife Habitat Management Guidelines*, which provides specific guidelines for snags, mast, and leave trees, and in *Directions 2000, The Strategic Plan, Forest Resources, Objective 2.4: "Forests will be connected by natural corridors (streams and rivers, old forest)".*

Strategies

C4a. 59 Define where management for old forest is appropriate in riparian areas and implement needed management.

C4a. 60 Manage RMZ forest composition to favor uneven-aged management of longer-lived species and extended rotations.

C4a. 61 Manage to meet or exceed DNR *Forestry-Wildlife Habitat Management Guidelines'* minimum requirements for cavity nesting trees within RMZs.

Focused Issue C5 How can the adverse impacts of forest management activities on aquatic plant species, fisheries, and wildlife habitat be minimized?

GDS C5a Riparian areas will be managed to provide critical habitat for fish, wildlife, and aquatic plant species.

Riparian areas encompass the transition zone between the terrestrial and aquatic habitats that occur along lakes, streams, and open-water wetlands. Riparian areas are among the most diverse and sensitive habitats found in these subsections. The management of riparian areas can influence water quality, water temperature, erosion rates, and deposition of woody debris in lakes and streams and the overall diversity of wildlife and plant species found in the watershed. Riparian areas provide corridors and connecting links of habitat for plant and wildlife species. Well-managed riparian areas are critical to protect, maintain, or enhance aquatic and wildlife habitats, aesthetics, recreation, and forest products.

Strategies

Specific strategies that provide for and promote management of critical habitat for fish, wildlife, and aquatic plant species are identified below.

C5a. 62 Manage stands within RMZs for longer-lived, uneven-aged, mixed-species to provide shade, moderated microclimate, coarse woody debris, microhabitat diversity, resiliency to natural catastrophes, bank stability, nutrient cycling, and carbon and nutrient input.

C5a. 63 Manage for long-lived conifers, near water bodies, to discourage beaver related damming and siltation.

C5a. 64 Maintain a filter strip between aquatic resources and treatment areas consistent with MFRC *Voluntary Site-level Forest Management Guidelines*.

C5a. 65 Follow MFRC *Voluntary Site-level Forest Management Guidelines* regarding approaching water crossings at or near right angles to stream flow to minimize stream bank disturbances and chose construction materials that minimize sediment input and flow obstruction.

C5a. 66 Follow MFRC *Voluntary Site-level Forest Management Guidelines* regarding the appropriate timing of water crossing installations to minimize disturbance to fish spawning and migration patterns in areas identified by Fisheries staff.

C5a. 67 Leave snag trees, mast sources, and den trees, as directed in DNR *Forestry-Wildlife Habitat Management Guidelines*.

3.4 Primary Issue Area: Access

Focused Issue D1 How can new access to stands identified for management during the 10-year planning period be established without negative impacts on forest resources?

GDS D1a Forest access routes will be well planned, with an increased level of collaboration among federal, county, private, and local units of government to share accesses, minimize new construction, and close access routes no longer needed for forest management purposes.

Access routes (provided by a network of federal, state, county, and private forest access roads) are needed to effectively manage forest stands identified for treatment during this 10-year plan. A network of forest roads and trails exists across all ownerships. Road inventory data are available for some public ownerships however only limited data are available for private and private industrial lands for these subsections. Though implementation of the New Access Needs component of this plan, which included review and use, as appropriate, of all existing access, and cooperation with other landowners, the overall density of roads in specific geographic areas will be minimized. Existing roads or previously used corridors of disturbance will be followed whenever feasible. The access routes that are selected must be developed in a way that minimizes the negative impacts on all resources potentially affected.

The objectives of the New Access Needs component of the CP-PMOP Plan is to first identify stands on the 10-Year Stand Exam List that are lacking access, then identify the type of road classification required, identify potential coordination and cooperation with other land managers, identify permits or approvals necessary, identify winter or summer access, recommend disposition after use, and miles of new access necessary.

The post-sale disposition for new access is of particular concern, requiring consideration during development of the New Access Needs List and as stands are placed on Annual Stand Exam Lists by Forestry Areas. New access roads and trails can be used for ongoing forest management, can be closed (e.g., gate, sign, slash, or berm), or can be abandoned, or reclaimed (e.g., with natural or planted vegetation). Limiting unplanned secondary usage should be a primary consideration in post-sale road planning. The timber sale appraiser will refine the proposed road access and post-sale disposition as part of the design of the timber sale. Final adjustments may be made at the pre-sale meeting between the timber sale administrator and the permittee.

Strategies

D1a. 68 Complete a timber access plan.

This strategy will be implemented through the following actions:

1. Completion of the New Access Needs List as required by SFRMP planning process;
2. Analyze existing road and access system and close any that are not needed for future management;
3. Identify new, permanent, or temporary access routes required to access stands identified for field visit and/or treatment;
4. Assess road and access fragmentation and density concerns;
5. Plan for maintenance, closure, or abandonment of new roads and access routes required for timber sales and post-sale treatments;
6. Obtain road use agreements to share corridors from agencies or easements where needed;
7. Identify and maintain access routes for stands requiring multiple entries; and,
8. Re-use existing access route footprints where possible, to minimize disturbance.

D1a. 69 As Annual Stand Exam Lists are prepared, continue to cooperate with other forest landowners to retain existing access to state land and to coordinate development and maintenance of new access routes across mixed ownerships.

This strategy will be implemented through the following actions:

1. Maximize the efficiency of the transportation system by involving all affected landowners in cooperative road planning efforts whenever possible;
2. Conduct road meetings with other agencies and share data;
3. Obtain road-use agreements to share corridors or easements among agencies where possible;
4. Retain access, over time across changing private land ownership and leasing patterns;
5. Implement forestry management by serving as many acres of forest land with as few miles of road as possible;
6. Plan access and locate roads and trails to minimize impacts on rare features and other cultural resources; and,
7. Minimize habitat fragmentation by roads and access routes.

D1a. 70 Develop long-term agreements with the United States Forest Service, county land departments, local governments, and private landowners where necessary to gain access to state lands.

Cooperative road planning that involves all affected landowners will be implemented to maximize the efficiency of the forest access system. The objective is to serve as many acres of

forest land with as few miles of road as possible. This objective will be realized by completion of timber access plans.

D1a. 71 Gate, barricade, or obliterate all roads constructed during the life of this plan that are not needed for future stand management.

This strategy will be implemented by closing non-essential accesses.

3.5 Primary Issue Area: Diversity / Complexity

Focused Issue E1 Within stands, how are biodiversity, native plant community composition, and structural complexity maintained or enhanced?

GDS E1a Diversity of plant species within stands will be maintained or increased.

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

Strategies

E1a. 72 Maintain the highest soil productivity possible by favoring regeneration and growth of native vegetation and trees using the MFRC *Voluntary Site-level Forest Management Guidelines.*

E1a. 73 Utilize harvest systems, methods, and sale regulations (e.g., process at stump) that protect advanced regeneration and maintain or improve the patterns, diversity, and composition of forest vegetation present in the stand prior to harvest.

When desirable to protect the existing seedlings and saplings in a stand, timber sale regulations will specify outcomes to protect these regenerating trees, such as delineating only a portion of a stand for treatment activity. To enhance seedling recruitment of some species, a partial canopy may be retained to meet needed moisture and light requirements of the seedlings.

E1a. 74 Preserve legacy patches and inclusions in stands for seed sources and native plant diversity, as well as to favor regeneration and seeding of native vegetation.

Foresters when selecting seed trees will consider resistance to windthrow, insect and disease risks, and the number and distribution of seed trees. Timber harvesting techniques and site preparation methods that expose mineral soil may be used on some sites to facilitate natural seeding. In general, foresters will use the least intensive site preparation necessary to successfully regenerate the site, while favoring retention of the existing ground-layer plant species.

E1a. 75 Establish and manage plantations to more closely resemble naturally occurring stands by planting a variety of tree species using variable-density thinning techniques, preserving existing natural vegetation, and preserving advanced regeneration.

E1a. 76 Develop methods to measure and monitor the within-stand diversity of plant species, and provide ongoing education and training on these techniques and methods.

In selected stands, foresters will manage for a mix of tree species and ages, and for diversity of structural characteristics (e.g., tree diameter, tree height, and scattered or clumped distribution) to provide conditions that promote within-stand diversity.

GDS E1b Age diversity as well as vertical and horizontal structure within-stands will be maintained or increased where compatible with other strategies in this plan.

Foresters will manage for the variety of species found in the stand, rather than single species management. Based on current stand composition and other considerations (e.g., insect and disease concerns or wildlife habitat), foresters will take advantage of opportunities to diversify stands when thinning is prescribed. Thinning intensities in stands may vary depending on current stand condition such as trees per acre, tree size, and species composition, or the future desired within-stand composition.

Strategies

E1b. 77 Apply techniques during the young forest growth stage that encourages age diversity and vertical/horizontal structure.

Field techniques that support this strategy include accepting initial lower stocking levels where significant within-stand diversity is an objective, and inter-plant low density and partially stocked stands with other species to further promote a mixed stand.

E1b. 78 Use intermediate treatments to provide age diversity and vertical/horizontal structure in the young forest, transition, and mature forest growth stages.

Field techniques that support this strategy include the following:

1. Implement variable-density thinning techniques to increase vertical and horizontal structures. Incorporate species and age diversity considerations into thinning projects;
2. Create canopy gaps to encourage growth of shade-intolerant trees and plants;
3. Manage stands so that they appear and function naturally by growing a variety of tree species. and by conserving existing natural vegetation;
4. Use uneven-aged management in lowland hardwood, ash, northern hardwood and long-lived mixed-conifer cover types to develop multiple ages and complex structure within the stand;
5. Use intermediate treatments in ERF stands to encourage advanced reproduction of desirable trees and develop structural complexity;
6. When planning intermediate treatments, consult the ECS *Field Guide* for information on the timing and nature of natural disturbance events and the successional paths of NPCs;
7. Provide coarse woody debris that will serve as habitat and nurse logs for tree seedlings; and,
8. Reserve trees that show signs of decadence, such as multiple and dead tops, bole and top decays, and cavities; or other features such as large diameter branches or distinctive bark features.

E1b. 79 Design final harvest projects in a way that will transmit a legacy of age diversity, and vertical/horizontal structure.

E1b. 80 Develop a methodology for measuring growth stages, within stand age diversity, plant species diversity, and vertical/horizontal structure, and use this methodology to quantify and monitor changes.

GDS E1c Native plant communities and their ecological functions will be conserved within stands and stand level ecological function will be maintained or improved.

A native plant community is a group of native plants that interact with each other and the surrounding environment in ways not greatly altered by humans or by introduced plant or animal species. These groups of native plants form recognizable communities (e.g., northern mesic mixed forest, northern mesic hardwood forest, and northern basin-rich spruce swamp NPC classes) that tend to repeat across the landscape and overtime. The DFFC goal is to retain the characteristics typically found in NPCs in some managed stands.

Native plant communities are basic elements within ecological classification systems. The Ecological Classification System (ECS) used in preparing the CP-PMOP Plan consists of maps, databases, and field guides that provide a scientific framework for managing natural resources. Implementing ECS as a management tool provides a more comprehensive understanding of the forests' full potential to produce timber and wildlife and protect water and soil resources. Using ECS information is essential for interdisciplinary communication and forest resource assessment and is the link between landscape-level goals and stand-level management. In addition, ECS supports other indicators of sustainable forest management as required by third-party forest certification systems.

Native plant communities are units of vegetation identified from the analysis of thousands of vegetation plots in Minnesota where the presence, height, and abundance of all vascular plants were measured. NPC *systems* are units linked by ecosystem functions such as nutrient cycling, seasonal availability of water, or particular types of disturbances. *Systems* have a significant number of species that occur in no other *system* because their physiological traits and functions are linked. Subordinate to NPC *systems* are NPC *classes*, which are units of vegetation that generally have uniform soil texture, soil moisture, soil nutrients, topography, and disturbance regimes. The NPC *classes* change rather gradually along ecological gradients, especially as amounts of water and nutrients available to plants change. Therefore, NPC c*lasses* within a NPC s*ystem* overlap broadly with one another in species composition.

Field Guides to the Native Plant Communities are available for use by land managers to aid in field identification. NPCs are identified by their vascular plants, soils, and characteristic landforms, which must be examined during the growing season. NPC *systems* and *classes* are the vegetation units most applicable for making management decisions. The *Field Guides* and associated ECS materials provide information on tree species suitability, patterns in recruitment/advanced reproduction opportunities, operability limitations of soils, natural history and historic fire return intervals, which is intended to help inform management decision-making.

Natural events, such as fire, windstorms, climatic cycles, and flooding are integral to the functioning of NPCs. These events alter the structure and composition of NPCs at the stand scale, but the overall structure and composition is rather stable across landscapes. Landscape summaries address the natural rotations of stand-altering events that affect NPC *classes*. Such summaries provide general guidance for the timing, intensity, and species selection of management activities in individual stands.

NPCs provide a range of ecological functions that are increasingly recognized as contributing to the quality of life in Minnesota. Among these functions are water filtration, flood moderation, carbon storage, moderation of water-table level, local temperature, erosion control, and development and enrichment of soil. Large tracts of NPCs provide opportunities for sustainable resource use, such as logging systems that mimic natural cycles in forests and help to perpetuate the beneficial functions that NPCs provide while supplying commercial products.

In Minnesota, NPCs provide habitat for thousands of plant and animal species. Many are uncommon in the state and many, such as the western prairie fringed orchid *(Platanthera praeclara)* and the Karner blue butterfly *(Lycaeides melissa samuelis*are) are quite dependent on specific NPCs for their long-term survival and viability in Minnesota. Four hundred-forty of these plant and animal species are uncommon enough that they are listed under state or federal endangered species legislation. In addition to relatively conspicuous plant and animal species, NPCs also are likely to be reservoirs of species that have not been thoroughly surveyed or studied in Minnesota. These include microorganisms such as fungi and bacteria (which often play important roles in uptake of nutrients by plants), and insects and other invertebrates (which can help to cycle nutrients in ecosystems or to pollinate plants).

