

Minnesota & Northeast Iowa Morainal

Section Forest Resource Management Plan

xx/xx/xxxx



DEPARTMENT OF NATURAL RESOURCES

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List of Abbreviations

Description
Annual plan addition
Consolidated-conservation land
Common stand assessment
Desired future condition
Department of Natural Resources
Ecological classification system
Eastern larch beetle
Endangered, threatened, and special concern species
Fish and Wildlife Division
Forest inventory and analysis
Forest inventory module
Forest resources issues team
Forest Stewardship Council
General direction statement
Geographic information system
High conservation value forest
Land utilization program
Minnesota Biological Survey
Minnesota Forest Resources Council
Minnesota & Northeast Iowa Morainal
Management opportunity area
Natural heritage information system
Natural origin red pine
Native plant community
Old forest management complex
Region area number
Ruffed grouse management area
Riparian management zone
Representative sample area
Sand Dunes State Forest
Sustainable Forestry Initiative
Section Forest Resource Management Plan
Species of Greatest Conservation Need
Site index
Special management zone
Scientific and natural area
Sustainable Timber Harvest (Analysis)
Wildlife management area

See the <u>Glossary</u> for definitions of terms used in this document.

Executive Summary

This Section Forest Resource Management Plan (SFRMP), provides guidance for vegetation management on state forest lands administered by the Minnesota Department of Natural Resources (DNR) Divisions of Forestry and Fish and Wildlife in the <u>Minnesota & Northeast Iowa Morainal Section(MIM)</u>. The primary audience for this plan is land managers within the DNR; however, it also serves to inform stakeholders and the interested public about DNR forest resource management in the MIM Section. This plan replaces the two plans that formerly covered a portion of the MIM Section: <u>the Anoka Sandplain SFRMP and the Hardwood Hills SFRMP</u>.

Narrative SFRMPs are components of the DNR's Forest Resource Management Plan System (Plan System) and complement the other two plan components: the strategic direction for forest resources management and the 10-year stand exam list. Together, these components form the authoritative plan for vegetation management on DNR-administered forest lands within the management pool. Additionally, they communicate how we intend to address the values we manage for to tribes, our stakeholders, and the public.

In 2016, Governor Dayton directed the DNR to reassess the sustainable harvest level for DNR-administered land (<u>Sustainable Timber Harvest Analysis, STHA</u>). In 2018, after a 16-month process including analysis by a modeling contractor, input from DNR Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources, and input from a stakeholder advisory group and the public, the DNR settled on new strategic direction for forest resources management in all ecological sections of the state. The new strategic direction ensures that the DNR will meet statutory requirements for managing DNR forest lands in the management pool while balancing multiple values and providing associated benefits in perpetuity. The strategic direction for this plan period is to continue developing desired forest age class distributions to sustainably supply multiple forest benefits, including timber products and wildlife habitat over time, by offering 870,000 cords per year for sale on timber harvest permits statewide. To test whether the DNR can stimulate markets and increase the management of forests threatened by emerald ash borer and Eastern larch beetle, the DNR decided to offer 30,000 additional cords of ash and tamarack annually as a pilot during the first five years of the plan period. This volume offered is the tool for initiating the disturbance needed to meet forest condition goals and ultimately provide broad social, economic, and environmental benefits over time¹.

To implement the Strategic direction, in 2019, the DNR created a 10-year stand exam list for all forested ecological sections in Minnesota, including the MIM Section². During fiscal years 2021 through 2030, the DNR plans to evaluate approximately 12,717 acres to potentially offer for sale within the MIM Section, or approximately 1,271 acres per year on average. This translates into an estimated 15,000 cords per year; however, actual cords offered per year from the MIM Section may vary. The DNR will determine which stands on this list are offered for sale based on interdisciplinary coordination and field examinations. Some stands on the stand exam list may not be offered for sale based on conditions on the ground and stand objectives, and some stands that are not needed to meet planned volumes may be released for planning in future years. Annual

¹ Sustainable Timber Harvest Determination: companion document to Mason, Bruce & Girard Sustainable Timber Harvest Analysis, March 1, 2018

² Sustainable Timber Harvest: Development of the DNR 10-year Stand Exam List report

stand exam lists are available for public comment each year (see the DNR's <u>annual stand exam lists webpage</u> for more information and to sign up for updates).

This SFRMP guides the implementation of the 10-year stand exam list and documents management opportunity areas that address forest resource values that cannot be addressed through individual stand management. This plan is intended to guide management for approximately the next ten years or until a new plan is developed for the Section that replaces this plan.

Guiding Principles for the SFRMP process

- Provide guidance for forest management activities that address landscape scale goals for ecological protection, timber production, and cultural/recreational values.
- Provide guidance to managers and foresters on implementing the strategic forest resource management direction.
- Ensure recommendations for vegetation management adhere to Department directions, guidelines, and policy, and recommendations are informed by informational resources within the interdisciplinary forest management policy system.
- Use the expertise of interdisciplinary team members across DNR divisions to identify issues, direction, and strategies for vegetation management on state-administered land in the MIM Section.
- Consider and incorporate public input in the planning process.

Planning Outcomes and Summary

- This plan calls for increasing within-stand compositional and structural diversity appropriate to native plant communities to address habitat objectives and increase resilience to climate change.
- Young and older forests for all cover types will continue to be represented on DNR-administered land, with amounts determined through this plan period's strategic direction. This plan recommends strategies aimed at providing older forest characteristics within stands. Especially on Division of Fish and Wildlife administered lands, in management opportunity areas such as old forest management complexes and older forest patches, in riparian areas, and in natural-origin pine stands.
- Riparian areas will be managed to retain their integrity and provide habitat for fish, wildlife, and plant species. Strategies for achieving this include increasing longer-lived species, increasing forest age, and applying <u>Minnesota Forest Resource Council Voluntary Site-Level Forest Management</u> <u>Guidelines</u> in riparian areas.
- As part of this process, management opportunity areas in the Section that were included during the 10-year stand exam list development process were reviewed. Management guidance was developed for them, and they were approved for implementation. These areas contribute toward meeting goals for providing habitat and ecosystem functions that require management at broader scales than individual stands.
- Forest cover type conversion goals in this plan are across the entire Section and emphasize:

- Decreasing a percentage of the aspen cover type and recognizing the potential decrease of ash cover type within the Section.
- Maintaining acres of jack pine, red pine, and tamarack cover types across the Section on sites appropriate to the native plant community.
- Increasing the amount of oak, northern hardwoods, and white pine on sites appropriate to the native plant community.
- Aspen, northern hardwoods, and oak will still be the most abundant cover types in the Section.
- Additional topics addressed in the plan include: limiting damage from insects, disease, and nonnative species; rare species; managing areas of high and outstanding biodiversity significance; minimizing forest management impacts on visual quality; protecting cultural resources; and evaluating and responding to disturbance events (e.g., fire and wind).

Chapter 1: Introduction

DNR's mission is to work with Minnesotans to conserve and manage the state's natural resources, provide outdoor recreation opportunities, and provide for commercial uses of natural resources in a way that creates a sustainable quality of life. State-owned, DNR-administered lands and associated resources are the foundation on which the Department is able to plan for and execute its mission for the benefit of all Minnesotans.

State statutes, including Sustainable Forest Resources Act (<u>Minnesota Statute 89A</u>), provide primary statutory direction for forest management conducted by the Minnesota Department of Natural Resources (DNR). Accordingly, it is the state's policy to "pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals," with sustainability defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." On wildlife management areas (WMAs) administered by the Division of Fish and Wildlife, the state's policy is "to perpetuate, and if necessary, reestablish quality wildlife habitat for maximum production of a variety of wildlife species" (<u>Minnesota Statute 86A.05 subd 8</u>).

The Department's mission, the land base available to meet the mission, and the laws governing various land types and management activities, provide context for understanding the results of forest management planning.

State Lands Foundational to Forest Management

Throughout Minnesota, the DNR manages approximately 5.6 million surface acres of state-owned land and 12 million acres of state-owned mineral rights that significantly contribute to the quality of life and economic opportunity in Minnesota. These lands and resources support natural resource-based economies, provide tourism and recreation opportunities, allow for the protection of rare resources, provide habitat for fish and wildlife, and provide important ecological services, like clean air and water.

State Trust Lands

The DNR manages school trust (2.5 million acres statewide) and university trust lands (25,840 acres statewide) on behalf of their respective beneficiaries, Minnesota's public schools, and the University of Minnesota. The Permanent School Fund and Permanent University Fund are trusts established in the Minnesota State Constitution and designated as perpetual sources of income for the named beneficiaries. The funds consist of two parts: the physical lands granted to the state by the federal government and the dollars in the fund that are generated from those lands. The Department manages the physical lands as a trustee obligation imposes fiduciary responsibilities on the Department to manage the trust fund lands in the best interests of the beneficiaries to fund Minnesota's public schools and the University of Minnesota.

School trust lands are managed to maximize long-term economic return consistent with sound natural resource conservation and management principles (<u>Minn. Stat. 127A.31</u>). See the Department's *Operational Order 121: Management of School Trust Lands* for more information about how we operationalize this constitutional and statutory directive. Investment income is distributed to the state's public school districts annually to fund

operations. There are approximately 12,519 acres of school trust lands in the Minnesota & North East Iowa Morainal (MIM) Section. School trust lands are managed by the DNR Division of Forestry.

State Non-Trust Lands

The DNR manages non-trust lands according to their applicable statutory purposes. In the MIM Section, these lands primarily include consolidated conservation lands (1,743 acres) and acquired lands (127,551 acres).

Consolidated conservation lands ("Con-Con lands") were transferred to state ownership through tax forfeiture, often when drainage projects in the 1920s and 1930s failed to turn wetlands into farmlands. Counties initially assumed debt for the delinquent drainage bonds until state laws transferred the debt and the title of the forfeited lands to the state. Income generated from DNR natural resource management on these lands is split evenly with the county. There are approximately 1,743 acres of Con-Con lands in the MIM Section. These lands are statutorily managed for conservation purposes. The granting authority for Con-Con lands is under the:

• Laws of MN 1931, Chapter 407 (Minn. Stat., secs. <u>84A.20</u> to <u>84A.30</u>), which covered lands in Aitkin, Roseau, and Mahnomen counties.

Acquired lands were gifted from private owners, organizations, or governmental entities, purchased to meet specific management or habitat needs, or otherwise conveyed to the state. These lands are managed according to the statutory authority under which they were acquired, which may direct their management for recreation, conservation, or commercial uses of natural resources. Approximately 127,551 acres in the MIM Section are acquired lands.

State Land Administration

This SFRMP applies to lands of these various statuses administered by the DNR Divisions of Forestry and Fish and Wildlife in state forests and wildlife management areas.

Wildlife Management Areas (WMA) and Aquatic Management Areas (AMA) are lands managed by the DNR Division of Fish and Wildlife as described in MN statute section <u>86A.05</u>. They are managed to maintain habitat for the production of fish and wildlife, to protect/develop and manage lakes, rivers, and streams critical for fish and aquatic life, water quality, for public hunting and fishing, trapping, and other compatible outdoor uses.

WMAs acquired or developed with funds authorized through the Federal Aid in Wildlife Restoration Act must comply with federal regulation 50 CFR Part 80.14: they must continue to serve the purpose for which they were acquired or developed and may not be used to produce income unless incidental to approved purposes. Forest management practices—including harvesting timber --on such lands must show a wildlife habitat maintenance or enhancement benefit and be consistent with WMA plan goals.

WMA may include some percentage of trust land. These portions are treated as trust land but are also focused on the goals of the WMA.

Approximately 86,515 acres within the MIM Section are WMA wildlife administered lands.

State forest lands are lands managed by the DNR Division of Forestry as described in chapter <u>89</u>. They are managed under the principles of multiple use and sustained yield. These lands are managed for forest resources that will best meet the needs of the people of the state, including timber, biological diversity, recreation, fish and wildlife habitat, rare and distinctive flora and fauna, as well as numerous other values. State forest lands include school trust lands and are managed under the additional requirements of school trust lands. There are approximately 9,737 acres of acquired state forest lands within the MIM Section.

The DNR's Forest Resource Management Plan System

The DNR's Forest Resource Management Plan system guides forest management activities on stateadministered lands, including when, where, how, and how much timber is harvested, to develop a mix of forest resource conditions that will provide multiple forest benefits continuously over time. Long-term planning helps ensure that state forest management activities meet statewide goals for various values, including ecological protection, timber production, cultural/recreational resource use, and wildlife habitat.

The DNR's Forest Resource Management Plan has two main components:

- <u>Strategic direction</u>
 - decisions for how to fulfill statutory requirements and balance multiple values sustainably through forest resource management
- Operational direction
 - <u>10-year stand exam list</u> operational plan for which forest stands to examine for potential management to meet the strategic direction
 - <u>Section Forest Resource Management Plans (SFRMPs)</u> narrative plans for what to consider when making management decisions for stands on the 10-year stand exam list to advance landscapescale goals



*wildlife habitat, biodiversity, timber productivity, forest health, water quality and quantity, economic impact

Interdisciplinary partners within DNR from the Divisions of Forestry, Fish & Wildlife, and Ecological & Water Resources develop the plans. The DNR also invites tribal and public input at various points in the planning process.

Minnesota & NE Iowa Morainal SFRMP

Scope of this Section Forest Resource Management Plan (SFRMP)

This SFRMP provides guidance for vegetation management on DNR-administered forest lands in the Minnesota & Northeast Iowa Morainal (MIM) Ecological Section, which contains the Anoka Sandplain, Big Woods, Hardwood Hills, Oak Savanna, and St. Paul Baldwin Plains Subsections (Map 1.1; a detailed explanation of DNR's ecological classification system (ECS), including sections and subsections, is available on the <u>DNR ECS webpage</u>). Vegetation management includes actions that affect the composition and structure of forest lands, such as timber harvesting, thinning, prescribed burning, biomass harvest, and reforestation. SFRMPs consider the condition and management of forest lands in other ownerships but only propose forest management direction and actions for DNR-administered lands.

This plan considers only a portion of DNR-administered lands in the MIM Section for management and uses cover type to classify vegetation for management on those lands (the cover type of a stand is generally determined by the predominant tree species or vegetation type in that stand). Forest land includes lands in the DNR forest stand inventory (Forest Inventory Module, or FIM), including cover types from aspen to stagnant conifers, muskeg, upland and lowland grass and brush, and other wetlands. Timberland includes cover types capable of producing merchantable timber and excludes very slow-growing trees (e.g., stagnant lowland conifers or offsite aspen). For this plan, managed acres include all DNR-administered forest lands that are available for management, excluding forest lands reserved as old growth, state parks, scientific and natural areas (SNAs), inoperable stands, etc. (see <u>Appendix A</u> for the full FIM query for managed acres).

Approximately 107,472 acres, or 75 percent, of DNR-administered lands are managed acres. Furthermore, 33,219 acres, or 23 percent, of DNR-administered lands are managed timber land acres, representing approximately 2.7 percent of the total forest land across all ownerships in the MIM Section.

Examples of forest resource management planning activities that are beyond the scope of SFRMPs include offhighway vehicle trail system planning, comprehensive road access plans, state park land management planning, old-growth forest designation, SNA establishment, wilderness designation, wildlife population goals, cumulative effects analysis at the watershed-level, fire management, and recreation facilities/systems planning.

Goals for the Planning Effort

This SFRMP provides goals and direction for resource managers in the MIM Section as they implement the strategic direction for this plan period and 10-year stand exam list, including:

- Desired Future Condition (DFC) Goals:
 - These are long-term (50+ years) and short-term (10 years) changes in vegetation structure and composition.
 - DFCs are achieved through management activities, including no action, which will best move the forest landscape toward the goals for state forest lands.
 - Some DFCs, for example, those related to harvest levels or age class distributions, are incorporated in the strategic direction for this plan period.

- Other DFCs expressed in this SFRMP, including cover type goals, are developed from assessment information, identified issues, and general direction statements in response to issues.
- General direction statements and strategies
 - General direction statements and strategies in Chapter 3 guide staff on what to consider when making decisions for stand management.
 - Products of this planning process include an implementation meeting and field guide for DNR staff.
- Management Opportunity Areas (MOAs)
 - MOAs identify good opportunities to address particular values on DNR-administered lands that can be difficult to achieve at the stand level. See <u>Section 3.13 in Chapter 3</u> for more information on MOAs.
 - MOAs include old forest management complexes (OFMCs), ruffed grouse management areas, older forest patch MOAs, open landscape priority areas, and deer yards, among others.
 - Links to management guidance documents developed for MOAs are included in Appendix E: Management Opportunity Areas in this plan.

Staff Involved in Developing SFRMPs

The Division of Forestry is responsible for developing and maintaining SFRMPs. To do that, planners and personnel from DNR Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources work together to develop SFRMPs, with oversight from regional and executive Forest Resource Issues Teams (FRITs). Regional and executive FRITs are comprised of the regional director and managers of the three divisions and division directors, respectively. The central (Region 3) FRIT oversaw staff work on the MIM SFRMP planning effort. Additional staff, such as Geographic information system (GIS) or administrative specialists, support SFRMP planning as needed.

Tribal Coordination Opportunities

Forest planners coordinate with native American tribes during the development of the SFRMP. This occurs at a minimum through a comment period on the draft plan. Additional opportunities to coordinate on forest planning may arise if plan revisions are proposed during plan implementation.

Public Involvement Opportunities

Public involvement in SFRMP development occurs, at a minimum, through a comment period on the draft plan.

Additional public review and comment opportunities may arise if plan revisions are proposed during plan implementation.

SFRMP Process Overview

The SFRMP process is divided into four steps (Table 1.1). In Step 1, the Forest Resource Planner gathers information to assess the current forest resource conditions in the Section. In step 2, the Planner works with

interdisciplinary specialists from the DNR divisions of Ecological and Water Resources, Fish and Wildlife, and Forestry to revise the draft SFRMP. In Step 3, the plan is reviewed by regional and statewide DNR leaders and made available for tribes and the public to comment. In Step 4, the plan is finalized, distributed, and implemented.

Steps	SFRMP Process Description						
Step 1	Initiating the Planning Process						
	Assemble baseline assessment information and develop an assessment document.						
	Establish a web page on the DNR website.						
	Update the mailing list of the public/stakeholders.						
	 Inform the public that the planning process is beginning, including sharing the 						
	estimated schedule and how and when they can be involved.						
Step 2	Develop Draft Plan						
	 Add Section context to issues to be addressed in the plan. 						
	 Develop strategies and desired future condition (DFC) goals consistent with the general 						
	direction statements and policy.						
	• Prioritize, develop, and/or revise Management Opportunity Area guidance documents.						
Step 3	Plan Review and Comment Periods						
	 Review the draft plan with regional and statewide DNR leadership. 						
	• Send draft plan to tribes for comment.						
	 Make the draft plan available to the public for comment. 						
	• Summarize tribal and public comments and respond to them; revise the draft plan in						
	response to comments as appropriate.						
Step 4	Final Plan						
	• Present a summary of comments, responses, and plan revisions for the Commissioner's						
	approval.						
	Commissioner approves the final plan.						
	Distribute the final plan.						
	 Provide plan implementation training to DNR staff involved in forest management and coordination. 						

Table 1.1: Summary of the planning process for the MIM SFRMP

Steps	SFRMP Process Description						
Step 5	Monitoring						
	 After implementation, plans are periodically monitored to assess their implementation and effectiveness. 						

Other Planning Efforts

There are several other DNR planning efforts that inform the creation of the MIM SFRMP, including The Forest Action Plan, Wildlife Action Plan, Wildlife Management Area Master Plans, and other operational plans such as the Sand Dunes Operational Plan.

MFRC Regional Landscape Planning

This plan also aligns with the goals and strategies related to vegetation management in the following Minnesota Forest Resources Council (MFRC) landscape plans:

- East Central Landscape Forest resources plan
- North Central Landscape Management plan
- West Central Landscape Forest Resources Plan
- Southeast Landscape Plan

By aligning with the corresponding MFRC plans, the decisions for the management of DNR-administered lands in this SFRMP incorporate recommendations from a broader landscape perspective across all ownerships. Having aligned goals and strategies assists in cooperation across ownerships in this larger landscape area.

