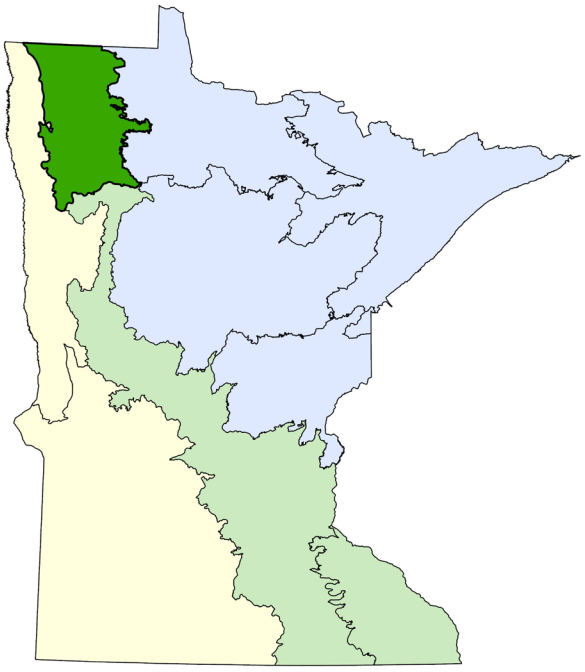
DEPARTMENT OF NATURAL RESOURCES

Aspen Parklands

Section Forest Resources Management Plan Narrative Guidance

March 2026



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List of Abbreviations

Abbreviation	Description
APA	Annual plan addition
Con-Con	Consolidated-conservation land
CSA	Cooperative 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 project
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) narrative 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 Lake Aggasiz, Aspen Parklands (AP) Ecological Section. The primary audience for this document is land managers within the DNR; however, it also serves to inform stakeholders and the interested public about DNR forest resource management in the AP Section. This SFRMP replaces the narrative guidance in the former Aspen Parklands SFRMP.

DNR forest management is shaped by a wide range of statutes, policies, plans, and site-level guidance. Section Forest Resource Management Plans, which include both strategic and operational components, play a key role in this broader network of direction and guidance, and are developed and implemented accordingly. For example, all SFRMP components are developed to meet statutory requirements and DNR policies, and considering other information such as wildlife management area (WMA) unit plans. Likewise, DNR forest managers account for DNR policies, procedures, and other relevant plans, such as WMA unit plans, alongside SFRMP guidance when deciding if and how to manage specific forest stands.

This SFRMP narrative informs implementation of the 10-year stand exam list and documents management opportunity areas (MOAs), which are areas on DNR-administered lands that offer good opportunities to maintain or create spatial patterns to address natural resource values that are difficult to achieve through individual stand management. It is intended to inform management for approximately the next 10 years or until replaced.

Guiding Principles for the SFRMP Process

- Provide guidance for forest management activities that address ecological protection, timber production, fish and wildlife habitat, and cultural and recreational values at the landscape scale.
- Provide guidance to managers and foresters implementing the SFRMP strategic direction and stand exam list.
- 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 AP Section.
- Consider and incorporate the results of public review in the planning process.

Planning Outcomes and Summary

- To increase resilience to climate change and enhance wildlife habitat and biodiversity, this plan calls for the following changes in forest conditions:
    - increasing within-stand compositional and structural diversity appropriate to the native plant community

    - decreasing a percentage of the aspen forest and ash cover types, which are vulnerable to changing climate conditions and attacks from emerald ash borer (ash only)
    - increasing acres of open landscapes (grass and brush), lowland hardwoods, oak savanna, and aspen openings
- The plan provides that young and older forest for all cover types will continue to be represented on DNR-administered land, with amounts determined through the STH decisions and development of the 10-year stand exam list. 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, reserve clumps, and in riparian areas.
- The plan includes strategies for managing riparian areas to retain their integrity and provide habitat for fish, wildlife, and plant species, including increasing longer-lived species and conifers, increasing forest age, and applying Minnesota Forest Resource Council Voluntary Site-Level Forest Management Guidelines in riparian areas.
- As part of this planning process, Management Opportunity Areas (MOAs) in the Section were reviewed. Management guidance was developed for these opportunity areas, which contribute toward meeting goals for providing habitat and ecosystem functions that require management at broader scales than individual stands.
- Additional topics addressed in the plan include limiting damage from insects, disease, and non-native species; producing forest conditions that support a range of wildlife habitats; managing for endangered, threatened, and special concern species; managing areas of high and outstanding biodiversity significance; minimizing forest management impacts on visual quality; protecting cultural resources; considering climate change mitigation and adaptation needs and opportunities; 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 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." In addition, 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 foundational to the DNR's ability to execute its mission for the benefit of all Minnesotans.

State Lands Foundational to Forest Management

The DNR manages 5.6 million surface acres of state-owned land throughout Minnesota 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, including 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 75,600 acres of school trust lands in the AP Section.

State Non-trust Lands

The DNR manages non-trust lands according to their applicable statutory purposes. In the AP Section, these lands primarily include consolidated conservation lands (101,000 acres), Volstead lands (240 acres), and acquired lands (173,000 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 in which the lands are located. There are approximately 92,500 total acres of ConCon lands in the AP Section. State law specifies that Con-Con lands be 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 addressed lands in Aitkin, Roseau, and Mahnomen counties.
- Laws of MN 1933, Chapter 402 (Minn. Stat., secs. 84A.31 to 84A.42), which addressed a reforestation project in Marshall County.

Volstead lands were purchased from the federal government with funds appropriated by the Minnesota 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 in which the lands are located. There are approximately 230 acres of Volstead lands in the AP 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. Approximately 178,500 acres in the AP Section are acquired lands.

Recreation Unit

The guidance in this SFRMP narrative applies to lands of the various statuses listed above in recreation units that have different statutory purposes.

Wildlife Management Areas (WMAs) are managed in accordance with MN Statutes section 86A.05. Specifically, WMA lands are developed and managed "…for the production of wildlife, for public hunting, fishing, and trapping, and for other compatible outdoor recreational uses." WMAs may include trust lands, which are managed to maximize long-term economic return to the trust while also incorporating WMA goals. WMAs cover approximately 336,800 acres in the AP Section.

State forest lands are managed according to MN Statutes chapter 89 under the principles of multiple use and sustained yield to provide multiple forest benefits over time, including wildlife habitat, biodiversity, wood supply and healthy natural resource economies, carbon storage and sequestration, forest health, recreation, and water quality and quantity. The Division of Forestry administers approximately 5,850 acres in the AP Section.

Layers of DNR Forest Management Direction and Guidance

Multiple layers of laws, policies, guidelines, and plans direct and inform forest management on DNR-administered lands. Together, they shape the DNR's mission, vision, goals, objectives, and strategies for forest management, with the aim of optimizing the balance of multiple forest values and their corresponding benefits sustainably over time. Because requirements differ across recreational units and land statuses managed by the DNR, the "optimal balance" of forest benefits varies depending on the authorized purpose of those lands.

Within this network of forest management direction and guidance, DNR forest management objectives are informed by data and analysis and are predicated on:

- Minnesota statutes that lay out the purpose and management goals of the units of the Outdoor Recreation System and forest management goals and policies (see above). For example, DNR's forest management on WMAs and aquatic management areas (AMAs), is conducted to advance fish and wildlife habitat, and forest management on state forest lands provides for multiple use and sustained yield.
    - Key state statutes include Outdoor Recreation System Classification and Purposes (Minn Stat. 86A.05); State Forests, Tree Planting, Forest Roads (Minn. Stat. Ch. 89); Sustainable Forest Resources Act (Minn. Stat. 89A.02); Permanent School Fund (Minn. Stat. 127A.30—127A.353); Wildlife Management Areas (Minn. Stat. 86A.05, subd. 8).
- The multiple forest values (i.e., wildlife habitat, biodiversity, wood supply and healthy natural resource economies, climate mitigation and adaptation, forest health, recreation, and water quality and quantity) toward which the DNR manages, with the relative emphasis among these values depending on the recreation unit and land status.
- The long-term, landscape-level desired future forest conditions (DFFCs) described in SFRMPs that DNR is seeking to achieve through forest management.

Additional direction clarifies how the DNR will advance forest management objectives, including:

- The Interdisciplinary Forest Management Coordination Framework, which governs how DNR disciplines work together to meet requirements and advance goals through forest management, including operational procedures such as the dispute resolution process and the Procedure: *Forest Habitat Management on Lands Administered by the Fish & Wildlife Division*.
- All policies, guidelines, and short-term direction included in the DNR's Interdisciplinary Forest Management Policy System.
- Minnesota's Forest Resources Council's Voluntary Site-Level Forest Management Guidelines, which the DNR uses as best management practices (BMPs) for all forest management work.
- The spatial 10-year Stand Exam List, which identifies the forest stands to consider for management (see the Development of the DNR 10-year Stand Exam List report for more details).
- Annual stand exam lists derived from the 10-year Stand Exam List.
- Strategies in SFRMPs and WMA plans.

- Other applicable division guidance, procedures, and manuals such as the Division of Fish and Wildlife directive on forest management on WMAs and AMAs/FMAs.

Together, these laws, policies, guidelines, procedures, and plans ensure the DNR manages forests sustainably; adheres to its mission; and meets its statutory, forest certification, contractual, and fiduciary obligations.

Section Forest Resource Management Plans are a key layer that interacts with others in DNR's broader network of forest management direction and guidance. They are developed to comply with all requirements, including applicable state and federal laws and DNR policies. Additional information from sources such as WMA unit plans, which provide fish and wildlife habitat management guidance within WMAs, are also considered when developing SFRMPs. Likewise, when implementing SFRMP direction and guidance, DNR forest managers comply with all requirements, including DNR policies and procedures, consider additional relevant guidance, and consult WMA plans when working within WMAs.