Native plant communities have also played an important role in the development of Minnesota's cultural history and heritage. For several thousand years, humans have been closely connected with the resources available from plant communities including sources of food, shelter, clothing, fuel, and medicine. In the last 150 to 200 years, the products and byproducts of NPCs have been a source of economic wealth in addition to sustenance, and have fueled trade, civic and cultural development across the state and even globally. The cultures that have grown up around the prairie farms, the fur trade, and the northern logging operations are conspicuous examples of how the byproducts of plant communities have shaped human communities in Minnesota. Finally, NPCs such as the northern pine forests, the

prairie marshes, and the eastern deciduous forests provide diverse aesthetic and recreational experiences for hunters, anglers, hikers, campers, bird-watchers, and other outdoor enthusiasts. (http://www.dnr.state.mn.us/npc/index.html)

The *Field Guides* present a concept of ecologically intact, "healthy" plant communities against which are weighed the effects of management activities in a particular stand. Stand management can conserve species composition, structural elements, and ecological function; enhance composition and structure of intact stands by moving their current state to one that is more desirable for any of a variety of reasons (wildlife habitat, more valuable trees, etc.) provided ecological function is not compromised; enhance composition, structure, and function of stands in poor ecological condition; impair intact communities by creating compositional and structural states that are less desirable or that threaten function; or destroy communities by altering function beyond recovery. The overriding goal of following strategies is to protect and enhance native plant communities through careful forest management.

Strategies

E1c. 81 Design and implement training that allows field staff to identify native plant communities, growth stages, natural disturbance intervals, suitable tree species, and soil operability ratings.

DNR staff from all divisions maintains access to the most up-to-date rare features locations and databases.

If rare feature locations occur in stands proposed for treatment, land managers confer with the appropriate Wildlife and Ecological Resource staff to determine if adjustments to proposed treatments are needed to protect the rare plant or animal, its habitat, or other rare features. The rare features database is regularly updated and available to Forestry Area offices. Area staff is trained in the use of the Natural Heritage Information System and routinely consult the rare features database as management or development activities are planned and implemented. Often joint site visits among DNR divisions are scheduled to provide comment concerning proposed preliminary treatments. As a result, stand selections or treatments can be adjusted, or stand prescriptions can include mitigation measures to protect rare plants or animals and habitats within the stand.

E1c. 82 Control non-native invasive species.

E1c. 83 Control herbivory through management of wildlife populations, through the use of repellents, fencing, or other practices that prove to be effective.

E1c. 84 Plan and execute stand maintenance and stand replacement silvicultural activities in a way that corresponds with the natural stand dynamics of the NPC.
Prescriptions for stands selected for treatment, development of access routes, and other forest management or development activities will include mitigation measures that protect the rare feature(s) within the stand. Mitigation includes measures that reduce the likelihood of the introduction or spread of exotic species (and the impacts of the control measures for exotic species, e.g., effects on rare species and/or habitat from use of herbicides to eradicate exotic species). Mitigation measures will be prescribed as part of the *Silvicultural Prescription Worksheet.*

E1c. 85 Ensure that regenerating tree species are suitable as indicated in the DNR's ECS *Suitability of Tree Species by Native Plant Community* tables.

E1c. 86 Provide growing conditions (i.e., sunlight, periodic fire, etc.) that will encourage species diversity in the ground, shrub, and sub-canopy layers.

E1c. 87 Use soil operability ratings to avoid rutting and compaction when applying stand treatments.

E1c. 88 Use herbicide and heavy site preparation methods sparingly, or find alternative techniques.

E1c. 89 Restore or mitigate impacts to NPCs following heavy mechanical or chemical site preparation, frequent and/or intense disturbance, or establishment of species that are not native to the NPC.

E1c. 90 Meet MFRC *Voluntary Site-level Forest Management Guidelines* (i.e. 5 percent minimum) for retention of large living trees, snags, down logs, tree regeneration, and undisturbed forest floor within stands after harvest.

3.6 Primary Issue Area: Wildlife Habitat

Focused Issue F1 How can habitat for all wildlife and plant species be provided?

In general, the health of wildlife and plant habitat can be measured by the number and diversity of species found and sustained on the landscape. Wildlife and plant species are an important indicator of the biological health of the forest and are important to society for their inherent values. Statutes, public expectations, interest group priorities, and DNR policies require the consideration of forest management on wildlife and plant species found on state-administered lands.

Several techniques have been developed to ensure that vegetation management is implemented to maintain diverse habitat for wildlife and plant species.

These techniques are:

A *landscape/coarse filter* approach emphasizes management of forest resources from a local to landscape scale to: *maintain the integrity of ecosystems processes, maintain components of the range of historic habitats and age classes, and retain/enhance structural attributes within habitats.* In using a landscape/coarse filter approach, it is assumed that a broad range of habitats encompassing the needs of most wildlife/plant species, and that their populations, will remain viable on the landscape. Habitat analysis and management emphasis in this plan were primarily completed at this level.

A *stand-level* approach emphasizes management of forest resources that are important wildlife habitat features (i.e., riparian areas, seasonal ponds, leave trees, snags, coarse woody debris, mast, etc.) at a stand or site scale. Stand-level management is achieved primarily through implementation of the MFRC *Voluntary Site-level Forest Management Guidelines.*

A *fine filter* approach considers the specific habitat needs of selected individual species that may not be met by the broader coarse filter approach. Providing habitat at this level will be guided primarily by department policies and guidelines that provide recommendations for habitat management at this finer level for a number of species. Examples include state or federally listed species (i.e. goshawk, red-shouldered hawk).

The DNR *Directions 2000, The Strategic Plan* calls for an objective of *"healthy self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species, especially those species listed as threatened or endangered."*

There are 250 wildlife species (14 amphibians, 9 reptiles, 174 birds, and, 53 mammals) that are either permanent residents or regular migrants that use habitats within the CP and PMOP. Each species has different habitat requirements, some of which conflict. Consideration of management needs for each individual species is impossible to accomplish with a single approach across the planning area thus leading to the *landscape/course filter, stand-level* and *fine filter* techniques.

GDS F1a Adequate landscape-level habitat and habitat components will be maintained for wildlife and plant species found within these two subsections.

The MFRC *Voluntary Site-Level Forest Management Guidelines* identifies specific practices that are used to provide for and maintain landscape level habitat components. All applicable *guidelines* will be

implemented by foresters. Further direction is provided foresters in the DNR *Forestry-Wildlife Habitat Management Guidelines*; *Interdisciplinary Forest Management Coordination Framework; Directions 2000*, *The Strategic Plan;* and, the MFRC's *North Central Region Landscape Plan*.

Strategies

Landscape / **course filter strategies** include those listed below.

F1a. 91 Provide for both young and old forests distributed across the landscape.

Young forest in this plan refers to stands that are 0-30 years old. The stands in this age class generally have conditions characteristic of young forests such as seedling and/or sapling successional stages. Examples of species that rely on young forest conditions are chestnut-sided warbler, red-tailed hawk, woodcock, and golden-winged warbler. Management will provide young forest habitat across the subsections over time.

Old forest includes stands that are beyond the normal rotation age established for the cover type. Old forest characteristics include forest conditions such as large-diameter trees, presence of snags and large amounts of coarse woody debris, and/or uneven-aged successional stages. Examples of species that rely on old forest conditions include boreal owl, hairy woodpecker, and northern flying squirrel. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time such as ERF and designated old growth forests will ensure available habitat for many of these species.

F1a. 92 Retain or increase the amount of coniferous forest, coniferous woodland, and mixed coniferous/deciduous forest as a cover type.

A number of wildlife species found within the subsections have some association or dependence on coniferous trees for food and/or cover needs, whether within conifer-dominated stands or in various mixes of conifer/hardwood stands (See Appendix M *Wildlife Habitat Relationships*). Several conifer species (white pine, white spruce, jack pine, and tamarack) have declined significantly from historic levels in these subsections.

Strategies have been included here that increase these cover types as the primary component, and increase conifer species as a component of other cover types.

F1a. 93 Maintain conifers as a component of deciduous cover types where suitable to the site.

Conifers provide important habitat characteristics to significant numbers of vertebrate fauna. Conifer stands, inclusions of conifers within mixed-species stands, conifer understory in mature aspen and birch stands are all important components of wildlife habitats. Clumped conifers are more windfirm, are better potential seed sources, can withstand snow and ice loads more successfully, and provide better cover.

F1a. 94 Retain or increase white cedar and oak as cover types and components of other cover types as they provide significant wildlife habitat.

Oak is often found as a component of other cover types. Because of the acorn mast they produce oak provides valuable food resources for wildlife and are often reserved from harvest. Mature oak also provides high quality cavities used by wildlife.

F1a. 95 Maintain or enhance existing large patches.
During selection of the 10-Year Stand Exam Lists, patch management, ERF, and OFMC designations, larger patches (101+ acres) were identified with a goal to maintain some of these areas on into the future. Stands that furthered patch management objectives were specifically identified as stands to which Forestry Areas (including Ecological Resources and Wildlife staff) gave particular consideration.

F1a. 96 Provide a variety of patch sizes across the landscape to reflect patterns produced by natural disturbances.

F1a. 97 Provide a balanced age-class structure in cover types managed with even-aged silvicultural systems.

A balanced age-class structure leads to relatively equal acreages in each age class out to the normal rotation age. To provide an even flow of early successional forest habitat, it is necessary to avoid large fluctuations in harvest levels within the aspen, balm of Gilead, birch, jack pine, and balsam fir cover types. By addressing current age-class imbalances to move toward a future balanced age-class structure (see aspen, balm of Gilead, birch, and balsam fir in Chapter 4, Cover type Management Recommendations), sustainability of game species habitat will be enhanced.

F1a. 98 Increase the productivity and maintain the health of even-aged cover types.

Managing to improve stocking levels and maintain health and vigor will help to ensure that density of young trees and shrubs will be suitable for game species.

Managing prescribed ERF aspen, balm of Gilead, birch, and balsam fir stands with a declining age-class structure from the normal to maximum rotation ages (see aspen, balm of Gilead, birch, and balsam fir in Chapter 4, Cover type Management Recommendations) will ensure that stands are harvested before they become too old to be regenerated back to the same cover type, thereby encouraging young growth stages beneficial to wildlife. Cover type change (facilitated or natural) of aspen, balm of Gilead, birch and balsam fir stands will be encouraged in stands that are currently decadent, inaccessible, mistyped, or beyond their maximum rotation age, again encouraging regeneration to young growth stages with positive impacts as wildlife habitat.

F1a. 99 Consider impacts to wildlife populations and habitat utilization in the design, management and regulation of forest management access and recreational trail systems.
This strategy will be implemented through:

1. following the MFRC's *Voluntary Site-Level Forest Management Guidelines* to minimize the amount of infrastructure length, width, and acreage needed to conduct forest management operations;
2. designing and building roads and forest access trails so they can be re-used if needed for future management;
3. avoiding lining road or forest access trail edges with long slash piles that serve as barriers to species movement; and,
4. considering rare features locations and MCBS sites of biodiversity significance when selecting locations for roads and trails to ensure critical habitats are not fragmented.

Stand/site-level strategies include those listed below.

F1a. 100 Favor and promote robust NPCs and retain elements of biodiversity significance (e.g., variety and abundance of native plants, intact ecological function, and intact structure within communities).

F1a. 101 Retain the integrity of, or improve riparian areas as habitat for dependant wildlife species and protect seasonal and permanent wetlands.

Riparian areas are among the most important parts of forest ecosystems. These areas have high plant diversity, both horizontally and vertically, from the water's edge, which contributes to the high diversity of animals that live in these areas. Minnesota also has a variety and abundance of wetlands including seasonal ponds. The mixture of land and water features across the landscape provides an important dimension to the habitats of many wildlife species.

F1a. 102 Maintain the productivity of forest soils to favor regeneration and growth of native vegetation and trees.

F1a. 103 Provide for the needs of species that depend on snags, cavity trees, bark foraging sites, and dead downed-woody debris.

A number of species rely on tree perches, existing tree cavities, or available trees that can be excavated to provide a cavity, insect foraging sites on dead or dying trees, or downed trees or slash for roosting, nesting, or cover. To provide for this habitat mitigation, measures will include implementing the snag retention recommendations found in the MFRC *Voluntary Site-level Forest Management Guidelines*. Historically, natural processes provided these habitat needs. More recently the extent of these natural processes has declined, resulting in fewer opportunities to maintain these unique habitats.

F1a. 104 Reserve a minimum of 5 percent undisturbed vegetation as legacy or reserve patches in clumps or strips to benefit wildlife, as well as to provide scattered super canopy long lived conifers, legacy or seed trees in each harvest unit.

Specific forest vegetation management practices will be implemented to provide adequate habitat for wildlife and plant species. In particular, legacy or reserve patches help to maintain the biological continuity of a harvested site. Biological continuity is defined as the perpetuation of the full complement of organisms (including fungi, soil invertebrates, ground layer plants, reptiles, amphibians, and small mammals) that have been successful in occupying the area. Reserve patches or strips also serve as wildlife travel lanes and corridors between habitats, and provide wildlife food and cover within recently harvested sites.

F1a. 105 Provide sufficient amounts of soft and hard mast to meet the needs of wildlife.

Soft mast such as blueberries, chokecherries, pin cherries, high bush cranberries, birch, aspen, alder catkins, etc. and hard mast such as acorns, hazel nuts, and ash and conifer seed are important foods for sustaining the wildlife populations that depend on them. Most shrubs that produce soft mast are associated with cover types requiring full sun such as aspen, oaks and pines. These communities require periodic severe disturbance such as fire or logging to set back competition and rejuvenate the mast producers.

F1a. 106 Retain and perpetuate aspen and birch inclusions/clones within all cover types, especially long-lived conifer types.

The aspen and birch community provides food and cover required by a broad range of wildlife species. High stem densities of regenerating aspen provide important habitat for grouse, snowshoe hares and other prey-based species. Preserving aspen inclusions and clones within other cover types will increase diversity and increase wildlife benefits and use of the stand.

F1a. 107 Support research needs concerning the impacts of forest thinning on wildlife species that rely on high stem density regeneration for habitat, particularly in aspen cover types.

F1a. 108 Retain conifers and protect conifer regeneration in clumps or strips to provide thermal cover, food, nesting cover, and structural attributes beneficial to wildlife.

Where available, deer strongly prefer white cedar as winter cover. Closed cedar canopies, (although not common), should be maintained as they protect deer against the most severe conditions. Clumps of cedar are also valuable during less severe winter conditions because they permit deer to use adjacent food sources. In addition balsam fir, white spruce and jack pine also provide important deer thermal cover.

