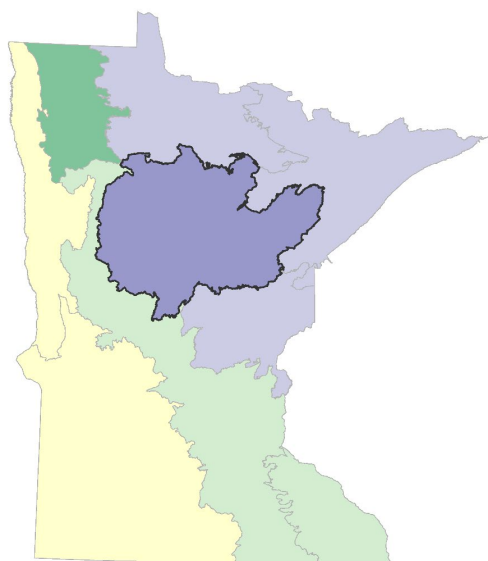

Northern Minnesota Drift and Lake Plains

Section Forest Resource Management Plan - DRAFT

MONTH, YEAR





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List of Abbreviations

Abbreviation	Description
APA	Annual plan addition
Con-Con	Consolidated-conservation land
CSA	Common stand assessment
DFC	Desired future condition
DNR	Department of Natural Resources
ECS	Ecological classification system
ELB	Eastern larch beetle
ETS	Endangered, threatened, and special concern species
EWR	Ecological and Water Resources Division
FAW	Fish and Wildlife Division
FIA	Forest inventory and analysis
FIM	Forest inventory module
FRIT	Forest resources issues team
FSC	Forest Stewardship Council
GDS	General direction statement
GIS	Geographic information system
HCVF	High conservation value forest
LUP	Land utilization program
MBS	Minnesota Biological Survey
MFRC	Minnesota Forest Resources Council
MOA	Management opportunity area
NHIS	Natural heritage information system
NPC	Native plant community
OFMC	Old forest management complex
RAN	Region area number
RGMA	Ruffed grouse management area
RMZ	Riparian management zone
RSA	Representative sample area
SFI	Sustainable Forestry Initiative
SFRMP	Section Forest Resource Management Plan
SGCN	Species in Greatest Conservation Need
SI	Site index
SMZ	Special management zone
SNA	Scientific and natural area
STH(A)	Sustainable Timber Harvest (Analysis)
WMA	Wildlife management area

See the [Glossary](#) 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 [Northern Minnesota Drift and Lake Plains \(MDLP\) Ecological Section](#). 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 MDLP Section. This plan replaces the two plans that formerly covered the MDLP Section: [the Chippewa Plains-Pine Moraines and Outwash Plains SFRMP and the portion of the “North-4” SFRMP that overlapped the St. Louis Moraines and Tamarack Lowlands Subsections](#).

Narrative SFRMPs are components of the DNR’s Forest Resource Management Plan System (Plan System), which is also comprised of the DNR’s forest management strategic direction and 10-year stand exam list. The strategic direction is designed to move DNR-administered forest lands toward conditions that ensure statutory requirements are met while balancing multiple values and providing associated benefits in perpetuity. This DNR implements the strategic direction by developing balanced forest age classes using timber harvest to transition older forests to younger forests. Sites to evaluate for potential timber harvest are planned on the 10-year stand exam list. Together, these components form the authoritative plan for vegetation management on DNR-administered forestlands within the management pool. Additionally, they communicate how we intend to address the values we manage to tribes, stakeholders, and the public.

The DNR’s forest management strategic direction and 10-year stand exam list for this planning period have already been completed. The strategic direction covers fiscal years 2019-2028, and the 10-year stand exam list includes two years of stand exams to ensure that interim lists are not needed while planning for the next plan period).^{1, 2} Within the Plan System, SFRMPs provide ecological Section-specific guidance for advancing landscape-level goals as we implement the 10-year stand exam list. SFRMPs are in place until replaced and are designed to cover a period of approximately 10 years.

During fiscal years 2021 through 2030, the DNR plans to evaluate and potentially offer timber sales from 216,800 acres in the MDLP Section, or approximately 21,700 acres per year, on average. This translates into an average estimate of 270,000 cords per year; however, actual cords offered per year from the MDLP Section may vary. Determinations about which stands on the stand exam list are included in offered timber sales, and how they should be harvested, are made based on field examinations and interdisciplinary coordination. Some stand exams will not result in offered timber sales based on conditions on the ground and stand objectives, and some stands that are not needed to meet planned volume may be released for planning in future years. Annual stand exam lists are available for public comment each year (see the DNR’s [annual stand exam lists webpage](#) for more information and to sign up for updates).

Guiding Principles for the SFRMP process

- Provide guidance for forest management activities that address landscape goals for ecological protection, timber production, and cultural/recreational values.

¹ The timing of SFRMP development in this planning cycle follows leadership decisions to put SFRMP on hold until the Sustainable Timber Harvest Analysis and 10-year stand exam list projects were completed.

² [Sustainable Timber Harvest: Development of the DNR 10-year Stand Exam List](#)

- Provide guidance to managers and foresters on implementing the forest management strategic direction.
- Ensure recommendations for vegetation management adhere to Department directions, guidelines, and policy.
- 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 MDLP Section.
- Consider and incorporate public input in the planning process.

Planning Outcomes and Summary

- As part of this planning process, management opportunity areas proposed in the Section 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.
- 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 forest 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 in management opportunity areas such as old forest management complexes and older forest patches, on Division of Fish and Wildlife administered lands, 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 and conifers, increasing forest age, and applying [Minnesota Forest Resource Council Voluntary Site-Level Forest Management Guidelines](#) in riparian areas.
- Forest cover type conversion goals in this plan emphasize decreasing a percentage of the aspen, ash, and white spruce cover types and increasing acres of lowland hardwoods, northern hardwoods, oak, jack pine, red pine, and white pine cover types. These goals are intended to increase resilience to climate change, provide wildlife habitat, and develop cover types on suitable NPCs. Aspen and lowland conifers (tamarack and black spruce) will continue to be the most abundant cover types in the Section.
- Additional topics addressed in the plan include: limiting damage from insects, disease, and non-native species; managing for endangered, threatened, and 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

State statutes, including the Sustainable Forest Resources Act ([Minnesota Statute 89A](#)), 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” ([Minnesota Statute 86A.05 Subdivision 8](#)). In addition, 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.

The 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 Lands Foundational to Forest Management

Throughout Minnesota, the DNR manages 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 such as 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. This 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 ([Minn. Stat. 127A.31](#)). Department policy provides direction on how to operationalize this constitutional and statutory directive (*DNR Operational Order 121: Management of School Trust Lands*). Investment income is distributed to the state’s public school districts annually to fund operations. There are approximately 745,750 acres of school trust lands in the MDLP Section.

University trust lands are managed to generate revenue for the permanent university fund. Investment income is distributed to the University of Minnesota annually, which is used to fund professorial chairs, scholarships for

students from the Iron Range, mineral and mineral-related research, a mining-related degree program offered through the University at the Mesabi Range Community and Technical Program, and scholarships for students to attend that program. There are approximately 5,200 acres of university trust land in the MDLP Section.

State Non-trust Lands

The DNR manages non-trust lands according to their applicable statutory purposes. In the MDLP Section, these lands primarily include consolidated conservation lands (1.7 million acres), Volstead lands (540 acres), and acquired lands (264,000 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 1.7 million acres of ConCon lands in the MDLP Section. These lands are statutorily managed for conservation purposes. The granting authority for Con-Con lands is under:

- Laws of MN 1929, Chapter 258 (Minn. Stat., secs. [84A.01](#) to 84A.11), which established the Red Lake Game Preserve in Beltrami, Lake of the Woods, and Roseau counties
- Laws of MN 1931, Chapter 407 (Minn. Stat., secs. [84A.20](#) to 84A.30), which covered lands in Aitkin, Roseau, and Mahnomen counties
- Laws of MN 1933, Chapter 402 (Minn. Stat., secs. [84A.31](#) to 84A.42), which covered a reforestation project in Marshall County.

Volstead lands were purchased from the federal government with funds appropriated by the Legislature. These lands carried unpaid county liens for drainage ditches intended to make the land suitable for farming but were unsuccessful. Income generated from DNR natural resource management on these lands is split evenly with the county. There are approximately 540 acres of Volstead lands in the MDLP Section. The granting authority for Volstead lands is under the Act of Congress, May 20, 1908 (“Volstead Act”) and the Act of Congress, May 1, 1958. Also, see [Laws of MN 1961, Ch. 472](#), as amended by [Laws of MN 1963, Ch. 390](#).

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 264,000 acres in the MDLP 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 (WMAs) are lands managed by the DNR Division of Fish and Wildlife as described in MN statute section [86A.05](#). They are developed and managed “...for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreational uses.” Wildlife management areas may include trust lands, which are managed to maximize long-term economic return to the trust while also incorporating WMA goals. Wildlife management areas cover approximately 74,642 acres in the MDLP Section.

State forest lands are lands managed by the DNR Division of Forestry as described in chapter [89](#). They are managed under the principles of multiple use and sustained yield 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, and other values. The Division of Forestry administers approximately 1,055,121 acres in the MDLP Section.

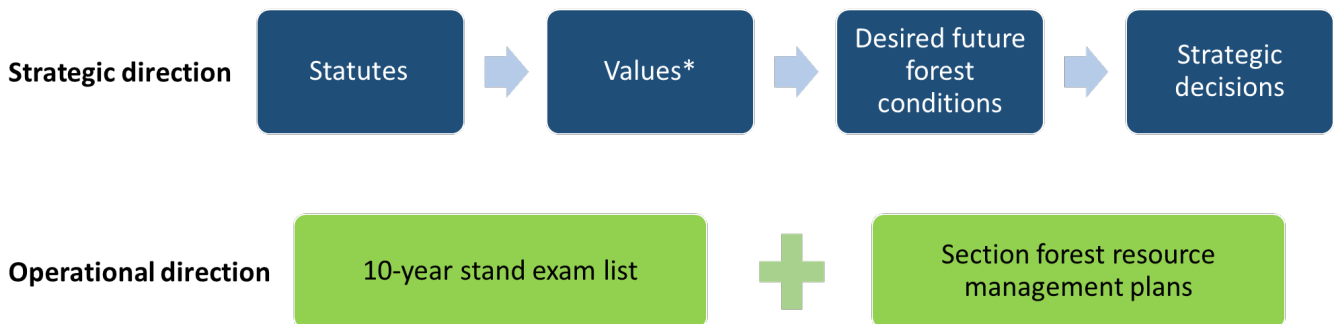
The DNR’s Forest Resource Management Plan System

The DNR’s forest resource management plan system guides forest management activities on state-administered 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 appropriately balance various values, including ecological protection, timber production, cultural/recreational resource use, and wildlife habitat.

The DNR's Forest Resource Management Plan consists of the following components:

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

Components of the DNR's Forest Resource Management Plan



*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.

This plan interacts with the other components of the Forest Resource Management Plan (the strategic direction and 10-year stand exam list) in the following ways:

- [Strategic direction documentation](#) includes information on strategic decisions and should be referenced when implementing the guidance in this plan.
 - Some outcomes of the STH analysis and 10-year stand exam list development processes specific to this Section, including cover type age class distributions, planned acres, rotation ages, and reserve amounts, are reported in this SFRMP.
- SFRMPs guide the implementation of the strategic direction and the 10-year stand exam list in the context of the NMOP Section.
 - This plan provides general direction and strategies to address multiple values while offering the planned amount of volume and managing stands on the 10-year stand exam list in the NMOP Section.
 - DNR foresters and partners from other divisions use general direction and strategies in this plan to make management decisions consistent with both the strategic direction and SFRMP goals.
- During modeling to develop the stand exam list, existing and draft MOA locations were consolidated statewide. The DNR developed and modeled silvicultural regimes to address MOA objectives and ran model scenarios assessing the harvest level impacts of those regimes.
 - SFRMPs communicate decisions about which MOAs are included in the plan and their final geography and provide guidance to staff on MOA implementation.

The strategic direction guides timber harvest statewide to address multiple forest management goals. As that strategic direction is implemented, DNR staff visit and evaluate stands on the stand exam list for potential harvest. Wildlife managers, ecologists, and foresters provide critical input at the site level using multiple sources of information, including resources present (e.g., rare species), site conditions, policies, and SFRMP goals. Through interdisciplinary coordination, DNR staff determine whether stands should be harvested, and for those that should be, develop site-specific prescriptions that protect and enhance biodiversity and wildlife habitat while meeting timber harvest goals. The strategies in Chapter 3 of this plan provide guidance to DNR staff on addressing those values in the NMOP Section.

For more information, visit the [DNR's sustainable analysis, decisions, and planning website](#).

Scope of this Section Forest Resource Management Plan (SFRMP)

This SFRMP provides guidance for vegetation management on DNR-administered forest lands in the Northern Minnesota Drift and Lake Plains (MDLP) Ecological Section, which contains the Chippewa Plains, Pine Moraines and Outwash Plains, St. Louis Moraines, and Tamarack Lowlands Subsections (Map 1.1; a detailed explanation of DNR's ecological classification system (ECS), including sections and subsections, is available on the [DNR ECS webpage](#)). 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 forest lands in the MDLP 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. Timberlands include cover types capable of producing merchantable timber and exclude very slow-growing trees (e.g., stagnant lowland conifers or offsite aspen). For this plan, managed acres are forest land acres available for management, excluding areas reserved as old growth, state parks, and scientific and natural areas (SNAs); inoperable stands; etc. (see [Appendix A](#) for the full FIM query for managed acres). Within the MDLP Section, approximately 1.07 million acres, or 91 percent, of DNR-administered forest lands are managed acres, representing approximately 20 percent of the total forest land across all ownerships in the Section.

Examples of forest resource management planning activities that are beyond the scope of SFRMPs include off-highway vehicle trail system planning, comprehensive road access plans, state park land management planning, old-growth forest designation, SNA establishment and management, 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 MDLP Section, taking into account the strategic direction for this plan period, including:

- **Desired Future Condition (DFC) Goals:**
 - These are short-term (10 years) and long-term (50+ years) changes in vegetation structure and composition.
 - DFCs are achieved through management activities, including no action, that will best move the forest landscape toward the goals for state forest lands.
 - DFCs for cover type age class distributions, and the harvest levels to develop or maintain them, 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 (GDS) and strategies**
 - General direction statements and strategies guide staff on what to consider when making decisions for stand-level 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 [Section 3.13 in Chapter 3](#) 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.
 - Management guidance documents developed for MOAs through SFRMP are included as appendices in this plan.

Staff Involved in Developing SFRMPs

The Division of Forestry is responsible for developing and maintaining SFRMPs. Division of Forestry planners work with personnel from DNR Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources 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 northwest (Region 1) FRIT oversaw staff work on the MDLP SFRMP planning effort. Additional staff, such as GIS or administrative specialists, support SFRMP planning as needed.

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 in the second step 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 distributed and implemented.

Table 1.1: Summary of the planning process for the MDLP SFRMP.

Steps	SFRMP Process Description
Step 1	<p>Initiating the Planning Process</p> <ul style="list-style-type: none"> • Assemble baseline assessment information and develop the Assessment document. • Establish a web page on the DNR website. • Update the mailing list of public/stakeholders. • Identify tribal coordination needs.

Steps	SFRMP Process Description
Step 2	<p data-bbox="272 279 505 310">Develop Draft Plan</p> <ul data-bbox="370 338 1455 548" style="list-style-type: none"> <li data-bbox="370 338 1101 369">• Add Section context to issues to be addressed in the plan. <li data-bbox="370 384 1455 457">• Develop strategies and desired future condition (DFC) goals consistent with the general direction statements and policy. <li data-bbox="370 472 1446 504">• Prioritize, develop, and/or revise Management Opportunity Area guidance documents. <li data-bbox="370 518 818 548">• Coordinate with tribes as needed.
Step 3	<p data-bbox="272 594 699 625">Plan Review and Comment Periods</p> <ul data-bbox="370 653 1455 1003" style="list-style-type: none"> <li data-bbox="370 653 1203 684">• Review the draft plan with regional and statewide DNR leadership. <li data-bbox="370 699 873 730">• Send draft plan to tribes for comment. <li data-bbox="370 745 1089 777">• Make the draft plan available to the public for comment. <li data-bbox="370 791 1414 865">• Summarize tribal and public comments and develop DNR responses; revise the draft plan in response to comments as appropriate. <li data-bbox="370 879 1455 953">• Present a summary of comments, responses, and plan revisions for the Commissioner’s approval. <li data-bbox="370 968 873 999">• Commissioner approves the final plan.
Step 4	<p data-bbox="272 1050 516 1081">Implement the Plan</p> <ul data-bbox="370 1098 1442 1213" style="list-style-type: none"> <li data-bbox="370 1098 704 1129">• Distribute the final plan. <li data-bbox="370 1144 1442 1213">• Provide plan implementation training to DNR staff involved in forest management and coordination.
Step 5	<p data-bbox="272 1266 412 1297">Monitoring</p> <ul data-bbox="370 1318 1446 1392" style="list-style-type: none"> <li data-bbox="370 1318 1446 1392">• Plans are periodically monitored to assess their implementation and effectiveness (see Appendix G for more information on SFRMP monitoring).

Other Planning Efforts

MFRC Regional Landscape Planning

This plan aligns with the goals and strategies related to vegetation management in the Minnesota Forest Resources Council (MFRC) [North Central Landscape Forest Resource Management Plan](#). By aligning with the corresponding MFRC plan, the goals and strategies for managing DNR-administered lands in this SFRMP incorporate recommendations from a broader landscape perspective across all ownerships. Having aligned goals and strategies assists cooperation across ownerships in this larger landscape area.

Planning Area Description

The MDLP Section consists of a total land area of approximately 8.5 million acres, including all or parts of the following counties: Koochiching, St. Louis, Beltrami, Polk, Clearwater, Itasca, Mahnomen, Cass, Hubbard, Becker, Aitkin, Wadena, Crow Wing, Carlton, Otter Tail, Todd, Morrison (Map 1.1). Much of the Section is rural, and it encompasses the small cities of Bemidji, Brainerd, and Grand Rapids. Forestry, tourism, and recreation, including hunting, fishing, snowmobiling, and skiing, are the most important land uses across the Section. Agriculture is locally important in the western and some areas of the eastern parts of the Section. Excluding water, most of the Section’s land area (approximately 72%) is covered by forest (based on 2016 National Land Cover data). Deciduous forests and woody wetlands are the dominant land cover classes in the Section (Table 1.2). Based on the DNR forest inventory, aspen, tamarack, lowland black spruce (stagnant and productive), red pine, and northern hardwoods are the most abundant timber species (Table 1.2).

Three tribal reservations intersect the Section. The Leech Lake Reservation is completely within MDLP and overlaps a large portion of the Chippewa National Forest, which is also primarily in MDLP. Roughly one-third of the White Earth Reservation overlaps the western edge of the MDLP Section, and a small portion of the northwest corner of the Fond du Lac Reservation overlaps the eastern edge of the Section.

The majority of land (55%) in the Section is owned by private individuals (91% of private land) and private industry (8% of private land). Approximately 42% of the land in MDLP is public and administered by federal, county, or state governments. The state of Minnesota administers 15% of the land in the Section. Tribes and the Bureau of Indian Affairs own approximately 1.3% of the land in the MDLP Section.

The DNR Division of Forestry administers most state-administered land in the Section (89%), followed by the Division of Wildlife (6%; Table 1.4). Over half, approximately 63%, 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 [MDLP SFRMP Assessment](#) document on the MDLP SFRMP Website.

Table 1.2: Generalized cover type composition of DNR-administered timber lands in the MDLP Section based on FIM inventory updated 2017 (including both managed and unmanaged acres – see [Scope of this SFRMP](#) above).

Cover Type Group	Acres	Percent
Aspen, birch, and balm-of-Gilead	350,382	39.4%
Lowland conifers (black spruce, tamarack, and white cedar)	306,541	34.4%
Northern hardwoods	90,497	10.2%
Pine (red pine, white pine, and jack pine)	81,391	9.1%
Ash and lowland hardwoods	44,634	5.0%
White spruce, balsam fir, and upland black spruce	16,648	1.9%
Total	890,093	100.0%

Map 1.1: Location of the Northern Minnesota Drift and Lake Plains Section.

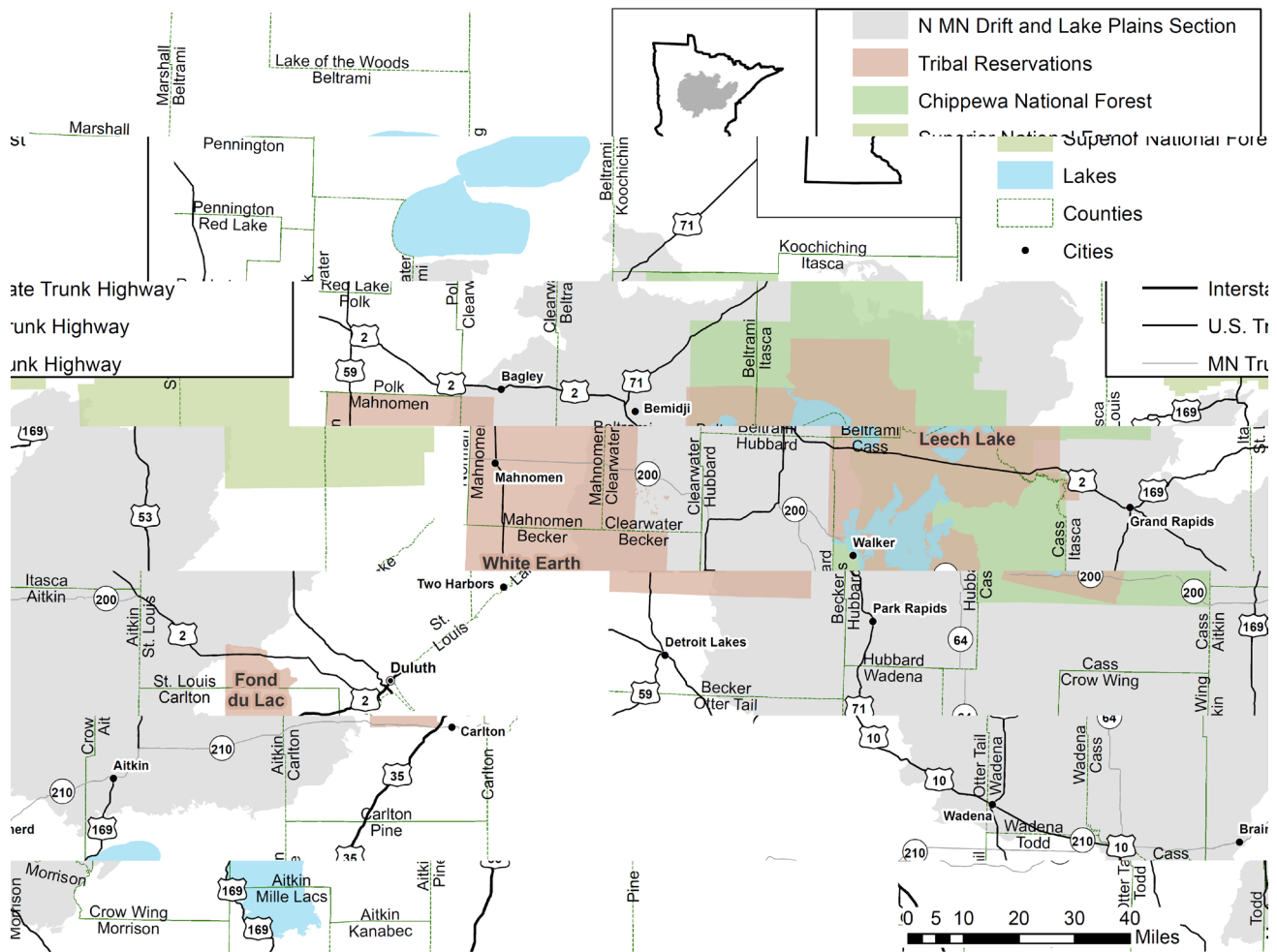


Table 1.3: Land ownership in the MDLP Section (acres; 2008 GAP Stewardship data).

Administrator Class	Acres	Percent
Private	4,742,033	55.4%
County/Other Public	1,610,229	18.8%
State-administered	1,325,203	15.5%
Federal	753,277	8.8%
Bureau of Indian Affairs	60,260	0.7%
Tribal	51,616	0.6%
Unknown	14,892	0.2%
Total	8,557,509	100.0%

Table 1.4: State-administered acres in the MDLP Section from the DNR’s forest inventory data (2017).

State Land Administrator	Non-trust	Trust	Total
Forestry	314,701	740,420	1,055,121
Fish and Wildlife	71,272	3,370	74,642
Camp Ripley	40,808		40,808
Parks and Trails	4,126	468	4,594
Water*	4,109		4,109
Ecological and Water Resources	1,914		1,914
DNR	59		59
Lands and Minerals	17		17

*Areas inventoried as open water.

Table 1.5: Acreages of state-administered forest lands in the MDLP Section (2017 DNR forest inventory data). Managed acres are those in the management pool (see [Scope of this Section Forest Resource Management Plan](#)).

School Trust Status	Forest Land	Timberland	Managed Forest Land	Managed Timberland
Trust	712,130	438,223	703,033	430,768
Non-Trust	459,371	330,981	364,437	257,125
Total	1,171,502	769,204	1,067,470	687,893

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.

Chapter 2: Issues Considered During SFRMP Planning

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 within the forest resources management planning scope, specifically those administered by the 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

Issues in this plan are addressed through management depending on the opportunities available, 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. [Appendix B](#) 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, 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.

DNR forest resource planning has long sought to balance acres between age classes up to standard rotation ages 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. At the same time, DNR-administered lands represent a broad range of growth stages and age classes on the landscape in various ways, including within-stand characteristics associated with older growth stages and stands representing older growth stages.

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

- vegetation conditions that maintain habitat for a wide range of plant and animal species
- greater potential to provide a sustainable yield of timber and a mixture of forest products
- ecological values, including healthier, diverse forest systems that are more resilient to insect and disease outbreaks and adverse effects of climate change

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, but are not limited to, stands that exceed the standard DNR rotation age for their cover type (see [Appendix F](#)); old forest characteristics such as large old trees and snags within younger stands or in reserves within harvested areas; older stands in state parks or scientific and natural areas; and designated old growth forests, which are high-quality representations of communities in the later stages of forest succession. Currently, an estimated 31% of DNR-administered managed timber acres in the MDLP Section that are managed even-aged are older than the rotation age for their cover type.