Examples of the layers of direction and guidance for forest management on DNR-administered lands

Laws and statewide strategic plans	Policies and procedures	Landscape and sub-landscape plans and direction	Site-level guidance and information
Sustainable Forest Resources Act (MS 89A) Forest Resource Management (MS 89) School Trust Lands (MS 84, subd. 18) State Outdoor Recreation Act (MS 86A.05) State Forests Wildlife Management Areas Federal Endangered Species Act DNR Strategic Conservation Agenda State Forest Action Plan State Wildlife Action Plan	Operational orders School trust lands Invasive species Climate adaptation and mitigation Interdisciplinary forest management policy system Rare species and native plant communities (NPCs) Bald eagle nests High conservation value forest (HCVF) Bat habitat conservation plan (HCP) policy Old growth forest Department and division policies, directives, procedures, guidelines and manuals	SFRMP WMA plans Minnesota Forest Resources Council (MFRC) landscape plans Sub-landscape direction (e.g., HCVF direction documents) Beltrami Island LUP Comprehensive Conservation Plan	MFRC site-level guidelines NPC field guides and silvicultural strategies Silvicultural case studies

Section Forest Resource Management Plans

Section Forest Resource Management Plans guide forest management activities on state-administered forest lands, primarily in state forests and WMAs, at the ecological section scale. SFRMPs have both strategic and operational components designed to advance long-term (50+ year) landscape scale goals over 10-year planning periods.

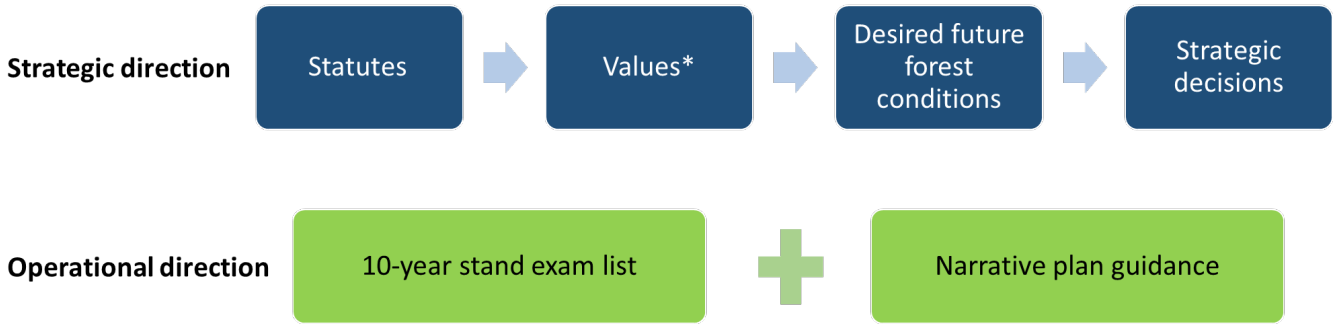
SFRMP strategic direction includes desired future forest conditions designed to sustainably supply a balance of forest benefits - wildlife habitat, biodiversity, wood supply and healthy natural resource economies, carbon storage and sequestration, forest health, recreation, and water quality and quantity - over the long-term at the landscape scale according to the statutory purpose and other requirements associated with the different lands the DNR manages.

SFRMP operational direction includes information regarding which forest stands DNR forest managers will visit for potential management (stand exam lists) and narrative guidance for what to consider when deciding if and

how to manage a specific forest stand. Implementation of stand exam lists and the guidance in this SFRMP narrative is conducted in the context of the broader network of DNR forest management direction (see above), which includes policies, procedures, and other plans that may influence forest management decisions for a particular stand. For example, the guidance in this SFRMP narrative is implemented in the context of policies for how to coordinate among DNR disciplines, procedures for how to administer the stand exam list and conduct forest management on Fish and Wildlife-administered lands, and state or federal requirements based on the recreation unit, land status, and resources on the ground.

SFRMP Components

SFRMP desired future conditions (DFCs) and strategic decisions meet statutory requirements and are informed by values. SFRMP operational direction includes the 10-year stand exam list and narrative guidance for advancing long-term landscape objectives through site-level decisions.



*wildlife habitat, biodiversity, wood supply and healthy natural resource economies, climate adaptation and mitigation, forest health, recreation, and water quality and quantity

SFRMP Implementation

As this SFRMP is implemented, DNR staff visit and evaluate stands in the AP Section on the stand exam list for potential management. After receiving comments from internal staff, tribes, and the public, DNR staff conduct stand examinations. These stand examinations can have several different outcomes. Some stand exams result in postponing management to another planning period for biodiversity, habitat, or silvicultural reasons (e.g., the stand is not ready to harvest). Sometimes, the forest inventory requires correction, and the site is not ready to harvest. In other cases, a treatment other than timber harvest is deemed most appropriate to meet the stand goals. And in still other cases, timber harvest is appropriate. Timber harvest can take many forms, including regenerating an entire site, applying an intermediate treatment such as thinning to improve tree growth, selectively cutting trees to adjust forest composition and structure, or addressing a forest health issue. DNR forest managers incorporate many sources of information and direction into these management decisions, including:

- Current site conditions
- Comments from DNR foresters, wildlife biologists, ecologists, and archaeologists; tribal natural resources staff; and the public
- Specific considerations regarding:

    - recreation unit classification (e.g., WMA, state forest)
    - land status (e.g., school trust, acquired, consolidated conservation)
    - resources on the site (e.g., rare native plant communities, federal or state endangered or threatened species, High Conservation Value Forest, water features, wildlife habitat components, legacy trees, bald eagle nests, recreational trails, roads, etc.)
- Best practices outlined in Minnesota Forest Resource Council Voluntary Site-Level Guidelines
- Narrative SFRMP guidance, including MOA goals and strategies
- WMA unit plan goals and strategies

DNR staff then develop site-specific prescriptions for stands that are identified for timber harvest that achieve landscape- and site-level forest management goals.

Scope of this Section Forest Resource Management Plan (SFRMP)

This SFRMP provides guidance for vegetation management on DNR-administered forest lands in the Aspen Parklands (AP) Ecological Section, which contains the Aspen Parklands Subsection; 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. SFRMP planning considers the condition and management of forest lands in other ownerships but only proposes forest management direction and actions for DNR-administered lands.

This plan considers only a portion of DNR-administered forest lands in the AP Section 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). The following terms describe subsets of DNR-administered lands and how they relate to the SFRMP:

- "Forest land" includes lands in the DNR forest stand inventory, including cover types from aspen to stagnant conifers, muskeg, upland and lowland grass and brush, and other wetlands.
- "Managed acres" refers to a subset of forest lands for which the SFRMP provides guidance. Managed acres exclude areas that are managed under other processes, such as scientific and natural areas, state parks, and aquatic management areas outside of Lake County.
- "Timberland" refers to managed acres for which timber harvest is a feasible management tool. Timberland includes cover types capable of producing merchantable timber and excludes very slow-growing trees (e.g., stagnant lowland conifers or offsite aspen). Timberland is the pool of acres the DNR uses to analyze how to use timber harvest as a tool to advance desired forest conditions, optimize multiple benefits, and develop stand exam lists (see Appendix A for the full forest inventory query for managed acres and timberland acres).

Not all forest management planning is addressed in this SFRMP, however. Examples of planning activities related to forest management that are beyond the scope of SFRMPs include comprehensive road access plans, state park land management planning, old-growth forest designation, scientific and natural area (SNA) establishment, wilderness designation, establishment of wildlife population goals, cumulative effects analysis at the watershed

level, fire management, and recreation facilities and systems planning (e.g., hunter walking trails, forest recreation areas, or off-highway vehicle trails planning).

Goals for the SFRMP Planning Effort

This SFRMP document includes goals and direction for resource managers in the AP Section, 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.
    - Strategic planning decisions include the estimated amount of timber volume necessary to offer during FY2019-2028 to advance DFCs over that period.
  - DFCs, including cover type goals, are developed from existing long-term SFRMP goals, assessment information, and identified issues.
- **Guidance to staff on stand exam list implementation**
  - General direction statements and strategies in Chapter 3 guide staff on what to consider when making forest stand management decisions while completing stand exams.
  - Products of this SFRMP planning process include an implementation training and field guide for DNR staff so they understand how to apply SFRMP guidance during stand exams.
- **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, 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

While the Division of Forestry is the lead division for developing and maintaining SFRMPs, the development process is interdisciplinary. Planners and personnel from the DNR Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources contribute to the development of SFRMP components, with oversight from 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 AP SFRMP planning effort. Additional staff, such as GIS or administrative specialists, support SFRMP planning as needed.

Tribal and Public Involvement Opportunities

Tribal and public involvement in SFRMP development occurs through a comment period on the draft plan. Tribal comment periods occur before public comment periods.

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

Narrative SFRMP Development Process Overview

Development of this narrative SFRMP guidance occurred in several 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 SFRMP team updated the issues and the general directions, strategies, and cover type recommendations to address the issues. In Step 3, the plan was shared first with tribal natural resource agency staff and then with the public. In Step 4, the plan is distributed and implemented.

Table 1.1. Summary of the planning process for the AP SFRMP.

Steps	SFRMP Process Description
Step 1	**Initiating the Planning Process** • 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.
Step 2	**Develop Draft Plan** • Add Section context to issues to be addressed in the plan. • Develop strategies and desired future condition (DFC) goals consistent with the general direction statements and policy. • Prioritize, develop, and/or revise Management Opportunity Area guidance documents. • Coordinate with tribes as needed.
Step 3	**Plan Review and Comment Periods** • Review the draft plan with regional and statewide DNR leadership. • Send draft plan to tribes for comment. • Make the draft plan available to the public for comment. • Summarize tribal and public comments and develop DNR responses; revise the draft plan in response to comments as appropriate. • Present a summary of comments, responses, and plan revisions for the Commissioner's approval. • Commissioner approves the final plan.
Step 4	**Implement the Plan** • Distribute the final plan. • Provide plan implementation training to DNR staff involved in forest management and coordination.
Step 5	**Monitoring** • Plans are periodically monitored to assess their implementation and effectiveness (see Appendix E for more information on SFRMP monitoring).

Other Planning Efforts

MFRC Regional Landscape Planning

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

Minnesota Prairie Conservation Plan

The AP includes some areas addressed in the Minnesota Prairie Conservation Plan, and attributes of this plan were incorporated as appropriate.