F1a. 109 Retain or increase white cedar and oak as a stand component.

F1a. 110 Use harvest systems, and sale regulations that protect advanced regeneration and maintain or improve patterns, diversity and composition of forest vegetation representative of the stand prior to harvest.

F1a. 111 Establish and manage plantations to more closely resemble naturally occurring stands by planting diverse tree species, preserving existing natural vegetation, and preserving advanced regeneration by using variable density thinning techniques, varying stem density, and using less intense methods.

F1a. 112 Give consideration to within stand occurrences of species that are endangered, threatened, or of special concern.

The DNR has designated four hundred-forty plants and animals as endangered, threatened and species of special concern. All species are part of the natural forest ecosystem and contribute to its healthy functioning. Where these species are known to occur, special considerations may be made as stand prescriptions are implemented. Three levels of review for threatened, endangered or species of special concern are implemented: 1) as background data in preparing the 10-Year Stand Exam List; 2) as part of Area Annual Stand Exam list; and 3) as *Stand Silvicultural Prescription Worksheets* are prepared.

A number of wildlife species that are known to occur within the CP-PMOP are identified as Species of Greatest Conservation Need (SGCN)(see Appendix L *Terrestrial, Vertebrates Species List*). These SGCN are identified in *Tomorrow's Habitat for the Wild and Rare, An Action Plan for Minnesota Wildlife, 2006*. Key habitats for SGCN have been identified statewide with five found in the CP-PMOP. These key habitats are upland shrub/woodland (jack pine woodland), upland coniferous forest in CP, upland coniferous forest (red-white pine) in PMOP, non-forested wetlands, and headwater to large rivers. Foresters will consider these unique resources as stand prescriptions are implemented.

Fine filter strategies include those listed below.

F1a. 113 Designate special management areas for the benefit of wildlife species.

Most forest management activities that benefit wildlife species in these subsections will result from decisions designed to meet multiple forest management objectives; the application of these objectives will move across the landscape over time (coarse filter). However in some cases, areas have been and will continue to be identified as SMAs with the intent of maintaining these areas over time to provide specific wildlife species benefits (fine filter).

Special Management Areas (SMAs) are defined as areas where approved management techniques are performed to benefit specific plant or wildlife species or groups of species. SMAs have been identified and are managed to benefit certain wildlife species such as ruffed grouse, prairie chickens, sandhill cranes, or red-shouldered hawks. Open wet meadows are another type of SMA that has been identified. See Appendix P (*Special Management Areas and Priority Open Landscapes)* for identification of data layers that were available to or were considered by DNR staff as the 10-Year Stand Exam List was prepared.

F1a. 114 Consider Natural Heritage Program data and other rare species information during development and implementation of both the 10-Year Stand Exam List and Annual Stand Exam Lists.

Natural Heritage Program data will be available and considered during development of the 10-Year Stand Exam Lists and also during the Annual Stand Exam List selection process. Before groundwork begins, field staff will check the database for known locations of rare species in stands planned for treatment and, if present, will seek advice from staff from other divisions or refer to established guidelines/considerations on avoiding negative impacts on these species.

In summary, habitats for wildlife and plant diversity will be maintained, enhanced and protected through the application of a landscape/coarse filter (i.e., SFMRP effort), stand/site-level (i.e., *Voluntary Site-level Forest Management Guidelines*), and fine-filter approach (e.g., management policies, species plans).

3.7 Primary Issue Area: Wildlife Populations

Focused Issue G1 How can sustainable wildlife populations be maintained at levels that are acceptable to user groups?

GDS G1a Forests will be managed to provide sustainable wildlife populations.

The DNR maintains a multiple use policy managing the state's forest lands. In implementing this policy the following resources have been adopted that provide direction in managing for multiple uses. Examples of these resources are cited here as they impact forest management to sustain wildlife populations:

1. The Division of Forestry maintains:
    - *Forestry- Wildlife Habitat Management Guidelines*
    - *Interdisciplinary Forest Management Coordination Framework*
    - *Directions 2000, The Strategic Plan*
    - The *Strategic Conservation Agenda 2003-2007*
    - Identified SMAs and openlands designed to identify lands unique to wildlife management; (See Appendix P, *Special Management Areas and Priority Open Landscapes);*
2. The Division of Ecological Resources maintains: *Tomorrow's Habitat for the Wild and Rare, An Action Plan for Minnesota Wildlife, 2006;*
3. The MFRC maintains the *Voluntary Site-Level Forest Management Guidelines* that takes into consideration forest management impacts on wildlife populations; and,
4. Additional germane resources cited for consideration by foresters include:
    - Green, J.C. 1995. *Birds and Forests: A Management and Conservation Guide*
    - Hunter, Malcolm L.1990. *Wildlife Forests and Forestry: Principles of Managing Forests*
    - North Central Forest Experimental Series, *Manager's Handbooks for Tree Species* (habitat sections).

Strategies

G1a. 115 Enhance habitat while completing land treatments by using practices and procedures outlined in the DNR *Forestry-Wildlife Habitat Management Guidelines* and the DNR's *Interdisciplinary Forest Management Coordination Policy.*

G1a. 116 Implement corridor planning and management**.**

G1a. 117 Adhere to the recommendations in the MFRC *Voluntary Site Level Forest Management Guidelines* regarding RMZs, leave trees, legacy patches, woody debris, etc.

G1a. 118 Identify and acquire critical habitat land parcels for management and protection of important species.

G1a. 119 Develop cooperative procedures with other land management agencies to coordinate wildlife management efforts.

G1a. 120 Use the openlands assessment and planning process to develop necessary strategies and DFFCs for the designated open lands.

Important open landscape complexes can be designated as priority open landscapes either as an LTA or Special Management Unit (SMU). These areas are important for a number of wildlife species. A significant portion of these areas exhibit early successional stages of vegetation that is dominated by shrubs, grass, and young growth stages of early successional trees on dry and wet sites. These areas were originally formed by catastrophic events such as windstorms, insect outbreak, flooding, or fire. Today, human activity is largely responsible for creating and mimicking these landscape patterns.

Depending on the designated area, management techniques such as prescribed burning, brushland shearing, or timber harvest will be used to maintain or enhance prairie, brushland, woodland, young forest, and other open conditions in each unit. Forest management within these areas generally involves managing early successional tree species at normal rotation ages, favoring deciduous tree species over conifers, managing for larger younger patches, leaving fewer snags and live trees in harvest areas, and promoting increased private lands coordination. See Appendix P, *Special Management Areas and Priority Open Landscapes* for identification of data layers that were available to or were considered by DNR staff as the 10-Year Stand Exam Lists were prepared.

G1a. 121 Identify habitat components and habitat distributions needed to sustain wildlife populations at levels that are acceptable to user groups, but not detrimental to forest vegetation.

3.8 Primary Issue: Sustainable Harvest

Focused Issue H1 What is the appropriate timber harvest level on state lands, with consideration for sustainability of all forest resources?

One of the primary outcomes of the SFRMP process is to develop a timber vegetation management plan for state forest lands in these subsections to be implemented over the next 10 years. The treatment levels will determine the future age-class distribution of the forest. Several cover types in the CP-PMOP have a pronounced age-class imbalance. Treatment levels will be the primary tool used to correct this imbalance over time.

Establishing the appropriate timber treatment level will require the successful integration of economic, social, and ecological factors. Timber harvest provides forest products for society and jobs for those in forest-related industries. Long-term demand for timber continues to grow. Managing for sustainability requires a timber harvest balanced with other forest benefits. Sustainable forests support a thriving timber industry, provide diverse habitats for plant and animal species, maintain water quality, and provide recreational opportunities.

GDS H1a Forests will be managed to provide a sustainable supply of forest products for human use, while minimizing negative impacts to wildlife habitat and forest biodiversity.

DNR is committed to sustaining healthy and productive forest ecosystems. Predictable, abundant, and sustainable harvests of quality wood supports a viable forest products industry that helps to maintain a strong state and local economy. Sustainable forests also support and protect diverse habitats for plant and animal species, and maintain water quality.

Strategies

H1a. 122. Move even-age managed cover types toward a balanced age class structure.

Treatment levels were developed for this plan by considering all appropriate GDSs, strategies and DFFCs and specifically the following factors:

1. age-class imbalances for even-aged cover types;
2. acres over rotation age;
3. representation of old and young forest;
4. planned increases or decreases in cover type acreages through conversion;
5. supply of timber; and,
6. criteria for uneven-aged management and thinning.

The DFFC goal is to move toward a balanced age-class distribution with a declining distribution for the ERF designated stands. This DFFC goal was compared to the current age-class distribution for all even-aged managed cover types. A spreadsheet model developed by DNR, was used to project, by 10-year plan implementation periods, the outcome of various scenarios of treatment levels that best move the cover types toward the desired long-term DFFC goals. The modeling was used for forest cover types

managed under even-aged silvicultural systems. Treatment levels were developed for each of the next six decades to move the current age distribution closer to the balanced age-class distribution goal. Cover types where there will be no even-aged final harvest in this 10-year plan were not modeled. These cover types included white pine, and white cedar. All white cedar stands are designated ERF by department policy (see Chapter 4, *Cover Type Management Recommendations* for further discussion).

Certain cover types have large acreages in the younger rather than older, age classes. Efforts are made to move these cover types to a more balanced age class distribution. This requires identification of stands for treatment that are younger than the identified normal rotation age.

CP-PMOP Plan treatment levels reflect the number of acres that will be field visited over the 10-year period. From the 10-Year Stand Exam List, Forestry Areas will identify Annual Stand Exam Lists. Following field visits of each stand on the Annual Stand Exam List, and completion the *Stand Silvicultural Prescription Worksheet*, treatments will be established and may include timber harvest, re-inventory/alteration (i.e., correcting or updating forest inventory data), forest development without harvest, or deferring treatment (treat in a future plan implementation period).

Table 3.8a summarizes the total acres selected and placed on the 10-Year Stand Exam List. This table shows the acres in each cover type that:

1. are available for timber management (Management Pool Acres);
2. meet the stand selection criteria (Stand Selection Pool Acres); and,
3. meet the treatment levels recommended in the CP-PMOP Plan (Stand Exam Acres).

Both even-aged and uneven-aged managed cover types are displayed by normal rotation and extended rotation forests. This table identifies the progression of acres by cover type through the Management Pool Acres, Stand Selection Pool Acres and CP-PMOP Planned Treatment Level culminating in Total Plan Stand Exam Acres.

Table 3.8a Managed Cover Type Treatment Summary

Cover type	Rotation[2] Class	Planned Rotation Age	Management Pool Acres (all ages)[3]	Stand Selection Pool Acres)[4]	CP-PMOP Planned Treatment Level[5]			Total Plan Stand Exam Acres
					Even	Intermediate Treatment[1]	Visit	
Ash/Lowland Hardwoods	Un-even-aged	No set rotation age	16,858	3,026	47	1,524	747	**2,318**
Aspen/Balm of Gilead	N	45/40	128,337	36,960	21,117	539	3,235	**31,965**
	ERF	80/75/60	54,932	18,247	5,538	553	983	
Birch	N	50	3,754	2,790	748	10	456	**3,911**
	ERF	65/50	5,711	4,918	1,761	155	781	
Northern Hardwoods	Un-even-aged	No set rotation age	16,163	8,213	296	5,041	831	**6,168**
Jack Pine	N	40	8,307	4,722	1,881	50	272	**4,495**
	ERF	65	6,071	3,554	1,653	292	347	
White Spruce	N	60/50	3,298	452	118	1,430	113	**3,971**
	ERF	90/60	3,782	1,202	258	1,902	150	
Balsam Fir	N	45	3,414	2,217	721	139	312	**2,203**
	ERF	60	4,278	2,855	432	174	425	
Tamarack	N	60/70	26,095	14,692	4,747	37	914	**7,741**
	ERF	105	15,559	11,449	1,771	31	241	
Black Spruce Lowland – Low SI	N	95	9,842	3,925	759	0	360	**2,542**
	ERF	130	11,617	5,150	1,292	0	131	
Black Spruce Lowland - High SI	N	65	1,768	1,018	142	31	158	**542**
	ERF	95	2,236	2,128	166	0	45	
Red (Norway) Pine	N	100	12,535	1,433	366	7,016	346	**19,531**
	ERF	170	21,646	48	145	11,127	531	
Oak – High SI	N	80	3,650	2,401	1,022	165	108	**1,760**
	ERF	120	2,828	1,875	86	379	0	
Oak - Low SI	N	50	3,541	3,303	1,483	165	343	**4,780**
	ERF	80	5,952	5,553	1,932	121	736	
White Pine	ERF	No set rotation age	2,027	1,485	104	731	121	**956**
Total Acres			**374,204**	**143,616**	**48636**	**33,150**	**13,108**	**94,894**

[1] Includes prescriptions such as thinning, selective harvest, uneven-aged management.
[2] Rotation Class: N -managed under normal rotation; ERF –managed as extended rotation forest.
[3] Management Pool Acres are timberland acres that are available for potential timber harvest after reserves (e.g., designated old-growth stands) are subtracted at the beginning of this planning process.
[4] The Management Pool Acres that met the stand selection criteria for treatment and age criteria based on normal and maximum rotation ages. Also refer to Appendix T (*Stand Exam List Instructions*, Attachment D-3) for additional acres that were identified as an uneven-aged management pool.
[5] 10-year planned treatment level (acres) for this plan implementation period (includes site visit acres).

Table 3.8b summarizes average age of stands selected for treatment for the even-aged managed cover types. This table shows that, on average, stands selected for aspen, birch, jack pine, balsam fir, lowland black spruce, and tamarack were older than the target normal rotation ages. On average, stands selected for red pine were older than the target normal rotation age.

