3. General Direction Statements (GDSs) and Strategies

Section **Page**

3.0 Introduction

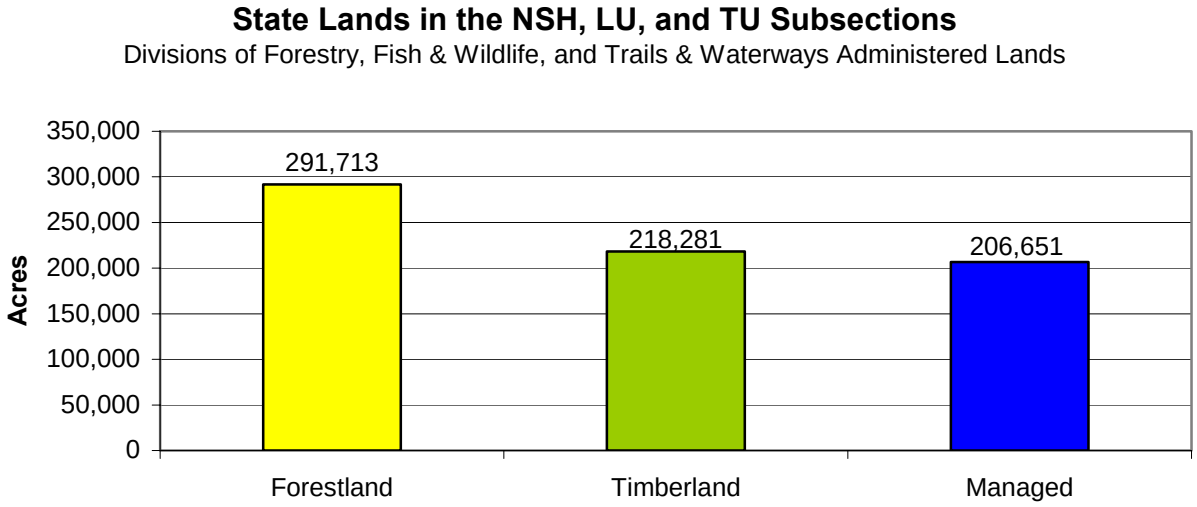
In response to the final list of issues identified in Chapter 2, the subsection team developed general direction statements (GDSs) to address the issues, strategies to achieve the general directions, and desired future forest composition (DFFC) goals. General direction statements consider direction provided 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 forestlands 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. Where possible (i.e., current ability to measure and quantify), DFFC goals were identified. DFFC goals are long-term (50+ years) goals for the ultimate desired condition of DNR forestlands 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, 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. In the next step, a final product of this planning process will be 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 will be used as a guide in the selection of stands and the application of treatments to selected stands during this 10-year plan.

Under the direction of the Minnesota Forest Resource Council (MFRC) Landscape Program, the Northeast Regional Landscape Committee completed a report in 2003 that included desired future forest conditions for the Northeast Landscape Region, which includes Cook, Lake, St. Louis, and Carlton counties. The Northern Superior Uplands Ecological Section is primarily located in these four counties and the three subsections included in this plan are located in this ecological section. This report recommended desired outcomes, long-term goals, and strategies for forestlands (specific recommendations were made for five ecosystem types) in the Northeast Landscape Region. The goals and strategies in this subsection plan for state-administered forestlands are generally consistent with those recommended by the Northeast Regional Landscape Committee.

Figure 3.a shows the state land acres administered by the divisions of Forestry, Fish and Wildlife, and Trails and Waterways in the three subsections. (In addition, the Division of Parks and Recreation administers 24,590 acres of state park lands in the North Shore Highlands Subsection. The state park lands are not addressed in this plan.) *Forestland* consists of all lands included in the forest inventory from aspen and pine cover types to stagnant conifers, muskeg, lowland brush, and lakes. *Timberland* includes those cover types that are capable of producing merchantable timber. Very slow growing trees (e.g., stagnant lowland conifers) are not included as timberlands. In this plan, *managed* acres are those acres available for timber management purposes. These managed acres are approximately 9 percent of the total forestland (all ownerships) in the three subsections. State lands reserved from harvest such as designated old-

growth stands (6,115 acres) and Scientific and Natural Areas (SNAs) (998 acres) are not included in managed acres.

Figure 3.a: Forestland, Timberland, and Managed Acres



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

In this chapter, the 28 general direction statements 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 is distributed across the landscape.

Consideration of old forest during planning was done to:

- Ensure an adequate representation of older growth stages in even-aged cover types.
- Address visual 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 natural community types.
- Provide large-diameter timber products.

A forest stand of any particular even-aged managed forest cover type is considered old forest whenever its age exceeds the normal rotation age agreed on by the landscape team for that cover type. Determining the amount of old forest to be sustained in these subsections required balancing several factors: timber productivity, economic impacts, historical forest conditions, and habitat requirements. The goal is to provide a representation of old forest that is sustainable over time, balanced with the need to provide a stable timber supply, increased timber productivity, and early successional forest habitat.

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 (done in the old-growth designation process).
- Designating forest that is held to an old forest condition (i.e., extended rotation forest).
- Specifying situations under which forest managers will create or maintain old forest characteristics within treated stands, based on site factors found there.

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

Uneven-aged managed stands and other state lands (e.g., state parks and scientific and natural areas) 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.

At the end of the 10-year period covered by this SFRMP plan, an average of 23 percent (currently 30 percent) of the even-aged managed cover types timberland acres will be over their normal rotation age. This acreage provides old forest conditions. The amount is higher than the DFFC goal of 9 – 14 percent (varies by cover type – see Table 3.1a) because of the large acreage currently over the normal rotation age in some cover types.

Modeling of even-aged cover type harvest levels over five decades indicates that the acreage of forest over normal rotation age will decline significantly (toward the DFFC) on these state timberlands. Table 3.1a shows projections for the even-aged cover types that were modeled. The table assumes full demand for timber offered for sale and harvest. Over the decades, the percent of old forest fluctuates because of the current unbalanced age-class distribution of the cover types. When the desired balanced age-class distribution is reached (See GDS-2A), the old forest percent should equal the percent of old forest desired as shown in the DFFC column.

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

Cover Type	DFFC	Percent by Decade					
		Current	2nd	3rd	4th	5th	6th
Aspen/BG[1]	11%	32%	19%	14%	7%	17%	20%
Birch[2]	14%	73%	54%	NA	NA	NA	NA
Jack Pine	9%	12%	13%	7%	4%	4%	4%
Balsam Fir	9%	40%	9%	8%	8%	10%	9%
Tamarack							
High Site Index	10%	12%	8%	17%	19%	16%	10%
Low Site Index	10%	13%	12%	14%	20%	21%	14%
Black Spruce Lowland							
High Site Index	10%	15%	23%	33%	32%	23%	15%
Medium Site Index	10%	14%	14%	20%	26%	24%	16%
Low Site Index	10%	19%	12%	14%	13%	13%	12%
Black Spruce Upland	9%	38%	35%	26%	16%	8%	4%

[1]BG – balm of gilead
[2]Birch modeling was only completed for the first decade because the maximum rotation age will be evaluated during this 10-year planning period.
Red (Norway) pine, white pine, white spruce, and cedar were not modeled because of their current age-class distribution and the small amount of harvest by clearcut methods that will occur in these cover types. Most harvest in these cover types during this planning period will be by thinning or selective harvest methods, so the stand age will not be changed.

GDS-1A Strategies

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

Normal rotation ages, maximum rotation ages, ERF rotation ages, and age of merchantability were developed for each of the even-aged managed cover types as shown in Table 3.1b.

Table 3.1b: Rotation Ages for Even-aged Managed Cover Types

Cover Type	Site Index	Merchantable Age	Normal Rotation Age	Maximum Rotation Age	ERF Rotation Ages[2]
Aspen/Balm of Gilead	65+	35	50	85	65-75-85
Aspen/Balm of Gilead	<65	40	55	85	65-75-85
Birch	60+	40	65	85	75-85
Birch	<60	45	55	85	75-85
White Pine[1]	All	35	180	240	180-210-240
Red Pine	All	35	120	240	200-220-240
Jack Pine	All	35	60	80	70-80
Black Spruce Upland	All	50	70	100	90-100
White Spruce	All	40	75	120	100-120
Balsam Fir	All	40	50	75	60-75
Black Spruce Lowland	40+	60	85	115	105-115
Black Spruce Lowland	29-39	65	100	135	120-135
Black Spruce Lowland	23-28	70	120	180	160-170-180
Tamarack	40+	50	85	115	105-115
Tamarack	23-39	60	100	150	130-140-150
Cedar[1]	All	75	160	NA	NA

[1]All white pine and white cedar cover type acres were designated as ERF.
[2]Multiple ERF rotation ages are used to achieve the desired declining age-class distribution from normal rotation age out to the maximum rotation age.

This information, along with an analysis of other data, was used to set a desired amount of effective ERF for these cover types. (See Appendix D, *Analysis of Old Forest Used to Determine the Desired Amount of Extended Rotation Forest*). **Prescribed ERF** is the cover type acreage designated for management as ERF. Stands designated as ERF will be held beyond the recommended normal rotation (harvest) age out to the established ERF rotation age(s). A stand at any age can be prescribed as ERF. **Effective ERF** is defined as the portion of the prescribed ERF acreage that is actually over the normal rotation age for the cover type. Figure 3.1a illustrates prescribed ERF and effective ERF for a cover type that has an even-aged class distribution with a declining acreage from normal rotation age to the maximum rotation age. Table 3.1c shows the amount of prescribed ERF and the long-term goal for effective ERF by cover type. It also shows the current acreage over the normal rotation by cover type.

Figure 3.1a: Extended Rotation Forest Example

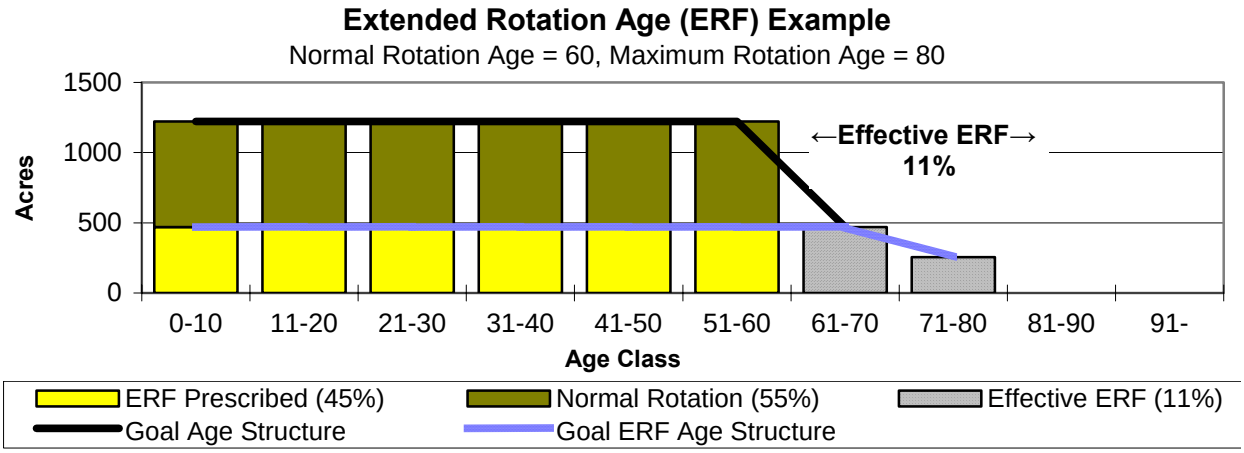


Table 3.1c: State Timberland ERF by Cover Type

Cover Type	Timber-land Acres[1]	Normal/ Maximum Rotation Age[2]	Prescribed ERF %[3]	Prescribed ERF Acres[4]	Effective ERF % Goal[5]	Current Acres >NRA[6]	Current Acres % > NRA[7]
Aspen/Balm of Gilead	67,453	50-55/85	39%	26,370	11%	21,840	32%
Birch	27,864	55-65/85[8]	45%	12,492	14%	20,308	73%
White Pine[9]	1,705	180/240	100%	1,705	NA	7	0.4%
Red Pine	8,519	120/240	30%	2,655	10%	8	0.1%
Jack Pine	5,260	60/80	44%	2,383	9%	616	12%
Black Spruce Upland	3,328	70/100	33%	1,098	9%	1275	38%
White Spruce	12,614	75/120	35%	4,462	12%	705	6%
Balsam Fir	11,937	50/75	31%	3,736	9%	4810	40%
BSL[10] (SI 40+)	5,426	85/115	41%	2,200	10%	836	15%
BSL (SI 29-39)	15,168	100/135	43%	6,374	10%	2179	14%
BSL (SI <29)	8,396	120/180	34%	2,902	10%	1590	19%
Tamarack (SI 40+)	2,889	85/115	43%	1,299	10%	345	12%
Tamarack (SI <40)	2,597	100/150	35%	953	10%	348	13%
Cedar[11]	15,186	160/160	100%	15,186	NA	2161	14%
	188,342		**45%**	**83,815**	**11%[12]**	**57,028**	**30%**

[1]Timberland Acres: Forestry, Wildlife, and Fisheries-administered lands considered available for timber harvest.
[2]Normal/Maximum Rotation Ages: Some cover types have multiple rotation ages. Harvest will occur at various ages from normal rotation age out to the maximum rotation age.
[3]Prescribed ERF %: percent of the timberland acres in the three North Shore subsections designated as ERF.
[4]Prescribed ERF Acres: acres designated in the three North Shore subsections as ERF.
[5]Effective ERF % Goal: Effective ERF is the portion of the designated ERF acreage that is above the normal rotation age of the cover type. This percent is a long-term goal of the portion of the cover type timberland acreage that will be managed or grown beyond the normal rotation age with some of the acreage held out to the maximum rotation age.
[6]Timberland acreage in 2003 that is older than the normal rotation age(s) established for the cover type.

[7]Percent of timberland acreage in 2003 that is older than the normal rotation age(s) established for the cover type.
[8]Birch maximum rotation age will be evaluated during this 10-year plan.
[9]All white pine was designated as ERF and will be managed on the rotation age of 180 or more according to Division of Forestry policy.
[10]BSL – black spruce lowland
[11]All white cedar was designated as ERF. Limited harvest proposed (30 acres per year) from stands aged 90 – 160 years old.
[12]Does not include white pine and cedar cover type acres in the calculated average percent of effective ERF.

b. Prescribe ERF stands within even-aged cover types so that when a balanced age-class distribution is achieved, the desired amount of effective ERF will be provided.

The amount of prescribed ERF was determined by modeling the desired amount of effective ERF for a cover type that is desired to be sustained over time. ERF stand designation used strategies to maintain similar acreages in each age class over time, and to provide for a sustainable supply of old forest and old forest benefits. 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 3.1d 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 3.1d: Effective ERF Percent (2004 – 2054)

Cover Type	2004	2014	2024	2034	2044	2054	Goal
Aspen/Balm of Gilead	14	11	7	5	11	14	11%
Birch	33	14	NA	NA	NA	NA	14%
Red Pine[1]	1	not modeled					10%
Jack Pine	4	3	4	4	4	4	9%
White Spruce[1]	6	not modeled					12%
Black Spruce Upland	13	16	14	9	6	4	9%
Balsam Fir	14	9	8	8	10	9	9%
BSL[2] (SI 40+)	6	10	16	18	12	7	10%
BSL (SI 29-39)	7	8	12	13	12	9	10%
BSL (SI <29)	8	9	11	12	13	12	10%
Tamarack (SI 40+)	6	5	10	13	13	10	10%
Tamarack (SI <40)	6	3	9	14	18	14	10%

[1]Red pine and white spruce were not modeled because of their current age-class distributions.
[2]BSL – black spruce lowland
Effective ERF estimates for white pine and cedar were not made since all their cover type acres will be managed under ERF rotation ages.

c. Target ERF stand selection to enhance old growth, riparian corridors, and patches.

When ERF stands were selected, stands were frequently designated in blocks to protect and enhance old growth and riparian corridors. Also, ERF facilitates patch management by

maintaining some old patches now and ensuring that some patches will be held beyond normal rotation age in the future (see GDS-1D).

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

During the selection of ERF stands, even-aged stands in riparian areas were given a high priority for ERF designation. 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 without harvest.

In stands where natural succession from a short-lived cover type (e.g., aspen or balsam fir) is well on its way toward the stand composition becoming a long-lived forest type (e.g., white pine or northern hardwoods), the stand should be left untreated and allowed to succeed naturally. Most of these stands will come from those identified for treatment in the high-risk, low-volume (HRLV) pool of stands. Field evaluation, including use of the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* (NPC Field Guide) and the Field Visit Decision Tree (Appendix E), will be used to help decide which stands to allow natural conversion. (See GDS-3A, strategy g).

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

Complete and follow long-term management plans for designated old-growth stands and the surrounding acres in the OFMC 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 F, Ecologically Important Lowland Conifers (EILC): Acreage Goals and Rationale, shows how the acreage to designate as EILC was determined for these subsections. Table 3.1e provides a summary of the acres designated by cover type. The designated EILC stands will be reserved from treatment during this 10-year planning period. These stands range in age from 2 to 213 years old. The EILC designated stands will be reviewed for continued protection during the next subsection planning process for these subsections based on the old-growth guidelines or other guidelines in place at that time. Old-growth guidelines will be amended sometime in the future to provide further direction on lowland conifers as an old-growth type. *(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.