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

- vegetation conditions found in older forests or later successional growth stages provide habitat for some animal, plant, and fungi species
 - Examples within MDLP include bald eagle nest sites, goblin fern, ram's head and lady's-slipper orchids, Goldie's fern, Lapland buttercup, four-toed salamanders, northern goshawks, red-shouldered hawks, many songbird species, cavity-dependent species (waterfowl, including goldeneyes, mergansers, and wood ducks; mammals, including gray and flying squirrels; and

secondary cavity-nesting birds such as nuthatches, great crested flycatchers, and barred owls), and old-forest related mycorrhizal fungi and epiphyte species.

- Old, large-diameter aspen is particularly important to woodpeckers, fisher, bats, raptors, pine marten, and secondary cavity-nesting species.
- development of late-successional native plant community (NPC) growth stages
- stable hydrology and groundwater in relatively undisturbed older forests, especially lowland forests
- traditional use of resources associated with old forest and a broad suite of ecosystem services
- recreational and aesthetic value
- greater overall structural and species diversity on the forest landscape

A3. Managing for young, early successional forest.

Young, early successional forest is defined in this SFRMP as the 0-30 age class of aspen, balsam-of-Gilead, birch, jack pine, and tamarack cover types. Currently, an estimated 26.8% of DNR-administered managed timber acres in the MDLP Section are young forest.

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

- vegetation conditions that support associated plant and animal (game and non-game) species
 - Examples of species within MDLP associated with young or early successional forest for at least part of their life cycle include ruffed grouse, whip-poor-will, American woodcock, red-tailed hawk, golden-winged warbler, chestnut-sided warbler, mourning warbler, white-throated sparrow, song sparrow, rose-breasted grosbeak, wild turkey, white-tailed deer, black bear, and snowshoe hare.
- edges between young and more mature forest that some species depend on
- traditional use of resources associated with young forest
- depending on distribution, young forest in larger blocks provides opportunities to create contiguous habitat of uniform age
- future opportunity to harvest forest products and develop habitat components over time

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

Some aspects of this issue category, including landscape spatial arrangement, were largely 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, within-stand diversity, and spatial arrangement of vegetative types.

Why is this issue important?

- the composition and structure within individual stands and across the forest landscape provide habitat for plant and wildlife species

- forests with greater species and structural diversity support a greater diversity of plant and animal life
- a variety of patch sizes on the landscape provide a range of habitat and economic opportunities
- connectivity among patches of vegetation is important for plant pollination and migration and to allow for wildlife to access different habitat components required for their annual life cycles
- healthy, productive, and diverse forests have increased resilience to climate change and support forest economies
- protecting native biodiversity and forest health, and ensuring sustained forest productivity helps support the public's trust in DNR managing these lands

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?

- the distribution of specific tree species in the Section provides for different social, economic, and ecological values
- tree species diversity supports ecological function (including genetic diversity) within native plant communities
- the tree species present within stands can influence wildlife habitat, including fish habitat (for example, the presence of conifers near cold-water trout streams)
- natural regeneration capacity within stands depends on tree species diversity (for example, whether the species present will be capable of suckering, layering, producing stump sprouts, or providing seed), insect and disease susceptibility, and availability of large downed trees that can serve as nurse logs
- artificial regeneration (seeding and planting) provides opportunities to maintain, change, or diversify species composition within stands
- different tree species support a range of mycorrhizal relationships necessary for healthy soils and trees
- climate change projections may impact which cover types are most appropriate for future vegetation management decisions

B3. Maintaining or enhancing critically imperiled and imperiled native plant communities in the Section.

Certain native plant communities are of particular conservation concern in the Section because of one or more of the following factors:

- limited geographic range or extent
- small area of the range occupied
- limited number of occurrences or low viability of occurrences
- environmental specificity
- short or long-term trend
- scope and severity of major threats
- intrinsic vulnerability

Examples of these types of communities in the Section include FDC12a (S2 rank), FDC23a (G2, S1S2 rank), FDC34a (S2 rank), FDN43a (S2 rank), MHN44b (S2 rank) (see the [DNR NPC website](#) and DNR field guides to native plant communities for more information).

Why is this issue important?

- Rare plant communities can provide unique and critical habitats for specialist plant and animal species, some of which can also be rare or uncommon.
- The [Minnesota Forest Resource Council's Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers](#) (MFRC site-level guidelines) and the [DNR's third-party forest certification programs](#) recognize rare plant communities as considerations during forest management planning.
- These plant communities contribute to overall forest biodiversity and reflect the unique conditions created by interactions between biotic and abiotic factors within this Section.

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 tree species, controlling insect or disease problems, and managing wildlife habitats.
- Natural stand-replacement disturbances (e.g., wind, fire, insects) often result in variable levels of disturbance across a site. Retaining characteristics of natural stand-replacement disturbance events during intensive management can help ensure the following:
 - maintenance of a diversity of plant species, structural complexity, and soil health
 - that invasive species or aggressive native species don't spread after management
 - avoidance of negative impacts of altered hydrology and runoff in or near wetland systems
 - that legacies and refugia for species are present 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.

Why is this issue important?

- A variety of vegetation patch sizes and ages provide habitat for a variety of species that require different configurations of vegetation conditions. For example, ruffed grouse need small patches of multiple aspen age classes in close proximity, while red-shouldered hawks need large areas of contiguous older forest.
- Larger old patches have become relatively rare on the landscape, especially for some habitat types (e.g., older upland conifers).
- Large blocks of older forest conditions provide forest interior habitat for area- and edge-sensitive species.

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

Why is this issue important?

- Connectivity is important for species' access to habitat, including species that need interior forest habitat.
- Increased forest edge can promote invasive species, resulting in reduced biodiversity and ecosystem simplification.
- Forest fragmentation negatively affects area-sensitive species such as northern goshawks, red-shouldered hawks, and Connecticut warblers that are not found in smaller tracts of forest.

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 plan and 10-year stand exam list within the Section and supplemental guidance on how we contribute to the sustainable timber harvest through management decisions.

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, which, if not corrected, could decrease our opportunity to sustainably offer and harvest timber, as well as provide a consistent supply of other forest resource benefits and 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 natural resource 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:
 - support a healthy and competitive timber industry
 - provide a diversity of vegetation types and associated plant and animal species
 - maintain water quality and quantity
 - maintain soil health, structure, and biodiversity
 - sequester and store carbon and support climate adaptation
 - provide a wide array of recreational opportunities

C2. Managing non-timber forest products.

Demand for some non-timber forest products (e.g., balsam boughs and decorative trees) has been light but is increasing for others.

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

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
- complexes of high-quality wildlife habitat
- 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
- refugia for plant and animal populations, and other ecosystem services, as other areas experience extreme climatic or disturbance events
- 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. It supports and promotes soil health, habitat for wildlife, and regeneration of trees, ground layer plants, lichen, fungi, and bryophyte species.
- Components of structural complexity provide habitat attributes for wildlife.
- Some forest management practices can reduce within-stand structural complexity and diversity.
- Reserves on timber sales offer the opportunity to promote or retain within-stand structural complexity.

E. Rare Features

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

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.

- Without protection, some rare species could decline or become extirpated. It is difficult and expensive to recover species once they are in decline.
- DNR Department-wide direction establishes the DNR's role in advocating for the maintenance and protection of habitat for rare features 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 and 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 protect rare species and ensure that any management within high conservation value forest (HCVF) sites enhances or maintains the high conservation value(s) associated with the site.
- This Section contains concentrations of rare species, including bog adder's mouth orchid, goblin fern, narrow triangle moonwort, four-toed salamander, northern goshawk, and red-shouldered hawk.

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 depend on healthy forest ecosystems and are important to society.
- Legal mandates, stakeholder expectations, and DNR internal policies concerning wildlife require the ecological integrity of the forest to be maintained and enhanced.
- Healthy wildlife populations provide social benefits, including tourism, recreation opportunities, and benefits to public health.
- The abundance of public forest land in the MDLP Section 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 such as ruffed grouse, American woodcock, black bear, and white-tailed deer are sought by hunters, and species such as fisher, beaver, and bobcat are important to trappers.
 - The Section provides unique wildlife viewing and photography opportunities for sought-after species, including boreal chickadee, Connecticut warbler, pine grosbeak, red crossbill, white-winged crossbill, great gray owl, gray jay, gray wolf, northern hawk owl, black-backed woodpecker, three-toed woodpecker, pine marten, sharp-tailed grouse, spruce grouse, and a large number of warbler species. For example, the [Sax-Zim Bog](#), which harbors many of these species, draws birders from around the world and contributed an estimated 1.18 million dollars to the local economy during the winter of 2018-2019.
- Reduced availability of important habitats is a concern for several species, including listed and special concern species.

- For example, in the MDLP Section, reduced conifer cover affects species, including white-tailed deer, black bear, pine marten, fisher, spruce grouse, ruffed grouse, songbird species, and northern goshawk.
- As another example, many wildlife species depend on open landscapes or brushland habitats within or near the forest, including sharp-tailed grouse, yellow rail, sandhill crane, and bobolink.

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 animals (e.g., creek heel splitter, pugnosed shiner) and plants (e.g., snail seed pondweed, purple-flowered bladderwort) are negatively affected by changes to these factors.
 - These factors also have the potential to affect important recreational fisheries in this Section, including cool water fish species like walleye, northern pike, and trout.
- The MDLP Section harbors the greatest concentration of wild rice lakes and rivers in the state. Wild rice is a fundamental value to tribal communities in Minnesota and is an important food source for wildlife.
- Management activities may affect permanent wetlands adjacent to upland stands.
- Seasonal ponds are particularly important for maintaining populations of 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.
- 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 riparian areas.

G2. Addressing cumulative impacts to aquatic resources of vegetation management on a watershed or sub-watershed level.

During the sustainable timber harvest analysis project, the DNR assessed the effect of applying watershed goals* in various harvest level model scenarios and found that the impact on watersheds was low regardless of the harvest level scenario. While this relatively coarse analysis indicated little effect on watersheds, the project concluded that we do not have sufficient data or methodology to comprehensively assess the cumulative impacts of harvest on watersheds across ownerships. Because we do not currently have the data or methodology to evaluate the effects of different forest cover types and conditions on watersheds relevant to the direction provided in the SFRMP, this plan does not include specific future direction related to cumulative impacts to aquatic resources at a watershed or sub-watershed level. 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 [Chapter 3, Section 3.5](#)). While this issue goes beyond the scope of the SFRMP, it is included in this plan to acknowledge its relevance to forest management and illustrate how DNR forest resource management contributes to watershed health.

Refer to the [One Watershed, One Plan program](#) for more information on comprehensive watershed plans.

Why is this issue important?

- The MDLP Section contains all or parts of 18 major watersheds.
- Vegetation management activities and the amount of forest cover on the landscape affect watershed or sub-watershed hydrology.
- Land use has a significant impact on the type of vegetation and vegetation management distributed across the Section.

*Watershed goals were defined as a threshold of forest land in a young (<15 years old) condition on DNR-administered land within priority catchments. Priority catchments contain a Lake of Biological Significance, Designated Trout Stream, Protected Tributary to a Designated Trout Stream, Lake of highest Phosphorus Sensitivity, or highly erodible soils, and have at least 500 acres administered by the DNR, representing more than 5% of the catchment area.

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.
- The DNR uses timber sales design to accomplish many of the vegetation management goals and strategies in this SFRMP.
- Maintaining a variety of forest industries is a critical component of our ability to manage forests.
- Revenue from timber harvest provides funding to the Permanent School Fund and state and county governments.

I. Disturbance Impacts on Forest Ecosystems

I1. Addressing small- to intermediate-scale disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.

Why is this issue important?

- Insects and diseases can reduce timber production and lumber grade, increase fire hazard, and reduce recreational enjoyment of the forest.
- Insect outbreaks can be beneficial for some wildlife species, such as woodpeckers or the spruce budworm specialist Cape May warbler; however, widespread pest outbreaks may cause high levels of tree mortality with significant ecological and economic consequences.

- Natural disturbances, as well as disturbances resulting from management, 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 effects, including browsing and grazing by wildlife (herbivory).
 - Herbivory can adversely affect successful forest regeneration, with economic and management consequences. It can reduce herbaceous plant diversity, which is important for functions such as soil health, nutrient cycles, and small wildlife food sources.

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, and reduce resiliency.
- 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 stand-replacing 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 change the condition of wildlife habitat.
- They may affect the plan's short and long-term desired future condition (DFC) goals.
- Many native plant communities and plant and animal species are adapted to disturbances such as fire. For some communities and species, large-scale disturbances can support the natural regeneration of native tree and ground layer species and maintain ecosystem functions such as nutrient cycling.
- The timing and location of catastrophic events are difficult to predict.

J. Climate Change

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

Why is this issue important?

- Minnesota's climate has warmed over the last century, a trend projected to continue (see the [DNR's Climate Trends](#) webpage for more information).

- Potential effects of climate change may include:
 - changes in frequency and intensity of precipitation events and disturbances such as fires and windstorms (blowdown)
 - changes in the distribution and survival of plant and animal species
 - increased reproductive capability and survival of some non-native invasive species, insect pests, and pathogens that affect forests and wildlife
 - changes in the abundance and habitat of tree species, including:
 - potential reductions in habitat for tree species, such as balsam poplar, black spruce, and jack pine
 - potential expansion of habitat for some tree species, such as eastern white pine, northern red oak, and red and sugar maple
 - see the [Northern Institute of Applied Climate Science projections for the Minnesota Drift and Lake Plains](#) for more information
- 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 wetland forests such as peatlands, where sensitive soils and specialized plant species depend on a specific range of hydrologic conditions.
- 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, and money in or near forested areas.
- Visual quality is an important consideration for vegetation management activities conducted adjacent to recreational trails, lakes, waterways, or near public roads and highways.
- Visual quality affects public perceptions of vegetation management and thus is important to maintain public support for forest resource management.

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.

- Road development, construction, and maintenance can influence disturbance, forest fragmentation, spread of invasive species, hydrology, and soil compaction.

M. Cultural Resources

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

A cultural resource is an archaeological site, cemetery, historical structure, historical area, or traditional use area that is of spiritual, traditional, scientific, or educational value. Examples include the archaeological remains of a 2,000-year-old American Indian village, 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.
- Protecting cultural resources and supporting their appropriate use shows respect for tribal and public values and customs.
- 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.

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 on DNR-managed lands accounts for administrative land status and relevant statutes. 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.
- Habitat management and protection for the benefit of wildlife 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 acts.
- 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 state and legal requirements upholds the public trust in the DNR managing these resources sustainably.

Chapter 3: Forest Types and Management Direction

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 revenue (including 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 DNR policy. This direction is designed to cover a period of approximately 10 years; however, SFRMPs are in place until replaced.

Interdisciplinary DNR staff members helped refine general direction statement (GDS) 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 ([Appendix B](#)). Goals and strategies for state-administered forest lands in this plan are consistent with multiple MFRC regional landscape committee plans' desired outcomes, long-term goals, and strategies for forest lands and ecosystem types in the region, including the [North Central Landscape Forest Resource Management Plan](#), which significantly overlaps the MDLP Section

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 [Section 3.13](#) and [Appendix E](#) for more information on MOAs.

General Direction Statements (GDS)

- follow direction provided in federal statutes, state statutes and rules, and Department policies, guidelines, and management direction
- incorporate DNR specialists' expert knowledge in their fields
- 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-administered forest lands in the Section ([see Scope of this SFRMP above](#))
- were identified where we currently have the ability to measure and quantify progress

Implementing SFRMP Management Direction

SFRMP direction is implemented to the extent possible given the context the DNR manages within, including policies, laws, Department direction, and resource conditions. SFRMP management direction does not supersede any policy, law, or Department direction, and those requirements must be followed first before applying SFRMP objectives. Forest managers need to be aware of and manage toward achieving the future direction of the SFRMP (SFRMP goals and strategies, and MOA intent, where applicable) within that context.

SFRMP objectives are not achievable on every stand. SFRMP general direction statements and strategies are developed at the landscape scale and implemented where site-level opportunities are present, not necessarily at every site. Objectives are advanced at this scale through a combination of:

- resource conditions preceding the current planning period
- the spatial and temporal configuration of stands on the 10-year stand exam list
- the design of management activities on DNR-administered lands within the planning area

Forest managers should seek opportunities to apply strategies designed to advance SFRMP goals and incorporate those strategies in management to the extent possible. At the same time, flexibility in implementing SFRMP goals, including MOA intent, is required because management also needs to address the following:

- site-specific conditions or broader management context, which may exist or develop over time (e.g., natural disturbances, inaccurate inventory, listed species, legal requirements)
- new or existing Department directions or policies

Role of Department Guidance Documents, Policy, and Management Recommendations

In addition to DFCs, GDSs, and strategies identified in this SFRMP, a vast array of planning documents, guidelines, policies, objectives, and initiatives direct vegetation management on state-administered land. Vegetation management decisions by the DNR must apply these directives appropriately while making individual site-level decisions. The DNR's interdisciplinary forest policy system 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 current DNR policies and apply guidelines as appropriate?
- Does the treatment align with the responsibilities of the land administrator or land status?
- Does the planned management meet MFRC site-level guidelines?
- Is the management activity appropriate to the NPC? Is it consistent with the ECS silvicultural interpretation?
- Does the stand present a good opportunity to contribute to SFRMP conversion goals?
- If an ETS species or Species in Greatest Conservation Need is present, have current guidelines or an EWR specialist been consulted?
- If appropriate, have climate change adaptation strategies been implemented?

- If a forest health issue is present, have current guidelines or a forest health specialist been consulted?
- Is the site in a MOA? If yes, have the MOA guidance documents been applied to the extent possible?
- Do management decisions align with local annual goals that are derived from the strategic direction and 10-year stand exam list?
- Have forest coordination 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 MDLP Section.

The GDSs and Strategies in this section address Issues: [A1](#), [A2](#), [A3](#), [B1](#), [B2](#), [C1](#), [F1](#), [J1](#)

Cover Type Direction

The following cover type management guidance summarizes current conditions and future management direction for each major cover type within the MDLP 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 the management direction provided in current DNR guidance and policies.

Some cover types include conversion goals, 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 1% change from aspen/balm-of-Gilead/birch cover types over 50 years, or about 300 acres per year across the Section. Cover type conversion goals in this SFRMP represent desired trends, not exact targets. Decisions on where and how conversions take place are made at the site level depending on current stand conditions, land status, land administrator, other site objectives, and Department policies and directions.

Broadly, management strategies for cover types fall into two categories: even-aged management and uneven-aged 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 the standard DNR rotation age 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 that 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 [Development of the 10-year Stand Exam List](#) report.

Table 3.1: General management strategies modeled to develop the 10-year stand exam list 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			✓	Jack pine		✓	
Aspen/balm of Gilead		✓		Norway (red) pine	✓	✓	
Birch		✓		Tamarack		✓	
Northern hardwoods	✓		✓	White cedar			✓
Oak	✓	✓	✓	White spruce natural			✓
Balsam fir		✓		White spruce -planted	✓	✓	
Black spruce-lowland		✓		White pine natural			✓
Black spruce-upland		✓		White pine - planted	✓	✓	✓ (FAW)

Ash/Lowland Hardwoods

The ash and lowland hardwoods (Ash/LH) cover types are combined into one management category for this SFRMP because they are commonly associated with each other and are managed under the same management prescriptions (uneven-aged treatments and thinnings). Species comprising this cover type group include black ash, green ash, silver maple, American and red elm, boxelder, and bur oak. 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. Ash is used for high-quality sawlogs, veneer, and ash used in pulpwood production has recently increased.

Current Acres: 41,370 acres in the MDLP Section (approximately 3.9% of managed state-administered forest acres in this Section)

- 35,680 acres are ash cover type
- 5,700 acres are lowland hardwoods cover type

Future Direction and Goals

- Decrease ash cover type acres and transition them to lowland hardwood stands.
 - Ash 10-year DFC: 34,680 acres (2.8% decrease)
 - Lowland hardwoods 10-year DFC: 6,700 acres (17.5% increase)
 - Ash 50-year DFC: 32,680 acres (8.4% decrease)
 - Lowland hardwoods 50-year DFC: 8,700 acres (52.4% increase)
- Increase within-stand diversity.
- 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

- Convert approximately 1,000 acres (3,000 acres total over 50 years) of the ash cover type to the lowland hardwood cover type.
 - Focus attempts at conversions or increasing diversity in relatively drier sites.
 - Also, consider conversions from ash to balm-of-Gilead (BAM), where BAM conversion has a higher likelihood of success than other species and can help maintain a forested condition over time.
 - This plan anticipates that some passive conversion from aspen to lowland hardwoods may also incidentally occur through natural succession, for example, within RMZs.
- 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 dominance of ash trees.
 - Promote non-ash species appropriate to NPC, such as yellow birch, northern white cedar, balsam poplar, American elm, or red maple in WFn53, WFn55, or WFn64 sites, and silver maple, American basswood, bur oak, American elm, or box elder in FFn57 sites.

- Consider alternative native species for reforestation efforts, following the latest research and management trials (e.g., hackberry, swamp white oak, Dutch elm disease-resistant American elm).
- Use forest management approaches that maintain water regulation and groundwater conditions suitable for forest growth.

Special Considerations

- Emerald ash borer (EAB)
- American elm has good to excellent suitability ratings for communities associated with the ash and lowland hardwood cover types but is susceptible to Dutch elm disease.
- Hydrologic damage (“swamping”) can occur, especially in wet forest NPCs, if the tree canopy is significantly reduced, affecting the potential of the site to regenerate and support tree species.

Aspen/Balm-of-Gilead

Aspen and balm-of-Gilead (A/BG) cover types are combined in the SFRMP because they are commonly associated with each other and are managed similarly. Aspen/BG-dominated native plant communities in the MDLP Section are typically mesic to wet-mesic forests with a mixture of hardwood species and some conifers in the canopy and understory. Aspen is also often a dominant species in the early successional stages of some fire-dependent plant communities. Pulpwood production is the most extensive use of these species.

Current Acres: 303,980 acres in the MDLP Section (approximately 28.5% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 300,980 acres (1.0% decrease)
- 50-year DFC: 288,980 acres (4.9% decrease)
- Move toward balanced age class distribution.
- Increase within-stand diversity.

Strategies

- Generally, use clearcut with reserves method to regenerate aspen.
- Convert approximately 3,000 acres (15,000 acres over 50 years) using NPC-suitable species.
 - Convert 1.0% of A/BG to other cover types to address NPC goals and climate change projections in this planning period:

Target Cover Type	NPC Targets	Approximate acres of aspen to convert
Northern hardwoods	MHn35, MHn46, MHn47	400
Oak	MHc26, FDc34, MHn35	1,000
Jack pine	FDc23, FDc24, FDc25	100
Red pine	FDc24, FDc34, FDn33, FDn43	600
White pine	FDc34, FDn33, FDn43	900

- Prioritize sites with low marketability for conversion from aspen (e.g., low density, over-mature stands, far from markets, poor access, etc.) as well as stands within old forest management complexes (OFMCs), old growth special management zones (SMZs), riparian management zones (RMZs), and MOAs with cover type or older forest goals (e.g., White Pine Management Areas and Interior Forest MOAs).
- Determine sites and species appropriate for conversion by field visits and NPC.
- Convert offsite aspen to cover types more appropriate to NPC if opportunities present themselves.
- Within reserves, maintain or increase other tree species components in aspen stands appropriate to NPC.

- To the extent practical, retain aspen trees that have, or have the potential to develop, cavities suitable for wildlife.

Special Considerations

- Conversion is challenging due to aggressive suckering.
- Sustainable timber harvest decisions for this plan period include maintaining at least 2.5% of the aspen cover type on DNR-administered lands at least 60 years old statewide for wildlife habitat. When the STH decisions were made, approximately 9.8% of the aspen cover type was at least 60 years old in the MDLP Section.
- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
 - stem decay and butt rot in wounded trees
 - white trunk rot as aspen ages
 - decline following tent caterpillar defoliation in over-mature stands
 - In low-density stands or stand edges, mortality from *Hypoxylon* cankers and *Saperda* stem borer may increase
 - preferred host for *Lymantria dispar*, which is not documented in the Section as of 2021
- Aspen habitat may decrease in Minnesota as climate change proceeds.
- Aspen is an important species for cavity-dependent wildlife.

Birch

The birch (Bi) cover type includes paper birch and yellow birch. Birch-dominated sites in the MDLP Section are not abundant but are typically found in mesic to wet-mesic forest NPCs. More commonly, birch occurs as a mixture of hardwood and conifer species in a range of fire-dependent and mesic hardwood communities. Yellow birch is primarily a component of other cover types, including lowland hardwoods, northern hardwoods, and white cedar.

Paper birch is primarily used in pulpwood production but also for sawlogs, fuelwood, and a variety of other products. Non-timber uses of birch include paper birch poles, which are increasingly used as decorative products. Birch is important culturally, especially birch bark for canoes and baskets. Parts of the birch tree are traditionally used for medicine, and the sap can be boiled into syrup.

Current Acres: 11,390 acres in the MDLP Section (approximately 1.1% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: maintain at approximately 11,390 acres
- 50-year DFC: maintain at approximately 11,390 acres
- Move toward balanced age class distribution to the extent possible.
- Increase within stand diversity.
- Manage birch as a component of other cover types within appropriate NPCs.

Strategies

- Use even-aged silvicultural approaches, including clearcut with reserves and shelterwood methods, to regenerate paper birch.
- Prioritize treating older paper birch stands first to retain the cover type and consider prescriptions that use local seed sources or seedlings and sprouting.
- In areas where birch bark is harvested (for example, within tribal reservations), consider the following:
 - reserving some large, healthy birch trees with good form near access routes
 - doing timber stand improvement projects in stands with birch stump sprouts to improve growth and straightness of birch as stands develop (e.g., through a decorative materials harvest or by contract)
- Manage stands selected for harvest that contain yellow birch to promote yellow birch regeneration.
 - A variety of methods can be used to regenerate yellow birch (ranging from uneven-aged gap harvests to seed tree or shelterwood approaches); however, yellow birch seeds require decaying coniferous nurse logs, tip-up mounds, or exposed mineral soil to germinate and sprout.
- Specifically, look to increase yellow birch in MHn47, WFn53, WFn55, and WFn64 NPCs.