Table 3.8b 10-Year Summary: Average Age of Stands Selected for Treatment for Cover Types Managed Primarily by Even-Aged Harvest Methods

Cover Type	Rotation Age Type[1]	SFRMP Rotation Ages[1]		Average Age of Stands Selected in Chippewa Plains	Average Age of Stands Selected in Pine Moraines & Outwash Plains	Target (DFFC) Ave. Treatment Age (Both Subsections)	Average Age of Stands Selected for Both Subsections
		CP	PMOP				
Ash	N/A	N/A	N/A	101		N/A	101
Lowland Hardwoods	N/A	N/A	N/A		71	N/A	71
Aspen	Normal	45	40	59	65	42	63
	ERF	80	75	65	71	73	70
Birch	Normal	50	50	79	76	50	77
	ERF	65	60	71	76	62	75
Bam	Normal	40	40	72		42	72
	ERF	60	60	71	80	73	74
Northern Hardwoods	N/A	N/A	N/A	62	85	N/A	81
Oak	Normal	80/50[2]	80/50[2]	101	80	80/50[4]	80
	ERF	120/80[2]	120/80[2]	86	83	113/70[4]	83
White Pine	N/A	N/A	N/A	124	40	N/A	61
Red (Norway) Pine	Normal	100	100	114	89	100	105
	ERF	170	170	106	97	154	99
Jack Pine	Normal	40	40	63	60	40	61
	ERF	65	65	68	66	60	66
White Spruce	Normal	60	50	65	68	60/50[3]	66
	ERF	90	60	63	59	80/60[3]	61
Balsam Fir	Normal	45	45	68	68	45	68
	ERF	60	60	75	72	57	73
Lowland Black Spruce	Normal	65/95[2]	65/95[2]	113		95/65[4]	113
	ERF	95/130[2]	95/130[2]	123	122	126/87[4]	123
Tamarack	Normal	60	70	114	112	61	114
	ERF	105	105	113	127	95	117
Stagnant Cedar	N/A	N/A	N/A		58	N/A	58

[1]Rotation ages as determined by Division of Forestry. Rotation ages were only determined for cover types to be managed as even-aged.
[2]Rotation ages are different based on site index for these species. See Table 3.1c, Chapter 3.
[3]First target average treatment age is for natural stands. Second average is for plantations.
[4]Target average treatment age is split between two site index classes. See Table 3.1c, Chapter 3.

H1a. 123 Achieve a declining age-class structure in ERF stands from normal rotation age through maximum rotation age.

Stands that are over normal rotation age and that exceed ERF age class acreages will be identified for treatments. ERF rotation ages specific to each cover type were used to achieve the desired declining age-class distribution beyond the normal rotation age. Treatment levels were developed to address many of these acres in the next 10 years. This will effectively bring the average treatment age closer to the desired rotation ages for the even-aged cover types. For some cover types, the amounts are so large that treating them all in the next decade would exacerbate the current age-class imbalance. For these cover types, some over-rotation age stands will be carried through this 10-year period and into the following decade to facilitate balancing the age classes. (In Table 3.8a, this would be the difference between the Stand Selection Pool Acres and the CP-PMOP Planned Treatment Level). For some cover types over time, the average treatment ages decrease to bring them closer to normal rotation ages. For jack pine, red pine and white spruce the average age increases as a result of holding stands longer to better balance the age-class distribution over time.

H1a. 124 Improve the distribution of ages and quality of timber in uneven-aged managed cover types. Stands identified on the 10-Year Stand Exam List will be site visited, treatment will be prescribed through the *Silvicultural Prescription Worksheet* or will be re-inventoried with a treatment strategy developed. To ensure that these treatment strategies are retained, a record keeping system, the *Silviculture and Roads Module* (*SRM*) will be utilized.

H1a. 125 Designate lowland conifer old growth from EILC stands and return undesignated stands to the harvest pool.

EILC include stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands that are examples of high quality NPCs and representative of lowland conifer NPCs found in the subsections. Appendix F, *Ecologically Important Lowland Conifers (EILC): Stand Designation Process,* outlines how EILC was determined for these subsections. Table 3.8c provides a summary of the EILC acres designated by cover type. The designated EILC stands will be reserved from treatment during the 10-year plan implementation period. EILC acres have been included in cover type treatment acre calculations for this 10-year Plan, therefore, EILC designations do not reduce the treatment level in these cover types. These acres may be released for treatment in subsequent plan implementation periods. The EILC designated stands will be reviewed for continued protection during the next subsection planning process based on all appropriate policy and guidelines in place at that time as directed by *DNR Memo, July 3, 2000, Old-Growth Forest Guidelines and Protection of Important Lowland Conifer Sites.*

Table 3.8c Ecologically Important Lowland Conifer Designation Summary

Cover type	State Forestland Acres	EILC Acres Designated[1]	Percent of Cover type Designated as EILC
Black Spruce Lowland	27,786	2,657	10%
Tamarack	44,275	5,951	13%
Cedar	13,195	2,023	15%
Stagnant Spruce	17,111	9,551	56%
Stagnant Tamarack	4,209	1,328	32%
Stagnant Cedar	10,142	1,397	14%
Lowland Conifers Total	**116,718**	**22,907**	**20%**

[1]includes acres identified as a stagnant cover type

EILC stands were identified in the CP-PMOP SFRMP and reserved from harvest until old growth lowland conifers are defined and incorporated in the *DNR Old-Growth Forest Guideline.* After being defined, suitable acres will be designated. Stands selected as EILC are examples of high-quality native plant communities representative of the range of lowland conifer native plant communities found in the subsection. Wildlife species that benefit from EILC include among others great gray owl, hawk owl, Connecticut Warbler, spruce grouse, northern bog lemming, and wintering yards for white-tailed deer.

H1a 126 Implement recommendations identified in the *MFRC's Voluntary Site-Level Forest Management Guidelines, Biomass Harvesting Guidelines for Forestlands, Brushlands, and Openlands*.

DFFC Statement

The treatment levels for even-aged cover types will be established with the DFFC of achieving a balanced age-class as shown in Chapter 4, Cover type Management Recommendations.

Focused Issue H2 How can an adequate and sustainable supply of non-timber forest products be ensured for the future?

GDS H2a Forests will be managed to provide a sustainable supply of non-timber forest products for human use while minimizing negative impacts to wildlife habitat and forest biodiversity.

The cultural importance and ecological role of special forest products (SFPs) resources are only beginning to be understood. SFPs include resources such as balsam boughs, spruce tops, sugarbush, willow, birchbark, and blueberries). Improving our species-specific knowledge, as well as broadening forest inventories and developing appraisal methods for most types of SFPs, will make determining sustainable harvest levels more accurate in the future. Under current rules, guidelines, and policy, SFP permits are issued for specific SFPs to ensure that harvest operations do not damage the site's potential for future production. Permits are needed for any product that would be used commercially. No SFPs permits are needed if harvest is solely for personal use. Harvest of SFPs may be restricted on some state-administered forest lands such as WMAs, AMAs, and SNAs. Specifically on WMAs, no commercial harvesting is permitted; however, personal use harvest is permitted.

Illegal "poaching" of SFPs on DNR lands is likely common. While this is currently a minor issue in most locations, it is likely to become more significant as demand for SFPs grow. In addition to resource sustainability and management issues, the state forfeits potential income from illegal harvest activity.

Most harvesters make regular observations about the resources they harvest, but usually without recording them. Engaging harvesters in mutually beneficial relationships can help develop field information on the resource and sustainable guidelines. Guidelines can be proposed to protect SFP species from over-harvest, prevent adverse impact to wildlife habitat and NPCs and unintended harvest of rare species. In addition, third party forest certification standards require that sustainable SFP management be addressed. If engaged by resource managers in a positive manner, many harvesters will exhibit stewardship attitudes and concern about protecting the resources they harvest, as they are dependent on a sustained resource.

Harvest of balsam boughs is a significant SFPs resource in these subsections. Figure 3.8a and Table 3.8d show the number of balsam bough permits issued by fiscal year for the CP-PMOP. Figure 3.8b and Table 3.8e show the total number of special forest products permits issued for selected fiscal years.

Figure 3.8a Balsam Bough Permits by Fiscal Year

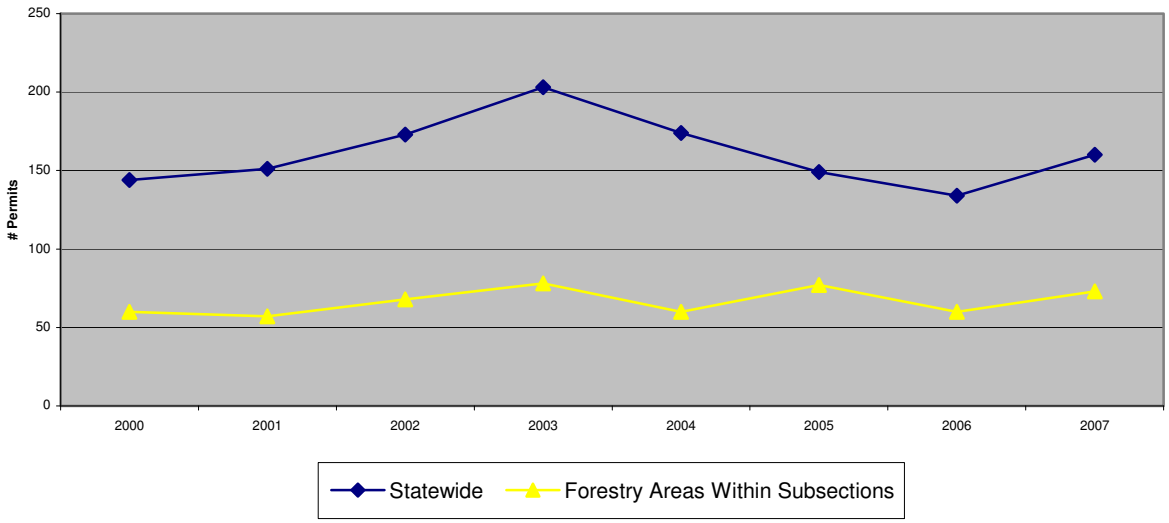


Table 3.8d Balsam Bough Permits by Fiscal Year

	2000	2001	2002	2003	2004	2005	2006	2007
Statewide	144	151	173	203	174	149	134	160
CP-PMOP Areas	60	57	68	78	60	77	60	73

Figure 3.8b Total Special Forest Products Permits by Fiscal Year (except balsam boughs)

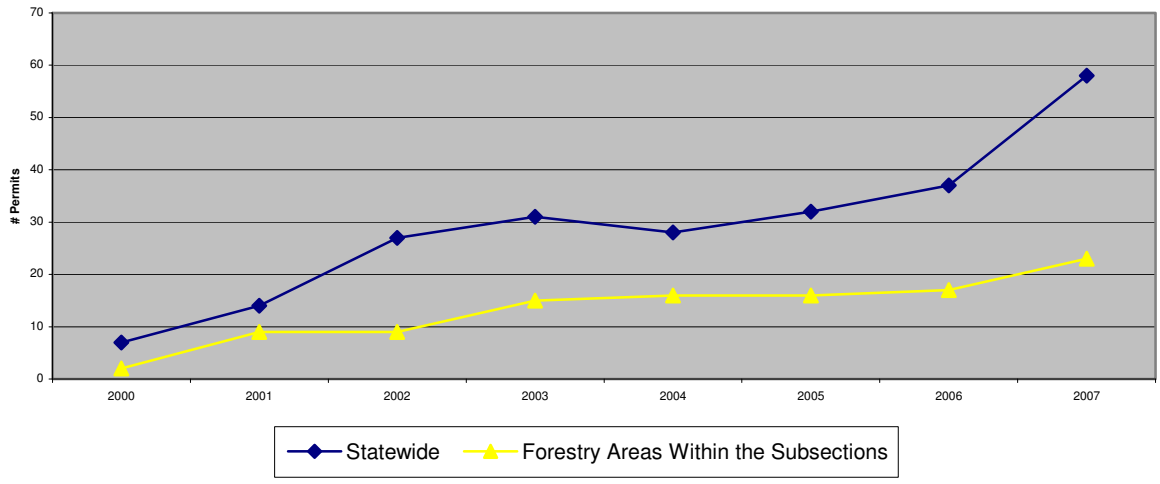


Table 3.8e Total Special Forest Products Permits by Fiscal Year (except balsam boughs)

	2000	2001	2002	2003	2004	2005	2006	2007
Statewide	7	14	27	31	28	32	37	58
CP-PMOP Areas	2	9	9	15	16	16	17	23

Strategies

H2a. 127 Implement the recommendations of the Special Forest Products (SFP) planning process.

H2a. 128 Increase supervision of SFP harvest permits and increase enforcement of rules against illegal harvesting activity.

H2a. 129 Manage selected forest stands for non-timber forest products.

H2a. 130 Support research to determine sustainable harvest levels for SFP (e.g., decorative spruce tops), criteria for managing harvests and methods of propagation.

H2a. 131 Use all available information including *"Careful Harvest Fact Sheets"* (Extension Web site), and the DNR Forestry's Utilization and Marketing Web site that supports sustainable harvest of non-timber forest products when approving SFP permits.

H2a. 132 Apply knowledge of existing traditional gathering areas of non-timber forest products when managing other forest resources.

For example, in implementing this strategy, field staff should consider the potential forest management impacts on known areas, such as those traditionally used for gathering maple syrup (sugarbushes) or gathering wild rice (ricing camps).

H2a. 133 Identify managers with local expertise in managing non-timber products and use their knowledge when managing non-timber forest products at the landscape and statewide levels.

H2a. 134 Reduce impacts by coordinating non-timber product harvests with timber harvest.

H2a. 135 Increase public knowledge about the sustainable use of non-timber forest products through dissemination of educational information and training.

3.9 Primary Issue Area: Timber Quality and Quantity

Focused Issue I1 How can timber productivity be increased on state lands?

The following, taken from the DNR *Conservation Agenda,* provides a context for efforts to increase timber productivity on state-administered lands.

> *"DNR currently increases wood fiber production by regenerating vigorous young forest stands through harvest; planting and seeding harvested and damaged sites; thinning overcrowded stands to improve vigor and reduce competition; monitoring and reducing the impacts of harmful insects, diseases, and exotic species; and matching tree species and management techniques to individual sites through its Ecological Classification System (ECS)."*

The *1994 Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota* recommended increasing the wood fiber productivity of timberlands to help mitigate the potential effects of current and increased harvest levels. The 2003 Governor's Task Force on the Competitiveness of Minnesota's Primary Forest Products Industry also listed, as a priority, increasing wood fiber productivity while conserving Minnesota's forest lands.

GDS I1a Forests will be managed to increase overall timber productivity.

