Chapter 3: General Direction Statements and Strategies

Section **Page**

3.0 Introduction

In response to the final list of issues identified in Chapter 2, the subsection 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 take into account the direction provided in state statues and rules; department policies, guidelines, and direction (e.g., *Directions 2000, The Strategic Document,* and *A Strategic Conservation Agenda 2003-2007),* and management that will sustain the forest resources 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 achieve the general direction.

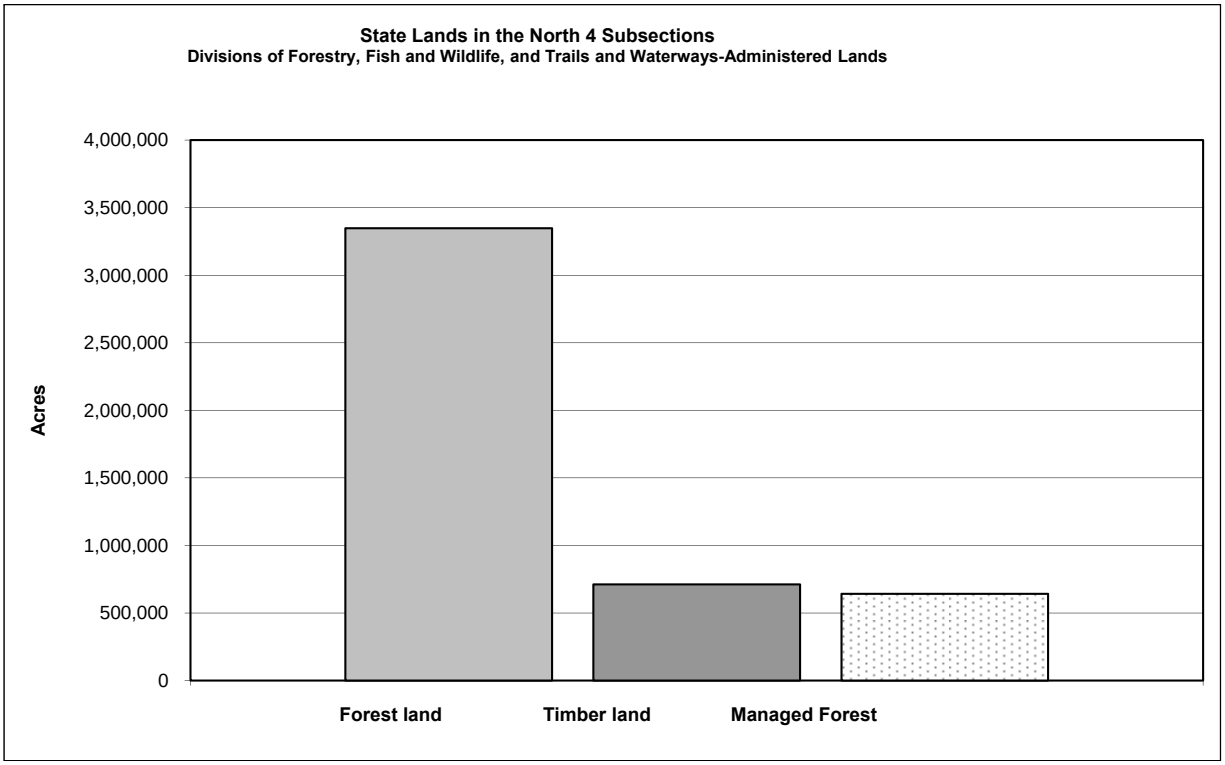
In situations where there is currently an ability to measure and quantify progress, DFFC goals were identified. DFFC goals are long-term (50+ years) goals for the ultimate desired condition of DNR forest lands in the subsections. Examples of DFFC goals are: cover-type acres, age-class distribution, amount of young and old forest, and cover-type treatment levels (e.g., harvest level). DFFC goals, general direction strategies (Chapter 3), and cover-type management recommendations (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 step of the plan provides recommended treatment levels by cover type to move toward the DFFC goals a 10-year stand treatment list, which will include information regarding locations, acres, and prescriptions for stands selected for treatment. The GDSs,

strategies, and DFFC goals presented in this chapter guided the selection of stands and the application of treatments to stands selected for treatment.

Under the direction of the Minnesota Forest Resource Council (MFRC) Landscape Program, the North Central Landscape and the Northeast Regional Landscape committees completed reports that included desired future forest conditions for all ownerships in the Northeast and North Central landscape regions, which include the following counties: Itasca, Aitkin, Cass, Becker, Clearwater, Crow Wing, Hubbard, Beltrami (southern half), Cook, Lake, St. Louis, and Carlton. The four subsections included in this plan (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are located in the two ecological sections covered by these MFRC landscape plans, i.e., the Northern Minnesota Drift and Lake Plains and the Northern Superior Uplands. Parts of the planning area are also located in the Northern Minnesota and Ontario Peatlands Section, which has not yet been the subject of a MFRC regional landscape plan. These reports recommend desired outcomes, long-term goals, and strategies for forest lands (specific recommendations were made for five ecosystem types) in the North Central and Northeast landscape regions. The goals and strategies in this subsection plan for state-administered forest lands are generally consistent with those recommended by the regional landscape committees.

Figure 3.a. shows the state land acres administered by the divisions of Forestry, Trails and Waterways, and the Wildlife Section of the Division of Fish and Wildlife in these subsections. Neither Fisheries Section-administered lands, nor state parks are addressed in this plan.

Figure 3.a. Forest Lands, Timber Lands and Managed Forest Lands in the North 4 Subsections



Forest land consists of all lands included in the forest inventory from aspen to stagnant conifers, muskeg, lowland brush, and lakes. *Timber land* includes those cover types that are capable of producing merchantable timber. Very slow growing trees (e.g., stagnant lowland conifers) are not included as timber lands. In this plan, *managed* acres are those acres available for timber management purposes. These managed acres are approximately 21 percent of the total forest land (all ownerships) in these subsections. State lands reserved from harvest such as designated old- growth stands and Scientific and Natural Areas (SNAs) (70,090 acres[1]) are not included in 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.

In this chapter, the 20 GDSs and associated strategies are grouped under 12 forest resource management topic areas or categories. Some categories have several GDSs to address the associated issues while others have only one.

3.1 Biological Diversity, Forest Composition, and Spatial Distribution

GDS-1A: Old forest in these subsections is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity.

Consideration of old forest during planning was done to:

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

A forest stand of any particular even-age managed forest cover type is considered old forest whenever its age exceeds the normal rotation age agreed on by the landscape rotation age work group for that cover type. Determining the amount of old forest to be sustained in these subsections required balancing many factors: timber productivity, economic impacts, historical forest conditions, habitat requirements, forest health, and timber quality. The goal is to provide a representation of older forest stands and old forest components that is sustainable over time, balanced with the need to provide a stable timber supply, increased timber productivity, and early successional forest habitat. Information about Minnesota's old-growth forest policy can be found at http://www.dnr.state.mn.us/forests_types/oldgrowth/index.html

[1] 1976 to 1998 Minnesota DNR GAP Stewardship – "All Ownership Types" data.

The type, acreage, and general location of old-growth forests in the North 4 Subsections can be found in the North 4 Subsections *Preliminary Issues and Assessment*, Chapter 3: http://files.dnr.state.mn.us/forestry/subsection/north4/n4chapter3_draft_20070717.pdf

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

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

Uneven-age 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.

GDS-1A Strategies

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

The acreage and age of DNR timber lands to be managed as Extended Rotation Forest (ERF) was provided to the North 4 team by the interdisciplinary statewide ERF Workgroup. Forests managed as ERF are key to achieving DFFCs for the North 4 subsections. Effective ERF (EERF), or "old forest", is the portion of ERF acreage that is actually over the normal rotation age (NRA) for the cover type. Because forest stands designated as ERF can (and should) be in any age class, there are cases where large numbers of acres must be designated ERF to achieve the identified old forest goal, due to the current cover-type age-class distribution. Cover types typically managed under even-age regimes are the focus of ERF designation – such a management designation is unnecessary for cover types managed under uneven-age regimes.

Designated ERF stands are harvested in stages between normal rotation age and maximum rotation age to help achieve the desired tapering distribution in older age classes. The harvest-scheduling model was programmed to consider ERF acreage goals together with other goals (see strategy c, following). There was some resistance to designating younger stands as ERF, so some adjustment was required to the original model run of ERF.

Figure 3.1.b: Extended Rotation Forest Example

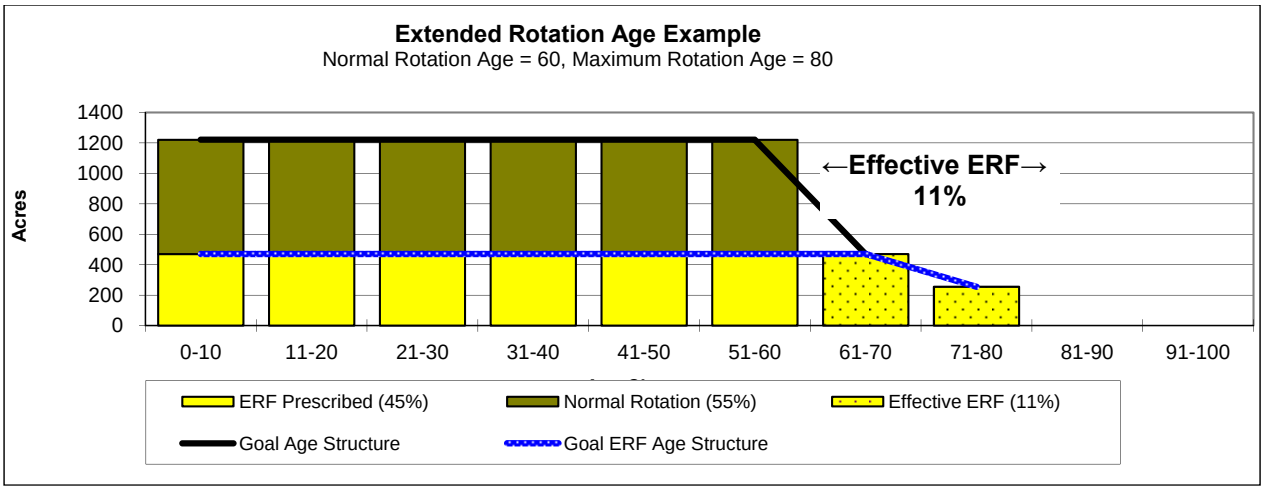


Table 3.1a: Current old forest acres for Even-age Managed Cover Types

Cover type	Acres[1]	Ac >NRA[2]	% >NRA	Goal % >NRA[3]
Aspen/balm of gilead	260,992	65,621	25	11.5-12.0
Birch	10,064	7,220	72	12.0
Black Spruce, Lowland	179,474	49,901	28	11.0 - 16.0
Tamarack	74,008	32,578	44	15.0
Jack Pine	13,506	2,325	17	12.0
Red Pine	20,992	1,493	7	100
White Spruce	10,695	70	1	10.0

[1] Managed Acres: Forestry and Wildlife lands considered available for timber harvest.
[2] Acres of managed forest older than the normal rotation age (NRA) established for the cover type.
[3] Old Forest percentage goal: Percent goal of cover-type timber land acreage to be managed beyond the normal rotation age. Not a range for each subsection – the range indicates the differences among subsections in percentages.

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b. Utilize Remsoft model to prescribe ERF stands in even-age managed cover types so that when a balanced age-class distribution is achieved, the desired amount of effective ERF will be provided.

Due primarily to existing imbalances in age classes in some cover types, there will be fluctuations in the amount of effective ERF until a balanced age-class distribution is reached. After this, fluctuations may occur periodically because of major disturbances such as wind or fire. Table 3.1 b - e shows the percent of effective ERF at the beginning of each decade based on the prescribed ERF and treatment levels (GDS-9) for the cover types. These estimates are based on modeling of proposed stand treatments over the next five decades.

Table 3.1 b - e: State Timber Land Percent Old Forest and Effective ERF Per Decade by Type for Even-age Systems

b. St. Louis Moraines	Period (10 yrs)						Goal %
Type	**0**	**1**	**2**	**3**	**4**	**5**	
Aspen Old Forest Area	19.1	11.2	9.2	12.3	14.1	11.8	
Aspen EERF Forest Area	3.3	3.9	6.3	10.4	13.0	10.3	12.0%
Birch Old Forest Area	45.3	24.0	6.9	0.0	1.6	15.4	
Birch EERF Forest Area	11.1	5.3	1.1	0.0	1.6	15.4	12.0%
Red Pine Old Forest Area	13.6	16.0	17.0	18.4	22.6	25.3	
Red Pine EERF Forest Area	13.6	16.0	17.0	18.4	22.5	25.2	53.3%
Jack Pine Old Forest Area	16.7	12.7	8.6	11.1	10.6	16.2	
Jack Pine EERF Forest Area	0.0	3.1	3.7	8.9	8.5	14.1	12.0%
White Spruce (planted) Old Forest Area	1.7	10.5	5.0	28.7	16.2	9.1	
White Spruce (planted) EERF Forest Area	0.6	2.9	2.2	14.0	5.3	2.8	10.0%
Balsam Fir Old Forest Area	38.8	10.1	1.9	0.0	0.0	0.0	
Balsam Fir EERF Forest Area	0.0	0.0	0.0	0.0	0.0	0.0	
BSL (SI 40+) Old Forest Area	36.0	33.1	21.9	16.9	11.1	11.0	
BSL (SI 40+) EERF Forest Area	16.2	13.0	7.7	5.6	4.7	5.3	15.0%
BSL (SI 30-39) Old Forest Area	18.0	25.9	26.3	22.7	19.2	13.0	
BSL (SI 30-39) EERF Forest Area	9.1	14.6	17.5	15.3	14.6	13.0	13.0%
BSL (SI <= 29) Old Forest Area	23.8	24.2	25.6	22.7	22.6	14.5	
BSL (SI <= 29) EERF Forest Area	13.1	14.9	16.6	15.7	16.0	14.5	11.0%
Tamarack (SI 40+) Old Forest Area	47.5	38.5	39.6	31.5	20.3	21.0	
Tamarack (SI 40+) EERF Forest Area	16.0	14.5	20.0	18.6	17.0	18.0	15.0%
Tamarack (SI < 40) Old Forest Area	27.4	28.5	20.1	10.0	13.2	15.1	
Tamarack (SI < 40) EERF Forest Area	13.7	13.6	7.5	2.4	11.9	15.1	15.0%

c. Tamarack Lowlands	Period (10 yrs)						Goal
Type	0	1	2	3	4	5	
Aspen Old Forest Area	23.3	15.2	11.6	10.3	13.9	10.5	
Aspen EERF Forest Area	4.8	3.3	7.3	8.1	13.0	10.5	11.5%
Birch Old Forest Area	40.2	3.4	4.2	4.2	2.0	40.0	
Birch EERF Forest Area	0.0	0.0	4.2	4.2	2.0	28.6	12.0%
Red Pine Old Forest Area	3.6	6.3	6.1	6.3	9.2	13.1	
Red Pine EERF Forest Area	3.6	6.3	6.1	6.3	8.7	11.4	37.2%
Jack Pine Old Forest Area	26.9	16.6	5.4	11.3	10.7	9.7	
Jack Pine EERF Forest Area	8.9	4.3	3.2	10.3	6.9	9.7	12.0%
White Spruce (planted) Old Forest Area	1.5	2.6	6.8	2.6	6.9	1.8	
White Spruce (planted) EERF Forest Area	0.0	0.8	4.2	0.8	3.3	0.8	10.0%
Balsam Fir Old Forest Area	54.3	13.8	1.5	0.0	0.0	0.0	
Balsam Fir EERF Forest Area	0.0	0.0	0.0	0.0	0.0	0.0	
BSL (SI 40+) Old Forest Area	48.1	33.1	19.9	15.2	8.6	10.8	
BSL (SI 40+) EERF Forest Area	14.2	10.5	3.5	3.6	6.2	10.8	15.0%
BSL (SI 30-39) Old Forest Area	18.0	23.5	28.1	25.6	19.8	13.0	
BSL (SI 30-39) EERF Forest Area	9.7	10.8	12.2	9.7	7.0	3.4	13.0%
BSL (SI <= 29) Old Forest Area	19.7	21.2	20.3	18.5	17.0	14.5	
BSL (SI <= 29) EERF Forest Area	7.7	9.4	11.8	12.9	14.1	14.5	11.0%
Tamarack (SI 40+) Old Forest Area	16.5	14.4	12.5	11.7	8.4	4.7	
Tamarack (SI 40+) EERF Forest Area	8.7	7.8	8.2	8.5	6.2	4.7	15.0%
Tamarack (SI < 40) Old Forest Area	5.4	7.1	6.9	6.2	3.5	1.8	
Tamarack (SI < 40) EERF Forest Area	3.4	4.6	4.4	3.8	2.2	1.8	15.0%

d. Nashwauk Uplands	Period (10 yrs)						Goal
Type	0	1	2	3	4	5	
Aspen Old Forest Area	9.7	2.7	4.5	9.2	12.2	12.0	
Aspen EERF Forest Area	1.5	1.1	4.2	9.0	11.9	12.0	12.0%
Birch Old Forest Area	66.1	15.9	0.3	0.0	0.4	21.3	
Birch EERF Forest Area	0.5	0.0	0.0	0.0	0.4	21.3	12.0%
Red Pine Old Forest Area	6.2	9.7	14.3	21.4	25.5	25.9	
Red Pine EERF Forest Area	6.1	9.7	14.2	21.4	25.4	25.8	53.3%
Jack Pine Old Forest Area	19.0	18.6	9.2	7.6	12.1	9.7	
Jack Pine EERF Forest Area	2.4	7.0	6.7	6.1	11.8	9.7	12.0%
White Spruce (planted) Old Forest Area	0.6	0.0	6.1	0.9	15.2	23.0	
White Spruce (planted) EERF Forest Area	0.0	0.0	6.1	0.9	12.9	8.8	10.0%
Balsam Fir Old Forest Area	26.8	10.4	11.8	0.0	0.0	0.0	
Balsam Fir EERF Forest Area	0.0	0.0	0.0	0.0	0.0	0.0	
BSL (SI 40+) Old Forest Area	50.6	44.8	16.9	6.4	4.5	4.5	
BSL (SI 40+) EERF Forest Area	19.4	17.8	7.3	4.8	4.5	4.5	15.0%
BSL (SI 30-39) Old Forest Area	12.1	23.8	27.5	25.6	20.9	12.9	
BSL (SI 30-39) EERF Forest Area	4.4	12.1	13.8	11.4	9.4	6.7	13.0%
BSL (SI <= 29) Old Forest Area	17.8	24.2	23.0	24.8	20.5	15.1	
BSL (SI <= 29) EERF Forest Area	11.1	15.8	17.2	20.4	17.7	15.1	11.0%
Tamarack (SI 40+) Old Forest Area	35.9	27.7	20.4	16.6	9.8	5.3	
Tamarack (SI 40+) EERF Forest Area	20.3	15.7	14.1	10.3	5.1	2.9	15.0%
Tamarack (SI < 40) Old Forest Area	5.1	20.5	19.6	13.6	6.8	0.1	
Tamarack (SI < 40) EERF Forest Area	2.5	13.1	14.1	7.4	2.2	0.0	15.0%

e. Littlefork-Vermilion Uplands	Period (10 yrs)						Goal
Type	0	1	2	3	4	5	
Aspen Old Forest Area	22.5	14.8	12.8	14.1	13.8	8.3	
Aspen EERF Forest Area	7.3	6.5	7.1	9.8	11.0	8.3	11.50%
Birch Old Forest Area	47.9	13.4	12.0	0.0	2.5	12.0	
Birch EERF Forest Area	7.0	6.9	8.2	0.0	2.5	12.0	12.00%
Red Pine Old Forest Area	9.2	12.9	15.3	19.3	26.2	27.6	
Red Pine EERF Forest Area	9.0	12.7	15.1	19.1	26.0	26.2	42.40%
Jack Pine Old Forest Area	20.0	13.0	9.3	11.5	8.9	8.7	
Jack Pine EERF Forest Area	5.3	3.7	6.2	11.4	6.4	8.7	12.00%
White Spruce (planted) Old Forest Area	0.0	0.9	1.8	19.5	16.3	43.1	
White Spruce (planted) EERF Forest Area	0.0	0.6	1.0	14.7	11.8	28.4	10.00%
Balsam Fir Old Forest Area	49.6	10.0	2.4	0.0	0.0	0.0	
Balsam Fir EERF Forest Area	0.5	0.2	0.0	0.0	0.0	0.0	
BSL (SI 40+) Old Forest Area	36.8	29.7	22.4	13.3	9.7	11.0	
BSL (SI 40+) EERF Forest Area	10.0	8.6	8.5	4.7	5.2	7.0	16.00%
BSL (SI 30-39) Old Forest Area	23.4	24.7	21.8	19.0	14.5	13.0	
BSL (SI 30-39) EERF Forest Area	11.7	13.3	12.3	11.2	9.2	7.2	13.00%
BSL (SI <= 29) Old Forest Area	32.3	32.0	23.4	21.9	17.4	15.5	
BSL (SI <= 29) EERF Forest Area	16.1	17.1	14.1	15.6	13.1	15.5	11.00%
Tamarack (SI 40+) Old Forest Area	45.7	40.9	37.1	25.8	20.6	12.8	
Tamarack (SI 40+) EERF Forest Area	27.8	26.1	22.3	13.1	10.1	7.0	15.00%
Tamarack (SI < 40) Old Forest Area	18.2	32.0	22.6	8.6	2.9	3.3	
Tamarack (SI < 40) EERF Forest Area	10.1	23.2	14.4	3.6	1.8	3.1	15.00%

c. The Remsoft harvest-scheduling model selected ERF, using the following criteria provided by the North 4 Core Team:

- Total prescribed ERF targets by type and subsection — Pre-selected plus model selected
- Cover-type Rules (all WP and C) — Pre-selected ERF
- Old Forest Management Complex — Pre-selected ERF
- Patches (those designated ERF) — Pre-selected ERF
- Natural Heritage Locations — Pre-selected ERF
- Ruffed Grouse Mgmt Areas — Pre-selected not ERF; neutral for distance
- Riparian (stands w/in 400’ of trout streams and their tributaries) — Pre-selected ERF
- Watershed Protection Area — Pre-selected ERF; neutral for distance
- Natural Conifer Rule (WS, RP) — ERF positive
- High Production Aspen (A, Bi, Bam) — ERF negative when SI>=70
- Plantation Conifers (WS, RP, JP and SI 60+) — ERF negative
- Natural Heritage Elements buffers — ERF positive
- Priority Open Landscapes — ERF negative
- Riparian (stands adjacent to Major River Centerline -- Traces in Minnesota) — ERF positive
- Riparian (adjacent to DNR 24K Lakes) — ERF positive

• Balance age class targets	Pre-selected plus model selected
• Watershed protection areas	Pre-selected ERF; neutral for distance

Parameters were prioritized from the top down. In addition, the model was programmed to select stands adjacent or in close proximity to each other, to result in some clumping.

d. Manage riparian management zones primarily to reflect old forest conditions.

Site-level forest management guidelines recommend managing for longer-lived conifers within riparian management zones (RMZs) in northern Minnesota. Some portions of RMZs will continue to be managed for early successional species (see GDS-5A, strategies b and c).

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

Field evaluation tools include use of the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province*[2] *(Native Plant Community (NPC) Field Guide),* and associated Silvicultural Interpretations.

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

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

g. Designate ecologically important lowland conifers according to department direction.

Ecologically important lowland conifers (EILC) include stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands, that are examples of high quality NPCs representative of lowland conifer NPCs found in the subsections. Appendix D, Ecologically Important Lowland Conifers (EILC): Acreage Goals and Rationale, describes the method the team used to designate EILC for these subsections. Table 3.1f summarizes the acres designated by cover type. The designated EILC stands will be reserved from treatment during this 10-year planning period, or until such time as designation or release decisions are made by the department. *(DNR Memorandum, July 3, 2000, Old-Growth Forest Guidelines and Protection of Important Lowland Conifer Sites)*

Note: EILC acres will be included in cover-type treatment acres calculations for this 10-year plan. Therefore, EILC designations will not cause a reduction in the treatment level in the black spruce, tamarack, and cedar cover types.

[2]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.

Table 3.1 f: Acres Designated as EILC by Subsection[3]

	Tamarack Lowlands	St. Louis Moraines	Nashwauk Uplands	Littlefork-Vermilion Uplands	Total
Black spruce					
Cover type Total Ac	26,353	17,504	6,570	129,082	179,509
EILC Acres	3,569	2,816	1,000	13,083	20,468
EILC % of Cover type	14	16	15	10	11
Tamarack					
Cover type Total Ac	42,009	5,762	1,746	24,616	74,133
EILC Acres	6,790	787	282	2,455	10,314
EILC % of Cover type	16	14	16	10	14
Cedar					
Cover type Total Ac	7,130	5,164	1,222	30,686	44,202
EILC Acres	1,862	1,102	145	3,670	6,779
EILC % of Cover type	26	21	12	12	15
Stagnant spruce					
Cover type Total Ac	38,340	9,371	4,358	90,715	142,784
EILC Acres	6,813	1,394	951	10,107	19,265
EILC % of Cover type	18	15	22	11	13
Stagnant tamarack					
Cover type Total Ac	23,624	1,806	2,118	6,691	34,239
EILC Acres	9,346	377	1,469	1,040	12,232
EILC% of Cover type	40	21	69	16	36
Stagnant cedar					
Cover type Total Ac	4,562	3,792	1,886	21,028	31,268
EILC Acres	938	828	892	6,656	9,314
EILC % of Cover type	21	22	47	32	30
Total Acres	142,018	43,399	17,900	302,818	506,135
EILC Acres	29,318	7,304	4,739	37,011	78,372
EILC % of Total	21	17	26	12	15

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

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

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

(See Chapter 4, Cover-type Management Recommendations and GDS-3A)
Examples of silvicultural treatments that can retain old forest components include:

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

[3] Acres based on "all_after_exchanges 10/9/02" data (does not include state park acres).

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

j. Consider the status of old forest within subsections when making decisions to add and offer uplanned wood for harvest.

GDS-1B: Species of Greatest Conservation Need and Key Habitats are maintained or enhanced in these subsections.

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

SGCN are defined as native animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Minnesota's SGCN list includes 292 native animal species. Key Habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Minnesota's CWCS identifies Key Habitats in terms of the DNR's three-volume *Field Guide to Native Plant Communities.* Appendix M in Chapter 7 contains a listing of SGCNs and Key Habitats known to occur in the North 4 subsections. By alerting resource managers and the public to SGCN and Key Habitats, activities can be reviewed and prioritized to complement Minnesota's CWCS.

GDS-1B Strategies

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

DNR staff from all divisions will have access to the most up-to-date SGCN and Key Habitat locations by coordinating with the Division of Ecological Resources.

b. Incorporate new SGCN and Key Habitat locations and data as they are collected in these subsections.

SGCN and Key Habitat data are collected to various degrees by MCBS, Natural Heritage & Nongame Research Program, and various other sources. As these new data are compiled they will be made available to DNR staff and applied to management decisions per the *Interdisciplinary Forest Management Coordination Framework*[4] *(Coordination Framework).*

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

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

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

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

Use the *Coordination Framework* to maintain or enhance SGCNs and Key Habitats. Ecological Resources will deliver SGCN and/or Key Habitat management considerations to forest managers for use in making forest management decisions for stands selected for treatment, access routes, and other management or development activities per processes outlined in the *Coordination Framework*.

SGCN and Key Habitat datasets are made available to area staff by Ecological Resources upon request.

GDS-1C: Forest cover-type composition on state lands moves closer to the range of cover-type composition that historically occurred within the ecosystems found in these subsections.

The proposed cover-type change goals reflect the SFRMP team's attempt to increase the acreage of cover types that have declined historically, while maintaining or enhancing important wildlife habitats and plant communities, and providing a sustainable level of forest products. The ecologic, economic, and social considerations used in developing the cover-type change goals for these subsections include:

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

GDS-1C Strategies

a. Increase the acres of jack pine, red pine, white pine, northern hardwoods, oak, white spruce/balsam fir and white cedar using the following actions:

Use the NPC Field Guide as a tool to guide the on-site evaluation of stands for conversion from one cover type to another or managing for mixed forest conditions (species composition and stand structure).

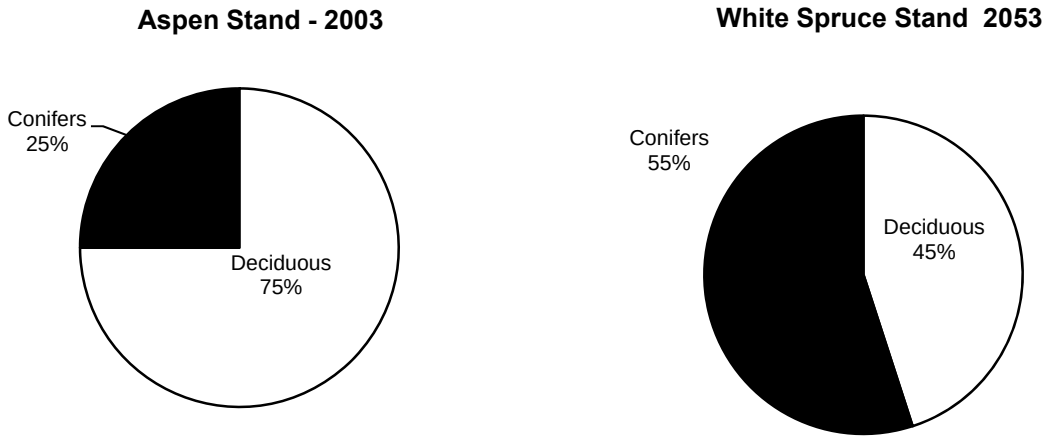
Options available include:

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

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

Figure 3.1d illustrates an example of an aspen stand being converted to a white spruce stand over time. Note that the stand retains a significant component (45 percent) of deciduous species such as aspen. Tree suitability tables (Appendix P) inform appropriate levels of species for a given native plant community.

Figure 3.1d: Example of an Increase in Conifer Cover-Type Acres: Aspen Stand Converts to a White Spruce Stand



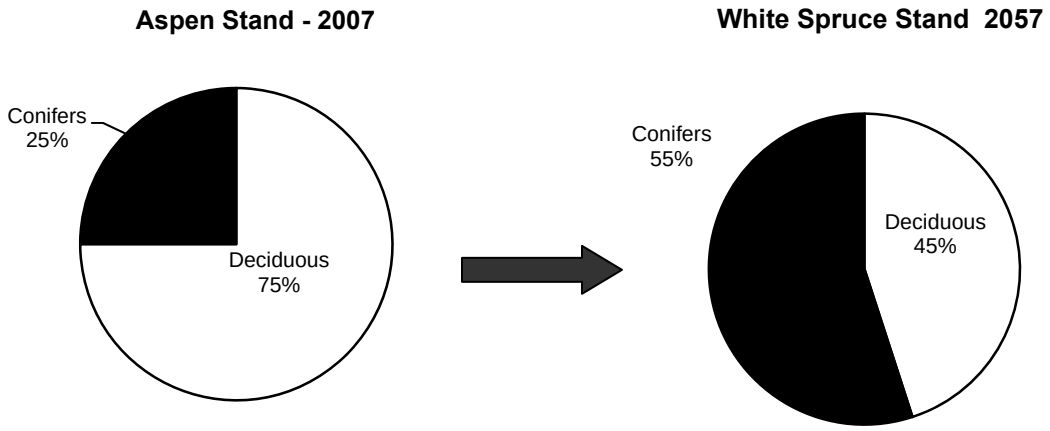
b. Increase mixed-forest conditions in some stands in all cover types.

Implementation of this strategy may range from application of the *Site-Level Guidelines* (e.g., legacy patches and conifer retention) in harvest operations, to other management such as mechanical site preparation, prescribed burning, seeding, and planting (see and strategies for within-stand diversity in GDS-3A).

The strategy to achieve this is to favor species found in native plant communities appropriate to the site, especially tree species that have significantly declined from historic levels such as white pine, red pine, jack pine, white cedar (upland), white spruce, tamarack (upland), and paper birch (*Preliminary Issues and Assessment*, Table 3.4). See Appendix P (tree suitability tables).

Figure 3.1.e. illustrates an example of an increase in mixed forest conditions within an aspen stand. In 2010, 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. By 2030, there is an increase in conifers within the aspen stand (from 15 percent to 25 percent), but the stand remains primarily comprised of aspen and an aspen cover type. Desired species composition would vary with native plant community.

Figure 3.1e: Generalized Example of an Increase in Mixed-Forest Conditions in an Aspen Stand



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

Department personnel have been involved in the MFRC Regional Landscape planning efforts for Minnesota for a number of years. Although the planning processes differ in scope and scale, they share a number of goals and are committed to maintaining close relationships.

Some inherent differences are:

- DNR manages state-administered forest lands by cover type, with goals by 10-year age classes, whereas MFRC Landscape Plan recommendations are based on ecosystem types and growth stages. There is no direct comparison between age-class distributions for cover types and range of natural variation growth stages for ecosystem types. However, the landscape and subsection plans share goals with respect to increasing white pine, red pine, jack pine, white spruce, upland tamarack, yellow birch, and upland white cedar. Older growth stages are being addressed through conversions to long-lived conifers, ERF, and retaining older forest components during thinning and final harvest of some stands.
- MFRC Landscape plans include all ownerships, therefore they do not identify specific acreage goals for recommended changes. When requested, Minnesota DNR will provide MFRC staff with information regarding state land management, to assist them in monitoring accomplishments in the MFRC regional landscapes. Chapter 7 (Appendices) of this plan includes the SFRMP implementation monitoring plan for state lands in these subsections.

GDS-1D: Patch management in these subsections maintains existing large patches and increases the average patch size on state lands over time, with consideration of natural spatial patterns.

There is broad consensus among scientists that managed forest landscapes are more fragmented and contain fewer large patches currently, than landscapes where spatial patterns are determined

primarily by natural disturbance and physical factors. It is estimated that the average overall patch size has declined nearly 50 percent since the 1930s in northeastern and north-central Minnesota (Northern Superior Uplands and Drift and Lakes Plains sections).[5,6] Stand selection and treatment as part of the SRFMP process can significantly reduce forest habitat fragmentation and maintain and promote larger patches over time. The best available information on natural spatial patterns in these subsections was used as a guide to understanding the distribution of patch sizes, cover-type groupings, and age classes for patch management on state lands.[7] Although this plan considered management activities on other ownerships, patch management primarily focuses on identifying opportunities that exist on 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. A **future patch** is defined as a group of adjoining stands that do not currently meet the patch definition, but that will be managed to enhance patch attributes over time.*

Patches are defined by age, size, and general cover-type grouping (Tables 3.1g, h). Patch ages are defined as old, intermediate, and young with an age range by category dependent on cover type. Patch sizes 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 inclusions, residual islands, legacy patches, corridors, and buffers.

Using Cooperative Stand Assessment (CSA) forest inventory data, the DNR Division of Forestry conducted an initial patch assessment for state lands in these subsections.[3] Patches were created in a GIS data layer by dissolving common stand boundaries between stands of the same cover-type group and age class (Table 3.1g). The initial patch assessment information was used as one of the tools for delineating the *current* patches and desired *future* patches on state lands in these subsections as described in the following paragraphs.

[5] Manolis, J. December 2003. *Project Summary: Results from the Minnesota Spatial Analysis and Modeling Project*. Minnesota Forest Resources Council and Minnesota DNR.
[6] MFRC. March 2003. *Recommended Desired Outcomes, Goals, and Strategies: Northeast Landscape Region*. Minnesota Forest Resources Council Landscape Program, Northeast Regional Landscape Committee.
[7] Minn. DNR. January 2008. Addressing Patch Management in SFRMP, page 38 in *SFRMP Process Guidebook IV*. (Draft).

Table 3.1g: Patch Ages by Cover-type Category, From the Initial Patch Assessment

Cover-type Groupings			Age Class Definition (In years)		
Code	Category	Sub-Category	Young	Inter.	Old
UC	Upland Conifers	jack pine and upland black spruce balsam fir	0-30	31-60	>60
		red pine and white pine	0-60	61-120	>120
		white spruce and upland white cedar	0-40	41-80	>80
LC	Lowland Conifers	tamarack, white cedar, and lowland black spruce	0-20	21-90	>90
UD	Upland Deciduous	aspen, birch, and balm of gilead	0-25	26-50	>50
XD	Upland Hardwoods	northern hardwood and oak	0-45	46-90	>90
LD	Lowland Deciduous	ash, lowland hardwood, and balm of gilead	0-45	46-90	>90

Table 3.1 h: Patch Size Classes for Patch Management in SFRMP

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

Table 3.1 i: Patch Type Codes for Patch Management in North 4 SFRMP

Patch Type Code	Description
PYUD	Patch young upland deciduous
PIUD	Patch intermediate upland deciduous
POUD	Patch old upland deciduous
PYXD	Patch young northern hardwoods
PIXD	Patch intermediate northern hardwoods
POXD	Patch old northern hardwoods
PYLD	Patch young lowland deciduous
PILD	Patch intermediate lowland deciduous
POLD	Patch old lowland deciduous
PYUC	Patch young upland conifer
PIUC	Patch intermediate upland conifer
POUC	Patch old upland conifer
PYLC	Patch young lowland conifer
PILC	Patch intermediate lowland conifer
POLC	Patch old lowland conifer

Tables 3.1.j - 3.1.n, following, provide a summary of the initial patch assessment for the North 4 subsections. By size class, the North 4 landscape contains a greater proportion of medium to small patches. By age class, abundance is variable by cover-type grouping; for example, young upland conifer patches are far more common in the North 4 than old upland conifer patches, while lowland conifer patches show a higher abundance in the intermediate and old age classes and lower abundance in the young age class. All North 4 upland cover-type groupings show a lower abundance, in many cases a complete absence, of large patches across all age classes. In particular, large patches of mature or older growth stage upland forest are very rare, and are not easily replaced once they are broken up or moved towards a young growth stage. In contrast, young and intermediate age large upland patches, although currently uncommon on state land included in the North 4 planning area, are more common across all ownerships in the planning area. It is much more feasible to create young and intermediate-age large upland patches where they are desired but not present.

Mature and older growth stage large patches have benefits for some wildlife species (e.g., goshawk, red-shouldered hawks) and provide conditions that favor many native plant species over invasive and weedy plant species. Without attention to the maintenance or creation of large old patches they are likely to be lost through time (as evidenced by the data in tables 3.1.j through 3.1.n) and with them go the plant and animal species that (1) require this type of habitat to survive or (2) benefit from secondary effects of large old patches (e.g., the lower competitive advantage of invasive plant species in large interior forest habitat).

Consideration of the initial patch assessment in stand-level decisions (e.g., grouping stands into harvest blocks based on the initial patch assessment) is an important component of providing for the range of patch conditions on the North 4 landscape. Opportunities to maintain and build large patches, both young and old, are of particular concern for the reasons previously stated. Small and medium sized patches of all age classes, although relatively common on the landscape today, also need attention so that they are retained or created on the landscape where desired and so that diversity of patch sizes is not lost over time in the effort to maintain and create large patches.