Special Considerations

- Old stands experiencing decay and die-back are more difficult to regenerate due to reduced vigor in stump sprouting.

- Live birch is an important food for 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.
- Bronze birch borer can be a concern in stressed trees.

Northern Hardwoods

Northern hardwood-dominated (NH) stands in the MDLP Section usually occur in mesic hardwood NPCs on upland sites with moist soils in settings protected from fire. Natural, mature NH stands are comprised of mixed species, including sugar maple, American basswood, red maple, elm, and additional species found in other cover type groups (oak, birch, aspen). Northern hardwood stands can also include conifers, including white pine, balsam fir, white spruce, and white cedar.

Species within the NH cover type are used for a variety of forest products. Maple is used for pulpwood production and, to a lesser extent, sawlogs and fuelwood. American basswood is used primarily for sawlogs and, to a lesser extent, pulpwood production and fuelwood. Maples are especially important culturally for collecting sap that is processed into maple syrup or sugar.

The northern hardwoods cover type is primarily managed as uneven-aged, so balancing age class distributions is not a goal for this cover type.

Current Acres: 37,530 acres in the MDLP Section (approximately 3.5% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 37,130 acres (1.1% increase)
- 50-year DFC: 35,530 acres (5.3% increase)
- Improve timber quality.
- Increase within-stand diversity appropriate to NPC.

Strategies

- When appropriate, use uneven-aged and gap management to regenerate NH and manage species composition.
- Convert approximately 400 acres (2,000 acres total over 50 years) of the aspen/balm of Gilead cover type to NH cover type.
 - Gradually convert from aspen-dominated stands to more diverse stands with additional hardwood trees.
 - Focus conversions from aspen to NH in MHn35, MHn46, and MHn47 NPCs.
 - Prioritize conversions from aspen to NH cover types or increases in NH species within aspen stands in locations with older forest or hardwood cover type goals, such as the Leech Lake Hardwood Resilience MOA, OFMCs, forest interior habitat MOAs, and old forest patches.
- Enhance opportunities for maple sap collection in known sap gathering areas (for example, within tribal reservations or where maple sap permits have been issued in the past). Strategies to consider include:
 - retaining maples, especially mid-larger diameter trees with larger crowns
 - Note that otherwise healthy trees with poor form from a timber perspective may be valuable trees to retain for sap production (e.g., frost-cracked trees).
 - spacing trees to promote larger crowns

- Increase the abundance of white pine, white spruce, and yellow birch where opportunities exist.
- Increase oak and maintain birch and basswood in mixed stands where appropriate opportunities exist.
- Follow practices to limit the spread and damage of earthworm invasion into hardwood forests.

Special Considerations

- Without larger disturbances such as gaps, shade-tolerant species such as maple and basswood will increase in abundance at the expense of shade-intolerant species such as birch and oak.
- Considering climate change and market forces, some aspen stands may gradually convert to more NH-dominated stands.
- Several rare species rely on mature NH stands for habitat, including goblin ferns, narrow triangle moonwort, red-shouldered hawks, and four-toed salamanders.
- Forest health concerns for species that occur in the northern hardwoods cover type include:
 - *Eutypella* canker in maple
 - basswood thrips
 - Dutch elm disease

Oak

The oak cover type includes northern pin, red, and bur oak. Natural, mature oak stands range from nearly pure oak to mixed stands, occurring in both mesic hardwood and fire-dependent NPCs. Oak species are commonly found as a component of other cover types, such as aspen, birch, northern hardwoods, and lowland hardwoods (bur oak). Oak is primarily used as sawlogs, with products manufactured for constructing and finishing homes and fuelwood.

Current Acres: 25,770 acres in the MDLP Section (less than 2.4% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 26,770 acres (3.9% increase)
- 50-year DFC: 29,770 acres (15.5% increase)

Strategies

- Convert approximately 1,000 acres (4,000 acres total over 50 years) of the aspen/balm of Gilead cover type to oak cover type.
 - Focus conversions from aspen to oak in MHc26, MHn35, and FDC34 NPCs.
 - Convert offsite oak to cover types more appropriate to NPC if opportunities present themselves.
- Use a range of approaches for regenerating oak, from even-aged strategies, including coppice, shelterwood, and seed tree methods, to uneven-aged strategies, including group selection, and thinning for intermediate treatments.
- Encourage mast development within oak stands and in oak trees in other cover types by promoting oak into the forest canopy.
- Increase within-stand diversity where appropriate, based on NPC and land status.
- Plan regeneration methods considering the amount of advanced regeneration.

Special Considerations

- Acorns are an important mast source for many species of wildlife.
- Considering climate change and market forces, some aspen stands may gradually include a greater component of oak.
- Forest health concerns in the oak cover type include:
 - Oak wilt is expanding in central Minnesota. As of the writing of this plan, oak wilt had been detected in the far south-central portion of the Section in Morrison and Crow Wing counties.
 - Bur oak blight may become more common and noticeable, particularly following wetter springs. Trees can tolerate some defoliation due to bur oak blight, but repeated significant defoliation can weaken and make them susceptible to other pests and diseases.
 - Two-lined chestnut borer is a concern in stressed trees.

Balsam Fir

Natural, mature balsam fir (BF) stands are typically mixed stands. Native plant communities most suitable for the BF cover type are FDn33, FDn43, and MHn44. Balsam fir typically grows best on wet-mesic sites where adequate soil moisture is available throughout the growing season but can be found as a minor component across a range of site conditions, usually where fire has been excluded.

Balsam fir is primarily used in pulpwood production and, to a lesser extent, for sawlogs and fuelwood. Balsam boughs are an important non-timber forest product.

The current balsam fir age class distribution is skewed to older age classes and does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)).

Current Acres: 7,240 acres in the MDLP Section (approximately 0.7% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: maintain at approximately 7,240 acres
- 50-year DFC: maintain at approximately 7,240 acres
- Desired within-stand composition is mixed, including long-lived conifers (e.g., pine, spruce) and upland hardwoods appropriate to NPC.
- Move toward balanced age class distribution.
- Maintain or increase balsam fir as a component of other mixed-species cover types, as appropriate to NPC.

Strategies

- Manage BF primarily as even-aged for pulpwood and bolts and to support wildlife habitat and biodiversity values.

Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
 - 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)

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. Lowland black spruce-dominated sites can occupy a range of forested rich and acid peatland NPCs. The black spruce (lowland) (BSL) cover type is managed as an even-aged cover type primarily for pulpwood and to support wildlife habitat and biodiversity values.

Current Acres: 61,680 acres in the MDLP Section (approximately 5.8% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: maintain at approximately 61,680 acres
- 50-year DFC: maintain at approximately 61,680 acres
- Move toward balanced age class distribution.
- Maintain or increase species diversity within BSL stands.

Strategies

- When appropriate, maintain or increase secondary component species such as tamarack, white cedar, balsam fir, and paper birch when appropriate to NPC and accounting for forest health concerns.
- Ensure a suitable seedbed for black spruce regeneration via seeding.
 - Compressing sphagnum (i.e., during frozen-ground clearcut harvest) provides a good seedbed for black spruce regeneration.
 - Prevent or minimize damage to sphagnum mosses during harvest activities to retain a suitable seedbed (for example, by operating on frozen ground when needed).

Special Considerations

- BSL grows slowly and may have reduced vigor in some NPCs.
- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist regarding Eastern dwarf mistletoe.
- BSL may lose habitat and decline in abundance according to some projected climate change scenarios.

Black Spruce (Upland)

Upland black spruce (BSU) stands are typically mixed with other conifers (often co-dominant with jack pine), aspen, and birch. BSU stands are found on nutrient-poor, dry to mesic sites. Few NPCs contain upland black spruce in this Section (e.g., FDn32).

In the MDLP Section, the current age class distribution of BSU does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). Because of the limited acres of BSU, balancing the age class distribution for this cover type is not a goal for this cover type.

Current Acres: 376 acres in the MDLP Section (<0.1% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: maintain at approximately 376 acres
- 50-year DFC: maintain at approximately 376 acres
- Maintain acres of BSU and increase upland black spruce abundance in other cover types.

Strategies

- Where appropriate, use small-gap strategies to perpetuate advanced regeneration of BSU, take advantage of seed trees, and reduce aspen competition.
- Where already present in other cover types, favor BSU as a reserve tree to maintain structural diversity and local seed sources.

Special Considerations

- Reduced seed sources and aspen competition challenge our ability to maintain and increase this cover type.
- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist regarding Eastern dwarf mistletoe.

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 [central and northern floristic regions](#) 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.

The dominant use of jack pine is saw bolts, followed by pulpwood production.

Most JP acres are in the 1-30 age classes, with generally declining acres through 100 years ([Appendix C](#)). The goal for this cover type is to move toward a balanced age class structure based on the standard DNR rotation age while maintaining or improving site productivity and stand health.

Current Acres: 16,640 acres in the MDLP Section (approximately 1.6% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 16,840 acres (1.2% increase)
- 50-year DFC: 17,640 acres (6.0% increase)
- 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.
- Maintain or increase jack pine as a component of other cover types as appropriate to NPC.

Strategies

- Convert approximately 200 acres (1,000 acres over 50 years total) of A/BG and white spruce cover types (approximately 100 acres each) to the JP cover type on appropriate sites, including FDc23, FDc24, and FDc25 NPCs.
- Perpetuate and increase black spruce when found in JP stands where opportunities are identified for reserved upland black spruce expansion. Sites classified as FDn32 may be most suitable.
- Consult local seed zones and [ECS floristic region](#) when developing reforestation plans.
- Where appropriate, include additional species suitable to the NPC in regeneration plans to increase within-stand diversity and climate change resilience (for example, white pine and red pine in FDc24 sites).

Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist concerning:
 - jack pine budworm
 - pine-oak and pine-pine gall rust, which can increase mortality and affect tree quality in younger stands

- Jack pine woodlands can have a naturally low stocking. For more information, DNR managers should refer to current DNR regeneration standards.
- Jack pine habitat is projected to decrease under some projected climate change scenarios, although the [Northern Institute of Applied Climate Science](#) (NIACS) ranks jack pine as being adaptable with potentially fair capability to persist in MDLP as climate changes.
- Many JP-dominated native plant communities (e.g., FDc23, FDn32) have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Red (Norway) Pine – Natural Origin

Red pine (RP) on DNR timberlands is treated as two distinct cover types. Planted stands are managed using an economic rotation age. Natural origin stands are managed with a longer rotation age to capture more of the natural range of variation in the lifespan of red pine trees and historic disturbance rotation periods of NPCs dominated by red pine. Natural origin red pine is regenerated to mimic the characteristics of natural origin stands.

Red pine-dominated NPCs in the MDLP Section are typically dry to mesic forests that range from nearly pure stands to mixtures with other conifers and hardwood species, especially aspen and birch.

Red pine is primarily used for sawlogs and, to a lesser extent, for pulpwood production.

The natural origin red pine age class distributions skew toward older age classes ([Appendix C](#)). Balancing the age class distribution is not a goal for natural origin red pine.

Current Acres: 10,520 acres in the MDLP Section (21.6% of total red pine acres; planted and natural origin red pine together represent approximately 4.6% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: see the conversion strategy that applies across the Red Pine cover type (natural origin and planted) below
- 50-year DFC: see the conversion strategy that applies across the Red Pine cover type (natural origin and planted) below
- 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, depending on NPC.
- Maintain or increase red pine as a component of other cover types as appropriate to NPC considering forest health concerns (e.g., *Diplodia* in reserves or adjacent stands).

Strategies

- Convert approximately 600 acres (3,000 acres over 50 years total) of the A/BG or white spruce cover type to a RP cover type.
 - To the extent possible, mimic the qualities and characteristics of natural origin stands (e.g., uneven spacing of planted pines, a mix of species appropriate to NPC, etc.).
 - Focus conversions in FDc24, FDc34, FDn33, and FDn43 NPCs.
- 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.
 - Consider creating or maintaining variable densities within stands when thinning.
 - Protect advanced regeneration of desirable understory species, where possible, considering forest health concerns (e.g., shoot blight).
 - Higher stand densities (basal area) are recommended along stand edges exposed to wind.

- In high-use and high-visibility areas, use irregular thinning techniques to break up the appearance of rows and uniform stand appearance. Example approaches include cross-thinning, small gap cuts, and thinning from above and below.
- 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*, [NPC silviculture strategies](#), and consider [NIACS climate change projections](#).
- Consider the following recommendations when regenerating red pine:
 - Use natural regeneration in natural origin stands when opportunities arise. Where natural regeneration is not feasible, consider implementing a mix of strategies, including natural seeding, artificial seeding, and planting.
 - 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 desired future conditions and NPC. Note that in some cases, reducing within-stand diversity may be appropriate in the short term to balance competition with desired regeneration (for example, when the understory is dominated by dense hazel and brush).
 - 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, under a higher drought code for better duff consumption, conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil.
 - Evaluate for the presence of *Diplodia* tip blight and canker (*Sphaeropsis sapinea*) and shoot blight (*Sirococcus conigens*).
- Consider the potential impacts of bark beetles during intermediate harvest in red pine (see below).

Special Considerations

- 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 projected to have fair capability to withstand climate change by [NIACS](#), with little or no projected change in habitat due to climate change in this century.
- The DNR is developing forest management guidelines for natural-origin red pine on school trust lands. When available, staff should refer to those guidelines for direction. Short-term direction is available for DNR staff managing High Conservation Value Forest sites on school trust land.
- Several RP-dominated FD communities (e.g., FDc34, FDn43) have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Red (Norway) Pine – 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. Red pine is planted in the MDLP Section on dry to mesic fire-dependent NPC sites; however, there are occasional examples of planted red pine on mesic hardwood sites as well (e.g., MHC26).

Red pine is primarily used for sawlogs and, to a lesser extent, for pulpwood production.

The age class distribution for planted red pine in the MDLP Section is not balanced and skewed toward older age classes ([Appendix C](#)).

Current Acres: 38,150 acres in the MDLP Section (78.3% of total red pine acres; planted and natural origin red pine together represent approximately 4.6% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: see the conversion strategy that applies across the Red Pine cover type (natural origin and planted) below
- 50-year DFC: see the conversion strategy that applies across the Red Pine cover type (natural origin and planted) below
- 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.
- Diversify stands as they age.
- Increase within-stand structure to maintain or improve site productivity, wildlife habitat, and biodiversity.

Strategies

- Convert approximately 600 acres (3,000 acres over 50 years total) of the A/BG or white spruce cover type to a RP cover type.
 - To the extent possible, mimic the qualities and characteristics of natural origin stands (e.g., uneven spacing of planted pines, a mix of species appropriate to NPC, etc.).
 - Focus conversions in FDc24, FDc34, FDn33, and FDn43 NPCs.
- For final harvests, consider using a regeneration strategy that mimics the creation of a natural origin stand (i.e., with associated species, especially jack, white pine, and oak where appropriate, and structural diversity).
- Use thinning to reduce stand density, increase future tree growth, quality and vigor, and obtain the desired composition of the stand. Recommendations are:
 - Conduct normal rotation stand thinnings in merchantable stands at approximately 10-year intervals, depending on site quality (refer to the [Red Pine Management Guide](#) for more information on thinning intervals).

- Older stands may have longer intervals between thinnings to compensate for slower growth rates and to facilitate the growth of desirable understory species.
- Consider incorporating silvicultural techniques aimed at addressing biodiversity or habitat objectives through increasing structural and compositional diversity during thinning.
- In high-use and high-visibility areas, use irregular thinning techniques to break up the appearance of rows and uniform stand appearance. Example approaches include cross-thinning, small gap cuts, and thinning from above and below.
- To regenerate RP, use clearcut with reserves or, where *Diplodia* risk is low or absent, a seed tree approach, considering the following recommendations:
 - Use the least intensive site preparation and release approach possible, with the intent of retaining NPC diversity/characteristics (refer to DNR policy on pesticide use).
 - 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, under a higher drought code for better duff consumption, conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil. This may be done before the final harvest to prepare seedbeds unless charred bark on harvested trees poses a problem ([“Red Pine Handbook”](#)).
 - 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.
 - Retain cavity trees or snags as recommended in the MFRC site-level guidelines.
- Increase the habitat value of planted red pine sites by retaining biological legacies such as large, healthy, live trees, decadent trees, snags, logs, and other coarse woody debris.

Special Considerations

- 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 projected to have fair capability to withstand climate change by [NIACS](#), with little or no projected change in habitat due to climate change in this century.
- Several RP-dominated FD communities (e.g., FDc34, FDn43) have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

Stagnant Spruce

The stagnant spruce (Sx) cover type is mostly composed of lowland black spruce or a mix of black spruce and other lowland conifers growing on very poor sites with organic soils that are saturated throughout the year and have low nutrient levels (typically acid peatlands NPCs). Stagnant spruce has a site index of less than 23, meaning that when trees are 50 years old, they are 22 feet tall or less.

Stagnant spruce (Sx) is not considered a commercial cover type; however, some harvest occurs for non-timber forest products, such as decorative spruce tops. Tree tops from 2 to 10 feet long are cut from selected trees, which typically grow new tops from lateral branches over time. Harvest level varies with tree size and quality and industry product specifications. In most stands, selection harvest ranges from 5-10 percent to as high as 20 percent of trees. Harvesting in higher quality stands has occurred periodically on a 10-15 year cycle.

Balancing the Sx age class distribution is not a goal for this cover type.

Current Acres: 67,290 acres in the MDLP Section (6.3% of managed state-administered forest acres in the Section)

Future Direction and Goals

- 10-year DFC: not applicable
- 50-year DFC: not applicable
- Maintain existing cover type to support ecological and wildlife values associated with stagnant spruce.

Strategies

- Consider the hydrologic effects of management activities within or adjacent to this cover type.
- When managing around stagnant spruce stands, use reserves to maintain corridors for plant and animal species.
- As the inventory is updated for lowland spruce stands, assess the site index for stands, especially those that are close to the boundaries between site index classes used for modeling (High - SI 40+, Medium - SI 30-39, Low – SI 23-29, Stagnant SI < 23).
- Old stagnant spruce stands (over 150 years old) represent areas that haven't been disturbed in a long time and support a unique, fragile ecosystem that takes a long time to recover from disturbance. If harvesting treetops in stagnant spruce, consider the age of the stand and take action to minimize disturbance in the oldest stands (> 150 years).

Special Considerations

- Forest inventory analysis (FIA) and cooperative stand assessment (CSA) inventory data disagree on the amount of stagnant spruce on the landscape.
- Eastern dwarf mistletoe is a forest health concern for black spruce.

Tamarack

Natural, mature tamarack (T) stands range from pure or nearly pure stands to mixed stands and predominantly occur in poorly drained peatland settings, although historically, upland tamarack had a larger extent than today. Secondary species in the cover type include black spruce, balsam fir, cedar, and birch. Typical tamarack-dominated NPCs include FPN81, FPN82, and FPW63.

Tamarack is primarily used for pulpwood production and, to a lesser extent, for sawlogs.

The current tamarack age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)).

Current Acres: 94,920 acres in the MDLP Section (approximately 8.9% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 94,920 acres (no change)
- 50-year DFC: 94,920 acres (no change)
- Move toward a balanced age class distribution.
- Increase within-stand diversity where appropriate to NPC considering forest health concerns
- Manage tamarack as a component of other cover types as appropriate to NPC.
- Maintain tamarack acres on the landscape and increase upland tamarack.

Strategies

- Harvest, leaving seed trees, in advance of Eastern larch beetle (ELB). Leaving approximately 10 tamarack per acre is recommended for successful seeding. Aerial seeding after clearcut may also be used for regeneration, especially if forest health concerns such as ELB render seed tree methods impractical or inadvisable.
- Increase tamarack within other cover types and on upland sites as appropriate
- Maintain or increase secondary component species of T stands where possible, such as black spruce, white cedar, balsam fir, and paper birch, to retain structural and compositional diversity and promote additional natural seeding. Consider the following:
 - reserving seed trees, reserve islands, clumps of mature trees, or advanced regeneration
 - including other species such as black spruce and cedar when artificial seeding
 - incorporating forest health concerns in decisions about which species to retain or increase (e.g., Eastern dwarf mistletoe in black spruce).

Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
 - eastern larch beetle (ELB)
 - larch casebearer

White Cedar

White cedar (WC) is long-lived and is the climax species in most NPCs in which it occurs (primarily WFn53, FPn63). Natural, mature WC stands range from pure to mixed stands. White cedar occurs on a wide range of site conditions. White cedar utilization is limited, and sawlogs, specialty products, and fuelwood are its main uses.

Current Acres: 28,480 acres in the MDLP Section (approximately 2.7% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 28,480 acres (no change)
- 50-year DFC: 28,980 acres (1.8% increase)
- Increase the abundance of white cedar as a component of other cover types
- Emphasize retaining WC in deer wintering areas.

Strategies

- While it is not a specific goal of this plan to increase WC acres in this 10-year period, consider conversions to WC when good opportunities arise.
- Maintain acreage of WC stands used as thermal cover areas by wildlife.
- Maintain or increase white cedar as a component of other forest cover types.
- Manage stands as multi-age and mixed-species stands.
- Consider increasing the amount of strip and patch cuts in WC stands to increase age class diversity.

Special Considerations

- Browsing by deer, mice, and snowshoe hare may limit the ability to increase or maintain WC stands.
- Limited harvesting occurs because markets are poor for cedar products and because of regeneration challenges, especially for upland cedar.
- White cedar swamps are home to many species of rare plants within this ecological section, including several state-listed orchids.

White Pine

White pine (WP) occurs as pure stands and as a component of many other upland cover types in the MDLP Section, including both fire-dependent and mesic hardwood NPCs. The WP cover type is relatively uncommon in MDLP. White pine is primarily used for sawlogs and manufactured into a variety of products, including lumber, cabinets, and interior building finishes. It is used to a lesser extent in pulpwood production.

WP stands receive uneven-aged management, so balancing age class distributions is not a goal for this cover type.

Current Acres: 3,182 acres in the MDLP Section (0.3% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 4,082 acres (28.3% increase)
- 50-year DFC: 7,182 acres (125.7% increase)
- Maintain age and species composition within stands.

Strategies

- Convert approximately 900 acres (4,000 acres over 50 years total) of A/BG or white spruce cover types to the 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.
 - Focus conversions in the two White Pine Management Area MOAs, which contain appropriate Land Type Associations for white pine, and MOAs with older forest goals, including OFMCs with appropriate NPCs (e.g., FDc34, FDn33, FDn43).
 - In some cases, passive conversions from aspen to WP may take place in RMZs.
- Manage white pine stands to maximize the potential for white pine regeneration in the understory.
- Increase the amount of white pine occurring as a component in mixed stands as appropriate to NPC.

Special Considerations

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

White Spruce

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 FD, MH, and WF native plant communities and is considered an excellent competitor in FDn43 and MHn44 NPCs. Natural origin white spruce is managed as an uneven-aged cover type, while planted white spruce is managed as an even-aged cover type. White spruce is primarily used in pulpwood production for paper products.

The current combined age class distribution of natural and planted white spruce is not balanced. Most WS acres fall within the 31-60 year age classes ([Appendix C](#)). Working toward balancing the age class distribution of planted WS is a goal for this cover type; however, this is not a goal for natural-origin WS.

Current Acres: 9,734 acres in the MDLP Section (approximately 0.9% of managed state-administered forest acres in this Section)

Future Direction and Goals

- 10-year DFC: 9,534 acres (2.1% decrease)
- 50-year DFC: 8,734 acres (10.3% increase)
- Increase species and structural diversity in both planted and natural origin WS stands appropriate to NPC.
- Move toward balanced age class distribution for planted WS.
- Maintain or increase the white spruce component of other cover types as appropriate to NPC.

Strategies

- Convert approximately 200 acres (1,000 acres over 50 years total) of WS cover types to JP, WP, or RP cover types on appropriate sites.
 - Focus conversions on WS plantations growing on sites where the NPC is more suitable to pine species:
 - convert to jack pine on FDc23 and FDc24
 - convert to white pine on FDc34 and FDn33
 - convert to red pine on FDc24 and FDc34
- Manage natural-origin WS as multi-age and mixed-species stands. Recommendations include:
 - Retain some super-canopy trees in patches or clumps at each treatment.
 - Encourage multi-layered understory development.
 - Emphasize regenerating white spruce in the understory.
 - 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 final harvest, consider converting plantation WS stands to mixed-species, structurally diverse stands using NPC information and considering [climate change projections](#) to select the most appropriate species.
 - For example, in WS stands in MHN44 communities, promote a mix of aspen, spruce, and fir.
- Avoid damaging shallow roots of white spruce during thinning. Consider the following strategies:
 - It is best to thin only when the ground is frozen and snow is present.
 - Conduct the first thinning before the plantation is 30 years old.
 - Consider forgoing intermediate treatments in lieu of final harvest, as WS may decline as a result of multiple stand entries.

Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
 - spruce budworm and yellow-headed spruce sawfly
 - needlecast diseases and other insects (e.g., spruce weevil, spruce beetle, etc.)
- Thinning damage to the shallow root system of WS (see above).

Open Landscapes (upland and lowland grass and brush)

The upland and lowland grass (UG/LG) and upland and lowland brush (UB/LB) cover types are managed together as open landscapes. Species composition is variable 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 to provide ecosystem services, including sustaining populations of wildlife and plants. Strategies in this plan focus on habitat for sharp-tailed grouse, which will also benefit other species associated with open landscapes.

Current Acres: 1,112,060 acres in the MDLP Section (19.4% of managed state-administered acres in this Section)

- 871,264 acres (78%) brushland (UB/LB) cover type
- 240,795 acres (22%) openland (UG/LG) cover type

Future Direction and Goals

- 10-year DFC: 1,112,060 brushland and openland acres (no change)
- 50-year DFC: 1,112,060 brushland and openland acres (no change)
- Maintain species diversity and abundance appropriate to NPC

Strategies

- Coordinate on open landscape projects designed to enhance open landscape conditions in sharp-tailed grouse habitat and consider the following strategies, some of which apply to forested stands adjacent to open areas:
 - Identify open landscape projects within the Section using available information and review by field staff.
 - Consider harvesting hardwood stands younger than rotation age.
 - Use prescriptions that enhance open landscape habitat conditions (e.g., creating larger blocks of even-aged cover types managed with a clearcut prescription, minimizing leave trees in the interior of harvest blocks, discouraging conifer planting).
 - Consider swapping upland stands over or approaching rotation age and merchantable lowland conifer stands with stands within or adjacent to open landscapes on stand exam lists.
 - 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, especially within two miles of a sharp-tailed grouse lek.
 - Discourage tree planting in open landscape areas.
 - 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.