Managing to achieve an ***overall*** increase in the timber productivity of state forest lands is one way to continue to provide the current (or greater) harvest volume and improve timber quality. Managing for an

overall increase in productivity where possible and practicable, allows other lands to be managed with less emphasis on timber productivity. Increases in overall timber productivity can be achieved during this 10-year plan by accelerating the rate at which the age-class imbalances are addressed; increasing intermediate stand treatments; converting to site-appropriate species; and continuing to protect soil productivity by applying the MFRC *Voluntary Site-Level Forest Management Guidelines*.

Further, to increase the *overall* timber productivity on state forest lands, sustainable treatment levels were developed and applied that included all planned increases or decreases to each cover type over the next 60 years**.** While 10-year treatment levels will vary above or below the sustainable level until the age classes are balanced, adjustments were made in some decades to reduce these variations. The long-term goal is to narrow the peaks and valleys in harvest levels to provide a relatively stable supply of timber from state lands.

Both even-aged and uneven-aged cover types will be managed using selective harvest treatments. Even-aged cover types that may be thinned include: aspen, balsam fir, white spruce, jack pine, red pine, and white pine under 90 years. The uneven-aged managed cover types include ash, lowland hardwoods, northern hardwoods and white pine over age 90 years. All stands that met the stand selection criteria were placed on the 10-year list and will be field visited for possible selective treatment. Some stands of the ash, lowland hardwoods, and northern hardwoods may be initially treated through even-aged methods to improve long-term stand age-structure and timber quality (see Chapter 4 for specific cover type treatment recommendations). Additional acreage may be selectively harvested or thinned if field evaluation shows that the stand meets the stand selection criteria for the cover type. These additional stands will be available for review during the Annual Stand Exam List or Annual Plan Addition review process.

Table 3.9a identifies total acres to be treated by treatment prescription for the 10-year plan implementation period. This table shows a total of 96,991 acres of stands have been selected and placed on the 10-Year Stand Exam List for site visits. Preliminary prescriptions range from clearcut to re-inventory. The actual management objective and prescription to be applied will be determined following the site visit and completion of a *Stand Silvicultural Prescription Worksheet*.

Table 3.9a 10-Year Summary: Preliminary Prescription Acres by Subsection

General Prescription	Detailed Prescription[1]	Chippewa Plains	Pine Moraines & Outwash Plains	Total
Even-aged	Clearcut with Reserves	11,245	31,348	42,593
	Clearcut with Reserves - sprouting	0	62	62
	Salvage - Clearcut	0	11	11
	Salvage-w/Rsrv-Clearcut-I&D	0	42	42
Seed Tree	Seed Tree w/Rsrv	179	0	179
	Seed tree	4,437	224	4,661
Shelterwood	Shelterwood	234	866	1,100
Uneven-aged	Uneven-aged Harvest	3,407	2,296	5,703
	Group Selection	0	32	32
	Salvage Cut-Selective Harvest	86	51	137
	Sanitation Cut-Selective Harvest	0	60	60
	Intermediate Harvest	249	0	249
Thinning	Commercial Thinning	6,375	18,996	25,371
	Selective Thinning-Commercial	3	279	283
Manage for Understory	Manage for Understory	527	658	1,185
On-site Visit	On-site Visit	4,951	3,546	8,497
Re-inventory	Re-inventory	4,238	2,589	6,827
	Total	**35,931**	**61,060**	**96,991**

[1] Refer to Appendix I (*Standard Codes in SFRMP)* for prescription definitions

Table 3.9b identifies the total acres to be treated by Forestry Area for the CP-PMOP subsections. This table breaks down the overall landscape level treatment goals by cover type by Forestry Area, giving each Area specific targets to guide selection of the Annual Stand Exam Lists over the next 10-year plan implementation period.

Table 3.9b CP- PMOP: 10-Year Planned Stand Examination Acres by Forestry Area

Covertype	Bemidji	Blackduck	Brainerd	Park Rapids	Detroit Lakes	Deer River	Little Falls	Total
Ash	265	260	273	276	42	689	0	1,806
Lowland Hardwoods	121	121	37	12	8	125	0	425
Aspen	5,145	2,932	7,764	12,520	1,045	1,611	301	31,319
Birch	712	434	1,970	258	44	491	0	3,909
Balm of Gilead	154	146	54	15	0	277	0	646
Northern Hardwoods	2,022	1,317	1,122	739	587	357	42	6,186
Oak	532	30	4,428	998	255	32	265	6,539
White Pine	148	99	422	117	94	60	47	985
Red (Norway) Pine	3,675	824	5,284	9,799	254	1,336	0	21,170
Jack Pine	1,107	52	486	2,840	0	9	0	4,494
Scotch Pine	0	0	7	7	0	0	0	14
White Spruce	1,014	251	768	1,501	165	271	0	3,969
Balsam Fir	632	342	323	605	33	269	0	2,204
Lowland Black Spruce	543	1,188	31	0	0	1,322	0	3,083
Tamarack	1,876	1,082	142	792	98	3,594	157	7,740
White Cedar	81	58	0	0	0	23	0	162
Stagnant Tamarack*	8	0	0	0	0	0	0	8
Stagnant Cedar*	0	0	0	0	0	14	0	14
Offsite Oak*	11	0	0	104	0	5	20	140
Cutover Area*	544	0	43	338	6	21	0	952
Lowland Grass*	28	0	0	11	0	0	0	40
Upland Grass*	28	0	0	273	4	0	0	304
Lowland Brush*	106	197	0	18	0	336	0	657
Upland Brush*	13	0	0	82	0	0	0	96
Agriculture*	0	0	0	18	4	0	0	21
Industrial Dev*	0	0	0	8	0	12	0	20
Recreation Dev*	0	0	6	0	0	0	0	6
Roads*	0	0	0	0	0	12	0	12
Marsh*	71	0	0	0	0	0	0	71
Total	18,837	9,333	23,157	31,330	2,639	10,864	831	96,991

***** During selection of the 10-Year Stand Exam List, stands were selected and prescriptions recorded under these cover type designations based on field knowledge, experience and air photo interpretation. Final prescriptions will be determined following site visits.

Strategies

l1a. 136 Support research that maximizes timber productivity (e.g., optimal stocking levels, mixed species management, treatment timing) without impacting wildlife and plant species.

Suggested techniques that support this strategy include: create a dedicated position as liaison to the University of Minnesota to suggest forestry research topics and secure funding in cooperation with the University of Minnesota and other research institutions; and, continued cooperation with the Management Section of Wildlife and Ecological Resources research staff; and/or create a forestry research unit to investigate and disseminate information about specific challenges and solutions relating to timber productivity on DNR administered lands.

l1a. 137 Apply management techniques to improve stocking and stand composition on general forestry lands.

The frequency and intensity of silvicultural treatments designed to increase timber productivity can vary across the subsections depending on a number of factors, including:

1. the specific cover types (aspen, jack pine, red pine, white spruce, northern hardwoods and red oak);
2. site index;
3. proximity to existing access;
4. stand origin: stands eligible for treatments can be planted or natural; and,
5. the degree of overlap with other management objectives: stands not intersecting the buffer of rare, or natural heritage elements, not WMAs, or not old growth.

Treatments to increase timber productivity may be implemented where appropriate within some special management units (e.g., ruffed grouse management units, OFMCs, priority open landscapes). The joint notification and review of stands as outlined in the *Interdisciplinary Forest Management Coordination Framework* will be implemented on these special management units.

The following techniques support strategies to improve stocking and stand composition for cover types managed primarily by even-aged silvicultural systems

1. Propose "final" regeneration harvest levels that best move the stand toward the desired, more balanced age class distribution.
2. Work toward conducting final regeneration harvests on "normal rotation" stands
3. at the identified normal rotation age, adjusting as needed to best move toward the desired age-class distribution.
4. Harvest some portion of normal rotation stands between the identified merchantability age and normal rotation age to help move towards desired age-class distribution, thus increasing timber productivity and contributing towards wildlife habitat objectives.
5. Harvest ERF stands between normal and maximum rotation age, but not beyond the identified maximum rotation age, to best move toward the desired age-class distribution.
6. Conduct intermediate commercial thinning in cover types and stands meeting identified selection criteria (e.g., BA, age, time since last thinning, site index, proximity to existing access, stand origin, considerations for other management objectives, etc.).
7. Conduct pre-commercial thinning in types and stands meeting identified selection criteria (e.g., certain cover types, age, site index, proximity to access, extent of overlap with other resource objectives/values, etc).
8. Given the limited amount of naturally regenerated red pine stands established in the past 70+ years, and the unique management opportunities natural origin stands may provide, natural origin red pine stands selected for potential treatment will be jointly reviewed to determine appropriate treatments.
9. Aspen stands selected for commercial or pre-commercial thinning will require close coordination between the Division of Forestry and Management Section of Wildlife before this prescription is implemented.

In cover types managed primarily under uneven or multi-aged systems, selectively harvest and/or thin stands meeting identified selection criteria (e.g., BA, age, time since last thinning, site index, proximity to existing access, considerations for other management objectives, etc.)

Additional techniques that apply both to even-aged and uneven-aged managed cover types to improve stocking and stand composition include the following:

1. The SRM will be used to schedule, monitor, and archive treatment regimes, including site visits, harvest, thinning, regeneration, release, re-inventory, etc.;
2. As stands are field visited, insect and disease levels will be monitored, with efforts to reduce negative impacts;
3. Regeneration surveys will be completed according to statute and policy. If stocking or species composition problems are found, action will be taken to correct problems.
4. Use 'improved' seed and planting stock when available, and appropriate;
5. Detailed analysis of stand characteristics, including green season ECS evaluation, will be done on sites being considered for more intensive application of silvicultural treatments to

improve timber productivity. The NPC *Field Guide* and supplemental NPC references will be used to help identify more productive site-appropriate species;
6. Manage native species only and in concert with ECS principles;
7. MFRC *Voluntary Site-level Forest Management Guidelines* will be applied. Consult other forest management guidance documents that may be appropriate;
8. Management will be coordinated with other DNR divisions according to the *Interdisciplinary Forest Management Coordination Framework*; and,
9. Available development budgets will be focused on stands with higher productivity potential.

Volume Comparison Between the Past Volumes Sold by Forestry Areas and the Recommended CP-PMOP SFRMP Treatment Levels

The DNR develops annual planned treatment levels on a cover type acreage basis. Conversion from cover type acres to cord volumes is a necessary step in comparing past volumes harvested to what is anticipated from implementation of this CP-PMOP SFRMP. Table 3.9c identifies the average volume by cover type and survey age class (i.e., age class at the time it was inventoried). Volume used for each cover type is the average cords per acre from the FIM dataset for stands in a merchantable age class in these subsections. These averages were used to estimate total volume in cords projected to result from implementation of this Plan.

Table 3.9d identifies the estimated volume in cords resulting from implementation of this CP-PMOP Plan. Figure 3.9a identifies the methods used for estimating cover type and species volumes (from acres to cords) for the CP-PMOP SFRMP. The harvest volume estimate provided in Table 3.9d is based on treatment acres, treatment method, and cords per acre based on forest inventory data and preliminary prescriptions (cords estimated to result from even-aged harvests, partial cut acres and field visit cords). The cords estimated represents a culmination of past division experience as to the volume that can be anticipated from the various treatment methods cited.

The amount of timber actually offered for sale will differ from these projected acres and volumes for the following reasons:

1. Forest inventory volumes will differ from timber appraisal volumes. Inventory data is not designed to provide information accurate or specific enough for timber sale purposes more specific/precise information and evaluation is gained through site visits;
2. Stands may have changed since the stand was last field visited for inventory (old stands that are falling apart and/or converting to other types due to storm, fire, I&D, flooding damage). These observations are made and recorded under the “on site visit” prescription;
3. Refinement of stand boundaries. Field visits result in stand boundary adjustments that frequently result in fewer acres in the stand;
4. Errors in the inventory;
5. Complexity of management decisions go beyond the criteria that are used to identify stands for inclusion in the 10-Year Stand Exam List. This is particularly true for northern hardwoods and other uneven-aged types where age and basal area criteria do not capture considerations for quality; and,
6. Management plan (i.e., stand exam) acres represent acres to be treated (not necessarily harvested). Treatment can include harvest, partial harvest, manage for understory, inventory alteration, and even a decision to do nothing. Not all management plan (i.e., stand exam) acres result in timber sales.