Table 3.1e: Ecologically Important Lowland Conifer Designation Summary

Cover Type	State Forestland Acres	EILC Acres Designated	Percent of Cover Type Designated as EILC
Black Spruce Lowland	28,876	5,121	18%
Tamarack	5,456	642	12%
Cedar	14,957	5,234	35%
Stagnant Spruce	16,244	6,686	41%
Stagnant Tamarack	3,042	2,432	80%
Stagnant Cedar	4,490	2,072	46%
Lowland Conifers Total	**73,065**	**22,187**	**30%**

h. Follow the MFRC's *Voluntary Site-Level Forest Management Guidelines* to retain components of old forest in even-aged cover types.

Examples of retention of old forest components include retaining leave trees (e.g., 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)
- Shelterwood with reserves
- Seed tree with reserves.

GDS-1B: 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 three 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:

- Range of natural variation
- Historic forest composition
- Historic disturbance regimes

- Wildlife habitat
- Forest insects and disease
- Forest productivity (e.g., match the species to the site using the NPC Field Guide)
- Generic environmental impact statement (GEIS) mitigation
- Increase availability of certain forest products (e.g., sawtimber)
- Costs of implementation
- Recreational values
- Aesthetics
- Climate change

Range of Natural Variation (RNV)
Of the above considerations, RNV analysis (See Appendix G, Process Used to Determine Forest Composition Goals) was the primary tool for identifying potential composition change goals. This analysis compared existing forest conditions with RNV in the Northern Superior Uplands ECS Section and provided an understanding of landscape-level forest composition and age structure.

Using RNV as a tool does not imply a goal to recreate a specific historic condition. Rather, RNV helps identify the range of composition, structure, and processes required to sustain an ecosystem and its desired products and services.[1]

Analysis of RNV, including the other considerations above, was used to determine the magnitude and location of forest cover type composition change goals in the subsections.

DFFC Goal: Move toward the desired cover type acreage goals recommended in this plan.

This plan will move these subsections toward more conifer cover type acreage in upland areas. Cover type increases will occur primarily in red (Norway) pine, white pine, jack pine, white spruce, and white cedar (upland). Some minor increases in oak and northern hardwoods are desired. Cover type decreases will occur primarily in the aspen, birch, and balsam fir cover types. Figures 3.1b and c and Tables 3.1f – i show the desired change in cover type acres for the subsections during the next 10 years and the 50+ years goal. Appendices H and I include tables that break down the cover type change goals by land type association (LTA) within the subsections.

[1] Minn. DNR. May 2002 (draft to elicit feedback). Range of Natural Variation: Information for Sustainable Forest Management. A Primer.

Figure 3.1b: Desired Cover Type Acreage Changes – 10-Year Goal

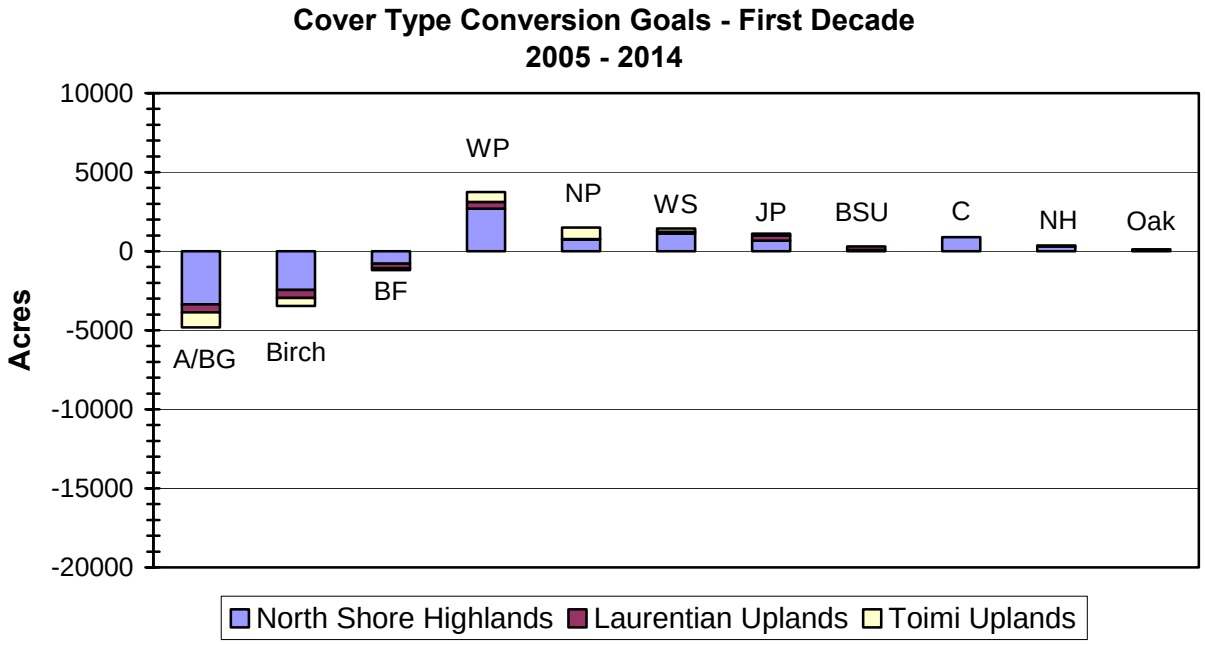
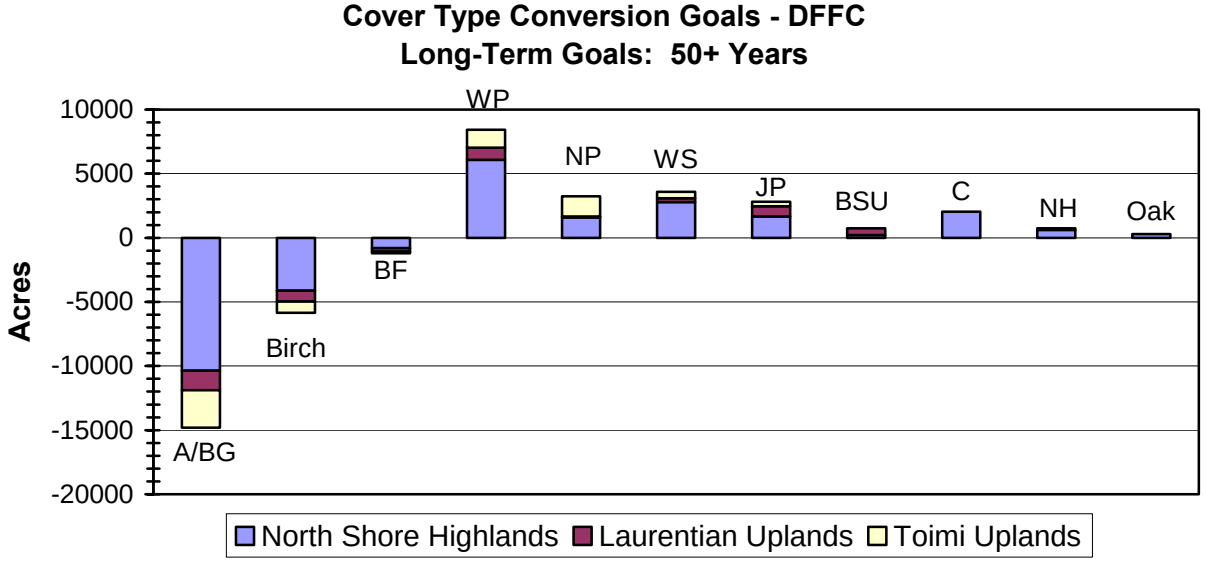


Figure 3.1c: Desired Cover Type Acreage Changes – Long-Term Goals (50+ years)



A/BG – aspen/balm of gilead, BF – balsam fir, WP – white pine, NP – Red (Norway) pine, WS – white spruce, JP – jack pine, BSU – black spruce upland, C – cedar, and NH – Northern Hardwoods.

Table 3.1f: Desired Cover Type Acreage Changes – 10 Years and 60 Years – North Shore Highlands, Laurentian Uplands, and Toimi Uplands Subsections

NSH, LU, and TU Subsections	Present – 2004	DFFC - 2014			DFFC - 2064		
Cover Type	**Acres**	**Acres**	**+/- Acres**	**% Change**	**Acres**	**+/- Acres**	**% Change**
Aspen/Balm of Gilead	67,406	62,593	-4,813	-7%	52,585	-14,821	-22%
Birch	27,961	24,494	-3,467	-12%	22,107	-5,854	-21%
Balsam Fir	11,928	10,734	-1,194	-10%	10,734	-1,194	-10%
White Pine	1,757	5,493	+3,736	+213%	10,195	+8,438	+480%
Red Pine	8,489	9,989	+1,500	+18%	11,723	+3,234	+38%
Jack Pine	5,268	6,383	+1,115	+21%	8,076	+2,808	+53%
Black Spruce, Upland	3,327	3,621	+294	+9%	4,061	+734	+22%
White Spruce	12,603	14,038	+1,435	+11%	16,189	+3,586	+28%
Cedar	15,314	16,214	+900	+6%	17,345	+2,031	+13%
Northern Hardwoods	10,898	11,262	+364	+3%	11,639	+741	+7%
Oak	155	285	+130	+84%	452	+297	+192%
Total Acres	165,106	165,106			165,106		

NSH - North Shore Highlands, LU – Laurentian Uplands, TU – Toimi Uplands
DFFC = Desired future forest composition

Table 3.1g: Desired Cover Type Acreage Changes – 10 Years and 60 Years – North Shore Highlands Subsection

North Shore Highlands Subsection	Present – 2004	DFFC - 2014			DFFC - 2064		
Cover Type	**Acres**	**Acres**	**+/- Acres**	**% Change**	**Acres**	**+/- Acres**	**% Change**
Aspen/Balm of Gilead	44,975	41,575	-3,400	-8%	34,606	-10,369	-23%
Birch	22,509	19,914	-2,595	-12%	18,384	-4,125	-18%
Balsam Fir	7,923	7,126	-797	-10%	7,126	-797	-10%
White Pine	989	3,845	+2,856	+289%	7,072	+6,083	+615%
Red Pine	4,902	5,637	+735	+15%	6,485	+1,583	+32%
Jack Pine	1,333	1,992	+659	+49%	2,990	+1,657	+124%
Black Spruce, Upland	953	1,043	+90	+9%	1,177	+224	+24%
White Spruce	8,472	9,589	+1,117	+13%	11,262	+2,790	+33%
Cedar	12,794	13,694	+900	+7%	14,825	+2,031	+16%
Northern Hardwoods	10,359	10,664	+305	+3%	10,980	+621	+6%
Oak	155	285	+130	+84%	452	+297	+192%
Total Acres	115,364	115,364			115,364		

Table 3.1h: Desired Cover Type Acreage Changes – 10 Years and 60 Years – Laurentian Uplands Subsections

Laurentian Uplands Subsection	Present – 2004	DFFC - 2014			DFFC - 2064		
Cover Type	**Acres**	**Acres**	**+/- Acres**	**% Change**	**Acres**	**+/- Acres**	**% Change**
Aspen/Balm of Gilead	11,534	11,076	-458	-4%	10,024	-1,510	-13%
Birch	3,529	3,152	-377	-11%	2,675	-854	-24%
Balsam Fir	2,855	2,573	-282	-10%	2,568	-287	-10%
White Pine	390	827	+437	+112%	1,345	+955	+245%
Red Pine	1,842	1,877	+35	+2%	1,917	+75	+4%
Jack Pine	3,493	3,816	+323	+9%	4,308	+815	+23%
Black Spruce, Upland	2,194	2,398	+204	+9%	2,704	+510	+23%
White Spruce	2,596	2,714	+118	+5%	2,892	+296	+11%
Cedar	1,896	1,896	0	0%	1,896	0	0%
Northern Hardwoods	290	290	0	0%	290	0	0%
Oak	0	0	0	0%	0	0	0%
Total Acres	30,619	30,619			30,619		

Table 3.1i: Desired Cover Type Acreage Changes – 10 Years and 60 Years – Toimi Uplands Subsection

Toimi Uplands Subsection	Present – 2004	DFFC - 2014			DFFC - 2064		
Cover Type	**Acres**	**Acres**	**+/- Acres**	**% Change**	**Acres**	**+/- Acres**	**% Change**
Aspen/Balm of Gilead	10,897	9,942	-955	-9%	7,955	-2,942	-27%
Birch	1,923	1,428	-495	-26%	1,048	-875	-46%
Balsam Fir	1,150	1,035	-115	-10%	1,035	-115	-10%
White Pine	378	821	+443	+117%	1,778	+1,400	+370%
Red Pine	1,745	2,475	+730	+42%	3,321	+1,576	+90%
Jack Pine	442	575	+133	+30%	778	+336	+76%
Black Spruce, Upland	180	180	0	0%	180	0	0%
White Spruce	1,535	1,735	+200	+13%	2,035	+500	+33%
Cedar	624	624	0	0%	624	0	0%
Northern Hardwoods	249	308	+59	+24%	369	120	+48%
Oak	0	0	0	0%	0	0	0%
Total Acres	19,123	19,123			19,123		

For this 10-year planning period, the Forestry area conversion goals will be based on the amount of high-risk, low-volume (HRLV) acreage the area has because it is estimated that these stands will provide the best opportunities for conversion to other cover types. In the cover type treatment modeling calculations, it was estimated that approximately one-half of the HRLV acres would be converted. These are preliminary estimates, the actual percentage may vary based on what the current stand composition and conditions are when the stand examinations are completed. Staff will use the Field Visit Decision Tree (Appendix E), Cover Type Management Recommendations (Chapter 4), and other plan direction, including GDS strategies (Chapter 3) and preliminary stand-level direction (e.g., preliminary stand prescriptions, preliminary management objectives, and the associated stand management recommendations and considerations) along with guides such as the NPC Field Guide to determine the actual stand treatment. The conversion acreage will be apportioned to the Forestry areas by the percent of their cover type acreage that meets the aspen, balm of gilead, birch, and balsam fir HRLV stand selection criteria because these are the cover types where a decrease in acreage is desired. Table 3.1j shows the increase in cover type acreage goals by Forestry area.

Table 3.1j: Conversion Goals by Forestry Area for the First Decade (2005-2014)

Conversion Goals by Area for First Decade (2005-2014): Cover Types With a DFFC of Increase in Acres									
Area	**WP**	**NP**	**JP**	**WS**	**BSU**	**Cedar**	**NH**	**Oak**	**Total**
Hibbing	70	28	21	27	5	17	7	2	**177**
Tower	60	24	18	23	5	14	6	2	**151**
Cloquet	500	201	149	192	39	120	49	17	**1267**
Two Harbors	3107	1248	927	1194	245	749	303	108	**7880**
Total Goal	**3736**	**1500**	**1115**	**1435**	**294**	**900**	**364**	**130**	**9474**

Within Forestry areas, the following should be considered in determining where to do the conversions from aspen, balm of gilead, birch, and balsam fir to other cover types:

- Location of HRLV stands
- LTA goals for changes in cover type composition
- Minnesota County Biological Survey (MCBS) site management recommendations
- Conifer emphasis areas
- NPC Field Guide – match species to the site
- Field Visit Decision Tree

Conversions may also be accomplished in non-HRLV stands. Methods to convert stands will range from intensive site preparation to managing for the understory species.

Mixed Forests

Tree species such as white pine, red pine, white cedar (upland sites in North Shore Highlands), white spruce, tamarack (upland), and yellow birch have significantly declined from historic levels in these subsections (*Preliminary Issues and Assessment*, Table 3.6). Currently, many stands are composed of a mixture of species, but the proportion of the above species has been reduced. The lack of fire in some forests has also altered forest composition. Therefore, a key strategy in moving forest composition toward RNV is the promotion of mixed forest conditions while managing and maintaining cover types. *Mixed forest conditions* in this plan refer to

vegetative composition and structure that is moving toward the mix and relative proportion (e.g., dominated by, common, occasional, or scattered) of species found in the native plant community for that site.[2] Tree species mix and proportion depends not only on the targeted growth stage (based on the rotation age for the desired cover type) but also species found in older growth stages.

Mixed forests that are managed toward the native plant community composition, structure, and natural disturbance regimes provide the range of conditions to which native organisms have adapted. Mixed forests are more likely to provide the variations in moisture, light, and nutrients necessary for the development of diverse microsites, and the compositional and structural components necessary for the development of niches. Mixed forests increase the likelihood that natural successional pathways will develop toward RNV ecosystem types and growth stages. A mixed forest may ameliorate damage from wind, fire, drought, and flood. The increased tree species diversity provided in mixed forests also increases the likelihood that forests will persist in the face of global climate change. Mixed forests are preferred because they offer social, economic, and ecological benefits not found in single species forests.

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

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

GDS-1B Strategies

a. Increase the acres of jack pine, upland black spruce, and long-lived upland conifer[3] cover types on state lands using the following actions:

Evaluate upland deciduous cover type HRLV stands for their potential to naturally succeed or be converted to long-lived conifers. A goal is to field visit and evaluate all the HRLV stands identified in this plan during the next 10 years. It is estimated that approximately 50 percent of the upland deciduous cover type HRLV acreage will become conifer stands (see the HRLV summary table in GDS-9A). Use the Field Visit Decision Tree (Appendix E) and the NPC Field

[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.
[3] White pine, red pine, white spruce, and white cedar (upland sites) are considered long-lived upland conifers. For this plan, balsam fir is not considered a long-lived conifer.