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 MDLP Section, including habitat suitability projections for those species under climate change, refer to the [NPC Silviculture Strategies for forest stand prescriptions](#) webpage.
- Convert cover types where appropriate (Table 3.2a and b; see Fig. 3.1 for example and Cover Type accounts for more detail).
 - Determine sites and species appropriate for conversion during site visits and native plant community evaluations.
 - Increase the acreage of white pine, red pine, jack pine, lowland hardwoods, and northern hardwoods while decreasing the acreage of aspen, ash, and white spruce. The cover type goals are intended to provide habitat, increase the representation of some cover types on the landscape, ensure cover types are suitable to NPC, mitigate forest health risks, and increase the resilience and adaptive capacity of forests facing climate change. Options to consider include:
 - Allow some stands to convert gradually over time, with or without harvest. Examples of this approach include converting aspen to white spruce, balsam fir, or northern hardwoods by retaining desired species via selective harvest or reserves to move the stand toward the desired cover type and within-stand composition. Using this approach, the desired species composition is increased over several plan periods rather than attempting a “hard” conversion in one plan period.
 - Attempt to convert some stands more rapidly using a variety of tools such as mechanical site preparation, prescribed burning, planting, seeding, and release.
 - Note: whether an option is appropriate depends on factors including resource condition, land administration and status, ability to offer the annual planned volume, operability, and marketing, among other considerations.

Figure 3.1: Example of converting an aspen stand to a white pine 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.

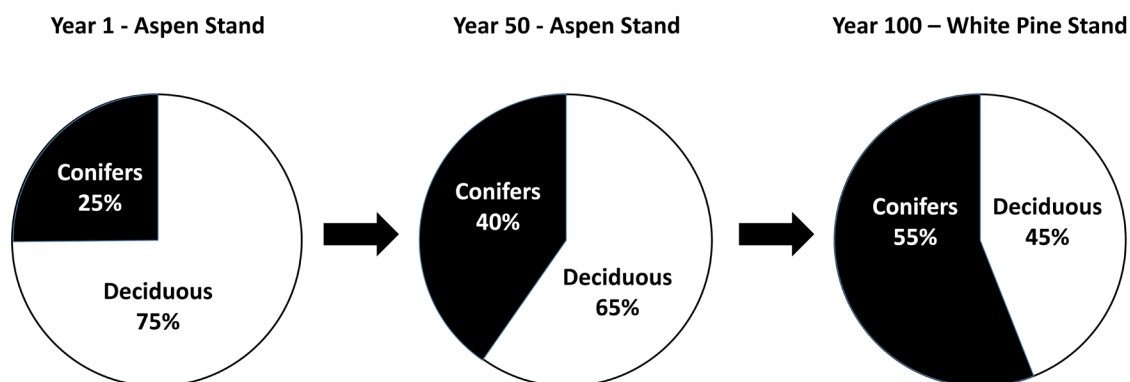


Table 3.2a: Current managed cover type acres in the MDLP Section from the DNR’s forest inventory and desired future conditions for the first decade and 50-year planning period (see Cover Types section below for more information on how conversion goals were developed). DFCs and percent change are relative to current acres. DFCs for cover type change represent general trends to work toward, not exact targets. As such, the DFCs for cover type reductions and increases do not necessarily balance to zero.

Cover Type	Current Managed Acres	10-year DFC*	10-year % change	50-year DFC	50-year % change
Ash	35,681	-1,000	-2.8%	-3,000	-8.4%
Aspen/Balm of Gilead	303,368	-3,000	-1.0%	-15,000	-5.0%
Balsam Fir	7,238	0	0.0%	-100	-1.4%
Birch	11,365	0	0.0%	0	0.0%
Black spruce lowland	61,224	0	0.0%	0	0.0%
Lowland hardwoods	5,722	+1,000	+17.5%	+3,000	+52.4%
Northern hardwoods	37,419	+400	+1.1%	+2,000	+5.3%
Oak	24,807	+1,000	+4.0%	+4,000	+16.1%
Offsite Aspen	364	0	0.0%	-364	-100.0%
Offsite Oak	504	0	0.0%	-504	-100.0%
Jack pine	16,619	+200	+1.2%	+1,000	+6.0%
Red pine	48,654	+600	+1.2%	+3,000	+6.2%
White pine	3,182	+900	+28.3%	+4,000	+125.7%
Tamarack	94,590	0	0.0%	0	0.0%
Upland Black Spruce	376	0	0.0%	0	0.0%
White Cedar	27,912	0	0.0%	+500	-1.8%
White Spruce	9,734	-200	-2.1%	-1,000	-10.3%

Table 3.2b: Annual average conversion goals (DNR managed lands acres) by Forestry Area (Region Area Number*) in the MDLP Section. The NPC targets column indicates NPCs where conversion to the target cover type may be most appropriate.

	NPC Target(s)	111	142	161	221	232	234	251	312	Total
Conversion from aspen										
Northern hardwoods	MHn35, MHn46, MHn47	7	5	8	7	7	2	2	1	40
Oak	MHc26, FDC34, MHn35	17	13	21	18	18	5	5	3	100
Jack pine	FDc23, FDc24, FDc25	2	1	2	2	2	1	0	0	10
Red pine	FDc24, FDc34, FDn33, FDn43	10	8	12	11	11	3	3	2	60
White pine	FDc34, FDn33, FDn43	15	12	18	16	17	5	4	3	90
Conversion from ash										
Lowland hardwoods	Relatively drier FF or WF sites	11	9	4	24	39	3	9	1	100
Conversion from white spruce										
Jack pine, Red pine, White pine	FDc23, FDc24; FDc34, FDn33, FDc24, FDc34	5	2	5	3	2	2	1	0	20
Total		68	50	70	80	96	20	24	11	420

*Region Area Number 111=Bemidji Forestry Area; 142=Backus, 161=Park Rapids, 221=Deer River, 232=Aitkin, 234=Hibbing, 251=Cloquet, 312=Little Falls

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 Laurentian Mixed Forest Province](#) and associated ECS [silvicultural strategies](#) to classify stands to NPC type and subtype and inform silvicultural prescriptions.
- Retain or develop components, such as species and structure, characteristic of various NPC growth stages within stands. For example, older growth stage characteristics can include large downed logs and standing dead trees, large living trees, tip-up mounds and nurse logs, and older, large, or unmerchantable wolfy trees.
- 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., [MN Forest Ecosystem Vulnerability Assessment and Synthesis](#) and [Climate Change Field Guide for Northern Minnesota Forests: Site-level considerations and adaptation](#)).

- 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 and [NIACS climate change projections for tree species in MDLP](#).
- Retain biological legacies through the incorporation of MFRC site-level guidelines.

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

GDS-1C Strategies

- Provide structural diversity characteristics, including:
 - sizes (diameter and height), abundance, and distribution of overstory trees
 - abundance and diversity of understory vegetation
 - arrangement (scattered or clumped) of vegetation in the stand
 - distribution, size, and decay class of snags and coarse woody debris
- Use methods such as selection harvesting to encourage diversity of species, ages, and stand structures where appropriate.
- Meet or exceed the MFRC site-level guidelines designed to maintain tree species diversity within a stand.
- Retain tree species 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.
- When protecting advanced regeneration is desirable, use harvest systems or methods that retain advanced regeneration and 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. To enhance seedling recruitment of some species, a partial canopy may be retained to meet the needed moisture and light requirements of the seedlings.
- Identify some stands where succession is allowed to occur to encourage the development of within-stand diversity. Movement to the next successional stage may be achieved with or without harvest.
- Look for and take opportunities to increase and/or maintain target species within stands, including white pine, white spruce, upland cedar, upland tamarack, upland black spruce, yellow birch, and red and bur oak as components within appropriate cover types and NPCs. Silvicultural practices that may increase the presence of these target species include planting, inter-planting, artificial or natural seeding, and leave tree selection.
- Across the landscape, manage planted and seeded stands to represent the variation in species composition within NPCs. This may be accomplished by:
 - accepting lower stocking levels of planted species in younger plantations if other desirable species are present
 - planting or seeding mixed species appropriate to the site

- using intermediate harvests to enhance age, species, and structural diversity
- 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, nuts, and berries) for wildlife benefits and to encourage natural regeneration.
- Recognize that some plant communities naturally have low species diversity due to natural site conditions and disturbance regimes. For example, low species diversity occurs in specialized peatland communities.
 - All of the above-listed methods to maintain or enhance species diversity still apply to these species-poor NPCs, but for a smaller set of species than would be found in other, more diverse NPCs.

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-aged 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
- projected shifts in cover type distribution in response to climate change
- expected future market and stand conditions
- incorporating intermediate treatments to achieve goals in conjunction with harvests

The statewide 10-year stand exam list was developed to implement the strategic direction for this plan period. See [the DNR 10-year stand exam list report](#) for more information. See Tables 3.3-3.4, Fig. 3.2, and [Appendix D](#) for acres and volume summaries for the 10-year stand exam list in MDLP. 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. The estimated volume from planned stand exam acres is not equivalent to the volume offered on timber sale permits, and volume offered is not equivalent to volume harvested.

After site visits and interdisciplinary coordination, foresters determine whether forest stands on the stand exam list should be appraised and offered for sale, have their inventory corrected, or have planned treatment delayed to later in the planning period or deferred 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 while moving forest conditions toward the DNR’s age class distribution goals:

- Emphasize visiting the oldest stands on the stand exam list first to evaluate for appropriate management.
- Consider SFRMP goals when proposing annual plan additions (APAs) and follow DNR APA policy when assessing how APAs (and deferred acres) interact with planned acres in offering the planned amount of volume.
 - Annual plan additions are stands or portions of stands that make sense to treat immediately (e.g., to address insects and diseases, operational considerations, opportunities to achieve SFRMP goals, or to adhere to policy) and are not on the stand exam list.
- Consider potential biomass harvest consistent with MFRC guidelines.
 - Biomass could be available as tops and limbs from timber harvests.
 - Non-commercial forest and brushlands may have the potential for biomass harvest.

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

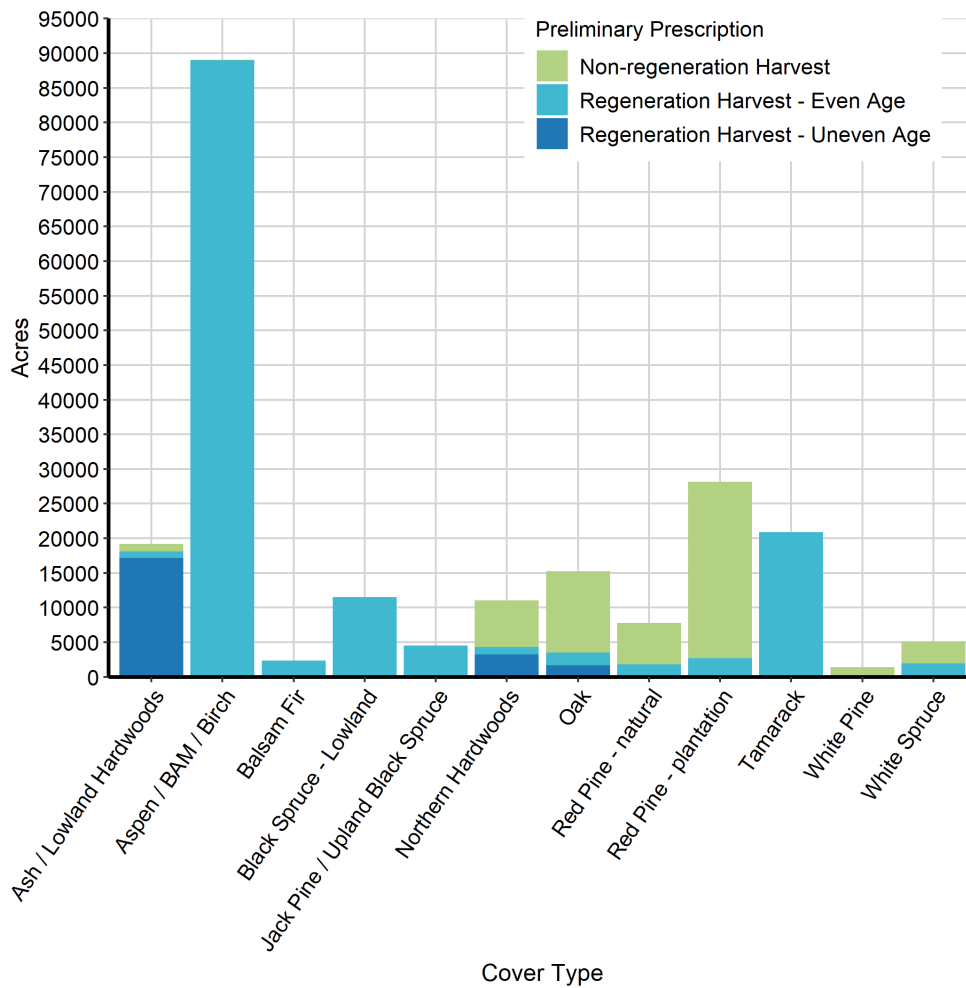
Modeled Cover Type	Forestry Acres Planned	Fish and Wildlife Acres Planned	Total Acres Planned
Aspen/Balm of Gilead SI<65	21,518	720	22,238
Aspen/Balm of Gilead SI>64	60,637	1,931	62,568
Balsam Fir	2,334	18	2,353
Birch	2,284	223	2,507
Black spruce lowland 29<SI<40	5,993	35	6,029
Black spruce lowland SI<30	3,427		3,427
Black spruce lowland SI>39	1,944	69	2,013
Ash/Lowland hardwoods	18,462	481	18,942

Modeled Cover Type	Forestry Acres Planned	Fish and Wildlife Acres Planned	Total Acres Planned
Northern hardwoods	10,352	660	11,012
Oak	14,377	884	15,261
Offsite oak	43		43
Jack pine	4,039	437	4,477
Red pine natural origin	7,694	110	7,804
Red pine planted	27,944	183	28,127
White pine	1,336		1,336
Tamarack SI<40	11,975	252	12,227
Tamarack SI>39	8,594	102	8,696
Upland Black Spruce	72		72
White Cedar	46		46
White Spruce	5,085	12	5,098
Total	208,158	6,117	214,275

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 MDLP 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 depends on the annual planned volume. On average, 260-270,000 cords are offered annually from DNR-administered lands in the MDLP Section. 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	2,195,290	75,578	2,270,869
Thinning	491,185	8,844	500,029
Uneven-aged harvest	138,843	13,235	152,080
Total	2,825,319	89,244	3,914,564

Figure 3.2: Acres on the 10-year stand exam list by cover types and preliminary prescription in the MDLP Section (for cover types with at least 500 acres planned). Regeneration harvests aim to develop a new age class in a stand through harvest, while non-regeneration harvests (e.g., thinning) aim to improve stand growth.



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, informal timber sales, or permits offered at auctions for a number of non-timber forest products, which may be restricted depending on administration.

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. This could include modifying management activities to avoid impacts on or encourage the development of certain non-timber forest products.
- Supervise and enforce special product permit regulations and permits sold at auction to ensure resource sustainability.
- Manage or use some forest stands for non-timber forest products. Examples could include:
 - favoring birch regeneration to produce birch poles
 - promoting sugar maple in areas used for syrup production
 - retaining balsam fir to maintain a balsam bough collecting area
- Consider known locations of important wildlife habitats, rare native plant communities, old growth forests (designated and candidate sites), old (>150 years) stagnant lowland conifers, 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: [A1](#), [A2](#), [A3](#), [B1](#), [B3](#), [B5](#), [B6](#), [D1](#), [D2](#), [E1](#), [F1](#), [J1](#)

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 make-up 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 early 20th century, timber harvesting practices and large wildfires in some portions of Minnesota caused much of the long-lived coniferous forest to be replaced by early successional species. The scale and intensity of timber harvest and wildfires had profound and long-lasting effects on seed sources, soil fertility, and subsequent re-vegetation. Current land

ownership patterns, forest resource management goals, and different ownership constraints influence distributions of species, age classes, natural and human disturbances, and NPC growth stages across the landscape.

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 oak and other hardwoods.

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 regenerate 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, projects 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 projected 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.

Mature to old forest conditions are represented in many ways on DNR-administered lands, ranging from stands over standard DNR rotation age for a cover type (hereafter referred to as “older forest”) to designated old growth forests. These conditions are created or maintained in many ways on DNR-administered land and on other ownerships in the MDLP landscape, including:

- Designation of [old growth forests](#).
- 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 offered is based on model results that provide for the development and retention of some older forest.
 - Management regimes on FAW-administered lands and in some management opportunity areas allow for older forest.
 - Ensuring that at least 2.5 of the aspen age class is at least 60 years old statewide.
- Some forest stands on DNR-administered lands (e.g., state parks and SNAs, inoperable stands, most representative sample areas (RSAs), and stagnant conifers) are not in the management pool.
- On average, approximately 30% of acres on DNR annual stand exam lists don't result in timber sales. A portion of these represent or will become older forests.
- Incorporating rare species protection into management activities may retain some local older forest conditions.
- Application of site-level guidelines to riparian management zones.
- Management for some High Conservation Values and Management Opportunity Areas may result in older forest.
- Conversions from shorter to longer-lived species (e.g., aspen to white pine or northern hardwoods).

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 original desired age class distributions from earlier SFRMPs are 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.

As reported in the [MDLP Assessment](#), the FIA estimates for acres over rotation age across ownerships are significantly greater than the original SFRMP benchmarks.

GDS-3A Strategies

- Allow some stands, especially those with existing old forest characteristics, to convert to long-lived cover types or under-represented NPC growth stages (e.g., white pine in FDc34a).
- Manage designated old-growth stands (Table 3.6) and SMZs according to DNR policy and OFMCs according to old growth policy and MOA guidance documents ([Appendix E](#)).
- Consider monitoring the condition of old growth forests when examining adjacent stands on the stand exam list.
- Consider nominating appropriate stands for old growth designation through the appropriate regional old growth committee, especially in new acquisitions that have not been evaluated before.
- Use silvicultural treatments that retain old forest components in some stands such as OFMCs, FAW-administered 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 retaining old forest in the area and the age class structure of the surrounding local landscape.
 - Account for forest health concerns while retaining older forest components, for example, *Diplodia*, in regenerating NORP stands.
- Use silvicultural prescriptions or reserves to create corridors that connect older stands.
- Target long-lived tree species to leave as legacies.

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

Species in 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 [Wildlife Action Plan](#) and the [Rare Species Guide](#) on the DNR website.

GDS-3B Strategies

- Use interdisciplinary forest management processes to apply SGCN data and Wildlife Action Plan guidance in vegetation management when conditions and opportunities are suitable.
- Maintain or enhance local habitat conditions for SGCNs during forest management, when feasible, given the land status.
 - Where appropriate, manage lowland conifer sites on WMAs for the benefit of spruce grouse, great gray owls, boreal chickadees, Connecticut warblers, black-backed and three-toed woodpeckers, gray jays, fishers, and martens.
- Manage some MOAs consistent with their association with SGCNs.
 - MOAs identified in this plan address specific SGCNs (either directly or indirectly), including American woodcock, sharp-tailed grouse, black-backed woodpecker, olive-sided flycatcher, boreal chickadee, golden-winged warbler, and long-eared bats.
- Implement climate change adaptation strategies in the [Wildlife Action Plan](#) where possible and appropriate.

- Use vegetation management strategies that retain connections between areas of habitat on the landscape.
- When possible, cooperate with adjacent landowners to maintain or enhance habitat.

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 in this plan is to set the stage in the short term (10 years) to maintain a 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. See the [MDLP Assessment document](#) or a summary of the current distribution of patches by size and age class in the MDLP Section.

In addition, 32 patch MOAs were adopted through this planning process in MDLP. The list of all MOAs, including patch MOAs, and links to their guidance documents are in [Appendix E](#).

GDS-3C Strategies

- In the 32 adopted patch MOAs, review and incorporate MOA guidance documents in management activities.
- Outside of patch MOAs, maintain existing large patches when feasible.
- Group harvest activities to maintain or create new large patches.
- Lump stands of similar age, cover type, and density while performing forest stand inventory to create larger stand sizes, considering land status and administrator.
 - Re-examine existing FIM boundaries and look for opportunities to update based on NPC, current remotely sensed data, and habitat and biodiversity information.
 - Consider the placement of reserves in timber sales that include similar grouped stands to help meet objectives in this plan (wildlife habitat, slope protection, habitat corridors, etc.)
- Consider increasing the “age window” for harvesting adjacent stands to maintain or create new large patches (harvesting at younger or older ages than normal).

- Where consistent with other site objectives, increase the size of clearcuts 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 (see the [MDLP Assessment](#) for a summary of MBS sites in the Section).

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 [DNR website](#).

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 following the guidance and directions contained in this plan. Forest management activities carried out in those MBS sites determined to be of greatest concern or importance will emphasize the following strategies to help minimize the impact of factors on which the MBS sites of biodiversity significance were ranked.

- Work with interdisciplinary coordination partners to clarify which MBS sites are of greatest concern or importance during management planning and which are feasible to manage for their biodiversity significance given their land status.
- Consider the broader context and significance of the MBS site as a whole when assigning management objectives and designing silvicultural prescriptions. Examples of strategies to consider include:
 - Emulate the range of within-stand composition, structure, and function of NPC growth stages associated with the MBS site rank when managing stands in MBS sites.
 - Apply variable density thinning or variable retention during harvest or reforestation where appropriate.
 - Emulate natural processes, and increase the use of prescribed fire as a silvicultural technique when managing fire-dependent NPCs.

- Locate roads and trails to minimize fragmentation of high and outstanding MBS sites and Watershed Protection Areas of Peatland SNAs (Hole in the Bog and Wawina Peatlands SNAs).
- MBS High and Outstanding sites of biodiversity significance were initially used to inform the identification of the current network of High Conservation Value Forest sites. Manage stands identified as having High Conservation Values consistent with DNR policy.
- 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. Endangered and threatened species are protected under federal or state law. Species listed as special concern are not statutorily protected but may be considered in management decisions. Up-to-date information on the state ETS list can be found on the DNR’s [ETS website](#). 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 rare species statutes and associated rules. Information on rare species in MN is available on the [Rare Species Guide website](#).

GDS-3E Strategies

- Provide DNR staff training on and access to the Natural Heritage Information System (NHIS).
- Incorporate new rare features inventory information into NHIS and management plans as it becomes available.
- Review the rare features database (NHIS) prior to all management activities (i.e., appraisal, access planning, harvesting, and stand development work).
- Implement strategies to maintain and enhance ETS species and their habitats during management as required by laws or DNR policies, or to the extent possible depending on land status for species not protected by law or DNR policy.
 - Coordinate with EWR specialists according to the DNR’s interdisciplinary coordination policy and refer to DNR guidelines or policies for rare species, the [Rare Species Guide](#), and other sources as appropriate for information on rare species protection and conservation during management.
- Where possible, incorporate management options to mitigate the effects of climate change on ETS species.
- The Leech Lake Band of Ojibwe maintains a separate list of threatened, endangered, and special concern (TES) species. Contact Leech Lake Division of Resource Management staff annually for updated TES information within the Leech Lake Reservation.

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

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 ranked [S1, S2, or S3](#) 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 [DNR native plant community classification webpage](#).

In addition to status ranks, NPC condition ranks indicate the ecological integrity or site-level quality of individual 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

- Prioritize management approaches that maintain or enhance the characteristics that contribute to a C or greater condition rank for rare NPCs (S1 through S3 rank).
- Apply deliberate management to stands identified as the highest quality examples of rare NPCs (rank B or above, depending on NPC).
 - When available, refer to guidance documents for specific rare NPCs.
 - Consult interdisciplinary coordination partners, including EWR regional ecologists, as needed to inform treatments to protect, maintain, or enhance the ecological integrity of rare NPCs.
 - Consider swapping stands when possible and appropriate to protect, maintain, or enhance high-quality examples of rare NPCs.
- Avoid creating access routes and landings in rare NPCs to the extent possible.

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

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 forests and 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 proximity of inoperable stands and reserved areas (e.g., old growth, SNAs, state parks) in providing representations of growth stages when developing prescriptions, and look for opportunities to complement/coordinate growth stages when similar conditions are adjoining.

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, jack pine, and tamarack cover types represents young, early successional forest in this plan. The goal of balancing age class distributions in even-aged 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 MDLP Section to meet age class and habitat goals 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 managing 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 [Appendix E](#).

3.4 Wildlife Habitat

The GDS and Strategies in this section address Issues: [A2](#), [B1](#), [B2](#), [D2](#), [E1](#), [F1](#), [G1](#)

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 positively or negatively affect wildlife species, as well as provide habitat for a variety of species. A range of vegetation conditions and components of species' habitats are provided in the MDLP Section through a variety of mechanisms:

- **Some species associated with older forest** are provided for in statutory preserves, old growth stands and old forest management complexes, some 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 or natural disturbance events.
- **Species associated with forest interior habitat** are provided for in areas with large patches of mature forest and some management opportunity areas (MOAs; see GDS 3C).

- **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.

Overall, providing a diversity of forest characteristics and forest stand age classes will help support wildlife species with different habitat requirements. Strategies throughout this plan promote and preserve wildlife habitat, including guidance related to:

- Increasing tree species and structural diversity within stands
- Ensuring there is older and younger forest habitat across the landscape
- Providing a range of NPC growth stages
- Protecting rare native plant communities; endangered, threatened, and special concern species; species in greatest conservation need; riparian areas, and high and outstanding sites of biodiversity significance

The strategies below provide additional, specific guidance related to wildlife habitat in the NMOP 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, deer management areas (aimed at providing winter habitat), open landscape management areas, patch MOAs, the Mississippi Headwaters MOA, and owl MOAs. Summary information for all MOAs and links to their guidance documents are in [Appendix E](#).