Planning Area Description

The MIM Section consists of a total land area of approximately 9.2 million acres, including all or parts of the following counties: Anoka, Becker, Beltrami, Benton, Blue Earth, Carver, Cass, Chisago, Clay, Clearwater, Crow Wing, Dakota, Dodge, Douglas, Fillmore, Freeborn, Goodhue, Hennepin, Isanti, Kandiyohi, Le Sueur, Mahnomen, McLeod, Meeker, Mille Lacs, Morrison, Mower, Nicollet, Norman, Olmsted, Otter Tail, Polk, Ramsey, Rice, Scott, Sherburne, Sibley, Stearns, Steele, Todd, Waseca, Washington, and Wright. (Map 1.1).

Much of this Section is rural but does encompass large metropolitan areas, including the twin cities metro area as well as the cities of Mankato, St. cloud, and Detroit Lakes. According to the most recent national land cover classification information (NLCD 2016), the largest land cover in the Section is agriculture (approximately 55%). Forests and woody vegetation (approximately 16%) are the second largest land cover within the Section.

Based on the DNR forest inventory of timberland considered in this plan, oak, aspen, and mixed hardwoods are the most abundant timber species (Table 1.2).

Most of the land within the Section is in private ownership (over 8.7 million acres; approximately 95%), with the State of Minnesota administering approximately 2.4% (approximately 222,782 acres) of the land (Table 1.3). Other landowners in the Section include tribes, counties, and the federal government (Table 1.3). Most DNR-administered land in the MIM Section is administered by the DNR Division of Wildlife (64.7%), followed by the Division of Parks and Trails (18.3%), and then the Division of Forestry (13%; Table 1.4). Approximately 11% of state-administered forest land available for management is school trust land (Table 1.5). For more detailed descriptions of the planning area, refer to the MIM SFRMP Preliminary Issues and Assessment document on the MIM SFRMP Website.





Table 1.2: Generalized cover type composition of DNR-administered lands in the MIN (2017 Fil	d cover type composition of DNR-administered lands in the MIM (20	017 FIM
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Cover Type Group	Acres	Percent
Lowland conifers (black spruce, tamarack, and white cedar)	1,640	1.2%
Aspen, birch, and balm-of-Gilead, hybrid poplar	8,715	6.1%
Pine (red pine, white pine, scotch pine, and jack pine)	4,180	2.9%
Lowland hardwoods (ash, elm, willow, cottonwood, and silver maple)	4,126	2.9%
White spruce, balsam fir, Norway spruce, upland larch, Red Cedar, and upland black spruce	350	.2%
Hardwoods (Central and Northern Hardwoods, including oak)	31,041	21.8%
Upland brush and upland grass	18,541	13.0%
Other non-forest (developed areas, lowland grass& brush, water)	73,641	52.8%
Totals	142,234	100%

Table 1.3: Land ownership in the MIM Section (2008 GAP)

Ownership	Acres	Percent
State-administered ³	222,728	2.42%
Private	8,736,327	94.97%
Tribal	3,072	0.03%
County/Other Public	92,505	1.00%
Private Industrial	21,936	0.24%
Federal	121,622	1.32%
Totals	9,198,190	100%

³ SFRMP only covers DNR Divisions of Forestry and Fish and Wildlife – Wildlife Section – Administered Lands.

Table 1.4: DNR-administered acres in the	MIM Section from the DNR'	s forest inventory data (2017 FIM)
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State administration	Non-School Trust Land	School Trust Land	Total
Division of Forestry	9,797	11,655	21,452
Division of FAW - Section of Wildlife	86,505	864	87,369
Scientific and Natural Areas	1,477	0	1,477
State Parks	28,042	0	28,042
Division of FAW - Section of Fisheries	1,694	0	1,694
Trails and Waterways	1,665	0	1,665
DNR	536	0	536
Grand Total	129,715	12,519	142,234

Table 1.5: Acreages of DNR-administered lands in the MIM. Managed acres are those in the management pool. (2017 FIM)

School Trust Status	DNR Land in FIM	Percent land in FIM	Timberland	Percent Timberland	Managed Acres	Percent Managed Acres	Managed Timberland	Percent Managed Timberland
Trust	12,519	7.9%	6,476	13.1%	12,172	11.3%	6,103	18.4%
Non- Trust	129,715	92.1%	42,766	86.8%	95,300	88.7%	27,116	81.6%

A Note on Data Limitations

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 do not affect the recommendations in this plan. For this reason, acreage goals in this plan should be viewed as desired trends, not exact targets. FIM data used in this plan is from the same dataset used for the Sustainable Timber Harvest and is from 2017.

Issue Definition

In this plan, issues are natural resource-related concerns that are directly affected by, or that directly affect, vegetation management decisions on lands administered by the Minnesota Department of Natural Resources (DNR) Divisions of Forestry and Fish and Wildlife. Relevant issues are defined by current, anticipated, or desired forest vegetation conditions and vegetation management trends, threats, and opportunities. The issues described in this chapter are broad, complex, and often interacting. The description of any one issue in this chapter does not imply a DNR goal to address the issue to a particular extent. Future direction in Chapter 3 of this SFRMP seeks to balance addressing these issues while following Department policies and direction and state and federal laws.

Some issues relevant to DNR-administered forest lands are outside the scope of the SFRMP process. For example, SFRMPs do not address recreation trail system issues or planning. However, aesthetic concerns along existing recreational trail corridors can be considered in determining forest stand management direction. As another example, the plan establishes vegetation goals associated with wildlife habitat but not goals for wildlife population levels.

All of the issues listed in this chapter are important to the management of DNR-administered land; however, the extent to which issues can be addressed through the SFRMP varies. Some issues raised in this chapter are primarily addressed through other planning processes but are included here due to their influence on the desired future conditions, general direction, and strategies given in this plan. For example, several vegetation management issues on DNR-administered land are addressed or determined through the development of the strategic direction and 10-year stand exam list components of our plan system, including:

- amount, type, and distribution of old and young forest
- desired age class distributions
- timber harvest levels
- landscape patterns of harvested stands

Although still important, some issues in this plan can only be addressed opportunistically given a variety of factors, including current natural resource conditions, managing to address various forest values, state and federal statutes, and Department direction and policy.

The guidance for future direction in Chapter 3 was developed to address the issues in Chapter 2. <u>Appendix B</u> contains a table showing the relationship between the general direction statements in Chapter 3 and the issues in Chapter 2 that they address. Each section in Chapter 3 indicates the issues related to that section.

How Issues Were Identified

Section Forest Resource Management Plan issues were developed using assessment information, Minnesota DNR policies and guidelines, local knowledge, existing plans, and public input through past planning processes.

Each SFRMP contains a common set of issues developed from previous SFRMPs. These common issues are refined and supplemented based on Section-specific conditions and considerations.

Issues

A. Forest Age and Growth Stages

Some aspects of this issue category, including the distribution of forest ages across DNR-administered lands, are addressed through the strategic direction and 10-year stand exam list plan system components. They are still included here because they are also relevant to implementing the plan system's strategic direction and 10-year stand exam list through SFRMP guidance.

A1. Representing growth stages and forest types across the landscape, given age class distribution goals.

Why is this issue important? Adequate representation of all age classes and growth stages provides:

- a supply of vegetation conditions that supports many species, including species with age-specific habitat requirements
- greater potential to provide a sustainable yield of timber
- ecological values, including healthier, diverse forests that are more resilient to insect and disease outbreaks and negative effects of climate change
- increase in forest-wide diversity
- greater ability to manage forest lands sustainably into the future

A2. Managing for older forest and old forest qualities on the landscape.

Mature to old forest is represented on DNR-administered land in a variety of ways. Examples include stands that exceed the normal rotation age for their cover type, old forest characteristics like large old trees and snags within younger stands, and designated old-growth stands, which are high-quality representations of stands in the later stages of forest succession. Currently, an estimated 46.6% of DNR-administered timberland managed acres, with an even-aged management rotation age, in the MIM Section are above the normal rotation age.

Why is this issue important? Old forest provides the following benefits:

- vegetation conditions of later successional growth stages associated with animal, plant, and fungi species' habitats
 - Old, large-diameter aspen is particularly important to woodpeckers, fishers, bats, and pine martens.
 - Older hardwood forests with diverse vertical forest structures are important to warblers, woodpeckers, and squirrels.
- development of late-successional native plant community (NPC) growth stages
- stable hydrology and groundwater in relatively undisturbed older forests, especially lowland forests
- overall structural and species diversity on the forest landscape
- within stand and landscape diversity and complexity

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- ecological services associated with old forest conditions, such as maintaining water quality, natural disturbance regimes, and biodiversity
- traditional use, recreational, and economic opportunities associated with old forest conditions

Tradeoffs include the potential for old forests to have reduced timber quantity and quality for some types of forest products compared to forests at or below normal rotation age.

A3. Managing for young, early successional forest.

Young, early successional forest is defined as the 0-30 age class of aspen, balm-of-Gilead, birch, and jack pine cover types. Currently, an estimated 6.1% of DNR-administered timberland managed acres in the MIM Section are young forests.

Why is this issue important? Young, early successional forest provides:

- vegetation conditions that support associated animal (game and non-game) species
 - Examples of species within MIM associated with young or early successional forest for at least part of their life cycle include: ruffed grouse, American woodcock, golden-winged warbler, chestnut-sided warbler, mourning warbler, white-throated sparrow, white-tailed deer, black bear, and snowshoe hare
- cover from predation and/or food supply for species that depend on dense young forest
- edges between young and more mature forests that some species depend on
- depending on distribution, young forest in larger blocks provides an opportunity to create a contiguous habitat of uniform age
- traditional use of the natural resources associated with young forests (e.g., berry picking)

B. Forest Composition, Structure, Spatial Arrangement, Growth Stages, and Native Plant Communities

Some aspects of this issue category, including the distribution of growth stages and landscape spatial arrangement, were addressed or determined through the strategic direction and 10-year stand exam list plan system components. They are still included here because they are also relevant to implementing the plan system's strategic direction and 10-year stand exam list through SFRMP guidance.

B1. Addressing biodiversity, forest health, and productivity of native plant communities through management of forest composition, structure, representation of growth stages, within-stand diversity, and spatial arrangement of vegetative types.

Why is this issue important?

- forest composition and structure have been simplified, and within-stand diversity has decreased
- reduction of species associated with specific declining habitats

- maintain a balance of age classes and representative forest structure within stands⁴
- patch size has decreased, and fragmentation has increased
- connectivity of vegetation patches used by wildlife has decreased
- ability to produce a diversity of forest products (e.g., sawtimber, aesthetics, non-timber forest products, recreation, and tourism)
- ability to provide ecologically intact landscapes
- non-native invasive species have increased, threatening forest ecosystem function
- ability to respond to climate change

B2. Determining which tree species to increase or manage within forest communities in the Section with respect to various natural resource objectives and projected environmental change.

Why is this issue important?

- historically unsustainable harvests, insect infestations, disease, drought, and browsing by wildlife have resulted in changes in forest age structure and composition. The consequences of this include:
 - reduced of regenerative capacity for tree species due to factors such as lack of large downed trees, insects, and disease, and a lack of seed trees
 - o change in mycorrhizal relationships necessary for healthy soils and trees
 - o changes to composition and structure necessary to sustain associated species
- decreased within stand native tree species diversity within forest communities, impacts forest ecosystem function
- maintain native plant community composition, structure, and function
- potential loss of the social, economic, and ecological values provided by these species
- climate change projections may impact decisions over which cover types are most appropriate for future vegetation management decisions

B3. Maintaining or enhancing highly imperiled, imperiled, and vulnerable to extirpation native plant communities in the Section.

Why is this issue important? Certain rare native plant communities are of particular concern in the Section because of one or more of the following factors:

- global or statewide rarity
- limited occurrence in the Section
- known association with rare species
- significant changes in composition as compared to historical conditions
- examples of high-quality, intact native plant communities used as controls to compare and monitor the effects of management

⁴ Note: DNR forest resource planning, through stand exam list development for SFRMP in the past and the strategic direction currently, has long sought to balance acres between age classes up to rotation age for even-aged cover types. Balanced age class distributions ensure a sustainable supply of timber and other forest values, including older forest, across the landscape over time from state-administered land.

- continued forest stand and landscape diversity
- overall forest biodiversity, sustainability, and resiliency

Examples of these types of communities in the Section include FDc23a (S1S2, G2), MHc38a (S1), UPn13 (S1 S2, G2), UPs13 (S1S2, G3), UPs14 (S1S2, G2G3) (see the <u>DNR NPC website</u> and DNR field guides to native plant communities for more information).

B4. Retaining characteristics of natural stand-replacement disturbance events while applying intensive management of forest communities.

Why is this issue important?

- Intensive management can include activities such as rock-raking and herbicide application. It is an
 important tool for successfully regenerating certain species, controlling insect or disease problems,
 and managing wildlife habitats.
- Although intensive management is a valuable tool, these activities also have the potential to:
 - reduce plant species and structural diversity, disrupt the soil profile, compact the soil, reduce native herbaceous species diversity, and increase non-native invasive plants or aggressive native plants
 - o simplify and fragment native plant communities at the stand and landscape scale
 - o alter hydrology to a greater extent than less intensive management
- Even in fire-dependent systems, where natural disturbance events (e.g., wind and fire) are relatively frequent, the resulting forest mosaic includes undisturbed vegetation and many legacies or refugia for species in the regenerating stand.

B5. Using management to better reflect natural landscape patterns (the size and configuration of growth stages and types resulting from broad-scale natural disturbances) in the Section.

Due to the dispersed nature of DNR-administered lands within MIM, the number and presence of large old patches greater than 250 acres in size and over rotation age are limited. Approximately 14,774 acres, or 10% of all DNR-administered lands within the forest inventory in MIM, are within large old patches. Most of these acres are within upland hardwoods, including northern hardwoods and oak.

Why is this issue important? Large patches and older growth stages are rarer on the landscape than smaller patches and younger growth stages. This results in the following:

- fragmentation and simplification of forest ecosystems at the landscape scale
- change in the spatial arrangement of vegetation patches used by plants and animals
- increased isolation of wildlife and plant populations
- potential loss or decline of species
- reduced resilience of forest ecosystems to disturbance events and climate change
- potential increases of certain populations to undesirable levels resulting in negative impacts to forest communities

B6. Reducing forest fragmentation to maintain connectivity among habitat types.

Why is this issue important? In this Section, forest fragmentation is greatly affected by the small amount of state-administered lands compared to other ownerships. Land use, such as the conversion of forest to agriculture, residential development, and ongoing sales of large tracts of land by private corporations, have the greatest impact on forest fragmentation. Together with forest management and harvesting across ownerships and other factors such as road and trail construction, these impacts have resulted in the following:

- reduced forest patch size
- altered forest composition, structure, and age
- increased forest fragmentation and simplification
- fragmentation of wildlife habitat cover types by suburban and urban sprawl
- reduced interior forest habitat, and increased edge disturbance, which can promote invasive species
- reduced biodiversity and the ability of the forest to produce a range of forest products
- reduced habitat connectivity and ecologically intact landscapes

C. Harvest Levels for Timber and Non-Timber Forest Products

The DNR's sustainable timber harvest level is part of the strategic direction of our forest resource management plan. This plan provides summary information about the strategic direction and 10-year stand exam list within the Section.

C1. Contributing to sustainable forest management that meets the Department plans for offering timber volume for sale while considering all forest resources and trust lands responsibilities.

Why is this issue important?

- Some cover types in the planning area have pronounced age class imbalances (<u>Appendix C</u>) which, if not corrected, decreases our opportunity to sustainably offer and harvest timber, as well as provide a consistent supply of other forest resource values over time.
- Timber harvest provides forest products for society.
- School trust land is mandated to provide economic benefit to the Permanent School Fund through sustainable management.
- Managing forests in a sustainable manner is a requirement for maintaining the DNR's Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI) certifications (forest certification). Sustainably managed forests can:
 - o support a healthy and competitive timber industry
 - o provide a diversity of vegetation types associated with plant and animal species
 - o maintain water quality and quantity
 - o maintain soil health, structure, and biodiversity
 - o sequester and store carbon and support climate adaptation
 - o provide a wide array of recreational opportunities

C2. Managing non-timber forest products.

Demand for non-timber forest products (e.g., decorative trees, birch bark, berries, and mushrooms) has been light within this Section.

Why is this issue important?

Non-timber forest products:

- diversify local economies and are a traditional harvest activity for some groups
- are particularly important in areas where employment opportunities in the mainstream economy are limited
- support local individuals, families, and cottage industries in an expanding worldwide market
- maintain a sustainable harvest of these resources

D. Biological Diversity

D1. Maintaining or enhancing biodiversity and native plant community composition, structure, and function through stand management within larger areas of biodiversity significance.

Why is this issue important?

Larger areas with biodiversity significance provide:

- reference areas to improve our understanding of ecosystems and help us evaluate the effects of vegetation management
- opportunities for large patch management and the maintenance, enhancement, or restoration of native plant communities at landscape scales
- potential for addressing biodiversity-related goals of the DNR and other landowners
- habitat for various native species across the landscape
- human health, safety, and welfare depend on ecosystem services provided by healthy, diverse forest communities

D2. Retaining or restoring within-stand structural complexity (e.g., vertical structure, stem size and density, coarse woody debris, and pit and mound micro-topography) when stands are harvested before reaching older growth stages in which these characteristics would normally develop.

Why is this issue important?

- Within-stand structural complexity supports a variety of plant and animal species and soil health and promotes the regeneration of some tree species.
- Some forest management practices can reduce within-stand structural complexity and diversity.

E. Rare Features

E1. Protecting rare plants and animals (including endangered, threatened, special concern, and Species of Greatest Conservation Need), their habitats, and other rare features in the Section.

Rare features and species exist across the MIM Section. These features and the habitats created by them are an important component of managing for rare species. Areas within the Section that provide valuable habitat for rare features include but are not limited to the Sand Dunes State Forest and Carlos Avery wildlife management area.

Why is this issue important?

- Protecting rare features on state lands is a key component of ensuring species, community, and forest-level biodiversity in the Section.
- DNR Department-wide direction acknowledges the effects of habitat loss and degradation on rare species and the DNR's role in advocating for the maintenance and protection of habitat for rare species throughout the state, regardless of ownership.
- The DNR is obligated to follow federal laws and rules concerning the protection of endangered and threatened species and associated habitats, as well as to follow state laws, rules, and policies concerning the protection of state endangered and threatened species.
- The DNR is required by third-party certification to ensure that any management within high conservation value forest (HCVF) sites enhances or maintains the high conservation value(s) associated with the site.

F. Wildlife

F1. Addressing the needs of game and nongame species through vegetation management.

Why is this issue important?

- Forest change affects forest wildlife, which depends on healthy forest ecosystems and is important to society.
- Several species listed by the state as endangered, threatened, or of special concern live in habitats managed through forest resource planning and management; these included forested, non-forested, and transitional habitat types within the Section.
- Legal mandates, stakeholders' expectations, and DNR internal policies require the ecological integrity of the forest to be maintained and enhanced.
- Some reasons to maintain ecological integrity related to wildlife habitat include:
 - the economic vitality of forest and tourism industries
 - o maintenance of recreation opportunities for the public
 - o the health of wildlife species and populations
 - o public health
 - o control of forest insects and disease

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- Potential loss of wildlife species and or populations from the Section.
- Potential loss of important habitat for all wildlife species, especially rare species.
- In the MIM Section, historical and more recent changes have affected wildlife species and their habitat, including:
 - o reduced number of larger patches of older forest and connections between such patches
 - o increased habitat fragmentation from agriculture, roads, logging, trails, and development
 - o alteration of natural fire disturbance events
- The location of public forest land in the MIM Section near the most populated areas in Minnesota draws thousands of people every year to observe, photograph, hunt, and trap the wide variety of wildlife in the area, supporting long-standing traditions and income to local economies.
 - Game species are sought by hunters throughout the Section.
 - Ruffed grouse, turkey, American woodcock, black bear, and white-tailed deer are found though out the Section.
 - Prairie chicken and sharp-tail grouse are found within the northwest portion of the Section and the state.
 - The Section provides unique wildlife viewing and photography opportunities for sought-after species, including Blanding's turtle, Northern goshawk, Acadian flycatcher, Louisiana waterthrush, cerulean warbler, black-billed magpie, red-headed woodpecker, and a large number of warbler species.
- Significant risk of up-listing or additional protections being applied to vanishing species.

G. Watersheds, including Riparian and Aquatic Areas

G1. Addressing the impacts of vegetation management on surface waters (wetlands, streams, and lakes).

Why is this issue important?