Planning Area Description

The Aspen Parklands Section (AP) is composed of a single landform, the basin of Glacial Lake Agassiz. About 60% of the Section consists of sandy deposits from the shallow portions of Glacial Lake Agassiz. About 12% of these sandy deposits are beach ridges or complexes of shoreline deposits that mark successively lower levels of the glacial lake as it drained. Loamy till deposited by glacial ice and then inundated and flattened by wave action forms about 30% of the Section. Clay and silt deposited in the deeper portions of the glacial lake cover about 10% of the Section.

In the AP, there is no clear correlation between vegetation and parent material, as transitions between landforms are gradual. Historic patterns of vegetation appear mostly related to the frequency and intensity of fire, which were influenced by variations in water table and soil moisture. The historic patchiness of fire created a complex mosaic of prairies, brushlands, woodlands, forests on uplands, wet prairies, meadows, fens, and wet forests in wetlands. Upland prairie and wetland prairie communities were the most extensive, covering 40% of the Section. Wet meadow and marsh communities were common in seasonally wet depressions, occupying 14% and 7% of the Section, respectively. Areas where the regional water table was at the land surface supported open rich peatland, forested rich peatland, and wet forest communities. These open and forested wetlands covered 10% of the Section. Fire-dependent forest/woodland communities were present where seasonally wet depressions, peatlands, and river valleys isolated upland sites from frequent fire, enabling the survival of trees. These woodland communities covered 22% of the AP and were variously described by early land surveyors in Minnesota as brush, brush with scattered timber, or timber, depending on the length of time since the last fire on the site. Mesic hardwood forest and floodplain forest communities were present on sites exceedingly well protected from fire and were rare in the Section.

Almost 84% of the land is in private ownership, with approximately 16% of the land in public ownership (federal, county, state). State ownership accounts for approximately 394,000 acres. The AP Section contains a small amount (0.33%) of land owned by the Red Lake Nation.

Map 1.1. Location of the Aspen Parklands Section.

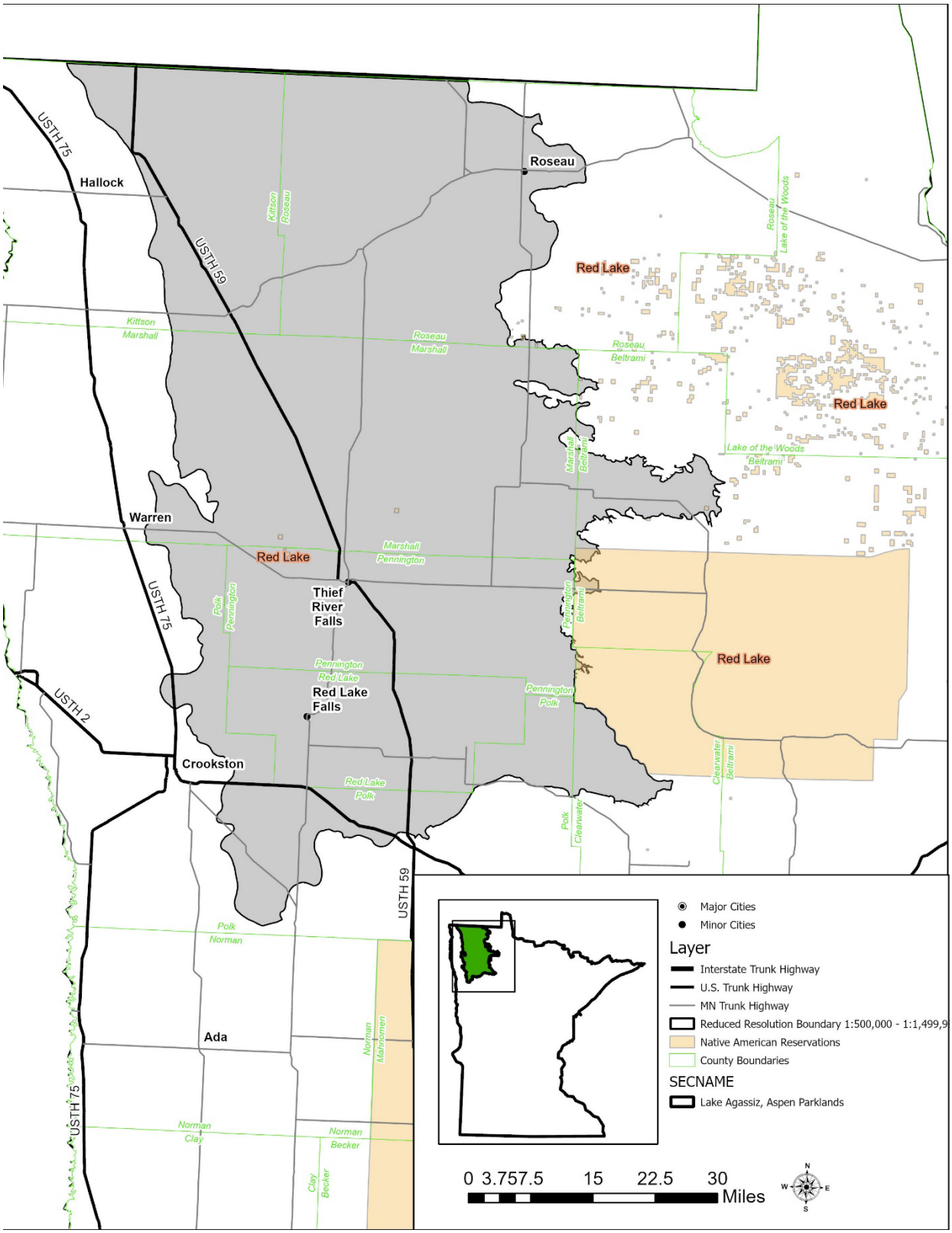


Table 1.2. Land ownership in the AP Section (acres; 2008 GAP Stewardship data).

Ownership	Acres	Percentage
County/Other Public	10,659	0.4%
Federal	68,892	2.3%
Private	2,462,773	83.6%
State	393,600	13.4%
Tribal	9,669	0.3%
Grand Total	**2,945,593**	**100.0%**

Table 1.3. State-administered acres in the AP Section from the DNR's forest inventory data (2017).

DNR Administrator	Acres	Percent
Division of Ecological and Water Resources	4,450	1.2%
Division of Fish and Wildlife	338,180	91.7%
Division of Forestry	22,291	6.0%
Division of Parks and Trails	3,097	0.8%
State (Undifferentiated)	865	0.2%
Grand Total	**368,883**	**100.0%**

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" refers to 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. Future direction in Chapter 3 of this SFRMP document decisions seeks to balance addressing these issues while following Department policies and direction (e.g., the sustainable timber harvest (STH) decisions) 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 guidance in SFRMPs. As another example, SFRMPs establish 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 decisions about forest management on DNR-administered land related to the issues listed below were addressed or determined through the development of the strategic 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 offered/harvest levels
- landscape patterns of harvested stands during the stand selection process

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, wildlife benefits from harvest prescriptions, state and federal statutes, and Department direction and policy.

The guidance for future direction in Chapter 3 was developed to address the issues in this chapter. Appendix B contains a table showing the relationship between the general direction statements in Chapter 3 and the issues in Chapter 2 that they are intended to address. Each section in Chapter 3 references the issues related to that section.

How Issues Were Identified

The SFRMP issues were developed using assessment information, DNR policies and guidelines, local knowledge, existing plans, and external 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, were addressed through the strategic 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 forests are 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 D); 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 AP 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 AP include bald eagle nest sites, goblin fern, ram's head and lady's-slipper orchids, Goldie's fern, Lapland buttercup, many songbird species, cavity-dependent species, primary excavators: northern flickers, yellow-bellied sapsuckers, waterfowl: goldeneyes, buffleheads mergansers, and wood ducks; mammals, including bats and flying squirrels; and secondary cavity-nesting birds such as nuthatches, great crested flycatchers, tree swallows, and eastern bluebirds, and old-forest related mycorrhizal fungi and epiphyte species.
    - Old, large-diameter aspen is particularly important to woodpeckers, fishers, bats, raptors, pine marten, and secondary cavity-nesting species.
- development of late successional native plant community (NPC) growth stages
- may provide 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
- traditional uses associated with older forests and forest health and wildfire risks

A3. Managing for young, early successional forest.

Young, early successional forest is defined in this SFRMP as the 0-30 age class of aspen, balm-of-Gilead, birch, jack pine, and tamarack cover types.

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 AP associated with young or early successional forest for at least part of their life cycle include: ruffed grouse, eastern whip-poor-will, American woodcock, red-tailed hawk, golden-winged warbler, chestnut-sided warbler, alder flycatcher, white-throated sparrow, song sparrow, rose-breasted grosbeak, white-tailed deer, and snowshoe hare.
- edges between young and more mature forest that some species depend on
- traditional use of resources associated with young forest
- future opportunity to develop habitat components over time and harvest forest products

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 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 and, subsequently, a greater capacity to cope and adapt to changing environmental conditions.
- A variety of patch sizes on the landscape provide a range of habitat, recreation, and economic opportunities.
- Connectivity among patches of vegetation is important for plant pollination and migration and allows 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 recreation and 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.
- Natural regeneration capacity within stands depends on tree species present (for example, whether the species present will be capable of suckering, layering, producing stump sprouts, or providing seed), insect and disease susceptibility, herbivory, vegetative competition, 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 will inform decisions over which cover types are most appropriate for future vegetation management.

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 trends
- scope and severity of major threats
- intrinsic vulnerability

Examples of these types of communities in the Section include OPp93a (G2, S2 rank), UPn13b (G2, S1S2 rank), Dry Sand - Gravel Oak Savanna (Northern) (G2, S1 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 habitat for specialist plant and animal species, some of which can also be rare or uncommon.
- Rare open land NPCs can be damaged by timber harvest operations if they are not identified and acknowledged during harvest planning.
- 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.
- As the climate continues to change, it is important to maintain these sites and communities as refugia for sensitive or at-risk species. Refer to the Northern Institute of Applied Climate Science (NIACS) Adaptation Workbook, Strategy 4: Maintain or create refugia, for a description of why it is important to maintain sensitive or at-risk species or communities.