Table 3.9c CP-PMOP Average Volume by Cover Type and Age Class

																	Merchantable age and over
Cover Type	**31 - 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**	**101 - 110**	**111 - 120**	**121 - 130**	**131 - 140**	**141 - 150**	**151 - 160**	**161 - 170**	**171 - 180**	**181 - 190**	**Average Cords/acre**
Ash		6	7	11	12	15	16	15	14	16	17	18	16	17	18	17	**14**
Lowland Hardwoods		5	8	9	12	16	17	13	11	17	12	22	20		27		**15**
Aspen*	15	17	19	22	24	26	21	17	10	5							**20***
Birch	7	13	15	17	18	19	18	17	18	16	10		14				**15**
Balm*	16	22	14	15	21	16	16		28								**17***
Northern Hardwoods		13	17	18	19	18	20	19	19	23	17	22					**19**
Oak	0	8	15	18	19	19	19	17	14	14	27	14			21		**17**
White Pine	21	21	19	29	17	17	13	12	8	8	3			5			**17**
Red Pine	21	25	23	27	18	21	19	16	15	13	12	19	15	9		8	**18**
Jack Pine	14	16	16	20	22	22	21	9									**17**
White Spruce	17	20	15	21	23	21	29										**21**
Balsam Fir	11	8	12	16	16	17	16	23	22								**16**
Black Spruce Lowland	2	7	5	9	10	10	11	11	11	11	11	10	8	6			**9**
Tamarack	3	3	5	9	11	12	13	13	13	14	13	10	11	15	11	20	**11**
Lowland White Cedar	11	2	10	10	13	17	18	19	18	22	20	19	20	20	22	22	**16**

*combined aspen / balm of Gilead averages 19 cords per acre considering total acres in each cover type

Table 3.9d CP-PMOP SFRMP Volume Estimations

MANAGEMENT PLAN	Ash /LH	Aspen/ BG	Birch	NH	Oak - High SI	Oak - low SI	White Pine	Red (Norway) Pine	Jack Pine	White Spruce	Balsam Fir	L Black Spruce - low SI	L Black Spruce - high SI	Tam-arack	Total
1. **Plan Total Acres**	**2,318**	**31,965**	**3,911**	**6,168**	**1,760**	**4,780**	**956**	**19,531**	**4,495**	**3,971**	**2,203**	**2,542**	**542**	**7,741**	**92,883**
2. Even-age Acres	47	26,655	2,509	296	1,108	3,415	104	511	3,534	376	1,153	2,051	308	6,518	**48,585**
3. Cords/Acre	14	19	15	19	17	17	17	18	17	21	16	9	9	11	
4. Even-age Cords	658	506,445	37,635	5,624	18,836	58,055	1,768	9,198	60,078	7,896	18,448	18,459	2,772	71,698	**817,570**
5. Partial cut Acres	1,524	1,092	165	5,041	544	286	731	18,143	342	3,332	313		31	68	**31,612**
6. Cords/Acre	4	6	5	6	5	5	5	5	5	6	5	3	3	3	
7. Partial Cut Cords	6,401	6,224	743	28,734	2,774	1,459	3,728	97,972	1,744	20,992	1,502	0	84	224	**172,581**
8. **Subtotal Cords**	**7,059**	**512,669**	**38,378**	**34,358**	**21,610**	**59,514**	**5,496**	**107,170**	**61,822**	**28,888**	**19,950**	**18,459**	**2,856**	**71,922**	**990,151**
9. Field Visit Acres	747	4,218	1,237	831	108	1,079	121	877	619	263	737	491	203	1,155	**12,686**
10. Field Visit Cords/Acre	7	10	8	10	9	9	9	9	9	11	8	5	5	6	
11. Field Visit Cords	2,615	20,036	4,639	3,947	459	4,586	514	3,947	2,631	1,381	2,948	1,105	457	3,176	**52,439**
12. Total Plan Cords	**9,673**	**532,705**	**43,016**	**38,305**	**22,069**	**64,099**	**6,010**	**111,117**	**64,453**	**30,268**	**22,898**	**19,564**	**3,312**	**75,099**	**1,042,590**
13. Annual Plan Cords	**967**	**53,270**	**4,302**	**3,830**	**2,207**	**6,410**	**601**	**11,112**	**6,445**	**3,027**	**2,290**	**1,956**	**331**	**7,510**	**104,259**

Figure 3.9a identifies the definitions and methods used to estimate the volumes identified in Table 3.9c.

Figure 3.9a Method Used for Estimating Cover type and Species Volumes for CP-PMOP SFRMP Plan

MANAGEMENT PLAN - data from SFRMP plan.
1. Management Plan Total Acres: The total cover type acres selected for harvest or stand examination in the management plan. These stand examination acres are determined for the subsection by cover type considering existing acreage, age-class distribution, rotation age, reserve areas, ERF, and application of other various forest management guidelines. *Note: Not all management plan acres result in timber sale acres.*
2. Even-age Acres: Acres from Step *1. Management Plan Total Acres* that have even-aged management prescriptions. Even-aged practices include prescription codes 1100 - 1299.
3. Cords/Acre: Average cord/acre figures for each cover type are obtained from reports based on forest inventory. Volume tables are based on subsection data and are gross volume figures. See *Table 3.9c: CP-PMOP Average Volume by Area by Cover type and Survey Age Class (i.e., age class at the time it was inventoried)*. Volume used for each cover type is the average cords per acres found in last column of the table: *Mgmt Age and Over.*
4. Even-Age Cords: This is a gross volume estimate of even-age harvest cords determined by multiplying *2.Even-age Acres* X *3.Cords/Acre*.
5. Partial Cut Acres: Acres from Step *1. Management Plan Total Acres* that have uneven-aged and thinning management prescriptions. Partial-cut practices include prescription codes 1300 - 1850.
6. Partial Cut Cords/Acre: Cords per Acre in *3. Cords/Acre* multiplied by 0.3. Assumes on the average, 30% of the volume is removed in a partial cut.
7. Partial cut Cords: This is a gross volume estimate of partial cut harvest cords determined by multiplying *5.Partial cut Acres* X *6.Cords/Acre*.
8. Subtotal Cords of Even-Age Acres and Partial Cut Acres
9. Field Visit (FV) Acres: This applies to acres with an "on site visit" prescription (9100).
10. FV Cords/Acre: Cords per Acre in *3. Cords/Acre* multiplied by 0.5. Assumes on the average, volume in FV stands is 50% of the average cords per acre for the cover type.
11. FV Cords: This is a gross volume estimate of FV harvest cords determined by multiplying *9. FV Acres* X *10. FV Cords/Acre.*/2 FV cords were divided by 2 since it is estimated that approximately one-half of these stands will result in a timber sale (other 50% would be alterations and/or succession to other cover types, etc.).
12. SFRMP Plan Total Cords: This is a gross volume estimate of cords available for timber harvest on the average in the subsection based on the SFRMP plan. Determined by adding *4. Even-age Cords*, *7. Partial cut Cords*, and *11. FV Cords* . These are gross volume figures that include acres that may not result in timber sales and volumes that will be reserved to meet site-level forest management guidelines or other guidelines and policies.
13. Annual Plan Cords: 12. *SFRMP Plan Total Cords* divided by 10.

Several methods are available to estimate cord volumes from stand selection acres. Table 3.9e identifies the estimated cords over the 10-year plan implementation period using the Walters-Ek method of volume estimating. This information includes cords resulting from the entire 10-Year Stand Exam List by cover type. The Walters-Ek method is shown here to provide a range of volume estimates which could result from implementation of this CP-PMOP SFRMP using this alternative method.

Table 3.9e CP-PMOP SFRMP Volume Estimations by Cover Type in cords (Walters-Ek Method)

Cover Type	Clearcut	Partial Cut	Field Visit	Cover Type Total
Ash	196	7,329	3,491	11,016
Aspen	671,268	7,556	10,262	689,085
Balm of Gilead	8,562	97	489	9,149
Balsam Fir	25,143	1,974	2,138	29,255
Birch	59,127	1,236	3,495	63,858
Jack Pine	79,159	1,913	1,805	82,877
Lowland Black Spruce	32,027	434	1,979	34,441
Lowland Hardwoods	392	1,467	649	2,508
Northern Hardwoods	6,890	41,578	3,772	52,240
Oak	110,101	7,084	6,639	123,824
Red (Norway) Pine	18,558	112,777	4,044	135,379
Scotch Pine	252	25		277
Tamarack	78,373	269	2,164	80,807
White Pine	2,116	6,120	473	8,710
White Spruce	6,568	10,695	633	17,896
Prescription Total	**1,098,733**	**200,554**	**42,034**	**1,341,321**

Table 3.9f summarizes the CP-PMOP estimated annual treatment in cords compared with past volumes sold by cover type. This table recites the annual volume estimates using both the Department FIM based method and Walters-Ek volume estimating methods. Two methods are included here to provide a range of cords based on the volume estimating method used. All summaries and references to volumes used throughout the CP-PMOP plan recites the cord volumes from the Department FIM based method. The Past Area Volumes (1995-2004) are an annual average of the total cords sold over that 10-year period.

Table 3.9f shows that past volumes from the CP-PMOP subsections equated to an average of 104,905 cords per year. The annual average volumes projected from implementation of the CP-PMOP Plan range from 104,259 cords (Department FIM based method, includes cords estimated to be derived from even-aged harvest, partial cut and field visit acres) to 134,132 cords (Walters-Ek).

In comparing past harvest volumes to proposed treatment levels resulting from this Plan the following should be considered:

1. the stable markets found in CP-PMOP leading to no backlog of wood;
2. past accelerated cuts carried out in the CP-PMOP landscape;
3. harvests in response to disease (budworm) and blowdown events; and,
4. consideration of multiple user groups (wildlife, recreation, cultural resources and unique habitats).

These factors may or may not be encountered during this next 10-year plan implementation period but can have an impact on the acres and volume of timber offered, actually sold or otherwise treated.

Table 3.9f Summary Estimated CP-PMOP Annual Treatment (cords) Compared With Past Area Volumes (cords)

Cover types	Past Area Volumes[2] 1995 - 2004	Projected Annual Treatment[1] 2008 – 2017 Dept FIM-based	Walters-Ek
Even-aged			
Aspen/BG	64,090	53,270	69,823
Birch	6,555	4,302	6,386
Jack Pine	10,708	6,445	8,288
Balsam Fir	4,410	2,290	2,926
Tamarack	3,780	7,510	8,081
BLS both site indexes	1,699	2,287	3,444
Oak both site indexes	4,191	8,617	12,382
Red (Norway) Pine	4,867	11,112	13,566
White Spruce	941	3,363	1,790
Cedar	194		
Uneven-aged			
NH	3,238	3,830	5,224
Ash LL HW		967	1,352
White Pine	232	601	871
Total	**104,905**	**104,259**	**134,132**

[1] 10-year planned volumes divided equally over plan years
[2] annual average of volume sold over the 10 year period
[3] includes scotch pine acres

3.10 Primary Issue Area: Visual Quality

Focused Issue J1 How will the impacts of forest management activities on visual quality be minimized?

Scenic beauty is a primary reason people choose to spend their recreation and vacation time in or near forested areas. Where working forests exist near recreational trails, lakes, waterways and public roads, field staff will consider the potential impacts of forest management activities on the visual quality of the site both during and following forest management activities.

GDS J1a Impacts of forest management on visual quality will be minimized.

In 1990, representatives of the Minnesota Resort Association and the Minnesota Forest Industries convened to address concerns about the specific impacts of various forest management practices on visual quality. A Timber and Tourism Steering Committee was formed to enhance communication, promote understanding and continue to discuss common concerns. Under the leadership of the steering committee, public and private forestry interests came together and developed a set of visual quality guidelines that are available to Forestry Areas. Prior to implementation of the SFRMP process, these guidelines were an early effort to consider visual issues as forest management was practiced.

Visual concerns were accommodated as the 10-Year Stand Exam Lists and New Access Needs lists were developed. Field staff consulted recreation trail / roads and highway layers and applied local knowledge and experience to avoid visual impacts when possible.

Further, as field foresters site visit and record stand objectives, as part of the *Silvicultural Prescription Worksheet* and also as a part of timber sales supervision and inspections, guidelines to maintain visual quality will be implemented. Particular consideration will be given to the *Visual Sensitivity Classifications* as developed between DNR and the following counties within the CP-PMOP: Becker, Beltrami, Cass, Clearwater, Crow Wing, Hubbard and Itasca; and, to nationally designated scenic routes including: the *Paul Bunyan Scenic Byway; Great River Road Scenic Byway*, and state designated *Lake Country Scenic Byway.* Foresters will also be alerted to resources such as *Visual Quality Best Management Practices for Forest Management in Minnesota, May 1994.*

Strategies

J1a. 138 Apply the MFRC *Voluntary Site-level Forest Management Guidelines* and the *Visual Quality Best Management Practices for Forest Management in Minnesota,* as they apply, to all vegetative management activities.

The MFRC *Voluntary Site-Level Forest Management Guidelines* contain recommended forest management techniques that will minimize the impacts of vegetative management activities on visual quality. *Directions 2000, The Strategic Plan, Objective 3.3,* states that the "*DNR will apply the appropriate guidelines so that visual quality is not adversely impacted during forest management activities."*

Examples of appropriate *MFRC Voluntary Site-Level Forest Management Guidelines* are listed below.

1. Reducing visual impacts due to alignment and location of roads by locating roads and trails to minimize visibility from nearby vantage points, such as scenic overlooks, streams, and lakes.
2. Reducing visual impacts of apparent harvest size by creating narrow openings into harvest areas to limit view from public roads, lakes and rivers, or recreation areas.
3. Reducing visual impacts of slash by favoring practices that allow for dispersed slash on the site, rather than piling slash, where dispersed slash does not conflict with management objectives or reforestation.
4. Reducing visual impacts of mechanical site preparation by use of low-impact site preparation methods, such as patch or row scarification.
5. Reducing visual impacts of timber stand improvement by timing logging so that it will not occur during periods of peak recreational use.

J1a. 139 Review and update as appropriate the *Visual Sensitivity Classification county maps.*

3.11 Primary Issue Area: Other Statutes

Focused Issue K1 How will foresters and wildlife managers achieve the goals of this plan and remain consistent with state and federal statutes?

Vegetative management on state forest lands is subject to a wide range and variety of existing statute, DNR policy, directives, and guidelines as well as vegetative management plans and guidelines for specific geographic units (i.e. WMAs). Chapters 2 and 3 of this plan summarized the range of documents and processes that must be considered as vegetative management decisions are made. These documents and processes must be considered at both the landscape planning level (during development of the CP-PMOP SFRMP, 10-Year Stand Exam List and New Access Needs List) and also at the stand specific level when field foresters site visit and determine specific treatments to apply through the *Silvicultural Prescription Worksheet.*

GDS K1a Forest management activities will continue to adhere to state and federal statutes.

Vegetative management will implement all appropriate statue, policy, guidance documents, and procedures such as the following:

1. Fish and Wildlife Directive No. 070205 *"Timber Harvesting on WMAs and AMAs";*
2. *Sustainable Forest Resources Act*, *1995;*
3. *Interdisciplinary Forest Management Coordination Framework*, *2007*;
4. State and federal-endangered species legislation and associated species lists;
5. Vegetative management related to Scientific and Natural Area guidelines and policy;
6. Coordinative agreements with U.S. Forest Service relating to the Chippewa National Forest;
7. Directives as established in the Trust Land Policy Act. MS 127A.31, and MS Chapter 90, The Timber Act, specifically 90.02, 90.041, 90.042, 90.41;
8. MS Chapter 84A, specifically 84A.31; and Chapter 89, specifically 89.001 thru 89.012; Chapter 89A, specifically 89.001 thru 89.012; and,
9. *Directions 2000, The Strategic Plan*.

Strategies

K1a. 140 Invite comment from, and coordinate with adjacent landowners.

K1a. 141 Ensure that forest resource managers maintain a working knowledge of all applicable state and federal statutes, rules, guidelines, and policies.

K1a. 142 Ensure that DNR forest managers have access to and consider appropriate related resource management policy, guidelines and plans of other divisions when vegetative management is prescribed.

3.12 Primary Issue Area: Cultural Resources

Focused Issue L1 How will cultural resources be protected during forest management activities on state administered lands?

GDS L1a Forest management activities will protect cultural resources on state administered lands.