- Management of riparian areas can influence water quality, water temperature, erosion rates, and deposition of woody debris in lakes and streams.
 - Well-managed riparian areas are critical to protect, maintain, or enhance aquatic habitat types, corridors, and connectivity for plant and animal species, aesthetics, recreation, water quality, and forest products.
 - Several rare insects (e.g., caddisflies), amphibians and reptiles, and plants (e.g., small white water lily) are affected by changes to these factors.
- Infrastructure such as roads, culverts, and stream crossings can influence water quality and stream connectivity.
- Management activities may affect permanent wetlands adjacent to upland stands. For example, young forests in the adjacent landscape may lead to faster and increased water runoff.
- Seasonal ponds and wetlands can influence water quality and wildlife populations.

- They retain snowpack later in the spring for an even melt and contribution to adjacent water bodies.
- They are important for maintaining wildlife populations such as amphibians, which have limited ability to disperse long distances.
- Many wildlife species and plants are associated with forested wetlands or the riparian forest interface. These areas also serve as movement corridors for additional species.
- Increased species diversity within riparian forests will help them be more resistant and resilient to forest diseases and climate change.
- Minnesota Forest Resource Council's *Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers, and Resource Managers* (MFRC site-level guidelines) serve as the DNR minimum standard for protections/mitigations related to surface waters.
 - Applying MFRC site-level guidelines without considering site-specific conditions may not be adequate to protect surface waters.

G2. Addressing cumulative impacts of vegetation management on aquatic resources on a watershed or subwatershed level.

Why is this issue important?

- The MIM Section contains all or parts of 29 major watersheds in Minnesota.
- Vegetation management activities and the amount of forest cover on the landscape affect watershed or sub-watershed hydrology and overall water quality.
- Land use has a significant impact on the type of vegetation and vegetation management.

Note: This SFRMP includes a description of this issue because of its relevance to forest management. However, SFRMPs are specific to vegetation management on a portion of State-administered lands and do not apply to all lands within the ecological section. <u>Comprehensive watershed management plans</u> are developed through a separate program. Because we do not currently have the data or methodology to fully evaluate the effects of different forest cover types and conditions on watersheds, this plan does not include specific future direction related to cumulative impacts on aquatic resources. Instead, this plan and DNR forest management focus on addressing water quality issues and impacts on aquatic resources by applying MFRC site-level guidelines and guidance for site-level decisions (see <u>Chapter 3, Section 3.5</u>).

H. Timber Productivity

H1. Maintaining or increasing timber productivity on state lands.

Why is this issue important?

- Minnesota's forests provide a range of environmental and economic services.
- Timber sales are how the DNR accomplishes much of the vegetation management activities covered under this SFRMP.
- Maintaining a variety of forest industries is a critical component of our ability to manage forests.
- Ability to sustainably provide forest products over time.

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I. Disturbance Impacts on Forest Ecosystems

11. Addressing disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.

Why is this issue important?

- Insects and diseases can alter and negatively affect forests and functioning forest ecosystems.
 - Widespread pest outbreaks outside their natural range cause high levels of tree mortality and can have significant ecological and economic consequences.
 - Insects and diseases can reduce timber production and lumber grade and increase fire hazards.
 - Aggressive control can impact non-target and/or native species, ecosystem function, and overall species diversity and still may not solve the problem.
 - Inadequate control may negatively affect timber volume, aesthetics, and recreational enjoyment of the forest.
- Natural disturbances can promote a diversity of tree species and forest structure and generate dead wood, which provides important habitat components and soil nutrients.
- Undesirable increases in certain wildlife populations can have adverse impacts, including browsing and grazing by wildlife (herbivory).

12. Addressing non-native invasive species threats and invasions.

Why is this issue important?

- Non-native invasive species can displace native species, carry or cause diseases, or disrupt natural community functions. They can change ecosystem function, simplify natural processes and plant communities, reduce resiliency, and cause the loss of sensitive and rare species and communities. EAB, buckthorn, garlic mustard, Dutch elm disease, oak wilt, nightcrawlers, and wild parsnip all are of significant concern within the Section.
- It is the DNR's policy, through the Invasive Species Operational Order, to prevent or limit the introduction of invasive species onto DNR-administered lands and waters and limit their spread and impact on high-value resources.
- Invasive species can result in economic loss, including loss of timber through increased competition and increased damage and control costs.
- Effective or practical methods to control most non-native and invasive species at a landscape scale don't exist.
- Increased use of public lands results in a greater risk for the transport of invasive species of all kinds.

13. Considering catastrophic natural disturbances in vegetation management decisions.

Why is this issue important?

- Catastrophic natural disturbance events such as wind and fire may negatively affect the amount of forest land available for harvest and marketable timber available for sale.
- They may affect this plan's short-term goals and long-term desired future condition (DFC) goals.
- The timing and location of catastrophic events are difficult to predict.

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J. Climate Change

J1. Managing vegetation to prepare for and respond to the effects of climate change.

Why is this issue important?

- The trend in Minnesota is becoming warmer and wetter on average, and temperatures and precipitation are projected to continue increasing through the end of this century.
- Effects of climate change may include:
 - changes in frequency and intensity of precipitation events and disturbances such as fires and windstorms (blowdown)
 - o changes in the distribution and survival of plant and animal species
 - increased reproductive capability and survival of some insect pests, pathogens, and non-native invasive species that affect forests and wildlife
 - negative effects on tree species, such as quaking aspen, black spruce, balsam fir, birch, jack pine, and northern red oak
 - expansion of habitat for some tree species, such as black walnut, eastern white pine, eastern red cedar, and bur oak
 - o reduced timber production and loss of, or more limited access to winter management sites
- Forests with lower species and structural diversity are projected to be less resilient to climate change impacts.
- Communities thought to be most vulnerable to changing climate include peatlands, priority coldwater cisco lakes, cool and cold-water streams, lowland conifer forests, and mesic hardwood forests.
- Climate change will affect future management options and decisions on site-appropriate cover types.
- Carbon sequestration by forests and wetlands, including soils, may be affected.

K. Visual Quality

K1. Minimizing the effects of vegetation management activities on visual quality.

Why is this issue important?

- Scenic beauty, or visual quality, is a primary reason people choose to spend their recreation and vacation time in or near forested areas.
- Visual quality is an important consideration for vegetation management activities conducted adjacent to recreational trails, campgrounds, day-use areas, lakes, waterways, or near public roads and highways.

L. Access to State Land

L1. Providing access to stands identified for management.

Why is this issue important?

- Access routes are necessary for vegetation management activities, insect and disease control, fire response, and recreation.
- Properly designed and managed access will result in the following:
 - o less land disturbance
 - o less forest fragmentation
 - o decreased spread of non-native invasive species and undesirable native plants and animals
 - o decreased conflicts with adjacent landowners
 - o limit impacts to water quality, changes to hydrology, and destruction of fish habitat

M. Cultural Resources

M1. Protecting cultural resources during vegetation management activities on state-administered lands.

A cultural resource is an archaeological site, cemetery, historic structure, historic area, or traditional use area that is of spiritual, traditional, scientific, or educational value. Examples include the archaeological remains of American Indian villages and use areas, an abandoned logging camp, a portage trail, a cemetery, food-gathering sites such as wild rice harvesting and maple sugaring camps, or a pioneer homestead.

Why is this issue important?

- Cultural resources are scarce, nonrenewable features that provide physical links to our past or the ability to continue to practice cultural traditions.
- They often possess spiritual, traditional, scientific, or educational values and should be treated as assets.
- In addition to federal and state laws that protect certain types of cultural resources, the MFRC sitelevel guidelines provide information and recommendations to assist private and public land managers in taking responsible actions when cultural resources are encountered.

N. Balancing Vegetation Management Needs with Legal Requirements

N1. Including various state and federal legal requirements in the SFRMP planning process.

Why is this issue important? Vegetation management takes administrative land status and relevant statutes into consideration. Some examples include:

• The DNR is mandated by the Minnesota State Constitution and state statute to manage school trust lands for the maximum long-term economic benefit of the Permanent School Fund, using sound natural resource conservation and management principles and other specific policies provided in state law.

- Wildlife habitat management and protection are mandated for acquired Wildlife Management Area (WMA) lands and the use of relevant federal grants and funding.
- The DNR must comply with federal and state endangered species laws.
- Not meeting these legal requirements could cause a loss in funding or revenue, corrective actions through third-party forest certification, and loss of authority to manage these lands.
- Following federal and state legal requirements upholds the public trust in the DNR managing these resources sustainably.

Introduction

Managing for sustainability requires that we address the issues identified in Chapter 2 to balance multiple forest benefits. Sustainably managed forests support a healthy and competitive timber industry, provide the diversity of habitats needed by plant and animal species, maintain water quality and quantity, provide funding to the School Trust Fund, and provide a wide array of recreational opportunities. This chapter provides future direction to forest managers that aims to balance the issues identified in this plan while adhering to Minnesota Department of Natural Resources (DNR) policy.

The planning team developed general direction statements (GDSs) and strategies in response to the list of issues in Chapter 2 and defined desired future condition (DFC) goals where appropriate (see below for definitions of GDSs and DFCs). An issue may be addressed through one or more GDSs, and some GDSs address multiple issues (<u>Appendix B</u>). Goals and strategies for state-administered forest lands in this plan are consistent with the MFRC landscape committees' desired outcomes, long-term goals, and strategies for forest lands and ecosystem types within the four MFRC landscapes regions within the MIM Section: east central, north central, west central, and southeast.

As part of the process of developing this plan, management opportunity areas (MOAs) were reviewed and adopted. Management opportunity areas provide opportunities to address values such as biodiversity, rare features, diversity of native plant community growth stages, and wildlife needs through vegetation management at a scale smaller than the landscape but larger than individual stands. See <u>Section 3.13</u> and <u>Appendix E</u> for more information on MOAs.

General Direction Statements (GDS)

- follow directions provided in federal and state statutes, laws, and rules, as well as all Department policies, guidelines, and management direction
- incorporate DNR specialists' expert knowledge in their fields when designing management prescriptions
- make recommendations such as increasing, decreasing, maintaining, or protecting a forest condition, output, or quality
- are grouped under 12 forest resource management categories. Some categories have several GDSs to address the associated issues, while others have only one
- include strategies to achieve the general direction

Desired Future Conditions (DFC)

• are short-term (10-year) and long-term (50+ years) goals for the desired condition of DNR forest lands in the Section

• were identified where we can measure and quantify progress toward meeting the DFC cover type goals

Role of Statutes, laws, Department Guidance Documents, Policy, and Management Recommendations

In addition to DFCs, GDSs, and strategies identified in this SFRMP, a vast array of laws, rules, planning documents, guidelines, policies, objectives, and initiatives direct vegetation management on state-administered land. Vegetation management decisions by the DNR must consider these directives as they apply to individual site-level decisions. The DNR's internal forest policy framework provides clarification and guidance to staff on how to interpret and implement these directives as they relate to one another.

Questions that should always be considered when implementing this plan include:

- Does the treatment meet the requirements of federal and state laws and rules?
- Does the treatment meet current DNR policies and apply guidelines as appropriate?
- Which DNR Division is the land administrator, and what is the land status?
- Is the site within an area with a WMA plan or other operational plan? If yes, have you considered and incorporated direction as appropriate?
- Does the planned management meet MFRC site-level guidelines?
- Is the management activity appropriate for the NPC? Is it consistent with the ECS silvicultural interpretation?
- Does the stand present a good opportunity to contribute to SFRMP conversion goals?
- Do planned actions account for endangered and threatened species
- If appropriate, have you considered and incorporated information on rare species (special concern and Species of Greatest Conservation Need) and associated habitats?
- If appropriate, have climate change adaptation strategies been implemented?
- If a forest health issue is present, have current guidelines or forest health specialists been consulted?
- Is the site in a MOA? If yes, have the MOA guidance documents been considered?
- Do management decisions align with local annual goals that are derived from the strategic direction and 10-year stand exam list?
- Have forest coordination processes and agreements been documented and followed?

The strategies for achieving GDSs throughout the rest of this chapter provide guidance beyond these overarching considerations to achieve the landscape goals in this SFRMP.

3.1 Forest Composition and Within-stand Diversity

Broadly, goals for forest composition and within-stand diversity in this section of the plan are to 1) maintain, or increase where appropriate, cover type diversity, and 2) increase within-stand diversity where appropriate. This

section begins with a description and guidance for each cover type and concludes with broader general direction statements and strategies for the MIM Section.

The GDSs and Strategies in this section address Issues: <u>A1</u>, <u>A2</u>, <u>A3</u>, <u>B1</u>, <u>B2</u>, <u>C1</u>, <u>F1</u>, <u>J1</u>

Cover Type Direction

The following cover type management guidance summarizes current conditions and future management direction for each of the major cover types within the MIM Section, including Section-specific cover type issues that field staff should focus on while planning and executing on-the-ground management activities. However, this section is not a comprehensive discussion of these cover types, and field staff should rely on current management direction provided on the DNR's internal interdisciplinary forest management policy system page. Those directions are updated to reflect current management guidance and policy.

Some cover types include cover type conversion goals (desired trends, not exact targets), which were developed considering the following:

- documented and modeled native plant communities
- historical forest composition, disturbance regimes, and range of natural variation
- wildlife habitat associations
- forest insects and diseases
- projected tree suitability under projected long-term climate change conditions
- societal values

Conversion goals in this plan equate to an approximate 5% change from aspen/balm-of-Gilead cover types over 50 years, or about 10 acres per year across the Section. Cover type conversions will be done on sites where appropriate to the site-specific conditions and NPC.

Broadly, management strategies for cover types fall into two categories: even-aged management and unevenaged management (Table 3.1). Even-aged managed cover types are managed with the goal of moving toward balanced age class distributions, with relatively equal acres in each 10-year age class through normal rotation age (NRA) for a cover type. Some stands within these cover types are thinned periodically to enhance individual tree growth, forest health, and within-stand diversity. Uneven-aged managed cover types are not managed for balanced age class distributions but to enhance within-stand diversity and composition and improve wood quality.

These broad management strategies were used during modeling to develop the DNR's 10-year stand exam list. It is important to remember those model assumptions, including standard types of management by cover type, are simplified assumptions for average management on the average stand in the average year. These simplified assumptions are necessary for the model, which cannot work with the nuance of site-level variation. In reality, sites may differ in their objectives and characteristics. For more information, see the DNR's <u>Development of the 10-year Stand Exam List</u> report.

Within a cover type, there can be a large variety of native plant communities and conditions, each of which might need distinct or different management strategies implemented. The DNR will determine site-level prescriptions and strategies based on field examinations and interdisciplinary coordination to meet stand management objectives.
Table 3.1: General management strategies by cover type. Actual prescriptions may vary depending on the results of field examinations and stand management objectives.

Cover Type	Thin	Even- Aged	Uneven- Aged	Cover Type	Thin	Even- Aged	Uneven- Aged
Ash/lowland hardwoods			\checkmark	Jack pine		\checkmark	
Aspen/balm of Gilead		\checkmark		Norway (red) pine	\checkmark	\checkmark	
Birch		\checkmark		Tamarack		\checkmark	
Northern hardwoods	1		\checkmark	White cedar			\checkmark
Oak	\checkmark	√	\checkmark	White spruce natural			\checkmark
Balsam fir		✓		White spruce planted	\checkmark	✓	
Black spruce-lowland		√		White pine natural			\checkmark
Black spruce-upland		✓		White pine planted	\checkmark	✓	✓ (FAW)

Ash/Lowland Hardwoods (Ash/LH)

The ash and lowland hardwood cover types are combined into one management category for this SFRMP because they are commonly associated with each other and are managed under similar management prescriptions. Wet forest and floodplain forest native plant communities that include ash and lowland hardwood species occur along water features or in depressions where the water table is generally within reach of plant roots.

These cover types are typically managed using uneven-aged treatments. The current age class distribution of these cover types in the MIM Section includes the majority of acres between the ages of 41 and 110 years old (<u>Appendix C</u>).

There is projected to be a loss of ash within these cover types within MIM due to natural processes, invasive species, and impacts due to climate change. This may result in a shift from ash-dominated stands to mixed lowland hardwood stands and the conversion of some of these stands to a different cover type.

Current Acres: 1,784 managed acres in the MIM Section (approximately 5.3% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 1,744 acres (2.2% decrease)
- 50-year DFC: 1,694 acres (5% decrease)
- Increase within-stand diversity with species appropriate to the NPC.
- Increase the resilience of sites to emerald ash borer (EAB).
- Maintain forested conditions of ash and lowland hardwood sites in the wake of EAB.

Strategies

- Follow Department guidelines on managing ash to address the threat of emerald ash borer, including:
 - Maintain an ash component in all stands, but reduce the overall number of ash.
 - Promote non-ash species appropriate to NPC. This may include elm, yellow birch, bur oak, white oak, silver maple, spruce, white cedar, and tamarack.
 - o Design prescriptions to protect forest hydrology and maintain water regulation.
 - See the <u>Division of Forestry ash management guidelines</u> for additional information on managing ash.

- Emerald ash borer (EAB)
- Reed canary grass can enter wetland sites and outcompete forest regeneration.
- Climate change and invasive species may reduce habitat for the ash-dominated stands and cover type.

Aspen/Balm-of-Gilead (A/BG)

Aspen (trembling and bigtooth) and balm-of-Gilead cover types are combined in the SFRMP because they are commonly associated with each other and are managed similarly. These stands are identified with aspen/balm-of-Gilead being the major component as measured by volume. Aspen/BG-dominated native plant communities in the MIM Section are typically fire-dependent, mesic, to wet-mesic forests with a mixture of hardwood species and some conifers in the canopy and understory.

The current A/BG age class distribution reflects a fairly balanced age class structure for even-age managed cover types (<u>Appendix C</u>).

Current Acres: 6,928 managed acres in the MIM Section (approximately 20% of state-managed acres)

Future Direction and Goals

- 10-year DFC: 6,788 acres (2% decrease)
- 50-year DFC: 6,583 acres (5% decrease)
- Maintain a balanced age class distribution.
- Increase within-stand diversity.

Strategies

- Use clearcut with reserves method to regenerate aspen.
- Convert approximately 140 acres (approximately 350 acres over 50 years) utilizing NPC-suitable species.
 - Convert aspen/balm-of-Gilead to other cover types to address NPC goals and climate change projections in this planning period.
 - Prioritize low-density, over-mature stands that are far from markets for conversion, as well as stands within old forest management complexes (OFMCs), old growth special management zones (SMZs), and riparian management zones (RMZs).
 - o Determine sites and species appropriate for conversion by field visits and NPC.
- Increase northern hardwoods species composition within aspen stands (including birch and oak) or conifers (including white pine, white spruce, red pine, balsam fir, and upland white cedar) as appropriate to NPC.
- Sustainable timber harvest model parameters included retaining 2.5% of aspen 60 years old and older statewide to provide habitat associated with older aspen.

Special Considerations

- Conversion is challenging due to aggressive suckering and regeneration of aspen.
- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - o stem decay and butt rot in wounded trees
 - o white trunk rot as aspen ages
 - o decline following tent caterpillar defoliation in over-mature stands

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- *Hypoxylon* cankers and *Saperda* stem borer mortality in low-density stands or stand edges
- Long distances to market may make harvesting and regenerating aspen stands challenging, especially in low-density, over-mature stands.
- Climate change effects may limit the ability to achieve goals for this cover type.

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Birch (Bi)

The birch cover type includes paper birch in MIM. Birch-dominated NPCs in the MIM Section are typically mesic to wet-mesic forests with a mixture of hardwood species and some conifers in the canopy and understory.

The Bi age class distribution does not reflect the desired balanced structure for even-aged managed cover types (<u>Appendix C</u>). Due to the small number of acres of this cover type in the MIM Section, attaining a balanced age class distribution is unlikely. However, improving the age-class balance remains a goal for Bi.

Current Acres: 186 managed acres in the MIM Section (approximately 0.5% of state-managed forest acres) Future Direction and Goals

- 10-year DFC: 186 acres (maintain)
- 50-year DFC: 186 acres (maintain)
- Move toward balanced age class distribution to the extent possible.
- Increase within stand diversity.

Strategies

- Use clearcut with reserves method to regenerate paper birch.
- Consider opportunities in Bi cover type to contribute to A/BG conversion goals (see Strategies for A/BG above)

- Balancing Bi age classes may not be attainable due to the small number of cover type acres.
- Live birch is an important wildlife component for grouse, turkey, and squirrels, as well as a food source for the yellow-bellied sapsucker.
- Dead birch is important for chickadee and nuthatch nest sites.
- Birch is used for non-timber harvest of chaga, birch bark, and poles.