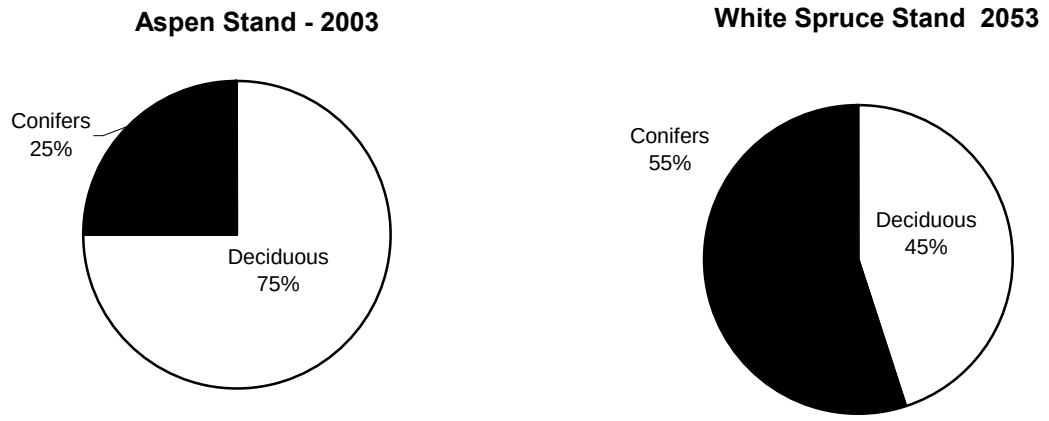
Guide as tools to guide the on-site evaluation of stands for conversion from one cover type to another or managing for mixed forest conditions (species composition and stand structure).

Follow specific cover type management recommendations in Chapter 4 such as:

- Allow some stands to convert through natural succession to long-lived conifer cover types without harvest. Emphasize this in stands with adequate advanced regeneration of long-lived conifer species.
- 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.

Figure 3.1d illustrates an example of an aspen stand being converted to a white spruce stand over time. In 2003, the aspen stand is 60 percent aspen and 15 percent other hardwoods. Conifer species comprise 25 percent of the aspen stand, consisting primarily of white spruce with some balsam fir, white pine, and red pine. Through stand treatments between 2003 and 2053, such as clearcut with reserves, selective harvest, site preparation, or tree planting, in 2053, the stand has become primarily conifers. In 2053, aspen comprises 30 percent of the stand and white spruce is 35 percent of the stand. With conifers becoming the predominant species group (55 percent) in the stand and white spruce comprising the largest portion, the cover type is now classified as white spruce. Species composition would vary with native plant community for the site. Note that the stand retains a significant component (45 percent) of deciduous species such as aspen.

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



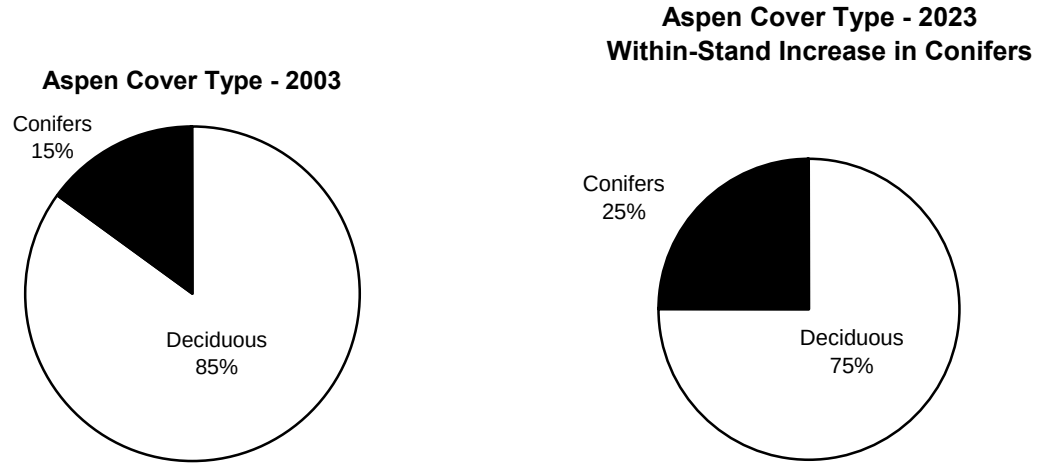
b. Increase mixed forest conditions in some stands in all cover types.

Implementation of this strategy may range from application of the MFRC's *Voluntary Site-Level Forest Management Guidelines* (e.g., legacy patches and conifer retention) in harvest operations to other management such as mechanical site preparation, prescribed burning, seeding, and planting (see also 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, white cedar (upland), white spruce, tamarack (upland), and yellow birch (*Preliminary Issues and Assessment*, Table 3.6).

Figure 3.1e illustrates an example of an increase in mixed forest conditions within an aspen stand. In 2003, 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 2023, 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 Within an Aspen Stand



c. Coordinate with the MFRC's Northeast Landscape Committee planning efforts on forest composition goals and objectives.

Department staff have been involved in the MFRC Northeast Landscape Region (Northern Superior Uplands Section) landscape planning efforts for northeastern Minnesota. Goals and strategies in this plan are generally consistent with those recommended in the Northeast Landscape Region Plan. Following are examples:

- Increase long-lived upland conifers (white pine, red pine, white spruce, cedar, tamarack).
- Retain/increase long-lived conifer component in aspen and birch cover types.
- Consider native plant communities and associated growth stages in stand management. Manage for older growth stages in some stands.
- Increase acres with older multi-aged conifers (white pine and white spruce component).
- Increase jack pine cover type and component in appropriate native plant communities.
- Increase the white pine, yellow birch, white spruce, and white cedar components in northern hardwood stands.

GDS-1C: 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 a broad consensus among scientists that managed forest landscapes are more fragmented and contain fewer large patches than are 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)[4]. 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[4,5].

Although this plan considered management activities on other ownerships, patch management primarily focuses on identifying opportunities that exist on large blocks of state land. To guide patch management on state lands, *a **patch** is defined as one or more adjoining stands that is relatively homogenous in structure, primarily in height and density, and is similar in vegetation cover and age*. Patch ages (Table 3.1k) are defined as old, intermediate, and young with an age range by category dependent on cover type. Patch sizes (Table 3.1l) range from small (less than 40 acres) to large (greater than 640 acres). Patches may have smaller areas (e.g., 10-15 percent of the patch area) within them that are not in the same patch category as the main patch, such as inclusion pockets or stands, and residual islands, 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[6]. Patches were created in a GIS data layer by dissolving common stand boundaries between stands of the same cover type group and age class. The initial patch assessment information was used as one of the tools for delineating the current patches on state lands in these subsections as described in the following paragraphs.

[4] Manolis, J. December 2003. *Project Summary: Results from the Minnesota Spatial Analysis and Modeling Project*. Minnesota Forest Resources Council (MFRC) and Minn. DNR.
[5] MFRC. March 2003. *Recommended Desired Outcomes, Goals, and Strategies: Northeast Landscape Region*. Minnesota Forest Resources Council Landscape Program, Northeast Regional Landscape Committee.
[6] Minn. DNR. March 2002. Addressing Patch Management in SFRMP. SFRMP Process Guidebook II. (Draft).

Table 3.1k: Patch Ages by Cover Type Category From the Initial Patch Assessment

Cover Type Groupings		Age Class Definition (In years)		
Category	**Sub-Category**	**Young**	**Inter.**	**Old**
Upland Conifers - UC	Jack Pine and Upland Black Spruce	0-20	21-60	>60
	Red Pine and White Pine	0-20	21-90	>90
	Balsam Fir, White Spruce and Upland White Cedar	0-20	21-80	>80
Lowland Conifers - LC	Includes Tamarack, White Cedar, Lowland Black Spruce	0-20	21-90	>90
Upland Deciduous - UD	Aspen, Birch, Balm of Gilead	0-20	21-50	>50
	Northern Hardwood and Oak	0-20	21-80	>80
Lowland Deciduous - LD	Includes Ash, Lowland Hardwood, Balm of Gilead	0-20	21-80	>80

Table 3.1l: 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

During subsection planning, DNR Area field staff conducted a stand designation process to identify stands for patch management, extended rotation forestry (ERF), ecologically important lowland conifers (EILC), old-growth special management zones (SMZs), old forest management complexes (OFMCs), and special management areas (SMAs)[7].

The goals of this project were to:

- Coordinate and apply stand selection criteria uniformly across the subsection.
- Incorporate landscape-level information across ownerships about existing spatial patterns and forest conditions across ownerships into stand selection decisions for patch management, ERF, EILC, SMZs, and OFMCs.
- Consider the effect of stand selections on rare features (see GDS-1F), cultural resources (see GDS-11), MCBS sites of biodiversity significance (see GDS-1E), and areas with special management designation (e.g., state parks, SNAs, wildlife management areas, etc.) in all decisions. (Also, see Stand Designation Process in Appendix M.)

During this step of the planning process, department staff identified some existing large patches (251+ acres) where the patch size will be maintained through management. Some blocks of

[7] Special Management Areas include: Conifer Emphasis Areas (CONES), Ruffed Grouse Management Areas, and Deer Management Areas, etc. (See Appendix N for list of codes).

stands were also identified where the goal is to create future large patches, sometimes in cooperation with other landowners. Cover type groups were broadened from the initial patch assessment categories (Table 3.1k) because large, continuous canopy, natural patches in these subsections typically included mixed forest of multiple cover types.

Goals during this 10-year planning period are to identify:

- Existing larger patches (size class 1 and 2, i.e., greater than 251 acres) on state lands, or where large patches could be managed across different ownerships.
- Opportunities for additional large patches on state lands in the future where they currently don't exist.

The following three tables (Tables 3.m – 3.o) list the identified patches alphabetically by Patch Name for each of the subsections. Patch Codes beginning with the letters M or FM identify patches that were delineated across mixed ownerships and the acreage listed is the state land acreage only. This is the reason why the acreage listed for some patches is less than 250 acres.

An example of a Patch Code definition is as follows:

FMPY1UM:
F = future patch (currently does not meet patch definition, but should be managed to become the defined patch).
M = delineated patch includes other ownerships lands. Acres are state lands only.
P = patch
Y = young age class. O = old. I = intermediate. V = uneven-aged managed patch, e.g., northern hardwoods.
1 = large patch size class (greater than 640 acres). 2 = medium large size class (251-640 acres).
U = upland. L = lowland. UL = a mix of upland and lowland stands.
M = mixture of conifer and deciduous cover types. C = primarily (85 percent or more) conifer cover types. D = primarily deciduous cover types. SLC = stagnant lowland conifers.

Table 3.lm: Patches Identified in the North Shore Highlands Subsection

	Patch Name	Patch Code	Acres
North Shore Highlands	Antilla Swamp	PO1LC	905
	Bailey Road	PY2UD	323
	Bailey Road Hardwoods	PV2UD	277
	Bally Creek	MPO1UD	117
	Bally Creek Road	FMPY1UM	861
	Beaver River	PO2UM	641
	Cannonball Lake	PO2ULM	419
	Caribou Lake	FMPV1ULM	856
	Castle Danger	PV2UD	278
	Cramer Lake	PO2UD	447
	Cross River	MPV1ULM	346
	Dixie	MPV2ULM	282
	East General Grade	PO2UM	631
	FDL Ravine	PV1UD	424

North Shore Highlands	Patch Name	Patch Code	Acres
(continued)	Fox Sucker	PY2UM	555
	Fry Creek	PO1ULM	782
	Fry Lake	PO2UD	245
	Grand Marais	MPO1UD	468
	Heffelfinger	PI1UC	3199
	Heffelfinger Fuelwood	PV2UD	278
	Hogbakka Trail	PV2UD	481
	Honeymoon Trail	PV1UM	648
	Hovland Woods SNA	PV1UD	1351
	Howell Creek	PY2UM	352
	Jonvik	FMPV1UM	1980
	Kadunce	FPY2UD	628
	KC Road	MPV2ULM	192
	Kellys Hill Road	FPY2UM	484
	Kettle Lake SE	PI1LC	1183
	Kettle Lake SW	PI1LC	1553
	Lake Andy	PV1ULM	2074
	Lester River	PO2UM	324
	Little Lake	FPY1UD	859
	Lost Lake	PO1ULM	1214
	Manitou River	PO1UD	1197
	Masse Cr	PY2UD	402
	Mississippi Creek	MPO1ULM	1299
	Mud Hole Lake	PO2ULM	364
	Mud/Elbow Creek	FMPY1UD	815
	North Manitou River	MPY2UD	206
	Osier Lake (mostly in LU)	PY2UC	71
	Poplar River	MPO1ULM	39
	Rogers Lake	PO2UD	649
	Scenic Overlook	PV2UD	317
	Spirit Lake	PI1LC	755
	Spirit Lake NW	PI1LC	793
	Spooner Road	PV2UD	509
	Spring Lake	MPY2UM	528
	State Trail East	PV2UD	334
	State Trail West	MPV2UD	519
	Sugarloaf	PO2UD	325
	Sundling Creek	PY1UM	1109
	Thunderbird Lake	PO2UD	348
	Tofte-Lutsen	MPV1UD	1059
	Upper Dead Fish North	PO2LM	218
	Upper Dead Fish South	PO2LC	336

North Shore Highlands	Patch Name	Patch Code	Acres
(continued)	W General Grade	PY2ULC	509
	West Finland	PV2UD	496
	North Shore Highlands Total		38854

Table 3.1n: Patches Identified in the Laurentian Uplands Subsection

Subsection	Patch Name	Patch Code	Acres
Laurentian Uplands	Big Lake	PY2LC	342
	Big Lake 234	PO2UD	270
	Burnt Creek	FPY1ULC	1831
	Chub Lake	PY2UM	284
	Coffee Lake	PY2UM	372
	Erie Rail	PY1ULM	663
	Fool Hen Creek	MPY1UD	204
	Greenwood Lake SE	PO2ULM	641
	Iowa Lake	MPV1UC	176
	Laurentian Road	PO2UD	370
	Moose Horn	PY2UM	271
	N of Pancore Lake Road	PY2UD	400
	Osier Lake (part in NSH)	PY2UC	336
	Pine Lake	PO2UD	256
	Rail Junction	PY2UD	324
	Seven Beavers	MPO1ULM	40
	Spruce Lake	PI1LC	2706
	Swamp	MPO1SLC	465
	Temperance	PO2UC	464
	The Grade	FPY2UC	316
	Laurentian Uplands Total		10731

Table 3.1o: Patches Identified in the Toimi Uplands Subsection

	Patch Name	Patch Code	Acres
Toimi Uplands	Breda Lake	PY2UD	254
	Mouse Lake	PO2ULM	618
	Mud Lake	PO1ULM	634
	Murphy Lake	PY2UM	564
	Stroud Lake	PY2ULM	541
	Sullivan Lake	PI1UC	864
	Third Lake	PY2ULM	541
	Tower Creek	PO2UD	321
	Whiteface River	FPY1ULM	680
		Toimi Uplands Total	5017

Table 3.1p through 3.1r summarize the patch designations for these three subsections.

Table 3.1p: Large Patch (Size Class 1 – 2) Acreage on State Forestlands by Subsection Summary

Subsection	State Forestland Acres in the Subsection	Large Patch Acres (Size Class 1 - 2)	Forestland Percentage in Large Patches	Even-aged Patch Acres	Uneven-aged Patch Acres
North Shore Highlands	174,004	38,854	22%	26,470	12,384
Laurentian Uplands	75,314	10,731	14%	10,555	176
Toimi Uplands	29,008	5,017	17%	5,017	0
Total	**278,326**	**54,602**	**20%**	**42,042**	**12,560**

Table 3.1q: Patch Summary by Age Class and General Forest Type (NTL[1] Subsections)

Patch Summary by Age Class			Total Acres by General Forest Type				
Age Class	**Size Class**	**Number**	**Average Size**	**Deciduous**	**Conifers**	**Mixed**	**Total**
Old	Large	11	651	1782	1370	4008	7160
Old	Medium Large	19	415	3231	800	3856	7887
Total Old		**30**	**502**	**5013**	**2170**	**7864**	**15047**
Intermediate	Large	7	1579	0	11053	0	11053
Total Intermediate		**7**	**1579**	**0**	**11053**	**0**	**11053**
Young	Large	8	878	1878	1831	3313	7022
Young	Medium Large	21	410	2537	1574	4492	8603
Total Young		**29**	**539**	**4415**	**3405**	**7805**	**15625**
Uneven-aged	Large	9	990	2834	2804	3276	8914
Uneven-aged	Medium Large	11	360	3489	0	474	3963
Total Uneven-aged		**20**	**644**	**6323**	**2804**	**3750**	**12877**
Summary		86	635	15751	19432	19419	54602

[1]NTL – North Shore Highlands, Toimi Uplands, and Laurentian Uplands

Table 3.1r: Patch Summary by Size Class and General Forest Type (NTL Subsections)

Patch Summary by Size Class				Total Acres by General Forest Type			
Age Class	**Size Class**	**Number**	**Average Size**	**Deciduous**	**Conifers**	**Mixed**	**Total**
Large	Old	11	651	1782	1370	4008	7160
Large	Intermediate	7	1579	0	11053	0	11053
Large	Young	8	878	1878	1831	3313	7022
Large	Uneven-aged	9	990	2834	2804	3276	8914
Total Large		**35**	**976**	**6494**	**17058**	**10597**	**34149**
Medium Large	Old	19	415	3231	800	3856	7887
Medium Large	Young	21	410	2537	1574	4492	8603
Medium Large	Uneven-aged	11	360	3489	0	474	3963
Total Med-Large		**51**	**401**	**9257**	**2374**	**8822**	**20453**
Summary		86	635	15751	19432	19419	54602

GDS-1C Strategies

a. Select stands for treatment during development of the 10-year stand examination list that group harvest activities to create, maintain, or enhance large patches.