GDS-4 Strategies

- Apply MFRC site-level guidelines to retain the integrity of riparian areas and protect wetlands (seasonal and permanent).
- Provide habitat elements for species that depend on perches, cavity trees, bark foraging sites (e.g., flaking bark and broken limbs), trees that can support large stick nests, and downed-woody debris through the application of MFRC site-level guidelines.
- Promote the development of mast- and berry-producing trees and shrubs to provide food for wildlife, including promoting oak into the forest canopy where present.
- Apply management recommendations for wildlife species' habitats in DNR guidelines and policies. Additional specific recommendations in this landscape include:
 - Increasing horizontal structural diversity on the ground within ½ mile of cedar stands to provide habitat for snowshoe hare and other species. Areas with >65% structural cover elevated off the ground 100-150 cm provide cover from predators (e.g., snag or tipped conifer trees, especially balsam fir, young conifers with low branches, tree tops, and larger slash off of the ground, and retained structure during salvage harvests).
- Provide for the needs of species associated with conifer stands and mixed conifer/hardwood stands. Opportunities include:

- Selection harvesting and reducing basal area (below the “B line” of the red pine stocking chart in the [Red Pine Management Guide](#) see page 30), taking wind-throw into consideration, on some red pine stands (for example, on appropriate non-school trust lands such as HCVF sites, or plantations in WMAs, etc.)
- Increasing acres of long-lived conifer cover types through active management or allowing some stands to naturally succeed to conifer types.
- Increasing mixed forest conditions in some stands through selection harvesting and stand improvement projects.
- Where opportunities exist, promote habitat connectivity through the placement of reserves (for example, between wetland features and older forests).
- Provide some site-specific benefits for game and nongame species through Management Opportunity Areas.
- Manage open landscape MOAs and other relevant areas within open landscape cover types (see Open Landscape cover type pg. 59) for the benefit of associated wildlife species.

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 the portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs.

Together, the DNR’s sustainable timber harvest level decision, the strategies in this plan, and the application of MFRC site-level guidelines contribute to overall watershed health by maintaining healthy forests on DNR-administered lands.

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

GDS-5A Strategies

- Retain a relatively continuous forest canopy cover in riparian management zones and minimize exposure of mineral soil within filter strips to protect and maintain water quality, aquatic and wildlife habitat types, and aesthetics.
- Maintain or increase old forest characteristics in riparian areas (e.g., longer-lived tree species, larger tree diameters, standing dead and down woody debris).
- Consider cover type conversions in RMZs to promote longer-lived tree species.
- Retain and promote conifer species to maintain shade, where appropriate, and discourage tree species beavers prefer, such as aspen and birch, in the RMZ of designated trout streams.

- Refer to Minnesota’s [Wildlife Action Plan](#), the MFRC’s Riparian Science Technical Committee’s [Analysis of Current Science Behind Riparian Issues](#), 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 stand exam review, timber sales supervision, and inspections.
- To the extent possible, maintain canopy cover around seasonal ponds.
- Favor reserves in locations around wetland habitats to maintain ecosystem functions.
- Consider management approaches that minimize impacts on reptiles, amphibians, and other sensitive species and seasonal wetland migrants.

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-aged managed cover types at their rotation ages ([Appendix E](#)).
- Use site preparation, inter-planting, release from competition (e.g., herbicide application or mechanical/hand release), and tree protection.
 - To the extent possible, use alternative approaches to minimize the use of pesticides (herbicides, insecticides, etc.), including mechanical site prep (e.g., roller chopping) and release (e.g., brushsaw) to control competition, where feasible.
 - Follow operational standards to control competing vegetation or forest insects and diseases on state lands.
- Where appropriate, 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.

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. Document their occurrence on state-managed lands (e.g., using the Early Detection Distribution and Mapping System website, [EDDMapS](#), or related apps).
- Involve private landowners and local units of government in gathering and disseminating information.
- Use the least intensive site preparation, release, and timber stand improvement methods appropriate to the site and management goals to ensure success and reduce the potential for invasive species introduction and establishment.
- Apply recommended strategies from DNR forest health specialists as appropriate.
- Refer to and apply the DNR’s invasive species policy and associated guidelines.
- Provide information 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.
- Where opportunities exist, implement prescribed burning to improve stand health and as a tool to prevent or control the effects of insect and disease outbreaks. When using prescribed fire to control pests, ensure that fire is used appropriately, considering the lifecycle of the pest to be controlled.

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

Wildlife species such as deer, hare, porcupine, beaver, and other rodents impact forests and plant regeneration through browsing, stem damage, and girdling. 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.
- Retain or promote conifer species in riparian areas to discourage beaver activity.
- Use mitigation techniques on sites where damage from wildlife is anticipated. Options to consider include:
 - Use protective measures such as fenced enclosures, bud capping, repellents, tree shelters, etc.
 - Seed or plant more heavily to account for expected mortality. When this strategy is employed, consider following up with pre-commercial treatments as needed to achieve the desired stand structure considering NPC, land administrator, and land status.
 - When practical, favor natural regeneration.
 - Seed or plant a mix of species rather than a single species, using NPC to help guide species selection.

3.8 Climate Change

The GDS and Strategies in this section address Issues: [B1](#), [B2](#), [B5](#), [F1](#), [G1](#), [H1](#), [J1](#)

GDS-8: Use best-available science to increase 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 likely 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, using resources including the DNR’s [Suitability of Tree Species by Native Plant Community table](#), including information on species affinity for warmer and/or dryer site conditions and [NIACS climate change projections for tree species in MDLP](#).
 - Favor tree species that are projected to have expanded habitat in MDLP under future climate conditions, especially in the Leech Lake Hardwood Resilience MOA.
- Evaluate site conditions with respect to climate change when selecting tree species for regeneration or conversion.
- Maintain refugia for species that cannot migrate by implementing the strategies throughout this plan that will provide a wide range of conditions and habitat types across the landscape.
- Seek to maintain connectivity of islands of habitat that allows the migration of plants and animals.

- Enhance genetic diversity in planting and seeding. Refer to [current seed collection zones](#) and related guidance.
- Maintain or increase conifers adjacent to coldwater streams to provide a cooling effect in warm weather and retain snowpack longer, slowing discharge in the spring.
 - Refer to the Kabekona Cisco and Mississippi Headwaters MOAs for two specific locations to apply this and other related strategies.

3.9 Visual Quality

The GDS and Strategies in this section address Issues: [B1](#), [K1](#)

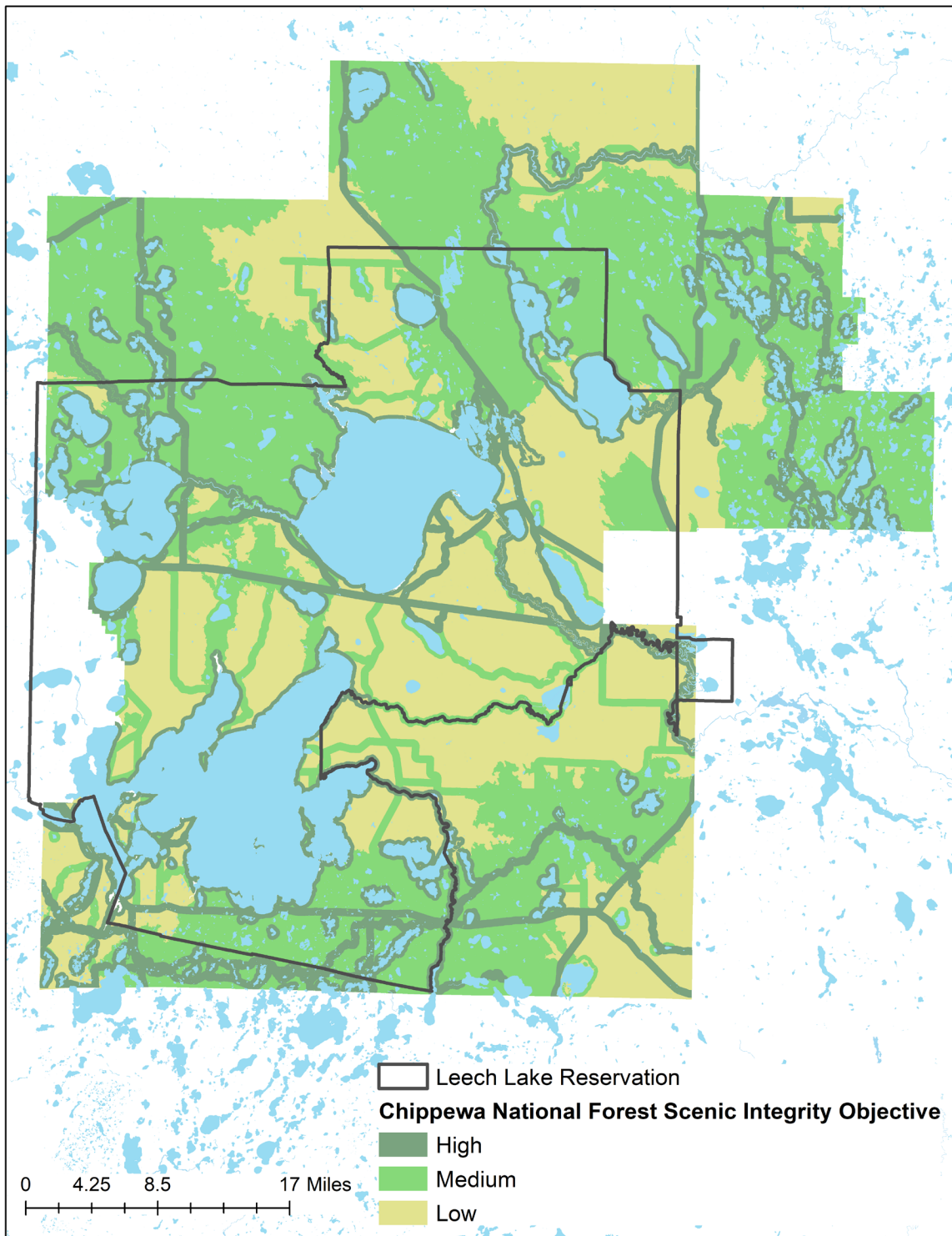
GDS-9: Minimize forest management impacts on visual quality in sensitive areas.

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 or recreation routes with moderate or high sensitivity ratings.
 - 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.
 - Incorporate considerations concerning species, wind firmness, and retention style (e.g., clumped) into prescription designs to maintain long-lasting visual quality along identified high-visual-quality roadways.
- Within the Leech Lake Reservation, incorporate information from the Chippewa National Forest plan's map of scenic integrity objectives into prescription designs to the extent possible (see map 3.1 below showing areas with low, medium, and high scenic integrity objectives). Chippewa National Forest plan data, including scenic integrity objective data, can also be viewed or downloaded from the [Chippewa National Forest geospatial data webpage](#).

Map 3.1. Chippewa National Forest Plan scenic integrity objectives (low, medium, high) within the Leech Lake Reservation. Data are available from the [Chippewa National Forest geospatial data webpage](#).



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:
 - use existing access routes where possible
 - consider existing recreational trail corridors and limit conflicts with recreational uses
 - eliminate unnecessary access routes
 - minimize forest land area lost to road development
 - review the Natural Heritage Information System database to avoid impacts on rare features
- 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 to avoid unauthorized uses.
- Evaluate whether access is needed in sensitive areas on a case-by-case basis through interdisciplinary coordination.
 - Avoid access routes across sensitive areas if possible.
 - 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

- Continue annual stand exam list review by DNR archeologists. Implement recommendations for mitigation as part of sale design.
- Where known locations of cultural resources exist (e.g., sugar bush, traditional harvest locations, etc.), consider options for minimizing impacts to or enhancing those resources.

3.12 Natural Disturbance Events

The GDS and Strategies in this section address Issues: [M1](#)

GDS-12: Promptly evaluate and determine appropriate responses 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, including:
 - Assessing the extent and significance of the event on forest lands in the Section and recommending forest management actions.
 - The Region FRIT may assemble or consult interdisciplinary representatives to help inform this assessment and recommendations.
 - Analyzing effects on planning objectives, including planned volume.
 - When disturbances involve multiple ownerships, the DNR will cooperate in the assessment and implementation of management actions with other agencies and landowners when possible.
- 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 while following existing APA and interdisciplinary coordination processes

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 [Appendix F](#)). On school trust lands within MOAs, standard DNR management rotation ages and reserve amounts apply unless otherwise specified in the DNR's Management of School Trust Lands Operational Order (see [Appendix F](#)). 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 stand exam list modeling in the MDLP 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 MDLP Section.

Management activities (timber sales, site prep, planting, etc.) within MOAs should be designed to meet the 10-year intent for the MOA and to implement the strategies identified to meet that intent to the extent possible while balancing other forest resources goals and adhering to DNR policies. However, not all MOA objectives are achievable on every stand within a MOA. Instead, objectives are met at the scale of the MOA through a combination of the resource conditions that preceded the current planning period, the spatial and temporal configuration of stands on the 10-year stand exam list, and the design of management activities within the MOA. There are multiple ways to achieve MOA goals, and the degree to which MOA guidance will impact any individual stand will vary (based on MOA goals and site conditions). Therefore, MOA implementation requires flexibility.

Individual MOA templates can be downloaded from the links in the tables for each MOA type in [Appendix E](#).

Appendix A: FIM Managed Acres Query

Total DNR Administration with inventory data (in Forest Inventory Module) in the MDLP Section = 1.23 million acres

Source: DNR FIM April 2017

- **Total managed acres = 1.14 million acres**

Land administered by the DNR Divisions of Forestry and Fish and Wildlife, excluding state parks, 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.

- **Total timberland forested cover types assigned managed acres = 690,000 acres**

Excludes non-forest (lowland brush, marsh, lowland grass, muskeg, upland grass, water, flooded, others) and forested stagnant and offsite cover types (stagnant spruce, tamarack, cedar, and offsite aspen and oak). Non-forest cover types assigned managed acres = 1.4 million acres, stagnant and off-site forest cover types assigned managed acres = 0.7 million 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 (GDSs are in columns and issues in rows). 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. Note: the table does not include Issue N1 because it concerns incorporating state and federal legal requirements into the SFRMP process.

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	X	X	X			X						X	X													X	
A2		X	X			X	X		X	X	X	X		X	X												
A3	X							X					X														X
B1	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X
B2	X	X	X											X							X						X
B3									X		X																
B4																	X										X
B5								X	X												X						
B6								X	X																		
C1	X			X																							X
C2					X																						
D1									X																		
D2		X	X			X								X													X
E1							X		X	X	X			X													
F1	X	X	X			X	X	X	X	X			X	X	X	X					X						
G1														X	X	X					X						
H1																	X	X	X	X							X
I1																			X								X
I2																			X								
I3																									X		
J1	X	X	X				X			X											X						X
K1																						X					
L1																							X				
M1																								X			

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, and Native Plant Communities

- B1. Addressing biodiversity, forest health, and productivity of native plant communities through management of forest composition, structure, 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 critically imperiled and imperiled 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 forest management that meets the Department plans for offering timber volume for sale 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 Species in 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 to aquatic resources of vegetation management on a watershed or sub-watershed level.

H. Timber Productivity

H1. Maintaining or increasing timber productivity on state lands.

I. Disturbance Impacts on Forest Ecosystems

I1. Addressing small- to intermediate-scale disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.

I2. Addressing non-native invasive species threats and invasions.

I3. Considering stand-replacing 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 structure 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 in Greatest Conservation Need to the extent possible.

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 to the extent possible.

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 that support critical 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 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.

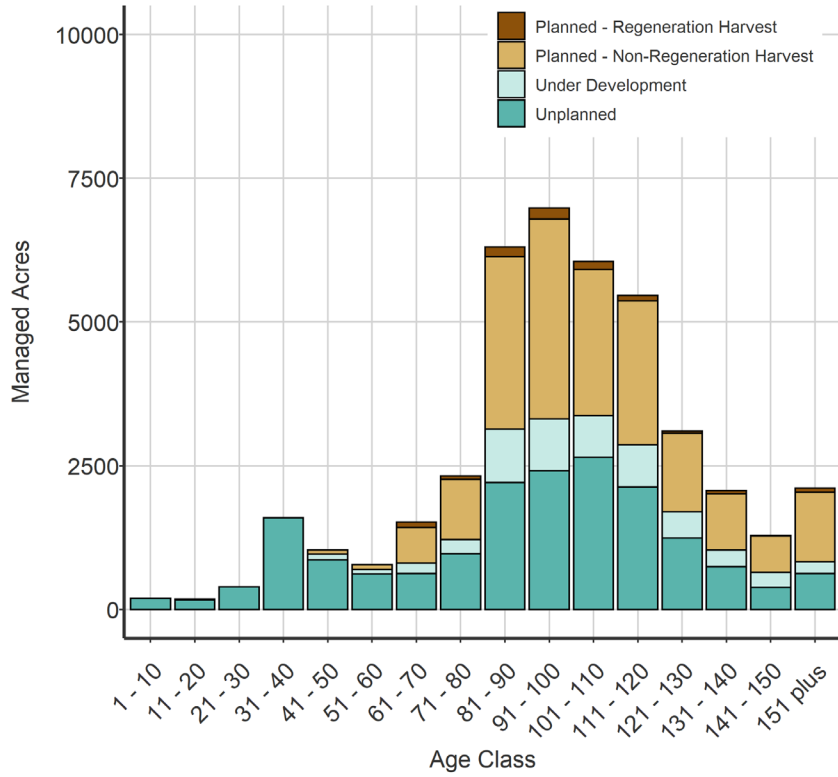
12. Natural Disturbance Events

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

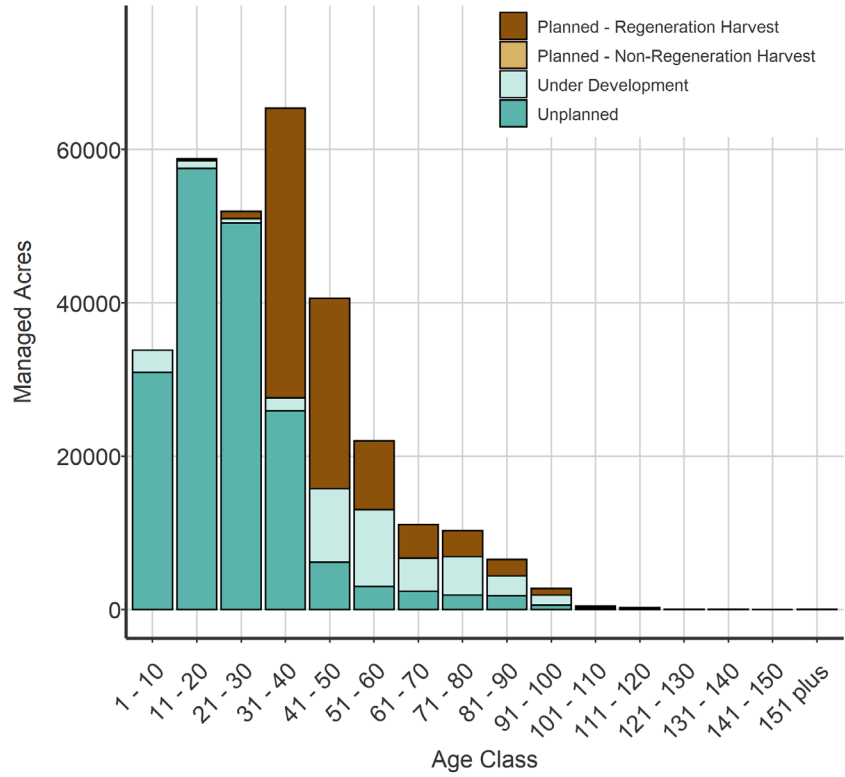
Appendix C: Cover Type Age Class Distributions

The charts in this appendix show the current age class distributions of managed acres as of 2019 for cover types listed in this plan in the Northern Minnesota Drift and Lake Plains. 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).