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 habitat.

- 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:
    - maintenance of a diversity of plant species, structural complexity, and soil health
    - 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?

- Large blocks of forest provide an opportunity to create contiguous habitat of uniform age and structure in patches of various sizes and ages.
- 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 Connecticut warblers 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.

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

Decisions concerning the amount of timber volume to offer for sale to accomplish the disturbance needed to develop the DNR's desired forest age class distributions and species mixes over time, consistent with the specific management objectives of different forest lands administered by the DNR, are part of the strategic direction for this planning period. Other aspects of management related to harvest levels, such as providing guidance related to annual plan additions or habitat, are within the scope of SFRMP.

C1. Contributing to sustainable timber harvest that meets the Department's plans to continue to develop the desired forest age class distributions and species mixes over time by offering timber volume for sale while considering all forest resources and the objectives of the different forest lands administered by the DNR.

Why is this issue important?

- Timber harvest sustainably provides forest products from a renewable resource that Minnesotans use every day, including:
  - building materials for homes, businesses, and other buildings, including lumber, cabin logs, flooring, paneling, building timbers, and engineered wood products
  - pulp, paper, and paper products used for printing documents, packaging, and numerous other applications
  - dissolved wood product used to create clothing and other products
  - utility poles that facilitate the transmission of the electricity our society depends on
- Sustainable timber harvest supports the state's economy.
  - Forest management directly produces thousands of jobs, billions of dollars in revenue, and millions of dollars in state and local taxes.
  - Forest management supports healthy forests that promote recreation, a $10 billion dollar industry in Minnesota.
  - Forest management that sustains healthy forests promotes ecosystem benefits, such as clean water, that support the state's economy overall.
- 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).

C2. Managing non-timber forest products.

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

Why is this issue important? Non-timber forest products:

- such as firewood sales can be an opportunity to get small isolated stands cut
- diversify local economies and support traditional harvest activities (e.g., maple syrup tapping) for some groups
- are particularly important in areas where employment opportunities 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
- ecosystem services that support human health, safety, and welfare

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.

- There are many different factors that may influence rare species and features, many beyond the control of forest managers. 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, as well as 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 to also 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, Wilson's phalarope, marbled godwit, and sharp-tailed grouse.

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 AP 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 sharp-tailed grouse, prairie chickens, snowy owls, rough-legged hawks, northern shrikes, great gray owl, gray wolf, pine marten, marbled godwit, Franklin's gill, eared grebe and golden-winged warblers.
- Loss of important habitats is a concern for several species, including listed species (e.g., golden-winged warbler).
- Many wildlife species in the AP Section 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 heelsplitter, black sandshell) and plants (e.g., snailseed 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 and northern pike.
- 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. Examples include pileated woodpeckers, wood ducks, common goldeneyes, and hooded mergansers.
- Applying Minnesota Forest Resource Council site-level guidelines without considering site-specific conditions may not be adequate to protect surface waters.

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[1] 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

[1] 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.

management focus on addressing water quality issues and impacts to 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 AP Section contains all or parts of 11 major watersheds.
- Vegetation management activities and the amount of forest cover on the landscape affect watershed and sub-watershed hydrology.
- Land use has a significant impact on the type of vegetation and vegetation management distributed across the Section.

H. Timber Productivity

H1. Maintaining or increasing timber productivity on some state lands.

Why is this issue important?

- Minnesota's forests provide a range of environmental and economic services. Healthy growing trees provide many ecosystem benefits, from habitat to carbon sequestration.
- The DNR uses timber sales design to accomplish the vegetation management goals and strategies in this SFRMP.
- The state's forest industry and economy will benefit from increased productivity and quality of timber.
- Increasing forest productivity will help the DNR meet its fiduciary obligation on trust lands.
- A robust forest industry 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, fire and wind events, and herbivory, on forest ecosystems.

Why is this issue important?

- Insects and diseases can reduce timber production and lumber quality, increase fire hazard, and reduce recreational enjoyment of the forest.
- Insect outbreaks can be beneficial for some wildlife species, such as woodpeckers or nesting birds; 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.

I2. 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 greater risk for the transport of invasive species of all kinds.

I3. 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 destroy or damage forest resources, reducing opportunities for commercial timber harvest and change the condition of wildlife habitat in the AP Section.
- Large-scale disturbance events 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 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.

Climate change will have various effects on the state's forests over time. Descriptions of these effects can also be found within the other issues described in this chapter and within the strategies found in Chapter 3.

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 include:
  - changes in frequency and intensity of precipitation events and disturbances
  - 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 quaking aspen, balsam poplar, and black spruce
    - potential expansion of habitat for some tree species, such as eastern white pine, eastern red cedar, northern white cedar, hackberry, northern red oak, northern pin oak, basswood, American elm, and red and sugar maple
- 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, will 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, 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.
- Debris from management activity may impede human access.
- 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.

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 is directed by administrative land status and relevant statutes and laws. Some examples include:

- The Minnesota State Constitution and state statute require the DNR 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.

- Acquired WMA lands are managed primarily for the benefit of wildlife 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 certain 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 ten 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). Broadly, strategies are designed to maintain or increase a site's and landscape's adaptive capacity to meet the challenges and opportunities identified within the issues with the goal of maintaining and increasing diversity across the landscape. Goals and strategies for state-administered forest lands in this plan are consistent with MFRC regional landscape committee plans desired outcomes, long-term goals, and strategies for forest lands and ecosystem types in the region.

As part of the process to develop 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 C for more information on MOAs.

General Direction Statements (GDS)

- follow direction provided in federal statutes, state statutes and rules, and DNR 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.

All 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:

- 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. DNR employees must apply these directives appropriately while making individual site-level decisions. The DNR's interdisciplinary policy system, which uses a variety of directional documents to communicate expectations to DNR staff on a range of land management issues, provides clarification and guidance to staff on how to interpret and implement these directives.

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

- Does the treatment meet the requirements of federal and state laws and rules?
- Does the treatment meet current DNR policies and apply guidelines as appropriate?
- Does the treatment align with the management objectives and requirements associated with the land status (e.g., if the treatment is on acquired WMA acres, is it primarily for habitat improvement? If the treatment is on school trust lands, does the prescription adhere to the DNR School Trust Lands policy?)?

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

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

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 AP 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 AP Section, including Section-specific cover type issues that field staff should focus on while planning and executing on-the-ground management activities. However, this section is not a comprehensive discussion of these cover types, and field staff should rely on current management direction provided on the DNR's internal Interdisciplinary Forest Management Direction Documents page and WMA unit plans where applicable. Those directions are updated to reflect current management guidance and policy.

Some cover types include conversion goals, which were developed considering:

- 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 and economic impacts

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 the current stand condition, 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.

NOTE: Although they may appear in some tables and data, only cover types equaling approximately 1% or greater of managed forestland are described in detail in the following cover type section.

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. For example, on lands administered by the Division of Fish and Wildlife, alternative strategies may be used to support fish or wildlife habitat values.

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 because they are commonly associated with each other and are managed under the same management prescriptions (unevenage treatments and thinnings). Species comprising this cover type group include black ash, green ash, silver maple, American and red elm, and boxelder. 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 and veneer, and ash used in pulpwood production has recently increased.

Current Acres: 3,151 acres in the AP Section (0.9% of state-managedacres in this Section)

Future Direction and Goals

- Decreasing ash cover type acres and transitioning them to lowland hardwood or lowland conifer stands to mitigate the threat from emerald ash borer (EAB).
  - Ash 10-year DFC: Decreasing
  - Lowland hardwoods 10-year DFC: Increasing
- Increase within-stand diversity.
- Increase resilience of sites to EAB.
- Maintain forested conditions of ash and lowland hardwood sites in the wake of EAB.

Strategies

- Convert ash cover type to the lowland hardwood or lowland conifers cover types.
  - Focus attempts at conversions or increasing diversity in relatively drier sites.
  - This plan anticipates that some passive conversion from aspen to lowland hardwoods or lowland conifers 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 northern white cedar, balsam poplar, American elm, or red maple in WFn53, WFn55, or WFw54 sites, and silver maple, American basswood, bur oak, American elm, or box elder in FFn57 sites.
    - Consider alternative 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 AP 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 early successional stages of some fire-dependent plant communities. Pulpwood production is the most extensive use of these species.

Current Acres: 84,789 acres in the AP Section (24.8% of state-managedacres in this Section)

Future Direction and Goals

- Decreasing aspen acres, possibly to aspen openings resembling UPn24b, to increase open land and other cover types and structural diversity across the landscape.
  - 10-year DFC: Decreasing forest by 5,000 acres, increasing openings by 2,200 acres
  - 50-year DFC: Decreasing forest by 7,426 acres, increasing openings by 3,267 acres
- Move toward a balanced age class distribution.
- Increase within-stand diversity.

Strategies

- Generally use clearcut with reserves method to regenerate aspen.
- Converting using NPC-suitable species.
  - Prioritize conversion to FAW and non-school trust lands.
  - 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), high conservation value forests (HCVFs), riparian management zones (RMZs), and MOAs with cover type or older forest goals (e.g., Deer Management Areas and Interior Forest MOAs).
  - Most of the reduction of A/BG should occur on Fish and Wildlife administered lands. Avoid conversion on school trust Lands.
  - 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 on appropriate land statuses.
- 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.
- When possible, rotate A/BG to maintain young stands and contribute to open landscape habitat types and young forest conditions.

- Staff are encouraged to look for opportunities to convert aspen/balm-of-Gilead to northern hardwoods where appropriate to the land administrator, land status, and NPC (primarily FDs36, MHs38, MHw36).