Table 3.1.j: North 4 Subsections *Timber Lands* Existing Patch Size Class Summary

Subsection	State Timber Land Acres	Class 1 Acres % of Timberland	Class 2 Acres % of Timberland	Class 3 Acres % of Timberland	Class 4 Acres % of Timberland	Class 5 Acres % of Timberland
St. Louis Moraines	147,881	4,628 3%	5,317 4%	30,395 21%	38,982 26%	68,019 46%
Tamarack Lowlands	163,517	8,753 5%	19,956 12%	39,476 24%	35,174 22%	60,157 37%
Nashwauk Uplands	52,460	0 0%	2,345 4%	9,018 17%	14,301 27%	26,796 51%
Littlefork-Vermilion Uplands	353,834	25,419 7%	25,126 7%	88,376 25%	87,813 25%	129,100 36%
Total	717,692	38,800 5%	52,744 7%	167,805 23%	176,271 25%	284,072 40%

Table 3.1.k: St. Louis Moraines *Timber Lands* Existing Patch Type Summary

PATCH TYPE	Class 1: Large		Class 2: Medium-Large		Class 3: Medium		Class 4: Small-Medium		Class 5: Small		Tally of Patch Code in Subsection	Acres of Patch Code in Subsection
	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES		
PYUD	1	867	8	3,250	71	11,535	189	11,856	1,073	15,417	1,342	42,925
PIUD	0	0	1	344	30	5,112	102	6,205	534	7,889	667	19,550
POUD	0	0	0	0	12	1,633	39	2,478	596	7,076	647	11,187
PYXD	0	0	0	0	1	274	4	199	57	874	62	1,347
PIXD	1	828	1	329	23	3,676	67	3,844	309	4,623	401	13,300
POXD	1	700	2	712	12	1,959	19	1,139	97	1,643	131	6,154
PYLD	0	0	0	0	0	0	0	0	26	250	26	250
PILD	0	0	0	0	2	379	6	324	175	1,990	183	2,692
POLD	1	671	0	0	3	353	42	2,557	307	4,176	353	7,757
PYUC	0	0	1	331	13	1,628	45	2,713	403	5,570	462	10,241
PIUC	0	0	0	0	0	0	17	984	271	3,092	288	4,077
POUC	0	0	0	0	0	0	5	286	97	1,097	102	1,383
PYLC	0	0	0	0	2	269	21	1,233	202	2,559	225	4,061
PILC	1	884	1	351	11	1,856	43	2,670	478	5,676	534	11,436
POLC	1	677	0	0	13	2,262	41	2,493	431	6,087	486	11,520
Total	6	4,628	14	5,317	193	30,935	640	38,982	5,056	68,019	5,909	147,881

Table 3.1.l: Tamarack Lowlands *Timber Lands* Existing Patch Type Summary

PATCH TYPE	Class 1: Large		Class 2: Medium-Large		Class 3: Medium		Class 4: Small-Medium		Class 5: Small		Tally of Patch Code in Subsection	Acres of Patch Code in Subsection
	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES		
PYUD	1	714	4	1,393	56	8,992	149	9,084	1,004	13,625	1,214	33,808
PIUD	0	0	0	0	17	2,346	60	3,559	426	6,240	503	12,145
POUD	0	0	2	934	7	936	37	2,149	494	6,052	540	10,071
PYXD	0	0	0	0	0	0	0	0	11	136	11	136
PIXD	0	0	0	0	6	1,000	25	1,590	130	2,017	161	4,607
POXD	0	0	0	0	1	306	11	687	31	457	43	1,450
PYLD	0	0	0	0	0	0	3	189	68	774	71	963
PILD	0	0	1	336	7	1,090	28	1,696	197	2,870	233	5,992
POLD	0	0	1	351	12	1,666	32	2,026	287	4,503	332	8,545
PYUC	0	0	2	850	6	919	17	910	297	3,352	322	6,032
PIUC	0	0	0	0	2	275	6	397	102	1,155	110	1,827
POUC	0	0	0	0	1	103	4	231	135	1,574	140	1,908
PYLC	0	0	9	3,584	21	3,434	49	3,090	223	3,208	302	13,317
PILC	4	3,943	14	6,634	63	12,347	74	4,666	569	7,985	724	35,574
POLC	4	4,097	13	5,874	34	6,061	75	4,900	444	6,210	570	27,143
Total	9	8,753	46	19,956	233	39,476	570	35,174	4,418	60,157	5,276	163,517

Table 3.1 m: Nashwauk Uplands *Timber Lands* Existing Patch Type Summary

PATCH TYPE	Class 1: Large		Class 2: Medium-Large		Class 3: Medium		Class 4: Small-Medium		Class 5: Small		Tally of Patch Code in Subsection	Acres of Patch Code in Subsection
	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES		
PYUD	0	0	4	1,555	34	4,823	89	5,631	454	6,538	581	18,546
PIUD	0	0	0	0	7	917	24	1,507	173	2,365	204	4,789
POUD	0	0	1	389	3	324	17	1,011	203	2,707	224	4,430
PYXD	0	0	0	0	1	125	0	0	7	96	8	220
PIXD	0	0	0	0	1	118	6	381	35	496	42	995
POXD	0	0	0	0	0	0	2	125	4	89	6	214
PYLD	0	0	0	0	0	0	1	56	15	184	16	240
PILD	0	0	0	0	0	0	0	0	31	310	31	310
POLD	0	0	0	0	0	0	9	526	121	1,691	130	2,218
PYUC	0	0	1	401	8	1,334	33	2,047	307	3,991	349	7,772
PIUC	0	0	0	0	3	398	7	464	135	1,640	145	2,503
POUC	0	0	0	0	0	0	3	201	53	610	56	811
PYLC	0	0	0	0	1	101	6	365	133	1,649	140	2,115
PILC	0	0	0	0	5	651	17	1,112	138	1,949	160	3,713
POLC	0	0	0	0	2	227	14	876	183	2,482	199	3,585
Total	0	0	6	2,345	65	9,018	228	14,301	1,992	26,796	2,291	52,460

Table 3.1.n: Littlefork-Vermilion Uplands *Timber Lands* Existing Patch Type Summary

PATCH TYPE	Class 1: Large		Class 2: Medium-Large		Class 3: Medium		Class 4: Small-Medium		Class 5: Small		Tally of Patch Code in Subsection	Acres of Patch Code in Subsection
	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES	TALLY	ACRES		
PYUD	0	0	3	1,191	110	17,235	291	17,713	1,940	27,474	2,344	63,613
PIUD	0	0	1	422	32	4,730	142	8,727	935	13,032	1,110	26,911
POUD	0	0	1	330	22	3,161	108	6,380	923	11,835	1,054	21,706
PYXD	0	0	0	0	0	0	1	53	6	94	7	147
PIXD	0	0	0	0	1	193	2	98	40	462	43	753
POXD	0	0	0	0	0	0	3	169	22	294	25	462
PYLD	0	0	0	0	1	113	10	575	199	2,604	210	3,292
PILD	0	0	0	0	3	381	25	1,545	290	3,749	318	5,674
POLD	0	0	0	0	19	3,078	95	5,549	733	10,482	847	19,109
PYUC	0	0	0	0	24	3,670	68	4,076	691	8,660	783	16,406
PIUC	0	0	0	0	12	1,839	35	2,051	383	4,632	430	8,522
POUC	0	0	1	343	5	769	29	1,685	386	4,899	421	7,696
PYLC	2	2,004	11	4,293	56	9,188	152	9,837	672	9,897	893	35,219
PILC	11	10,164	23	9,907	118	19,590	226	13,740	1,085	15,342	1,463	68,743
POLC	12	13,250	20	8,640	138	24,429	245	15,616	1,010	15,645	1,425	77,581
Total	25	25,419	60	25,126	541	88,376	1,432	87,813	9,315	129,100	11,373	355,834

"Designated" Patches

Maintaining *and* creating large (Class 1) and medium large (Class 2) old patches of managed upland forest on the landscape is a priority of this plan.

After analyzing the initial patch assessment data in relationship to other pertinent topics (e.g., forest management activities, rare species, forest interior wildlife species, species in greatest conservation need, key habitats, game species), the team, with input and review from field staff, identified 53 patches and future patches for patch management emphasis (Table 7.11 in Appendix N, Chapter 7). All 53 patches have a long-term goal of management to include components of older NPC growth stages. Forty-three of the designated patches direct this effort to size-class 1 and 2 patches, seven focus on size-class 3 patches, and three focus on size-class 4 and 5 patches. Although the case has been made for focusing on large patches, the inclusion of some smaller patch size-classes in the 53 designated patches provides the opportunity to practice old forest silviculture within a patch context at a variety of spatial scales. The intent is to set the stage in the short-term (10 years) for an improved distribution of patch sizes and age classes across the North 4 landscape over the long-term (50 years).

Delineation of the 53 patch boundaries was done by combining the initial patch assessment with documented and/or inferred upland forest NPC *system* boundaries. Each of the 53 designated patches is intended to contain one upland forest native plant community *system* (to be verified and adjusted per initial field assessment as outlined in the Strategies that follow). Each designated patch may contain a variety of cover-type groups (Table 3.1g) because large patches and potential large future patches in these subsections typically include mixed forest of multiple cover types.

Tables 3.1 o – 3.1 r provide a brief summary of the 53 designated patches. A unique code identifies each patch within the North 4 FIM dataset that provides a general idea of the patch direction. An example of a North 4 Designated Patch Code definition is as follows:

FPXXN: **F** = future patch (the group of stands do not currently meet patch definition; management is directed towards a desired future patch condition; if the group of stands do currently meet the patch definition the "F" is dropped from the code).
P = patch
XX = Patch management direction: **XD** = Northern Hardwoods; **UC** = Upland Conifers; **UD** = Upland Deciduous; **LD** = Lowland Deciduous; **WW** = Undefined direction to be determined by field evaluation
N = patch number (used in the master North 4 FIM shapefile to identify individual patches)

Specific locations and the stands included in the 53 North 4 designated patches can be found in the North 4 10-year FIM shapefile. A map showing general locations is provided on pages 7.129 and 7.130, and a table listing the 53 designated patches is provided in Appendix N, Chapter 7.

Table 3.1o: St. Louis Moraines Summary of Designated Patches

Designated Patch Type	Patch Size Class	Tally	Acreage
PXD	1	3	3,267
PXD	2	1	448
PUM	2	2	1,156
PUD	2	2	938
FPXD	1	3	3,039
FPXD	2	1	590
FPXD	3	1	153
FPWW	2	8	3,897
FPWW	3	1	157
FPUD	2	1	267
FPUC	2	4	1,463
FPUC	3	2	306
	Total	29	15,681

Table 3.1p: Tamarack Lowlands Summary of Designated Patches

Designated Patch Type	Patch Size Class	Tally	Acreage
PLD	5	1	34
FPXD	1	1	904
FPWW	2	2	957
FPUC	3	2	381
FPUC	4	1	57
FPUC	5	1	26
Total		8	2,359

Table 3.1q: Nashwauk Uplands Summary of Designated Patches

Designated Patch Type	Patch Size Class	Tally	Acreage
PXD	2	1	611
FPXD	1	1	656
FPXD	2	2	1,189
	Total	**4**	**2,456**

Table 3.1r: Nashwauk Uplands Summary of Designated Patches

Designated Patch Type	Patch Size Class	Tally	Acreage
PUC	2	1	620
FPWW	2	4	2,064
FPWW	3	1	227
FPUC	1	1	732
FPUC	2	5	2,682
	Total	**12**	**6,325**

GDS-1D Strategies

a. Maintain or increase average harvest block size across the landscape.

During stand selection, the Remsoft model was programmed to group stands across the landscape as a way of increasing average patch size over time.

b. During assignment of fiscal years to 10-year stand exam list, group harvests within patches in close temporal proximity.

c. At the area level, using the *Coordination Framework*, initiate the following process for each of the designated patches within the patch:

- Develop short- and long-term plans for management of designated patches following the direction in this plan to either develop the desired future patch or retain features of an existing patch as the patch is managed.
- Classify the patch to NPC *type*. Collect NPC data sufficient to reliably classify the entire patch to NPC *type*. Develop patch management plans and silvicultural prescriptions that reflect application of NPC data.
- Identify all of the stands within the patch to be treated, and coordinate those treatments over the coming decade so that short-term actions complement the long-term patch goal.

d. For the long term (50 years+), manage designated patches to include characteristics of older NPC growth stages.

These conversions may occur in cover types such as aspen, birch, and balsam fir adjacent to, or within patches. This will occur through both natural succession and conversion through active management. See GDS-1B for forest composition goals. Possible management strategies include:

- Shelterwood harvest and protection of advance regeneration;
- Thinning and underplanting in even-age managed cover types;
- Enter some stands in the 0-10 age class to conduct thinning activities to begin long-term cover-type conversion (see GDS-9A);
- Group selection harvests to promote natural regeneration;
- Variable density and variable retention thinning within even-age managed cover types.

e. In the short term (10 years), apply management strategies that contribute to the long-term goal stated in (d) above.

Based on field evaluation,

- Some patches may warrant management toward a younger growth stage as an interim step to retain or build the integrity of the future old patch. Emphasize retention of older NPC growth stage components within *all* designated patches.
- Some patches may warrant allowing some stands to naturally succeed to the next growth stage as a means to achieve the long-term goal.
- All patches will require an explicit effort to combine cover type and NPC data in the short term in order to achieve the long-term goal.

f. For stands outside of the 53 designated patches, incorporate the initial patch assessment in stand-level decisions.

- Look for opportunities to build or retain patches that are lacking on the landscape as displayed in tables 3.1j through 3.1n above.
- When adding unplanned stands, consider their relationship to the initial patch assessment (i.e., Does the unplanned stand complement or hinder identified patch goals?).

g. When possible, cooperate with other landowners in patch management to maintain existing large patches and increase the average patch size across forest land of multiple ownerships.

- Efforts should be made to work with other landowners to identify other large patches not identified during this process.

GDS-1E: Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to sustain or minimize the loss to the biodiversity significance factors on which these MCBS sites were ranked.

MCBS sites are areas of land, ranging from 10s to 1,000s of acres in size that contain intact native plant communities, populations and/or concentrations of rare species, critical animal habitat, and/or functional landscapes representative of pre-European settlement Minnesota. The MCBS "site" provides a geographic framework for evaluating and communicating statewide and regional biodiversity significance.

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

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

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

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

O - OUTSTANDING. MCBS sites containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state.

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

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

B - BELOW MCBS MINIMUM BIODIVERSITY THRESHOLD (BMT) FOR STATEWIDE SIGNIFICANCE. MCBS sites lacking significant populations of rare species and/or natural features that meet MCBS minimum standards for size and condition. These include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movements, buffers surrounding higher quality natural areas, and open space areas.

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

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

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

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

MCBS is currently at various stages within the North 4 planning area. Aitkin, Carlton, and Crow Wing counties are nearing completion. Itasca County is currently in-progress and portions of St. Louis, Koochiching, and Beltrami counties within the planning area are scheduled for survey initiation within the timeframe of this plan. *(*See process description in Section 5.5a on page 5.43, *Preliminary Issues and Assessment).*

Based on MCBS survey work completed as of September 2007, Table 3.1s provides a summary of biodiversity significance and survey priority rankings for MCBS sites that include state lands.

Table 3.1s: Summary of Biodiversity-Significance Rankings for MCBS Sites That Contain State-Administered Lands (May 2004)

Subsection	Rank	Number of MCBS Sites	Total MCBS Site Acres[1]	State Forest land[2] Acres[1]	Timber Land[3] Acres[1]	Acres[1] that Meet the 10-Year Stand Selection Criteria
St. Louis Moraines[4]	O	0	0	0	0	0
	H	18	147,939	65,179	41,513	10,970
	M	38	169,206	43,167	29,059	9,208
	B	3	4,027	122	83	0
	Hp	12	197,372	36,937	25,321	4,246
	Mp	41	91,989	17,106	12,109	2,179
	Total	**112**	**610,533**	**162,511**	**108,085**	**26,603**
Tamarack Lowlands[5]	O	0	0	0	0	0
	H	7	121,673	109,314	50,492	7,224
	M	20	74,244	67,651	29,617	7,173
	B	1	978	122	27	0
	Hp	10	59,072	9,274	5,655	310
	Mp	1	2,105	544	245	0
	Total	**39**	**258,072**	**186,905**	**86,036**	**14,707**
Nashwauk Uplands[6]	Hp	0	0	0	0	0
	Mp	12	34,545	11,069	6,122	1,371
	Total	**12**	**34,545**	**11,069**	**6,122**	**1,371**
Littlefork Vermilion Uplands[6]	Hp	0	0	0	0	0
	Mp	11	42,419	24,520	17,826	2,632
	Total	**11**	**42,419**	**24,520**	**17,826**	**2,632**

[1]Acres are based on the intersection of shapefiles from DNR North 4 SFRMP forest inventory, MCBS sites, and SFRMP adjusted subsection boundaries. Minor acreage differences will occur when newer versions of these shapefiles (and MCBS sites) are used because of updates and/or adjustments to stand and MCBS site boundaries.
[2]*Forest land* acres include all cover types on lands administered by the Division of Forestry and the Division of Fish and Wildlife that are available for management. It does not include lands in a reserve status (e.g., old-growth stands and SNAs) or state park lands.
[3]*Timber land* acres include only the cover types that produce merchantable timber on lands administered by the Division of Forestry and the Division of Fish and Wildlife. It does not include stagnant cover types (e.g., stagnant spruce), lowland brush, etc.
[4]Subsection summary includes MCBS sites within Cass, Aitkin, Crow Wing, Carlton, and Itasca counties. MCBS sites have not yet been delineated within the St. Louis County portion of the subsection.
[5]Subsection summary includes MCBS sites within Aitkin, Crow Wing, and Itasca counties. MCBS sites have not yet been delineated within the St. Louis County portion of the subsection.
[6]Subsection summary includes MCBS sites within Itasca County only. MCBS sites have not yet been delineated within the remaining portions of the subsection.

Forest management activities such as timber harvesting, site preparation, access route construction and maintenance, and tree planting will occur on Forestry- and Wildlife-administered lands within MCBS sites following the guidance and directions contained in Chapter 3 – General Directions Statements and Chapter 4 – Cover-type Management

Recommendations. Forest management activities carried out in those MCBS sites determined to be of greatest concern or importance for SFRMP will emphasize the following strategies to help minimize the loss of the factors on which the MCBS sites were ranked.

GDS-1E Strategies

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

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

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

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

c. Determine location and composition of stand conversions based on NPCs. (GDS-3B)

Foresters will determine the NPC Class for stands planned for site preparation and tree planting forest development activities using the *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province*. Additional information to help determine in which NPC class a stand is located will become available as MCBS completes NPC mapping for MCBS sites of outstanding and high statewide biodiversity significance, and as various other efforts continue to expand the collection and application of NPC data in Minnesota.

The NPC Field Guide and associated ECS Silvicultural Interpretations[8], and information in Appendix P: Suitability of Tree Species by Native Plant Community, will help foresters determine appropriate management direction for the identified NPC.

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

d. Allow some stands to succeed to the next native plant community growth stage, with or without harvest. (GDS-1A, Strategy e.)

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

[8] http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

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

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

Examples include:

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

f. Apply variable density thinning during harvest or reforestation.

Variable density techniques may be prescribed during the planning of timber sales and/or forest development activities. Using this approach, harvest (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.

g. Apply variable retention harvest techniques during harvest.

The main objectives of variable retention are to retain the natural range of stand structure and forest functions. With retention systems, forest areas to be retained are determined before deciding which areas will be cut. Standing trees are left in a dispersed or aggregate form to meet

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

- See legacy patches recommendations in *MRFC Voluntary Site-level Forest Management Guidelines, Wildlife Habitat Section, pages 43-47.*
- During harvest, retain tree species and diameters present at older growth stages, in clumps or dispersed, to more closely replicate pattern after natural disturbance. Include retention of large, downed logs. For example: Leave legacy patches throughout the stand; islands of residual vegetation that include tree species present at older growth stages.

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

ERF designated stands will help maintain old forest conditions within MCBS sites and will retain older growth stages on the landscape for longer periods of time than stands managed as normal rotation forests. When ERF stands are harvested within MCBS Sites make efforts to retain the older forest components that are present in the stand or retain features that allow older forest components to continue developing.

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

j. Locate roads to minimize fragmentation of a MCBS site. (GDS-1D and 10)

Roads contribute to a decrease in interior forest conditions and an increase in terrestrial invasive species abundance. All efforts should be taken to minimize new road construction and enlarging existing roads/trails in MCBS sites.

k. Emulate natural disturbance conditions in large patch management. (GDS-1C)

In this plan, patches are considered to be "large" if they are 250 or more in size. Large patches include both even-age and uneven-age patches. Managing for and maintaining large patches on the landscape will minimize habitat fragmentation as well as provide valuable wildlife habitat for some species. Thirty of the 53 designated patches identified in this plan fall within MCBS sites of biodiversity significance or survey priority areas.