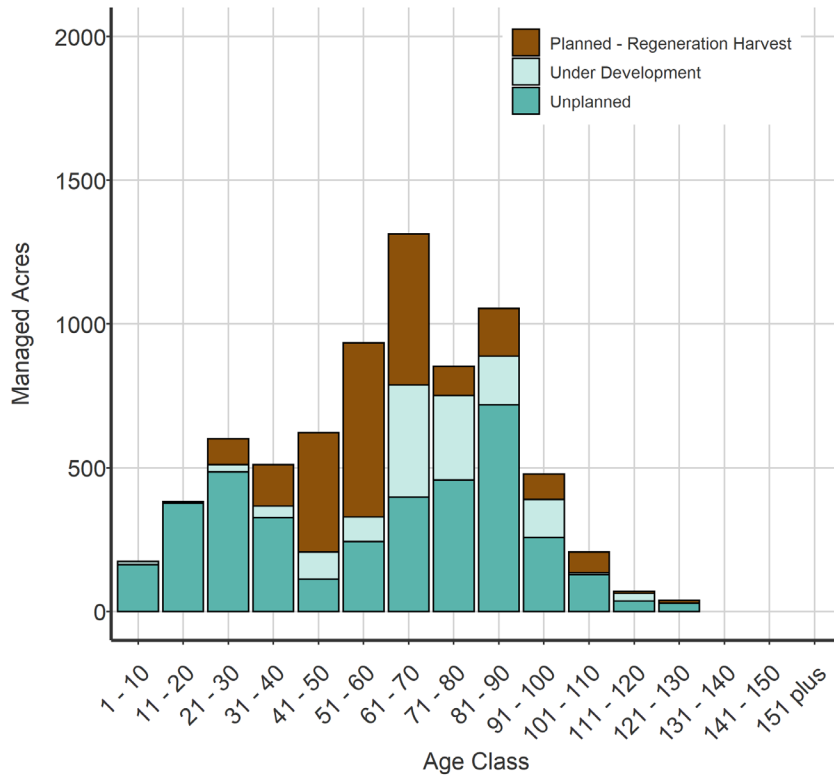
Ash/Lowland Hardwoods



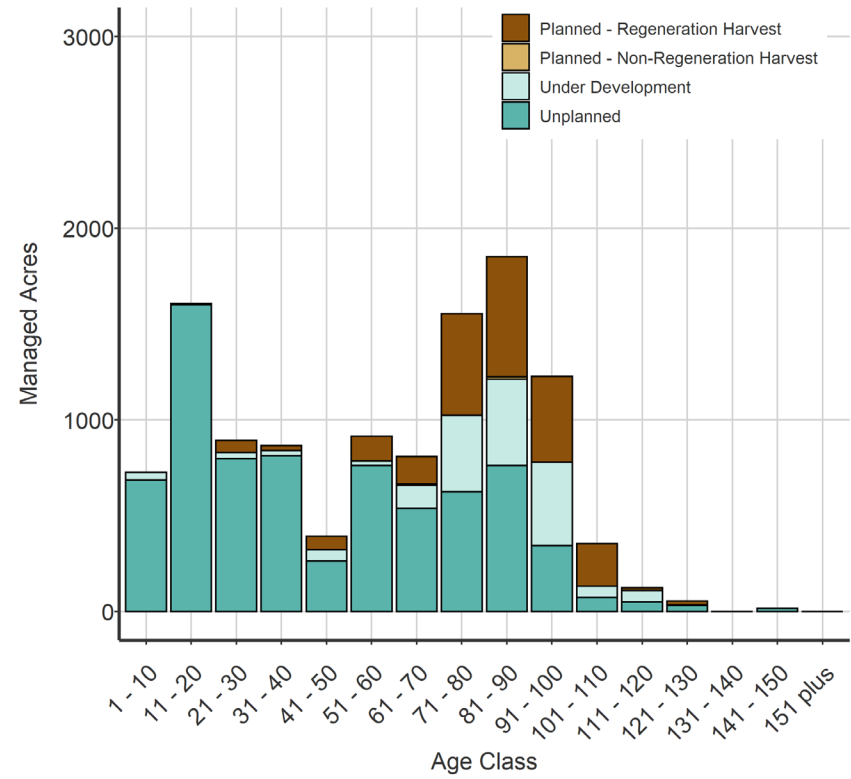
Aspen



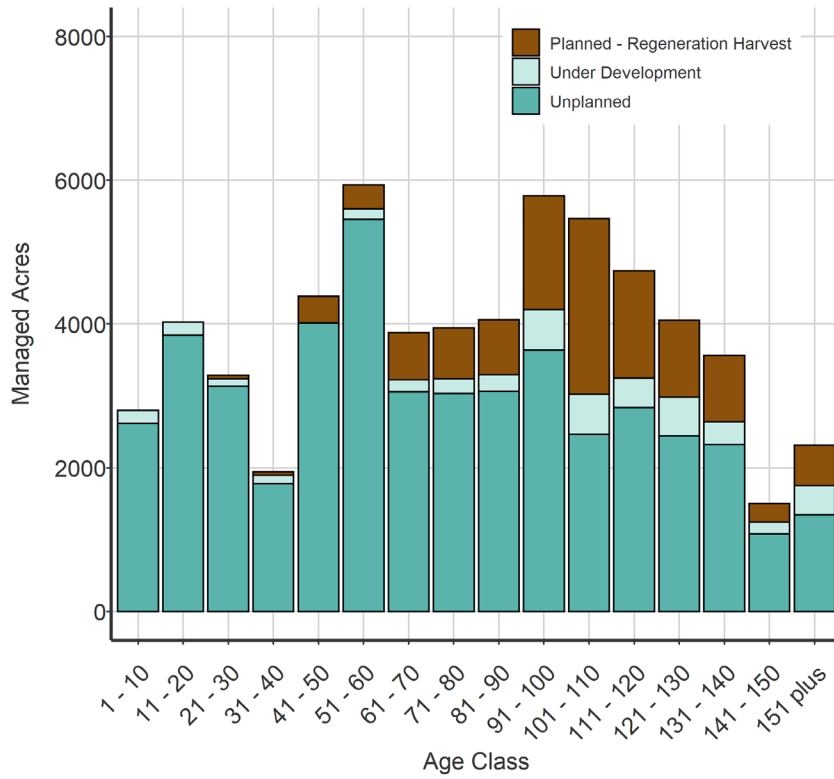
Balsam Fir



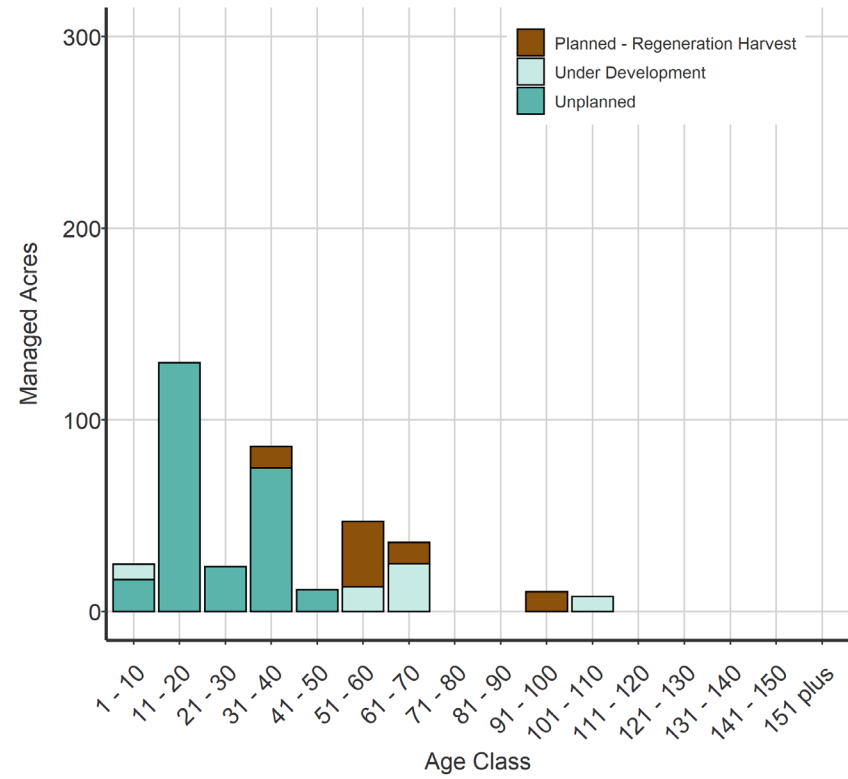
Birch



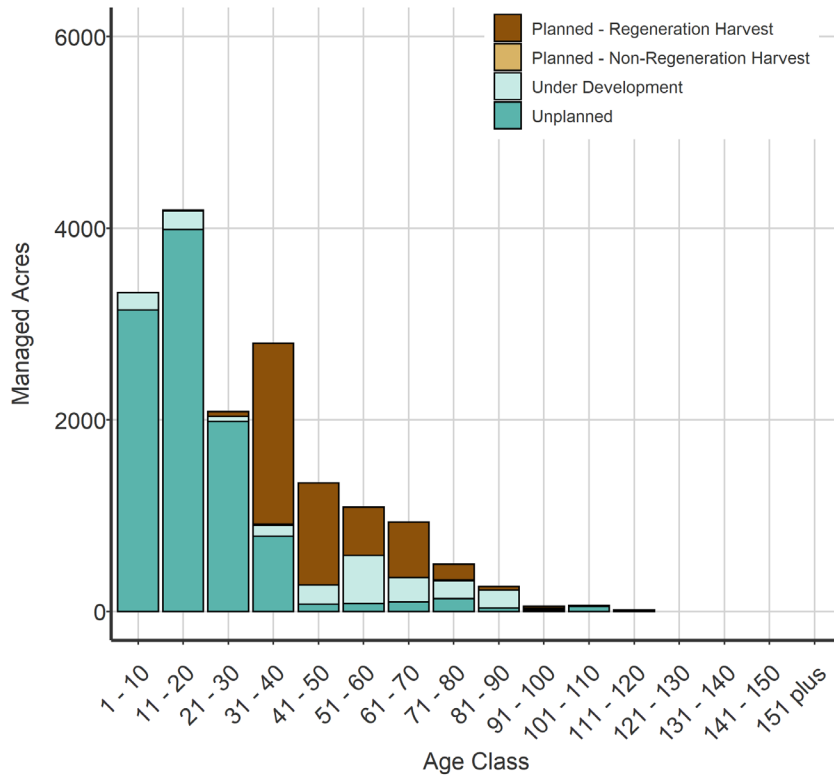
Black Spruce Lowland



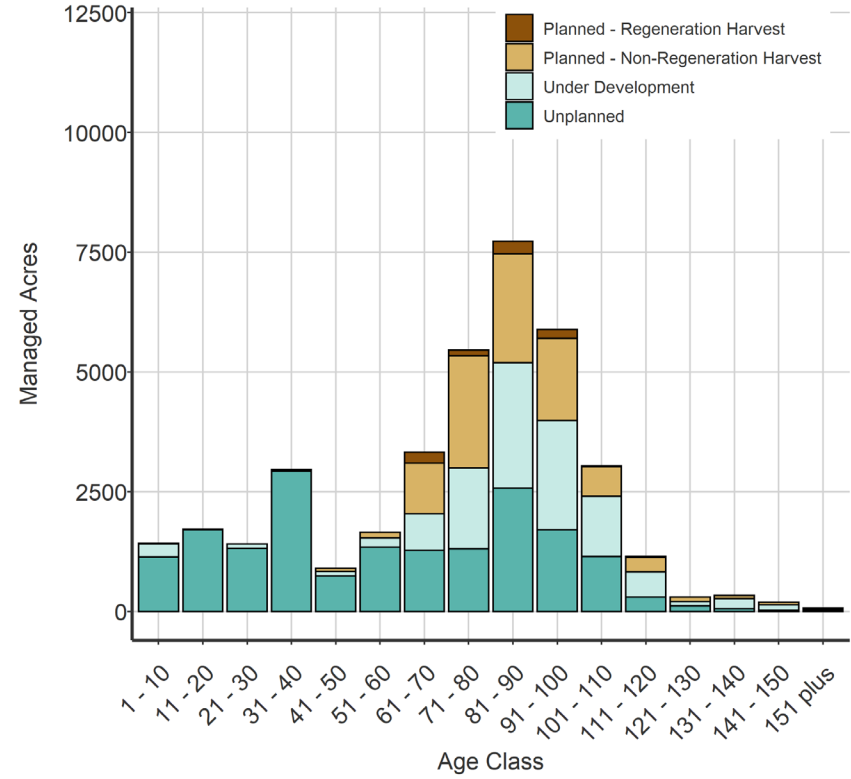
Black Spruce Upland



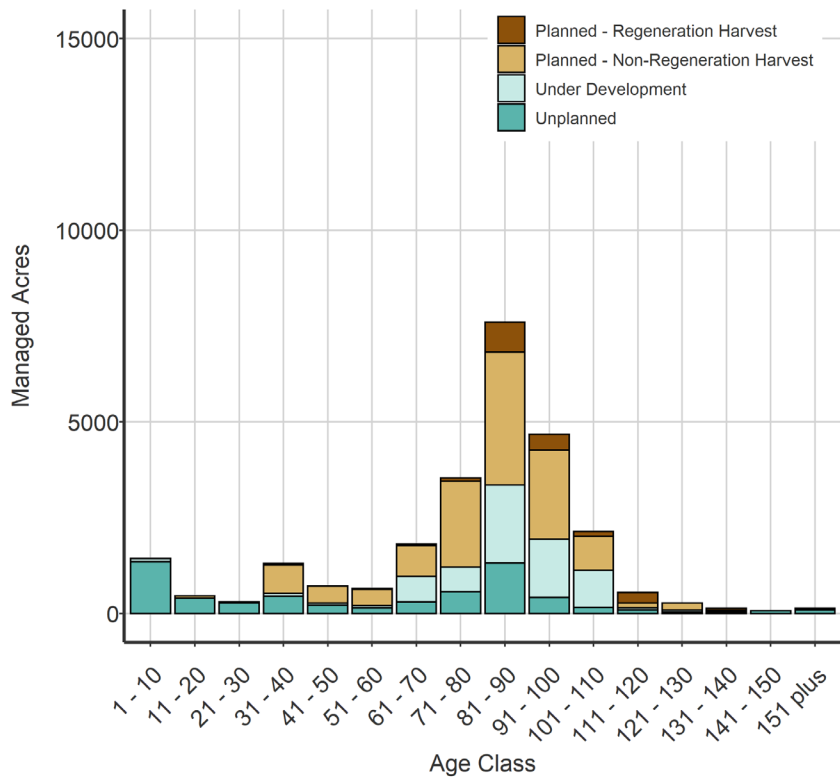
Jack Pine



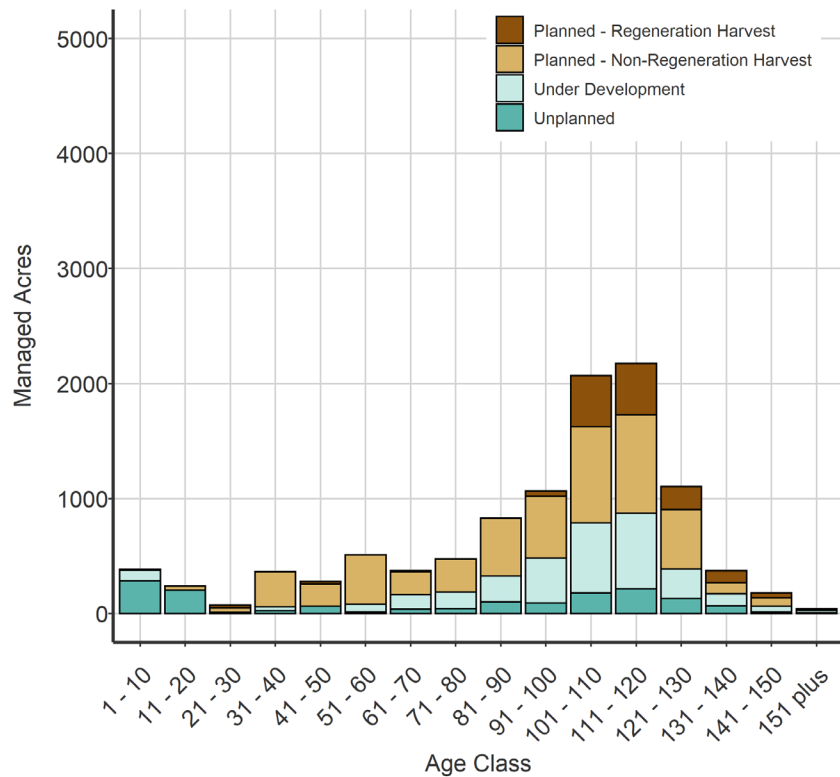
Northern Hardwoods



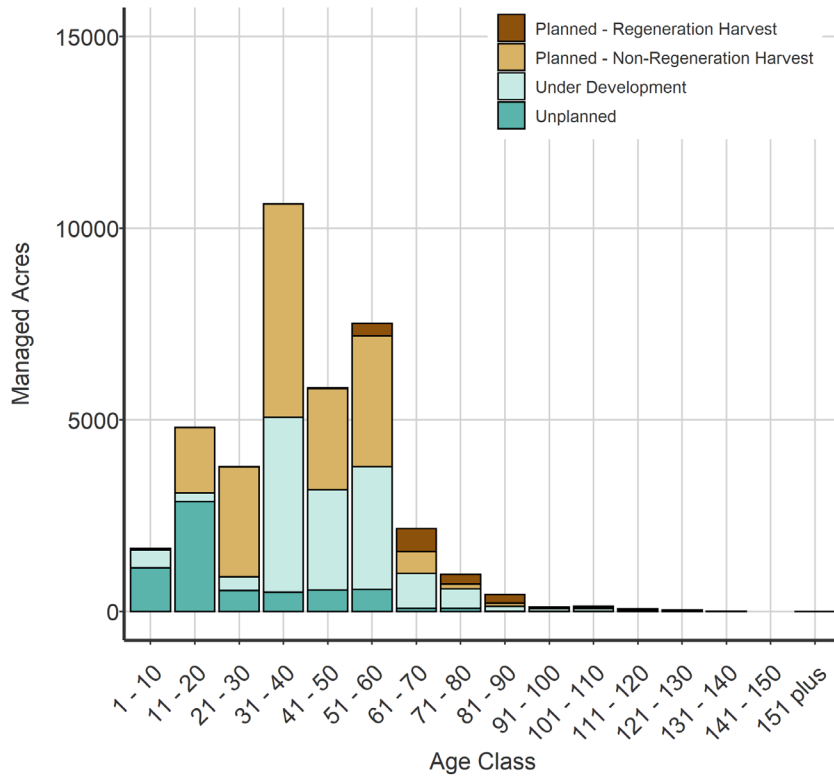
Oak



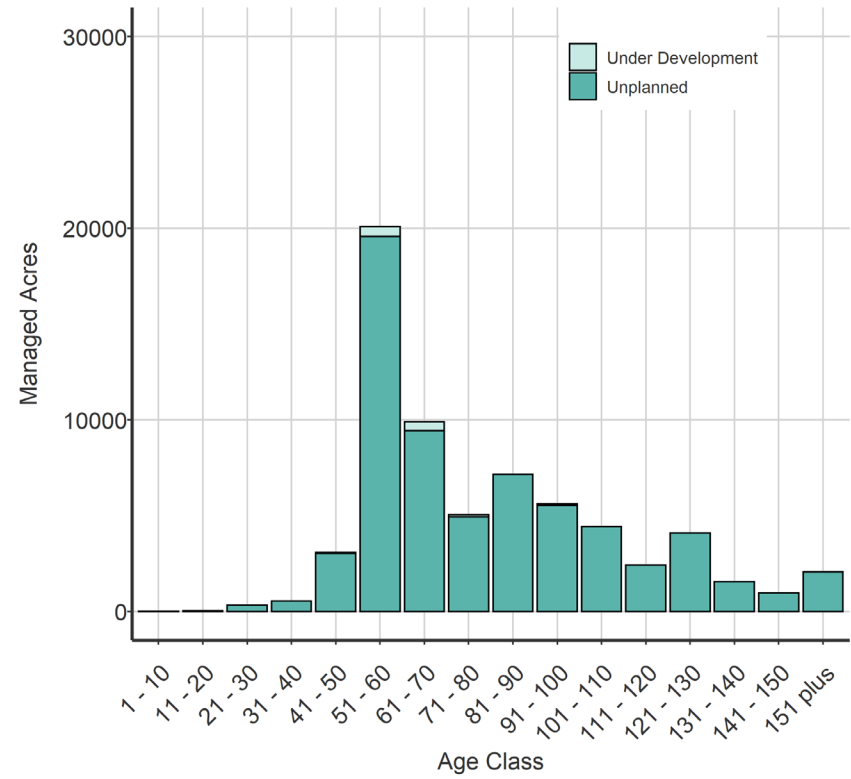
Red Pine Natural Origin



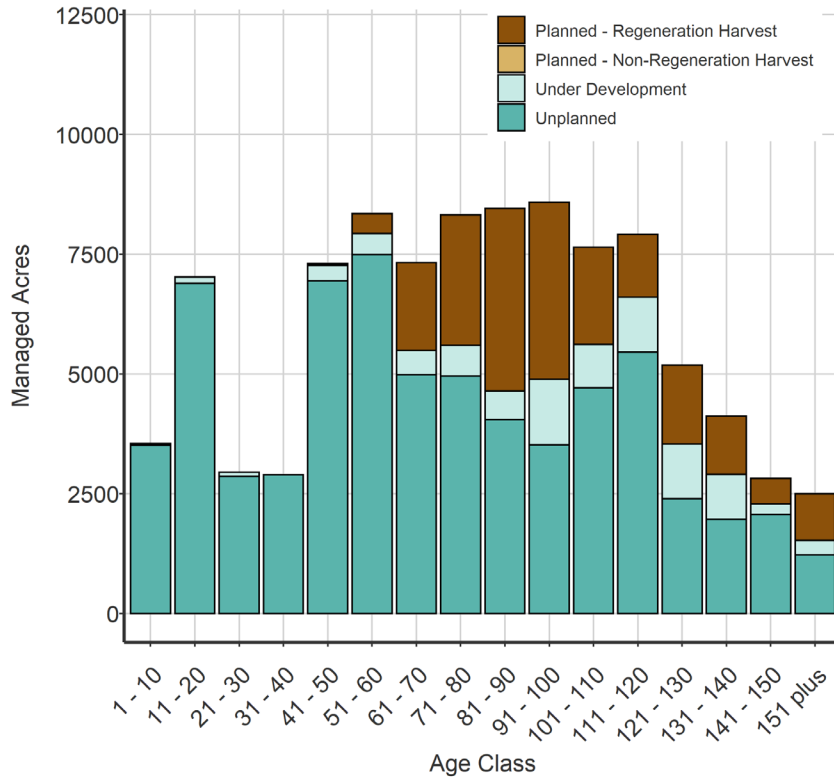
Red Pine Plantation



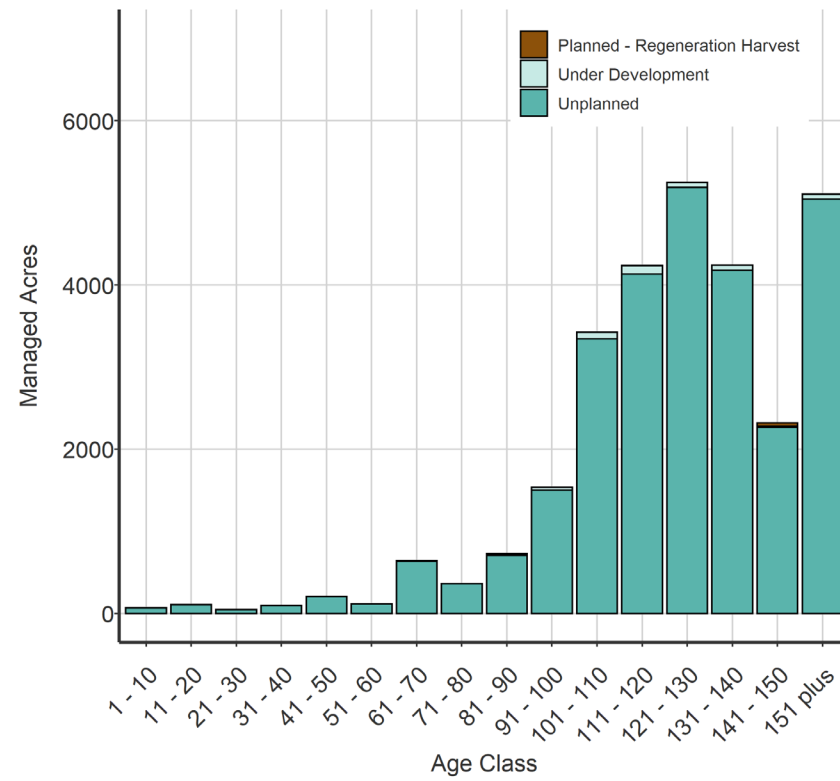
Stagnant Spruce



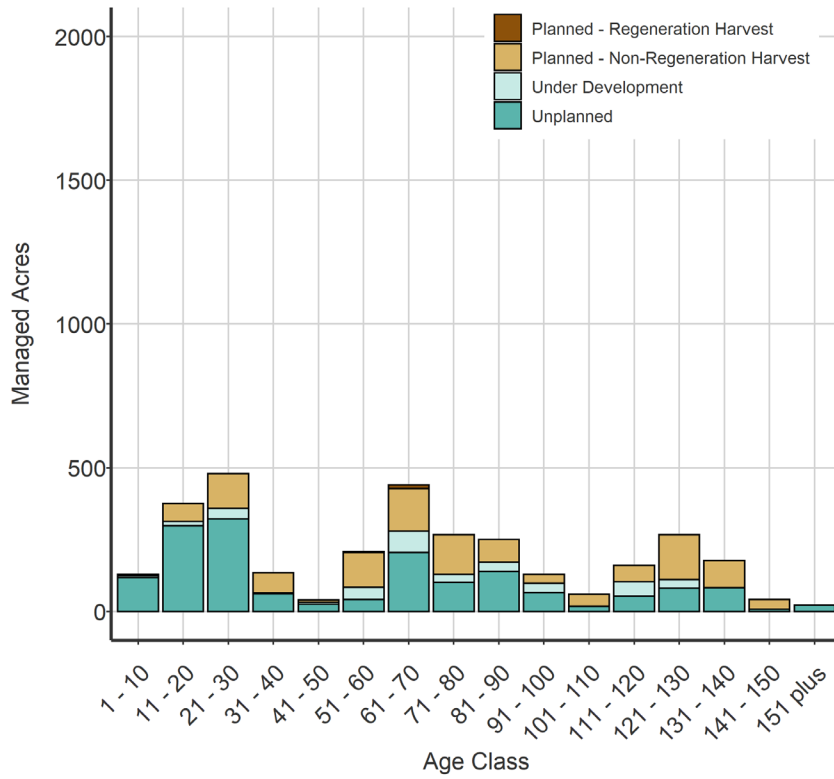
Tamarack



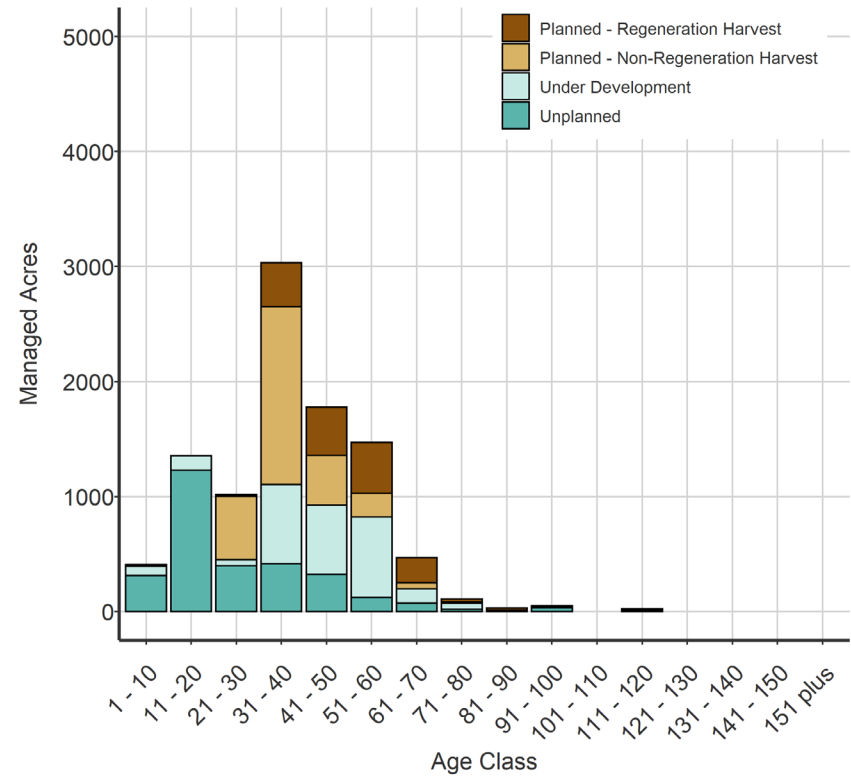
White Cedar



White Pine



White Spruce



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 MDLP Section. The 10-year stand exam list for the MDLP 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 [Sustainable Timber Harvest: Development of the DNR 10-year Stand Exam List report](#).

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

Administrator	Acres Planned	Modeled Volume
Forestry	210,667	2,825,319
Wildlife	6,136	89,244
Total	216,803	2,914,564

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 MDLP. SI = Site Index.

Cover Type	111 FOR	111 FAW	142 FOR	142 FAW	161 FOR	161 FAW	221 FOR	221 FAW	232 FOR	232 FAW	234 FOR	234 FAW	251 FOR	251 FAW	312 FOR	312 FAW	Total
Aspen/Balm of Gilead SI < 64	4,855	77	3,839	153	3,277	81	5,270	69	2,278	194	838	60	1,532	87	22		22,630
Aspen/Balm of Gilead SI > 64	12,343	78	7,528	319	9,908	44	14,950	197	10,788	1,227	3,718		2,656	34	73	32	63,895
Balsam Fir	708	17	163		242		771		276		128	1	77				2,384
Birch	282	3	778	133	185	82	687		295		28	5	55				2,532
Black spruce lowland 29<SI<40	810		211		55		2,291		1,352	35	480		818				6,053
Black spruce lowland SI<30	633		68		13		549		1,100		360		725				3,447
Black spruce lowland SI>39	415	18	196		81	10	440	27	376	11	111	3	331				2,019
Ash and Lowland hardwoods	2,741	7	2,239	184	807	11	3,299	116	8,655	150	524		392		29	14	19,166
Northern hardwoods	2,593	37	1,333	228	306	128	1,542	86	4,297	168	137	12	192				11,060
Oak	1,165		8,212	523	1,412	191	382	41	2,874	60	0		88		244	69	15,261
Offsite Oak			16		27						0		0				43
Jack Pine	870	27	134	6	1,832	355	593		208	51	412		0				4,487
Red pine - natural	1,473	37	1,333		1,970	58	2,416		323		178	15	5				7,809
Red pine - planted	5,124	6	4,589	13	10,634	108	3,446	2	3,069	54	1,020		56		14		28,134
White pine	380		347		287		7		207		119		30				1,377
Tamarack SI<40	1,706	12	262		260		2,098	53	4,653	178	267		2,729	8			12,227
Tamarack SI>39	2,259	33	378	10	501	30	1,997		2,651		209	11	600	19			8,696
Upland Black Spruce					11				5		56		0				72
White Cedar	46										0		0				46
White Spruce	1,374	5	520	7	1,395		731		576		346		173				5,126
Non-forest (grass or brush)	211		3		26	20	78				0		0				338
Total	39,986	356	32,147	1,575	33,232	1,116	41,546	592	43,984	2,127	8,931	107	10,459	148	382	115	216,803

Note: 111=Bemidji Forestry Area; 142=Backus, 161=Park Rapids, 221=Deer River, 232=Aitkin, 234=Hibbing, 251=Cloquet, 312=Little Falls

Appendix E: 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).

Individual MOA templates can be downloaded from the links in the tables for each MOA type below.

Deer Management Areas

Deer management areas provide habitat elements, such as winter cover, for deer on the landscape.

Map E.1: Deer management/winter habitat areas in the MDLP Section.