Special Considerations

- Desire to rotate A/BG in this section to contribute to open landscape habitat types.
- Active conversion is challenging due to aggressive suckering.
- Aspen greater than 12” DBH is an important species for cavity-dependent wildlife.
- 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.
- 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 low-density stands or stand edges, mortality from *Hypoxylon* cankers and *Saperda* stem borer may increase
    - preferred host for *Lymantria dispar* (spongy moth), which is not documented in the Section as of 2021
- Aspen habitat will decrease in Minnesota as climate change proceeds.

Oak

The oak cover type includes bur oak and red 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 fuelwood within this Section.

Current Acres: 4,051 acres in the AP Section (1.2% of state-managedacres in this Section)

Future Direction and Goals

- Increasing oak acres to promote cover type diversity and wildlife habitat.
  - 10-year DFC: increasing approximately 800 acres
  - 50-year DFC: increasing approximately 1,188 acres
- Maintain and restore oak savanna structure and characteristics where appropriate to the site and NPC.

Strategies

- Convert to oak cover type.
  - Focus conversions from aspen to oak in FDw34, UPn13, and UPn24 NPCs.
  - Convert offsite oak to cover types more appropriate to NPC if opportunities present themselves.
  - Much of the conversion to oak will be as a savanna.
- 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:
  - Two-lined chestnut borer is a concern in stressed trees.
  - Armillaria root disease commonly attacks stressed oak trees, often in tandem with two-lined chestnut borer.
  - Climate change is expected to cause further stress to oak trees and exacerbate existing pests and diseases.

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 FPw63 and lesser amounts of FPn63 and FPs63.

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

Current Acres: 3,719 acres in the AP Section (1.1% of state-managedacres in this Section)

Future Direction and Goals

- 10-year DFC: Maintain
- 50-year DFC: Maintain
- Move toward a balanced age class distribution.
- Increase within-stand diversity where appropriate to NPC and consider forest health concerns.
- Manage tamarack as a component of other cover types as appropriate to NPC.
- Maintain tamarack acres on the landscape.

Strategies

- Harvest where appropriate, leaving seed trees in advance of eastern larch beetle (ELB). Leaving approximately ten 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

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: 187,524 acres in the AP Section (54.8% of state-managedacres in this Section)

Future Direction and Goals

- Increasing open landscape acres to provide habitat for wildlife and plants associated with open landscapes.
  - 10-year DFC: increase by approximately 2,000 acres
  - 50-year DFC: increase by approximately 2,971 acres
- Maintain species diversity and abundance appropriate to NPC.

Strategies

- Reference may be made to the Prairie Plan to address specific concerns.
- Coordinate on open landscape projects designed to enhance open landscape conditions 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 out upland stands over or approaching rotation age and merchantable lowland conifer stands for 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.
  - Consider impacts to calcareous fens, rare species, and adjacent native prairie when planning management activities.
  - Coordinate across divisions on projects designed to set back or maintain successional stages (e.g., prescribed fire, mechanical winter shearing, or mowing).

- Examples of suitable NPCs for conversion from aspen include OPp91, OPp93, and WPn53. These are lowland plant communities that often experience aspen encroachment and may be areas to focus conversions away from aspen. Upland NPCs suitable for conversion from aspen to open lands include UPn12, UPn13, and UPn23.
- 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 AP Section, including habitat suitability projections for those species under climate change, refer to the *NPC silviculture strategies for forest stand prescriptions* website.
- Convert cover types where appropriate (Table 3.2 and see 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 oak savanna and lowland hardwoods while decreasing the acreage of aspen, balm-of-Gilead, and ash. 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.
    - Attempt to convert some stands more rapidly using a variety of tools such as mechanical site preparation, prescribed burning, planting, seeding, and release.
    - Restore some aspen stands to oak savanna on sites with appropriate NPCs.
    - 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.

Table 3.2. Current managed cover type acres in the AP 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).

tableCover Type	Current Managed Acres	Estimated Trend in Acres (first plan decade)	Estimated Trend in Acres (50-year DFC)	Final Cover Type Acres (current + 50-year DFC)
Ash/lowland hardwoods	3,151	0	0	3,151
Ash	--	Decrease	Decrease	0
Lowland hardwoods	--	Increase	Increase	3,151
Aspen/balm-of-Gilead (BAM)	84,789	-2,800	-4,159	80,630
Aspen/BAM forest or woodland	--	-5,000	-7,426	--
Aspen/BAM openings	--	+2,200	+3,267	--
Balsam fir	118	0	0	118
Birch	91	0	0	91
Black spruce - lowland	1,698	0	0	1,698
Central hardwoods	153	0	0	153
Jack pine	165	0	0	165
Northern hardwoods	177	0	0	177
Oak	4,051	+800	+1,188	5,239
Oak forest or woodland	--	0	0	--
Oak savanna	--	+800	+1,188	--
Red (Norway) pine	77	-32	-32	45
Stagnant spruce	842	0	0	842
Stagnant tamarack	45	0	0	45
Tamarack	3,719	0	0	3,719
White cedar	182	0	0	182
White pine	3	0	0	3
White spruce	151	0	0	151
Grass/brush	187,524	+2,000	+2,971	190,495
Other non-forest (e.g., marsh)	54,946	0	0	54,946
Unknown	59	0	0	0 (all classified to other cover types)

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: Prairie Parkland and Tallgrass Aspen Parklands Provinces* and associated ECS silvicultural strategies to classify stands to NPC type and subtype and inform silvicultural prescriptions.
- Determine whether to retain, remove, or develop components, such as species and structure, characteristic of various NPC growth stages within stands by considering land status requirements. 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.
- Oak savannas may be restored by removing encroaching aspen, as deemed appropriate by the native plant community.
- Use the most up-to-date and 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 tree response to climate change information, on the *NPC silviculture strategies for forest stand prescriptions* website.
- Retain biological legacies through the incorporation of MFRC site-level guidelines.

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

GDS-1C Strategies

- Provide structural diversity characteristics, including:
    - 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 the 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 while considering factors such as land status. 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, DED-resistant American elm, basswood, 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, look for and take opportunities to 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 to create a fully stocked stand
    - 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: Provide a sustainable supply of timber.

Providing a sustainable supply of timber is one of the forest benefits for which state forests are managed, and an ancillary benefit of habitat management on acquired DNR WMA and Aquatic Management Area (AMA) lands. 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 track that disturbance because it is the most efficient and effective metric currently available to 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 specific land statuses (e.g., school trust lands, WMAs, state forests)
- 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
- expected future market and stand conditions
- incorporating intermediate treatments to achieve goals in conjunction with harvests

Considering these factors, the DNR determined how much timber volume to offer on average annually to achieve the disturbance needed to sustain a balance of multiple values and forest benefits over time and to meet the objectives for different forest lands administered by the DNR.

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 and Table 3.3 - Table 3.4 for acre and volume summaries for the 10-year stand exam list in the AP Section). Note that the DNR plans more stand acres and volume than may be necessary, based on model estimates, to ensure that the DNR will offer as much volume annually as planned. Thus, the estimated volume from planned stand exam acres is not equivalent to the volume offered on timber sale permits, and the volume offered is not equivalent to the volume harvested.

After site visits and interdisciplinary coordination, DNR staff 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:

- 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 to achieve planned volume.
    - Annual plan additions are stands or portions of stands that make sense to treat immediately (e.g., to address insect and disease, 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 forests and brushlands may have the potential for biomass harvest.
- Note that during the STH process, some stand swapping into AP from other ECS sections was allowed, and this may not have been fully completed.

Table 3.3. Planned stand exam list acres and by cover type and land administrator on 10-year stand exam list for the AP 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	176	11,954	12,131
Aspen/Balm of Gilead SI > 65	40	2,729	2,768
Balsam Fir		38	38
Ash/lowland hardwoods		373	373
Oak	25	65	90
Jack Pine		17	17
Red Pine planted		45	45
Tamarack SI<40		89	89
Tamarack SI>39		164	164
White Spruce	120	11	131
Total	**361**	**15,485**	**15,846**

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 AP Section. The model estimated volume using yield estimates and assumptions about how DNR lands are managed to address multiple values. Volume offered for sale depends on the annual planned volume needed to advance DFFCs. 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	5,323	210,301	215,624
Thinning	75	543	618
Uneven-aged harvest	0	1,875	1,875
Total	**5,398**	**212,719**	**218,117**

GDS-2B: Manage 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.
- Consider managing or using some forest stands for non-timber forest products. Examples include retaining balsam fir to maintain a balsam bough collecting area, where appropriate.
- 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.

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., 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 AP landscape, including:

- 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 50% 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. (Op Order 121)
- Application of site-level guidelines to riparian management zones.
- Management for some High Conservation Values and Management Opportunity Areas may result in older forest.

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.

GDS-3A Strategies

- Allow some stands, especially those with existing or potential old forest characteristics, to convert to long-lived cover types or under-represented NPC growth stages.
- Manage designated old growth stands (Table 3.5) and SMZs according to DNR policy and OFMCs according to old growth policy and MOA guidance documents (Appendix C).
- 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, relevant MOAs, and natural origin red pine stands.
    - When making decisions to add and offer unplanned acres 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.
- Use silvicultural prescriptions or reserves to create corridors that connect older stands.
- Target long-lived tree species to leave as legacies.

Table 3.5. Old growth acres within AP by cover type.

Cover Type	Candidate Old Growth	Designated Old Growth	Grand Total
Ash		172.4	172.4
Lowland Hardwoods		79.7	79.7
Northern Hardwoods		117.8	117.8
Oak		176.7	176.7
Black Spruce (Lowland)	2.8		2.8
Grand Total	**2.8**	**546.6**	**549.4**

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.
- Manage MOAs associated with SGCNs appropriately.
    - MOAs identified in this plan address specific SGCNs (either directly or indirectly), including American woodcock, sharp-tailed grouse, and golden-winged warbler.
- 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.

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

In addition, patch MOAs were adopted through this planning process in AP. The list of all MOAs, including patch MOAs, and links to their guidance documents is in Appendix C.

GDS-3C Strategies

- In the adopted patch MOAs, review and incorporate MOA guidance documents in management activities.
- Group harvest activities to maintain 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.
    - Consider 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.).
- Where consistent with other site objectives, increase the size of clear-cuts while retaining adequate residuals.
- When possible, cooperate with other landowners in patch management to maintain existing large patches and increase the average patch size across forest land of multiple ownerships.