When assigning a treatment year to stands during the stand selection process, time or group timber harvest activities to create, maintain, and enhance large patches. Harvesting stands at younger or older ages than established rotation ages may be necessary to maintain or create new large patches.

- Where even-aged management is used for a large patch, compress all the final harvests within a 5 - 15 year period to achieve a relatively even-aged forest canopy.

b. During development of the annual stand examination lists, review and revise stands selected for treatment as needed to ensure that harvest activities are grouped to create, maintain, or enhance large patches.

c. Convert some even-aged managed stands to uneven-aged managed stands to enhance existing uneven-aged managed patches.

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

d. Convert some uneven-aged managed stands to even-aged managed stands to create, maintain, or enhance large even-aged managed patches.

These conversions may occur in stands such as poor-quality northern hardwoods or northern hardwoods on fire-dependent sites. Stands may be converted to mixed stands of aspen, white pine-red pine, white spruce, or upland cedar.

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

GDS-1D: Habitat fragmentation is managed to minimize the impacts on species that are negatively affected by fragmentation.

Unlike the more developed and agricultural portions of the state, *forest fragmentation*[8] has not progressed to the same degree in northeastern Minnesota.[9] However, habitat fragmentation is a concern in these subsections. Habitat fragmentation has the potential to interfere with species seasonal migration and dispersal, negatively affect survival requirements, and reduce patch size to a level smaller than some animal species territories. Through planning and implementing the strategies below, habitat fragmentation from timber harvest, forest access roads, and trail construction will be minimized.

GDS-1D Strategies

a. Avoid breaking up larger patches.

During stand selection for patch management, ERF, and OFMC designations, larger patches (250+ acres) were identified with a goal to maintain some of them into the future.

b. Minimize the fragmenting of habitat with roads and forest access trails.

- Follow the MFRC's *Voluntary Site-Level Forest Management Guidelines* to minimize the amount of infrastructure length, width, and acreage needed to conduct forest management operations.
- Design and build roads and forest access trails so they can be re-used in the future rather than constructing new access routes.
- Avoid lining road or forest access trail edges with long slash piles that serve as barriers to species movement.
- Consider rare features locations and MCBS sites of biodiversity significance when selecting locations for roads and trails to insure critical habitats are not fragmented by roads and forest access trails.

c. Identify opportunities to maintain existing and potential connections between larger patches when developing the 10-year stand examination list.

[8] *Forest fragmentation* occurs in landscapes with distinct contrasts between land uses, such as between woodlots and farms. *Habitat fragmentation* occurs where a contiguous or homogeneous forest area of a similar cover type and age is broken up into smaller dissimilar units.
[9] Green, Janet C. 1995. *Birds and Forests: A Management and Conservation Guide*. MN DNR.

d. Leave live trees and snags within most even-aged managed timber harvests to mitigate the effects of habitat fragmentation.[10]

Follow the MFRC's *Voluntary Site-Level Forest Management Guidelines (General Guidelines, pages 72-75)* for snags and leave trees to aid in the movement of species across a stand following harvest.

e. Restore or maintain original stand size in forest management activities.

Prescribe management activities at a scale to restore or maintain original stands, rather than break-up stands, except when required to meet another management objective (e.g., within moose, deer, and ruffed grouse management areas).

GDS-1E: Management of state lands within MCBS sites of statewide biodiversity significance implements 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 tens to thousands of acres in size, selected for survey because they are likely to contain relatively undisturbed native plant communities, large populations and/or concentrations of rare species, and/or critical animal habitat. The MCBS site provides a geographic framework for recording and storing data and compiling descriptive summaries.

These MCBS sites currently provide intact, functional ecosystems and the ecological and social benefits of associated ecosystem services (e.g., water quality). Within areas of statewide biodiversity significance, high quality, representative NPCs[11] generally predominate, providing habitat for associated plant and animal species. These areas often contain concentrations of rare species and rare NPCs. They also serve as ecological reference areas to improve our understanding of natural processes and ecosystem function, and to help us evaluate the effects of management on biodiversity.

Through a systematic, statewide survey process conducted by the Minnesota County Biological Survey, the North Shore Highlands, Laurentian Uplands, and Toimi Uplands subsections are being evaluated to identify areas of statewide biodiversity significance. (See process description in *Section 5.5a on page 5.43, Preliminary Issues and Assessment).*

MCBS sites are ranked according to the four levels below in order to communicate the relative significance for native biological diversity of surveyed areas to natural resource professionals,

[10] Hunter, Malcolm L. Jr., 1997.The biological landscape. In *Creating a Forestry for the 21st Century: The Science of Ecosystem Management*, e.d. K.A. Kohn and J.F. Franklin. Washington, D.C., Island Press.
[11] Minn. DNR 2001. Definitions of Terms used by the Minnesota County Biological Survey and the Natural Heritage and Nongame Research Programs (10 Oct 2001). Minn. DNR Ecological Services Division. Minnesota County Biological Survey.

state and local government officials, and the public. Important factors in ranking MCBS sites include:

- Occurrences and types of rare species.
- Occurrences and types of rare NPC elements.
- Size of NPC occurrence and the context within which these elements occur.
- Exhibits the potential for intact landscape-level processes (e.g., natural disturbances)
- Encompasses examples of high quality NPCs.

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

1. **O - OUTSTANDING.** MCBS sites containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state.
2. **H - HIGH.** MCBS sites containing the "best of the rest", such as MCBS sites with very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes.
3. **M - MODERATE.** MCBS sites containing significant occurrences of rare species and/or moderately disturbed native plant communities and landscapes that have a strong potential for recovery.
4. **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.
5. **Hp** - MCBS LSA or MCBS site with **Preliminary Survey Priority of HIGH** (Laurentian Uplands and Toimi Uplands subsections).
6. **Mp** - MCBS LSA or MCBS site with **Preliminary Survey Priority of MODERATE** (Laurentian Uplands and Toimi Uplands subsections).

MCBS field surveys are complete and survey results are being compiled for the North Shore Highlands Subsection. MCBS survey is in progress in the Laurentian Uplands and Toimi Uplands subsections. Upon completion of the survey, MCBS results include the following information about MCBS sites of statewide biodiversity significance:

- MCBS biodiversity significance maps for each subsection.

- MCBS ecological evaluations (recommendations) for MCBS sites of Outstanding and High statewide biodiversity significance.
- Element Occurrence Records (EORs) for documented rare feature locations.
- Vegetation plot data (relevé), sampling of representative and high quality NPCs.
- NPC mapping for MCBS sites of Outstanding and High statewide biodiversity significance.

Based on MCBS survey work completed as of May 2004, Table 3.1s provides a summary of biodiversity significance 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 Forestland[2] Acres[1]	Timberland[3] Acres[1]	Acres[1] that Meet the 10-Year Stand Selection Criteria
North Shore Highlands	O	24	128,473	15,146	12,719	4,028
	H	47	186,140	49,631	36,947	9,984
	M	88	325,163	51,799	40,898	12,091
	B	8	18,903	3,485	2,946	444
	Total	**167**	**658,679**	**120,061**	**93,510**	**26,547**
Laurentian Uplands	Hp	23	167,367	36,148	19,810	5,256
	Mp	11	67,319	6,409	4,396	1,491
	Total	**34**	**234,686**	**42,557**	**24,206**	**6,747**
Toimi Uplands	Hp	6	20,293	2,457	1,844	387
	Mp	6	90,373	8,355	6,788	1,535
	Total	**12**	**110,666**	**10,812**	**8,632**	**1,922**
		213	**1,004,031**	**173,430**	**126,348**	**35,216**

[1]Acres are based on the intersection of shapefiles from DNR forest inventory (nltcsa2g - 11/26/2003), MCBS sites source file (7/28/2003), and SFRMP plan adjusted subsection boundaries. Minor acreage differences will occur when newer versions of these shapefiles (nltcsa and MCBS sites) are used because of updates and/or adjustments to stand and MCBS site boundaries.
[2]*Forestland* 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]*Timberland* 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.

Forest management activities such as timber harvesting, site preparation for cover type conversion, timber sale access road construction, 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. Forest management activities carried out in those MCBS sites determined to be of greatest concern or

importance for SFRMP planning 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 planning over the 10-year planning period.

MCBS sites of greatest concern or importance for SFRMP planning were determined to be those MCBS sites with state lands that have a biodiversity significance rank of Outstanding or High (NSH)[12], or have a preliminary survey priority of High (LU and TU)[13]. 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.

Table 3.1t: Summary of MCBS Sites With a Biodiversity Significance Rank of Outstanding, High, and Preliminary Survey of High That Contain State-Administered Lands (May 2004)

Subsection	Rank	Number of MCBS Sites	Total MCBS Site Acres[1]	State Forestland[2] Acres[1]	Timberland[3] Acres[1]	Acres[1] that Meet the 10-Year Stand Selection Criteria
North Shore Highlands	O	24	128,473	15,146	12,719	4,028
	H	47	186,140	49,631	36,947	9,984
Laurentian Uplands	Hp	23	167,367	36,148	19,810	5,256
Toimi Uplands	Hp	6	20,293	2,457	1,844	387
	Total	**100**	**502,273**	**103,382**	**71,320**	**19,655**

[1]Acres are based on the intersection of shapefiles from DNR forest inventory (nltcsa2g - 11/26/2003), MCBS sites source file (7/28/2003), and SFRMP plan adjusted subsection boundaries. . Minor acreage differences will occur when newer versions of these shapefiles (nltcsa and MCBS sites) are used because of updates and/or adjustments to stand and MCBS site boundaries.
[2]*Forestland* 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]*Timberland* 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.

b. Consider the broader context and significance of the MCBS site as a whole when assigning management objectives and selecting stands for treatment.

[12] NSH – North Shore Highlands Subsection
[13] LU and TU – Laurentian Uplands Subsection and Toimi Uplands Subsection

Preliminary management objectives (Appendix J) were assigned to stands that meet the stand selection criteria in these MCBS sites prior to stands being field visited, so the forest management activities prescribed will have the greatest likelihood of meeting the goals of this GDS. Preliminary management objectives were assigned using information and recommendations received from Forestry, Wildlife, Fisheries, and Ecological Services field staff.

Stand selections and management prescriptions should be made considering the broader context and significance of the MCBS site as a whole. During the 10-year stand selection process, stands selected within MCBS sites should consider MCBS site-level impacts (i.e., how stand(s) treatments affect the MCBS site as a whole).

The final management objectives that will actually be carried out in each stand or groups of stands will be determined after a field visit has been completed by a forester, along with other divisions when appropriate. When making the final management decision, foresters will consider the preliminary management objective assigned as well as all input received from other divisions.

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 what NPC Class a stand is located in will become available as MCBS staff completes the NPC mapping for MCBS sites of Outstanding and High statewide biodiversity significance.

The NPC Field Guide and additional information (e.g., Suitability of Tree Species by Native Plant Community Table) will provide foresters with a suite of options and will help determine what tree species are most appropriate for the identified NPC.

d. Allow some stands to succeed naturally to long-lived conifer communities. (GDS-1A, Strategy e.)

Most likely candidates for natural succession would be some HRLV stands if these stands contain adequate regeneration stocking levels for the site to convert to long-lived conifer communities.

e. Strive to emulate the within-stand composition, structure, and function of older vegetative growth stages (VGSs) when managing some stands.

Examples from GDS-2C, Strategy b. are:

- Coarse woody debris
- Snags
- Leave trees or legacy patches include super canopy trees
- Increased diameter classes in uneven-aged stands
- Species composition

f. Apply variable density techniques during harvest or reforestation.

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

g. Apply variable retention 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 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.

- ERF is prescribed on 46 percent of timberlands (include acres) inside MCBS sites compared to 40 percent outside.

i. Maintain or increase within-stand species, age, and structural composition that is moving toward the mix and proportion of species found in the native plant community appropriate to that site. (GDS-3A and 1B)

For example:

- Retain or create a legacy of species that are found in older growth stages so that maintenance or movement of the stand toward other growth stages is an option.
- Use silvicultural techniques during forest management activities, such as leave islands of long-lived conifers with surrounding areas of shelterwood or selective harvest in aspen stands to recruit desired species through natural seeding.
- 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.

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

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

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

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

Large patches in this plan are considered to be patches that are 250 acres and larger. They include both even-aged and uneven-aged patches. Managing for and maintaining large patches on the landscape will minimize habitat fragmentation and increase the size of intact ecosystems as well as provide valuable wildlife habitat for some species.

- Large patches are designated on 26 percent of forestlands inside these MCBS sites compared to 15 percent outside.
- 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.)*

n. Apply special management recommendations for known rare features. (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.

o. Defer management of some stands for further assessment (e.g., EILC and nominated natural areas).

- EILC is designated on 47 percent of lowland conifer acreage inside these MCBS sites compared to 16 percent outside. Table 3.1u shows the EILC designation by cover type breakdown comparing the designations in relation to all lowland conifers on state lands within the subsections to those within these high ranked MCBS sites. The designated EILC stands will be reserved from treatment during this 10-year planning period. Designated stands range in age from 2 to 213 years old. These reserved stands will be reviewed for continued protection during the next 10-year planning process for these subsections based on the old-growth guidelines or other guidelines addressing EILC in place at that time. *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.*

Table 3.1u: Ecologically Important Lowland Conifer (EILC) Designation Summary

Cover Type	State Forestland Acres	EILC Acres[1] Designated	Percent Designated as EILC	Percent of EILC in MCBS O, H, and Hp[2] Sites
Black Spruce Lowland	28,876	5,121	18%	65%
Tamarack	5,456	642	12%	71%
Cedar	14,957	5,234	35%	64%
Stagnant Spruce	16,244	6,686	41%	77%
Stagnant Tamarack	3,042	2,432	80%	98%
Stagnant Cedar	4,490	2,072	46%	71%
	73,065	**22,187**	**30%**	**73%**

[1]Managed acres. [2]O – Outstanding, H – High, Hp – High priority for MCBS survey

- Some stands in MCBS sites recommended for nomination as a *natural area* may be deferred for further assessment. Based on completed MCBS survey work, MCBS plant ecologists have identified 15 MCBS sites that meet MCBS criteria for consideration as natural areas. These MCBS sites are listed in Appendix K, *MCBS Sites Nominated as Natural Areas by MCBS Staff*. A *natural area* is a MCBS site where the primary management goal is to protect, enhance, or restore ecological processes and native plant community composition and structure. For the MCBS sites identified to be considered as natural areas, an *Ecological Evaluation* is written to characterize the ecological significance of the MCBS site as a whole and to serve as a guide for conservation action by the various landowners. Subsequently, a MCBS site (or portions of a MCBS site) that is recommended as a natural area *may* be identified by the landowner or land management agency *(landowner's option)* for conservation activities such as special vegetation management (ecologically based silviculture and forest development activities, such as strategies recommended in this SFRMP plan for managing state lands in MCBS sites), designation as a park (city, county, state, or private), nonmotorized recreation area, nomination as scientific and natural area, reserve, etc.

  For this SFRMP plan, the following procedure will be used for stands selected for treatment in these MCBS sites on state-administered lands:

  During the interdisciplinary review of annual stand examination lists (i.e., annual harvest plans), stands selected for treatment in the recommended natural areas may be identified for a joint field visit by staff from the Forestry and Ecological Services divisions (and other divisions as applicable) to determine the appropriate management. Management options include:
  - Treat the stand according to assigned preliminary prescription.
  - Agree on a new management prescription based on the NPC Field Guide and other ECS products.
  - Defer treatment for further evaluation and review.

p. Consider timber productivity when managing stands in these MCBS sites. (GDS-6)

Since MCBS sites that have a biodiversity significance rank of Outstanding or High (NSH) or have a preliminary survey priority of High (LU and TU) comprise 35 percent of the North Shore SFRMP state-administered timberland acres (36 percent of the acres in the 10-year stand selection pool), timber productivity will be considered while implementing the other strategies on stands identified for management.

q. Provide an opportunity for further input by the divisions into the management of stands during the annual stand examination list review.

Fisheries, Wildlife, and Ecological Services staff will have at least two weeks to review each annual stand examination list before the list will be submitted by Forestry for public review. During this review, division staff may provide comments for consideration by the forester before the forester determines a stand's final management objectives. They may also tag specific stands requesting to do an on-site field visit with the forester in order to provide additional input before the final management objective and prescriptions are assigned to those specific stands. This will ensure that the most current information on these MCBS sites is considered in the management of stands.

r. Forestry, Wildlife, and Ecological Services staff 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:

- Staff will seek to implement stand-level management activities that achieve landscape-level biodiversity goals and objectives in coordination with collaborative groups such as the Manitou Collaborative and the Sand Lake/Seven Beavers Committee.
- When assisting private landowners with woodland stewardship plans, provide information on the biodiversity significance of these MCBS sites.
- MCBS staff will communicate and deliver information about priority MCBS sites of biodiversity significance to other landowners within these MCBS sites.

This intent of this strategy is to provide information on the MCBS sites and cooperate in forestland 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 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[14]. The resulting S-Rank is a value (S1 to S5) assigned to a NPC type (or subtype) that best characterize the relative rarity or endangerment of the NPC statewide (Table 3.1v).

Table 3.1v: 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.