A cultural resource is an archaeological site, cemetery, historic structure, historic area, or traditional use area that is of cultural or scientific value. Cultural resources are remaining evidence of past human activities. To be considered important, a cultural resource generally has to be at least 50 years old. Examples of cultural resources are archaeological remains of an historical or ancient Indian village, an abandoned logging camp, a portage trail, a cemetery, food gathering sites such as ricing camps and sugarbushes, or a pioneer homestead. They often possess spiritual, traditional, scientific, and educational values and are assets to be considered as forest management is applied.

The following are the primary guidelines and policy field foresters are directed by as cultural resources, or the potential of cultural resources, are encountered:

1. Division of Forestry Circular letter 3460-5 dated 6-1-99; which outlines data search procedures involving the division archeologist;
2. Division of Forestry *Timber Sales Manual*, policy and procedures;
3. MFRC *Voluntary Site-level Forest Management Guidelines*;
4. *National Historic Preservation act of 1966*; and,
5. *Archeological Resources Protection Act of 1979.*

In addition, the DNR will provide the 10-Year Stand Exam List, New Access Needs List and Annual Stand Exam Lists to the local tribal agencies as part of the public review and comment process.

Strategies

L1a. 143 Subsection plans will consider the impacts of forest treatments on cultural resources consistent with all adopted DNR policy and guidelines.

The DNR's forest archeologist maintains the latest information about recorded cultural resources in the area covered by the CP-PMOP Plan.

When Annual Stand Exam Lists are prepared or Annual Plan Additions are developed, DNR policy requires that they be reviewed by the DNR forestry archaeologist for known or suspected cultural resource locations. Stand locations are checked against the inventory of recorded cultural resources and are evaluated to assess their potential to contain unrecorded cultural resources. The archaeologist notifies the Forestry Areas regarding whether or not a cultural resource concern is identified for any of the planned or added stands. In addition, if an undocumented cultural resource is found during a stand site visit, it will be noted and reported to the forest archaeologist. If a stand has a cultural resource concern, specific management strategies for protecting the cultural resource will be incorporated into sale design and permit regulations or other forest management activities (e.g., site preparation and road construction).

The overall objective is that field foresters will have access to cultural resource information, be trained in field level identification of potential sites, and will share known information with the forest archaeologist and other field foresters. The cultural resources will be protected and preserved as forest vegetation management is implemented.

L1a. 144 Share data on known cultural sites and consider impacts to these sites as silvicultural treatments are applied.

L1a. 145 Increase cultural resource training for field staff, stress the importance of preserving cultural resources, and encourage the reporting of new sites.

L1a. 146 Evaluate the existing Cultural Resource Review procedure to improve efficiency and reduce time required for site review.

3.13 Primary Issue Area: Rare Species / Features

Focused Issue M1 How can rare plants and animals, their habitats, and other rare features be protected?

Protecting rare features on state lands is a key component of ensuring species, community, and forest-level biodiversity in these subsections. In 1978, the Minnesota Legislature, through the Legislative Committee on Minnesota Resources (LCMR), established requirements for the DNR (Natural Heritage Program) to collect and disseminate data on Minnesota's significant biological resources. Information on the distribution, abundance, and ecology of rare species, their habitats, and other rare features gathered by the DNR (Minnesota County Biological Survey and Natural Heritage and Nongame Research Program) provides much of the basis for determining the status of rare features in the state. The DNR acknowledges its leadership role in advocating for maintaining habitat of rare features throughout the state, regardless of ownership, and in protecting and providing habitat for rare and threatened species on state lands (*Directions 2000, The Strategic Plan*). Element occurrence information is maintained on the Natural Heritage data system that can be accessed by DNR personnel. These recorded locations are kept up-to-date, and continually being added to as additional data are received from qualified observers and from the County Biological Survey efforts. Appendix O, *Areas of High or Outstanding Biodiversity within the CP-PMOP* identifies where surveys have been completed and acreages of identified sites. Appendix J identifies *Native Plant Communities* and their S-Ranks as

GDS M1a Forest management will continue to implement measures to sustain or enhance existing biodiversity.

Biodiversity will be maintained and increased as forest management is practiced on state forestlands. The primary procedures that direct activities relative to maintaining and increasing biodiversity include the following:

1. In the department's *Directions 2000*, *The Strategic Plan,* DNR:
    - acknowledges a leadership role in advocating for and maintaining habitat for rare features throughout the state, regardless of ownership, and in protecting and providing habitat for rare and threatened species on state lands;
    - states that a forest with a variety of tree species, native plant communities, and age classes provides habitat for more species and has greater potential to provide a sustainable yield of timber;
    - states that DNR will develop compatible forest information across all ownerships, focusing on spatial features of landscape and coordinate access to databases that provide information on forest composition, wildlife habitat, rare species, and cultural resources; and,
    - states that forests will support self-sustaining fish and wildlife populations (especially those species listed as threatened or endangered);

2. The *MFRC's Voluntary Site-Level Forest Management Guidelines* for landowners, loggers, and resource managers advises that the best information on occurrence of sensitive native plants sites and communities is being gathered by the Minnesota County Biological Survey (and should be considered as forest management is implemented);

3. Minnesota Statutes, Section 84.0895: Endangered Species statute;

4. Minnesota Rules, Chapter 6134: *List of Endangered, Threatened, and Special Concern Species* (available on DNR Web site);

5. Federal Endangered Species Act of 1973 as amended (16 USC 1531-1544) (See Ecological Services on DNR Web site for list of Minnesota species included);

6. Coffin, B. and L. Pfannmuller, eds. 1989. *Minnesota's Endangered Flora and Fauna*. University of Minnesota Press, Mpls.;

7. Statewide Heritage Conservation Status Ranks (S-ranks) for Native Plant Community Types (elements) in Minnesota, Natural Heritage and Nongame Research Program and Minnesota County Biological Survey, Minnesota Department of Natural Resources; MN DNR, 2004.; and,

8. Bald and Golden Eagle Protection Act and Guidelines 2007.

Strategies

M1a. 147 Complete the Minnesota County Biological Survey (MCBS) for all counties within the subsections.

MCBS sites are areas of land, 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 MCBS site provides a geographic framework for recording and storing data, and compiling descriptive summaries.

These MCBS sites currently provide intact, functional ecosystems and the ecological and social benefits of associated ecosystem services (e.g., water quality). Within areas of statewide biodiversity significance, high quality, representative NPCs generally predominate, providing habitat for associated plant and animal species. These areas often contain concentrations of rare species and rare NPCs. They also

serve as ecological reference areas to improve understanding of natural processes and ecosystem function, and to help evaluate the effects of management on biodiversity.

Through a systematic, statewide survey process conducted by the MCBS the counties within the CP-PMOP, subsections are being evaluated or have been scheduled for evaluation, to identify areas of statewide biodiversity significance (see Figure 3.13a).

MCBS sites are ranked according to the four levels identified below in order to communicate the relative significance for native biological diversity of surveyed areas to natural resource professionals, state and local government officials, and the public. Important factors in ranking MCBS sites include:

1. occurrences and types of rare species;
2. occurrences and types of rare NPC elements;
3. size of NPC occurrence and the context within which these elements occur;
4. exhibits the potential for intact landscape-level processes (e.g., natural disturbances); and,
5. encompasses examples of high quality NPCs.

MCBS site boundaries are initially determined through aerial photo interpretation and are revised following field inventory. Some MCBS sites may be split into additional MCBS sites or subsites, to reflect different biodiversity ranks. Contiguous MCBS sites forming a large, functional landscape may be ranked uniformly according to the landscape criteria. These guidelines are intended to be applied across the state, but not all criteria may be applicable to all regions -- e.g., portions of the state are highly fragmented and completely lack significant components of functional landscapes. Consultation with other plant and animal survey staff working within the same ECS subsection is essential to determine the overall statewide significance of MCBS sites across the subsection. In addition, biodiversity significance rankings may need to be updated as survey work is completed in these ECS subsections.

Based on the above process, MCBS sites receive one of the following ranks:

1. **O - OUTSTANDING.** MCBS sites containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state;
2. **H - HIGH.** MCBS sites containing the “best of the rest” such as MCBS sites with very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes;
3. **M - MODERATE.** MCBS sites containing significant occurrences of rare species and/or moderately disturbed, native plant communities and landscapes that have a strong potential for recovery; and,
4. **B - BELOW MCBS MINIMUM BIODIVERSITY THRESHOLD (BMT) FOR STATEWIDE SIGNIFICANCE**. MCBS sites lacking significant populations of rare species and/or natural features to 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.

Figure 3.13a identifies the status of the MCBS surveys for counties within the CP-PMOP subsections.

Figure 3.13a Status of Minnesota County Biological Surveys Within the CP-PMOP, 2007

County	MCBS survey complete	MCBS survey partial	MCBS survey not started yet	MCBS Published
Becker		x		
Beltrami			x	
Cass	x			
Clearwater		x		
Crow Wing	x			
Hubbard		x		
Itasca		x		
Koochiching			x	
Mahnomen	x			x
Morrison	x			x
Ottertail	x			
Todd	x			
Wadena		x		

Upon completion of the survey, MCBS results include the following information about sites of statewide biodiversity significance:

1. MCBS biodiversity significance maps for each subsection;
2. MCBS ecological evaluations (recommendations) for MCBS sites of Outstanding and High statewide biodiversity significance;
3. Element Occurrence Records (EORs) for documented rare feature locations;
4. Vegetation plot data releve sampling of representative and high quality NPCs; and,
5. NPC mapping for MCBS sites of Outstanding and High statewide biodiversity significance.

Published MCBS sites of biodiversity significance have been completed for two counties within the CP-PMOP subsections: Morrison and Mahnomen. Within these two counties exist 29 sites ranked as High or Outstanding Biodiversity. Of these 29 sites, six are located at least partially within state forest boundaries and were available as the CP-PMOP Plan and 10-Year Stand Exam List was prepared (See Appendix O, *Areas of High or Outstanding Biodiversity*). In addition, the 10-Year Stand Exam List was reviewed by Ecological Resources staff against other known but not yet published locations of biodiversity sites. The CPMOP team considered this review, and resulting stand comments were incorporated into the SFRMP FIM database. This information will then be available to field staff as stands are site visited and management objectives determined. MCBS information is considered at three levels: 1) preparation of the Plan and 10-Year Stand Exam Lists; 2) preparation of Area Annual Plan Lists or Annual Plan Additions; and 3) as *Stand Silvicultural Prescription Worksheets* are prepared.

M1a. 148 Maintain the ecological integrity of Native Plant Communities (NPCs) by documenting and managing known locations with a statewide rank of critically imperiled (S1) or imperiled (S2), and those with S-ranks of S3 to S5 that are rare or otherwise unique in these subsections.

During site visit of stands on an Annual Stand Exam List, foresters will implement the *Stand Silvicultural Prescription Worksheet* process that among other factors considers the NPC Class characteristics to determine most appropriate management. NPC Class characteristics are outlined in the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province*. Additional information to help determine what NPC Class a stand is located in will become available as MCBS staff completes the NPC mapping for MCBS sites of Outstanding and High statewide biodiversity significance.

The NPC *Field Guide* and additional information (e.g., *Suitability of Tree Species by Native Plant Community*, http://www.dnr.state.mn.us/forestry/ecs_silv/index.html will provide foresters with a suite of options to help determine which tree species are most appropriate for the identified NPC.

M1a. 149 Consult the Natural Heritage database (including the rare features database) prior to prescribing or implementing forest management activities.

DFFC Statement
The full range of all growth stages is well represented on the landscape.

3.14 Primary Issue Area: Managing Impacts

Focused Issue N1 How should the impacts of forest insects and disease on forest ecosystems be addressed?

GDS: N1a Forest management will minimize damage to forests from native insects and diseases.

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

Minimizing impacts to forest resources from native insects and diseases is a priority element for field staff. The primary directives and resources which guide field staff in managing these potential impacts includes the following:

1. Division of Forestry's *Forest Development Manual - Section D -Cover type Management Guide;*
2. DNR Insect and Disease Program publication library, including:
    - *How to Identify and Manage Pine Bark Beetles* -DNR publication
    - *How to Manage Jack Pine to Reduce Damage from Jack Pine Budworm* - USDA Forest Service NA-FR-01-94
    - *Spruce -Fir Silviculture and the Spruce Budworm in the Lake States* - Mich Coop Forest Pest Management Program Handbook 83-2
    - *Two Lined Chestnut Borer* - USDA Forest Insect and Disease Leaflet 168
    - *The Bronze Birch Borer* - Mark E. Ascerno - Mn Extension Service - AG_FS_1417-A
    - *How to Identify and Minimize White Trunk Rot of Aspen* - USDA Forest Service publication HT-63
    - *How to Identify Hypoxylon Canker of Aspen* - North Central Forest Experiment Station - 1976 –5;
3. *MFRC's Voluntary Site-level Forest Management Guidelines; and,*
4. *Field Guide to the Native Plant Communities of Minnesota - The Laurentian Mixed Forest Province*

Strategies

N1a. 150 Manage identified forest insect and disease occurrences to contain and reduce impacts, using techniques appropriate for the species involved.

Information gathered and provided by the agencies and resources noted above is used as a basis for decisions regarding where and when insect and disease problems require action involving vegetation management. In responding to occurrences, field staff will prepare collaboratively developed intervention plans *before* pest outbreaks (e.g., the strategic plan for the cooperative management of gypsy moth in

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

N1a. 151 Identify, document, and monitor native insect and disease populations (e.g. jack pine budworm, ips bark beetle, two lined chestnut borer, or diplodia shoot blight) as part of the *Forest Health Monitoring Program,* and establish occurrence levels above which management action should be taken.

Early identification and risk assessment of new exotic species introductions improve the potential to develop and implement appropriate responses. Monitoring known insect and disease pests, conditions conducive to outbreaks, and populations of harmful exotic plants can provide useful information for predicting potential outbreaks and documenting and predicting range expansion. DNR staff will involve private landowners and local units of government in gathering and disseminating information concerning insect populations and disease outbreaks to help determine when and where preventive measures or control actions must be taken.

Mutually established protocols for data collection and information sharing among federal (EPA, USDA) and state agencies improve capacity to respond to the spread of established exotic species into new areas, new species introductions, and outbreaks of established pests and diseases.

N1a. 152 Manage the vegetative content and structure of stands to reduce the potential impact of insects and disease.