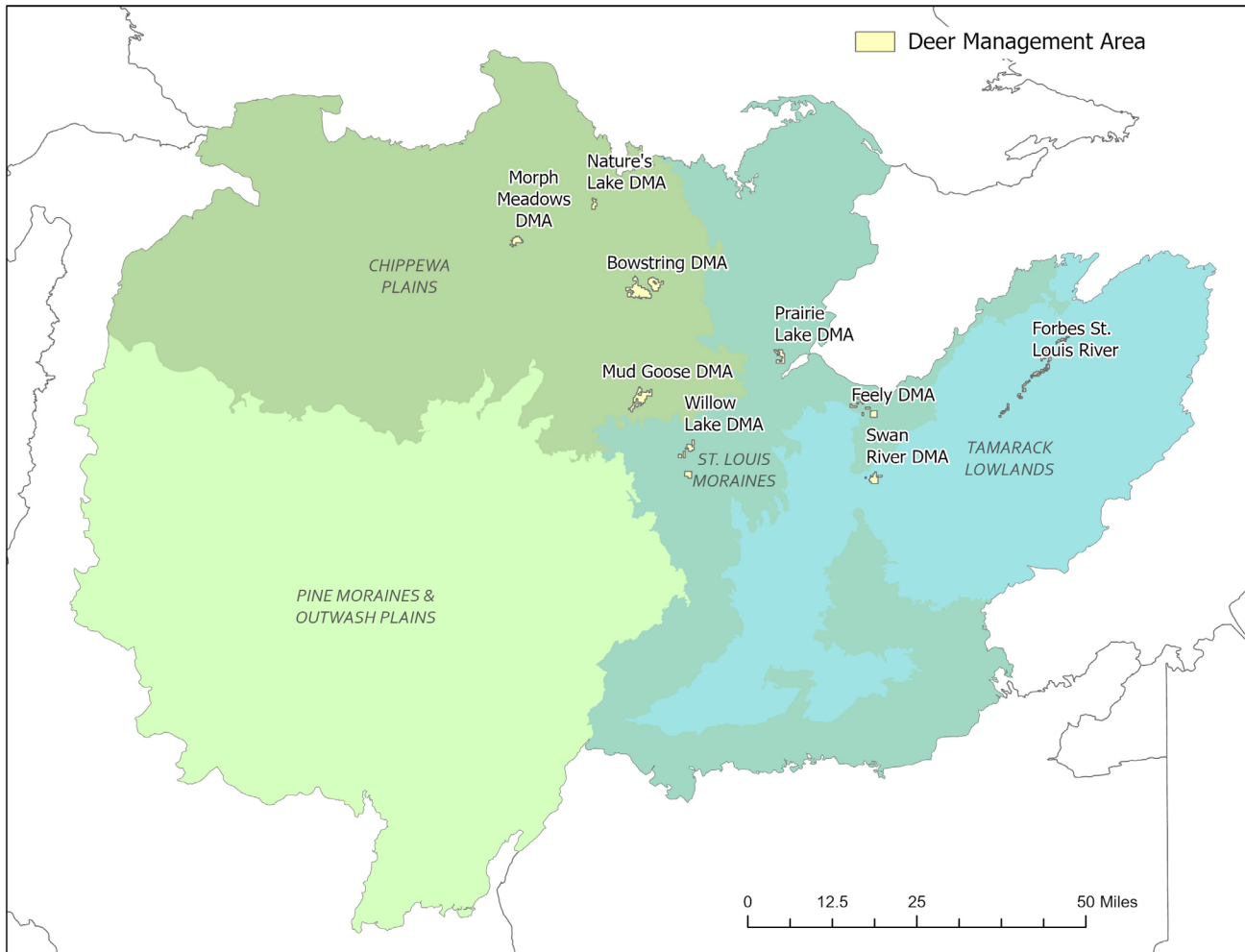


Table E.1: Deer management/winter habitat areas in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Acres
Forbes St. Louis River DMA	Hibbing Area	3,044
Morph Meadows DMA	Bemidji Area	935
Swan River DMA	Deer River Area	1,076
Feely DMA	Deer River Area	1,420
Mud Goose DMA	Deer River Area	2,614
Nature's Lake DMA	Deer River Area	517
Bowstring DMA	Deer River Area	5,104
Prairie Lake DMA	Deer River Area	980
Willow Lake DMA	Deer River Area	1,619

Owl MOA

Owl MOAs are designed to consistently provide all habitat needs for owl species, using timber harvest to rotate areas that provide various nesting and prey-production habitat elements over time.

Map E.2: Location of Owl MOAs in the MDLP Section.

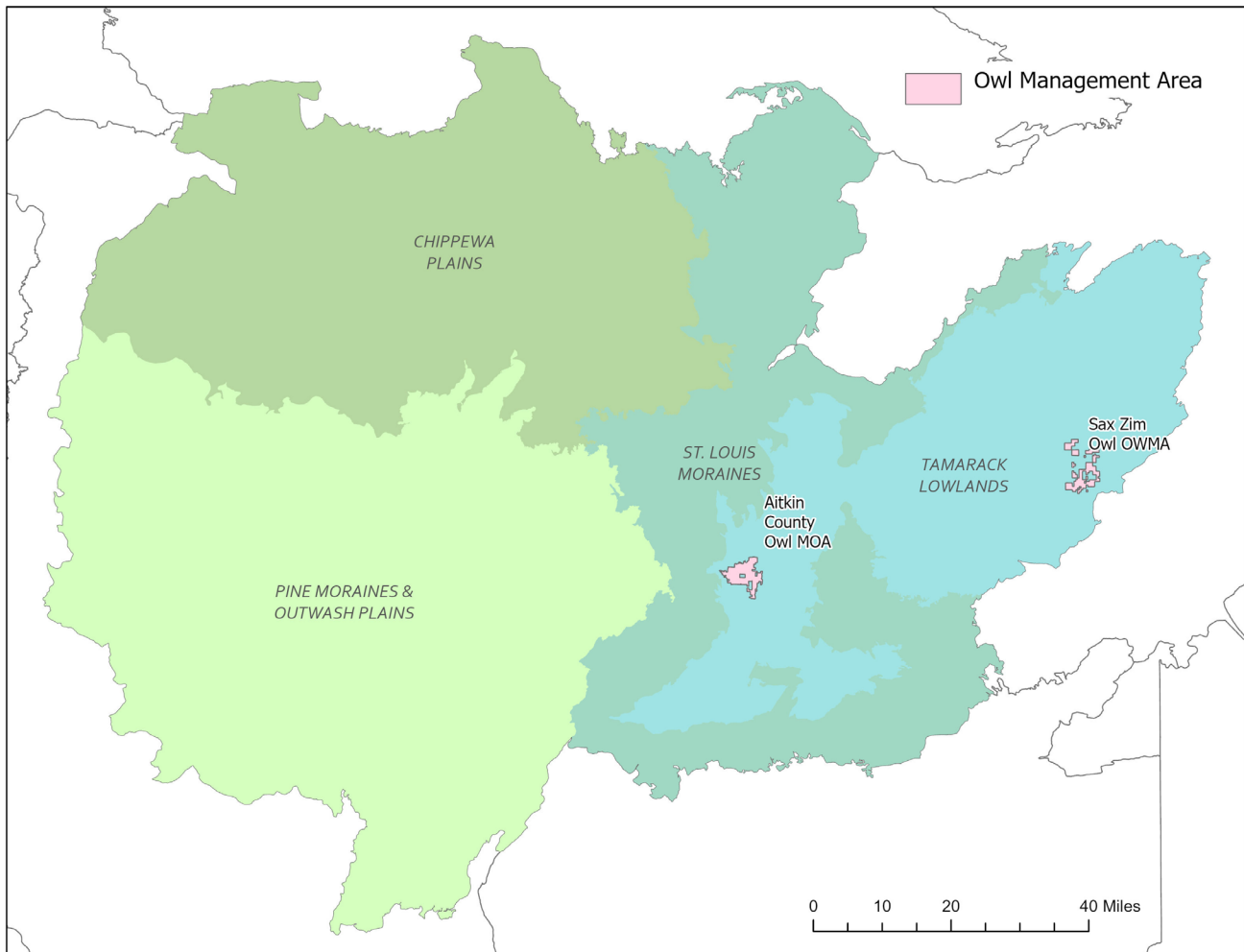


Table E.2: Owl MOAs in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA name	Forestry Area	Acres
Aitkin County Owl MOA	Aitkin Area	10,172
Sax Zim Owl OWMA	Cloquet Area	8,787

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 forest characteristics. Refer to the DNR Old Growth Forests Guidelines and amendments for more information.

Map E.3: Location of old forest management complexes in the MDLP Section.

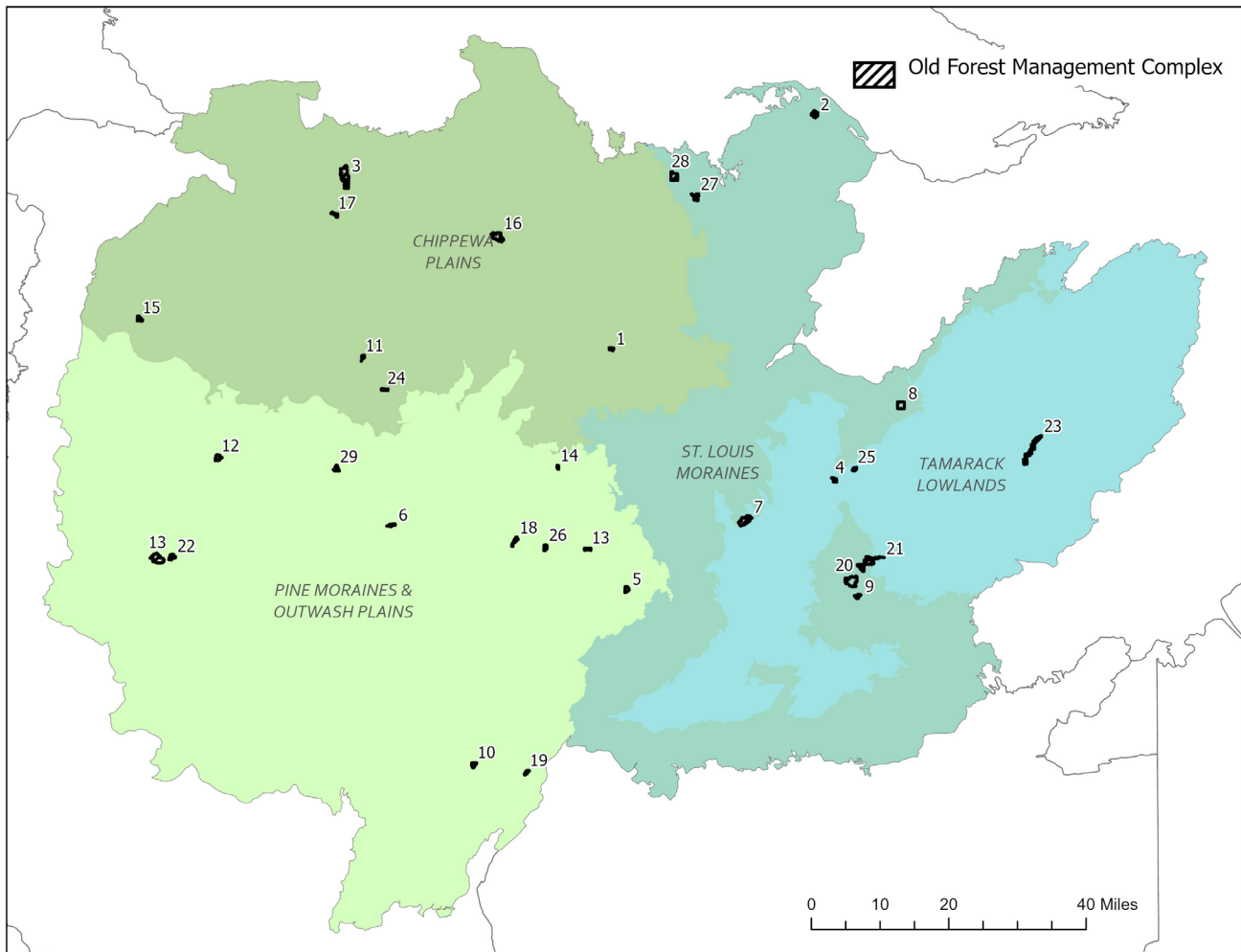


Table E.3: Old forest management complexes in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

Number	MOA Name	Forestry Area	Acres
1	Ball Club OFMC	Deer River Area	111
2	Battle Lake OFMC	Deer River Area	268
3	Buena Vista OFMC	Bemidji Area	1,471
4	County line OFMC	Deer River Area	183
5	Crooked Lake OFMC	Backus Area	241
6	Crystal Lake OFMC	Backus Area	149
7	Dagle Lake OFMC	Aitkin Area	941
8	Fairbanks OFMC	Hibbing Area	636
9	Glacier Lake OFMC	Aitkin Area	184
10	Gull Lake OFMC	Backus Area	237
11	Hart Lake OFMC	Bemidji Area	132
12	Hungry Man OFMC	Park Rapids Area	327
13	Lake George OFMC	Backus Area	128
14	Lomish Lake OFMC	Backus Area, Deer River Area	82
15	Lower Rice Lake OFMC	Bemidji Area	223
16	Morph Meadows OFMC	Bemidji Area	858
17	Movil Lake OFMC	Bemidji Area	178
18	Mule Lake OFMC	Backus Area	230
19	North Long Lake OFMC	Backus Area	134
20	Remote Lake OFMC	Aitkin Area	1,199
21	Savanna Portage OFMC	Aitkin Area	1,215
22	Smoky Hills OFMC	Park Rapids Area	286
23	South Whiteface OFMC	Cloquet Area	1,083

Number	MOA Name	Forestry Area	Acres
24	Spring Lake OFMC	Bemidji Area	119
25	Swan River OFMC	Deer River Area	146
26	Thirtysix Lake OFMC	Backus Area	191
27	Three Lakes OFMC	Deer River Area	330
28	Turtle River OFMC	Deer River Area	629
29	Waboose Lake OFMC	Park Rapids Area	247
13	Wolf Lake Tower OFMC	Park Rapids Area	1,040

Patch MOAs

Large forest patches reduce habitat fragmentation and provide for some species dependent on continuous areas of older forest. They also help represent natural variability in patch size across the landscape. This plan includes:

- eleven older and three intermediate-aged lowland conifer patch MOAs
- three older lowland hardwood patch MOAs
- two intermediate-aged upland conifer patch MOAs
- three intermediate-aged and five older upland hardwood patch MOAs
- five intermediate-aged patch MOAs that are a mix of cover types

Map E.4: Location of patch MOAs in the MDLP Section.

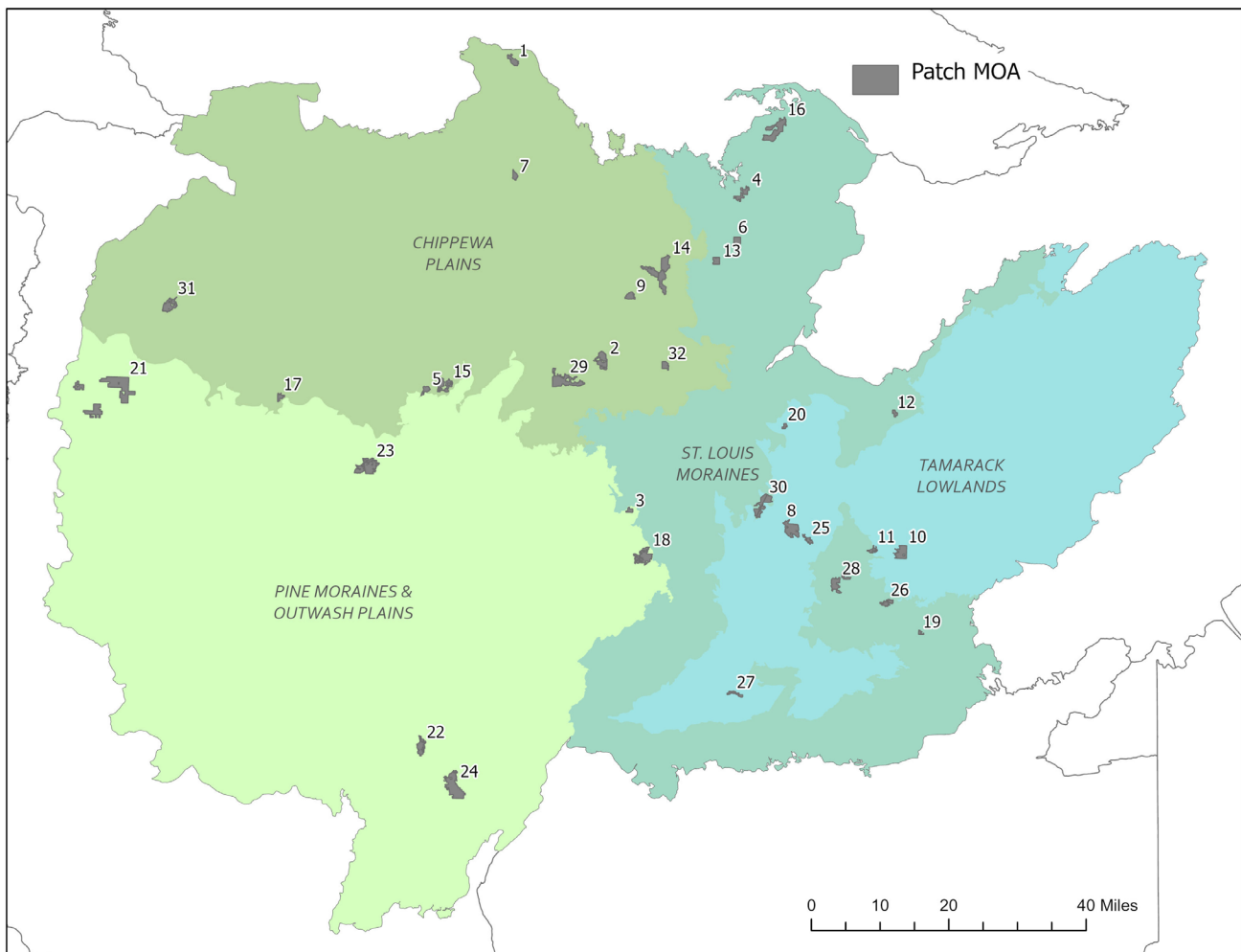


Table E.4: Patch MOAs in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

Number	MOA Name	Current condition	Forestry Area	Acres
1	Armstrong Creek PATCH	Intermediate-aged lowland conifer	Deer River Area	772
2	Ball Club PATCH	Older lowland conifer	Deer River Area	1,638
3	Big Rice Lowland Conifer PATCH	Older lowland conifer	Backus Area	301
4	Cameron Lake PATCH	Intermediate-aged mix of cover types	Deer River Area	1,017
5	Crooked Creek PATCH	Older lowland conifer	Bemidji Area	510
6	Dock Lake PATCH	Intermediate-aged mix of cover types	Deer River Area	635
7	Dunbar River PATCH	Older lowland conifer	Deer River Area	443
8	East Hill River PATCH	Older lowland conifer	Aitkin Area	2,219
9	Fishermans Brook PATCH	Older lowland conifer	Deer River Area	648
10	Floodwood Bog PATCH	Older lowland conifer	Aitkin Area	1,625
11	Floodwood Lowland Hardwood PATCH	Older lowland hardwood	Aitkin Area	356
12	Goodland PATCH	Intermediate-aged mix of cover types	Deer River Area	288
13	Grave Lake PATCH	Intermediate-aged mix of cover types	Deer River Area	598
14	Grouse Creek PATCH	Older lowland conifer	Deer River Area	3,909
15	Hardwood Point PATCH	Older lowland conifer	Bemidji Area	1,323
16	Highway 1 PATCH	Older lowland conifer	Deer River Area	2,874
17	Lake George Conifer PATCH	Intermediate-aged upland conifer	Bemidji Area	407
18	Land O'Lakes Upland Hardwood PATCH	Intermediate-aged upland hardwood	Backus Area	2,205
19	Little Tamarack River PATCH	Intermediate-aged upland hardwood	Cloquet Area	153
20	McKinley Lake PATCH	Intermediate-aged upland conifer	Deer River Area	222

Number	MOA Name	Current condition	Forestry Area	Acres
21	MDLP Forest Interior PATCH	Upland hardwood	Bemidji Area	7,331
22	Meadowbrook Upland Hardwood PATCH	Older upland hardwood	Backus Area	1,229
23	Paul Bunyan Upland Hardwood PATCH	Intermediate-aged upland hardwood	Park Rapids Area	2,920
24	Pillsbury Older Upland Hardwood PATCH	Older upland hardwood	Backus Area	3,766
25	Pokegama Creek PATCH	Older lowland hardwood	Aitkin Area	408
26	Prairie River PATCH	Older lowland hardwood	Aitkin Area	622
27	Rice River PATCH	Older upland hardwood	Aitkin Area	437
28	Savanna Hardwoods PATCH	Older upland hardwood	Aitkin Area	1,586
29	Six Mile Brook PATCH	Intermediate-aged lowland conifer	Deer River Area	3,070
30	Taylor Lake PATCH	Older upland hardwood	Aitkin Area	2,037
31	Upper Rice Lake PATCH	Intermediate-aged lowland conifer	Bemidji Area	1,541
32	White Oak Lake PATCH	Older lowland conifer	Deer River Area	574

Open Landscape Management Area

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.5: Location of open landscape management areas in the MDLP Section.

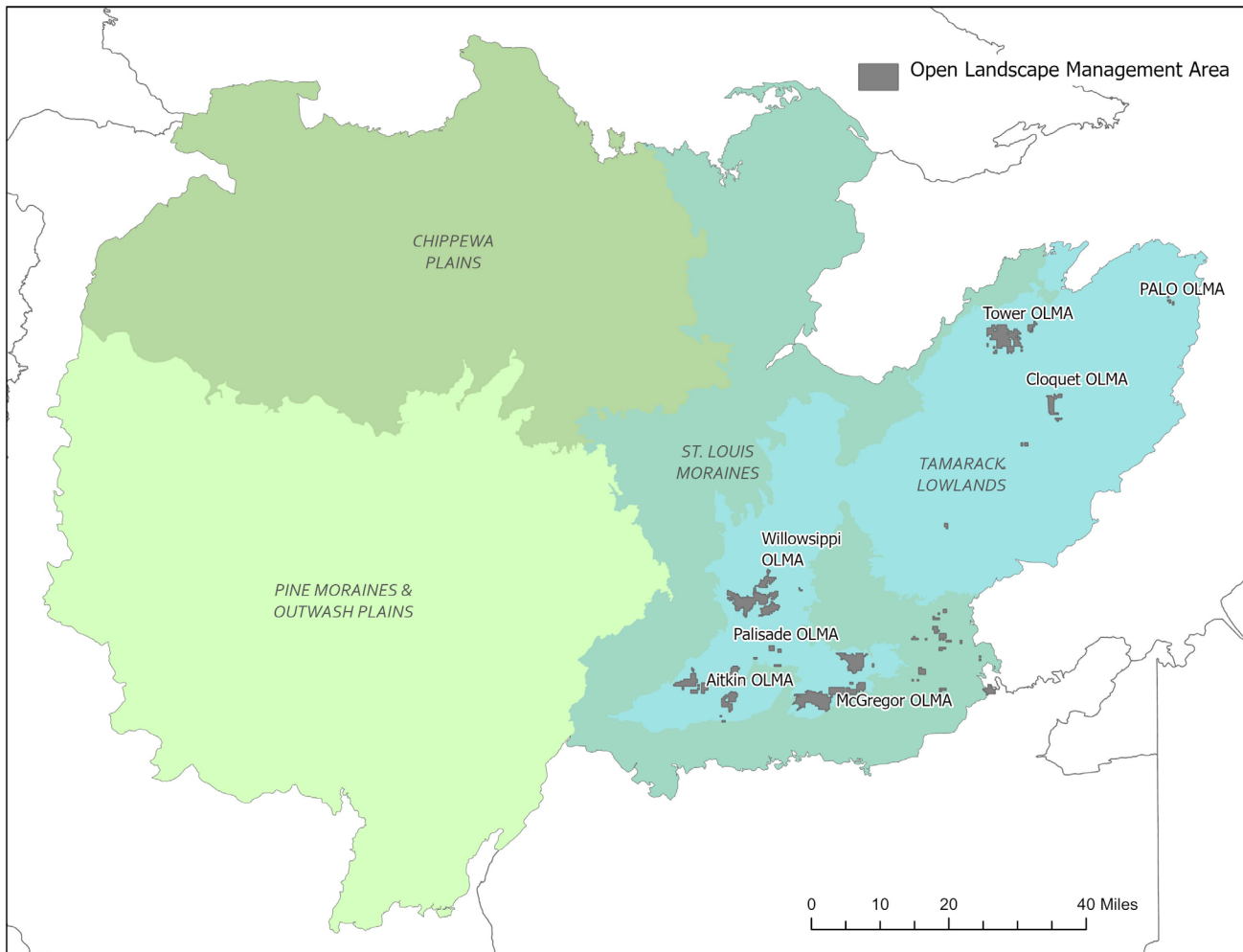


Table E.5: Open landscape MOAs in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Acres
Aitkin OLMA	Aitkin Area	7,613
Cloquet OLMA	Cloquet Area	6,595
McGregor OLMA	Aitkin Area	13,691
Palisade OLMA	Aitkin Area	762
PALO OLMA	Hibbing Area	348
Tower OLMA	Hibbing Area	8,117
Willowsippi OLMA	Aitkin Area	10,482

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 RGMA is meant to maximize the abundance of grouse to provide quality hunting experiences around Hunter Walking Trail networks.

Map E.6: Location of ruffed grouse management areas in the MDLP Section.