NPCs with an S-Rank of S1 or S2 that are known to occur in these subsections are listed in Table L.2 in Appendix L. NPC types with S-Ranks of S3 to S5 that are rare, high quality, or otherwise unique in these subsections are listed in Table L.3 in Appendix L. *Note: At this time, the lists are drafts for these three subsections. The management of native plant communities will receive further review and department direction as NPC field guides and other ECS-based products (e.g., acceptable operating season, suitability of tree species, and silvicultural options for NPCs) become available and are integrated into forest management activities on state lands.* A complete list of the Statewide S-Ranks for NPC types in Minnesota is available from the Natural Heritage and Nongame Research Program.[15]

Known 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. Because MCBS prioritizes survey efforts within MCBS sites, most documented locations of rare NPCs are within MCBS sites. However, there may also be locations of rare NPCs documented in areas outside MCBS sites.

GDS-1F 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.

[14] NatureServe - In cooperation with the Network of Natural Heritage Programs and Conservation Data Centers. 2002. Element Occurrence Data Standard. Arlington, VA.
[15] Minn. DNR 2004. Statewide Heritage Conservation Status Ranks (S-Ranks) for Native Plant Community Types (elements) in Minnesota. Natural Heritage and Nongame Research Program and Minnesota County Biological Survey. Minnesota Department of Natural Resources. St. Paul, MN 55155.

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.

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

DNR staff are being trained in the use of the *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province* for identification of NPCs. Additional ECS products, such as silvicultural interpretations for management of NPCs, are being developed for use by field staff for implementing ECS-based management on state lands.

c. During the development of the 10-year stand examination list and during annual stand review, stands with known locations of critically imperiled (S1) or imperiled (S2) NPCs and those NPCs with S-Ranks of S3 to S5 that are rare or otherwise unique in these subsections will be identified by Ecological Services staff.

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

GDS-1G: 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) created under Minnesota's Endangered and Threatened Species Statute, draws attention to species that are at greatest risk of extinction within the state and special regulations are applied to those listed as endangered or threatened. By alerting resource managers and the public to species in jeopardy, activities can be reviewed and prioritized to help preserve the diversity and abundance of Minnesota's flora and fauna.

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 species, community, and landscape-level biodiversity. Implementation of the strategies below will improve the DNR's ability to protect rare species and their habitats in these subsections.

GDS-1G Strategies

a. 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.

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

The MCBS has been recently completed in the North Shore Highlands and work is planned for the Toimi Uplands and Laurentian Uplands subsections in 2005.

c. 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.

d. 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 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).

e. 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).

3.2 Age-Class Distribution

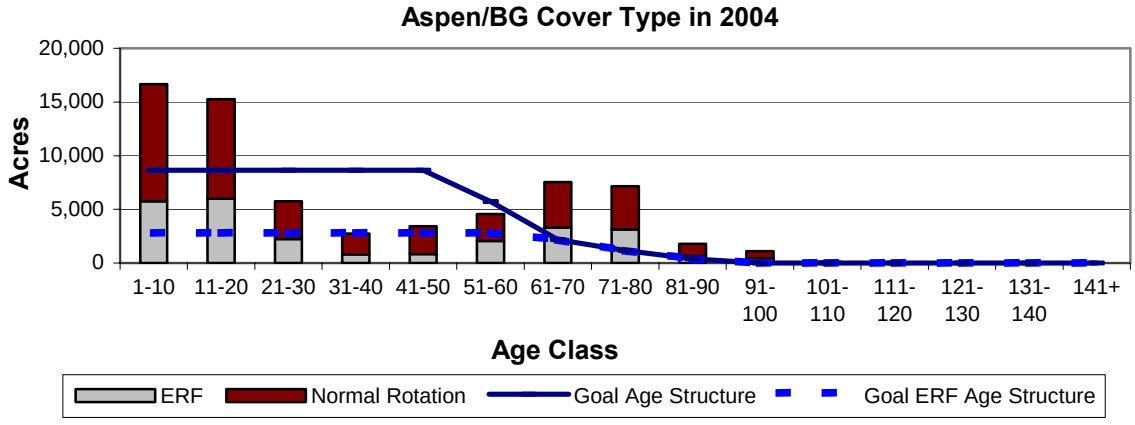
GDS- 2A: Even-aged managed cover types will be managed to move toward a balanced age-class structure.

A balanced age-class structure has relatively equal acres in each 10-year age class out to the normal rotation age. The 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 younger age classes and move these cover types toward a more balanced age over time. A goal is to minimize large fluctuations in harvest levels to the extent possible.

Figure 3.2a 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-aged 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



Note: The 1-10 age class is inflated because it includes 7,590 acres currently under timber sale permits or are acres on the FY2004 annual harvest plan that haven't been harvested yet. This acreage will be treated within the next 1 – 5 years.

The following strategies will be implemented to move even-aged 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.

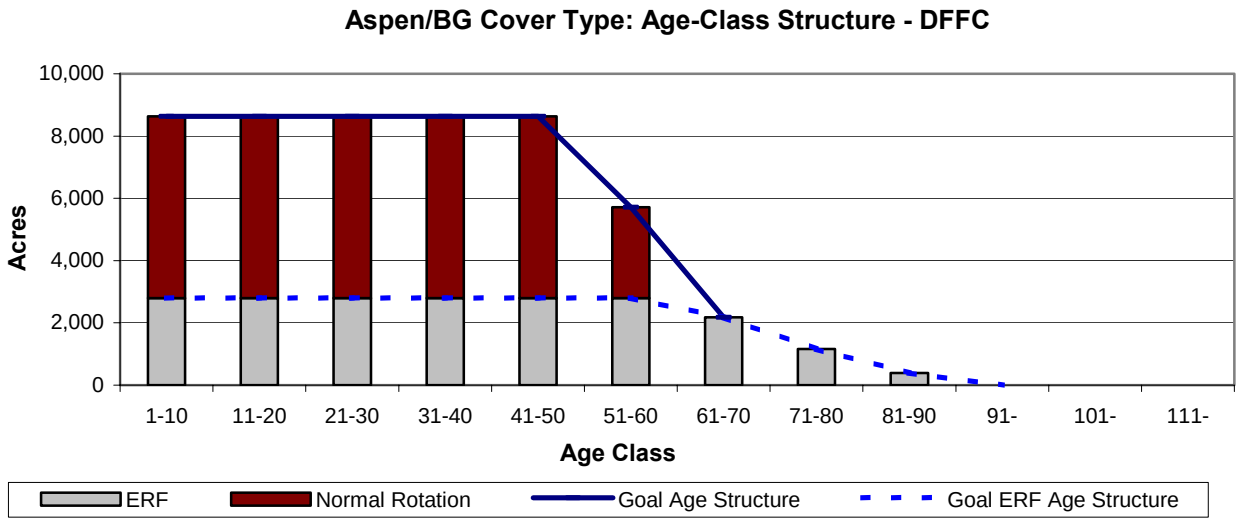
Three primary parameters: normal rotation age, maximum rotation age, and ERF percentage will determine what the general balanced age-class distribution for each cover type will be. While it may not be possible to attain this balanced structure within 50 years, it can be accomplished more quickly by adjusting short-term harvest levels. This will also help minimize the effects of the impending decrease in harvestable acres.

- Develop criteria to identify stands that can be carried over to next 10-year plan or more to minimize age imbalance in the next 10-20 years (re-evaluate deferred stands during next plan).
- When selecting stands for harvest, area teams will select within targeted age classes that will move toward a balanced age-class structure.

GDS-2B: ERF stands in even-aged 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-aged managed cover type. Figure 3.2b shows an example for the aspen/balm of gilead cover type DFFC.

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 percent of the acres over normal rotation age (effective ERF) with a declining age-class distribution from normal rotation (average 53 years) out to the maximum age (85 years). Figure 3.2b illustrates the tapering off of the age-class distribution after age 50 because of two normal rotation ages of age 50 and 55 years, depending

on the site index of the stand. In this example, about 400 acres, or less than 1 percent (0.7 %) of the desired cover type acreage (52,613 acres), are held out to the maximum harvest age of 85. 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 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-aged managed cover types:

GDS-2B Strategies

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

Desired old forest conditions in even-aged 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 stand treatment acres to the appropriate age classes to move toward the declining age-class structure after normal rotation age.

Desired old forest conditions will be achieved by harvesting appropriate acreages from each age class of ERF over normal rotation age. The remaining unharvested acres will contribute to old forest conditions until they reach the maximum rotation age.

GDS-2C: State lands include a representation of each of the growth stages that historically occurred in the ecosystems found in these three subsections.

Growth stages incorporate both 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 mesic mixed forest (FDn43) NPC, there are three growth stages separated by two transition periods[16]. 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.

[16] 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.

GDS-2C Strategies

a. Provide representations of growth stages in the desired age-class distributions (GDS-1A, 2A, 2B and 2D) and through the forest composition goals (GDS-1B) for these subsections.

Some examples of how a representation of growth stage species composition and ages will be provided on state lands are:

- Increase long-lived conifers
- ERF
- Mixed forest

b. Strive to emulate the within-stand composition, structure, and function of older growth stages when managing some stands (GDS-3A and 3B and Chapter 4).

Some examples of how this will be accomplished are:

- Coarse woody debris
- Snags
- Leave trees include super-canopy trees
- Legacy patches
- Increased diameter classes in uneven-aged managed stands
- Retention of target species (e.g., yellow birch, upland white cedar, and white pine)

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

d. Coordinate with the MFRC's Northeast Landscape Committee planning efforts on forest composition goals and objectives.

Department staff have been involved in the MFRC Northeast Landscape Region (Northern Superior Uplands Section) landscape planning efforts for northeastern Minnesota. Goals and strategies in this plan are generally consistent with those recommended in the Northeast Landscape Region Plan. Following are examples relating to growth stages:

- Increase long-lived upland conifers (white pine, red pine, white spruce, cedar, tamarack).
- Retain/increase long-lived conifer component in aspen and birch cover types.
- Consider native plant communities and associated growth stages in stand management. Manage for older growth stages in some stands.
- Increase acres with older multi-aged conifers (white pine and white spruce component).
- Increase jack pine cover type and component in appropriate native plant communities.
- Increase the white pine, yellow birch, white spruce, and white cedar components in northern hardwood stands.

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 48 percent of the timberland acres in these subsections. The long-term DFFC is that these cover types will comprise 40 percent of the timberland acres.
- Currently, the 0-30 age group of aspen, balm of gilead, birch, and jack pine cover types comprise 46 percent of the total timberland acres of these four cover types. The long-term DFFC is that the 0-30 age group comprises 48 percent of their acres.

Young early successional forest will be adequately represented over time using a regulated amount of harvesting in the aspen, balm of gilead, birch, and jack pine cover types. Most of the harvest will occur through clearcutting methods. Harvest prescriptions will attempt to mimic the intense wildfires and wind events that occurred naturally to initiate fully stocked, early successional forest. A variety of harvest sizes will be used while maintaining existing large patches and creating opportunities for large patches in the future by grouping of harvest activities. For aspen, balm of gilead, and jack pine, 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 this 10-year planning period.

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 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 are the sizes of overstory trees (diameter and height), understory vegetation, and their arrangement (scattered or clumped) within the stand. Structural characteristics also include the presence or absence of snags and coarse woody debris. Retaining large-diameter structures provide micro-sites for seed germination, cavities for nesting and den sites, and important escape cover within stands.

GDS-3A Strategies

a. Use selective harvesting to encourage diversity of species, ages, and stand structures within stands of white pine, lowland hardwoods, ash, northern hardwoods, and some stands of cedar, red pine, and white spruce.

See the cover type management recommendations in Chapter 4.

b. Implement the MFRC's *Voluntary Site-Level Forest Management 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[17], site index, and soils data 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.

[17] 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.

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

Resistance to windthrow, insect and disease risks, and the 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. In some stands, use the least intensive site preparation necessary to successfully regenerate the site, while favoring retention of the existing ground-layer plant species.

f. Use harvest systems or methods that protect advanced 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.

g. 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 (e.g., HRLV 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. The Field Visit Decision Tree (Appendix E) should be used as a guide in the stand evaluation.

h. Increase and/or maintain by reserving from harvest, target species including white 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, and soils data, or if the species is now present and doing well on the site, can aid in determining the appropriate species for the site.

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

More 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 stands, such as lowland black spruce, jack pine, and red pine can naturally exhibit low species diversity. Stands with low species diversity are natural and have occurred historically in association with large-scale disturbances, particularly fire.

j. Use ERF in some even-aged management stands to encourage greater structural diversity. (GDS-1A)

k. Encourage fruit and mast-producing species.

Follow the MFRC's *Voluntary Site-Level Forest Management 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, and northern basin-rich spruce swamp NPC classes) that tend to repeat across the landscape and over time. The goal is to retain the characteristics typically found in NPCs 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. Increasing within-stand tree species diversity with the appropriate mix of tree species encourages development of the NPC composition, structure, and function.

GDS-3B Strategies

a. Train field staff in the use of the *Field Guide to the Native Plant Communities in Minnesota: The Laurentian Mixed Forest Province* and native plant community classification to classify stands to NPC.

The NPC Field Guide was published in 2003 and training for field staff occurred in 2004. Additional NPC references are being developed to help determine management prescriptions for a stand.

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[18] *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 three subsections are particularly important to tourism because they include two of the top tourist destinations in the state: the North Shore of Lake Superior and the Superior National Forest. 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, black-throated blue warbler, gray jay, black-backed woodpecker, raven, and bald eagle.

There are 260 nongame species known or predicted to occur within these three subsections[19]. 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.

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[20]) 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

[18] In this plan, *nongame species* include amphibians, reptiles, and those mammal and bird species that are not hunted or trapped.
[19] *North Shore Highlands/Toimi Uplands/Laurentian Uplands SFRMP Preliminary Issues and Assessment*, Pages 7.3 to 7.24.
[20] Hunter, M.L. 1990. *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biodiversity*. Prentice-Hall Inc., Englewood Cliffs, N.J.

recommendations for habitat management at this finer level for a number of species, such as state or federal listed species (e.g., bald eagles).

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 66 species within the subsections that are associated with old forest and old forest conditions such as large-diameter trees and/or uneven-aged successional stages. Examples of species are osprey, boreal owl, hairy woodpecker, and northern flying squirrel. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time (GDS-1A and 2B) will ensure available habitat for many of these species. Extended rotation forests (ERF) and designated old-growth forest are examples.

b. Provide young forest distributed across the landscape.

Young forest in this plan refers to stands that are 0-30 years old. There are 130 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, woodchuck, 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 of 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.

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 MFRC's *Voluntary Site-Level Forest Management 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 MFRC's *Voluntary Site-Level Forest Management 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[21] (see Appendix P - Wildlife Habitat Relationships). Several conifer species (white pine, white spruce, jack pine, and tamarack) have declined significantly from historic levels in these subsections[22]. The following strategies will be used to meet coniferous habitat needs:

- Increase acres of long-lived conifer cover types through active management, allowing some stands 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 MFRC's *Voluntary Site-Level Forest Management Guidelines.*
- Apply the Cover Type Management Recommendations (Chapter 4).
- Identify conifer emphasis areas (CONE) to maintain or expand locations where habitat and timber management goals are managed toward extensive areas of predominantly conifer cover types.

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 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).

[21] Green, J.C. 1995. *Birds and Forests: A Management and Conservation Guide*. Minnesota Department of Natural Resources.
[22] Minnesota DNR. 2002. *North Shore Highlands/Toimi Uplands/Laurentian Uplands SFRMP Preliminary Issues and Assessment*, Table 3.6

The long-term goal of moving forest composition toward the range of natural variability (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/considerations on avoiding negative impacts to these species.

j. Apply the DNR management recommendations for habitats of nongame species as described in DNR guidelines and policies. For example:

- **Provide adequate conditions for gray wolves in the subsections.**

  Follow recommendations in the *Forestry Wildlife Habitat Management Guidelines*[23] manual (GDS-10) to ensure adequate and spatially distributed habitat to support a healthy population of wolf prey species (primarily white-tailed deer and moose). (GDS 4B)

- **Follow guidelines for management around bald eagle nests**.

  Use the *Management Guidelines for Bald Eagle Breeding Areas (Appendix E)*[23] and/or advice from regional nongame staff when an eagle nest is discovered near a proposed or active treatment area.

- **Use management that enhances or protects wood turtle nesting sites.**

  Follow the *Memorandums of Understanding for Management of the Cloquet River Turtle Management Area* and *the St. Louis River Turtle Management Area*[24] and other guidelines on wood turtle habitat management.

- **Review the Northern Goshawk Management Considerations (dated 12-03-2004) relating to landscape and site management for the northern goshawk.**

  The *Northern Goshawk Management Considerations and Interim Guidelines*[25] include information on:
  - Reporting of potential goshawk nests and field verification of their use.
  - Coordination between divisions on a plan for management around goshawk nests.

[23] Minnesota DNR. 1985. *Forestry-Wildlife Guidelines to Habitat Management*.
[24] Minnesota DNR. 2001. *St. Louis River and Cloquet River Wood Turtle Management Plans.* Northeast Region. Grand Rapids, MN.
[25] Minnesota DNR Memorandums. 12/03/2004: *Northern Goshawk Management Considerations* and 4/9/2002: *Interim Northern Goshawk Management Guidelines.*

- Consideration for ERF designation, thinning, selective harvest, and large patch management around known goshawk nests.

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

Game[26] 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 and the desires of interest groups, and Department of Natural Resources (DNR) internal policies require the consideration of game species in the management of state-administered forestlands. The DNR strategic plan, *Directions 2000,* states 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." [27]

The abundance of public forestland 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. A limited moose hunt offers a coveted, once-in-a-lifetime hunting experience for Minnesota resident hunters each fall. Trappers come from across the state to target thriving populations of fisher and marten.

The subsections also include two of the top tourist destinations in the state, the North Shore of Lake Superior and the Superior National Forest. Many tourists appreciate and seek out opportunities to observe game species during their trips to this area, where they have a chance to observe a number of species that are less common or absent elsewhere, such as moose, black bear, beaver, fisher, marten, and spruce grouse.