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

l. Apply special management recommendations for known rare features, Species of Greatest Conservation Concern, and Key Habitats. (GDS-1G)

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

Species of Greatest Conservation Need (SGCN) and Key Habitats are identified as part of Minnesota's Comprehensive Wildlife Conservation Strategy (CWCS). SGCN are defined as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Key Habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Minnesota DNR participates in the State Wildlife Grants Program (SWG), created by the US Congress in 2001. Congress mandated that to participate in the SWG Program, states, in partnership with other conservation agencies and organizations, must develop a Comprehensive Wildlife Conservation Strategy (CWCS) to identify and manage their SGCN. Management activities will be carried out in a manner that complements Minnesota's CWCS. See Appendix M on page 7.67 for more details.

m. Defer management of some stands that have been identified as having high conservation value for further assessment (e.g., EILC and nominated natural areas, and rare or representative ecosystems).

- Designated EILC stands will be reserved from treatment during this 10-year planning period or until old-growth guidelines or other EILC guidelines are in place. See Appendix D for more detailed information on EILC acre goals and rationale. *Note: EILC acres will be included in cover-type treatment acres calculations for this 10-year plan. Therefore, EILC designations will not cause a reduction in the treatment level in the black spruce, tamarack, and cedar cover types.*
- Other reasons that may lead to a recommendation to defer a stand from treatment include nominated old-growth, rare native plant communities, rare species habitat, or significant negative impacts to a site's biodiversity significance.

n. Consider timber productivity, trust responsibilities, and other forest management priorities when managing stands in these MCBS sites. (GDS-6)

- Land status and timber productivity will be considered while implementing the other strategies on stands identified for management.
- Areas will follow DNR policy regarding replacing stands that are deferred from treatment.
- Consistent with the *Coordination Framework*, other divisions will have an opportunity to review proposed preliminary MCBS sites.

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

For example:

- DNR resource management staffs will seek to implement stand-level management activities that achieve landscape-level biodiversity goals and objectives across ownerships.
- When assisting private landowners with woodland stewardship plans, provide information on the biodiversity significance of these MCBS sites.

- MCBS personnel will communicate and deliver information about priority MCBS sites of biodiversity significance to other landowners within these MCBS sites.

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

GDS-1F: Rare plants and animals and their habitats are protected, maintained, or enhanced in these subsections.

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

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

GDS-1F Strategies

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

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

f. Incorporate new rare features inventory information as the Minnesota County Biological Survey is completed in these subsections.

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

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

h. During the development of the 10-year stand examination list and annual stand examination lists, land managers check the rare features database and flag those stands proposed for treatment that include a rare feature for follow-up consultation.

If rare feature locations occur in stands proposed for treatment, land managers confer with the appropriate Wildlife or Ecological Services 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 area offices.
- Area staff persons are trained in the use of the Natural Heritage Information System and regularly consult the rare features database as management or development activities are planned and implemented.
- Stand selections or treatments are adjusted or stand prescriptions include mitigation measures to protect the rare plants or animals and their habitat within the stand. Often adjustments are to be deferred until the field visit (see next strategy).

i. Harvest prescriptions, access plans, and other management proposals identify and implement measures that protect rare features.

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

GDS-1G: Rare native plant communities are protected, maintained, or enhanced in these subsections.

Minnesota's native plant communities (NPCs) have been evaluated and assigned an S-Rank based on the Heritage Conservation Status Rank (S-Rank) system developed by NatureServe[9]. The resulting S-Rank is a value (S1 to S5) assigned to a NPC type (or subtype) that best characterizes the relative rarity or endangerment of the NPC statewide (Table 3.1v).

Table 3.1t: Statewide Heritage Conservation Ranks (S-Ranks) for Native Plant Community Types

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

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

Appendix L provides a list of Native Plant Community (NPC) Types and Subtypes and associated Conservation Status Ranks for Minnesota[2] known or likely to occur in the North 4 subsections. *Note: As MCBS and native plant community interpretations progress across the North 4 subsections S-ranks will be revisited and refined as justified.* A complete list of the Statewide S-Ranks for NPC types in Minnesota is available from the DNR Natural Heritage and Nongame Research Program.[10]

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

Because MCBS is a primary source for NPC data and MCBS prioritizes survey efforts within MCBS sites, most documented locations of rare NPCs are within MCBS sites. However, there may also be locations of rare NPCs documented in areas outside MCBS sites. This will become more common as NPC data collection is being completed by other DNR Divisions and a growing number of cooperators within the North 4 subsections.

GDS-1G Strategies

a. Complete the Minnesota County Biological Survey (MCBS) and document known locations of NPCs with a statewide rank of critically imperiled (S1) or imperiled (S2), and those NPCs with S-Ranks of S3 to S5 that are rare or otherwise unique in these subsections.

b. Manage known locations of critically imperiled (S1) or imperiled (S2) NPCs and those NPCs that are rare statewide or with limited occurrences in these subsections to maintain their ecological integrity.

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 (e.g. application of ECS silvicultural interpretations).

DNR personnel have been trained in the use of the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* for identification of NPCs. Additional

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

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.

c. Ecological Resources staff identified stands that are high quality examples of rare native plant communities. Those stands were removed from consideration for placement on the 10-year stand exam list.

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

For a discussion of key habitats and species in greatest conservation need, go to GDS-1B, page 3.13.

3.2 Age-Class Distribution

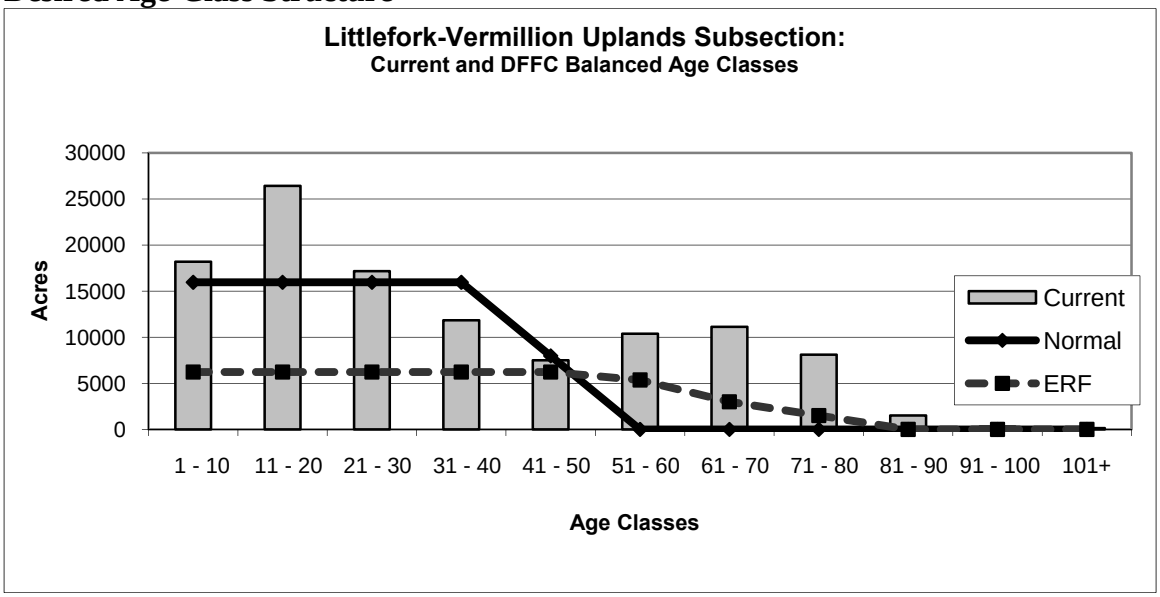
GDS- 2A: Even-age managed cover types will be managed to move toward a balanced age-class structure.

A balanced age-class structure has relatively equal acres in each 10-year age class out to the normal rotation age. A goal is to provide an even flow of wildlife habitat and timber harvest. A steady supply of these resources over time is important to wildlife, recreation, the forest products industry, and the local economies that depend on them.

The current age-class distributions of the aspen, balm of gilead, birch, balsam fir, black spruce, and tamarack cover types indicate an impending decrease in harvest age acres to varying degrees in the near future (10-20 years). This current imbalance of age classes is due to harvest and subsequent fires in the early 1900s, coupled with subsequent lack of markets and low harvest rates. As the second growth forest moves beyond normal rotation age, increased timber demand in recent years has provided an opportunity to create more forest in younger age classes and move these cover types toward a more balanced age over time. A goal is to minimize large fluctuations in harvest level to the extent possible.

Figure 3.2.a., for example, shows the current age-class distribution of the aspen/balm of gilead cover type and the desired future forest composition (DFFC) or goal of an even age-class distribution. The graph includes current conditions and goals for both cover-type acres managed under normal rotation ages and extended rotation ages (ERF).

Figure 3.2a: Comparison of Current Aspen/Balm of Gilead Age-Class Distribution to the Desired Age-Class Structure



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

GDS-2A Strategies

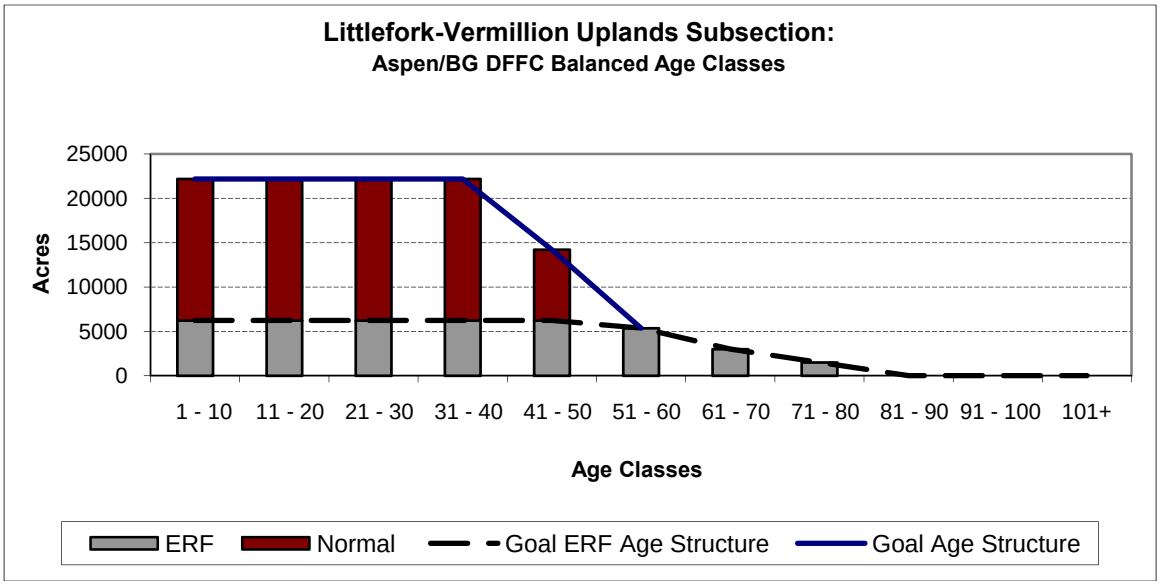
a. Target the selection of stand treatment acres to the appropriate age classes.

The Remsoft model was parameterized to attempt to balance age classes by selecting stands from specific age classes based on criteria developed during the planning process, including normal rotation age, maximum rotation age, and ERF percentage. Achieving a balanced age-class distribution for balsam fir and birch cover types was not possible due to the extent of the current age-class imbalance (see Chapter 4 for specific cover-type information). While it may not be possible to attain this balanced structure within 50 years, it can be accomplished more quickly by adjusting short-term harvest levels. This will also help minimize the effects of the impending decrease in harvestable acres.

GDS-2B: ERF stands in even-age managed cover types will be managed to achieve a declining age-class structure from the normal rotation age to the maximum rotation age.

DNR guidance to SFRMP teams requires the development of a declining age-class structure from normal rotation age to the determined maximum rotation age for each even-age managed cover type. Figure 3.2b shows an example for the aspen/balm of gilead cover-type DFFC for the Littlefork-Vermilion Uplands Subsection.

Figure 3.2b: Desired Age-Class Structure for the Aspen/Balm of Gilead Cover Type



The ERF goal for this cover type is to have 11.5 percent of the acres over normal rotation age (effective ERF) with a declining age-class distribution from normal rotation (45 years) out to the maximum age (80 years). Figure 3.2b illustrates the tapering off of the age-class distribution after age 40 because of the actual normal rotation age being 45 i.e., the mid-point of a ten-year age-class. Achieving the desired declining age-class structure requires harvest to occur between the normal rotation ages and the maximum rotation age.

ERF stands, when they are beyond the normal rotation age (11.5 percent of the cover-type acreage in this example), will provide old forest habitat, recreational opportunities of older forests, and opportunities for large-diameter timber product management.

The following strategies will be used to achieve the desired declining age-class structure in even-age managed cover types:

GDS-2B Strategies

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

The Remsoft model identified a list of ERF stands based on criteria provided by the team and reviewed by field staff (see GDS-1A, strategy b, on page 3.10: Model Criteria for Selecting ERF Stands). Old forest conditions in even-age managed cover types will be achieved by designating some stands in each of these cover types for ERF management. In addition to evenly distributing the designation of ERF stands among age classes, spatial considerations (e.g., patch management) will be used to develop and maintain desired old forest conditions. See GDS-1A.

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

The Remsoft model provided for the achievement of old forest conditions by harvesting appropriate acreages from each age class of ERF over normal rotation age. The remaining un-

harvested acres will contribute to old forest conditions until they reach the maximum rotation age.

GDS-2C: State lands will include representation of each of the Native Plant Community growth stages that historically occurred in these subsections.

Growth stages incorporate both horizontal and vertical developmental stages (stand structure changes over time) and successional stages (species composition changes over time) that occur after a disturbance. For example, in the Northern Wet-mesic Boreal Hardwood-conifer Forest (MHn44) NPC, there are three growth stages separated by one transition period.[11] In the past, growth stages developed through natural disturbances such as wind and fire. Now, growth stages additionally are emulated through forest management activities such as timber harvest, prescribed burns, and forest development activities.

These growth stages are very important to the wildlife species that inhabit these plant communities. Wildlife habitat and the species occurrence can vary with growth stage, for example, white-tailed deer may use the early growth stage of MHn44 for feeding but use the old forest and mature growth stage for winter thermal cover. Northern goshawks will not use the early growth stage of MHn44 but will use the old forest and mature growth stage for nesting and hunting. Songbird populations will change in MHn44 as the community matures, and will become more diverse as the structure becomes more complex with time.

The plan will not establish acreage goals for growth stages by ecosystem type or native plant community. The strategies in the plan will provide representation of all NPC growth stages. Young and intermediate growth stages are adequately represented on the landscape. Older growth stages are more of a concern; management strategies can provide some components of older growth stages in much younger stands by leaving coarse woody debris, snags, super canopy trees, and legacy patches. Stands can also be managed to maintain the existing growth stage or assist in moving the stand to the next older growth stage. Strategies below, the *Field Guide to Native Plant Communities*, and the Silvicultural Interpretations can provide options for accomplishing these goals.

GDS-2C Strategies

a. Determine growth stages stands selected for treatment in these Subsections.

Stands in this plan will be classified to NPC per DNR policy. Encourage the use of growth-stage information in developing stand management prescriptions.

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

Focus on characteristics of older growth stages due to their relative rarity.

[11] 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.

c. Consider the contribution of non-timber land cover types (e.g., stagnant conifer types), inoperable stands, and reserved areas (e.g., old growth, SNAs, state parks) in providing representations of growth stages.

d. Designated representative ecosystems and High Conservation Value Forests per forthcoming DNR direction.

e. Apply ECS Silvicultural Interpretations to management decisions.

GDS-2D: Young, early-successional forest is distributed across the landscape over time.

The 0-30 age group of aspen, balm of gilead, birch, and jack pine cover types represents young, early successional forest in the context of this GDS. The desired long-term cover-type acres and balanced age-class distribution for these cover types will determine the amount of young forest planned to be sustained over time.

- Currently, these four cover types comprise 40 percent (see table 4.1 on page 4.5) of the managed acres in these subsections. Because of the goal to increase the acreage of conifers in these subsections, the long-term result of applying the plan strategies will be that these early successional cover types will comprise 35 percent of managed acres.
- Currently, the 0-30 age group of aspen, balm of gilead, birch, and jack pine cover types comprise 66 percent of the total acres in these four cover types. When a balanced age class is achieved, and conversions to conifers have been accomplished, the 0-30 age group will comprise 63 percent of the total acres in these four cover types. See tables 3.2k-o, following.

Table 3.2a: Littlefork-Vermilion Uplands Early-Successional Forest Cover Types – Acres by Decade

Early-Successional Forest Cover-type Acres Littlefork-Vermilion Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	110886	108692	99704	98964	97348	95593
Birch*	1434	1422	1219	1219	1219	1219
Jack Pine	7694	8165	10003	10151	10475	10826
Total	120014	118279	110926	110334	109042	107638

Table 3.2b: Nashwauk Uplands Early-Successional Forest Cover Types – Acres by Decade

Early-Successional Forest Cover-type Acres Nashwauk Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	23994	23249	20691	20691	20691	20691
Birch*	2686	2686	2686	2686	2686	2686
Jack Pine	2552	2643	3129	3129	3129	3129
Total	29232	28578	26506	26506	26506	26506

Table 3.2c: St. Louis Moraines Early-Successional Forest Cover Types – Acres by Decade

Early-Successional Forest Cover-type Acres St. Louis Moraines						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	64930	61594	58428	58428	58428	58428
Birch*	4050	3738	3486	3486	3486	3486
Jack Pine	2488	2620	2860	2860	2860	2860
Total	71468	67952	64774	64774	64774	64774

Table 3.2d: Tamarack Lowlands Early-Successional Forest Cover Types – Acres by Decade

Early-Successional Forest Cover-type Acres Tamarack Lowlands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	55034	53888	48290	48044	48044	47153
Birch*	1800	1744	1530	1530	1530	1530
Jack Pine	1845	1906	2313	2330	2330	2393
Total	58679	57538	52133	51904	51904	51076

Table 3.2e: North 4 Early-Successional Forest Cover Types – Acres by Decade

Early-Successional Forest Cover-type Acres North 4 Totals						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	254844	247422	227113	226127	224511	221865
Birch*	9969	9589	8921	8921	8921	8921
Jack Pine	14579	15335	18305	18470	18794	19207
Total	279392	272346	254339	253518	252226	249993

Table 3.2f: St. Louis Moraines Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old Littlefork-Vermilion Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	70568	69224	55577	53178	54031	60465
Birch*	525	1019	972	873	431	431
Jack Pine	4741	4463	5789	4435	5918	7104
Total	75834	74706	62338	58486	60380	68000

Table 3.2g: Nashwauk Uplands Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old Nashwauk Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	18657	17238	11627	10211	11049	11639
Birch*	871	2113	2620	1852	623	489
Jack Pine	1696	1540	1678	1240	1751	2080
Total	21224	20891	15925	13303	13423	14208

Table 3.2h: St. Louis Moraines Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old St. Louis Moraines						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	45131	44111	38472	37872	38096	38803
Birch*	2198	2684	2974	1563	1145	1644
Jack Pine	1739	1608	1602	1252	1399	1678
Total	49068	48403	43048	40687	40640	42125

Table 3.2i: Tamarack Lowlands Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old Tamarack Lowlands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	37048	38532	32656	31570	31617	31683
Birch*	886	1261	1279	688	555	574
Jack Pine	1159	808	1380	955	1437	1547
Total	39093	40601	35315	33213	33609	33804

Table 3.2j: North 4 Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old North 4 Totals						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	171404	169104	138332	132830	134794	142590
Birch*	4480	7077	7845	4976	2754	3138
Jack Pine	9335	8419	10449	7882	10505	12409
Total	185219	184600	156626	145688	148053	158137

Table 3.2k: Littlefork-Vermilion Percent of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Percentage of Cover Type Under 30 Years Old Littlefork-Vermilion Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	64	64	56	54	56	63
Birch*	37	72	80	72	35	35
Jack Pine	62	55	58	44	56	66
Total	63	63	56	53	55	63

Table 3.2l: Nashwauk Uplands Percent of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Percentage of Cover Type Under 30 Years Old Nashwauk Uplands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	78	74	56	49	53	56
Birch*	32	79	98	69	23	18
Jack Pine	66	58	54	40	56	66
Total	73	73	60	50	51	54

Table 3.2m: St. Louis Moraines Percent of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Percentage of Cover Type Under 30 Years Old St. Louis Moraines						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	70	72	66	65	65	66
Birch*	54	72	85	45	33	47
Jack Pine	70	61	56	44	49	59
Total	69	71	66	63	63	65

Table 3.2n: Tamarack Lowlands Percent of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Percentage of Cover Type Under 30 Years Old Tamarack Lowlands						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	67	72	68	66	66	67
Birch*	49	72	84	45	36	38
Jack Pine	63	42	60	41	62	65
Total	67	71	68	64	65	66

Table 3.2o: North 4 Percent of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Percentage of Cover Type Under 30 Years Old North 4 Totals						
Cover type	**Current**	**1st Decade**	**2nd Decade**	**3rd Decade**	**4th Decade**	**5th Decade**
Aspen/BG	67	68	61	59	60	64
Birch*	45	74	88	56	31	35
Jack Pine	64	55	57	43	56	65
Total	66	68	62	57	59	63

Regulated harvest of aspen, balm of gilead, birch, and jack pine cover types will ensure that young, early-successional forest will be adequately represented over time. Stands retained in these cover types will be managed to move towards a more balanced age-class structure than currently exists, which will provide a more consistent amount of young forest over time. Most of the harvest in these cover types will occur through clearcut methods. Harvest prescriptions will attempt to mimic the intense wildfires and wind events that occurred naturally to initiate fully stocked, early successional forest. Maintenance of existing large patches and creation of additional large patches in the future will be accomplished by grouping of harvest activities and using a variety of harvest sizes. For aspen, balm of gilead, and jack pine, the emphasis will be on maintaining an adequate amount of young age classes on the landscape through a regulated harvest level. For paper birch, the focus will be on increasing regeneration of birch stands back to birch, especially during the current 10-year planning period.