Central Hardwoods (CH)

Central hardwood-dominated plant communities in the MIM Section usually occur on upland sites with moist soils in settings protected from fire. These stands are generally located in the southern portion of the MIM Section on central and southern mesic native plant communities. They are comprised of a mix of hardwood species, including oak, hickory, cherry, maple, and butternut.

Current Acres: 186 acres in the MIM Section (approximately 0.5% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 186 acres (maintain)
- 50-year DFC: 186 acres (maintain)
- Improve timber quality.
- Enhance or maintain aesthetic values.

Strategies

- Use uneven-aged and gap management to regenerate CH and manage species composition.
- Increase diversity of oak species within stands and maintain a mix of CH hardwood species within mixed stands.

Special Considerations

• Considering climate change, some oak, northern hardwoods, or aspen stands may gradually convert to more CH-dominated stands.

Northern Hardwoods (NH)

Northern hardwood-dominated plant communities in the MIM Section usually occur on upland sites with moist soils in settings protected from fire. Natural, mature NH stands are comprised of a mix of species, including oak, birch, maple, and basswood.

Current age class distributions for the NH cover type show that the majority of NH stands are between the ages of 71 to 110 years old, with very few NH forests younger than 60 (<u>Appendix C</u>). Northern hardwoods are typically, but not always, managed as an uneven-aged cover type and were modeled as uneven-aged, so balancing age class distributions is not a goal for this cover type.

Current Acres: 7,000 acres in the MIM Section (approximately 20% of state-managed acres)

Future Direction and Goals

- 10-year DFC: 7,050 acres (.7% increase)
- 50-year DFC: 7,140 acres (2% increase)
- Improve timber quality.
- Enhance or maintain wildlife habitat.
- Enhance or maintain aesthetic values.

Strategies

- Use uneven-aged and gap management to regenerate NH and manage species composition.
- Allow some upland forest sites to naturally transition to northern hardwoods based on site-specific characteristics and NPC.
- In the central and northern portions of MIM, increase the abundance of conifers appropriate to the NPC, such as white pine or white spruce, as a component within stands.
- Increase oak species diversity within NH stands while maintaining birch and basswood in mixed stands.

Special Considerations

• Considering climate change and market forces, some aspen and oak stands may gradually convert to more NH-dominated stands.

Oak (O)

The oak cover type includes oak forest, oak woodland, and oak savanna native plant communities and contains northern pin, red, white oak, and bur oak. Natural, mature oak stands range from nearly pure oak to mixed stands. Oak species are also commonly found as a component of other cover types, such as aspen, birch, northern hardwoods, and lowland hardwoods (bur oak).

The oak acres in the MIM Section are distributed unevenly across all age classes (<u>Appendix C</u>). Most oak acres are greater than 71 years old, with very few acres in younger and middle age classes.

Current Acres: 11,644 acres in the MIM Section (approximately 12.1% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 11,764 acres (1% increase)
- 50-year DFC: 11,880 acres (2% increase)
- Maintain age and species composition within stands.
- Create a more balanced age-class distribution of oak stands.
- Maintain and restore oak savanna structure and characteristics where appropriate to the site and NPC.

Strategies

- Consider the amount of advanced regeneration when planning regeneration methods and potential competition from shade-tolerant species.
- Increase the mixture of oak species, such as bur and white oak, within oak stands as appropriate to the NPC.
- Evaluate each stand to determine the best prescription when regenerating oak. Utilize even-age or uneven-aged strategies (including clear-cuts and gap creation) as appropriate based on site-specific characteristics (i.e., stand condition, NPC) and desired future condition.
- Use prescribed fire to maintain and or create oak stands.

- Acorns are an important food source for many species of wildlife.
- Management to maintain or increase oak may require an aggressive management regime. Including clearcutting, prescribed burning, or timber stand improvement and planting to adequately regenerate oak stands.
- Shade-tolerant species such as maple and basswood can outcompete shade-intolerant species such as oak, resulting in stands converting to northern hardwood-dominated stands.
- Considering climate change and market forces, some oak stands may gradually convert to more NHdominated stands.
- Non-native invasive species such as buckthorn is of particular concern when managing and regenerating oak. When present, efforts should be made to control buckthorn when regenerating oak.

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - Oak wilt is a common problem within oak stands in the central and southern portions of MIM.
 When possible, management should be designed to suppress oak wilt infections within stands.

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Balsam Fir (BF)

Natural, mature balsam fir stands are typically mixed stands. Found primarily in the central and northern portions of MIM, balsam fir is best suited to wet-mesic sites where adequate soil moisture is available throughout the growing season.

Due to the very small number of acres within this cover type, a balanced age-class distribution may not be possible.

Current Acres: 43 acres in the MIM Section (approximately <0.1% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 43 acres (Maintain)
- 50-year DFC: 43 acres (Maintain)
- Desired within-stand composition is mixed, including long-lived conifers and upland hardwoods appropriate to NPC.
- Manage balsam fir as a component of other mixed-species cover types.

Strategies

- Manage BF primarily as even-aged for pulpwood and bolts.
- Increase the mixture of other species that are appropriate to the NPC to increase species diversity.
- Use intermediate treatments to control species composition and speed up stand development.
 - o best results from release treatments in young, vigorous stands (approx. 6-10 feet tall)

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - o spruce budworm
- Climate change may reduce habitat for the BF cover type.
- In some situations, this cover type may be managed as uneven-aged (particularly when there is a major natural-origin white pine component).

Black Spruce (Lowland)

The black spruce (lowland) (BSL) cover type is managed as an even-age cover type for pulpwood. Natural, mature BSL stands range from pure or nearly pure stands to mixed stands, including secondary species such as tamarack, balsam fir, cedar, white pine, and birch.

Due to the very small number of acres within this cover type, a balanced age-class distribution may not be possible.

Current Acres: 11 acres in the MIM Section (approximately <0.1% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 11 acres (maintain)
- 50-year DFC: 11 acres (maintain)
- Maintain species diversity within BSL stands.

Strategies

• Maintain secondary component species such as tamarack, white cedar, balsam fir, and paper birch.

- BSL grows slowly and may have reduced vigor in some NPCs, especially on sites compacted by harvest operations.
- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist regarding Eastern dwarf mistletoe.
 - Eastern dwarf mistletoe may be addressed differently, depending on the land administrator.
- BSL may lose habitat and decline in abundance according to some projected climate change scenarios.
- As stands are harvested, consider management to reduce the potential of a rise in water level.
- Harvest has the potential to release Sphagnum mosses and/or ericaceous shrubs, altering the groundcover and suppressing black spruce regeneration.

Jack Pine

The jack pine (JP) cover type is managed primarily as an even-aged cover type for pulpwood and bolts and to support wildlife habitat and biodiversity. Mature JP stands are often nearly pure but can include other conifers, birch, and possibly red maple. Most JP stands occur as woodland NPC classes and are found on dry, sandy upland sites. Jack pine in the <u>central and northern floristic regions</u> are adapted to different disturbance regimes. Central floristic region jack pine is adapted to more frequent fire and has a shorter life span and few serotinous cones.

Most JP acres are older than 30 years, with a large amount of JP on lands not within the management pool (<u>Appendix C</u>). Due to the number of acres available for management, creating and maintaining a balanced age class structure may be difficult within this cover type. The goal for this cover type is to maintain JP as a cover type on the landscape while trying to create a more balanced age class distribution, as well as maintaining or improving site productivity and stand health.

Current Acres: 198 acres in the MIM Section (approximately 0.5% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 198 acres (Maintain)
- 50-year DFC: 198 acres (Maintain)
- Move toward a more balanced age class structure.
- Desired within-stand composition is relatively pure jack pine in younger growth stages. As stands mature, other species may increase depending on NPC.

Strategies

- Manage JP as even-aged to create younger growth stages of NPC typical of JP cover types.
- Increase diversity of conifer and hardwood species within young JP stands.
- Consider local seed zones and ECS floristic regions in reforestation plans.

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - o Jack pine budworm
- Jack pine woodlands can have naturally low stocking. For more information, refer to regeneration standards in *Regeneration Monitoring: Procedures and Standards* for information on jack pine stocking levels in the northern floristic region.
- Jack pine is expected to decrease in abundance and has reduced habitat under some projected climate change scenarios.
- Many JP-dominated Fire-dependent communities have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Red (Norway) Pine (RP) - Natural Origin

Red pine DNR timberlands are treated as two distinct cover types. Natural origin stands (NORP) are managed to reflect a more natural age class distribution, with a final harvest followed by a regeneration strategy mimicking the creation of a natural origin stand.

NORP stands within the MIM Section have been found on dry pine woodlands (FDc23) and dry-mesic pinehardwood forests (FDc34) in the central and northern parts of MIM. These stands range from nearly pure stands of red pine to mixtures with other conifers and hardwood species, especially aspen and birch.

Most NORP acres within the management pool in the MIM Section are in the 11-40 age classes, with very few acres within the management greater than 40 years old. The majority of natural origin red pine on lands outside of the management pool are in the 81-120 age classes. (<u>Appendix C</u>). Balancing the age class distribution is not a goal for natural origin red pine.

Current Acres: 191 acres in the MIM Section (0.5 % of state-managed forest acres; 7.7% of total red pine acres, both planted and natural origin red pine together represent approximately 7.8% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 191 acres (Maintain)
- 50-year DFC: 191 acres (Maintain)
- Desired structure within red pine ranges from predominantly single-canopied even-aged stands to multi-canopied, mixed-aged stands with red pine, other conifers, and deciduous species as co-dominants.

Strategies

- Thinning in natural origin stands should maintain or increase within-stand diversity, retaining red pine as the main cover type, by the following methods:
 - Reserve individual trees or patches of other species appropriate to the site, where possible.
 - o Consider creating or maintaining variable densities within stands when thinning.
 - Protect advanced regeneration of desirable understory species, where possible.
 - Higher stand densities (basal area) are recommended along stand edges exposed to wind and along high visual quality corridors, such as major roads and lakes.
 - Consider underplanting shade-tolerant species, where seed sources or advance regeneration for these are lacking. For species suggestions, refer to the *Field Guide to Native Plant Communities* of Minnesota and <u>NPC silviculture strategies</u>.
- Consider the following recommendations when regenerating red pine:
 - o Use natural regeneration in natural origin stands when opportunities arise.
 - Evaluate and prepare an adequate seedbed or planting site for red pine regeneration while retaining areas of undisturbed ground layer.
 - Maintain or enhance within-stand diversity during site preparation and release treatments considering the desired future condition and NPC.

- Prescribed fire in mature red pine stands can be an effective management tool for eliminating shrub competition, reducing thick duff layers, and preparing seedbeds. Summer fires conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil.
- Evaluate the presence of *Diplodia* tip blight and canker (*Sphaeropsis sapinea*) and shoot blight (*Sirococcus conigens*) in understory pine.
- Consider the potential impacts of bark beetles during intermediate harvest in red pine (see below).

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - Diplodia tip blight and canker (Sphaeropsis sapinea)
 - shoot blight (*Sirococcus conigens*)
 - bark beetles (*Ips* and *Dendroctonus* spp.)
- Red pine is at the edge of its range in the western and central portions of this planning area. Climate change effects may increase the negative impacts of deer browse, drought, *Diplodia*, and bark beetles.
- Topic-specific Forest Management Guidelines for natural-origin red pine are forthcoming for school trust lands as of the writing of this document.
- Many RP-dominated Fire-dependent communities have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Red (Norway) Pine (RP) – Planted

Red pine (RP) on DNR timberlands is treated as two distinct cover types. Planted stands are managed using an economic rotation age. They are typically dominated by planted red pine but often include components of jack pine, birch, and aspen.

Found within the central and northern portions of MIM and largely within the Anoka Sandplain Subsection, most planted RP acres are in the 31-70 age classes, with generally declining acres to 120 years (<u>Appendix C</u>). Balancing the age class distribution of planted RP is a goal in this planning period.

Current Acres: 2,285 acres in the MIM Section, 7.4% of managed acres (92.3% of managed red pine acres; planted and natural origin red pine together represent approximately 7.8% of state-managed acres)

Future Direction and Goals

- 10-year DFC: 2,285 (Maintain)
- 50-year DFC: 2,285 (Maintain)
- Move toward a more balanced age class structure for classes between 0 years and economic rotation age.
- Manage for high-value forest products, biological diversity, riparian buffers, recreation, aesthetics, and wildlife habitat where possible or appropriate.
- Increase species diversify within stands as they age.
- Increase within-stand structure to maintain or improve site productivity, wildlife habitat, and biodiversity.

Strategies

- For final harvests, consider using a regeneration strategy that mimics the creation of a natural origin stand (i.e., with associated species, especially jack and white pine, and structural diversity).
- Use thinning to reduce stand density to increase future tree growth, quality, and vigor and to obtain the desired composition of the stand. Recommendations are:
 - Conduct normal rotation stand thinning in merchantable stands at approximately 10-year intervals, depending on site quality.
 - Older stands may have longer intervals between thinning to compensate for slower growth rates and to facilitate the growth of desirable understory species.
 - Consider incorporating variable density thinning or other techniques to meet biodiversity or habitat objectives.
- To regenerate RP, use clearcut or clearcut with reserves. Use the following considerations:
 - When appropriate to site conditions, consider summer harvest to allow for scarification of soil in preparation for regenerating the stand.
 - Maintain or enhance within-stand diversity during site preparation and release treatments considering the desired future condition and NPC.

- Evaluate and prepare an adequate seedbed or planting site for red pine regeneration while retaining areas of undisturbed ground layer.
- Prescribed surface fire in mature red pine stands can be an effective management tool for eliminating shrub competition, reducing thick duff layers, and preparing mineral seedbeds. Summer fires conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil. This may be done before harvesting to prepare seedbeds unless charred bark on harvested trees poses a problem (<u>"Red Pine Handbook"</u>).
- Consider the risk of *Diplodia* tip blight and canker (*Sphaeropsis sapinea*) and shoot blight (*Sirococcus conigens*) infection on sites where taller infected red pine or jack pine are left on or next to sites being regenerated to red pine.
- o Retain cavity trees or snags as recommended in the MFRC site-level guidelines.
- Reserve biological legacies such as large, healthy, live trees, decadent trees, snags, logs, and other coarse woody debris.
- Continue to monitor the results of Adaptive Forest Management Projects as needed.

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - Diplodia tip blight and canker (Sphaeropsis sapinea)
 - shoot blight (*Sirococcus conigens*)
 - bark beetles (*Ips* and *Dendroctonus* spp.)
- Red pine is at the edge of its range in the western and central portions of this planning area. Climate change effects may increase the negative impacts of deer browse, drought, *Diplodia*, and bark beetles.
- Many RP-dominated fire-dependent communities have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Tamarack

Natural, mature tamarack (T) stands range from pure or nearly pure stands to mixed stands and predominantly occur in poorly drained peatland settings. Secondary species in the cover type include black spruce, balsam fir, cedar, and birch. Tamarack-dominated stands are found within the central and northern portions of MIM. Typical tamarack-dominated NPCs include FPn82, FPs63, and FPw63.

The current T age class distribution does not reflect the desired balanced age class structure for even-age managed cover types (<u>Appendix C</u>). Most T acres are in the 61-70 and 81-90 year age classes.

Current Acres: 1,429 acres in the MIM Section (approximately 4.2% of state-managed forest acres)

Future Direction and Goals

- 10-year DFC: 1,429 acres (maintain)
- 50-year DFC: 1,429 acres (maintain)
- Move toward balanced age-class distribution
- Maintain T acres on the landscape

Strategies

- Harvest, leaving seed trees, in advance of Eastern larch beetle (ELB). Leaving approximately ten tamaracks per acre is recommended for successful seeding.
- Increase tamarack within other cover types and on upland sites as appropriate
- Maintain or increase secondary component species of T stands where possible by:
 - o reserving seed trees, reserve islands, clumps of mature trees, or advanced regeneration
 - o include other species such as black spruce and cedar when artificial seeding

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - Eastern larch beetle (ELB)
 - Tamarack is at the edge of its natural range, in the southern edge of this planning area. Southern stands are facing significant threats from changes in hydrology, climate, and invasive species.
 Due to these conditions, it may be difficult to maintain tamarack acres within this Section.

White Pine (WP)

White pine occurs as pure stands and as a component of many other upland cover types in the MIM Section. A stand can belong to the WP cover type if it contains greater than 33% white pine by volume or basal area. The WP cover type is uncommon in MIM.

The WP age class distribution includes most acres in the 31-50 and 61-70 age classes, with relatively even distributions in the other age classes (<u>Appendix C</u>). WP stands generally receive uneven-aged management, so balancing age class distributions is not a goal for this cover type.

Current Acres: 1,040 acres in the MIM Section (3.1% of state-managed acres)

Future Direction and Goals

- 10-year DFC: 1,050 acres (.9% increase)
- 50-year DFC: 1,090 acres (4.8% increase)
- Maintain age and species composition within stands.

Strategies

- Convert approximately 10 acres (approximately 50 acres over 50 years total) of A/BG/Bi cover type to WP cover type.
 - Assess the suitability of stands that include white pine for capacity to convert to the WP cover type considering NPC and *Suitability of Tree Species by Native Plant Community* table.
- Manage white pine stands to maximize the potential for white pine regeneration in the understory.
 - White pine abundance can be encouraged by selective thinning within appropriate stands.
- Increase the amount of white pine occurring as a component in mixed stands as appropriate to NPC.

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - o white pine blister rust
- Deer herbivory is a challenge for white pine recruitment.

White Spruce (WS)

White spruce (WS) stands vary from planted monotypic stands of nearly pure white spruce to natural-origin stands that include other canopy tree species. White spruce occurs as mixed stands in the fire-dependent, mesic hardwood, and wet forest native plant communities. Natural-origin white spruce is managed as an uneven-aged cover type, while planted white spruce is managed as an even-aged cover type.

The current combined age class distribution of natural and planted white spruce is not balanced. Most WS acres fall within the 41-50 year age class (<u>Appendix C</u>). Due to the small number of acres of WS within the MIM Section, working toward balancing the age class distribution of planted WS may be difficult but is still a goal for this cover type; however, this is not a goal for natural-origin WS.

Current Acres: 220 acres in the MIM Section (approximately 0.6% of state-managed acres)

Future Direction and Goals

- 10-year DFC: 220 acres (maintain)
- 50-year DFC: 220 acres (maintain)
- Increase species and structural diversity in planted WS stands.
- Move toward balanced age class distribution for planted WS.

Strategies

- Manage natural-origin WS as multi-aged and mixed-species stands. Recommendations include:
 - o Retain some super canopy trees in patches or clumps at each treatment.
 - o Encourage multi-layered understory development.
 - o Emphasize regenerating white spruce in the understory.
 - o Use single-tree and group selection harvest methods for stands that are already multi-aged.
 - For even-aged stands, use shelterwood, seed tree with reserves, or group selection harvest methods to move the stand toward becoming multi-aged.
- Manage planted WS as normal rotation stands on an even-aged basis for pulpwood, bolts, and sawtimber products.
- After the final harvest, convert planted WS stands to mixed species, structurally diverse stands using NPC information to select the most appropriate species.

- Insect and disease concerns see current management guidelines or consult a Forest Health Specialist:
 - o spruce budworm and yellow-headed spruce sawfly
 - o needle cast diseases and other insects (e.g., spruce weevil, spruce beetle, etc.)
- Thinning damage to the shallow root system of WS
 - Thin when the ground is frozen and snow is present.
 - Conduct the first thinning before the planted WS is 30 years old.

• Consider forgoing intermediate treatments in lieu of final harvest, as WS may decline as a result of multiple stand entries.

Open Landscapes (UG/LG, UB/LB)

The upland and lowland grass and upland and lowland brush cover types are managed together as open landscapes. The MIM Section is within the transition from timberlands to more open landscapes. Species composition is variable within these open landscapes and depends on factors such as NPC, hydrology, disturbances, management history, presence of invasive species, etc. In this Section, most lowland brush acres are dominated by willow and alder species.

Management emphasizes maintaining and enhancing these cover types so they can provide ecosystem services, including sustaining populations of wildlife and plants.

Current Acres: 41,617 acres in the MIM Section

- 15,014 acres (36%) brushland (UB/LB) cover type
- 26,602 acres (64%) open land (UG/LG) cover type

Future Direction and Goals

- 10-year DFC: 41,671 brushland and open land acres (maintain)
- 50-year DFC: 41,671 brushland and open land acres (maintain)
- Maintain species diversity and abundance appropriate to NPC.
- Maintain open landscape acres on the landscape.