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.
- Alteration of natural fire disturbance events.

Both natural events and forest vegetation management through stand treatments, and their location, can potentially impact (negative or positive) game species.

There are 35 game species known or predicted to occur within the three subsections[28]. 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

[26] In this plan, *game* species include those terrestrial species that are hunted and trapped.
[27] Minnesota DNR. 2000. *Directions 2000: The Strategic Plan.* St. Paul, MN.
[28] Minnesota DNR. 2002. *North Shore Highlands/Toimi Uplands/Laurentian Uplands Subsection Forest Resource Management Plan, Preliminary Issues and Assessment*, pages 7.4 to 7.20.

across the planning area. To insure 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 14 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 P - Wildlife Habitat Relationships). Some examples of these species are moose, white-tailed deer, black bear, 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 23 game species within these subsections that are associated with old forest and old forest conditions such as large-diameter trees and/or uneven-aged successional stages (See Appendix P - Wildlife Habitat Relationships). Some examples of these species are fisher, marten, spruce grouse, hooded merganser, moose, 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 extended rotation forest (ERF) stands are examples of strategies that will provide old forest values across the landscape.

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

A balanced age-class structure leads to relatively equal acreages in each age class out to the normal rotation age. To provide an even-flow of early successional forest habitat, it is necessary to avoid large fluctuations in harvest levels within the aspen, balm of gilead, birch, jack pine, and balsam fir cover types. By 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-aged managed cover type stands.

There are 14 game species that rely on dense young seedling and/or sapling stage successional stages within even-aged managed cover types for food or cover. Managing to improve stocking levels in these stages and maintain health and vigor (GDS-2D and 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 to old to be regenerated back to the same cover type. Conversion (facilitated or natural) of aspen, balm of gilead, and birch stands will occur primarily in stands that are currently decadent, inaccessible, mistyped, or beyond their maximum rotation age (GDS-9A and 6).

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 P - 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 MFRC's *Voluntary Site-Level Forest Management Guidelines.*
- Apply the Cover Type Management Recommendations (Chapter 4).
- Identify conifer emphasis areas (CONEs) to maintain or expand locations where habitat and timber management goals are to manage toward extensive areas of predominantly conifer cover types.

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. (GDS-3A)

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

g. Designate 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:

1) Select and manage ruffed grouse management areas (RGMA) to:
   - Maximize diversity of age classes in the upland deciduous cover types.
   - Maximize the age difference between adjacent stands.

- Harvest stands near normal rotation ages and in 10 – 30 acre blocks.
  - Minimize conversion to conifers.
  - Clump rather than scatter reserved conifers and snags while meeting the *MFRC's Voluntary Site-Level Forest Management Guidelines*.

2) Select and manage moose management areas (MMA) to:
   - Maintain a diversity of age classes.
   - Promote mixed coniferous/deciduous stands.
   - Promote development of coniferous stands near riparian or upland feeding areas.
   - Prescribe stand treatments (e.g., clearcut with reserves or brush shearing) of 41 to 250 acres (patch classes 3-4).

3) Select and manage deer management areas (DMA) to:
   - Maintain a diversity of age classes in the upland deciduous cover types.
   - Maintain or increase within stand diversity.
   - Prescribe stands treatments (e.g., clearcut with reserves) of 10 – 40 acres (patch class 5).

4) Select and manage deer yard management areas (DMAY) 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.

3.5 Riparian and Aquatic Areas

GDS-5A: Riparian areas are managed to provide critical[29] habitat for fish, wildlife, and plant species.

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

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

Although riparian areas are important in all subsections and for all aquatic ecosystems, management of riparian areas along streams in the North Shore Highlands Subsection is extremely important from a fisheries perspective. This subsection includes over 95 percent of the cold-water streams used as spawning and nursery areas for Lake Superior migratory fish populations. These species include the native "coaster" brook trout and all three introduced and now naturalized Pacific salmon species. These are some of the most unique and sensitive habitats in Minnesota. This subsection is very susceptible to high volumes of surface run-off, which increases erosion and changes the hydrology of the streams. High runoff occurs because of the very low volume of surface soils (mostly bedrock), areas of heavy clay density, and very steep slopes. Maintaining water quality and cold-water temperatures are very important for these streams. Vegetation management will play a major role in the future fish production, water and habitat quality, and aquatic species diversity in these streams.

GDS-5A Strategies

a. Apply the MFRC's *Voluntary Site-Level Forest Management Guidelines* relating to riparian areas.

Some examples from the guidelines are:

1) 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
2) Manage for long-lived conifers as an option where beaver are to be discouraged near water bodies.
3) Avoid creating large cleared areas within the RMZ.
4) Maintain a filter strip between the water body and harvest area.
5) Approach water crossings at or near right angles to the stream direction, and use measures to minimize streambank disturbances.

DNR forestry staff checks 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 forestland ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.) in the state.

b. Using the flexibility built into site-level guidelines, determine the appropriate RMZ width and residual tree densities after conducting an on-site evaluation of the RMZ area. A forester (and other division staff when appropriate) will conduct the evaluation before carrying out any timber harvest activity in riparian areas.

Each RMZ is unique and the site-level guidelines allow flexibility to determine the most appropriate RMZ based on the hydrology, topography, and existing vegetation of the site. Interdisciplinary teams will identify stands for the 10-year stand examination list. The list and associated GIS information will be provided to fisheries, wildlife, ecological services, and forestry division staff with forest resource management responsibilities in the subsections. This will allow staff to identify and review the stands that fall within riparian management zones before proposed management activities are set up and completed. In addition, department staff will have another opportunity during the review of annual stand examination lists to identify those stands with RMZs that need further review. Stands needing further review will be discussed among the interested DNR division staff, and if necessary, a field visit will be conducted to more thoroughly evaluate and discuss the proposed management.

The DNR Section of Fisheries administers 10,561 acres of forestland in the North Shore Highlands Subsection. The primary objective on fisheries-administered lands adjacent to streams is riparian protection. Stands, or portions of stands, of aspen, balm of gilead, and birch on fisheries-administered lands along trout streams may be converted to conifers, if determined to be desirable and feasible after the site evaluation. If an aspen, balm of gilead, or birch stand was designated as ERF, it will continue with an ERF designation when converted to a conifer cover type. Final field approval of sale design on fisheries-administered lands rests with the Area Fisheries Supervisor.

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

Old forests provide the best source of woody debris in aquatic systems and habitat for a wide variety of wildlife species. During the selection of ERF stands, even-aged stands in riparian areas received a high priority for ERF designation. 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 (OFMC) and ecologically important lowland conifers (EILC) stands (EILC during this 10-year management period) within riparian areas will be managed to maintain or increase old forest conditions.

d. Using the NPC Field Guide, manage for the appropriate species 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 promoted next to trout streams. Beaver use these species for food and building dams, which can affect both aquatic and terrestrial habitat.

e. Apply the Shipstead-Newton-Nolan Act restrictions, where applicable, on state lands in the subsection.

The far northeastern portions of the North Shore Highlands and Laurentian Uplands subsections are within the Shipstead-Newton-Nolan (SNN) Act protection area. The SNN Act is a federal law that limits most forestry activities within 0 - 400 feet of navigable lakes and streams. The Shipstead-Newton-Nolan Area Map on Page A.70 in the Appendix shows where the SNN Act

applies in these subsections. DNR has been and will continue applying these laws, where applicable, on state lands. Following are excerpts from the laws:

> *Minn. Statutes 92.45 (Little Shipstead-Newton-Nolan Act): Within the area in Cook, Lake, and St. Louis counties described in the act of Congress approved July 10, 1930, the timber on state lands is subject to restrictions like those now imposed by the act on federal lands.*
>
> *Shipstead-Newton-Nolan Act: The principle of conserving the natural beauty of shore lines for recreational use shall apply to all Federal lands which border upon any boundary lake or stream contiguous to this area, or any other lake or stream within this area which is now or eventually to be in general use for boat or canoe travel, and that for the purpose of carrying out this principle, logging of all such shores to a depth of four hundred feet from the natural water line is forbidden, except as the Forest Service of the Department of Agriculture may see fit in particular instances to vary the distance for practical reasons: Provided, that in no case shall logging of any timber other than diseased, insect infested, dying or dead be permitted closer to the natural shore line than two hundred feet, except where necessary to open areas for banking grounds, landings, and other uses connected with logging operations."*

f. Follow the recommendations in the St. Louis River Management Plan.

The *St. Louis River 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 plan.

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 MFRC's *Voluntary Site-Level Forest Management 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.
- Ensure through timber sale planning and administration that skidding and other equipment operation in upland stands take place outside of wetland inclusions 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 wetland inclusions and seasonal ponds.

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

b. Develop prescriptions that consider site-specific conditions such as soils, topography, hydrology, past management, and existing and desired vegetation when applying site-level considerations and guidelines.

The site-specific prescriptions will be developed during the stand examination field visit.

3.6 Timber Productivity

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

Increasing the timber productivity of state forestlands 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-aged managed non-ERF stands at their normal rotation age. (See GDS-2A and 9A)

b. Field visit all the identified high-risk, low-volume (HRLV) stands during this 10-year plan period to address stands with heavy insect or disease damage, or old, low volume stands. (See HRLV Section in GDS-9A)

- The acreage identified as HRLV stands will comprise the increase in stand treatment level. Treating these HRLV acres during this 10-year plan will more quickly address the age-class imbalance in the cover types. A Field Visit Decision Tree (Appendix E) has been developed to guide appraisers when stand examination field visits are made. Also, the NPC Field Guide and supplemental NPC references may be used to help identify more productive site-appropriate species. 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).

HRLV stands may be treated more rapidly than distributing the acreage equally in each of the years of the 10-year plan.

c. Thin or selectively harvest in some aspen, balm of gilead, birch, white pine, red pine, jack 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.) The amount of thinning will depend on whether a stand meets the criteria for thinning based on a field examination or if there are markets for the timber.

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

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

e. Apply and supervise the implementation of the MFRC's *Voluntary Site-Level Forest Management 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 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 (all of which have been documented in these subsections). There is potential for significant adverse impacts from other species present in these subsections, such as: tansy, spotted knapweed, purple loosestrife, and leafy spurge. Management will seek to minimize impacts from these species, limit the introduction of new exotic species, and minimize the impact of control measures on vulnerable native species.

Local introductions and spread of harmful exotic plants can 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. 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 (EPA, USDA) and state agencies improve capacity to respond to the spread of established exotic species into new areas, new species introductions, and outbreaks of established pests and diseases.

b. 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.

c. 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).

d. In extended rotation forest (ERF) stands, a higher level of impact 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 forestlands.

Wildlife species such as moose, 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. Two keys to success are coordination between department staff and adequate funding. 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 or moose 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 forestlands. Management is based on our current knowledge and will be adjusted based on future research findings.

Several climate models (e.g., atmospheric-ocean general circulation models, or AOGCM[30]) in use around the world predict global climate change. The Intergovernmental Panel on Climate Change (IPCC) refers to climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The models agree that average temperatures are increasing and predict more variable changes in precipitation. This global warming will affect forests and wildlife in Minnesota.[31,32]

Scientists believe the predicted climate change will affect the size, frequency, and intensity of disturbances such as fires and windstorms (blowdown). It will affect the survivorship of existing plant and animal species and the distributions of plants and animals. Even at modest levels, independent studies are finding mounting evidence that the current climate change influences plant and animal ranges and behavior[33]. 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. 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.[34] There is a need to facilitate species adaptation to change in response to possible rapid climatic changes.

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[30] 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.
[31] Weflen, K., *The Crossroads of Climate Change*. Minnesota Conservation Volunteer, January-February 2001, Minnesota Department of Natural Resources, St. Paul, MN.
[32] Pastor, John, personal communication at March 13, 2003 SFRMP meeting. Natural Resources Research Institute, University of Minnesota-Duluth.
[33] 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.
[34] 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.

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

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

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

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

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

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

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

- Use the NPC Field Guide when selecting the species most appropriate for the site.

d. Use the concept of carbon sequestering 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 trees, dead trees, fallen leaves, and soil. The storage of carbon is called

carbon sequestration. Carbon also remains stored in wood that is harvested and processed into wood products.[35] 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, addressing stands of high-risk low-volume timber to increase the stocking and growth rate of timber will help in sequestering carbon. Stands will be field examined to determine if there is sufficient advanced regeneration. If the site lacks adequate regeneration, it may be site prepped for planting or seeding with an appropriate species to result in a more fully stocked stand. Stands that contain a variety of species are more likely to fully occupy a site, increasing the overall wood volume grown on the site. Increasing the biomass over what is currently on these under-stocked sites will help sequester carbon. The following are some examples of forest management strategies in this plan that will help in carbon sequestration:

- Address high-risk, low-volume (HRLV) stands.
- Balance the age-class distribution in even-aged managed cover types.
- Emphasize longer-lived species.
- Use longer rotations on forested wetlands cover types.
- Designate forest stands to be managed as extended rotation forest (ERF).
- Reserve and maintain old-growth forests.
- Increase timber productivity.
- Retain leave trees, snags, and coarse woody debris on harvested sites.

e. 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 that slows discharge in the spring.

- Follow the MFRC's *Voluntary Site-Level Forest Management Guidelines* for riparian corridors.
- See Riparian GDS-5A.

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

3.8 Visual Quality

GDS-8: Minimize forest management impacts on visual quality.

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

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

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 MFRC's *Voluntary Site-Level Forest Management 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*)[36] 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-aged cover types (both normal and extended rotation forest), and improves the age-structure and timber quality of uneven-aged cover types.

SFRMP treatment levels reflect the number of acres that will be field vi d over the 10-year period, and will be divided into annual stand examination lists. 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).

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

Table 3.9a shows the acres in each cover type that:

- are available for timber management (management pool),
- are the calculated treatment levels (management pool divided by rotation age),
- meet the stand selection criteria (selection pool acres),
- meet the HRLV criteria, and
- are the SFRMP treatment levels recommend in this plan.

Table 3.9a: Even-aged Cover Type Treatment Acres[1]

Cover Type	Rotation[2] Class	Planned Rotation Age[3]	Management Pool Acres[4]	Stand Selection Pool Acres[5]	10-Year Calculated Treatment Level[6]	HRLV[7] Acres	SFRMP Planned Treatment Level[8]	Total Treatment Level 2005-2014
Aspen/Balm of Gilead	N	53*	40,837	12,539	7,719	3,520	9,719	13,176
	ERF	73*	25,343	6,729	3,457	2,737	3,457	
Birch	N	57*	15,097	10,876	2,666	3,507	4,780	8,543
	ERF	82*	11,610	4,950	1,415	3,426	3,763	
Jack Pine	N	60	2,801	405	467	33	347	468
	ERF	75*	2,377	40	315	121	121	
White Spruce	N	75	8,132	224	1,084	143	203	203
Balsam Fir	N	50	8,198	2,846	1,640	2,056	2,880	3,800
	ERF	69*	3,384	1,468	492	857	920	
Tamarack - High Site Index (SI)	N	85	2,875	605	186	55	336	447
	ERF	111*	1,290	78	116	19	111	
Tamarack Low SI	N	100	1,636	459	164	35	231	330
	ERF	140*	953	43	68	99	99	
Black Spruce Lowland - High SI	N	85	3,194	549	376	129	528	799
	ERF	112*	2,178	874	194	71	271	
Black Spruce Lowland – Med SI	N	100	8,781	3,224	878	268	1,166	1,720
	ERF	129*	6,354	995	494	201	554	
Black Spruce Lowland – Low SI	N	120	5,480	1,068	457	304	950	1,130
	ERF	170*	2,899	66	171	174	180	
Black Spruce Upland	N	70	2,188	844	313	156	470	564
	ERF	96*	1,091	125	113	64	94	
Total Acres			156,698	49,007	22,785	17,975	31,180	31,180

[1]A spreadsheet model developed by DNR staff was used to project by 10-year periods the outcome of various scenarios of treatment levels that best move toward the desired long-term treatment level. The modeling was used for forest cover types managed under even-aged silvicultural systems. Cover types where there will be no even-aged final harvest in this ten-year plan were not modeled. These are red pine, white pine, and ERF white spruce. Cedar was also not modeled because there will be only a very limited amount of treatment, see Chapter 4 for further explanation.
[2]Rotation Class: N – portion of cover type managed under normal rotation; ERF – portion of cover type managed as extended rotation forest
[3] * indicates that the age shown is an average of multiple rotation ages (years).
[4]Management Pool Acres are timberland acres that are available for potential timber harvest after reserves (e.g., designated old-growth stands), inoperable stands (non-HRLV), etc. are subtracted.
[5]The Management Pool Acres that meet the stand selection criteria for treatment.

[6]Calculated Treatment Level = (Management Pool Acres) Rotation Age) X 10. This would be the treatment level per decade in even-aged managed cover types if all age-classes had equal acres (i.e., an even age-class distribution).
[7]Acres in the Stand Selection Pool that meet the high-risk, low-volume (HRLV) criteria.
[8]10-year planned treatment level (acres) for this planning period (includes HRLV acres).