Young, early successional tree species will also be present in other cover types. Many of the aspen and birch stands that are converted to other cover types will still have a significant component of aspen and birch within the stands (see GDS-1B, Strategy a. and Figure 3.1d). Many of these cover type conversions will occur in aspen and birch stands that are already in decline due to old age, insect or disease problems, or other damage agents.

GDS-2D Strategies

a. Move aspen, balm of gilead, paper birch, and jack pine cover types toward a balanced age-class structure. (GDS-2A)

b. Increase the treatment level for the paper birch cover type. (GDS-9A)

c. Regenerate most paper birch harvest sites to well-stocked, young paper birch stands.
See paper birch cover-type management recommendations in Chapter 4. In the birch cover type, there are currently very few acres (approximately 140 acres, or 0.4 percent of the cover-type acres) in the 0-30 age group.

d. Maintain young, early successional forest in a variety of patch sizes to provide habitat for the associated species.
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. (GDS-1C)

3.3 Within-Stand Composition and Structure

GDS-3A: Species, age, and structural diversity within some stands will be maintained or increased.

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

GDS-3A Strategies

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

See the cover-type management recommendations in Chapter 4.

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

The MFRC guidelines provide direction on retaining leave trees and snags, conifer retention and regeneration, and timber stand improvement (TSI) activities, among others.

c. Use the NPC Field Guide,[12] site index, soils data, and ECS Silvicultural Interpretations to aid in determining the species composition and structure most appropriate for the site.

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

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

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

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

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

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

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

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

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

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

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

[12] 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.

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

These target species historically were more abundant than at present, both in terms of number and distribution. These target species are important to wildlife and biodiversity, as well as providing a variety of forest products over time. The *NPC Field Guide*, site index, soils data, and ECS Silvicultural Interpretations, and observations that the species is now naturally occurring and doing well on the site, can aid in determining the appropriate species for the site.

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

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

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

Some plant communities can naturally exhibit low species diversity. Low species diversity can be natural and has occurred historically in peatlands and in association with large-scale disturbances, particularly fire.

k. Use ERF in some even-age managed stands to encourage greater structural diversity. (GDS-1A)

l. Encourage fruit and mast-producing species.

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

GDS-3B: Some stands on state lands will be managed to reflect the composition, structure, and function of native plant communities.

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

This GDS differs from GDS-3A in that it emphasizes managing for the suite of species, growth stages, and disturbance regimes appropriate to the NPC class or type identified using the NPC Field Guide. Whereas GDS-3A emphasizes species, age, and structural diversity in and of itself

without direct connection to the native plant community. In managed stands, defining tree species diversity and relative abundance, age-class distribution, and structural diversity within a native plant community paradigm lends support to the development and/or maintenance of NPC composition, structure, and function through time. Forest management that incorporates native plant community form and function is more likely to accommodate a greater proportion of Minnesota's native biodiversity than forest management focused on a single or select group of species.

GDS-3B Strategies

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

b. Follow strategies in GDS-2C relating to retaining components of various growth stages in stands.

3.4 Wildlife Habitat

GDS-4A: Adequate habitat and habitat components exist, simultaneously at multiple scales, to provide for nongame species found in these subsections.

Nongame[13] *species* are an important indicator of the biological health of the forest and are important to society for their inherent values. Legal statutes, public expectations and desires of interest groups, and Department of Natural Resources (DNR) internal policies require the consideration of nongame species in the management of state-administered lands. The DNR strategic plan *Directions 2000* (Minnesota DNR 2000) 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."

These subsections are important to the tourism industry in Minnesota[14],[15]. Many tourists appreciate and seek out opportunities to observe nongame species during their trips to this area, where they have a chance to see a number of species that are rare elsewhere, such as the timber wolf, great grey owl, gray jay, black-backed woodpecker, snowy owl, and common loon.

There are 214 nongame species known or predicted to occur within these subsections[16]. Each species has different habitat requirements, some of which conflict. Individual consideration of management needs for each species is therefore impossible to accomplish with a single approach across the planning area[17].

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[13] In this plan, *nongame species* include amphibians, reptiles, and those mammal and bird species that are not hunted or trapped.

[14] U.S. Fish and Wildlife Service. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. *National Overview.* Issued May 2007.

[15] U.S. Fish and Wildlife Service. Wildlife Watching in the U.S.: The Economic Impacts on National and State Economies in 2006.
Addendum to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Report.2006-1.

[16] Minnesota DNR. 2007. *North-4 Subsections Preliminary Issues and Assessment*. Pp 7.2-7.33.

[17] Minnesota Department of Natural Resources, 2006. *Tomorrow's Habitat for the Wild and Rare:*

Several management techniques will be considered to ensure that the subsections are managed to maintain and enhance the habitat of nongame species. The two primary approaches are:

A *coarse filter* approach (Hunter, 1990[18]) emphasizes management of forests from a local to landscape scale to: maintain the integrity of ecosystem processes, maintain components of the range of historic habitats and age classes, and retain/enhance structural attributes within habitats. In using a coarse filter approach, it assumes that a broad range of habitats encompassing the needs of most species will be met, and their populations will remain viable on the landscape. Habitat analysis and management emphasis in this plan were primarily done at this level.

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

A *meso filter* focuses on conservation of critical ecosystem elements such as structures (logs, snags, pools, springs, streams, reefs, and hedgerows) and processes (fire, flooding) that would be missed by a coarse or fine filter. An example of how these three scales work would be that a meso filter would focus on coarse woody debris (CWD), the processes that created the CWD, and the features it provides to associated biodiversity; a coarse filter would focus on the ecosystem in which the CWD exists, while a fine filter would focus on a species that may use the CWD.[19]

GDS-4A Strategies

a. Provide old forest distributed across the landscape.

Old forest includes stands that are beyond the normal rotation age established for the cover type. There are 126 nongame species within the subsections that are associated with old forest and old forest conditions such as large-diameter trees and/or uneven-age successional stages. Examples of species are osprey, great gray owl, northern goshawk, hairy woodpecker, and northern flying squirrel. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time (GDS-1A and 2B) will ensure available habitat for many of these species. Extended rotation forests (ERF) and designated old-growth forest are examples.

An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

[18] Hunter, M.L. 1990. *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biodiversity*. Prentice-Hall Inc., Englewood Cliffs, N.J.

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

b. Provide young forest distributed across the landscape.

Young forest in this plan refers to stands that are 0-30 years old. There are 59 nongame species within the subsections that are associated with young forest or young forest condition such as seedling and/or sapling successional stages. Examples of species are chestnut-sided warbler, red-tailed hawk, mourning warbler, and gray wolf. Areas managed for young forest conditions (GDS-2A and 2D) will provide young forest habitat across the subsections.

c. Provide a variety of patch sizes across the landscape that better reflect patterns produced by natural disturbances, and attempt to maintain existing large patches.

Providing a variety of patch sizes that better reflect the patterns created by natural disturbance factors (GDS-1C) and efforts to reduce the effects of habitat fragmentation (GDS-1D) will help provide habitat for nongame species with different patch size requirements. See also GDS-1C: Patches.

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

Many nongame species are associated with forested wetlands or the riparian forest interface. These areas also serve as movement corridors for additional species. Consideration for the health and integrity of riparian areas (GDS-5A) and protection or mitigation of other wetlands (GDS-5B) will serve to provide such needs.

- Apply the *Site-Level Guidelines* relating to riparian areas and seasonal and permanent wetlands.

e. Provide for the needs of species that depend on perches, cavity trees, bark foraging sites, and 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. Historically, natural processes provided these habitat needs. Today, the frequency and size of these processes have declined.

- Use the *Site-Level Guidelines* relating to leave trees, snags, and coarse woody debris to provide these important habitat features.

f. Provide for the needs of species associated with conifer stands and mixed conifer/hardwood stands.

A number of nongame species found within the subsections have some association or dependence on coniferous trees, whether within conifer-dominated stands or in various mixes of conifer/hardwood stands[20] (see Appendix L: Wildlife Habitat Relationships). Several conifer species (white pine, white spruce, jack pine, and tamarack) have declined significantly from historic levels in these subsections.[21] The following strategies will be used to meet coniferous habitat needs:

[20] Green, J.C. 1995. *Birds and Forests: A Management and Conservation Guide*. Minnesota Department of Natural Resources.
[21] Minnesota DNR. 2007. *North 4 Subsections SFRMP Preliminary Issues and Assessment*, Table 3.4.

- Increase acres of long-lived conifer cover types through active management in appropriate NPCs to naturally succeed to conifer types, or by increasing mixed forest conditions in some stands (GDS-1B).
- Increase the presence of some conifers as a component of other cover types (GDS-3A).
- Follow the conifer retention guidelines found in the *Site-Level Guidelines.*
- Apply the Cover-type Management Recommendations (Chapter 4).

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

Managing for a mix of tree species and ages along with a diversity of structural characteristics (e.g., tree diameter, tree height, and scattered or clumped distribution) in some stands will provide conditions for species that require within-stand diversity (GDS-3A).

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

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

- Identify and manage high-quality and/or rare native plant communities so they are maintained or enhanced (GDS-1F).
- Use the NPC Field Guide and associated Silvicultural Interpretations to manage some stands to reflect the composition, structure, and function of native plant communities (GDS-3B).
- Maintain or increase biodiversity, where ecologically appropriate, within areas of statewide biodiversity significance (GDS-1E).

The long-term goal of moving forest composition toward the range of natural variation (GDS-1B) will also produce habitat for species associated with natural disturbance processes and native plant communities.

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

Natural Heritage Program data will be available and considered during the 10-year and annual stand examination selection process. Before groundwork begins, field staff will check the database for known locations of rare nongame species in stands planned for treatment (GDS-1G) and, if present, will seek advice from appropriate staff or refer to established guidelines or considerations on avoiding negative impacts to these species.

j. Apply the DNR management recommendations for habitats of nongame species (e.g., gray wolves, bald eagles, wood turtles, northern goshawk, 4-toed salamander) as described in DNR guidelines and policies.[22] Follow recommendations in the *Forestry Wildlife Habitat Management Guidelines*[23] manual, apply considerations provided in Ecological Resources Rare Species Fact Sheets**.**

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

[22] Minnesota DNR. 2007. *North 4 Subsections SFRMP Preliminary Issues and Assessment*, Figure 1, p. *xv.*
[23] Minnesota DNR. 1985. *Forestry-Wildlife Guidelines to Habitat Management*.

According to breeding bird monitoring work in northern Minnesota (e.g., NRRI Technical Report: NRRI/TR-2005/04[24]; USFWS Breeding Bird Survey; Audubon Christmas Bird Counts; DNR's State Wildlife Action Plan), there have been significant declines in populations for some neo-tropical birds. Widespread declines have been reported for ground nesting birds and species found mainly in mature forest habitats. Birds with lowland coniferous, deciduous, mixed forest, and early-successional vegetation-type preferences also showed widespread declines in these subsections. Strategies have been developed throughout this plan that address the need to maintain or enhance habitat for both short-distance and long-distance (neo-tropical) migratory birds, especially those with declining trends in these subsections. For example, see GDS-1A, Old Forest; GDS-1C, Patch Management; GDS-1E, MCBS Sites; GDS-3A, Within-stand Diversity; and strategies in this GDS-4A, Habitat for Non-game species. Using a coarse filter approach, patch management, ERF, providing a range of age-classes from young to old, within-stand diversity, etc., provide a range a habitats for a variety of species, including neo-tropical songbirds. At a finer scale, some stands have been identified where management recommendations and objectives for forest birds (e.g., scarlet tanager) should be considered.

GDS-4B: Adequate habitat and habitat elements exist, simultaneously at multiple scales, to provide for game species found in these subsections.

Game[25] species are an important indicator of the biological health of the forest and are important to society for their recreational, economic, and inherent values. Legal statutes, public expectations, the desires of interest groups, and DNR internal policies require the consideration of game species in the management of state-administered forest lands. The DNR strategic plan, *Directions 2000*, states that an "objective is healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species," and for "populations of fish, wildlife and plant species to sustain recreational opportunities." [26]

The abundance of public forest land in the subsections draws many hunters and trappers to the area each fall. Ruffed grouse, woodcock, black bear, and white-tailed deer hunting traditions are long-standing and important to local economies. Trappers come from across the state to target thriving populations of fisher, beaver, bobcat and marten.

The North 4 team utilized available information and review by field staff to identify and approve the following open landscape priority LTAs within the planning area: Koochiching Peatlands, Cook Till Plain, Rausch Till Plain, Effie Till Plain, Little-Big Fork Till Plain, and Ericsbug Till Plain within the Littlefork Vermilion Uplands subsection; Warba Lake Plain, Floodwood Peatlands, Esquagama Sand Plain, Aurora Till Plain, Moose-Willow Peatlands, and Palisade Lake Plain in the Tamarack Lowlands subsection; and Wright Till Plain, Rice Lake Moraine, and Automba Drumlin Plain within the St. Louis Moraines subsection.

These subsections are important to the tourism industry in Minnesota. Many tourists appreciate and seek out opportunities to observe game species during their trips to this area, where they

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

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

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

have a chance to see species such as the black bear, white-tailed deer, spring waterfowl, and spruce grouse.[27]

Ecologically, there have been historic and more recent changes to these subsections that have affected game species and their habitat:

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

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

There are 42 game species known or predicted to occur within the four subsections. Each species has different habitat requirements, some of which conflict. Individual consideration of management needs for each species is therefore impossible to accomplish with a single approach across the planning area. To ensure that the subsections are managed to maintain and enhance the habitat of game species, a number of management techniques will be considered using both a coarse filter approach and a fine filter approach (GDS-4A).

GDS-4B Strategies

a. Provide young forest distributed across the landscape.

Young forest in this plan refers to stands that are 0-30 years old. There are 13 game species within these subsections that are associated with young forest or young forest conditions such as seedling and/or sapling successional stages (see Appendix L: Wildlife Habitat Relationships). Some examples of these species are white-tailed deer, black bear, snowshoe hare, ruffed grouse, and woodcock. Areas managed for young forest conditions (GDS-2A and 2D) will provide a distribution of young forest habitat across the subsections.

b. Provide old forest distributed across the landscape.

Old forest includes stands that are beyond the normal rotation age established for the cover type. There are 24 game species within these subsections that are associated with old forest and old forest conditions, such as large-diameter trees and uneven-age successional stages (see Appendix L: Wildlife Habitat Relationships). Some examples of these species are fisher, marten, spruce grouse, hooded merganser, and white-tailed deer. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time (GDS-1A and 2B) will ensure available habitat for many of these species. Designated old-growth forest and ERF stands are examples of strategies that provide old forest values across the landscape.

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

[27] U.S. Fish and Wildlife Service. Wildlife Watching in the U.S.: The Economic Impacts on National and State Economies in 2006.

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 beginning now, to address current age-class imbalances to move toward a future balanced age-class structure (GDS-2A, 2D, and 9A and aspen, balm of gilead, birch, and balsam fir cover-type recommendations), future sustainability of game species habitat will be enhanced.

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

There are 13 game species that rely on dense young seedling and/or sapling stage successional stages within even-age managed cover types for food or cover. Managing to improve stocking levels in these stages and maintain health and vigor (GDS-2D and GDS-6) 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 (GDS-2B and aspen, balm of gilead, birch, and balsam fir cover-type recommendations) will ensure that stands are harvested before they become too old to be regenerated back to the same cover type.

e. Provide for the needs of species associated with conifer stands and mixed conifer/ hardwood stands.

A number of game 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 L: Wildlife Habitat Relationships). Several conifer species (white pine, white spruce, jack pine, and tamarack) have declined significantly from historic levels in these subsections. The following strategies will be used to increase conifers:

- Increase acres of long-lived conifer cover types through active management, allow some stands to naturally succeed to conifer types, or increase mixed forest conditions in some stands (GDS-1B).
- Increase the presence of some conifers as a component of other cover types (GDS-3A).
- Follow the conifer retention guidelines found in the *Site-Level Guidelines.*
- Apply the Cover-type Management Recommendations (Chapter 4).
- Patch management in some cases will emphasize conifer NPCs.

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

Managing for a mix of tree species, ages, and structural characteristics (such as tree diameter and height, and scattered or clumped distribution) in some stands will provide conditions for species that require such diversity (see GDS-3A).

- Apply the *Site-Level Guidelines* for leave trees, snags, coarse woody debris, riparian management zones, conifer and mast species retention and regeneration, and road maintenance or closure.

g. Continue to manage special management areas for the benefit of game species.

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

- Manage ruffed grouse management areas to: Maximize diversity of age classes in the upland deciduous cover types.
    - Maximize the age difference between adjacent stands.
        - Clump rather than scatter reserved conifers and snags while following *Site-Level Guidelines*.
        - Harvest stands near normal rotation ages and in 10 - 30 acre blocks.
- Maintain upland shrub communities.
    - Consider management of shrub species and aspen clones within riparian management areas.
    - Create or maintain wildlife openings for woodcock and hunter use.
- Manage deer yard management areas to:
    - Maintain and/or increase the white cedar cover type or white cedar component within other cover types.
    - Maintain or increase the conifer component in aspen, balm of gilead, and birch cover types.
        - Emphasize browse production within or near conifer winter cover.

- Manage priority open landscape areas (OLAs) for the benefit of wildlife species (e.g., sharp-tailed grouse, yellow rail, sandhill crane, bobolink):
    - Utilize available information and review by field staff to identify and approve open landscape projects within designated OLAs in the planning area;
    - Apply Remsoft model input criteria that discourages placement of ERF in OLAs;
    - Apply Remsoft model input criteria that allow selection of younger-aged hardwood stands for even-age management during stand selection modeling;
    - Coordinate across divisions on management prescriptions for selected stands within OLAs in a manner that enhances open landscape habitat conditions (e.g., create larger blocks of even-age cover types managed with a clearcut prescription, minimize snag and leave tree presence in the interior of harvest blocks, discourage conifer planting);
    - Coordinate across divisions on management projects designed to enhance open landscape conditions in OLAs (e.g., prescribed burns, shearing, or mowing of brush).