Strategies

- Coordinate across divisions on open landscape projects designed to enhance open landscape conditions:
 - Identify open landscape projects within the Section using available information and review by field staff.
 - Encourage biomass removal on timber sales and promote brushland biomass harvest when feasible.
 - Enhance and maintain open habitat landscapes by increasing patch size and connectivity.
 - Discourage tree planting and tree establishment in open landscape areas on NPCs where tree species are not appropriate. Consider maintaining trees on NPCs where tree species are appropriate.
 - Coordinate across divisions on projects designed to set back or maintain successional stages (e.g., prescribed fire, mechanical winter shearing, or mowing).
- Encourage communication and coordination within DNR, with private landowners, and with other agencies and organizations to ensure awareness of open landscapes and recommended management.

Special Considerations

• Some ash and tamarack stands may convert to lowland brush open landscapes naturally due to climate change and invasive species.

GDS 1A: Maintain diversity of cover types.

GDS-1A Strategies

- Retain cover types appropriate to native plant communities.
 - For more information on species appropriate to NPCs in the MIM Section, including habitat suitability projections for those species under climate change, refer to the <u>NPC Silviculture</u> <u>Strategies for forest stand prescriptions</u> webpage.
- Convert cover types where appropriate (Table 3.2; see Figure B.1 for example and Cover Type accounts for more detail).
 - Determine sites and species appropriate for conversion after evaluating site-specific conditions and identifying the Native plant community.
 - Increase the acreage of white pine and oak. These cover types have declined compared to historical (i.e., pre-European settlement) conditions, or their habitat is projected to expand due to climate change. Options available include:
 - Allow some stands to convert through natural succession with or without harvest (e.g., aspen to oak). Applicability of this option depends on land administration and status, ability to offer the annual planned volume, operability, and marketability, among other considerations.
 - Artificially convert some stands to suitable species to the NPC using a variety of tools such as mechanical site preparation, prescribed burning, planting, or seeding.
 - Selectively harvest some stands to facilitate movement toward the desired cover type and within-stand composition.
 - Restore some Northern Hardwood and Oak woodlands to Oak Savanna on sites with appropriate NPCs.

Figure 3.1: Example of converting an aspen stand to a white spruce stand, resulting in an increase in conifer cover type acres. Cover type conversions such as this attempt to move a cover type to a different growth stage and species mixture. True conversions are realized after years of effort and maintenance.



Table 3.2: Current managed cover type acres in the MIM Section from the DNR's forest inventory and desired future conditions for the first decade and 50-year planning period (see Cover Types section below for more information on how conversion goals were developed).

Cover Type	Current Cover Type Acres	Conversion Acres (first plan decade)	Conversion Acres (50-year DFC)	Final Cover type Acres (current + 50-year DFC)
Oak	11,644	+120	+236	11,880
Northern hardwoods	7,000	+50	+140	7,140
Aspen/balm-of- Gilead/birch	6,928	-140	-346	6,582
Ash/lowland hardwoods	1,784	-40	-90	1,695
Red (Norway) pine	2,285	0	0	2,285
Tamarack	1,429	0	0	1,429
White pine	1,040	+10	+50	1,090
Central hardwoods	186	0	0	186
Jack pine	198	0	0	198
Red (Norway) Pine – natural origin	191	0	0	191
White spruce	220	0	0	220
Birch	186	0	0	186
Balsam Fir	55	0	0	55
Black Spruce – lowland	11	0	0	11
Black Spruce – upland	2	0	0	2

GDS-1B: Manage within stands to reflect the composition, structure, and function of native plant communities.

GDS-1B Strategies

- Use the Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province and associated ECS <u>silvicultural strategies</u> to classify stands to NPC type and subtype and inform silvicultural prescriptions.
- Retain or incorporate components, such as species and structure, characteristic of various NPC growth stages in stands.

- Use available climate change projections when choosing species to reserve, regenerate, or introduce in stands.
 - Consider the projected increase or decline of species and habitats as climate change progresses (e.g., <u>MN Forest Ecosystem Vulnerability Assessment and Synthesis</u> and <u>Climate Change Field</u> <u>Guide for Northern Minnesota Forests: Site-level considerations and adaptation</u>).
 - Apply best-available information, such as the Suitability of Tree Species by Native Plant Community table, including information on species affinity for warmer and/or dryer site conditions.
- Retain biological legacies through the incorporation of MFRC site-level guidelines.

GDS-1C: Maintain or increase the diversity of species, ages, and structures within stands.

GDS-1C Strategies

- Provide structural diversity characteristics, including:
 - o sizes (diameter and height), abundance, and distribution of overstory trees
 - o understory vegetation
 - o arrangement (scattered or clumped) of vegetation in the stand
 - o distribution, size, and decay class of snags and coarse woody debris
- Use selection harvesting to encourage diversity of species, ages, and stand structures.
- Meet or exceed the MFRC site-level guidelines designed to maintain tree species diversity within a stand.
- Retain tree species, stand structure, and ground layer diversity within stands when prescribing release and timber stand improvement rather than managing for one species.
- Take advantage of opportunities to diversify stands when prescribing intermediate treatments.
- 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 should specify outcomes to protect these regenerating trees. In some cases, portions of the stand may be delineated to protect regeneration by restricting harvest activity in those areas. For some tree species, to enhance the recruitment of seedlings, a partial canopy may be retained to meet needed moisture and light requirements of the seedlings.
- Identify some stands where succession is allowed to occur to encourage the development of withinstand diversity. The movement to the next successional stage may be achieved with or without harvest.
- Increase and/or maintain target species, including white pine, white spruce, upland cedar, upland tamarack, yellow birch, and oak, as components within appropriate cover types. Silvicultural practices that may increase the presence of these target species include planting, inter-planting, artificial or natural seeding, and leave tree selection.

- Manage planted and seeded stands to represent the array of NPCs and variation within NPCs. This may be accomplished by:
 - accepting lower stocking levels of planted species in younger planted stands if other desirable species are present
 - o planting or seeding mixed species appropriate to the site
 - o using intermediate harvests to enhance age, species, and structural diversity
 - using the least intensive site preparation necessary to successfully regenerate the site while favoring retention of the existing ground layer plant species
 - When using intensive site prep methods, consider leaving legacy patches of the existing ground layer to assist in the recolonization of the site.
- Encourage fruit and mast-producing species (e.g., trees and shrubs that produce acorns and nuts) for wildlife benefits as well as to encourage natural regeneration.
- Recognize that some plant communities naturally have low species diversity due to site conditions and regular disturbance events. This low species diversity occurred historically in peatlands and in association with large-scale disturbances, such as fire.

3.2 Harvest Levels

The GDSs and Strategies in this section address Issues: C1, C2

GDS-2A: Manage stands to provide a sustainable supply of timber.

The DNR uses timber harvest to create the disturbance needed to develop or maintain a mix of forest age classes that provide broad social, economic, and environmental benefits in perpetuity. The DNR uses timber volume to plan and implement that disturbance because it is the most efficient and effective metric we have to align our actions to our objectives and evaluate our progress. The amount of timber volume the DNR plans to offer annually in this plan period was determined considering the results of STHA modeling and the following factors, among others:

- Statutory requirements for how the DNR manages forest lands
- age class imbalances for even-age managed cover types
- acres over rotation age
- representation of young and old forest
- varying goals based on administration or land status
- wildlife habitat and biodiversity
- supply of timber
- criteria for uneven-aged management and thinning
- forest growth and sustainability
- forest health concerns
- expected future market and stand conditions

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• incorporating intermediate treatments to achieve goals in conjunction with harvests

The statewide 10-year stand exam list was developed to implement the DNR's strategic direction for this plan period. See <u>the DNR 10-year stand exam list report</u> for more information. See Tables 3.3-3.4, Fig. 3.2, and <u>Appendix D</u> for acre and volume summaries for the 10-year stand exam list in MIM. Note that the DNR plans to visit more stand acres that contain more volume than necessary, based on model estimates, to ensure that the DNR will offer as much volume annually as planned. Thus, the estimated volume from planned stand exam acres is not equivalent to the volume offered on timber sale permits, and the volume offered is not equivalent to the volume harvested.

After site visits, foresters determine the management prescription and treatment for each forest stand on the stand exam list. This could result in the stand being appraised and offered for sale, having the inventory corrected, having a non-timber sale treatment, or having a planned treatment deferred to later in the planning period or to another planning period.

GDS-2A Strategies

In addition to the statewide 10-year stand exam list, the following strategies aim to contribute to providing a sustainable timber supply over time:

- Emphasize visiting stands older than normal rotation age and visiting the oldest stands first to evaluate for appropriate management. While evaluating older stands, consider SFRMP goals within GDS-3A.
- Consider SFRMP goals when proposing annual plan additions (APAs) and follow APA and joint coordination policies when adding APAs.
 - Annual plan additions are stands or portions of stands that make sense to treat immediately (e.g., to address insects and diseases, operational considerations, or to adhere to policy) and are not on the stand exam list.
- Consider potential biomass harvest consistent with MFRC guidelines.
 - o Biomass could be available as tops and limbs from timber harvests.
 - Non-commercial forests and brushlands may have the potential for biomass harvest.

Table 3.3: Planned stand exam list acres by cover type and land administrator on the 10-year stand exam list for the MIM Section (FY 2021-2030). SI = Site Index. (2017 FIM)

Modeled Cover Type	Forestry Acres Planned	Fish and Wildlife Acres Planned	Total Acres Planned
Ash/Lowland hardwoods	164	188	352
Aspen/Balm of Gilead SI < 65	242	735	977
Aspen/Balm of Gilead SI > 64	403	874	1,277
Balsam fir	19	0	19
Birch	0	64	64
Central hardwoods	0	23	23
Northern hardwood	922	667	1,590
Oak	1,854	3,576	5,429
Offsite oak	10	16	25
Jack pine	93	61	154
Red pine - natural origin	124	6	129
Red pine - planted	1,624	152	1,777
White pine	367	187	553
Tamarack SI < 40	21	62	84
Tamarack SI > 39	21	16	37
White cedar	2	0	2
White spruce	6	21	26
Non-forest (grass or brush)	0	21	21
Total	6,028	6,689	12,717

Table 3.4: Model estimated volume (cords) for acres on the FY2021-2030 stand exam list by land administering DNR Division and treatment groups in the MIM Section. The model estimated volume using yield estimates and assumptions about how DNR lands are managed to address multiple values. The volume offered for sale over the plan period may differ from the estimated volume on the 10-year stand exam list, in part because it will be unnecessary to offer all stands for sale to meet the annual planned volume. As staff implement this plan, conduct stand exams, and make management decisions, monitoring will inform the accuracy of the model assumptions.

Treatment Group	Forestry Volume (cords)	Fish and Wildlife Volume (cords)	Total Volume (cords)
Even-aged harvest	34,235	46,439	80,674
Thinning	19,861	14,687	34,548
Uneven-aged harvest	31,080	31,396	62,475
Total	85,176	92,521	177,697





GDS-2B: Manage the availability of non-timber forest products.

Non-timber forest products include decorative materials, foods, herbs, medicinal materials, and specialty items.

Foresters issue special product permits or informal timber sales for a number of non-timber forest products, which may be restricted depending on the location.

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

GDS-2B Strategies

- Maintain or enhance known traditional gathering areas of non-timber forest products when managing forest resources.
- Supervise and enforce special product permit regulations to ensure resource sustainability.
- Consider managing or using some forest stands for non-timber forest products.
- Identify and coordinate with DNR specialists, known locations of important wildlife habitats, rare native plant communities, or rare species before issuing special product permits.
- Maintain non-timber forest products projected to be negatively impacted by climate change.

3.3 Biological Diversity, Young and Old Forest, and Spatial Distribution

The GDSs and Strategies in this section address Issues: <u>A1</u>, <u>A2</u>, <u>A3</u>, <u>B1</u>, <u>B3</u>, <u>B5</u>, <u>B6</u>, <u>D1</u>, <u>D2</u>, <u>E1</u>, <u>F1</u>, <u>J1</u>

Many factors influence biological diversity, forest composition, and spatial distribution of forest patches, including:

Soils and hydrology: Nutrient and water availability are fundamental to determining species making up a native plant community. Demand for these resources and the ability of each tree species to compete alters the makeup of the forest.

Natural disturbance: In conjunction with insects and disease, weather and wildfire events were once the primary natural disturbance factors affecting forest stands. Alteration of the landscape after European settlement and the subsequent types and frequencies of other disturbance events have helped to shape the current forest.

Past and current timber harvesting and land management practices: In the mid-19th century to the early 20th century, agriculture and timber harvesting expanded across central and southern Minnesota into the northern portions of the MIM Section. This caused much of the forests within this Section to be harvested or converted to agriculture. This has had profound and long-lasting effects on seed sources, soil fertility, and subsequent revegetation. Current land ownership patterns, land use, forest resource management goals, and different ownership constraints influence the distribution of forest species, age classes, and NPC growth stages across the landscape. In this Section, the amount of land converted to agriculture continues to impact hydrology, forest connectivity and productivity, and overall access to forests.

Natural succession: As some 20th-century forests have matured beyond the maximum age for early successional tree species, there have been moderate declines in quaking aspen, balm-of-Gilead, and paper birch cover type acreages and corresponding increases in cover types dominated by mid- and late-successional tree species such as northern hardwoods and long-lived conifers.

Wildlife browse: Browsing effects on vegetation vary with herbivore densities, including deer and snowshoe hare, and the availability and selection of browse material. In many areas today, it can be extremely difficult to grow several tree species that are preferred by deer or hares. White pine, upland white cedar, oaks, and many other forest plants often fail to survive without protection from browsing or a reduction in deer numbers.

Invasive species: Invasive plants, animals, and diseases have established their presence and continue to emerge as significant factors affecting forest vegetation and biological processes. Among other effects, invasive species can disrupt natural succession, hinder regeneration, change soil structure and chemistry, or displace native trees and plants.

Climate Change: The 2014 Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis, a report from the Northwoods Climate Change Response Framework project, predicts that over the next 150 years, habitat for many common species will decline (e.g., quaking aspen, paper birch, tamarack, black spruce). However, habitat for some species is projected to increase (e.g., American basswood, black cherry, northern red oak, eastern white pine). Forests with lower species and structural diversity are predicted to be less resilient to climate change impacts. In addition, fragmented landscapes will provide less opportunity for desired native species to migrate in response to climate change.

GDS-3A: Ensure older forest stands and older forest characteristics within stands are distributed across the landscape.

Conditions range from stands being over standard DNR rotation age for a cover type ("older forest") to stands designated as old growth. These stands represent mature to old forest on the landscape. These conditions also exist on other ownerships in the MIM landscape and are created or maintained in many ways on DNR-administered lands, including:

- Designation of <u>old-growth stands</u>.
- Incorporating older forest values in sustainable timber harvest analysis and stand exam list modeling:
 - Older forest across ownerships is accounted for during DNR planning (see below).
 - Planned volume is based on model results that provide for the development and retention of some older forest.
 - Management regimes on FAWadministered lands and in some management opportunity areas allow for older forest.
 - Modeling to ensure at least 2.5% of the aspen cover type is 60 years old or older statewide.

- Some forest stands on DNRadministered lands (e.g., state parks and SNAs, inoperable stands, most representative sample areas (RSAs), and stagnant conifers that are not in the management pool.
- On average, approximately 20% of acres within MIM on DNR annual stand exam lists don't result in timber sales. A portion of these acres represent or will become older forests.
- Application of site-level guidelines to riparian management zones.
- Management for High Conservation Values and state-listed species.
- Conversions from shorter to longerlived species (e.g., aspen to pine or oak).

In addition, the DNR uses an adaptive approach to monitor and manage forest age classes, including older forest, across ownerships at a landscape level:

- 1. The SFRMP original desired age class distribution is applied as a benchmark across all ownerships.
- 2. Forest age class distributions across all ownerships and on DNR-administered timberlands are periodically monitored.
- 3. DNR forest age class management may be adjusted in response to changing conditions across all ownerships.

GDS-3A Strategies

• Communicate any discrepancies between old forest benchmarks and current old forest across ownerships that are found during monitoring or plan preparation work to managers with recommendations on how to address them.

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- Allow some stands, especially those with old forest characteristics, to succeed to long-lived cover types or under-represented NPC growth stages (e.g., FDn32c, d).
- Manage designated old-growth stands (Table 3.5) and SMZs according to DNR policy and OFMCs according to old growth policy and MOA guidance documents (<u>Appendix E</u>).
- Use silvicultural treatments that retain old forest components in some stands such as OFMCs, FAWadministered lands, riparian areas, in relevant MOAs, and natural origin red pine stands.
 - When making decisions to add and offer unplanned wood for harvest, consider the habitat values of old forest in the area and the age-class structure of the surrounding local landscape.
- Use silvicultural prescriptions or reserves to create corridors that connect older stands.
- Target long-lived tree species to leave as legacies.

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Old growth type	Designated	Future Old Growth	Grand Total
Aspen	54.3	0	54.3
Ash	16.8	0	16.8
Central Hardwoods	92.5	0	92.5
Lowland hardwoods	208.8	0	208.8
Northern hardwoods	2,003.4	0	2,003.4
Oak	804.5	0	804.5
Red pine	8.4	0	8.4
White pine	152.9	0	152.9
Grand Total	3,341.6	0	3,341.6

Table 3.5: Old growth acres within MIM by cover type.

GDS-3B: Maintain or enhance vegetation conditions associated with known occurrences of Species of Greatest Conservation Need.

Species of Greatest Conservation Need (SGCN) are native animals whose populations are rare, declining, or vulnerable to decline and are below levels necessary to ensure their long-term health and stability. For more information, refer to Minnesota's <u>Wildlife Action Plan</u> and the <u>Rare Species Guide</u> on the DNR website.

GDS-3B Strategies

- Use interdisciplinary forest management processes to apply SGCN data and Wildlife Action Plan guidance to maintain or enhance habitat when conditions and opportunities are suitable.
- Manage MOAs consistent with their association with SGCNs.
 - MOAs identified in this plan address specific SGCNs (either directly or indirectly), including American woodcock, spruce grouse, olive-sided flycatcher, golden-winged warbler, and Connecticut warbler.
- Consider climate change adaptation strategies in the <u>Wildlife Action Plan</u>.

GDS-3C: Maintain existing large patches and increase average patch size on state lands over time, with consideration of natural spatial patterns. Identify ways to increase average patch size over time.

Patches are made up of one or more adjoining stands that are relatively homogenous in structure, primarily in height and density and are similar in vegetation cover and age. Patches may be formally recognized as patch management opportunity areas (MOAs), but patches of forest vegetation can also be created, maintained, or enhanced outside of MOAs through stand exam list development and decisions made during stand management.

In this plan, patches:

- are categorized as old, intermediate, and young within cover types or groups of cover types
- range in size from small (less than 40 acres) to large (greater than 640 acres)
- may have smaller areas within them that are not in the same patch category as the main patch, such as inclusions, residual islands, legacy patches, corridors, and buffers

The primary goal of this plan is to set the stage in the short term (10 years) to improve the distribution of patch sizes and age classes across the landscape over the long term (50 years). The strategies below provide general guidance for working toward these goals.

In addition, two mature to old forest patch MOAs were adopted through this planning process. The list of all MOAs, including patch MOAs, and links to their guidance documents are in <u>Appendix E</u>.

GDS-3C Strategies

- Review and incorporate MOA guidance documents in management activities.
- Maintain existing large patches.
- Group harvest activities to maintain or create new large patches.
- Lump stands of similar age, cover type, and density while performing forest stand inventory.
- Increase the "age window" for harvesting adjacent stands to maintain or create new large patches (harvesting at younger or older ages than normal).
- Increase the size of clear-cuts while retaining adequate residuals.
- When possible, cooperate with other landowners in patch management to maintain existing large patches and increase the average patch size across forest land of multiple ownerships.

GDS-3D: Maintain or enhance vegetation conditions associated with existing biodiversity significance factors within MBS sites of high and outstanding biodiversity significance to the maximum extent possible.

Minnesota Biological Survey (MBS) sites of biodiversity significance contain intact native plant communities, populations, and/or concentrations of rare species, critical animal habitat, and/or functional landscapes typically representative of pre-European settlement Minnesota (Table 3.6).