Focused Issue N2 How will threats and invasions of exotic species be managed?

GDS N2a Damage to forests from exotic species will be minimized.

Establishment of populations and subsequent damage to forest ecosystems by invasive, exotic species results partially from rapid intercontinental and global trade and travel. Natural resource managers are concerned about the introduction and establishment of exotic insect, disease, and plant species on public land. Invasion of forest ecosystems by exotic species can cause significant economic losses and expenditures for control because they destroy or displace native plants and animals, degrade native species habitat, reduce productivity, pollute native gene pools, and disrupt forest ecosystem processes (e.g., hydrological patterns, soil chemistry, moisture-holding capability, susceptibility to erosion, and fire regimes). Examples of exotics with known adverse effects on Minnesota forest resources include: white pine blister rust, gypsy moth, and European buckthorn (all of which have been documented in these subsections). There is potential for significant adverse impacts from other species present in these subsections, such as: tansy, spotted knapweed, purple loosestrife, and leafy spurge. Management will seek to minimize impacts from these species, limit the introduction of new exotic species, and minimize the impact of control measures on vulnerable native species.

Local introductions and spread of harmful exotic plants can occur through several activities. Forest management activities have significant potential as an avenue for unintentional introductions of exotic plants, especially in less developed portions of the subsections. Establishing and promoting practices that minimize these introductions will slow the spread of harmful exotics and reduce the associated losses. Quarantines, early detection, eradication and control measures need to be implemented when and where invasive and exotic species are found in order to minimize their impact on forest ecosystems. Further, to guard against the invasion of non-native species, DNR is considering adoption of policy and guidelines that require contractors to steam-clean equipment before use on new sites.

As stand-level decisions are made, field foresters are required to consider the stand location in relation to the ECS and LTA, to ensure that all prescriptions are consistent with the native plant communities that have evolved on the site (See Appendix E, *Silviculture Prescription Worksheet*). Also when decisions are

made which result in, or lead to stand conversions or replacements, consideration will be given to fully occupy the stand with native species.

Concerning emerald ash borer, this Plan recognizes the program to certify firewood vendors; enforcing statutes that specific species of wood not be imported into the state, and requiring that firewood not be transported more than 100 miles in an effort to curtail importation of wood potentially infested with emerald ash borer. Further, the ash cover type will be reduced by 4% over the next 10 years and 11% over the 50-year plan implementation period.

Strategies

N2a. 153 Identify, document and monitor exotic species populations (e.g. gypsy moth, garlic mustard, common buckthorn, emerald ash borer, and earthworms) as part of the *Forest Health Monitoring Program* on state-managed lands.
Resources that will be employed by field staff to identify, monitor and respond to damage from exotic species includes the following:

1. DNR invasive species Web site, - (http://www.dnr.state.mn.us/invasives/index.html);
2. Exotic Invasive Plant Species in Minnesota - Michael Brakke, August 2005 – Community Forestry Resource Center Web site http://www.forestrycenter.org/search.cfm contains references to use of controlled burning in managing buckthorn and garlic mustard;
3. *Field Guide to the Native Plant Communities of Minnesota - The Laurentian Mixed Forest Province,* Ecological Classification System, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program; and,
4. Gypsy Moth Status- *DNR Forest Insect and Disease Newsletter* Dec 2004.

N2a. 154 Contain and reduce impacts caused by exotic species using proven techniques.

N2a. 155 Manage the impact of exotic species using techniques such as aggressive containment or seasonal timing.

This strategy will be implemented by:

1. Developing management plans and stand treatment prescriptions using recognized exotic species management sources, while considering ecological processes and functions and impacts to native species and habitats;
2. Providing information and training via logger education programs to equipment operators and tree fellers regarding techniques that minimize spread or introduction;
3. Emphasizing the use of fire in management for prevention of spread of exotic species, where appropriate;
4. Modifying or timing harvest operations to minimize exotic species spread, (e.g., frozen ground operation);
5. Appling control measures one to two years prior to harvest operations when feasible: and,
6. Direct-seed all exposed mineral soil with native grasses and herbs immediately after site preparation.

Focused Issue N3 How will natural disturbances such as fire and blow down be considered in forest management decisions?

GDS N3a Natural disturbance events will be evaluated to determine the appropriate forest management response to address the effects on the landscape.

By evaluating known disturbance events (e.g., fire, wind, or insects and disease), land managers will be able to recommend what, if any, forest management activities are necessary to mitigate the impacts of the event. Depending on the scale of the event and potential positive or negative impacts, management

recommendations will range from no action to salvage harvesting and/or prescribed burning. Where quick action is needed to salvage timber from damaged stands, the Annual Plan Addition process including public review will be used.

The following resources will be used by field staff to evaluate events to determine the appropriate response:

1. Division of Forestry's *Forest Development Manual* - Section D -Cover type Management Guide:
    - How to Identify and Manage Pine Bark Beetles - Mn DNR publication
    - Two Lined Chestnut Borer - USDA Forest Insect and Disease Leaflet 168;
2. *Blue Stain- A Guide to the Causes, Identification and Prevention of Blue Stain Damage in Cut Logs*; University of Wisconsin Extension Publication GWQ043;
3. *Timber Salvage Guidelines*; published by North Carolina Dept. of Environment and Natural Resources, Division of Forest Resources at: www.dfr.state.nc.us/storm/storm_timbersalvageguidelines.htm;
4. *How to Evaluate and Manage Storm-damaged Forest Areas*; by Barry, Doggett, Anderson, and Swain; Management Bulletin RS-MB 63, Sept 1993, USDA Forest Service Southern Region, Forest Health, Asheville, NC. www.forestpests.org/storm;
5. Wallmo, O.C. and J.W. Schonen; 1980; *Response of Deer to Secondary Forest Succession in Southeast Alaska,*. For. Science 26: 448-462; and,
6. *Woodland Wildlife Management,* Miller, Brian K. Woodland Cooperative Extension Service, Purdue University, FNR-102.

Strategies

N3a. 156 Accept a higher level of disturbance in ERF stands, provided the level of impact does not jeopardize the ability to regenerate the stand to the desired cover type or jeopardize the management goals of surrounding stands.

N3a. 157 Evaluate large-scale (i.e., hundreds to thousands of acres) and small-scale (i.e., tens of acres) disturbance events to determine appropriate action.

N3a. 158 Implement efforts to salvage usable timber stumpage from damaged stands in a timely manner to minimize losses due to decay and staining.

Focused Issue N4 How can vegetation be managed to reduce animal damage, crop depredation, nuisance animals, potential spread of animal disease, and possible human health impacts (e.g., Lyme disease)?

GDS N4a Negative impacts caused by wildlife species on forest vegetation will be reduced.

The DNR's *Directions 2000, The Strategic Plan* directs foresters to reduce the vulnerability of forests that includes impacts from wildlife, to levels consistent with forest ecosystem sustainability. Further, *The Strategic Plan*, states that fish and wildlife population goals will continue to be an important consideration in planning timber harvests, old growth management, reforestation, and forest recreation. The Division of Fish and Wildlife advises that field staff use the expertise of the *Wildlife Depredation Program* when regeneration plans call for use of repellents or exclusion techniques. Also the North Central Forest Experiment Station *Manager's Handbook Series* advises field staff to avoid planting susceptible species in locations surrounded by habitat attractive to hare or deer without a plan for protection from browsing. Additional resources to control depredation can be found in *Eastern Deciduous Forest: Ecology and Wildlife Conservation*; Yahner, R.H. 1995, University of Minnesota Press, Mpls. (*Large Mammals as Forest Pests*, pg. 56-60).

Strategies

N4a. 159 Expand the knowledge of field staff related to preventing or reducing damage caused by wildlife through training and/or field level information sharing.

This strategy will be implemented by:

1. conducting training sessions that address the factors that affect damage, potential solutions, and prevention based on research and experience;
2. coordinating field visits at problem sites with area wildlife staff and the appropriate land manager; and,
3. collecting information from damaged sites for database entry and analysis of wildlife damage.

N4a. 160 Consider the potential for wildlife damage to artificial or natural regeneration when prescribing site management measures.

Before stand management objectives are identified, field foresters will work with area wildlife staff to identify sites where potential exists for significant wildlife damage.

N4a. 161 Incorporate damage prevention strategies at all phases of forest management.

In implementing damage prevention, field staff will consider:

1. planting on sites where edge (irregular boundaries) is minimized;
2. planting larger sites;
3. planting susceptible species away from the edge of the site;
4. using protective measures such as fenced enclosures, bud capping, repellents, tree shelters, etc.; and,
5. implementing more efficient protection control measures, clump plantings and/or locate them to be easily accessible.

N4a. 162 Focus artificial forest regeneration efforts in areas less likely to be impacted by wildlife species.

This strategy will be implemented by:

1. avoiding unprotected plantings of susceptible species (i.e., those known to be a preferred food source such as white cedar and white pine) near known seasonal concentrations of deer or other detrimental species';
2. avoiding planting susceptible species in locations surrounded by habitat attractive to ungulates without a plan for protection from browsing;
3. in mixed species plantations, scattering susceptible species among species that are less susceptible to wildlife damage; and,
4. in larger mixed species plantations, planting susceptible species in the middle of the site.

N4a. 163 Apply mitigation strategies where wildlife damage is anticipated (e.g., considering stock sources that are less palatable to wildlife).

Focused Issue N5 How should forest management respond to global climate change within the planning period?

GDS N5a Forest management practices will consider the impacts of climate change on forest lands, and will attempt to mitigate these impacts using current knowledge and future research findings.

Several climate models (e.g., atmospheric-ocean general circulation models, AOGCM[1]) in use around the world predict global climate change. The Intergovernmental Panel on Climate Change (IPCC) refers to climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The models agree that average temperatures are increasing and predict more variable changes in precipitation. This global warming will affect forests and wildlife in Minnesota.[2,3]

Scientists believe the predicted climate change will affect the size, frequency, and intensity of disturbances such as fires and windstorms (blowdown). It will affect the survivorship of existing plant and animal species and the distributions of plants and animals. Even at modest levels, independent studies have found mounting evidence that the current climate change influences plant and animal ranges and behavior[4]. Some plant and animal species may not be able to adapt to the rate of change. Increases in the reproductive capability and survivorship of exotic species, insect pests, and pathogens will impact forests and wildlife. At a landscape level, certain tree species, such as black spruce, balsam fir, birch, and jack pine will respond negatively to increased soil warming and decreased soil moisture. Carbon sequestration by forests and wetlands may be affected because of accelerated decomposition rates.

Most tree species in Minnesota have reached the limit of their geographic range somewhere within the boundaries of the forested portion of the state. Predictions have been made on the potential future distributions of trees.[5] There is a need to facilitate species adaptation to change in response to possible rapid climatic changes.

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

Strategies

The following strategies, as they are implemented, will begin to direct vegetation management towards mitigating and slowing the effect of climate change on most vulnerable species and native communities. Implementation of the appropriate *MFRC's Voluntary Site-Level Forest Management Guidelines* will guide field staff to management activities to maintain or promote or enhance ETS species on the site, and will avoid forest management activities that isolate or eliminate populations of tree species at the edge of their range.

N5a. 164 Reference *the MFRC Voluntary Site-level Forest Management Guidelines* for identification and management of tree species currently found at, or near the edge of their range.

N5a. 165 Maintain or increase species diversity across the subsections.

The forest composition and within-stand diversity goals of this plan will provide a more diverse forest across the two subsections. By maintaining a variety of species across these subsections, the forest will be more resilient and more genetically diverse, thus better able to adapt to the anticipated climate change. Maintaining species diversity within and among stands will minimize the risk of widespread insect and disease outbreaks that could result from adverse climatic change.

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

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

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

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

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

N5a. 166 Ensure connectivity that encourages the migration of plants and animals as climate changes the landscape.

Maintaining forest spatial patterns where patches of vegetation are connected will allow the flow of plants, animals, and processes (e.g., seed dispersal) between suitable habitats. The ability of species to move to a new more hospitable site is a critical survival tactic. The following are some of the techniques that have been used to address this strategy:

1. Stands selected for patch management were located to increase their effective patch size or to increase connectivity between patches, SNAs, riparian areas, and OFMCs;
2. OFMCs were designated around old-growth stands;
3. ERF stands were designated along riparian corridors; and,
4. EILC stand selection for this plan implementation period considered connectivity.

N5a. 167 Evaluate site conditions with respect to climate change when selecting tree species for future forest stands.

Boreal species such as balsam fir, spruce, tamarack, aspen, and paper birch should be selected for cool, moist soils, or northwest to east facing slopes where these species would suffer less temperature and moisture stress. On drier, warmer sites encourage species such as jack pine, red pine, white pine, red maple, oak, or other hardwoods. On deep clay or silty clay loams encourage sugar maple, basswood, and yellow birch.

N5a. 168 Apply the concept of carbon sequestering to remove carbon dioxide from the atmosphere.

Climate models (e.g., *Hadley Centre for Climate Prediction and Research-UK, carbon cycle models*) predict that, as future atmospheric carbon dioxide concentrations increase, global temperatures will increase. Forests have the ability to remove carbon dioxide through photosynthesis and to store the carbon as woody material. Carbon is stored in all forest components including living trees, dead trees, fallen leaves, and soil. The storage of carbon is called *carbon sequestration*. Carbon also remains stored in wood that is harvested and processed into wood products.[1] The carbon remains stored in wood until it is gradually released through slow decay or is released rapidly when it is burned.

Forest management activities, such as ensuring existing stands are adequately stocked and ensuring regeneration is adequate after harvest, sequester carbon. Basically, any activity that provides healthy and productive forests will increase carbon sequestration. Stands will be field examined to determine if there is sufficient advanced regeneration. If the site lacks adequate regeneration, it may be site prepped for planting or seeding with an appropriate species to result in a more fully stocked stand. Stands that contain a variety of species are more likely to fully occupy a site, increasing the overall wood volume grown on the site. Increasing the biomass over what is currently on these under-stocked sites will help sequester carbon.

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

1. Balance the age-class distribution in even-aged managed cover types;
2. Emphasize longer-lived species;
3. Use longer rotations on forested wetlands cover types;
4. Designate forest stands to be managed as extended rotation forest (ERF);
5. Reserve and maintain old-growth forests;
6. Increase timber productivity; and,
7. Retain leave trees, snags, and coarse woody debris on harvested sites.

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