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

Minnesota Biological Survey (MBS) sites of biodiversity significance contain intact native plant communities, populations, and/or concentrations of rare species, critical animal habitats, and/or functional landscapes.

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 will occur on Forestry- and Fish and Wildlife-administered lands within MBS sites following the guidance and directions contained in this plan, as well as completed WMA unit plans, where applicable. 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 to 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.
- 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 they become 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.
    - Maintain or enhance the habitat needed for ETS species.
    - Maintain connectivity of islands of habitat that allows the migration of plants and animals.

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 document 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 AP Section to meet age class and habitat goals through the implementation of the STH decision 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 forest for wildlife species (e.g., ruffed grouse management areas). Management opportunity areas are summarized, with links for their management guidance documents, in Appendix C.

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 AP 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 and 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 AP 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), old forest management complexes, and patch MOAs. Summary information for all MOAs and links to their guidance documents are in Appendix C.

GDS-4 Strategies

- Manage relevant areas within open landscape cover types (see Open Landscape cover type) for the benefit of associated wildlife species.
- Apply MFRC site-level guidelines to retain the integrity of riparian areas and protect wetlands (seasonal and permanent).
- Provide for the needs of 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 and the DNR's Wildlife Management Leave Tree and Snag Guidelines.
- Promote the development of mast- and berry-producing trees and shrubs, or retain them where they already exist, 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.
    - Provide for some of the needs of species that depend on perches, cavity trees, bark foraging sites, and downed-woody debris through the application of MFRC site-level guidelines and leave tree and snag guidelines.
    - Where appropriate, retain some storm-damaged large-diameter trees for the development of cavities for wildlife.
- Manage for stands with high species and structural diversity as appropriate for the NPC.
- Provide for the needs of species associated with conifer stands and mixed conifer/hardwood stands. Opportunities include:
    - 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 site-specific benefits for game and nongame species through Management Opportunity Areas.
- Manage relevant areas within open landscape cover types (see Open Landscape cover type pg. 41) 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 diversity in ash stands.
- 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.
    - Minimize equipment travel and avoid placing landings and logging debris in wetland areas. Verify that landing locations are appropriate (e.g., avoid wetlands when possible) 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. Verify locations of wetlands.
- 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 to 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 some state timberlands.

GDS-6 Strategies

- Move toward harvesting stands in even-aged managed cover types at their rotation ages (Appendix D).
- Use site preparation, inter-planting, release from competition (e.g., herbicide application or mechanical/hand release), and tree protection.
    - Consider the use of alternative approaches to minimize the use of pesticides (herbicides, insecticides, etc.), including mechanical site prep (e.g., roller chopping) and release (e.g., brush saw) to control competition, where feasible.
    - Follow operational standards to control competing vegetation or forest insects and diseases on state lands.
- 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 to limit their impact on individual sites to a level that allows goals for timber production, water quality, aesthetics, recreation, wildlife, and biodiversity to be realized. 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, 4Trees mobile observation recorder, or related apps).

- Involve private landowners and local units of government in gathering and disseminating information.
- Consider and reduce the potential for the effects certain site preparation, release, and timber stand improvement methods may have in regard to introducing and establishing invasive species.
- 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 forest 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 the fire is used appropriately, considering the lifecycle of the pest to be controlled. Insect and disease concerns related to damaged residuals should also be taken into account.

GDS-7B: Reduce undesired 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.
    - Area Forestry and Wildlife staff should work together 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 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 NPC Silviculture Strategies for forest stand prescriptions NPC Silviculture Strategies for forest stand prescriptions, which includes information on species affinity for warmer and/or wetter site conditions, and NIACS climate change projections for tree species in AP.
    - Favor tree species that are projected to have expanded habitat in AP under future climate conditions.
- 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.

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.

3.10 Access to State Land

The GDS and Strategies in this section address Issues: L1

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 hunter-walking trails, 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: M1

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

A cultural resource could include an archaeological site, cemetery, historic structure, historic area, or other element of cultural heritage, including traditional use areas of spiritual, traditional, scientific, or educational value. 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 the annual stand exam list review by DNR archeologists, as well as public and tribal partners. Implement recommendations for mitigation as part of the sale design.
- Where known locations of cultural resources exist (e.g., traditional harvest locations, etc.), minimize impacts to or enhance those resources.

3.12 Natural Disturbance Events

The GDS and Strategies in this section address Issues: I3, 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), DNR land managers will be able to quickly recommend what, if any, forest management activities are necessary to mitigate the impacts of the event on DNR-administered lands. 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 DNR-administered 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.
    - Analyze effects on how disturbances might interact with how much volume is offered to advance desired future conditions.

    - 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 DNR 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), and providing older forest and older forest characteristics distributed throughout the Section (e.g., old forest management complexes).

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 D). 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 D). In practice, MOA reserve amounts can be applied on average at the MOA scale to meet MOA objectives.

The preliminary MOAs included in the stand exam list modeling in the AP 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 AP 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.

Management opportunity areas are not "no-harvest" zones. Normal procedures, including annual plan additions (APAs; stands added to the stand exam list in a given year), are allowed within MOAs and may be necessary to manage appropriately. Management opportunity area goals should be considered when determining annual stand exam list transactions, including APAs. As with stands on the annual stand exam list, management within APA stands is expected to follow the MOA intent and strategies to the extent possible.

The full set of MOA management guidance documents for AP is available on the DNR's AP SFRMP webpage. Individual MOA templates can be downloaded from the links in the tables for each MOA type in Appendix C.

Appendix A: DNR Forest Inventory Managed Acres Query

Total DNR Administration with inventory data (in Forest Inventory Module) in the AP Section = 346,811 acres
Source: DNR forest inventory (FIM) April 2017

- Total managed acres = 341,941 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 = 94,682 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 = 242,529 acres
  stagnant and off-site forest cover types assigned managed acres = 4,729 acres
  Forest cover type query: "MN_CTYPE" <> 0 AND "MN_CTYPE" < 75 OR "MN_CTYPE" = 81
  Non-forest FIM query: "MN_CTYPE" = 0 OR "MN_CTYPE" > 81
  Stagnant and offsite cover types FIM query: "MN_CTYPE" >= 75 AND "MN_CTYPE" <= 79

Appendix B: Summary of Issues and General Direction Statements

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

	GDS																								
Issue	**1A**	**1B**	**1C**	**2A**	**2B**	**3A**	**3B**	**3C**	**3D**	**3E**	**3F**	**3G**	**3H**	**4**	**5A**	**5B**	**6**	**7A**	**7B**	**8**	**9**	**10**	**11**	**12**	**Cover Types**
A1	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
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 timber harvest that meets the Department's plans to continue to develop the desired forest age class distributions and species mixes over time by offering timber volume for sale, considering all forest resources and the objectives of the different forest lands administered by the DNR.

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 some state lands.

I. Disturbance Impacts on Forest Ecosystems

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

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

I3. Considering stand-replacing catastrophic natural disturbances in vegetation management decisions.

J. Climate Change

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

K. Visual Quality

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

L. Access to State Land

L1. Providing access to stands identified for management.

M. Cultural Resources

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

N. Balancing Vegetation Management Needs with Legal Requirements

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

Summary of General Direction Statements

3.1 Forest Composition and Within-stand Diversity

GDS 1A: Maintain diversity of cover types.

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

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

3.2 Harvest Levels

GDS-2A: Provide a sustainable supply of timber.

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

3.3 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.

3.4 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.

3.5 Riparian and Aquatic Areas

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

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

3.6 Timber Productivity

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

3.7 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 undesired impacts of wildlife on forest vegetation on state forest lands.

3.8 Climate Change

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

3.9 Visual Quality

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

3.10 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.

3.11 Cultural Resources

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

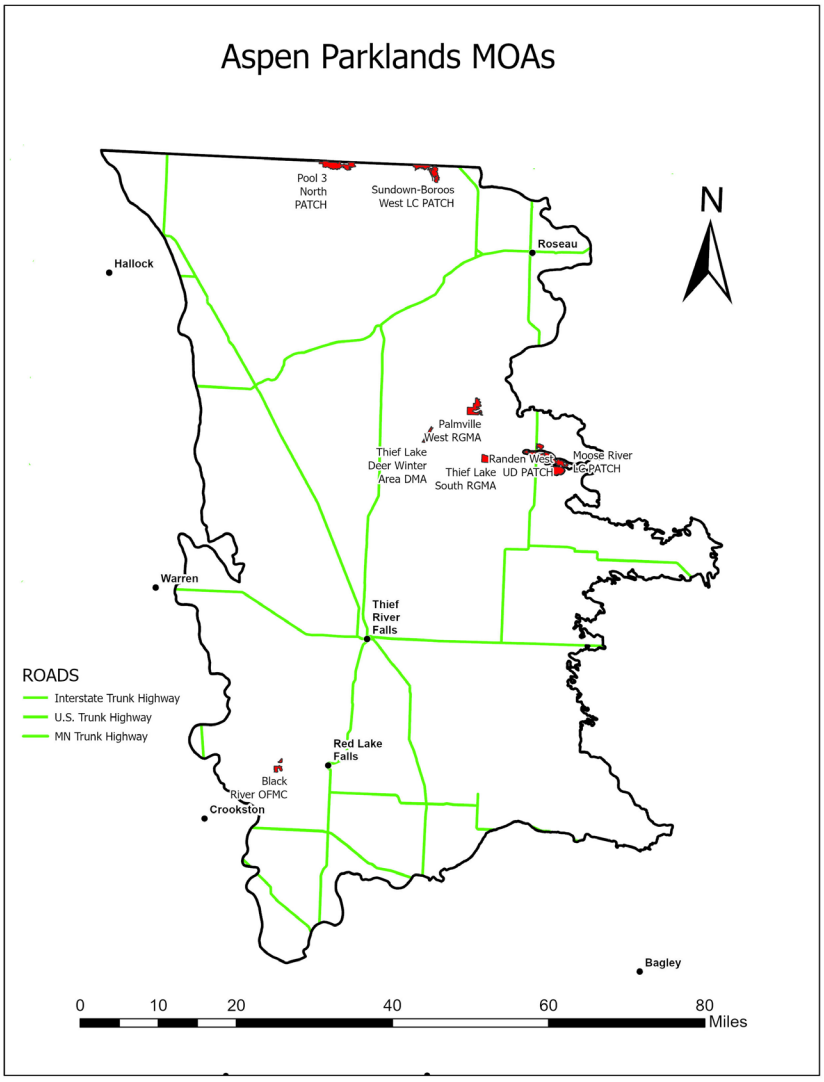
3.12 Natural Disturbance Events

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

Appendix C: 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).