3.5 Riparian and Aquatic Areas

GDS-5A: Riparian areas are managed to provide critical[28] habitat for fish, wildlife, and plant species.

Riparian areas encompass the transition zone between the terrestrial and aquatic habitats that occurs along lakes, streams, and open-water wetlands. A r*iparian management zone* (RMZ) is that portion of the riparian area where site conditions and landowner objectives are used to

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

determine management activities that address riparian resource needs. Riparian areas are among the richest habitats 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, water quality, and forest products.

The emphasis for riparian areas along all trout streams in these subsections will be to manage for longer-lived, uneven-age, mixed-species stands to better maintain cold-water temperatures in these streams. For other riparian areas, manage for the appropriate species for the site, which may include a range of age classes and forest types within and adjacent to these riparian areas.

GDS-5A Strategies

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

Some examples from the guidelines are:

- Manage for longer-lived, uneven-aged, mixed-species stands within the RMZ to provide:
    - Shade and moderated microclimate
    - Coarse woody debris
    - Microhabitat diversity
    - Resiliency to natural catastrophes
    - Bank stability
    - Nutrient cycling and carbon and nutrient input
- Manage for long-lived conifers as an option where beaver are to be discouraged near water bodies.
- Avoid creating large cleared areas within the RMZ.
- Maintain a filter strip between the water body and harvest area.
- Approach water crossings at or near right angles to the stream direction, and use measures to minimize streambank disturbances.

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

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

The Remsoft model was programmed to identify ERF in riparian areas prior to stand selection. Old forests provide the best source of woody debris in aquatic systems and habitat for a wide variety of wildlife species. Longer rotation age reduces the frequency of future harvest activities and may provide opportunities for a wider variety of forest products. Old forest management complexes and EILC stands in riparian areas will be managed to maintain or increase old forest conditions.

c. Using the NPC Field Guide and associated ECS Silvicultural Interpretations, manage for a species appropriate for the site. Emphasize conifers where appropriate and discourage aspen and birch in the RMZ.

Shorter-lived species such as aspen and birch should not be encouraged next to trout streams. Beaver use these species for food and building dams, which can affect both aquatic and terrestrial habitat. In some riparian areas, it may be appropriate to manage for aspen, birch, and brush cover types. Retaining some deciduous species in RMZs is important for organic matter and nutrient inputs from leaf fall (allochthonus inputs).

d. Follow the recommendations in the St. Louis Cloquet Whiteface Corridor Management Plan.

The *St. Louis Cloquet Whiteface Corridor Management Plan (1994)* includes recommendations for forest management zones adjacent to the St. Louis, Cloquet, and Whiteface rivers. The Tier One Zone extends 200 feet outward from the top of the riverbank. The Tier Two Zone extends out as far as ½ mile from the Tier One Zone. Most of the management recommendations and objectives are similar to those recommended in this SFRMP.

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

This document identifies Species in Greatest Conservation Need and associated Key Habitats.

GDS-5B: Forest management on state lands adequately protects 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. These areas are protected using different site-level forest management guidelines than those required for riparian areas adjacent to lakes, streams, and rivers or permanent open water ponds.

GDS-5B Strategies

a. Apply the *Site-Level Guidelines*.

Some examples of recommendations from the guidelines are:

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

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

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

End moraines have a high concentration of seasonal ponds that are easily missed if field evaluations occur outside of spring and early summer seasons. Identification of landforms important for vernal pools, or seasonal wetlands, will help in their identification year-round.

For a discussion of key habitats and species in greatest conservation need, go to GDS-1B, page 3.13.

3.6 Timber Productivity

GDS-6: Timber productivity and quality on state timber lands is increased.

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

GDS-6 Strategies

a. Move toward harvesting even-age managed non-ERF stands at their normal rotation age (see GDS-2A and 9A).

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

Some past SFRMPs have addressed this through identification of high risk low volume stands (HRLV).

c. Thin or selectively harvest in some aspen, balm of gilead, birch, white pine, red pine, balsam fir, white spruce, northern hardwoods, lowland hardwoods, ash, and oak stands to capture mortality and/or increase growth rates.

These treatments may be prescribed for both normal rotation stands and ERF stands. This plan has developed a pool of stands that will be evaluated for thinning or selective harvest (see Chapter 4, Cover-type Management Recommendations). Thinning in jack pine types is not standard procedure in the North 4 Subsections, but may be considered on appropriate NPCs, with coordination per the *Coordination Framework* to explore innovative techniques, and with the intention of meeting specific SFRMP management objectives. The amount of thinning will depend on whether stands meets merchantability criteria based on a field examination, and whether there are markets for the timber.

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

See GDS-3A, Strategy i, for strategies to maintain plant diversity within plantations.

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

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

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

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

For example, avoid damage to residual trees during harvest or thinning operations.

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

h. Respond to insect and disease problems, as appropriate. (GDS-7A)

3.7 Forest Pests, Pathogens and Exotic Species

GDS-7A: Limit damage to forests from insects, disease, and exotic species to acceptable levels where feasible.

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

Natural resource managers are concerned about the introduction and establishment of 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. 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 happen 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. Global warming effects and a variety of insect and disease concerns (e.g. oak wilt (*Ceratocystis fagacearum*), two-lined chestnut borer (*Agrilus bileneatus*), gypsy moth (*Lymantria dispar*), and armillaria root rot (*Armillaria spp*.) may impact oak management on some sites. Establishing and promoting practices that minimize these introductions will slow the spread of harmful exotics and reduce the associated losses.

GDS-7A Strategies

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

Early identification and risk assessment of new exotic species introductions improve 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. Involve private landowners and local units of government in gathering and disseminating information. This information helps determine when and where preventive measures to limit impacts or control action must be taken.

Mutually established protocols for data collection and information sharing among federal (U.S. Environmental Protection Agency, U.S. Department of Agriculture) and state agencies improve capacity to respond to the spread of established exotic species into new areas, new species introductions, and outbreaks of established pests and diseases.

b. Follow Minnesota DNR Operational Order 113 (Invasive Species) to minimize the spread of invasive exotic species during forest management activities.

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

d. Manage existing forest insect and disease problems, as appropriate.

Information gathered and provided by the agencies mentioned above is used as a basis for decisions regarding where and when insect and disease problems require action involving vegetation management.

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.

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

- DNR Operational Order No. 59 - Pesticides and Pest Control
- Divisions of Forestry and Fish and Wildlife - Pesticide Use Guidelines
- Pesticide Labels

Refer to Material Safety and Data Sheets for each pesticide and adjuvant being used or recommended.

- *MFRC Site-Level Guidelines* relating to pesticide use.

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

- Develop management plans and stand treatment prescriptions using the DNR Forest Development Manual and other recognized insect and disease management sources, while considering ecological processes and functions and impacts to native species and habitats.
- Provide information and training via logger education programs to equipment operators and tree fellers regarding techniques that minimize damage to retained trees (e.g., leave trees or crop trees).
- Emphasize the use of fire in management for prevention of insect and disease outbreaks (e.g., regeneration, residual stem, and slash management in black spruce stands to reduce the spread of eastern dwarf mistletoe disease).

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

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

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

Wildlife species such as deer, hare, porcupine, beaver, and other rodents impact forests and plant regeneration through browsing, stem damage, and girdling. Solutions require an understanding of the dynamics of herbivory, seasonal wildlife movements, population structure, population control tools and their effectiveness, and proven repellents or exclusion methods. Keys to success include coordination between department staff, adequate funding, and sharing information regarding successful exclusion or abatement methods. The management strategies below attempt to minimize adverse impacts.

GDS-7B Strategies

a. Improve field staff knowledge about the complexity of factors that affect solutions to preventing or reducing damage caused by wildlife. Do this through training and/or field level coordination on sites where problems exist.

- Conduct training sessions addressing the factors that affect damage, potential solutions, and prevention based on research and experience.
- Coordinate field visits at problem sites with area wildlife staff and the appropriate land manager.
- Collect information from damaged sites for database entry and analysis of wildlife damage.
- Use the expertise of the DNR – Section of Wildlife's Depredation Program and research units when regeneration plans call for use of repellents or exclusion techniques.

b. Consider the potential for wildlife impacts to planted or natural regenerating trees before damage occurs. Coordinate on preventative strategies before planting or timber sales begin.

- Work with area wildlife staff to identify sites where significant damage may occur before forest management activities occur. Where necessary, incorporate plans for post-sale damage mitigation into forest regeneration and development plans.
- In riparian areas, favor tree species less palatable to beavers.

c. Focus forest regeneration efforts in areas less likely to be negatively impacted by wildlife species.

- Avoid 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 deer concentration areas.
- Avoid planting susceptible species in locations surrounded by habitat attractive to ungulates without some plan for protection from browsing.
- In mixed species plantations, scatter susceptible species amongst less susceptible ones.
- In larger mixed species plantations, plant susceptible species in the middle of the site.

d. On sites where damage from wildlife species is anticipated, use mitigation techniques to reduce damage when planting susceptible tree species.

- Favor planting on sites where edge (irregular boundaries) is minimized.
- Plant larger sites.
- Plant susceptible species away from the edge of the site.

- Use protective measures such as fenced exclosures, bud capping, repellents, tree shelters, etc.
- To more efficiently implement protection control measures, clump plantings and/or locate them to be easily accessible.

e. When deciding what to plant, consider species or stock sources (if available) that are less palatable to wildlife.

- Consider the potential for seedling damage and/or growth reduction from wildlife damage in selection of susceptible species planting stock.

GDS-7C: Forest management on state lands attempts to mitigate global climate change effects on forest lands. Management is based on our current knowledge and will be adjusted based on future research findings.

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

In an important step forward for Minnesota's environment, Governor Tim Pawlenty appointed a Minnesota Climate Change Advisory Group in 2007. The new group is part of the Governor's Next Generation Energy Initiative and will develop a comprehensive plan for reducing the state's greenhouse gas emissions. "Our global climate is warming, at least in part due to the energy sources we use," Governor Pawlenty said. "We cannot solve it by ourselves, but we need to lead and do our part. We also need to push for an effective national and international effort."

Minnesota DNR is supporting the Governor's climate change initiative with the following programs:

Minnesota Forests for the Future (Forest Land Easements) Forest easements are a cost-effective tool for retaining forest lands in private ownership and maintaining important recreational opportunities, wood products production, fish and wildlife habitat, and climate change mitigation by capturing and storing carbon dioxide from the atmosphere. State funding will provide for easement acquisition or acquisition of interests in lands by fee title, gift, or donation. These efforts will prevent development and conversion of forest land, provide forest values in perpetuity, and allow landowners to continue to manage forests sustainably for timber and other products while retaining land in private ownership.

Several climate models (e.g., atmospheric-ocean general circulation models[29]) in use around the world predict global climate change. The Intergovernmental Panel on Climate Change refers to climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The models agree that average temperatures are increasing and predict

[29] 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.

more variable changes in precipitation. This global warming will affect forests and wildlife in Minnesota.[30,31]

Scientists believe the predicted climate change will affect the size, frequency, and intensity of disturbances such as fires, windstorms, and insect outbreaks. It will affect the survivorship of existing plant and animal species and the distributions of plants and animals. Even at modest levels, independent studies are finding mounting evidence that the current climate change influences plant and animal ranges and behavior.[32] 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. Certain tree species, such as black spruce, balsam fir, birch, and jack pine will respond negatively to increased soil warming and decreased soil moisture in. Carbon sequestration by forests and wetlands may be affected because of accelerated decomposition rates.

Most tree species in Minnesota reach the limit of their geographic range somewhere within the boundaries of the forested portion of the state. Predictions have been made on the potential future distributions of trees.[33] There is a need to facilitate species adaptation to change in response to possible rapid climatic changes.

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

GDS-7C Strategies

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

b. Maintain or increase structural diversity across the subsections.

Structural characteristics include the size (diameter and height), abundance and distribution of overstory trees, understory vegetation, and their arrangement (scattered or clumped) within the stand. Structural characteristics also include the presence or absence of snags and coarse woody

[30] Weflen, K., *The Crossroads of Climate Change*. Minnesota Conservation Volunteer, January-February 2001, Minnesota Department of Natural Resources, St. Paul, MN.
[31] Pastor, John, personal communication at March 13, 2003 North Shore SFRMP meeting. Natural Resources Research Institute, University of Minnesota-Duluth.
[32] 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.
[33] 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.

debris and the way these features are distributed in space. Appropriate structural types, amounts, and arrangements vary by native plant community and growth stage. By maintaining or increasing structural diversity across these subsections, the forest will provide habitat to a greater number of species than a forest with uniform structural diversity. For example, large-diameter structures, both standing and lying on the ground, provide micro-sites for seed germination, cavities for nesting and den sites, and important escape and nesting cover within stands. This variety will assist the forest to survive as well as serve as a reproductive source for forest plant and animal migration in the face of accelerated climate change.

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

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

- Stands selected for patch management were located to increase their effective patch size or to increase connectivity between patches and adjacent NPCs.
- ERF stands were grouped on the landscape and placed around old-growth stands and along riparian corridors.
- Remsoft was programmed to group selected stands to maintain and/or create larger patches and minimize fragmentation.

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

- Where available, MCBS sites of biodiversity significance are used as a means to identify, quantify, compare, and monitor NPC spatial patterns as they relate to North 4 SFRMP direction.
- Classification of stands to NPC and application of *ECS Silvicultural Interpretations* provide a means to maintain NPC spatial patterns on managed lands.
- Plan harvests to minimize road construction and landings.
- Stand management incorporates actions that minimize the potential for invasive species establishment.

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

- Use the NPC Field Guide, associated silvicultural references, existing tree distributions, and modeled future tree distributions when selecting the species most appropriate for the site.

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

Climate models (e.g., *Hadley Centre for Climate Prediction and Research-UK, carbon cycle models*) predict that, as future atmospheric carbon dioxide concentrations increase, global temperatures will increase. Forests have the ability to remove carbon dioxide through photosynthesis and to store the carbon as woody material. Carbon is stored in all parts of the forest including living plants, dead plants, fallen leaves, and soil. The storage of carbon is called

carbon sequestration. Carbon also remains stored in wood that is harvested and processed into wood products.[34] The carbon remains stored in wood until it is gradually released through slow decay or is released rapidly when it is burned.

Forest management activities, such as ensuring existing stands are adequately stocked and ensuring regeneration is adequate after harvest, sequester carbon. Basically, any activity that provides healthy and productive forests will increase carbon sequestration. In this plan, stands in a wide range of age-classes will be evaluated for treatment. Increasing the stocking and growth rate of timber will help in sequestering carbon. Stands will be field examined to determine if there is sufficient advance regeneration. If the site lacks adequate regeneration, silvicultural techniques will be used that result in a more fully stocked stand. Stands that contain a variety of tree species are more likely to fully occupy a site, increasing the overall wood volume grown on the site. Increasing the woody biomass over what is currently on these under-stocked sites will help sequester carbon. The following are some examples of forest management strategies in this plan that will help in carbon sequestration:

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

f. Maintain or increase conifers adjacent to coldwater streams to moderate the microclimate that provides a cooling effect in warm weather and retains a snowpack longer, slowing discharge in the spring.

- Follow the *Site-Level Guidelines* for riparian corridors.
- See Riparian GDS-5A.

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

3.8 Visual Quality

GDS-3.8: Minimize forest management impacts on visual quality in sensitive areas.

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

Scenic beauty is a primary reason people choose to spend their recreation and vacation time in or near forested areas. Where forests are near recreational trails, lakes, waterways, public roads, and highways, consider impacts of forest management activities to the visual quality of the site during and after management activities.

GDS-8 Strategies

a. Apply the *Site-Level Guidelines* on visual quality on all vegetative management activities.

The MFRC guidelines contain many recommended forest management techniques that will minimize the impacts of vegetative management activities on visual quality. *Directions 2000* (*Objective 3.3*)[35] states that the "DNR will apply the appropriate guidelines so that visual quality is not adversely impacted during forest management activities." Several examples of the recommended techniques included in the guidelines are listed below:

- Minimize visibility of harvest areas by limiting the apparent size of the harvest area.
- Avoid management operations during periods of peak recreational use whenever possible.
- Locate roads and trails to minimize visibility from nearby vantage points, such as scenic overlooks, streams, and lakes.
- Encourage long-lived species and other visually important species (e.g., paper birch) along high visual quality identified roadways. This will minimize the frequency of management activities. It will also provide larger-crowned, larger-diameter trees that improve forest aesthetics.
- Reduce visual penetration with appropriate curves in the road alignment.

DNR forestry staff checks the application of visual quality guidelines as a part of timber sales supervision and inspections. Roads have been classified based on visual quality ratings. Classifications can be viewed on the DNR Web site at:
http://www.dnr.state.mn.us/forestry/visual_sensitivity/index.html

3.9 Harvest Levels

GDS-9A: The SFRMP treatment level for each cover type moves toward the desired age-class structure of even-age managed cover types (both normal and extended rotation forest), and improves the age-structure and timber quality of uneven-age managed cover types.

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

Treatment levels were developed for this plan by considering the other General Direction Statements (GDSs), and specifically the following factors:

- Age-class imbalances for even-age managed cover types

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

- Acres over rotation age
- Representation of young and old forest
- Planned increases or decreases in cover-type acreages through conversion
- Supply of timber
- Criteria for uneven-age management and thinning

Table 3.9a: Rotation Ages for Even-Age Managed Forest Cover Types by Subsection

Abbreviations: SI = site index; MA = merchantable age; NRA = normal rotation age; MRA = maximum rotation age

Subsection	Aspen				Balm of Gilead				Birch				Oak[1]			
	SI	MA	NRA	MRA	SI	MA	NRA	MRA	SI	MA	NRA	MRA	SI	MA	NRA	MRA
Littlefork-Vermilion Uplands	All	30	45	80	All	30	45	80	All	35	50	70			NA	
Nashwauk Uplands	All	30	50	80	All	30	50	80	All	35	50	70			NA	
St. Louis Moraines	All	30	40	85	All	30	40	85	All	35	50	90			Partial Harvest	
Tamarack Lowlands	All	30	40	65	All	30	40	65	All	35	50	90			NA	

Subsection	Red Pine				Jack Pine				White Spruce[2]				Balsam Fir[3]			
	SI	MA	NRA	MRA	SI	MA	NRA	MRA	SI	MA	NRA	MRA	SI	MA	NRA	MRA
Littlefork-Vermilion Uplands	All	25	100	180	All	30	50	65	Planted	30	70	90	All	30	50	50
Nashwauk Uplands	All	25	100	220	All	25	50	70	Planted	30	60	90	All	30	50	50
St. Louis Moraines	All	25	100	220	All	25	50	70	Planted	30	50	70	All	30	50	50
Tamarack Lowlands	All	25	100	160	All	30	50	65	Planted	30	50	70	All	30	50	50

Subsection	Lowland Black Spruce[4]				Tamarack				Upland Black Spruce			
	SI	MA	NRA	MRA	SI	MA	NRA	MRA	SI	MA	NRA	MRA
Littlefork-	23-29	70	120	180	23-39	50	90	150	All	30	50	65
Vermilion Uplands	29-39	60	100	140	40+	30	60	120				
	40+	40	70	100								
Nashwauk Uplands	23-29	70	120	180	23-39	50	90	150	All	30	50	70
	29-39	60	100	140	40+	30	60	120				
	40+	40	70	100								
St. Louis Moraines	23-29	70	120	180	23-39	50	80	140	All	30	50	70
	29-39	60	100	140	40+	30	60	100				
	40+	40	70	100								
Tamarack Lowlands	23-29	70	120	180	23-39	50	90	150	All	30	50	65
	29-39	60	100	140	40+	30	60	120				
	40+	40	70	100								

Notes:

1. *Oak:* Because of the relatively small oak cover-type acreage in the subsections and that currently most oak stands in the subsections are managed through selective or shelterwood harvest methods, no even-age rotation ages were developed for the 10-year planning period.
2. *White Spruce:* Even-age management is recommended for most planted stands except where stands have become mixed species stands (e.g., WS, BF, aspen, and/or birch mix). Typically, uneven-age management is recommended for natural-origin stands. Some natural-origin stands may need to be managed under even-age methods due to current stand conditions.
3. *Balsam Fir:* No ERF is recommended for even-age managed balsam fir. Recommend that a portion of the BF cover type (e.g., mixed stands of BF, WS, aspen, and/or birch) be managed as uneven-age managed, mixed species stands where older BF may be retained. Also, older BF will be a component in other cover types. Some BF stands should be treated before the 50-year NRA to move a stand toward another cover type (e.g., long-lived conifers). Most BF stands that are clearcut initially regenerate to other cover types.
4. *Lowland Black Spruce*: Because of the gradient from high site index to lower site index stands in adjacent black spruce stands, some lower site index stands may need to be treated prior to the recommended rotation ages to treat the area during one entry for patch management, access, or other reasons.