MBS sites are ranked as having outstanding (O), high (H), or moderate (M) biodiversity significance or as being below (B) the MBS minimum biodiversity threshold for statewide significance based on the following factors:

- rare species occurrences (element occurrences)
- native plant community quality, rarity, and size
- landscape context and presence/absence of landscape-level functions

More information about MBS, including background, definitions, and maps of sites of biodiversity significance, is available on the <u>DNR website</u>.

Rank	Number of Sites	Total Acres	Total state stand acres	Total state- managed acres
Outstanding	83	64,214	24,846	19,598
High	273	120,289	23,789	13,567
Moderate	1,158	302,817	43,145	29,533
Below	1,212	112,126	12,152	8,312

Table 3.6: Sites of biodiversity significance acres in the MIM Section summarized by ranking as of June 2020.

GDS-3D Strategies

Forest management activities such as timber harvesting, site preparation, access route construction and maintenance, and tree planting will occur on Forestry- and Wildlife-administered lands within MBS sites. MBS information should be used in conjunction with other available information and management direction to inform site-level management. The following strategies will help to minimize the loss of the factors on which the MBS sites of outstanding and high biodiversity significance were ranked.

- Follow interdisciplinary coordination direction when working within MBS sites of outstanding or high significance.
- Consider the broader context and significance of the MBS site as a whole when assigning management objectives and designing silvicultural prescriptions. For example:
 - Emulate the within-stand composition, structure, and function of NPC growth stages when managing stands in MBS sites.
 - Apply variable density thinning or variable retention during harvest or reforestation where appropriate.
 - Increase the use of prescribed fire as a silvicultural technique in managing fire-dependent NPCs.
 - Locate roads and trails to minimize fragmentation of high and outstanding MBS sites.
- Manage stands identified as having High Conservation Values consistent with DNR policy. Refer to specific directions on managing for <u>High conservation values</u> for additional information.
- As opportunities arise, inform other landowners of the significance of shared MBS sites, their biodiversity objectives, and the management options for addressing them.

GDS-3E: Protect, maintain, or enhance endangered, threatened, and special concern species and their habitats in the Section.

Minnesota's List of Endangered, Threatened, and Special Concern Species (ETS list) highlights plants and animals at risk of disappearing from Minnesota. Special regulations apply to endangered and threatened species. Species listed as special concern are not statutorily protected but are considered in management decisions. Up-to-date information on the state ETS list can be found on the DNR's <u>ETS website</u>. Vegetation management decisions will comply with federal laws, including the Endangered Species Act, state laws, and Department listed species direction.

The DNR has a leadership role in the administration and application of MN ETS list species statutes and associated rules. Information on rare species in MN is available on the <u>*Rare Species Guide* website</u>.

GDS-3E Strategies

- Provide DNR staff access to the Natural Heritage Information System (NHIS).
- Incorporate new rare features inventory information as it becomes available.
- Consult the rare features database (NHIS) prior to all management activities (e.g., appraisal, harvesting, stand development work, etc.).
- When ETS species are present, follow joint coordination processes to coordinate with DNR specialists to design management to prevent the take of federally and state-listed species.
- Refer to Department ETS list species guidelines as they become available.
- Consult the *rare species guide* when appropriate.
- Protect and enhance rare features during management activities.
- Use management to mitigate the effects of climate change on ETS list species.

GDS-3F: Protect, maintain, or enhance rare native plant communities in the Section.

Minnesota's NPCs are ranked based on NatureServe's Conservation Status Rank system (S-Rank), indicating the relative rarity or endangerment of the NPC statewide. These ranks are:

- S1 critically imperiled
- S2 imperiled
- S3 vulnerable to extirpation
- S4 apparently secure; uncommon but not rare
- S5 secure, common, widespread, and abundant

Some NPCs with ranks of S3 or lower are also considered globally imperiled, as indicated by corresponding "G-Ranks". More information on status ranks, including a complete list of S-Ranks and G-Ranks by NPC, is available on the <u>DNR native plant community classification webpage</u>.

In addition to status ranks, NPC condition ranks indicate the quality of NPC occurrences. NPC condition is ranked on a continuum from A through D, with an A rank indicating an excellent quality NPC and a D rank indicating a poor quality NPC. Consult the appropriate regional ecologist for more information on condition rank definitions.

GDS-3F Strategies

- Maintain or enhance the characteristics that contribute to a C or greater condition rank for S1 through S3 NPCs.
- Apply special management to stands identified as the highest quality examples of rare NPCs (rank B or above, depending on NPC).
- Coordination between Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources staff will determine treatments needed to protect, maintain, or enhance the ecological integrity of rare NPCs.
- Consider swapping stands, when possible, to protect, maintain, or enhance high-quality examples of rare NPCs.
- Utilize existing access routes and landings, and avoid creating new access routes and landings in rare NPCs to the extent possible.

Special considerations

 UPs14 Southern dry savanna NPC class and its associated types are an important rare native plant community (S1 to S2 conservation status ranks). It is found on rare geologic features such as within the Sand Dunes State Forest and within High Conservation Value Forests throughout the MIM Section. Coordination between the Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources staff is important to design management within these sites to protect, maintain, and enhance the characteristics found within this NPC.

GDS-3G: Represent all native plant community class growth stages on state lands.

Growth stages are successional stages within a native plant community class that develop over time following an initial stand-establishing disturbance. Plant and animal species utilize various growth stages in different ways.

This SFRMP does not establish acreage goals for growth stages by ecosystem type or native plant community. Young and mature growth stages are represented on a variety of DNR-administered lands. Older forest stages are represented in designated old-growth stands and in some protected areas such as state parks and SNAs.

GDS-3G Strategies

- Look for opportunities to maintain and/or develop characteristics of under-represented growth stages.
- Consider the contribution of inoperable stands and reserved areas (e.g., old growth, SNAs, state parks) in providing representations of growth stages when developing prescriptions.

GDS-3H: Ensure young, early successional forest is distributed across the landscape over time.

The 0-30 year age group of aspen, balm-of-Gilead, birch, and jack pine cover types represents young, early successional forest in this plan. The goal of balancing age class distributions in even-age managed cover types determines the amount of young forest sustained over time. Young, early successional tree species are also present in other cover types.

In this planning period, sufficient young forest is being created and maintained in the MIM Section through the implementation of the strategic direction and the 10-year stand exam list. Management opportunity areas that are a part of this plan provide further direction for the management of some young, early successional forests for wildlife species (e.g., ruffed grouse management areas). Management opportunity areas are summarized, with links for their management guidance documents, in <u>Appendix E.</u>

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3.4 Wildlife Habitat

The GDS and Strategies in this section address Issues: <u>A2</u>, <u>B1</u>, <u>B2</u>, <u>D2</u>, <u>E1</u>, <u>F1</u>, <u>G1</u>

GDS-4: Provide a variety of vegetation conditions and habitat components at multiple scales simultaneously to support wildlife species found in the Section.

Game and nongame wildlife populations reflect the biological health of the forest and are important to society for their inherent values. Both natural events and forest vegetation management have the potential to affect wildlife species positively or negatively, as well as provide a variety of habitats for short-distance and long-distance migrants. A range of vegetation conditions and components of species' habitats are provided in the MIM Section through a variety of mechanisms:

- Some species associated with older forest are provided for in statutory preserves, old-growth stands and old forest complexes, inoperable or unmerchantable stands, management regimes that allow older rotation ages and greater reserve amounts on Fish & Wildlife administered land, stands that are not harvested at rotation age for a variety of reasons, and on other ownerships (see GDS-3A for additional examples).
- **Species associated with younger forest** are provided for on state lands and other ownerships in timberlands that are regenerating after harvest.
- **Structural elements within stands that many species depend on** are provided through the application of MFRC site-level guidelines and strategies in this plan.
- **Some individual species' needs** are addressed through state and federal laws and Department policies and guidelines.
- Wildlife management areas (WMA) provide habitat and values for various wildlife species.

Overall, providing a diversity of forest characteristics and forest stand age classes will help support wildlife species with different habitat requirements. Strategies in this section provide additional, specific guidance related to wildlife habitat in the MIM Section.

Through this planning process, management opportunity areas (MOAs) focused on providing wildlife habitat at landscape spatial scales were adopted. These include ruffed grouse management areas and open landscape management areas. Summary information for all MOAs and links to their guidance documents are in <u>Appendix E</u>.

GDS-4 Strategies

- Emphasize wildlife habitat values when conducting management and timber harvests within wildlife management areas.
- Manage to retain the integrity of riparian areas and protect wetlands.
- Provide for some of the needs of species that depend on perches, cavity trees, bark foraging sites, and downed-woody debris through the application of MFRC site-level guidelines.
- Apply management recommendations for wildlife species' habitats in DNR guidelines and policies.

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- Provide for the needs of species associated with conifer stands and mixed conifer/hardwood stands. Opportunities include:
 - o Selection harvesting and reducing basal area on some red pine stands on WMAs.
 - Increasing acres of long-lived conifer cover types through active management or allowing some stands to naturally succeed to conifer types.
 - o Increasing mixed forest conditions in some stands through selection harvesting.
- Provide some site-specific benefits for game and nongame species through Management Opportunity Areas.

3.5 Riparian and Aquatic Areas

The GDSs and Strategies in this section address Issues: A2, B1, F1, G1

Riparian areas encompass the transition zone between the terrestrial and aquatic habitats that occur along lakes, streams, and open-water wetlands. A riparian management zone (RMZ) is a portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs.

GDS-5A: Manage riparian areas to provide vegetation conditions associated with habitat for fish, wildlife, and plant species.

GDS-5A Strategies

- Retain a relatively continuous forest cover for the protection and maintenance of aquatic habitat types, aesthetics, recreation, and forest products.
- Manage to maintain or increase old forest characteristics in riparian areas.
- Emphasize conifers to maintain shade, where appropriate, and discourage species beavers prefer, such as aspen and birch, in the RMZ of designated trout streams.
- Refer to Minnesota's <u>Wildlife Action Plan</u>, the MFRC's Riparian Science Technical Committee's <u>Analysis of Current Science Behind Riparian Issues</u>, and other applicable research for information on managing riparian areas for wildlife and other ecological considerations.

GDS-5B: Protect wetlands and seasonal ponds during forest management.

Wetland areas include lowland forested areas, lowland brush and lowland grass cover types, and seasonal ponds. These areas are protected using different MFRC site-level guidelines than those required for riparian areas adjacent to lakes, streams, and rivers or permanent open-water ponds.

GDS-5B Strategies

- Meet or exceed MFRC site-level guidelines to emphasize the protection of water quality and wetland health.
 - Verify that landing locations are appropriate (e.g., avoid wetlands) based on the cover type.

- Check the application of wetlands and seasonal pond guidelines as a part of the stand exam review, timber sales supervision, and inspections.
- Maintain canopy cover around seasonal ponds.
- Favor reserves in locations around wetland habitats to maintain ecosystem functions.

3.6 Timber Productivity

The GDS and Strategies in this section address Issues: **B1**, **B4**, **H1**

GDS-6: Increase timber productivity and quality on state timberlands.

GDS-6 Strategies

- Move toward harvesting stands in even-age managed cover types at their rotation ages (<u>Appendix</u> <u>F</u>).
- Use site preparation, inter-planting, release from competition (e.g., herbicide application or mechanical/hand release), and tree protection.
- Consider alternative approaches to minimize the use of pesticides (herbicides, insecticides, etc.).
 - Consider mechanical site prep (e.g., roller chopping) and release (e.g., brush saw) to control competition where feasible.
 - Follow operational standards to control competing vegetation or forest insects and diseases on state lands.
- Apply selection harvest treatments and thinning to increase tree quality and forest health.
- Continue to improve, implement, supervise, and enforce current DNR timber sale regulations to protect and minimize damage to sites or residual trees from treatment activities.
- Manage certain stands for large-diameter, high-quality products by retaining adequate stocking and basal area.

3.7 Forest Pests, Pathogens, and Non-native Invasive Species

The GDSs and Strategies in this section address Issues: **B1**, **H1**, **I1**, **I2**

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

Forest management will not attempt to eliminate native insects and diseases or their processes from the landscape but rather 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. Addressing native and non-native insects and diseases in forest management planning and activities can significantly reduce or avoid many adverse economic and environmental impacts on Minnesota forests.

GDS-7A Strategies

- Identify and monitor insect, disease, and non-native invasive species populations as part of the forest health monitoring program, and document their occurrence on state-managed lands.
- Involve private landowners and local units of government in gathering and disseminating information.
- Consider the least intensive site preparation, release, and timber stand improvement methods possible to ensure success.
- Apply recommended strategies from DNR forest health specialists as appropriate.
- Provide information and training to operators and contractors regarding techniques that minimize damage to retained trees (e.g., leave trees or crop trees) and minimize the spread of invasive insects, diseases, and plants consistent with Department policy and direction on the management of invasive species.
- Consider implementing prescribed burning to improve stand health as a tool to prevent or control the effects of insect and disease outbreaks.
- Buckthorn is a significant concern within the central and southern portions of MIM. Based upon site level conditions, plans and strategies to control buckthorn, pre- and or post-timber harvest, should be considered and implemented as appropriate.

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

Wildlife species such as deer, hare, rabbits, porcupines, beaver, pocket gophers, and other rodents impact forests and plant regeneration through browsing, stem damage, and girdling. The management strategies below attempt to minimize adverse impacts.

GDS-7B Strategies

- Consider the potential for wildlife impacts on planted or naturally regenerating trees before damage occurs.
 - 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.
- Favor conifer species in riparian areas to discourage beaver activity.
- Use mitigation techniques on sites where damage from wildlife is anticipated.
 - Seed or plant more heavily to account for expected mortality.
 - o Seed or plant a mix of species rather than a single species.
 - Plant less palatable species along site edges and susceptible species away from surrounding vegetation types preferred by herbivores.
 - Use protective measures such as fenced enclosures, bud capping, repellents, tree shelters, etc.

3.8 Climate Change

The GDS and Strategies in this section address Issues: <u>B1</u>, <u>B2</u>, <u>B5</u>, <u>F1</u>, <u>G1</u>, <u>H1</u>, <u>J1</u>

GDS-8: Use best-available science to increase the resilience of forests and help them adapt to climate change.

Minnesota DNR recognizes that climate change is occurring at a rate that exceeds historical levels and will have serious implications for people and the natural world.

Most tree species in Minnesota reach at least one of the limits of their geographic distribution within the boundaries of the forested portion of the state. Projections of future tree distributions can help guide climate change adaptation.

Although the effects of climate change on forest vegetation at the ecological section scale are uncertain, the following strategies will help monitor and adapt to the projected effects of climate change.

GDS-8 Strategies

- Maintain or increase species and structural diversity.
- Consider increasing climate-adapted species within stands appropriate for the NPC. Examples include:
 - increasing the number of species within a stand projected to do well in response to climate change
 - o increasing genetic diversity of trees seedlings planted for species found within stands
- Maintain refugia for species that cannot migrate.
- Maintain connectivity of islands of habitat that allows the migration of plants and animals.
- Enhance genetic diversity in planting and seeding. Evaluate site conditions with respect to climate change when selecting tree species for regeneration or conversion appropriate to the NPC.
- Maintain or increase canopy cover with NPC-appropriate species within riparian areas adjacent to cold water streams to provide shade and a cooling effect in warm weather and retain snowpack longer, slowing discharge in the spring.

3.9 Visual Quality

The GDS and Strategies in this section address Issues: B1, K1

GDS-9: Minimize forest management impacts on visual quality in sensitive areas.

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

GDS-9 Strategies

- Apply MFRC site-level guidelines for visual quality, including:
 - Minimize visibility of harvest areas along travel routes, recreation routes, campgrounds, and day-use areas with moderate or high sensitivity ratings.
 - o Avoid management operations during periods of peak recreational use whenever possible.
 - Locate landings, areas of heavy slash, roads, and trails to minimize visibility from nearby vantage points, such as scenic overlooks, streams, and lakes.
 - Consider species, wind-firmness, and retention style (e.g., clumped) to maintain long-lasting visual quality along identified high visual quality roadways.

3.10 Access to State Land

The GDS and Strategies in this section address Issues: K1

GDS-10: Plan forest access routes and collaborate with federal, tribal, private, and local units of government to share access and minimize new construction.

GDS-10 Strategies

- When planning access routes:
 - o use existing access routes where possible
 - o control access to limit conflicts with recreation
 - o eliminate unnecessary access routes
 - o minimize forest land area lost to road development
- Cooperate with other landowners to retain existing access to State land and coordinate new road access.
- Close access routes at the conclusion of management activities when appropriate.
 - Avoid access routes across sensitive areas when practicable.
 - Follow joint coordination policies and procedures where access routes occur in sensitive areas.
 - If the only reasonable access to stands to be treated is across sensitive areas, then strive to minimize impacts.

3.11 Cultural Resources

The GDS and Strategies in this section address Issues: L1

GDS-11: Protect cultural resources on state-administered lands.

Cultural resources are usually remaining evidence of past human activities. To be considered important, a cultural resource generally has to be at least 50 years old. They often possess spiritual, traditional, scientific, and educational values. In addition to federal and state laws that protect certain types of cultural resources, the MFRC site-level guidelines provide information and recommendations to assist private and public land managers in taking responsible actions when cultural resources are encountered.

GDS-11 Strategies

• Annual stand exam lists are reviewed by DNR archeologists. Recommendations for mitigation are implemented as part of the sale design.

3.12 Natural Disturbance Events

The GDS and Strategies in this section address Issues: M1

GDS-12: Promptly evaluate and determine an appropriate response to natural disturbance events on state land.

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. Where quick action is needed to salvage harvest timber from damaged stands, the annual plan addition process, including interdisciplinary coordination and public notice, will be used.

GDS-12 Strategies

- The Department will evaluate large-scale (hundreds to thousands of acres) disturbance events to determine appropriate action.
 - Assess the extent and significance of the event on forest lands in the Section.
 - Recommend forest management actions.
 - o Analyze effects on planned volume offered.
 - When possible, cooperate in the assessment and implementation of management actions with other agencies and landowners.
 - Communications protocol:
 - Initial notification/Call to action: Responsible land manager calls a meeting of decisionmakers of all affected divisions within the first few days after the initial assessment.
 - Follow-up and evaluation: complete a multi-discipline After Action Review at the request of the regional manager.
- Local land managers will evaluate and determine appropriate actions for small-scale (tens of acres) disturbance events and take the appropriate action needed to address the situation.

3.13 Management Opportunity Areas

Management opportunity areas (MOAs) are areas on DNR-administered lands that offer an opportunity to maintain or create spatial patterns to address natural resource values that are difficult to achieve at the stand level or through the normal stand development process. They contribute toward meeting goals in this plan, including providing wildlife habitat for a range of species (e.g., ruffed grouse management areas), providing older forest and older forest characteristics distributed throughout the Section (e.g., old forest management complexes), and considering species of special concern or conservation need in management (e.g., northern forest owl MOA).

Preliminary MOAs were incorporated in the modeling to create the DNR's 10-year stand exam list for fiscal years 2021-2030. For some MOA types, cover type harvest age and the percent of stand area reserved from harvest differed compared to standard DNR management on non-school trust lands (see <u>Appendix F</u>). On school trust lands within MOAs, standard DNR management rotation ages and reserve amounts apply unless otherwise specified in the Management of School Trust Lands Operational Order (see <u>Appendix F</u>). In practice, MOA reserve amounts can be applied on average at the MOA scale to meet MOA objectives.

As part of developing this SFRMP, the preliminary MOAs included in the stand exam list modeling in the MIM Section were evaluated by DNR staff and managers in the Divisions of Ecological and Water Resources, Fish and Wildlife, and Forestry. As a result of that review process, MOAs and MOA guidance documents, which guide MOA implementation, were adopted in the MIM Section. Management opportunity areas will be implemented to the extent possible within the context of current policy and Department direction (e.g., Management of School Trust Lands Operational Order, Sustainable Timber Harvest decisions).

The full set of MOA management guidance documents for MIM is available on the <u>DNR's MIM SFRMP webpage</u>. Individual MOA guidance documents can be downloaded from the links in the tables for each MOA type in <u>Appendix E</u>.