The full set of MOA management guidance documents for AP is available on the DNR's AP SFRMP webpage. 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 C.1. Deer management/winter habitat areas in the AP Section.

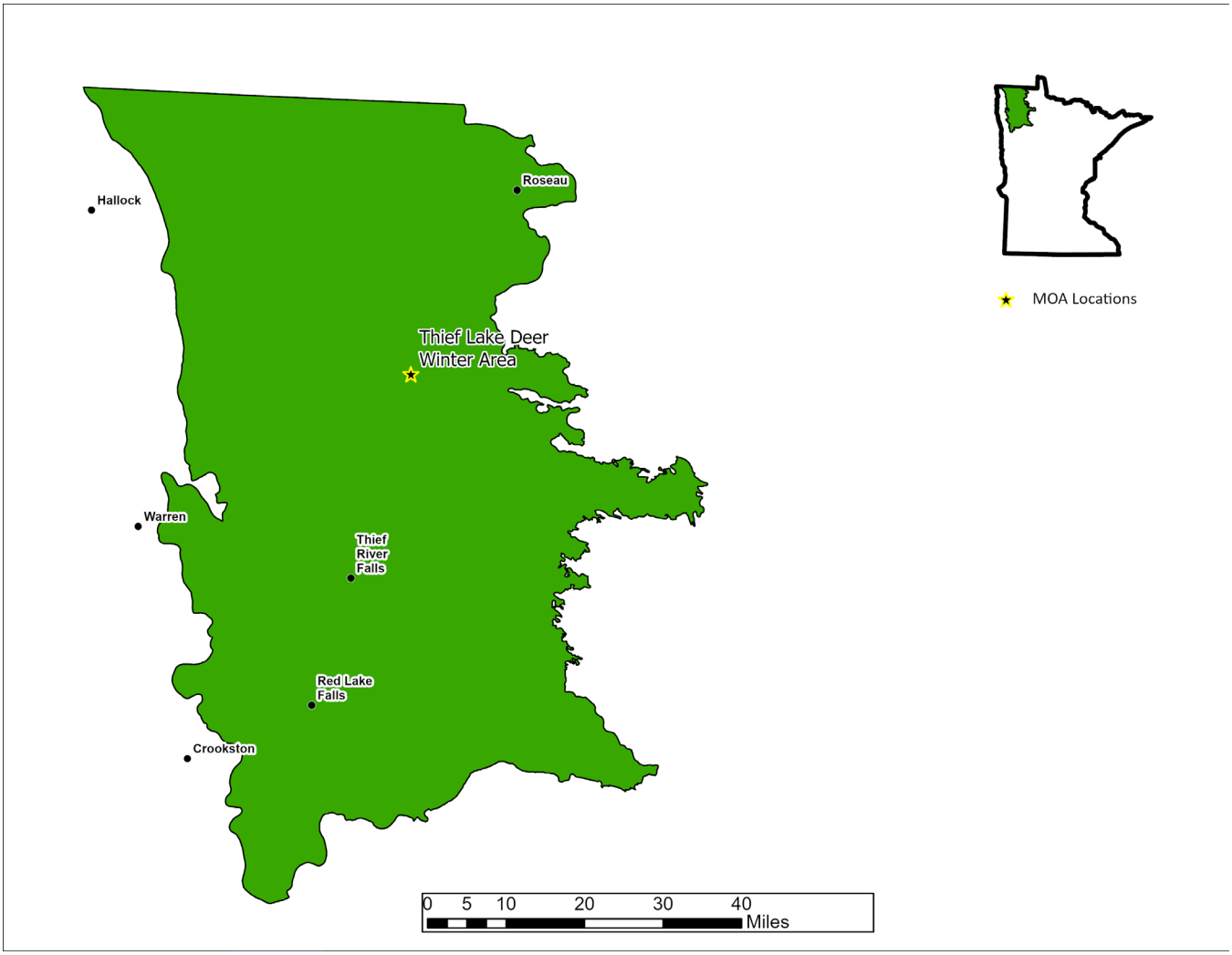


Table C.1. Deer management/winter habitat areas in the AP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Total Stand Acres
Thief Lake Deer Winter Area	Warroad Area	384

Old Forest Management Complex (OFMC)

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

Map C.2. Location of old forest management complexes in the AP Section.

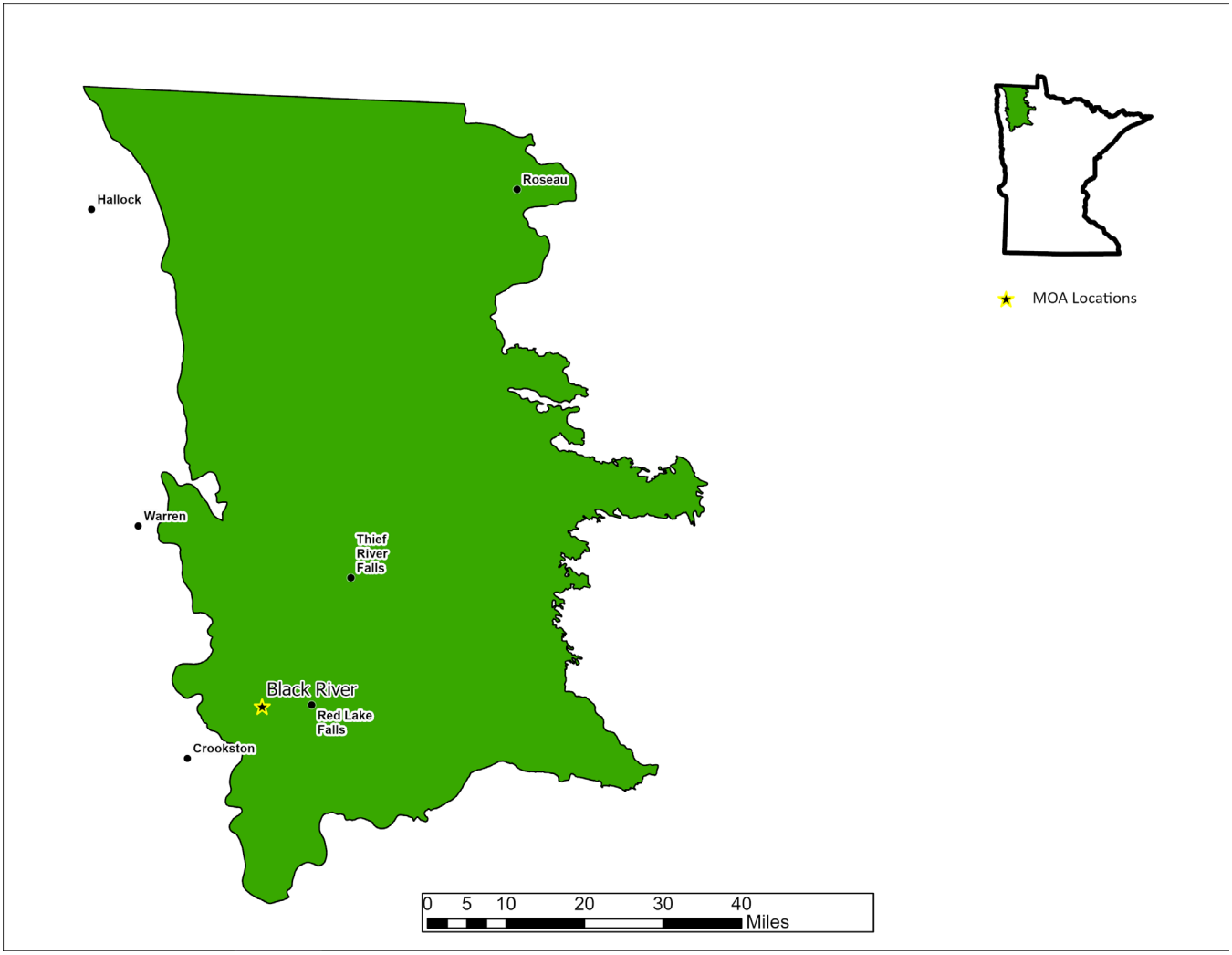


Table C.2. Old Forest management areas in the AP Section. Click on the name of a MOA to view or download its management guidance document.

MOA Name	Forestry Area	Total Stand Acres
Black River	Bemidji Area	450

Patch MOA (PATCH)

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 two lowland conifer patch MOAs, one younger forest patch MOA, and one older upland hardwood patch MOA.

Map C.3. Location of patch MOAs in the AP Section.