Table 3.9b: Managed Cover-type Treatment Pool Summary – summarizes total acres of even-age and uneven-age managed cover types in the stand exam pool selected by DNR Forestry administrative areas for treatment during the 10-year plan implementation period.

Cover type	Rotation Class	Planned Rotation Age (LtfkV/NU/StLM/TL)	Management Pool Acres**	Total Plan Treatment Pool Acres***
Ash/Lowland Hardwoods	Uneven-Age	N/A	**52,343**	**3,207**
Aspen/Balm of Gilead	Normal	45/50/40/40	**174,412**	**54,448**
	ERF Max	80/80/85/65	**86,596**	
Birch	Normal	50	**5,822**	**3,197**
	ERF Max	70/70/90/90	**4,242**	
Northern Hardwoods/Oak	Uneven-Age	N/A	**27,781**	**13,265**
Jack Pine / Upland Black Spruce	Normal	50	**7,395**	**2,120**
	ERF Max	65/70/70/65	**7,611**	
White Spruce (Planted)	Normal	70/60/50/50	**4,351**	**6,825**
	ERF Max	90/90/70/70	**5,174**	
White Spruce (Natural)	Uneven-Age	N/A	**1,169**	**455**
Balsam Fir	Normal	50	**16,033**	**7,718**
Tamarack - High SI	Normal	60	**11,769**	**2,784**
	ERF Max	120/120/100/120	**12,787**	
Tamarack - Low SI	Normal	90/90/80/90	**27,620**	**3,070**
	ERF Max	150/150/140/150	**21,832**	
Black Spruce Lowland - High SI	Normal	70	**16,019**	**4,699**
	ERF Max	100	**12,989**	
Black Spruce Lowland - Med SI	Normal	100	**47,972**	**7,496**
	ERF Max	140	**46,706**	
Black Spruce Lowland - Low SI	Normal	120	**28,929**	**8,530**
	ERF Max	180	**26,859**	
Red Pine	Normal	N/A		**15,351**
	ERF Max	180/220/220/160	**20,992**	
White Pine	Normal	N/A		**635**
	ERF Max	N/A	**1,541**	
White Cedar	Normal	N/A	**43,510**	**0****
	ERF Max	N/A		
Totals			**712,454**	**133,800**

* Stands were given a preliminary prescription of uneven-age as a bookkeeping measure for tracking conversions.
** Management pool acres [data source: All_results1_dec_2008_addedfields.dbf] using man_acres field and adjusted cover types
*** Total plan Treatment Pool acres [data source: lfv/nsh/slm/tam_ready_4_final_model.dbf (10/29/2008)] using t_acres field and adjusted cover types; *amended by remodeling in Dec. 2010 to add red pine and bsl acres*.
**** White Cedar was not selected for treatment during stand selection: a small annual pool (approximately 80 acres) will be selected for treatment consideration by Littlefork Area staff

GDS-9A Strategies

Following are descriptions and/or examples of how the above factors were considered.

Even-age Cover Types

a. Age-Class Imbalances

The long-term goal (DFFC) is to move toward a balanced age-class distribution with a declining distribution for the ERF designated stands. This goal was compared to the current age-class distribution for all even-age managed cover types. A Remsoft harvest-scheduling model was used to schedule harvest over the next 50 years for forest cover types managed under even-age silvicultural systems. Treatment levels were developed to move the current age distributions closer to goals by the end of the 50-year planning period. At that time, most even-age managed cover types will be closer to a balanced age-class structure. Due to existing imbalances and the other considerations below, a balance will not always be achieved in 50 years (see Figures 3.9a and 3.9b).

Figure 3.9a: Current Age-Class Distribution of the Aspen/Balm of Gilead Cover Type in the Tamarack Lowlands Subsection

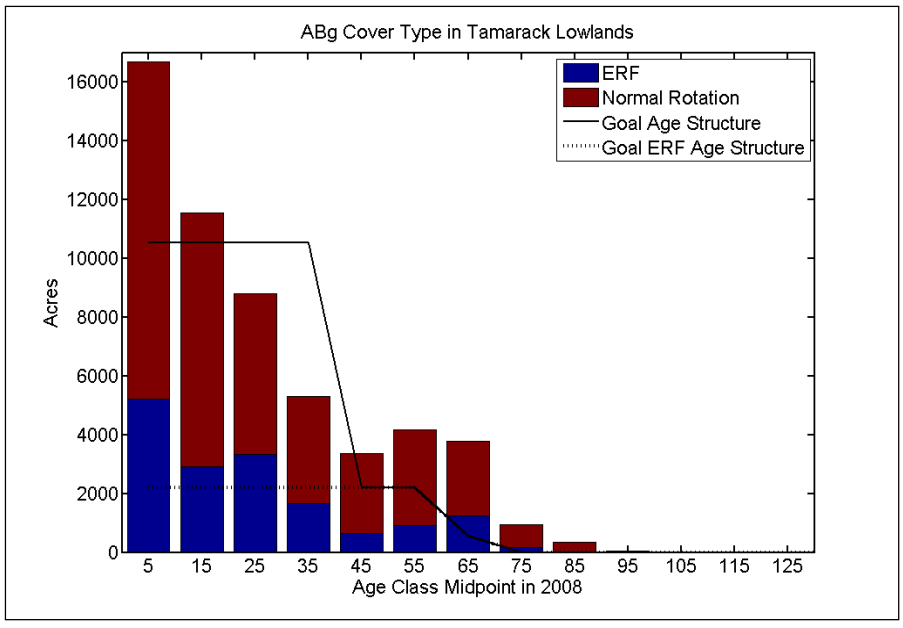
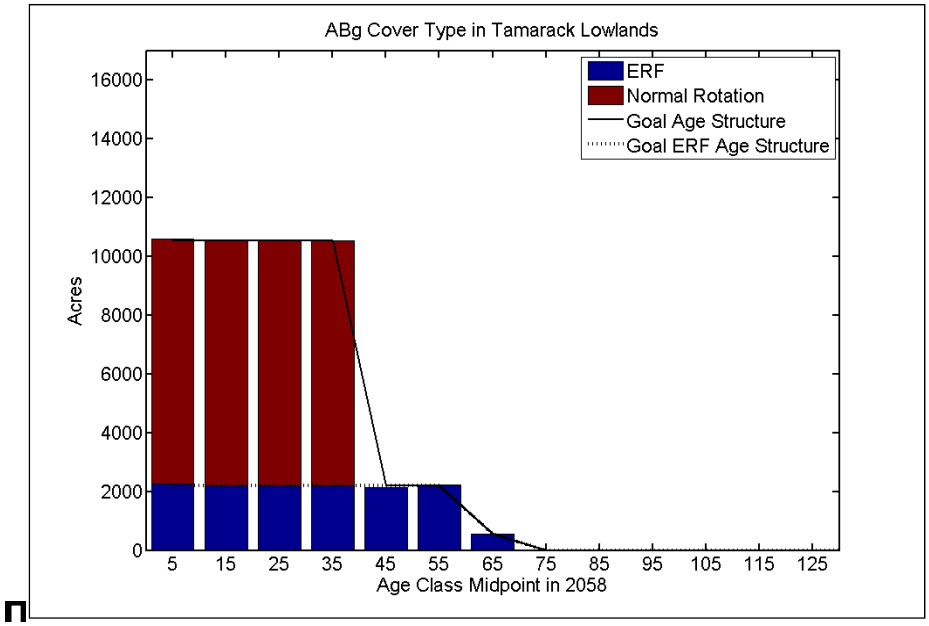


Figure 3.9b: Estimated Aspen/Balm of Gilead Cover Type Age-Class Distribution in 2058



b. High-risk, low-volume stands

For SFRMP purposes, the *maximum rotation age* is the estimated maximum age at which a cover type will retain its biological ability to regenerate to the same cover type and remain commercially viable as a marketable timber sale. The Remsoft model was programmed to select all stands that will reach or exceed maximum rotation age during 10-year planning period. Table 3.9b focuses on acres of timber land over rotation age in these subsections.

c. Treating Stands Older than Normal Rotation Age

There is currently a surplus of acres beyond the normal and ERF rotation ages established by this plan, in most even-age managed cover types. Several different ERF rotation ages were used for each cover type, as a way of achieving 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 normal rotation age for the even-age cover types. For many cover types, the resulting acreages 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. After the first decade, there is no plan to carry stands in even-age cover types beyond the established maximum rotation ages. For some cover types in succeeding decades, the average treatment age increases as a result of holding stands longer to better balance the age-class distribution over time. See Tables 3.9c and 3.9d, following.

Table 3.9c: Acres Over Rotation Age by Cover type and Subsection

Cover type	Rotation Class	Planned Rotation Ages				Acres** Over Planned Rotation Age			
		Ltfk-V	Nash-Upld	St.L Mor	Tam Lwds	Ltfk-V	Nash-Upld	St.L Mor	Tam Lwds
Aspen/balm of gilead	Normal	40	50	40	40	19,059	1,918	10,464	9,994
	ERF Max*	80	80	85	65	257	165	114	328
Birch	Normal	50	50	50	50	404	819	1,348	723
	ERF Max	70	70	90	90	190	971	66	0
Jack Pine / BSU	Normal	50	50	50	50	674	278	274	267
	ERF Max	65	70	70	65	495	147	150	94
White Spruce (Planted)	Normal	70	60	50	50	0	11	19	67
	ERF Max	90	90	70	70	0	0	0	0
Balsam Fir	Normal	50	50	50	50	4,272	221	882	1,507
Tamarack - High SI	Normal	60	60	60	60	2,328	185	771	2,357
	ERF Max	120	120	100	120	93	0	150	151
Tamarack - Low SI	Normal	90	90	80	90	2,201	317	896	4,951
	ERF Max	150	150	140	150	51	0	27	121
Black Spruce Lowland - High SI	Normal	70	70	70	70	4,469	473	614	596
	ERF Max	100	100	100	100	1,558	0	15	255
Black Spruce Lowland - Med SI	Normal	100	100	100	100	8,115	235	636	933
	ERF Max	140	140	140	140	690	0	60	67
Black Spruce Lowland - Low SI	Normal	120	120	120	120	5,220	174	780	1,596
	ERF Max	180	180	180	180	452	0	0	0
Red Pine	Normal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ERF Max	180	220	220	160	9	0	0	0

*The oldest age that even-age managed ERF stands can be held. There are actually several ERF rotation ages per cover type.
** This table does not include acres currently under timber sale contract.

[Source data: “Table 3.9a Rotation Ages”, and “FINAL_ HARVEST_AGE_SUMMARY.xls”]

Table 3.9d: Rotation Age and Modeled Average Stand Treatment Age for Even-Age Managed Cover Types

Cover type	Rotation Class	Planned Rotation Ages				Average Treatment Ages																			
						Ltfk-V					Nash-Upld					St.L Mor					Tam Lwds				
						Period					Period					Period					Period				
		Ltfk-V	Nash-Upld	St.L Mor	Tam Lwds	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Aspen/balm of Gilead	Normal	40	50	40	40	66	50	49	51	47	57	44	40	49	50	50	49	41	41	42	59	48	44	42	40
	ERF Max*	80	80	85	65	65	64	56	57	58	70	66	56	55	62	52	62	45	55	58	68	57	51	56	51
Birch	Normal	50	50	50	50	80	74	52	45	45	82	92	48	45	45	75	93	66	45	48	75	81	83	47	48
	ERF Max	70	70	90	90	86	76	64	0	55	89	103	0	0	0	69	97	90	0	55	0	55	60	70	0
Jack Pine	Normal	50	50	50	50	74	68	52	47	53	84	68	52	46	52	74	49	51	48	52	79	67	51	45	50
	ERF Max	65	70	70	65	75	70	63	60	59	68	81	63	56	60	83	72	64	55	64	74	68	55	61	63
White Spruce (Planted)	Normal	70	60	50	50	60	86	75	76	77	78	60	58	57	0	0	64	59	58	65	0	61	70	63	62
	ERF Max	90	90	70	70	0	85	75	75	79	0	0	67	65	65	0	58	57	57	66	0	65	68	70	65
Balsam Fir	Normal	50	50	50	50	64	58	48	41	43	56	63	47	40	48	57	58	48	40	47	67	59	50	42	47
Tamarack - High SI	Normal	60	60	60	60	109	114	109	109	78	109	101	112	116	118	108	101	99	87	79	112	94	69	115	105
	ERF Max	120	120	100	120	106	112	111	114	96	105	104	115	115	120	111	103	100	93	85	100	125	119	118	115
Tamarack - Low SI	Normal	90	90	80	90	127	126	113	100	83	112	115	125	121	113	128	128	127	102	90	135	103	118	78	92
	ERF Max	150	150	140	150	140	146	125	117	118	10	89	103	80	131	80	138	114	94	106	118	153	88	141	150
Black Spruce Lowland - High SI	Normal	70	70	70	70	99	104	96	84	64	101	100	100	76	50	88	99	97	85	51	96	100	100	93	82
	ERF Max	100	100	100	100	106	107	92	93	79	88	102	100	93	0	85	101	98	97	0	107	101	99	80	82
Black Spruce Lowland - Med SI	Normal	100	100	100	100	121	136	119	127	93	125	117	131	126	124	103	124	117	118	110	101	110	119	137	123
	ERF Max	140	140	140	140	135	144	139	138	139	85	114	128	127	129	126	129	135	136	137	135	124	134	140	135
Black Spruce Lowland - Low SI	Normal	120	120	120	120	150	153	152	153	144	136	131	134	114	148	137	153	158	143	143	146	139	158	144	119
	ERF Max	180	180	180	180	174	174	167	163	168	155	135	149	161	170	130	166	172	177	0	131	149	140	170	0

*The oldest age that even-age managed ERF stands can be held. There are actually several ERF rotation ages per cover type.

d. Maintaining Old Forest

In some even-age cover types, there are currently more acres of old forest than the amounts of effective ERF established in this plan (see GDS-1A). However, due to the age-class imbalance, planning for desired amounts in the future was a part of treatment level considerations. In some cover types, the amount of prescribed ERF that is over normal rotation age (effective ERF) will not meet the established effective ERF goals (DFFC) in some future decades (see Table 3.9e). In these cases, holding non-ERF stands past the established normal rotation age ensures higher levels of old forest on the landscape, as well as helping to balance the age classes. Because stands will not be held past their established maximum rotation age, in some cover types a temporary drop below desired levels may occur for several decades. Some cover types exceed the old forest DFFC in the later decades 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 3.9e: Percent Old Forest Per Decade by Type by Subsection for Even-age Systems.

St. Louis Moraines Subsection	**Percentage per Period (10 yrs)**					
Type	0	1	2	3	4	5
Aspen Old Forest Area	19.1	9.9	8.4	12.4	14.2	11.9
Birch Old Forest Area	45.3	27.7	12.2	0.0	1.6	20.4
Red Pine Old Forest Area	13.6	16.2	16.8	18.5	22.7	25.4
Jack Pine Old Forest Area	16.7	14.5	7.4	10.8	18.8	13.8
White Spruce (planted) Old Forest Area	2.8	11.5	4.2	28.7	28.3	9.0
Balsam Fir Old Forest Area	38.8	22.7	1.7	0.0	0.0	0.0
BSL (SI 40+) Old Forest Area	36.0	31.5	21.5	16.5	9.0	11.0
BSL (SI 30-39) Old Forest Area	18.0	26.8	24.6	21.0	17.5	13.0
BSL (SI <= 29) Old Forest Area	23.8	27.9	22.1	19.1	18.6	14.5
Tamarack (SI 40+) Old Forest Area	47.5	39.2	39.3	31.2	20.1	18.0
Tamarack (SI < 40) Old Forest Area	27.4	29.2	19.9	9.4	12.9	15.1

Tamarack Lowlands Subsection	**Percentage per Period (10 yrs)**					
Type	0	1	2	3	4	5
Aspen Old Forest Area	23.2	13.4	10.6	10.1	12.4	10.5
Birch Old Forest Area	40.2	16.8	14.0	4.2	0.8	27.4
Red Pine Old Forest Area	3.6	6.4	5.9	6.3	9.2	13.0
Jack Pine Old Forest Area	26.9	21.3	5.3	15.9	10.2	9.9
White Spruce (planted) Old Forest Area	1.9	4.4	7.0	3.9	6.0	0.7
Balsam Fir Old Forest Area	54.3	29.1	4.1	1.7	0.0	0.0
BSL (SI 40+) Old Forest Area	48.1	38.4	22.4	17.7	10.9	10.8
BSL (SI 30-39) Old Forest Area	18.0	25.1	27.9	27.4	21.6	13.0
BSL (SI <= 29) Old Forest Area	19.7	21.0	20.3	16.5	16.2	17.5
Tamarack (SI 40+) Old Forest Area	16.5	14.7	12.8	11.7	8.4	4.7
Tamarack (SI < 40) Old Forest Area	5.4	7.4	7.4	6.4	3.5	1.8

Nashwauk Uplands Subsection	Percentage per Period (10 yrs)					
Type	0	1	2	3	4	5
Aspen Old Forest Area	9.7	3.0	4.5	9.0	11.7	12.0
Birch Old Forest Area	66.1	20.2	0.0	0.0	0.4	19.9
Red Pine Old Forest Area	6.2	9.8	14.2	21.3	25.3	25.8
Jack Pine Old Forest Area	19.0	17.7	8.6	7.7	12.2	9.8
White Spruce (planted) Old Forest Area	0.6	0.0	6.1	0.9	15.2	23.0
Balsam Fir Old Forest Area	26.8	11.0	12.6	0.0	0.0	0.0
BSL (SI 40+) Old Forest Area	50.6	47.4	18.4	6.4	4.5	4.5
BSL (SI 30-39) Old Forest Area	12.1	24.2	27.9	25.6	20.9	12.9
BSL (SI <= 29) Old Forest Area	17.8	24.2	24.6	24.8	20.5	15.1
Tamarack (SI 40+) Old Forest Area	35.9	29.9	20.4	16.6	9.8	5.3
Tamarack (SI < 40) Old Forest Area	5.1	22.7	19.6	13.6	6.8	0.1

Littlefork-Vermilion Uplands Subsection	Percentage per Period (10 yrs)					
Type	0	1	2	3	4	5
Aspen Old Forest Area	22.5	13.5	12.7	14.7	14.8	8.3
Birch Old Forest Area	47.9	18.4	15.4	0.0	2.5	12.0
Red Pine Old Forest Area	9.2	12.9	15.4	19.5	26.3	27.5
Jack Pine Old Forest Area	20.0	13.7	9.5	12.8	9.0	8.7
White Spruce (planted) Old Forest Area	0.2	1.0	1.8	18.9	15.7	43.7
Balsam Fir Old Forest Area	49.7	19.4	2.3	0.0	0.0	0.0
BSL (SI 40+) Old Forest Area	36.8	31.1	21.6	12.4	8.3	11.0
BSL (SI 30-39) Old Forest Area	23.4	24.9	21.0	18.0	13.6	13.0
BSL (SI <= 29) Old Forest Area	32.3	32.5	32.3	30.3	23.6	15.5
Tamarack (SI 40+) Old Forest Area	45.7	40.3	34.9	25.8	20.6	12.8
Tamarack (SI < 40) Old Forest Area	18.2	31.6	20.5	8.6	2.6	3.1

e. Maintaining young forest

The plan specifically targeted some conversion to take place in young and middle-aged stands to enhance the likelihood of achieving a successful type conversion.