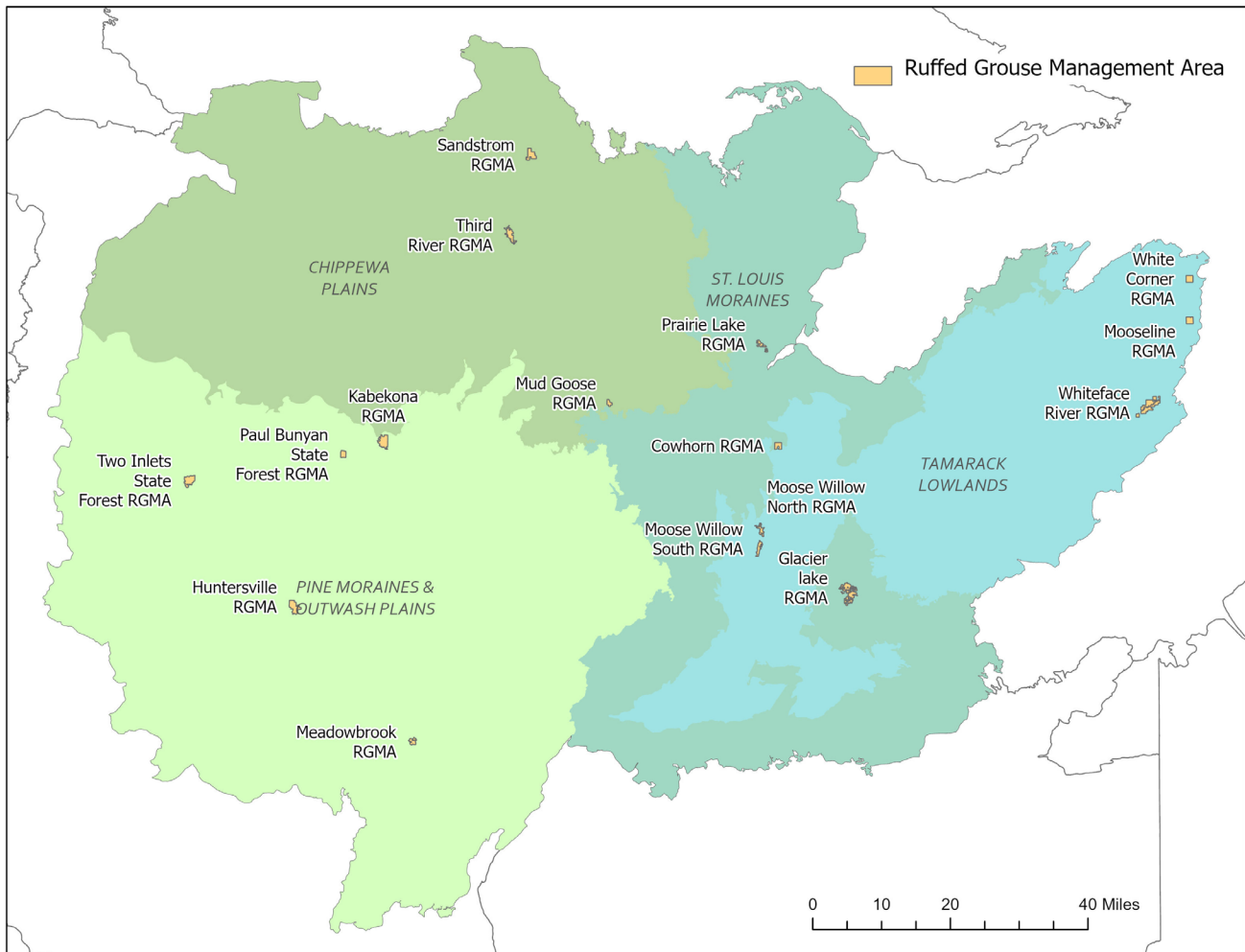


Table E.6: Ruffed grouse management areas (RGMA) in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Acres
Cownhorn RGMA	Deer River Area	565
Glacier Lake RGMA	Aitkin Area	2,070
Huntersville RGMA	Park Rapids Area	1,261
Kabekona RGMA	Park Rapids Area	1,353
Meadowbrook RGMA	Backus Area	474
Moose Willow North RGMA	Aitkin Area	537
Moose Willow South RGMA	Aitkin Area	572
Mooseline RGMA	Hibbing Area	640
Mud Goose RGMA	Deer River Area	300
Paul Bunyan State Forest RGMA	Park Rapids Area	459
Prairie Lake RGMA	Deer River Area	502
Sandstrom RGMA	Deer River Area	945
Third River RGMA	Bemidji Area	1,015
Two Inlets State Forest RGMA	Park Rapids Area	1,135
White Corner RGMA	Hibbing Area	629
Whiteface River RGMA	Cloquet Area	2,199

White Pine Management Areas

White pine management areas are locations with high potential to grow white pine.

Map E.7: Location of white pine management areas in the MDLP Section.

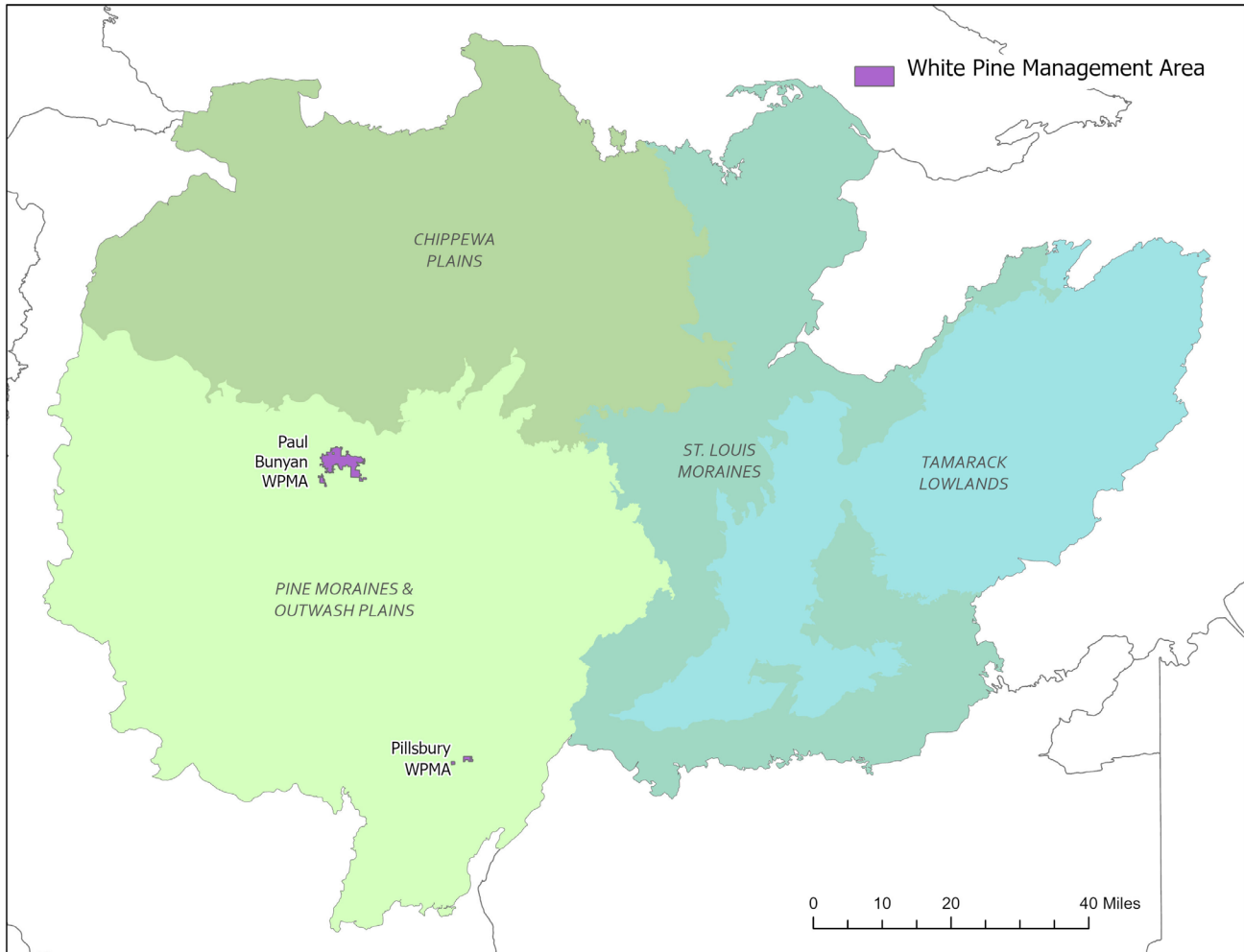


Table E.7: White pine management areas (WPMAs) in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Acres
Paul Bunyan WPMA	Park Rapids Area	9,316
Pillsbury WPMA	Backus Area	666

Landscape Management Opportunity Areas

Landscape MOAs address forest resource values that aren't captured in another category above. They provide the opportunity to address landscape-level values, for example, increasing conifer cover in an area.

Map E.8: Location of MOAs that address other landscape-scale objectives not captured in other categories.

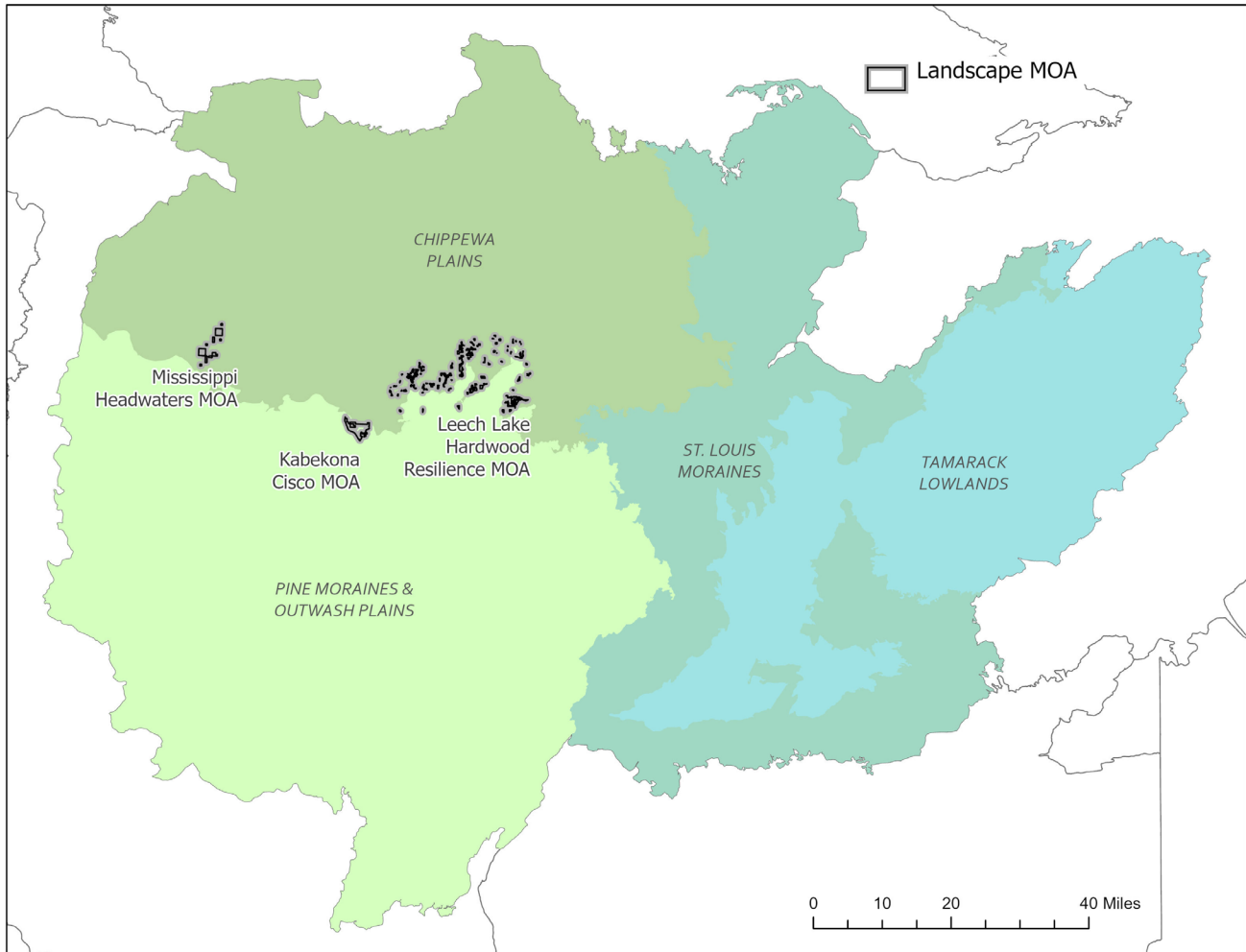


Table E.8: Landscape MOAs in the MDLP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Acres
Kabekona Cisco MOA	Park Rapids Area	2,901
Leech Lake Hardwood Resilience MOA	Bemidji Area	4,262
Mississippi Headwaters MOA	Bemidji Area	1,985

Appendix F: Modeled Management Regimes

During landscape-scale planning, the DNR uses management regimes to develop strategic direction and stand exam 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 the 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.

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 to estimate volume resulting from harvest. Differences in management were incorporated into the analysis for 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 MDLP, 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 include 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 from the standard regimes to benefit the forest resources in specific locations. Examples include areas on non-school trust lands with native plant communities that have global conservation ranks, old growth forest stand special management zones, and management opportunity areas (MOAs).

The modeled management regimes used to develop the 10-year stand exam list for MDLP 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 offering the amount of planned volume 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-Aged 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
Deer management area/winter habitat area	DMA
Owl management area	OWMA

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

Cover Type	Standard DNR		Fish and Wildlife		OG SMZ		OFMC		Patch		HCVF Low		OLMA	
	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	60	10	40	10	55	10	50	10	50	10	45	10
Aspen/ Balm-of-Gilead - SI < 65	50	5	60	10	50	10	60	10	55	10	55	-	45	10
Birch	50	5	60	15	50	10	65	10	60	10	60	10	50	10
Jack Pine	45	5	45	15	45	5	50	5	45	5	45	5	-	-
Black Spruce Upland	45	5	45	15	45	5	50	5	45	5	45	5	-	-
Balsam Fir	45	5	50	15	45	10	55	15	50	15	50	15	-	-
White Spruce Planted	50	5	45	5	-	-	50	5	50	5	45	5	-	-
White Spruce Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Black Spruce Lowland - SI 40+	80	5	80	10	80	5	80	10	80	10	80	10	-	-
Black Spruce Lowland - SI 30-39	100	5	100	10	100	5	100	10	100	10	100	10	-	-
Black Spruce Lowland - SI 23-29	120	5	120	10	120	5	120	10	120	10	120	10	-	-
Tamarack - SI 40+	65	5	65	5	65	5	65	5	65	5	60	5	-	-
Tamarack - SI < 40	75	5	75	5	75	5	75	5	75	5	70	5	-	-
Red Pine Planted - SI 65+	60	5	50	10	60	5	60	5	60	5	60	5	-	-
Red Pine Planted - SI 55-64	65	5	50	10	65	5	65	5	65	5	65	5	-	-
Red Pine Planted - SI < 55	70	5	50	5	70	5	70	5	70	5	70	5	-	-
Red Pine Natural	100	5	110	66	100	10	100	10	100	10	95	10	95	5
White Pine Planted - SI 65+	60	5	45	20	-	-	60	-	65	-	60	10	-	-
White Pine Planted - SI 55 – 60	65	5	45	20	-	-	60	-	65	-	60	10	-	-
White Pine Planted - SI < 50	70	5	45	20	-	-	60	-	65	-	60	10	-	-
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Oak - SI 75+	80	5	90	15	-	-	-	20	80	20	-	20	90	20
Oak - SI < 75	50	5	90	15	-	-	-	20	80	20	-	20	90	20
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-

Note: Dashes indicate that standard (for Division of Forestry administered and school trust lands) or FAW management regimes apply for even-aged managed cover types, or that the cover type is managed uneven-aged.

Cover Type	Standard DNR		Fish and Wildlife		RGMA		HCVF Med		DMA		OWMA	
	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	60	10	45	10	50	5	40	10	40	10
Aspen/ Balm-of-Gilead - SI < 65	50	5	60	10	10	45	50	5	50	10	50	10
Birch	50	5	60	15	50	10	50	5	60	10	60	10
Jack Pine	45	5	45	15	-	-	45	5	45	5	45	5
Black Spruce Upland	45	5	45	15	-	-	45	5	45	5	45	5
Balsam Fir	45	5	50	15	-	-	45	10	50	15	50	15
White Spruce Planted	50	5	45	5	-	-	-	5	50	-	50	5
White Spruce Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-
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+	65	5	65	5	-	-	65	5	-	-	60	5
Tamarack - SI < 40	75	5	75	5	-	-	75	5	-	-	70	5
Red Pine Planted - SI 65+	60	5	50	10	-	-	60	5	-	-	60	-
Red Pine Planted - SI 55-64	65	5	50	10	-	-	65	5	-	-	65	-
Red Pine Planted - SI < 55	70	5	50	5	-	-	70	5	-	-	70	-
Red Pine Natural	100	5	110	66	-	-	110	5	110	10	-	-
White Pine Planted - SI 65+	60	5	45	20	-	-	60	5	-	-	-	-
White Pine Planted - SI 55 – 60	65	5	45	20	-	-	65	5	-	-	-	-
White Pine Planted - SI < 50	70	5	45	20	-	-	70	5	-	-	-	-
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-
Oak - SI 75+	80	5	90	15	90	20	60	10	80	15	80	15
Oak - SI < 75	50	5	90	15	90	20	60	10	80	15	80	15
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 age and treatment BA columns refer to the stand age and basal area, respectively, 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.”

MDLP 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	N/A	20
Northern hardwoods	> 40	>= 40	N/A	20
White pine (natural)	All	>= 45	N/A	20
White spruce (natural)	All	>= 80	N/A	20
Central hardwoods	All	>= 30	N/A	20

MDLP 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
NH	All	>= 60	NA	20
Oak	All	>= 60	NA	20
White Pine (natural)	All	>= 60	NA	25
White Pine (planted)	All	>= 30	NA	15
White Spruce (natural)	All	>= 55	NA	20
White Spruce (planted)	All	>= 55	NA	20

MDLP 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
Northern Hardwoods	All	>= 60	NA	20
Oak	All	>= 60	NA	20
White Pine (natural)	All	>= 60	NA	20
White Pine (planted)	All	>= 35	NA	20
White Spruce (natural)	All	>= 55	NA	20
White Spruce (planted)	All	>= 55	NA	20

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

MDLP Owl Management Area MOA Uneven-Aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
White Spruce (natural)	All	>= 52	NA	20

MDLP 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

MDLP 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 (natural)	All	>= 45	NA	20
White Pine (planted)	All	>= 30	NA	20
White Spruce (natural)	All	>= 35	NA	20
White Spruce (planted)	All	>= 80	NA	20

MDLP 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

The following tables list the thinning regimes that were used in the model. It indicates when a stand is available for thinning the model based on the site index, the number of times it has already been thinned, and the age of the stand. For example, an unthinned red pine stand is available for its first thinning at age 25, next at age 35, next at age 45, and so on, until it reaches age 90.

MDLP Standard DNR Thinning Regimes

Cover type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	>=60	Unthinned	30	70
Central Hardwoods	>=60	Thin1	45	70
Central Hardwoods	>=60	Thin2	60	70
Northern Hardwoods	<=35	Unthinned	30	70
Northern Hardwoods	<=35	Thin1	45	70
Northern Hardwoods	<=35	Thin2	60	70
Oak	All	Unthinned	40	80
Oak	All	Thin1	55	80
Oak	All	Thin2	70	80
Red Pine (natural)	All	Unthinned	25	90
Red Pine (natural)	All	Thin1	35	90
Red Pine (natural)	All	Thin2	45	90
Red Pine (natural)	All	Thin3	55	90
Red Pine (natural)	All	Thin4	65	90
Red Pine (natural)	All	Thin5	75	90
Red Pine (planted)	All	Unthinned	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	Unthinned	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	Unthinned	30	60

MDLP Division of Fish and Wildlife Thinning Regimes

Cover type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	All	Unthinned	80	100
Central Hardwoods	All	Thin1	105	125
Central Hardwoods	All	Thin2	130	150
Central Hardwoods	All	Thin3	155	175
Central Hardwoods	All	Thin4	180	200
Northern Hardwoods	All	Unthinned	80	100
Northern Hardwoods	All	Thin1	105	125
Northern Hardwoods	All	Thin2	130	150
Northern Hardwoods	All	Thin3	155	175
Northern Hardwoods	All	Thin4	180	200
Oak	All	Unthinned	80	100
Oak	All	Thin1	105	125
Oak	All	Thin2	130	150
Oak	All	Thin3	155	175
Oak	All	Thin4	180	200

MDLP Ruffed Grouse Management Area (RGMA) MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Oak	All	Unthinned	50	65
Oak	All	Thin1	70	85
White Spruce (natural)	All	Unthinned	25	35
White Spruce (natural)	All	Thin1	40	50
White Spruce (natural)	All	Thin2	55	65
White Spruce (planted)	All	Unthinned	50	65
White Spruce (planted)	All	Thin1	70	85

MDLP HCVF and G1/G2 Medium Harvest Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Red Pine	All	Unthinned	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

MDLP Older Forest Patch MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Central Hardwoods	>=60	Unthinned	30	40
Central Hardwoods	>=60	Thin1	45	55
Central Hardwoods	>=60	Thin2	60	70
Oak	>=60	Unthinned	30	40
Oak	>=60	Thin1	45	55
Oak	>=60	Thin2	60	70
Red Pine	All	Unthinned	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	Unthinned	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 (natural)	All	Unthinned	25	80
White Spruce (natural)	All	Thin1	40	80
White Spruce (natural)	All	Thin2	55	80
White Spruce (planted)	All	Unthinned	30	60

Appendix G: Section Forest Resource Management Plan

Monitoring

This appendix describes the DNR’s approach to monitoring Section Forest Resource Management Plans (SFRMPs). The SFRMP monitoring approach is updated as needed to reflect current Department policies and processes.

Monitoring Purpose

SFRMP monitoring brings DNR staff together to learn about how work under a plan is going and, when applicable, revisit plan goals. In doing this, we address the following broad questions with respect to the multiple values embedded in DNR forest resources planning and management:

- **Implementation monitoring:** Are management actions and documented management intent consistent with the plan? (Are we doing what we said we would?)
- **Effectiveness monitoring:** Are management actions moving DNR forestlands toward the goals outlined in the plan? (Is our plan having the intended effect?)

Monitoring Approach

We could ask hundreds of possible questions about the implementation and effectiveness of management actions on state forestland. In some cases, data are insufficient to answer a question through monitoring. Other questions are confounded, making it difficult to distinguish one cause or effect from another. Time is a critical factor. It can take years to execute a planned treatment and decades for the DNR forest inventory to reflect a change such as a cover type conversion. Given these limitations, SFRMP monitoring attempts to identify and focus on the most important questions that we can reasonably address.

The DNR executes implementation and effectiveness monitoring depending on data availability and where we are in the plan period. For example, it is difficult to monitor plan effectiveness (i.e., on-the-ground effects) earlier in the plan period. Monitoring metrics or indicators are developed at the beginning of the monitoring process accounting for these factors. In general, though, the DNR uses several long-standing data sources for monitoring, including:

- forest inventory data, historical and contemporary
- planning datasets, which include planned stand exams and a snapshot of resource conditions at the time of planning
- annual stand exam list and annual plan addition datasets
- stand exam list accomplishments, including whether stands were appraised, altered, or deferred; prescriptions and prescription comments; documented management objectives; etc.
- timber sales data, including volume offered, sold, and scaled
- DNR Geodatabase Data Resource Site (GDRS) data
- Forest Inventory and Analysis (FIA) data

Other data sources may become available over time or may be available for specific geographies. The SFRMP monitoring process is adaptive and evaluates available data and monitoring approaches during each monitoring project.

Communicating Results

Written reports summarizing monitoring results are prepared approximately every five years (i.e., at plan midpoint and plan end). Final reports are accessible via the DNR website.

Monitoring results are also communicated to internal audiences through a monitoring meeting at the end of each SFRMP monitoring project.

Audience

SFRMP monitoring reports have both internal and external audiences. Internal audiences include DNR field staff, Forest Resource Issue Teams (FRITs), and other DNR decision-makers. External audiences include tribes, forest certification auditors, adjacent landowners, the Minnesota Forest Resources Council, loggers, recreational forest users, the forest products industry, members of environmental organizations, etc.

Roles and Responsibilities

Successful implementation and monitoring of the SFRMP process depend on many people's work. Following is an explanation of general roles and responsibilities associated with plan monitoring.

Policy and Planning Supervisor: Oversee forest resources planners and ensure that monitoring projects are conducted appropriately within the planning system.

Forest Resources Planners: Manage monitoring projects, gather and analyze monitoring data, and write monitoring reports. Incorporate monitoring in SFRMP training for field staff. Communicate the nature and importance of SFRMP monitoring to field staff.

Forestry Field Staff: Accurately record the results of on-site visits (i.e., stand examinations), completing required and additional data as necessary to document decisions regarding site objectives and planned management actions.

Timber Sales, Silviculture, and Inventory Program Foresters: Accurately and promptly record data into the appropriate database.

Forest Resource Issues Teams: Assign resources and support monitoring projects as needed.

Interdisciplinary Field Staff: Participate in SFRMP monitoring projects as assigned.

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 forestlands 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 10 years, into which the age range of trees or forest stands is divided for classification or use.

Age class distribution: The proportionate amount of various age classes of a forest or forest cover type within a defined geographic area (e.g., ecological classification system subsection). 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 socio-economic 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 animals such 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 harvest method used to regenerate shade-intolerant species, such as aspen and jack pine.

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

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 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 (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, historical structure, historical 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 --> 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 even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years).

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 current status of, and monitors recent trends in, forest area, volume, growth, and removals.

Forest Inventory Module (FIM): The FIM provides a database and application through which field foresters can maintain an integrated and centralized inventory of the forests on publicly owned lands managed by the Division of Forestry and other 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: Consists of all lands included in the forest inventory that have forested cover types, from aspen and pine cover types to stagnant conifers.

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

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

Forest stand: A group of trees occupying a given area and sufficiently uniform in species composition, age, structure, site quality, and condition so as to be distinguishable from the forest 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 the mortality or blowdown of an individual tree or group of trees. Gap management uses timber harvest methods to emulate this type of forest spatial pattern.

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

Group selection: A process of harvesting patches of selected trees to create openings in the forest canopy and to encourage 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 Laurentian Mixed Forest Province are periods of stand maturation where the mixture of trees in the canopy is stable. Growth stages are separated by periods of transition where tree mortality is high and different among the species, usually involving the death of early successional species and replacement by shade-tolerant species or longer-lived species.

Habitat: “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 disrupts the soil profile and leaves coarse woody debris in piles; 2) broadcast herbicide use that eliminates or dramatically reduces herbaceous plant and shrub diversity; 3) Conversions of mixed forest stands through 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 pine plantations. Examples where more intensive management may be needed, include regenerating a site successfully to a desired species, controlling insect or disease problems, and managing wildlife habitat (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 Areas (MOA): 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-forestland: Land that has never supported forests and land formerly forested where 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, medicinals, decoratives, 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 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 older forest characteristics 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 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 in 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.

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 alternative 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 in 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 plantation. A mixed stand is composed of a mixture of species, such as a northern hardwood stand consisting of maple, birch, basswood, and oak. An even-aged stand is one in which all of the trees present are essentially the same age, usually within 10 years of age for aspen and jack pine stands. An uneven-aged stand is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

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

Stand density: The number 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, re-inventory, 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 desirable number for best growth and management, such as well-stocked, overstocked, and partially stocked. A measure of the proportion of an area actually occupied by trees.

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 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 forests 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, and 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 within a plantation).

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

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.