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

- Age-class imbalances for even-aged cover types
- High-risk, low-volume stands (HRLV)
- Acres over rotation age
- Representation of old and young forest
- Planned increases or decreases in cover type acreages through conversion
- Supply of timber
- Criteria for uneven-aged management and thinning

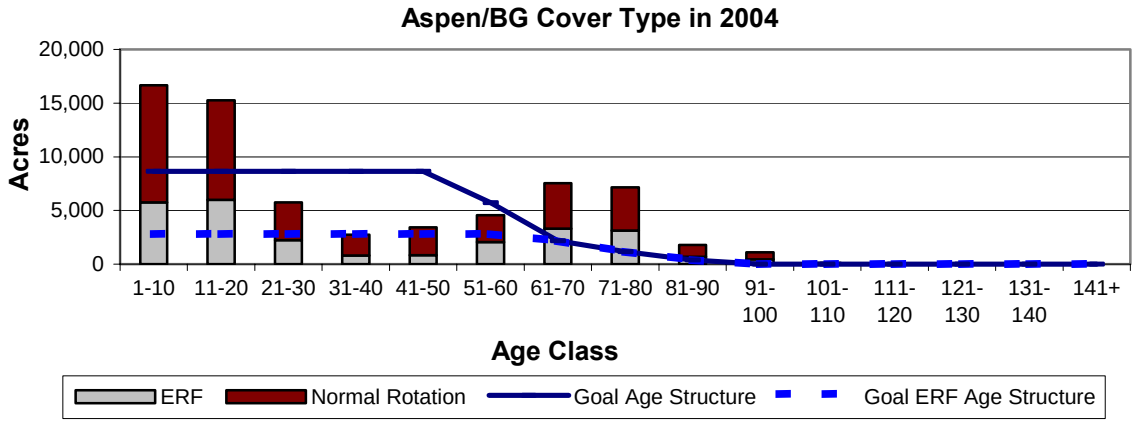
GDS-9A Strategies

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

1. Even-aged Cover Types

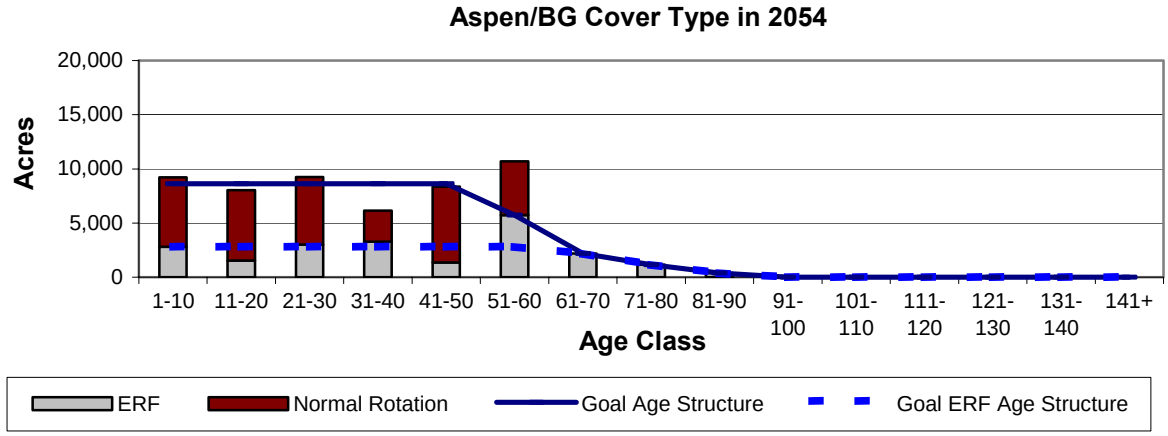
a. Age-Class Imbalances: The long-term goal (DFFC) is to move toward a balanced age-class distribution with a declining distribution for the ERF designated stands. This goal was compared to the current age-class distribution for all even-aged managed cover types. A spreadsheet model developed by DNR staff was used to project by 10-year periods the outcome of various scenarios of treatment levels that best move toward the desired long-term treatment level. The modeling was used for forest cover types managed under even-aged silvicultural systems. (Cover types where there will be no even-aged final harvest in this ten-year plan were not modeled. These are red pine, white pine, and ERF white spruce. Cedar was also not modeled because there will be only a very limited amount of treatment, see Chapter 4 for further explanation.) Treatment levels were developed for each decade for the next 60 years that would move the current age distribution closer to the goal at the end of 60 years. At the end of 60 years, all even-aged cover types will be closer to a balanced age-class structure, but due to existing imbalances and the other considerations below, a balance will not be achieved in 60 years. See Figures 3.9a and 3.9b.

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



Note: The 1-10 age class is inflated because it includes 7,590 acres currently on timber sale permits or are acres on the FY2004 annual harvest plan that haven't been harvested yet. This acreage will be treated within the next 1 – 5 years.

Figure 3.9b: Estimated Aspen/BG Cover Type Age-Class Distribution in 2054



b. High-risk, low-volume (HRLV) criteria were developed for each of the even-aged managed cover types to identify stands that are at high risk due to old age (i.e., exceeding the established maximum rotation age), high risk due to a high percentage of the trees in the stand being affected by damage (e.g., insects, disease, or wind), or a very low timber volume in mature stands (less than 7.6 cords per acre). 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. For some cover types, such as balsam fir, additional insect and disease damage considerations were also used. Table 3.9b includes the criteria that were used for identifying high-risk, low-volume stands in the applicable cover types. Table 3.9c shows the acres by cover type that met the HRLV criteria. All of the HRLV stands will be site visited during the next 10 years to:

- Determine whether the stand has a marketable timber volume for treatment through a timber sale,

- Prescribe a treatment plan to either retain its current cover type or convert to a more desired cover type through active management or through natural succession, and
- Update the inventory.

It is estimated that approximately one-half of the HRLV acreage will be treated through timber harvest. It is estimated the remainder will be treated through inventory alterations to the current stand composition (e.g., alter to the understory type) or be converted to other cover types without harvest. See Figure 3.9c. These are preliminary estimates, the actual percentage may vary based on what the current stand composition and conditions are when the stand examinations are completed. Staff will use the Field Visit Decision Tree (Appendix E), Cover Type Management Recommendations (Chapter 4), and other plan direction, including GDS strategies (Chapter 3) and preliminary stand-level direction (e.g., preliminary stand prescriptions, preliminary management objectives, and the associated stand management recommendations and considerations) along with guides such as the NPC Field Guide to determine the actual stand treatment.

Figure 3.9c: Estimated Treatment of HRLV Stands

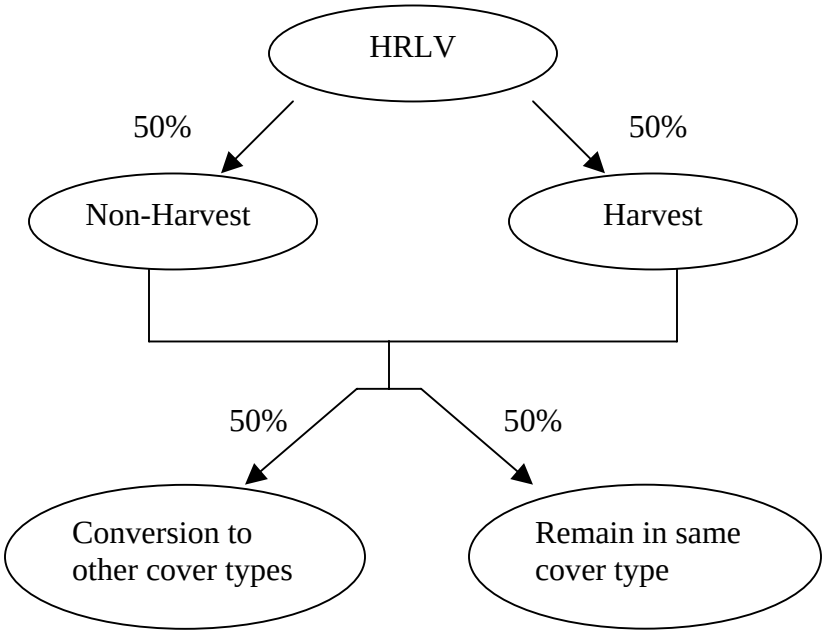


Table 3.9b: Criteria Used for Identifying High-Risk, Low-Volume (HRLV) Stands

Cover Type	Maximum Rotation Age	Criteria for High % Damaged	Criteria for Low Volume Stands
Aspen/BG	∃85 years old	∃51% affected & >50 years	∃50 years old & <7.6 cords/acre
Birch	∃85 years old*	∃51% affected & >50 years	∃50 years old & <7.6 cords/acre
Jack Pine	∃80 years old	Not Applied	Not Applied
Balsam Fir	∃75 years old	∃51% affected & >50 years	∃50 years old & <7.6 cords/acre
W Spruce	∃120 years old	Not Applied	∃75 years old & <7.6 cords/acre
BSL SI 40+	∃115 years old	∃26% affected & >85 years	∃85 years old & <7.6 cords/acre
BSL 29-39	∃135 years old	∃51% affected & >100 years	∃100 years old & <7.6 cords/acre
BSL SI <29	∃180 years old	∃51% affected & >130 years	∃130 years old & <7.6 cords/acre
BSU	∃100 years old	Not Applied	∃70 years old & <7.6 cords/acre
Tam SI 40+	∃115 years old	∃51% affected & >85 years	∃85 years old & <7.6 cords/acre
Tam SI <40	∃150 years old	∃51% affected & ∃100 years	∃100 years old & <7.6 cords/acre

*The maximum rotation age for the birch cover type is being evaluated during this 10-year planning period.

Table 3.9c: High-Risk, Low-Volume (HRLV) in Even-Aged Cover Types

Cover Type	HRLV Acres	Management Pool Acres	Percent HRLV
Aspen/Balm of Gilead	6,257	66,180	9%
Birch	6,933	26,707	26%
Jack Pine	154	5,178	3%
Balsam Fir	2,913	11,582	25%
White Spruce	293	12,614	2%
BS Lowland SI 40+	200	5,372	4%
BS Lowland SI 29-39	469	15,134	3%
BS Lowland SI <29	478	8,379	6%
BS Upland	220	3,279	7%
Tamarack	208	6,754	3%
Total	**18,125**		

Based on the established HRLV criteria, the amount of HRLV acres in some cover types was so high that adjustments had to be made to lower the non-HRLV treatment level. This adjustment was necessary so that the total cover type treatments did not exacerbate the current age-class imbalance.

Using Table 3.9a, a comparison can be made between:

- HRLV and SFRMP treatment level to show how much of the treatment will be due to HRLV conditions of the stands. For example, in normal rotation age aspen, 3,520 acres of the 9,719 acres of the SFRMP treatment level will come from HRLV designated stands
- The sustainable (calculated) treatment level and the SFRMP treatment level, to indicate the higher treatment level planned during the next 10 years to help address HRLV acres

and the age-class imbalance. For example, in normal rotation age aspen, the SFRMP treatment level is 2000 acres higher for this 10-year period than the long-term sustainable treatment level based on the current cover type acreage.

- The SFRMP treatment level and the selection pool acres to show how many acres meet the stand selection criteria but will be treated in future decades. This will facilitate balancing the age classes and retaining the desired amount of old forests. For example, in the aspen/balm of gilead cover type there are currently 12,539 acres that meet the stand selection criteria for treatment. The SFRMP Treatment Level recommends treating 9,719 acres, leaving 2,820 acres to be treated in the following decade to help balance the age classes and to provide old forest benefits.

c. Treating Over Rotation Age Stands: In most even-aged managed cover types there is currently a surplus of acres beyond the normal and ERF rotation ages established for this plan. Multiple ERF rotation ages where used in each of the cover types to achieve the desired declining age-class distribution beyond the normal rotation age. Treatment levels were developed to address many of these acres in the next 10 years. This will effectively bring the average treatment age closer to the desired rotation ages for the even-aged cover types. For many cover types, the amounts are so large that treating them all in the next decade would exacerbate the current age-class imbalance. For these cover types, some over-rotation age stands will be carried through this 10-year period and into the following decade to facilitate balancing the age classes. (In Table 3.9a, this would be the difference between the Stand Selection Pool Acres and the SFRMP Planned Treatment Level) After the first decade, no stands in the management pool are planned to be carried 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 Table 3.9d.

Table 3.9d: Average Stand Treatment Age for Even-Aged Managed Cover Types

Cover Type		Planned Rotation Age	Past Harvest Age[1]	Average Treatment Age by Decade					
				1st[2]	2nd	3rd	4th	5th	6th
Aspen/BG	Normal	53*	72	78	73	61	51	55	56
	ERF	73*		80	86	85	59	66	66
Birch[3]	Normal	57*	82	88	NA	NA	NA	NA	NA
	ERF	82*		88	NA	NA	NA	NA	NA
Jack Pine	Normal	60	72	77	70	59	55	52	60
	ERF	75*		99	85	66	69	63	68
White Spruce	Normal	75	79	83	62	54	60	61	75
Balsam Fir	Normal	50	76	76	55	53	46	50	50
	ERF	69*		82	83	81	74	72	75
Tamarack High Site Index (SI)	Normal	85	98	87	95	95	95	93	74
	ERF	111*		98	81	111	105	109	113
Tamarack Low SI	Normal	100	118	115	110	110	110	105	100
	ERF	140*		132	104	113	121	130	134
Black Spruce Lowland High SI	Normal	85	107	100	97	100	107	110	116
	ERF	112*		90	97	105	108	113	120
Black Spruce Lowland Medium SI	Normal	100	109	115	107	111	116	120	123
	ERF	129*		120	109	126	128	129	133
Black Spruce Lowland Low SI	Normal	120	160	140	124	126	126	120	120
	ERF	170*		151	181	155	162	169	167
Black Spruce Upland	Normal	70	90	96	90	90	94	72	62
	ERF	96*		102	101	100	100	110	108

* Number is an average of more than one rotation age.
[1]Average age of stands reported from annual harvest plans in the previous 5 years.
[2]Includes HRLV stands.
[3]Birch treatment level only determined for 1st decade. Further analysis planned prior to next plan.

d. Maintaining Old Forest: In most even-aged 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 most 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 will occur for one or two 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: Old Forest: Percent of Managed Acres Over Normal Rotation Age

Cover Type	DFFC	Percent by Decade					
		Current	2nd	3rd	4th	5th	6th
Aspen/BG	11%	32%	19%	14%	7%	17%	20%
Birch[1]	14%	74%	54%	NA	NA	NA	NA
Jack Pine	9%	11%	13%	7%	4%	4%	4%
Balsam Fir	9%	14%	9%	8%	8%	10%	9%
Tamarack							
High SI	10%	11%	8%	17%	19%	16%	10%
Low SI	10%	13%	12%	14%	20%	21%	14%
Black Spruce Lowland							
High SI	10%	16%	23%	33%	32%	23%	15%
Medium SI	10%	14%	14%	20%	26%	24%	16%
Low SI	10%	19%	12%	14%	13%	13%	12%
Black Spruce Upland	9%	39%	35%	26%	16%	8%	4%

[1]Birch modeling was only done through the first decade. Further analysis of the maximum rotation age will be done prior to the next plan.

e. Maintaining young forest: Moving toward and eventually maintaining a balanced age-class distribution will ensure that young forest (0-30 years old) exists on the landscape over time. (See GDS-2D.) The percentage of young forest per decade was considered when determining 10-year treatment levels and the levels were adjusted to ensure that there was enough young forest over the 60-year planning period. In some cover types, higher levels of young forest will occur in the initial decades due to the accelerated treatment of the acres currently over the rotation ages. Table 3.9f shows the amount of young forest per decade for all even-aged cover types.

Table 3.9f: Young Forest Summary: Percent of Cover Type 0-30 Years Old

Cover Types	DFFC %	Young Forest: Percent by Decade					
		Current	2nd	3rd	4th	5th	6th
Aspen/BG	49	57	66	51	39	49	49
Birch[1]	46	20	45	NA	NA	NA	NA
Jack Pine	46	64	64	68	54	45	43
Balsam Fir	55	46	64	62	51	47	54
Tamarack							
High SI	32	31	42	40	37	34	31
Low SI	27	23	29	31	33	30	30
Black Spruce Lowland							
High SI	32	21	35	42	41	38	35
Medium SI	27	22	29	36	33	32	30
Low SI	23	17	27	28	29	21	20
Black Spruce Upland	39	34	49	61	53	42	37

[1]Birch modeling was only done through the first decade. Further analysis of the maximum rotation age will be done prior to the next plan.

f. Planned Increases/Decreases in Cover Type Acres: The long-term (60-year) desired future forest condition calls for decreases in the aspen/balm of gilead, paper birch, and balsam fir cover types and a corresponding increase in the white pine, white spruce, red pine, jack pine, white cedar, northern hardwoods, black spruce upland, and oak cover types. These cover type changes are not planned to occur proportionately throughout the 60-year period, because of considerations for the acres beyond rotation age, amount of HRLV, and balancing the age-class distribution. For example, approximately 45 percent of the cover type changes are planned to occur in the first decade considering the large acreage of HRLV now and to balance the age-class distribution. The intent is to take advantage of advanced (existing) conifer or northern hardwoods regeneration in these stands, and the reduced sprouting potential in older forests that may make conversions easier and less costly to achieve. The remaining 55 percent of the conversions will take place in the later decades to facilitate balancing the age classes. See Table 3.9g.