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 (see GDS-2D for specific discussion about young, *early successional* forest). 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 rotation age.

f. Planned Increases/Decreases in Cover-type Acres

The long-term (50-year) desired future forest condition calls for decreases in the aspen/balm of gilead, and paper birch cover types. Conversions will result in changes to cover-type acreages based on NPC site classification. If there are increases, they will likely be in the white pine, white spruce, red pine, jack pine, white cedar, northern hardwoods, and oak cover types. These

cover-type changes are not planned to occur proportionately throughout the 50-year period, because of considerations for the acres beyond rotation age and balancing the age-class distribution.

Table 3.9f: Cover-type Conversion Goals for the First Decade by Subsection

		Subsection Totals				
		L-VU	SLM	NU	TL	Total
Available	Aspen/BG	112,462	68,739	24,343	55,448	260,992
Acres	Birch	1,434	4,102	2,728	1,800	10,064
Conversion	Aspen/BG	-3179	-3591	-1666	-1608	-9044
Acres	Birch	-27	-402	-925	-132	-1486
Treatment	Aspen/BG	20613.3	18291.2	3803.4	11740.9	54448.8
Acres	Birch	529	927.6	1315.5	424.1	3196.2

Conversions were allocated to forestry administrative areas based on available aspen, balm of gilead, and birch acres in patches, percentage of those species in a specific LTA, and LTA conversion goals. For details see Appendix E: Cover-type Conversion Goals, on page 7.15.

g. Supply of Timber

A Remsoft harvest-scheduling model was used to achieve a sustainable treatment level, taking into consideration any planned increases or decreases in each cover type over the next 50 years (see Table 3.9e). 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. Tables 3.9g-h, following, summarize treatment levels in acres by decade, applying all North 4 planning factors.

2. Uneven-age Management and Thinning

All uneven-age and some even-age managed cover types will be managed using selective harvest treatments (see Tables 3.9g-h). The uneven-age managed cover types include ash, lowland hardwoods, northern hardwoods, white pine over age 90, some balsam fir, and the ERF portion of the white spruce cover type. Thinning in jack pine types is not standard procedure in the North 4 Subsections, but may be considered on appropriate NPCs, with coordination per the *Coordination Framework* to explore innovative techniques, and with the intention of meeting specific SFRMP management objectives. Cover types that will be thinned include balsam fir, jack pine, white spruce, red pine, white pine, and aspen and/or birch (for long-term conversion goals, see Appendix E, page 7.15). All stands that meet the criteria will be field- visited for possible selective treatment. Some of the ash, lowland hardwoods, and northern hardwoods may be initially treated through even-age methods to improve long-term stand age-structure and timber quality. See Chapter 4 for specific stand 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 harvest plan or annual plan addition review process.

Table 3.9g: Treatment Levels for Even-Age Managed Cover Types by Decade for North 4 SFRMP Area (All Subsections Combined)

Cover Type		10-year Treatment Acres by Decade				
	Previous Decade*	2010 - 2019	2020 - 2029	2030 - 2039	2040 - 2049	2050 - 2059
Aspen/BG	53,220	54,448	44,358	44,627	45,808	52,154
Balsam Fir [1]	8,970	5,423	3,636	1,132	2,979	2,885
Birch	8,640	3,197	1,647	821	286	2032
BSL[2]	25,350	20,725	18,577	16,837	16,481	16,934
Jack Pine/BSU	3,650	2,120	2,426	2,817	4,498	4,207
Red pine[3]	0	319	~150	~150	~150	~150
Tamarack	11,060	5,854	9,338	9,351	8,223	8,656
White Sp. [4]	0	0	667	700	1,854	1,909

[1]Balsam fir will be treated with two primary prescriptions—as even-age on productive upland sites; and as uneven-age on less productive, more mesic sites. Final prescriptions based on field evaluation may change acres from one prescription type to another.
[2]7,183 acres added in the first decade in response to public review process; actual stands still being identified by field visit.
[3]Red pine final harvest was added in response to public and internal review processes; actual stands still being identified.
[4] White spruce treatments will vary depending on stand origin. Plantations will normally be managed with thinning. No stands will reach an age requiring final harvest within the 10 years covered by the plan.
* Previous harvest levels are an approximation from DNR Forestry administrative area annual stand examination lists from FY2001 to FY2008, based on legal descriptions roughly corresponding to subsection boundaries.

Table 3.9h: Treatment Levels for Uneven-Age Managed Cover Types for North 4 SFRMP Area (All Subsections Combined)

Cover Type	Previous Decade*	2010-2019
	Treatment Acres	Treatment Acres
Ash/Lowland Hardwoods	9,460	3,207
Balsam Fir [1]	0	2,295
Northern Hardwoods/Oak	18,450	13,265
White Pine [2]	0	150
White Spruce [3]	0	455

[1]Balsam fir will be treated with two primary prescriptions – even-age on productive upland sites; and uneven-age on less productive, more mesic sites. Final prescriptions based on field evaluation may change acres from one prescription type to another.
[2] White pine initial prescriptions include both uneven-age and thinning. Final prescriptions based on field evaluation may change acres from one prescription type to another.
[3]White spruce treatment will vary depending on stand origin. Natural-origin stands will normally be managed with uneven-age prescriptions.
* = Previous harvest levels are an approximation from DNR Forestry administrative area annual stand examination lists from FY2001 to FY2008, based on legal descriptions roughly corresponding to subsection boundaries.

Table 3.9i: Thinning Treatment Levels for North 4 SFRMP Area (All Subsections Combined)

Cover Type	Previous Decade*	2010-2019
	Treatment Acres	Treatment Acres
Red Pine	7,800	14,351
White Pine [1]	350	485
White Spruce [2]	2,920	6,825

[1] White pine initial prescriptions include both uneven-age and thinning. Final prescriptions based on field evaluation may change acres from one prescription type to another.

[2] White spruce treatment will vary depending on stand origin. Plantations will normally be managed with a thinning prescription.

* = Previous harvest levels are an approximation from DNR Forestry administrative area annual stand examination lists from FY2001 to FY2008, based on legal descriptions roughly corresponding to subsection boundaries.

3. Biomass Harvesting

Although there is no target or DFFC for biomass harvest at this time, the North 4 SFRMP team estimates that roughly 400,000 - 600,000 tons of biomass would be available as tops and limbs from roundwood harvests proposed in this plan. This is an emerging market in response to demand for alternative energy production. Minnesota DNR policy is changing in response to this changing market.

- Biomass as tops and limbs will be available for purchase on most timber sale sites where roundwood is harvested. Sites not available for biomass harvest are defined in the MFRC Biomass Harvesting Guidelines[36].
- In addition some non-commercial forest sites are available for biomass harvest consistent with biomass harvesting guidelines as markets demand. The wildlife section has identified some areas with potential for biomass harvest from brushlands.

4. Stands Reserved or Deferred for Further Evaluation

A total of 165 stands was identified by the North 4 SFRMP team to be reserved or deferred during the 10-year planning period. *Timber land* acres to be deferred total 2,986 acres; the *forest land* acreage to be deferred is 3,423. These stands will become available for active management after evaluations are completed if they are released from the reserved or deferred status. Evaluation procedures for EILC stands are being developed in a separate process as this plan goes to print (2009). Because these deferred acres were included in the cover-type treatment level calculations, the proposed treatment levels recommended in this plan were not affected by the deferrals.

[36] http://www.frc.state.mn.us/FMgdline/Final_Draft_for_MFRC_Approval_Forest_BiomassHarvest_Guidelines.pdf

Table 3.9j: Summary of North 4 Deferred Stands *Timber Land* acres by Subsection

Subsection	Acres
Littlefork-Vermilion Uplands	561
Nashwauk Uplands	865
St.Louis Moraines	203
Tamarack Lowlands	1,357
Total	**2,986**

Table 3.9k: Summary of North 4 Deferred Stands *Timber Land* acres by Cover Type

Cover Type	Acres
Ash	376
Lowland hardwoods	190
Aspen	517
Birch	456.0
Balm of gilead	18.1
Northern hardwoods	670
Oak	132
White pine	17
Red pine	160
Jack pine	53
White spruce	9
Balsam fir	185
Lowland black spruce	30
Tamarack	26
Cedar	147
Total:	**2,986**

Table 3.9l: Summary of North 4 Deferred Stands *Timber Land* acres by Reason for Deferment

Reason for Deferment	Acres
Land status restrictions[1]	234
Old-growth nomination[2]	956
SNA nomination[3]	426
Stand adjacent to USFS cRNA[4]	758
Stand is inoperable[5]	575
Stand is private land[6]	38
Total	**2,986**

[1]FHA tax-forfeit lands transferred to DNR-Wildlife with a "no timber harvest" covenant attached to the deed.
[2]Stands nominated for DNR old-growth evaluation offered by all three Divisions.
[3]Stands nominated for SNA evaluation and/or additions to existing SNAs by the Divisions of Ecological Resources and/or the Division of Fish & Wildlife.
[4]Stands deferred from management per DNR-FRIT direction to defer stands from management that are adjacent to Superior National Forest cRNAs. These stands are to be evaluated for conservation consideration by the Division of Ecological Resources.
[5]Stands suggested for removal from the stand selection pool by the Cloquet Area due to inoperability. Stands are either thin, narrow stands along rivers or small stands surrounded by DNR designated old-growth.
[6]One stand in the Littlefork Area that is in FIM but is actually private land.

5. Acres Comparison between the Past Plan and the Recommended SFRMP Treatment Levels

Past forest resource management plans were based on Division of Forestry area administrative boundaries while this SFRMP is based on ECS subsection boundaries. The proportion of each of the forestry area's cover-type acres in these subsections was used to calculate the estimated portion of past area plans treatment acres by cover type in these subsections. These estimates were used for comparing the past cover-type acres treatment levels to those recommended in this SFRMP. Table 3.9g (above) provides a total acres treatment level by cover-type comparison between the past plan and those recommended in this SFRMP.

6. Volume Comparison between the Past Plan and the Recommended SFRMP Treatment Levels

Minnesota DNR develops annual planned treatment levels on a cover-type acreage basis rather than a volume basis. This SFRMP Estimate (2010-2019) provided in Figure 3.9m for harvest volume is an estimate produced by the Remsoft harvest-scheduling model, based on treatment acres, yield equations,[37] treatment method,[38] and cords per acre based on forest inventory data and preliminary prescriptions. It is a rough estimate because not all treatment acres are suitable, or result in timber sales; the treatment method (prescription) may change after the field

[37] Walters, David K. and Alan R. Ek. Whole Stand Yield and Density Equations for Fourteen Forest Types in Minnesota; Department of Forest Resources, University of Minnesota, 1530 North Cleveland Avenue, St. Paul, MN 55108.
[38] For all thinnable types, volume yield was assumed to be 10 cd/acre, and all uneven-age systems used 33% of nominal Walters and Ek volumes.

examination of the stand; and the forest inventory volume data (cords per acre) is typically not as accurate as the more intensive appraisals that are completed for timber sales. The previous decade volume given for comparison (1997-2006) is based on actual average volume sold per year.

Table 3.9m: Remsoft Model Estimate of Volume[1] (cords) to be Offered for Sale in First Plan Decade by Treatment Type and Species

Species Group	LVU	NU	SLM	TL	North 4 Totals
Aspen species group	362,928	61,247	256,780	199,296	880,250
Balsam fir	52,215	7,805	25,268	20,557	105,845
Black spruce[2]	173,847	38,604	26,894	49,153	288,498
Jack pine	15,149	4,249	6,648	3,590	29,635
Northern white cedar	11,479	1,421	4,288	4,735	21,923
Red pine[3]	34,272	32,217	47,427	22,258	136,174
Paper birch	30,559	15,890	30,771	19,621	96,842
Tamarack	37,085	2,013	7,430	31,417	77,945
White pine	4,397	1,990	3,423	3,064	12,873
White spruce	37,387	9,849	14,342	12,904	74,482
Other species	53,601	16,488	99,172	56,534	225,795
Treatment group					
Total Volume From Even-age Harvest	693,411	131,641	318,870	331,963	1,475,885
Total Volume From Thinning	72,112	46,432	64,228	35,948	218,720
Total Volume From Group Selection	14,865	7,407	82,582	42,377	147,231
Total Volume From Conversion	32,530	6,293	56,764	12,839	108,426
Total Harvest Volume Estimate from Woodstock-Stanley model:	812,918	191,773	522,444	423,127	1,950,262
Estimated range of Anticipated	772,272	182,184	496,322	401,971	1,852,749
Volume to be Offered (+/-5%)	853,564	201,362	548,566	444,283	2,047,775
1997-2006 10-y Actual Volume Sold[4]	879,860	212,800	441,350	381,540	1,915,550

Data source: "FINAL_YIELD_SUMMARY.xls"

[1] Walters and Ek yield equations/tables were used in the W-S model (Walters, David K. and Alan R. Ek. Whole Stand Yield and Density Equations for Fourteen Forest Types in Minnesota; Department of Forest Resources, University of Minnesota, 1530 North Cleveland Avenue, St. Paul, MN 55108). However, for all thinnable types, volume yield was assumed to be 10 cd/acre, and all uneven-age systems used 33percent of nominal Walters and Ek volumes.

[2] Approximately 103,000 cords additional volume added following public review and development of alternative modeling scenarios (December 2010).

[3] Volumes not available by subsection, but approximately 35,000 cords of red pine final harvest volume is being added following public and internal review (December 2010).

[4] Approximation based on legal descriptions roughly corresponding to subsection boundaries.

GDS-9B: The harvest of nontimber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity.

Nontimber forest products, also known as special forest products, can be categorized into five general areas: decorative materials, foods, herbs, medicinal materials, and specialty items. Nontimber forest products include, but are not limited to: boughs, decorative trees (e.g., Christmas trees), spruce tops, birch tops, *Lycopodium spp.* (also referred to as princess pine or

ground pine), diamond willow, bark, burls, conks, mushrooms, berries, ginseng, Labrador tea, rose hips and blossoms, seedlings, cones, nuts, native plant seed, aromatic oils, and extractives.

The social importance, ecological role, and function of special forest products resources are only beginning to be understood. Improving our species-specific knowledge, as well as broadening forest inventories and developing appraisal methods for most types of nontimber forest products, will make determining sustainable harvest levels possible in the future. Currently, special product permits or informal timber sales are issued for some nontimber forest products (e.g., balsam boughs and decorative trees) to ensure that harvest operations do not damage the site's potential for future production. Harvest of nontimber forest products may be restricted on some state-administered forest lands such as WMAs, aquatic management areas (AMAs), and SNAs.

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

GDS-9B Strategies

a. Consider known traditional gathering areas when managing other forest resources. For example, consider forest management effects on known areas such as those traditionally used for gathering maple syrup (sugarbush areas) or gathering wild rice (ricing camps) when planning forest management activities.

b. Supervise and enforce special product permit regulations to ensure that the site's capacity for future production is not jeopardized. Consider managing or using some forest stands for nontimber forest products, such as balsam boughs, berry patches, or decorative tops.

c. Implement Minnesota DNR regional targets for sustainable decorative tree top (black spruce) harvest. See Chapter 4, Section 4.16, stagnant spruce cover-type management recommendations.

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

e. Forest managers should proceed judiciously when issuing special products permits for species where limited knowledge and understanding constrains our ability to know if we are managing these groups of species sustainably (e.g., commercial harvest of mushrooms, *Lycopodium spp*, and native plant seed).

3.10 Access to State Land

GDS-10: Forest access routes are well planned and there is a high level of collaboration with federal, private, and local units of government to share access and minimize new construction.

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. The overall density of roads in specific geographic areas can be minimized through cooperation with other landowners in the subsections. The access routes that are selected must be developed in a way that protects or minimizes the negative effects on other forest resources.

GDS-10 Strategies

a. Continue to seek cooperation with other forest landowners to retain existing access to state land and to coordinate new road access development and maintenance across mixed ownerships. Cooperative road planning that involves all affected landowners will be done whenever possible to maximize the efficiency of the transportation system. Use the DNR GIS-based road and trail inventory. The goal is to serve as many acres of forest land with as few miles of road as possible.

b. Follow Minnesota statutes and guidelines and DNR policies for state forest roads.

- Follow the *Site-Level Guidelines* for road design, construction, maintenance, reconstruction, and closure.
- Follow the guidelines and policies relating to roads and trails in the *DNR Forestry Road Manual* and the *Forestry-Wildlife Habitat Management Guidelines (page 50)*.
- Use the *DNR Site-Level Design and Development Guidelines for Recreational Trails* for guidance on post-sale treatment.

c. Apply the department direction regarding access roads across EILC and other areas that have been reserved (or deferred) from treatment during the 10-year plan.

- Evaluate on a case-by-case basis (DNR Forestry administrative area review by Forestry, Fisheries and Wildlife, and Ecological Services staff) as access is needed in these areas, applying the following principles (in order):
  1) Avoid access routes across EILC areas, if possible. For example:
     - Use other reasonable access routes that don't involve EILC stands if they are available. For example, go around the EILC area if it is small.

  2) If the only reasonable access to stands to be treated is across EILC areas, then strive to minimize impacts. For example:
     - Use seasonal/temporary access versus a permanent road. (Since EILC are in lowland areas, this road access would typically be seasonal winter roads.)
     - Use narrow corridors.
     - Use routes causing the least disturbance.
     - Use only during frozen ground conditions that support the equipment using it.

d. Follow strategies identified under other General Direction Statements that apply to roads throughout the planning, development, and disposition of forest roads.

- GDS-1E, Strategy b: Minimize the fragmenting of habitat with roads and forest access trails.
- GDS-1E, Strategy j: Locate roads to minimize fragmentation of a MCBS site.
- GDS-1G, Strategy f: Harvest prescriptions, access plans, and other management proposals identify and implement measures that protect rare features.
- GDS-4B, Strategy f: Apply the *Site-Level Guidelines* . . . road maintenance or closure.

- GDS-8, Strategy a: Apply the *Site-Level Guidelines* on visual quality on all vegetative management activities.

Refer to the identified GDSs and strategies for more details on the listed strategies.

e. Complete a timber access plan.

After the 10-year stand exam list was compiled, field personnel completed a timber access plan. The purpose of the timber access plan is to identify any new road and any temporary access needed to access stands identified in SFRMP for field visit and/or treatment. The new access plan will help in assessing road access/fragmentation/density concerns. It will also provide post-sale treatment intentions on the estimated new access/temporary access locations. Existing roads or previously used corridors of disturbance will be followed whenever feasible. The timber access plan will identify where USDA Forest Service road permits are required. For new roads and temporary access, the road classification (whether it is winter or summer access), miles of new road, and proposed post-sale treatment will be documented.

Table 7.17 on page 7.381 in Chapter 7 *Ten-Year Stand Examination List and New Access Needs* displays miles, season of use, and type of access for stands identified as needing new access during the planning period.

The proposed post-sale treatment information on new roads and trails can be used for planning the maintenance, closure (e.g., gate, sign, slash, or berm), abandonment, or reclamation (e.g., with natural or planted vegetation) of the access route. Limiting unplanned secondary usage should also be considered in post-sale road planning. The timber sale appraiser will refine the proposed road access and post-sale treatment plan 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.

Most temporary roads will not be maintained after harvest is completed. These access routes should be used again for future forest management activities instead of disturbing new areas.

3.11 Cultural Resources

GDS-11: Cultural Resources will be protected on state-administered lands.

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

GDS-11 Strategies

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

3.12 Natural Disturbance Events

GDS-12: Natural disturbance events that occur on state land within these subsections are promptly evaluated to determine the appropriate forest management needed to their impacts.

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

GDS-12 Strategies

a. The subsection planning team will evaluate large-scale (100's to 1000's of acres) disturbance events to determine appropriate action. If large-scale disturbance events occur during the 10-year plan, the core team will assess the extent and significance of the event on the structure and condition of forest lands in the subsections. The team will propose forest management actions to be implemented within the area impacted by the event and determine whether adjustments to the short-term harvest levels are needed.

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

b. Local land managers will evaluate and determine appropriate actions for small-scale (10s of acres) disturbance events. After small-scale disturbances, local forest and wildlife managers will do a timely evaluation of the disturbance area and take the appropriate action needed to address the situation.