Appendix A: FIM Managed Acres Query

Total Minnesota Department of Natural Resources (DNR) Administration with inventory data (in Forest Inventory Module) in the MIM Section = 154,246 acres

Source: DNR FIM April 2017

• Total managed acres = 106,336

Land administered by the DNR Divisions of Forestry and Fish and Wildlife, excluding state parks, Camp Ripley, the Boundary Waters Canoe Area Wilderness, scientific and natural areas, meandered waters, Metro Greenways, old-growth stands, stands in the Prairie Parkland planning unit, inoperable stands, TMBR_STAT=3 (inoperable flag in FIM), representative sample areas, and Fisheries-administered lands (except in Lake County)

 Total timberland forested cover types assigned managed acres in MIM = 33,317 acres. Excludes non-forest (lowland brush, marsh, lowland grass, muskeg, upland grass, water, flooded, others). Non-timberland forest cover types assigned managed acres = 73,096 acres. Stagnant and off-site forest cover types assigned managed acres = 668 acres. Forest cover type query: "MN_CTYPE" <> 0 AND "MN_CTYPE" < 75 OR "MN_CTYPE" = 81 Non-forest FIM query: "MN_CTYPE" = 0 OR "MN_CTYPE" > 81 Stagnant and offsite cover types FIM query: "MN_CTYPE" >= 75 AND "MN_CTYPE" <= 79

Appendix B: Summary of Issues and General Direction Statements

Table B.1: General direction statements (GDSs) that address each issue. The Cover Types column indicates whether one or more cover type accounts in section 3.1 address an issue. See below for a summary of each Issue and GDS, Chapter 2 for a full description of each issue, and Chapter 3 for a full description of each GDS.

	GDS																								
Issue	1A	1B	1C	2A	2B	3A	3B	3C	3D	3E	3F	3G	3H	4	5A	5B	6	7A	7B	8	9	10	11	12	Cover Types
A1	Х	Х	Х			Х						Х	Х												Х
A2		Х	Х			Х	Х		Х	Х	Х	Х		X	Х										
A3	Х							Х					Х												X
B1	Х	Х	Х			Х	Х	Х	Х	Х	X	Х	Х	X	X	Х	Х	Х	Х	Х	X			Х	X
B2	Х	Х	Х											Х						Х					Х
B3									Х		Х														
B4																	Х								Х
B5								Х	Х											Х					
B6								Х	Х																
C1	Х			Х																					Х
C2					Х																				
D1									х																
D2		Х	х			х								X											Х
E1							х		X	x	Х			X											
F1	х	Х	х			х	X	X	X	X			x	X	х	Х				Х					
G1														X	X	X				X					
H1																	х	x	х	X					X
11																	~	X	~	~					X
12																		X							~
12																								X	
13	Y	Y	Y				Y			Y										Y				~	Y
JI K1	^	^	^				^			^										^	v				^
																					^	V			
																						X	N		
M1																							Х		

Summary of Issue Statements

A. Forest Age and Growth Stages

A1. Representing growth stages and forest types across the landscape, given age class distribution goals.

A2. Managing for older forest and old forest qualities on the landscape.

A3. Managing for young, early successional forest.

B. Forest Composition, Structure, Spatial Arrangement, Growth Stages, and Native Plant Communities

B1. Addressing biodiversity, forest health, and productivity of native plant communities through management of forest composition, structure, representation of growth stages, within-stand diversity, and spatial arrangement of vegetative types.

B2. Determining which tree species to increase or manage within forest communities in the Section with respect to various natural resource objectives and projected environmental change.

B3. Maintaining or enhancing highly imperiled, imperiled, and vulnerable to extirpation native plant communities in the Section.

B4. Retaining characteristics of natural stand-replacement disturbance events while applying intensive management of forest communities.

B5. Using management to better reflect natural landscape patterns (the size and configuration of growth stages and types resulting from broad-scale natural disturbances) in the Section.

B6. Reducing forest fragmentation to maintain connectivity among habitat types.

C. Harvest Levels for Timber and Non-Timber Forest Products

C1. Contributing to sustainable timber harvest that meets the Department plan for offering timber volume while considering all forest resources and trust lands responsibilities.

C2. Managing non-timber forest products.

D. Biological Diversity

D1. Maintaining or enhancing biodiversity and native plant community composition, structure, and function through stand management within larger areas of biodiversity significance.

D2. Retaining or restoring within-stand structural complexity (e.g., vertical structure, stem size and density, coarse woody debris, and pit and mound micro-topography) when stands are harvested before reaching older growth stages in which these characteristics would normally develop.

E. Rare Features

E1. Protecting rare plants and animals (including endangered, threatened, special concern, and Species of Greatest Conservation Need), their habitats, and other rare features in the Section.

F. Wildlife

F1. Addressing the needs of game and nongame species through vegetation management.

G. Watersheds, including Riparian and Aquatic Areas

G1. Addressing the impacts of vegetation management on surface waters (wetlands, streams, and lakes).

G2. Addressing cumulative impacts of vegetation management on aquatic resources on a watershed or subwatershed level.

H. Timber Productivity

H1. Maintaining or increasing timber productivity on state lands.

I. Disturbance Impacts on Forest Ecosystems

- 11. Addressing disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.
- 12. Addressing non-native invasive species threats and invasions.
- 13. Considering catastrophic natural disturbances in vegetation management decisions.

J. Climate Change

J1. Managing vegetation to prepare for and respond to the effects of climate change.

K. Visual Quality

K1. Minimizing the effects of vegetation management activities on visual quality.

L. Access to State Land

L1. Providing access to stands identified for management.

M. Cultural Resources

M1. Protecting cultural resources during vegetation management activities on state-administered lands.

N. Balancing Vegetation Management Needs with Legal Requirements

N1. Including various state and federal legal requirements in the SFRMP planning process.

Summary of General Direction Statements

1. Forest Composition and Within-stand Diversity

GDS 1A: Maintain diversity of cover types.

GDS-1B: Manage within stands to reflect the composition, structure, and function of native plant communities.

GDS-1C: Maintain or increase the diversity of species, ages, and structures within stands.

2. Harvest Levels

GDS-2A: Manage stands to provide a sustainable supply of timber.

GDS-2B: Manage the availability of non-timber forest products.

3. Biological Diversity, Young and Old Forest, and Spatial Distribution

GDS-3A: Ensure older forest stands and older forest characteristics within stands are distributed across the landscape.

GDS-3B: Maintain or enhance vegetation conditions associated with known occurrences of Species of Greatest Conservation Need.

GDS-3C: Maintain existing large patches and increase average patch size on state lands over time, with consideration of natural spatial patterns. Identify ways to increase average patch size over time.

GDS-3D: Maintain or enhance vegetation conditions associated with existing biodiversity significance factors within MBS sites of high and outstanding biodiversity significance to the maximum extent possible.

GDS-3E: Protect, maintain, or enhance endangered, threatened, and special concern species and their habitats in the Section.

GDS-3F: Protect, maintain, or enhance rare native plant communities in the Section to the maximum extent possible.

GDS-3G: Represent all native plant community class growth stages on state lands.

GDS-3H: Ensure young, early successional forest is distributed across the landscape over time.

4. Wildlife Habitat

GDS-4: Provide a variety of vegetation conditions and habitat components at multiple scales simultaneously to support wildlife species found in the Section.

5. Riparian and Aquatic Areas

GDS-5A: Manage riparian areas to provide vegetation conditions associated with habitat for fish, wildlife, and plant species.

GDS-5B: Protect wetlands and seasonal ponds during forest management.

6. Timber Productivity

GDS-6: Increase timber productivity and quality on state timberlands.

7. Forest Pests, Pathogens, and Non-native Invasive Species

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

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

8. Climate Change

GDS-8: Use best-available science to increase the resilience of forests and help them adapt to climate change.

9. Visual Quality

GDS-9: Minimize forest management impacts on visual quality in sensitive areas.

10. Access to State Land

GDS-10: Plan forest access routes and collaborate with federal, tribal, private, and local units of government to share access and minimize new construction.

11. Cultural Resources

GDS-11: Protect cultural resources on state-administered lands.

12. Natural Disturbance Events

GDS-12: Promptly evaluate and determine an appropriate response to natural disturbance events on state land.

Appendix C: Cover Type Age Class Distributions

The charts in this appendix show the current age class distributions of forested acres as of 2021 for cover types listed in this plan in the Minnesota & North East Iowa Morainal (FIM 2017 used for STH). Acres under development (that are in the process of some management action) at the time of plan writing are indicated in each chart, as are stand-exam acres that are planned to be visited through 2030. Acres planned on the 10-year stand exam list are further broken out by generic preliminary prescriptions of Non-regeneration Harvest (e.g., thinning) or Regeneration Harvest (e.g., primarily clearcut with reserves for even-aged managed cover types and selection harvest for uneven-aged managed cover types).













Appendix D: Planned Acre and Volume Summary Tables

This appendix includes summary tables for volume estimates and planned acres from the 10-year stand exam list for the Minnesota & North East Iowa Morainal (MIM)Section. The 10-year stand exam list for the MIM Section was created at the same time as the 10-year stand exam lists for all other ecological planning sections. Additional details on modeling, stand selection criteria, and stand exam list results are available in the <u>Sustainable Timber Harvest: Development of the Minnesota Department of Natural Resources (DNR) 10-year</u> <u>Stand Exam List report</u>.

Table D.1: Planned acres and model estimated volume (cords) by DNR administrator within MIM on the Fiscalyear 2021-2030 stand exam list.

Administrator	Acres Planned	Modeled Volume
Forestry	6,018	85,176
Wildlife	6,674	92,521
Total	12,692	177,697

Table D.2: Cover type planned stand exam acres by DNR Division of Forestry administrative Area (3-digit Region/Area Number (RAN)) and land administering Division (FOR = Division of Forestry, FAW = Division of Fish and Wildlife) over FY 2021-2030 within MIM. SI = Site Index.

Cover Type	111	111	142	142	161	161	312	312	341	341	344	344	Total
	FAW	FOR	FAW	FOR	FAW	FOR	FAW	FOR	FAW	FOR	FAW	FOR	
Ash/Lowland hardwoods	4	51	0	0	0	54	46	53	0	0	138	6	352
Aspen/Balm of Gilead SI < 65	154	118	14	0	76	79	206	46	107	0	174	0	974
Aspen/Balm of Gilead SI > 64	63	239	0	0	40	40	206	124	111	0	353	0	1,176
Balsam fir	0	19	0	0	0	0	0	0	0	0	0	0	19
Birch	0	0	0	0	9	0	0	0	0	0	55	0	64
Black spruce lowland SI < 30	0	0	0	0	0	0	0	0	0	0	0	0	0
Black spruce lowland SI 30-39	0	0	0	0	0	0	0	0	0	0	0	0	0
Black spruce lowland SI 40+	0	0	0	0	0	0	0	0	0	0	0	0	0
Central Hardwoods	0	0	0	0	0	0	0	0	23	0	0	0	23
Northern hardwood	73	647	0	0	149	145	26	92	251	38	168	0	1,589
Oak	204	546	42	0	597	718	1,370	456	164	25	1,199	109	5,430
Offsite Oak	0	0	0	0	0	0	16	10	0	0	0	0	26
Offsite aspen	0	0	0	0	0	0	0	0	0	0	0	0	0
Jack pine	0	0	0	0	0	0	47	93	0	0	15	0	155
Red pine - natural origin	0	7	0	0	0	0	6	117	0	0	0	0	130
Red pine - planted	0	131	0	0	0	14	0	1,471	0	0	152	8	1,776
White pine	0	0	0	0	0	0	0	367	153	0	34	0	554
Stagnant black spruce lowland	0	0	0	0	0	0	0	0	0	0	0	0	0
Stagnant cedar	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarack SI < 40	0	21	0	0	0	0	0	0	0	0	62	0	83
Tamarack SI > 39	0	14	0	0	0	0	16	7	0	0	0	0	37
Upland black spruce	0	0	0	0	0	0	0	0	0	0	0	0	0
White cedar	0	0	0	0	0	0	0	2	0	0	0	0	2
White spruce	0	106	0	0	0	0	0	49	0	0	21	1	177
Misc. Conifer	0	0	0	0	0	0	0	0	21	6	0	0	27
Non-forest (grass or brush)	0	0	0	0	0	0	0	0	21	0	0	0	21
Total	498	1,900	55	0	977	1,050	1,937	2,885	850	69	2,372	124	12,717

Note: RAN 111=Bemidji Forestry Area; 142=Backus; 161=Park Rapids; 312=Little Falls; 341=Sandstone; 344=Lewiston

Appendix E: Management Opportunity Areas

Management opportunity areas (MOAs) are areas on Minnesota Department of Natural Resources (DNR)administered lands that offer an opportunity to maintain or create spatial patterns to address natural resource values that are difficult to achieve at the stand level or through the normal stand development process. They contribute toward meeting goals in this plan, including providing wildlife habitat for a range of species (e.g., ruffed grouse management areas), providing older forest and older forest characteristics distributed throughout the Section (e.g., old forest management complexes), and considering species of special concern or conservation need in management (e.g., northern forest owl MOA).

The full set of MOA management guidance documents for MIM is available on the <u>DNR's MIM SFRMP webpage</u>. Individual MOA guidance documents can be downloaded from the links in the tables for each MOA type below.

Old forest management complex (OFMC)

The conservation value of designated old growth can be further enhanced by managing additional stands around old-growth stands and their special management zones (SMZs) as OFMCs. Old forest management complexes complement and support values represented in the designated old-growth stands. They serve policy, management, and ecological purposes and include three elements: 1) designated old-growth or future old-growth stands, 2) SMZs around these stands, and 3) additional stands managed for older growth stage characteristics. Refer to the DNR Old Growth Forests Guidelines and amendments for more information. Map E.1: Location of old forest management complexes in the MIM Section.



Table E.1: Old Forest management areas in the MIM Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
Dead Lake	Park Rapids	579
Headquarters Road	Sandstone	396
Logger Lake	Bemidji	598
Long lake	Park Rapids	190
Safners's Trail	Sandstone	138
White Earth Hardwoods	Bemidji	1,900

Minnesota & NE Iowa Morainal SFRMP

Patch MOA (PATCH)

Older forest patches reduce habitat fragmentation and provide for some species dependent on large, continuous areas of older forest. They also help represent natural variability in patch size across the landscape. This plan includes four old, lowland conifer patch MOAs and one intermediate-aged upland deciduous patch MOA that is intended to provide older forest patch values in the future.



Map E.2: Location of patch MOAs in the MIM Section.

Table E.2: Patch MOAs in the MIM Section. Click on the name of a MOA to view or download its management guidance document (PIUD = patch intermediate upland deciduous; POLC = patch old lowland conifer).

Name	Fo	orestry Area	Total Stand Acres
Forest Interior	Be	emidji	1,970
Pickerel Hill Forest Interior	Pa	ırk Rapids	975

Open Landscape Management Area (OLMA)

Forests or patches of trees in these areas are managed to benefit species with open landscape habitat requirements. Forest stands on the edge of open landscapes may be harvested at or before standard DNR harvest ages to create regenerating trees that temporarily mimic brushland habitat. Map E.3: Location of open landscape MOAs within the MIM Section.



Table E.3: Open landscape MOAs in the MIM Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
Bluff Prairie (portions also located within Paleozoic	Lewiston	1,633
Plateau Section)		

Ruffed Grouse Management Areas (RGMA)

Ruffed grouse management areas are managed to supply all of the habitat needs of ruffed grouse, as well as other species with similar habitat requirements, such as woodcock, and maximize their abundance. These species need several age classes of certain forest cover types, especially aspen, within a relatively small area. Configuration of habitat elements within RGMAs is meant to maximize the abundance of grouse to provide quality hunting experiences around Hunter Walking Trail networks.



Map E.4: Location of ruffed grouse management areas in the MIM Section.

Table E.4: Ruffed grouse management areas (RGMAs) in the MIM Section. Click on the name of a MOA to view or download its management guidance document.

	Forestry	Total Stand
Name	Area	Acres
Hubble Pond	Park Rapids	3,412

Appendix F: Modeled Management Regimes

During landscape-scale planning, the DNR uses management regimes to develop strategic direction and standexam lists that will move forests toward desired conditions. Management regimes for even-aged managed cover types (in which trees within stands are the same age) include rotation ages (the age at which a forest stand is available for final harvest) and reserve amounts. Across the landscape, balancing the acres in each age class up to the rotation age while maintaining some acres over rotation age for habitat is the goal for even-aged managed cover types so that the forest benefits associated with each age class are available in perpetuity. For cover types that are typically managed uneven-aged, the aim is to develop age and structural diversity within stands by developing more than one age class.

In the STH analysis, model parameters that defined management activities (regimes) were necessarily simplified and generic and were meant to represent the average management activity in the average stand. Differences in management were incorporated into the analysis for the Division of Forestry and Division of Fish and Wildlife administered lands. During modeling to develop the 10-year stand exam list for each ecological section, including MIM, DNR leadership of the Divisions of Ecological and Water Resources, Fish and Wildlife, and Forestry, with input from project team members and field staff, made decisions on management regimes that further defined the STH model parameters. These included standard prescriptions by cover type, even-aged rotation ages and reserve amounts, and uneven-aged parameters by cover type, DNR administrator, and ecological section. In some cases, management regimes also differed within areas designated as needing management different from the standard regimes to provide particular forest resource benefits. Examples include areas with native plant communities that have global conservation ranks, old growth forest special management zones, and management opportunity areas (MOAs).

The modeled management regimes used to develop the 10-year stand exam list for the MIM section are reported below. It is important to remember that these simplified assumptions were necessary for the model, which cannot work with the nuance of site-level variation; however, in reality, sites may differ in their objectives and characteristics. While achieving the DNR's strategic direction depends on generally following these model assumptions, they do not represent rigid rules for site-level management. Some flexibility in the application of those parameters during management activities is necessary, which is purposefully undefined to maintain the ability of professional field staff to make their best judgments based on site-specific conditions.

Even-Age Management Rotation Age and Reserves Tables

Table Abbreviations:

- RA = rotation age
- SI = site index
- UE = managed uneven-aged (reserve amounts do not apply)
- RES % = percent of stand acres reserved from harvest

Special Management Area/Management Area Type	Abbreviation
Old growth special management zones	OG SMZ
Old forest management complex	OFMC
High conservation value forest modeled assuming low/medium harvest	HCVF Low/HCVF Med
Open landscape management area	OLMA
Ruffed grouse management area	RGMA
Forest Patch	РАТСН

Dashes indicate that standard DNR or Division of Fish and Wildlife management regimes apply for even-age managed cover types or that the cover type is managed uneven-aged.

Note: School trust lands follow standard rotation ages regardless of the land administrator.