Table 3.9g: Cover Type Conversion Goals (DFFC) and Estimated Decrease and Increase By Decade

		Conversion Acres by Decade						
Cover Type	**60-year DFFC Acres**	**2005-2014**	**2015 - 2024**	**2025-2034**	**2035-2044**	**2045-2054**	**2055-2064**	**Total Acres**
DECREASING								
A/BG	-14,821	-4813	0	0	0	-5000	-5008	**-14821**
Bi	-5,854	-3467	-870	-815	0	0	-702	**-5854**
BF	-1,194	-1457	0	0	0	0	0	**-1457**
Decrease Total	**-21,869**	**-9737**	**-870**	**-815**	**0**	**-5000**	**-5710**	**-22132**
INCREASING								
JP	2,808	1115	418	418	418	418	21	**2808**
BSU	734	293	110	110	110	110	1	**734**
WS	3,586	1435	342	342	342	342	783	**3586**
WP	8,438	4000	0	0	0	2400	2038	**8438**
NP	3,234	1500	0	0	0	900	834	**3234**
C	2,031	900	0	0	0	600	531	**2031**
NH	741	364	0	0	0	200	177	**741**
O	297	130	0	0	0	30	137	**297**
Increase Total	**21,869**	**9737**	**870**	**870**	**870**	**5000**	**4522**	**21869**
Balance	0	0	0	55	870	0	-1,188	-263
Cover types in **bold** have data from treatment model except Bi from 2015 - 2064 and uneven-aged managed portion of WS.								
WS uneven-aged acres (all ERF) conversion portion is 1305 acres. Added 40% for conversion in 1st decade (same as even-aged portion, remainder in last decade.)								
Conversion to WP, NP, C, NH, and O approximately 45% of total in 1st decade because of corresponding decrease in A/BG, Bi, and BF in 1st decade.								
2045-2054 decade approximately 30% of conversions to WP, NP, C, NH, and O.								
2055-2064 decade approximately 25% of conversions to WP, NP, C, NH, and O.								

g. Supply of Timber: A sustainable treatment level was developed that includes any planned increases or decreases to each cover type over the next 60 years. (Table 3.9h) 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.

Table 3.9h: Treatment Levels for the Even-Aged Cover Types

Cover Type	10-Year Treatment Acres by Decade						
	2005-2014	2015-2024	2025-2034	2035-2044	2045-2054	2055-2064	DFFC[3]
Aspen/BG	13176	6158	9287	8916	14211	15672	**8630**
Birch[1]	8543	NA	NA	NA	NA	NA	**3450**
Jack Pine	468	766	691	673	818	1135	**1220**
White Spruce[2]	203	215	824	1223	1391	1515	**1390**
Balsam Fir	3800	1367	1479	1908	2126	1811	**1955**
BSL High SI	799	691	702	658	528	537	**575**
BSL Medium SI	1720	1752	1536	1486	1480	1294	**1365**
BSL Low SI	1130	589	671	523	507	529	**630**
Tam High SI	447	310	311	346	246	278	**305**
Tam Low SI	330	260	259	259	259	234	**235**
BSU	564	529	406	361	406	506	**530**

[1]Birch modeling was only done through the first decade because the maximum rotation age is being evaluated.
[2]Non-ERF White Spruce
[3]Treatment level when desired future forest composition (DFFC) goals are reached, i.e., cover type conversions and even-aged class distribution goals are achieved. Large decreases from current to DFFC treatment acres in aspen/BG, birch, and balsam fir cover types result in increases in DFFC treatment levels in the white pine, red pine, jack pine, and white spruce cover types. White pine and red pine cover types were not modeled because of the current age-class distribution.

2. Uneven-aged Management and Thinning:

Both even-aged and uneven-aged cover types will be managed using selective harvest treatments (See Table 3.9i). The uneven-aged managed cover types include ash, lowland hardwoods, northern hardwoods, white pine over age ninety and the extended rotation forest (ERF) portion of the white spruce cover type. Even-aged cover types that will be thinned include aspen, balsam fir, white spruce, jack pine, red pine, and white pine under ninety (See Table 3.9j). All stands that meet the criteria will be field visited for possible selective treatment. Some of the ash, lowland hardwoods, and up to 20 percent of the northern hardwoods may be initially treated through even-aged methods to improve long-term stand age-structure and timber quality. See Chapter 4 for specific 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 as listed in the tables below. These additional stands will be available for review during the annual harvest plan or annual plan addition review process.

Table 3.9i: Treatment Levels for the Uneven-Aged Managed Cover Types

Cover Type	Criteria[1]	2005-2014 Total Acres[2]
Ash	SI=45+, BA=120+, DBH=7"+	191
Lowland Hardwoods	SI=45+, BA=120+, DBH=7"+	15
Northern Hardwoods	BA=100+, DBH=5"+	4443
White Spruce (ERF)	Age=25-105, BA=140+	0[3]
White Pine over 90 years old	BA=110+, Field visit evaluation	0[3]

[1]SI – site index; BA – basal area (square feet per acre); DBH – tree diameter at breast height
[2]Total is for the decade. Approximately one-tenth of the acres will be on annual treatment plans.
[3]WS and WP acres are included with the cover type acres listed in Table 3.9j.

Table 3.9j: Thinning Treatment Levels

Cover Type	Criteria[1]	2005-2014 Total Acres[2]
Aspen	SI=70+, Age 28-36, BA=100+	105
Balsam Fir	SI=50+, Age 25-45, BA=120+	0
White Spruce (NRA)	Age 25-60, BA=140+	1250[3]
Jack Pine	SI=60+, Age 21-40	0
Red Pine	Age=25+, BA=120+	2000[3]
White Pine under 90 years old	BA=110+, Field visit evaluation	500[3]

[1]SI – site index; BA – basal area (square feet per acre); DBH – tree diameter at breast height; NRA - Normal Rotation Age
[2] Total is for the decade. Approximately one-tenth of the acres will be on annual treatment plans.
[3]WS, NP, and WP thinning acres for this SFRMP are estimated based on past Area plans. Modeled inventory data underestimated the potential thinning acreage. During FY2001 – 2004 in these cover types, an average of 480 acres of thinning acres per year were on the annual harvest plans.

3. Stands Reserved or Deferred for Further Evaluation

Stands that have been identified to be reserved or deferred for further evaluation during the 10-year planning period (e.g., EILC stands, additional old-growth candidate recommendations, and those stands associated with PRNAs) will become available for active management after evaluations are completed if they are released from the reserved or deferred status. High-risk, low-volume stands (HRLV) and other stands meeting the stand selection criteria that are released from the reserved/deferred status which are in need of treatment may be added to the harvest plan through the annual plan additions review process. Because these reserves/deferrals acres were included in the cover type treatment level calculations, the treatment levels recommended in this plan should not be adjusted. If additional stands are added, then a corresponding acreage on the treatment list would have to be deferred from treatment until the next planning period. Exceptions: 1) All HRLV stands that are released from the reserved or deferred status will be evaluated and treated, as appropriate, during this 10-year planning period. 2) If a large disturbance event occurs, management would be based on the strategies in GDS-12.

4. 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 plan 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 plan. Figure 3.9d provides a total acres treatment level by cover type comparison between the past plan and those recommended in this SFRMP plan. Table 3.9k provides a more detailed acres breakdown by generalized treatment method for comparing the past plan (estimated proportion of past Area plans in these subsections) with the treatment level recommended in this SFRMP plan.

Figure 3.9d: Acres Comparison Between the Past Forestry Area Plans and the SFRMP Treatment Level

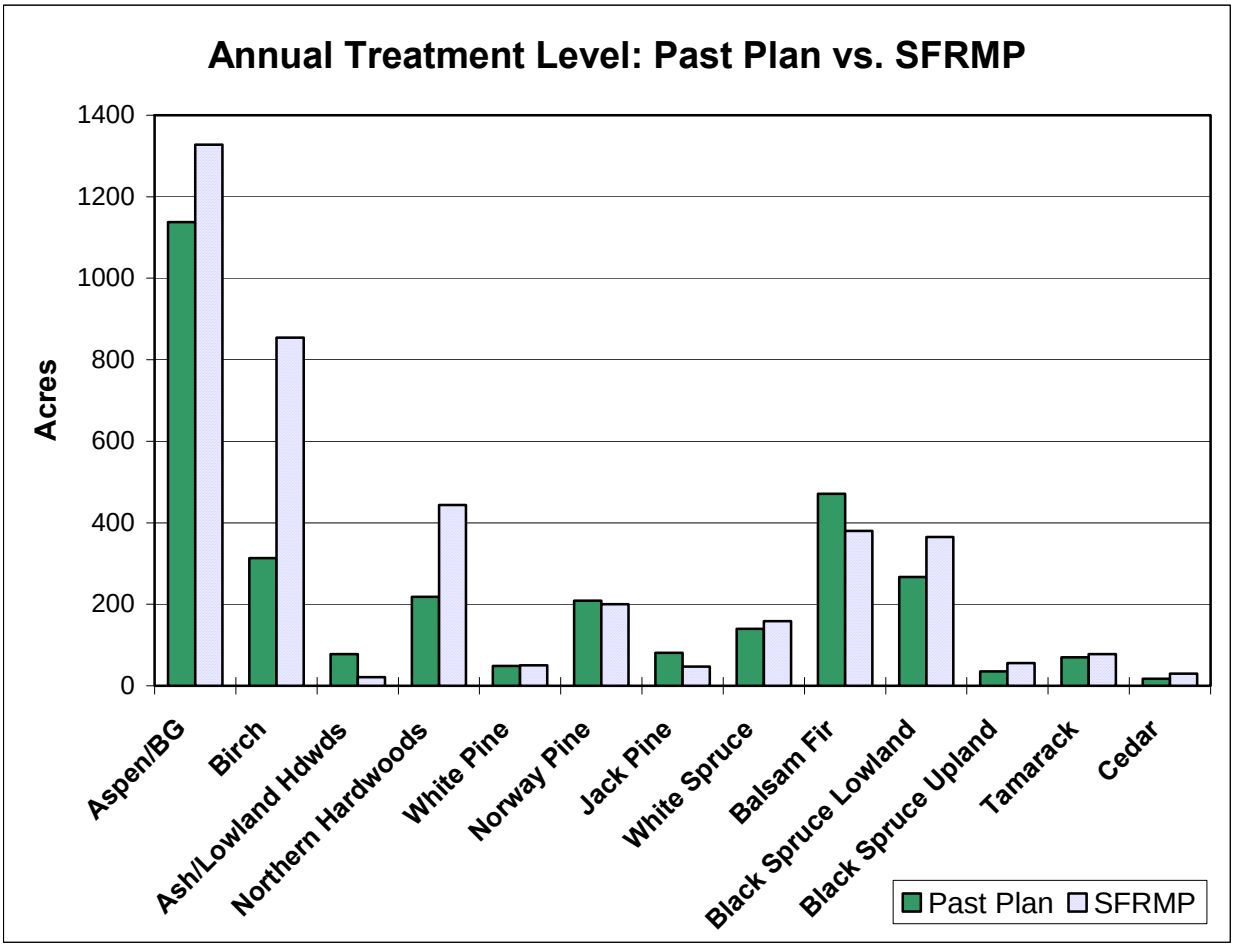


Table 3.9k: Annual Treatment Level: Past Area Plans and SFRMP by Generalized Treatment Method

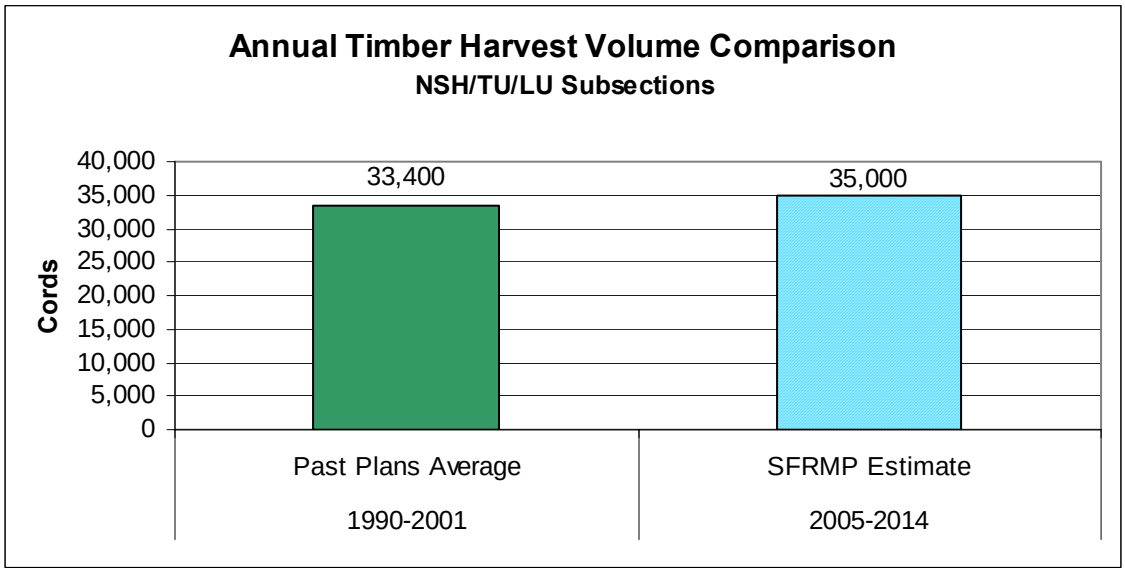
	Even-Aged[1]		Partial Cut[2]		HRLV[3]		Total	
Cover Type	**Past**	**SFRMP**	**Past**	**SFRMP**	**Past**	**SFRMP**	**Past**	**SFRMP**
Aspen/BG	1093	692	45	10	0	626	**1138**	**1328**
Birch	303	161	10	0	0	693	**313**	**854**
Ash/Lowland Hdwds	25	0	53	21	0	0	**78**	**21**
Northern Hardwoods	56	0	162	444	0	0	**218**	**444**
White Pine	0	0	49	50	0	0	**49**	**50**
Red Pine	1	0	208	200	0	0	**209**	**200**
Jack Pine	69	32	12	0	0	15	**81**	**47**
White Spruce	14	20	126	125	0	14	**140**	**159**
Balsam Fir	471	89	0	0	0	291	**471**	**380**
Black Spruce Lowland	267	250	0	0	0	115	**267**	**365**
Black Spruce Upland	35	34	0	0	0	22	**35**	**56**
Tamarack	70	57	0	0	0	21	**70**	**78**
Cedar	14	30	3	0	0	0	**17**	**30**
	2418	1365	668	850	0	1797	**3086**	**4012**

[1]SFRMP Even-Aged treatment acres are less than the past for those cover types that have HRLV treatment acres in the SFRMP plan.
[2] WP, NP, and WS thinning (375 acres per year total) for this SFRMP is estimated based on past Area plans. Modeled inventory data underestimated the potential thinning acreage. During FY2001 – 2004, an average of 480 acres of thinning acres per year were on the annual harvest plans for these cover types.
[3] It is estimated that approximately 50 percent of the HRLV acres will be treated through the use of timber harvest. Other HRLV stand treatments include update the forest inventory, manage for the understory, prepare the site for planting, seeding, or natural regeneration, and defer treatment to a later year. (Harvest may be a part of these other treatments.)

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

The DNR develops annual planned treatment levels on a cover type acreage basis rather than a volume basis. This SFRMP Estimate (2005-2014) provided in Figure 3.9e for harvest volume is an estimate based on treatment acres, treatment method, 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 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 Past Plans Average (1990-2001) is based on actual average volume sold per year.

Figure 3.9e: Volume Comparison of Past Area Plans and the SFRMP Treatment Level



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: decoratives, foods, herbs, medicinals, and specialty items. Nontimber forest products include, but are not limited to: boughs, decorative trees (e.g., Christmas trees), birch tops, lycopodium (also referred to as princess pine or ground pine), diamond willow, bark, burls, conks, mushrooms, berries, 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* 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 forestlands 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 (sugarbushes) 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.

c. Consider managing or using some forest stands for nontimber forest products, such as balsam boughs, berry patches, or decorative tops.

d. Develop a sustainable treatment level for decorative tree top (black spruce) harvest.

See Chapter 4, Section 4.16, stagnant spruce cover type management recommendations.

e. 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.

f. 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, 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 GIS-based road inventory compiled by the MFRC– Northeast Landscape Committee to facilitate this strategy. The goal is to serve as many acres of forestland with as few miles of road as possible.

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

- Follow the MFRC's *Voluntary Site-Level Forest Management 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* (currently being developed) 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 (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-1D, Strategy b: Minimize the fragmenting of habitat with roads and forest access trails.
- GDS-1E, Strategy l: Locate roads to minimize fragmentation of a MCBS site.
- GDS-1F, Strategy f: Harvest prescriptions, access plans, and other management proposals identify and implement measures that protect rare features.
- GDS-4B, Strategy f:
- GDS-8, Strategy a: Apply the MFRC's *Voluntary Site-Level Forest Management 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 stands proposed for treatment during the next 10 years are identified during the next step of this planning process, staff will complete 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 permit 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.

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 and should be treated as assets rather than liabilities. 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. Identify stands that have known cultural resources and consider them during stand selection, stand examinations, and the forest management activity.

The forest archeologist has provided the latest information about recorded cultural resources in the area covered by the North Shore SFRMP. This information will be used during the 10-year stand selection process. Stands that have cultural resources in or near them will be identified as having special conditions that should be taken into consideration as timber sales or other forest management activities are planned.

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

b. Collaborate with local tribal agencies to enhance the opportunities to identify and protect cultural resources located within the three subsections.

At a minimum, the DNR will provide the 10-year and annual stand examination list data to the local tribal agencies.

c. Apply the MFRC's *Voluntary Site-Level Forest Management Guidelines* pertaining to cultural resources in the management of state lands.

Examples include: identification, avoidance, protection, mitigation, or additional surveys.

3.12 Disturbance Events

GDS-12: Disturbance events that occur on state land within these three subsections are promptly evaluated to determine the appropriate forest management needed to address the impacts of the disturbance on the landscape.

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 forestlands 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.

b. Local land managers will evaluate and determine appropriate actions for small-scale (10's 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.