	Stand	ard DNR	Fish an	d Wildlife	00	OG SMZ		MC	Patch		HCVF Low		OLMA	
Cover Type	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%
Ash/Lowland Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Aspen/Balm-of-Gilead – SI 65+	40	5	45	10	40	10	50	10	-	-	45	10	-	-
Aspen/ Balm-of-Gilead – SI < 65	50	5	45	10	50	10	55	10	-	-	50	-	-	-
Birch	45	5	45	15	45	10	50	10	-	-	45	10	-	-
Jack Pine	35	5	45	15	35	5	50	5	-	-	45	5	-	-
Black Spruce Upland	35	5	45	15	35	5	50	5	-	-	45	5	-	-
Balsam Fir	45	5	45	15	45	10	50	5	-	-	45	5	-	-
White Spruce Planted	50	5	45	5	-	-	50	5	-	-	45	5	-	-
White Spruce Natural	50	5	UE	UE	-	-	-	-	-	-	-	-	-	-
Black Spruce Lowland – SI 40+	80	5	80	10	80	5	80	10	-	-	80	10	-	-
Black Spruce Lowland – SI 30-39	100	5	100	10	100	5	100	10	-	-	100	10	-	-
Black Spruce Lowland – SI 23-29	120	5	120	10	120	5	120	10	-	-	120	10	-	-
Tamarack – SI 40+	85	5	85	5	85	5	85	5	-	-	80	5	-	-
Tamarack – SI < 40	85	5	85	5	85	10	85	5	-	-	80	5	-	-
Red Pine Planted – SI 65+	60	5	50	5	60	5	60	5	-	-	60	5	-	-
Red Pine Planted – SI 55-64	65	5	50	5	65	5	65	5	-	-	65	5	-	-
Red Pine Planted – SI < 55	70	5	50	5	70	5	70	5	-	-	70	5	-	-
Red Pine Natural	115	5	110	66	115	10	115	10	-	-	110	10	-	-
White Pine Planted – SI 65+	60	5	UE	UE	-	-	60	15	-	-	60	10	-	-
White Pine Planted – SI 55 – 60	65	5	UE	UE	-	-	60	15	-	-	60	10	-	-
White Pine Planted – SI < 50	70	5	UE	UE	-	-	60	15	-	-	60	10	-	-
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Oak – SI 75+	60	5	90	15	-	-	-	20	-	-	-	20	-	-
Oak – SI < 75	60	5	90	15	-	-	-	20	-	_	-	20	-	-
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-

	Sta	ndard DNR	Fisl Wi	n and Idlife	RG	GMA	HCVF	Med	UP	PLD	IN.	т	DI	MA	М	MA	OW	MA
Cover Type	RA	RES %	RA	RES %	RA	RES %	RA	RES %	RA	RES %	RA	RES %	RA	RES %	RA	RES %	RA	RES %
Ash/Lowland Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aspen/Balm-of-Gilead – SI 65+	40	5	45	10	45	10	40	10	40	10	40	10	-	-	-	-	-	-
Aspen/ Balm-of-Gilead – SI < 65	50	5	45	10	10	45	50	10	50	10	50	10	-	-	-	-	-	-
Birch	45	5	45	15	50	10	45	5	45	5	45	10	-	-	-	-	-	-
Jack Pine	35	5	45	15	-	-	40	5	40	5	40	5	-	-	-	-	-	-
Black Spruce Upland	35	5	45	15	-	-	40	5	40	5	40	5	-	-	-	-	-	-
Balsam Fir	45	5	45	15	-	-	45	5	45	5	45	5	-	-	-	-	-	-
White Spruce Planted	50	5	45	5	-	-	50	5	50	5	50	5	-	-	-	-	-	-
White Spruce Natural	50	5	UE	UE	-	-	50	-	-	-	-	-	-	-	-	-	-	-
Black Spruce Lowland – SI 40+	80	5	80	10	-	-	80	5	80	5	80	5	-	-	-	-	-	-
Black Spruce Lowland – SI 30-39	100	5	100	10	-	-	100	5	100	5	100	5	-	-	-	-	-	-
Black Spruce Lowland – SI 23-29	120	5	120	10	-	-	120	5	120	5	120	5	-	-	-	-	-	-
Tamarack – SI 40+	85	5	85	5	-	-	85	5	-	5	85	5	-	-	-	-	-	-
Tamarack – SI < 40	85	5	85	5	-	-	85	5	-	5	85	5	-	-	-	-	-	-
Red Pine Planted – SI 65+	60	5	50	5	-	-	60	5	60	5	60	5	-	-	-	-	-	-
Red Pine Planted – SI 55-64	65	5	50	5	-	-	65	5	65	5	65	5	-	-	-	-	-	-
Red Pine Planted – SI < 55	70	5	50	5	-	-	70	5	70	5	70	5	-	-	-	-	-	-
Red Pine Natural	115	5	110	66	-	-	110	5	110	5	110	5	-	-	-	-	-	-
White Pine Planted – SI 65+	60	5	UE	UE	-	-	60	5	60	5	60	5	-	-	-	-	-	-
White Pine Planted – SI 55 – 60	65	5	UE	UE	-	-	65	5	65	5	65	5	-	-	-	-	-	-
White Pine Planted – SI < 50	70	5	UE	UE	-	-	70	5	70	5	70	5	-	-	-	-	-	-
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oak – SI 75+	60	5	90	15	90	20	80	10	80	10	80	10	-	-	-	-	-	-
Oak – SI < 75	60	5	90	15	90	20	80	10	80	10	80	10	-	-	-	-	-	-
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Uneven-aged Management Regimes

The model used to develop the 10-year stand exam list selected stands for uneven-aged management based on criteria including cover type, site index, stand age, stand basal area, and the time since the last treatment. The following tables show uneven-aged management regimes included in the model used to develop the 10-year stand exam list. The "lock" numbers in each table represent the number of years that must pass after treatment before a stand is eligible for subsequent treatment. The treatment BA columns refer to the basal area at which a stand is eligible for treatment in the model. Parameters that do not apply to a given cover type or section are denoted "NA".

MIM Division of Forestry Uneven-aged Regimes

Note: Trust lands were modeled with Forestry regimes regardless of land administrator or management opportunity area type.

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	All	>= 70	NA	20
Central Hardwoods	All	>= 30	NA	20
Northern Hardwoods	> 40	>= 40	NA	20
White Pine (natural)	All	>= 45	NA	20
White Spruce (natural)	All	>= 80	NA	20

MIM Division of Fish & Wildlife Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Red Pine	>=65	>=40	NA	25
White Spruce	All	>= 70	NA	20
White Spruce Planted	All	>= 25	NA	10

MIM Old-Growth Special Management Zone (OG SMZ) Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	All	>= 60	NA	20
Central Hardwoods	All	>=75	NA	20
NH	All	>= 75	NA	20
Oak	All	>= 75	NA	20
White Pine	All	>= 60	NA	25
White Pine Planted	All	>= 30	NA	15
White Spruce	All	>= 55	NA	20

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
White Spruce Planted	All	>= 55	NA	20

MIM Old Forest Management Complex (OFMC), HCVF, and G1/G2* Low Harvest Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	All	>= 40	NA	20
Central Hardwoods	All	>= 75	NA	20
Northern Hardwoods	All	>= 75	NA	20
Oak	All	>= 75	NA	20
White Pine	All	>= 60	NA	20
White Spruce	All	>= 55	NA	20

*G1/G2 are NatureServe global conservation status ranks indicating a native plant community is critically imperiled or imperil

MIM Ruffed Grouse Management Area (RGMA) MOA Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
White Pine	All	>= 45	NA	20
White Spruce	All	>= 80	NA	20

MIM HCVF and G1/G2 Medium Harvest Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	>= 45	NA	>= 90	20
Central Hardwoods	All	>= 30	>=110	20
Northern Hardwoods	>= 40	NA	>= 110	20
Oak	>= 60	>= 50	NA	20
Oak	<= 55	>= 80	NA	20
White Pine	All	>= 45	NA	20
White Pine Planted	All	>= 30	NA	20
White Spruce	All	>= 35	NA	20
White Spruce Planted	All	>= 80	NA	20

MIM Older Forest Patch MOA Uneven-aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Northern Hardwoods	All	>= 30	>= 110	20
Oak	<= 55	>= 80	NA	20
White Pine Planted	All	>= 30	NA	20
Central Hardwoods	<= 55	>= 30	>= 110	20

Thinning Regimes

MIM Standard DNR Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	>= 60	Un-thinned	30	70
Central Hardwoods	>= 60	Thin1	45	70
Central Hardwoods	>= 60	Thin2	60	70
Northern Hardwoods	<=35	Un-thinned	30	70
Northern Hardwoods	<=35	Thin1	45	70
Northern Hardwoods	<=35	Thin2	60	70
Oak	All	Un-thinned	40	80
Oak	All	Thin1	55	80
Oak	All	Thin2	70	80
Red Pine	All	Un-thinned	25	90
Red Pine	All	Thin1	35	90
Red Pine	All	Thin2	45	90
Red Pine	All	Thin3	55	90
Red Pine	All	Thin4	65	90
Red Pine	All	Thin5	75	90
Red Pine Planted	All	Un-thinned	25	90
Red Pine Planted	All	Thin1	35	90
Red Pine Planted	All	Thin2	45	90
Red Pine Planted	All	Thin3	55	90
Red Pine Planted	All	Thin4	65	90
Red Pine Planted	All	Thin5	75	90
White Pine Planted	All	Un-thinned	25	90
White Pine Planted	All	Thin1	35	90
White Pine Planted	All	Thin2	45	90
White Pine Planted	All	Thin3	55	90
White Pine Planted	All	Thin4	65	90
White Pine Planted	All	Thin5	75	90
White Spruce Planted	All	Un-thinned	30	60
MIM Division of Fish and Wildlife Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	All	Un-thinned	50	65
Central Hardwoods	All	Thin1	70	70
Northern Hardwoods	All	Un-thinned	50	65
Northern Hardwoods	All	Thin1	70	85
Oak	All	Un-thinned	70	85
Oak	All	Thin1	90	105

MIM Ruffed Grouse Management Area (RGMA) MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Oak	All	Un-thinned	50	65
Oak	All	Thin1	70	85
White Spruce	All	Un-thinned	25	35
White Spruce	All	Thin1	40	50
White Spruce	All	Thin2	55	65
White Spruce Planted	All	Un-thinned	50	65
White Spruce Planted	All	Thin1	70	85

MIM HCVF and G1/G2 Medium Harvest Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Red Pine	All	Un-thinned	40	150
Red Pine	All	Thin1	55	150
Red Pine	All	Thin2	70	150
Red Pine	All	Thin3	85	150
Red Pine	All	Thin4	100	150
Red Pine	All	Thin5	115	150

MIM Older Forest Patch MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	>=60	Un-thinned	30	40
Central Hardwoods	>=60	Thin1	45	55
Central Hardwoods	>=60	Thin2	60	70
Oak	>=60	Un-thinned	30	40
Oak	>=60	Thin1	45	55
Oak	>=60	Thin2	60	70
Red Pine	All	Un-thinned	40	150
Red Pine	All	Thin1	55	150
Red Pine	All	Thin2	70	150
Red Pine	All	Thin3	85	150
Red Pine	All	Thin4	100	150
Red Pine	All	Thin5	115	150
White Pine	All	Un-thinned	40	150
White Pine	All	Thin1	55	150
White Pine	All	Thin2	70	150
White Pine	All	Thin3	85	150
White Pine	All	Thin4	100	150
White Pine	All	Thin5	115	150
White Spruce	All	Un-thinned	25	80
White Spruce	All	Thin1	40	80
White Spruce	All	Thin2	55	80
White Spruce Planted	All	Un-thinned	30	60

Glossary

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

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

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

Age class distribution: The proportionate amount of various age classes of a forest or forest cover type within a defined geographic area (e.g., ecological classification system subsection). A cover type age class distribution is **balanced** when it has an even number of acres in each age class (usually 5- to 10-year increments) up to the normal rotation age for the cover type.

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

Annual plan addition: Stands added to the stand exam list and released for public comment as needed throughout the year. Examples of reasons for APAs include insect, disease, animal, or environmental damage (e.g., storm or fire) that needs to be treated quickly; operational considerations such as harvesting a stand adjacent to a stand on the exam list, avoiding repeated entries to stands with limited or difficult access, and cooperating with adjacent landowners; and incorrect inventory, such as incorrect stand boundaries or cover type classification, for stands that should be harvested.

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

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

Assessment: A compilation of information about the trends and conditions related to natural and socioeconomic resources and factors.

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

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

Biodiversity Significance: The relative value, in terms of size, condition, and quality, of native biological diversity for a given area of land or water. (Adapted from Guidelines for MBS Statewide Biodiversity Significance Rank): The Minnesota Biological Survey (MBS) uses a statewide ranking system to evaluate and communicate the biodiversity significance of surveyed areas (MBS sites) to natural resource professionals, state and local government officials, and the public. MBS sites are ranked according to several factors, including the quality and types of Element Occurrences, the size and quality of native plant communities, and the size and condition of the landscape within the Site. Areas are ranked as Outstanding, High, Moderate, or Below the Minimum Threshold for statewide biodiversity significance.

Outstanding Sites: Those containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state.

High Sites: Those containing very good quality occurrences of the rarest species, high-quality examples of the rarest native plant communities, and/or important functional landscapes.

Moderate Sites: Those containing significant occurrences of rare species and/or moderately disturbed native plant communities and landscapes that have a strong potential for recovery.

Sites Below the Minimum Threshold: Those lacking significant populations of rare species and/or natural features that meet MBS 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.

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

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

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

Competition: The struggle between trees or other vegetation to obtain sunlight, nutrients, water, and growing space.

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

Conversion: Changing a stand or site from one cover type to another through management actions (active) or without management actions (passive).

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

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

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

Cover Type: Expressed as the tree species having the greatest presence, greater than 40% (i.e., in terms of volume for older stands or number of trees for younger stands), in a forest stand. A stand where the major tree species is aspen would be considered an aspen cover type.

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

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

Desired Future Condition (DFC): Broad vision of landscape vegetation conditions in the long-term future.

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

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

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

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

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

Ecological evaluation: A concise report containing descriptions of the significant natural features of a site, such as the flora, fauna, rare features, geology, soils, and any other factors that provide an interpretation of the site's history, present state and biodiversity significance. Management and protection recommendations are often included in these reports. Evaluations are produced by the Minnesota Biological Survey (MBS) at the completion

of MBS work in a given county or ecological classification system (ECS) subsection and are generally reserved for those sites with the highest biodiversity significance in a geographic region, regardless of ownership.

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

Ecological Section and Subsection: Section and subsection are levels within the DNR's Ecological Classification System (ECS). From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province --> Section --> Subsection --> Land Type Association --> Land Type Phase.

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

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

Enhance: To modify a vegetative community component for the purpose of favoring a certain function or value. For example, changing the structure of a degraded plant community to bring it closer to a native plant community.

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

Even-aged prescription: Planned forest management action that promotes the stand composition of trees of primarily the same age or age class. Examples of even-aged silvicultural treatments, or prescriptions, include clearcut and shelterwood harvests.

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

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

Forest Inventory Module (FIM): The FIM provides a database and application through which field foresters can maintain an integrated and centralized inventory of the forests on publicly owned lands managed by the Division

of Forestry and other DNR Divisions. In the field, foresters collect raw plot and tree data. Those data are summarized in stand-level data that are linked to a spatial representation of stand boundaries.

Forest land: Includes lands in the DNR forest stand inventory (Forest Inventory Module, or FIM), including cover types from aspen to stagnant conifers, muskeg, upland and lowland grass and brush, and other wetlands.

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

From: The Dictionary of Forestry. 1998. The Society of American Foresters. J.A. Helms, ed.

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

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

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

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

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

Fragmentation: Breaking up contiguous or homogeneous land cover through conversion to different vegetation types, age classes, or uses. Forest fragmentation occurs in landscapes with distinct contrasts between land uses, such as between woodlots and farms. Habitat fragmentation occurs when a contiguous or homogeneous forest area of a similar cover type and age is broken up into smaller dissimilar units.

Free to grow: When seedlings have grown taller than the surrounding competing vegetation.

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

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

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

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

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

Habitat: "The resources and conditions present in an area that produce occupancy – including survival and reproduction – by a given organism. Habitat is organism-specific; it relates the presence of a species, population, or individual (animal or plant) to an area's physical and biological characteristics. Habitat implies more than vegetation or vegetation structure; it is the sum of the specific resources that are needed by organisms." (Hall et al., 1997)

Herbivory: A plant-animal interaction whereby an organism eats some or all of a plant. Herbivory occurs both above and below ground. Dominant herbivores include beaver, deer, moose, hares, rabbits, small mammals, and forest tent caterpillars.

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

Intensive management: Intensity of management refers to the degree of disturbance associated with silvicultural treatments. In this plan, references to it range from less intensive to more intensive management. Examples of more intensive management are;

- 1) Site preparation techniques, such as rock-raking, that disrupt the soil profile and leave coarse woody debris in piles
- 2) broadcast herbicide use that eliminates or dramatically reduces herbaceous plant and shrub diversity
- 3) Conversions of mixed forest stands through clearcutting and/or site preparation that result in the establishment of a more simplified monotypic stand such as mostly pure aspen regeneration or high-density planted pine stands.

Minnesota & NE Iowa Morainal SFRMP

Examples where more intensive management may be needed are: to regenerate a site successfully to a desired species, control insect or disease problems, and wildlife habitat management (e.g., maintenance of wildlife openings).

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

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

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

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

Managed acres: Acres that are available for management purposes.

Management Opportunity Area (MOA): These are groups of stands intended to use vegetation management to provide opportunities to address values such as biodiversity, rare features, diversity of native plant community growth stages, and wildlife needs that can't be addressed through site-level management within individual stands.

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

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

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

Mesic: Moderately moist.

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

Minnesota Forest Resources Council (MFRC): The Minnesota Forest Resources Council is a state council established by the Sustainable Forest Resources Act (SFRA) of 1995 to promote long-term sustainable management of Minnesota's forests.

MFRC Voluntary Site-Level Forest Management Guidelines: A set of best management practices for timber harvesting and forest management on forested lands in Minnesota.

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

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

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

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

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

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

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

Non-forest land: Land that has never supported forests and land formerly forested where use for timber management is precluded by development for other uses such as crops, improved pasture, residential areas, city parks, improved roads, and power line clearings.

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

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

Non-timber forest products: Non-timber forest products, also known as special forest products, can be categorized into five general areas: foods, herbs, medicinal, decorative, and specialty items. Special forest products might include berries, mushrooms, boughs, bark, Christmas trees, lycopodium, rose hips and blossoms, diamond willow, birch tops, highbush cranberries, burls, conks, Labrador tea, seedlings, cones, nuts, aromatic oils, extractives.

Normal Rotation Age (NRA): For even-aged managed cover types, normal rotation age is based on the age of trees at which their average annual growth for some metric (height, basal area, diameter) is maximized. Normal rotation age also considers other available data related to forest productivity, wood quality, and local knowledge.

Older forest: A forest stand of any particular forest cover type is considered an older forest whenever its age exceeds the normal rotation age established for that cover type.

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

Old Forest Management Complex (OFMC): Represents an area of land made up of several to many stands that are managed for old growth, and their special management zones (SMZ), in the vicinity of designated old-growth stands.

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

Overstory: The canopy in a stand of trees.

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

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

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

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

Pulpwood: Wood cut or prepared primarily for manufacture into wood pulp or chips for subsequent manufacture into paper, fiberboard, or chipboard. Generally, trees five to 12 inches in diameter at breast height are used.

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

Rare plants: All species that are listed as Federally endangered, threatened, or as candidates for Federal listing; all species that are State listed as endangered, threatened, or special concern. Several rare species are also tracked, which currently have no legal status but need further monitoring to determine their status.

Rare animal: All animal species that are listed as Federally endangered or threatened, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened, or special concern. Several rare species are also tracked, which currently have no legal status but need further monitoring to determine their status. For example, some Species of Greatest Conservation Need (SGCN) have no legal status, but SGCN includes both listed and non-listed species.

Rare species: A plant or animal species that is designated as endangered or threatened at the federal or state level, designated as species of special concern by the state of Minnesota, Species of Greatest Conservation Need, or an uncommon native species that do not (yet) have an official designation, but whose distribution and abundance need to be better understood.

Refuge/refugia: Area(s) where plants and animals can persist through a disturbance event or as climate changes.

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

Release: Freeing seedlings from competition before they are free to grow.

Resilience: Ability for a forest ecosystem to respond and recover from a disturbance or change to maintain ecological function.

Resistance: Ability for a forest ecosystem to retain ecological function after a disturbance or change.

Restore: To return a stand, site, or ecosystem to its original structure and species composition through active management actions.

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

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

Rotation age: The age at which a forest stand (primarily even aged) receives its final harvest. This is an administrative decision based on economics, site condition, growth rates, and other facts.

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

Sapling: A tree that is one to five inches in diameter at breast height.

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

Scientific and Natural Area (SNA): Areas established by the DNR Division of Ecological and Water Resources to preserve natural features and rare resources of exceptional scientific and educational value.

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

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

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

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

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

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

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

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

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

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

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

Snag: A standing dead tree.

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

Special Management Area (SMA): An area that receives alternate modeling during stand selection and different treatment during management to account for values other than timber on the landscape. Different types of

special management areas are determined by statute (e.g., endangered and threatened species), by policy (e.g., old growth special management zones), or during the SFRMP process (management opportunity areas).

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

Species of Greatest Conservation Need (SGCN): Animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability, as defined in the state Wildlife Action Plan.

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

Stand age: In the DNR's forest inventory, the average age of the main species within a stand.

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

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

Stand selection criteria: Criteria used to help identify stands to be treated.

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

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

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

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

Sustainability: Protecting and restoring the natural environment while enhancing economic opportunity and community well-being. Sustainability addresses three related elements: the environment, the economy, and the

community. The goal is to maintain all three elements in a healthy state indefinitely. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

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

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

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

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

Timberland: Forestland capable of producing timber of marketable size and volume at the normal harvest age for the cover type. It does not include lands withdrawn from timber utilization by statute (e.g., Boundary Waters Canoe Area Wilderness) or administrative regulation such as designated old-growth forest and state parks. On state forestlands, this includes stands that can produce at least three cords per acre of merchantable timber at the normal rotation age for that cover type. It does not include very low-productivity sites such as those classified as stagnant spruce, tamarack, cedar, offsite aspen, or non-forestland.

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

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

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

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

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

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

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

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

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

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

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

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

Wildlife Management Area (WMA): Areas established by the Department of Natural Resources, Section of Wildlife, to manage, preserve and restore natural communities, perpetuate wildlife populations, and provide recreational and educational opportunities.

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