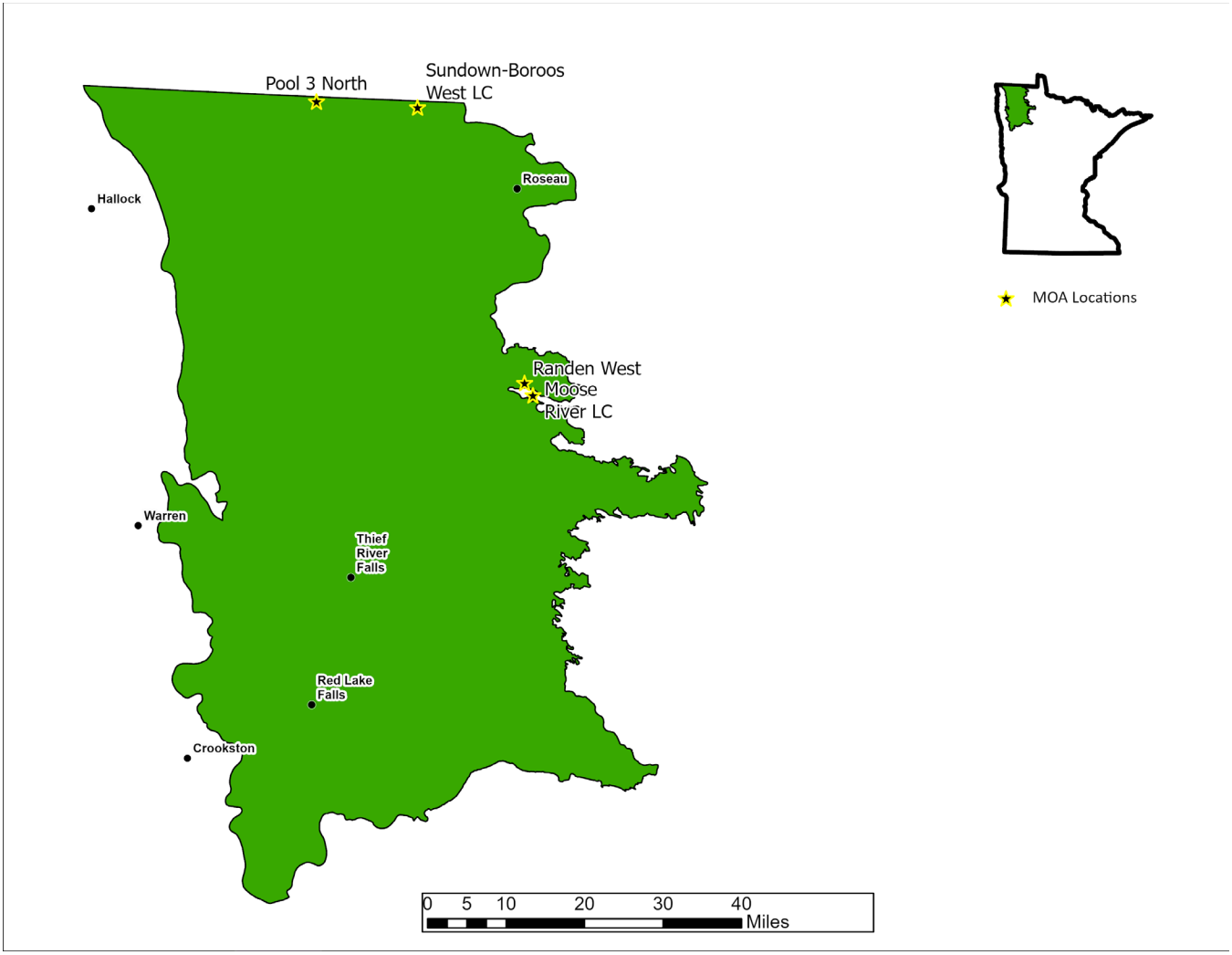


Table C.3. Patch MOAs in the AP Section. Click on the name of a MOA to view or download its management guidance document (LC = lowland conifer, YF = young forest, UD = upland deciduous).

MOA Name	Forestry Area	Total Stand Acres
Moose River LC	Warroad Area	3,012
Pool 3 North YF	Warroad Area	1,978
Randen West UD	Warroad Area	268
Sundown-Boroos West LC	Warroad Area	1,427

Ruffed Grouse Management Areas (RGMAs)

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. The configuration of habitat elements within RGMAs is meant to maximize the abundance of grouse and to provide quality hunting experiences around Hunter Walking Trail networks.

Map C.4. Location of ruffed grouse management areas in the AP Section.

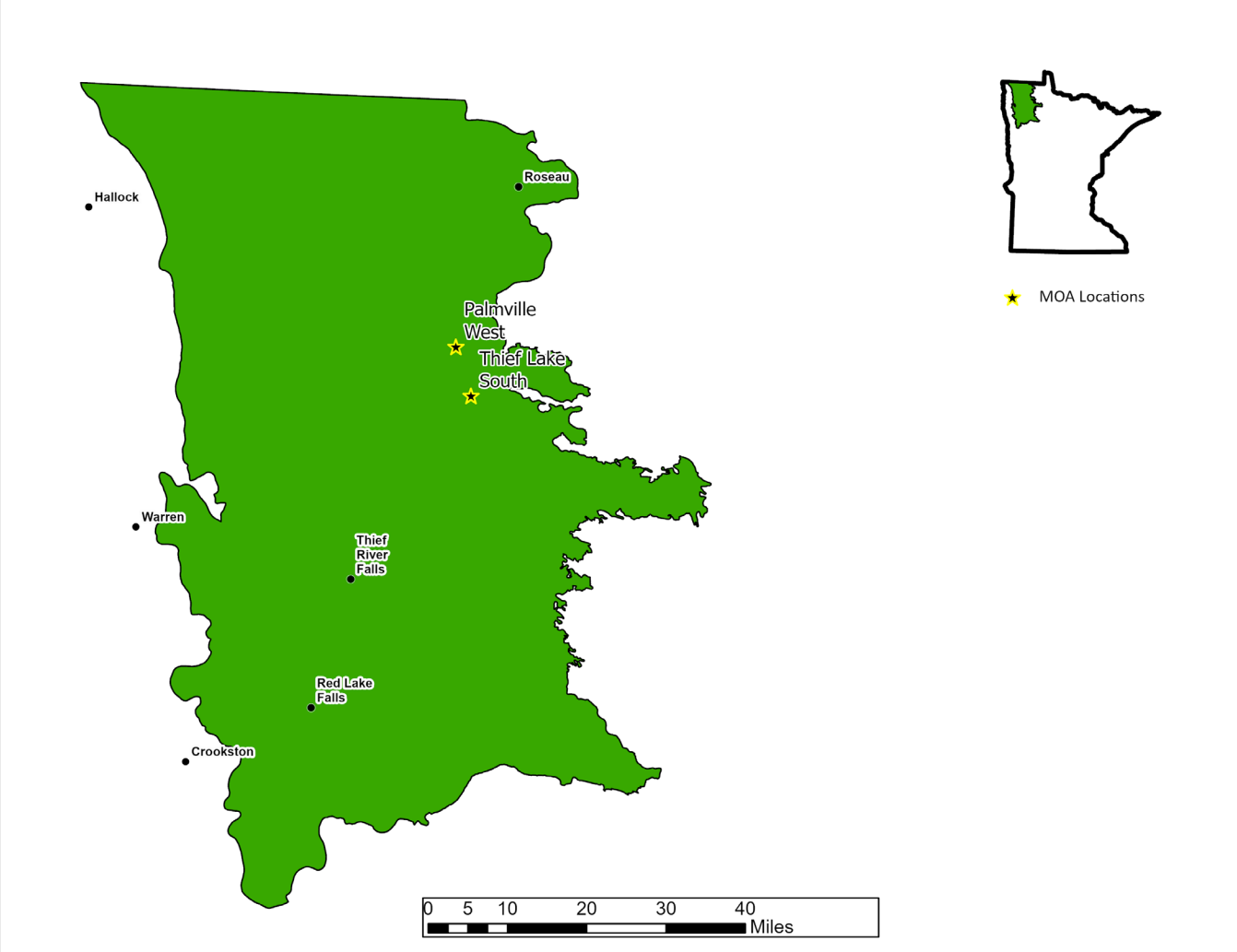


Table C.4. Ruffed grouse management areas (RGMAs) in the AP Section. Click on the name of a MOA to view or download its management guidance template.

MOA Name	Forestry Area	Total Stand Acres
Palmville West	Warroad Area	1,753
Thief Lake South	Warroad Area	564

Appendix D: 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 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 AP, 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 AP are reported below. It is important to remember that these simplified assumptions were necessary for the model, which cannot work with the nuance of site-level variation; however, in reality, sites may differ in their objectives and characteristics. While achieving the planned level of disturbance 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		RGMA	
	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%
Ash/Lowland Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-
Aspen/Balm-of-Gilead - SI 65+	40	5	45	10	40	10	50	10	45	10	45	10	45	10	45	10
Aspen/ Balm-of-Gilead - SI < 65	50	5	45	10	50	10	55	10	50	10	50	-	45	10	45	10
Birch	45	5	45	15	45	10	50	10	45	10	45	10	50	10	50	10
Jack Pine	50	5	45	15	50	5	50	5	45	5	45	5	-	-	-	-
Black Spruce Upland	50	5	45	15	50	5	50	5	45	5	45	5	-	-	-	-
Balsam Fir	50	5	45	15	50	10	50	5	45	5	45	5	-	-	-	-
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+	80	5	85	5	80	5	80	5	80	5	75	5	-	-	-	-
Tamarack - SI < 40	100	5	85	5	100	5	100	5	100	5	95	5	-	-	-	-
Red Pine Plantation - SI 65+	60	5	55	5	60	5	60	5	60	5	60	5	-	-	-	-
Red Pine Plantation - SI 55-64	65	5	60	5	65	5	65	5	65	5	65	5	-	-	-	-
Red Pine Plantation - SI < 55	70	5	65	5	70	5	70	5	70	5	70	5	-	-	-	-
Red Pine Natural	120	5	115	66	120	10	120	10	120	10	115	10	115	5	-	-
White Pine Plantation - SI 65+	60	5	UE	UE	-	-	60	15	65	-	60	10	-	-	-	-
White Pine Plantation - SI 55 – 60	65	5	UE	UE	-	-	60	15	65	-	60	10	-	-	-	-
White Pine Plantation - SI < 50	70	5	UE	UE	-	-	60	15	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+	60	5	55	15	-	-	-	20	80	20	-	20	90	20	90	20
Oak - SI < 75	60	5	55	15	-	-	-	20	80	20	-	20	90	20	90	20
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-	-	-

Note: Dashes indicate that either standard DNR or FAW division management regimes apply for even-aged managed cover types or that the cover type is managed uneven-aged.

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 a treatment before a stand is eligible for a subsequent treatment. The treatment BA columns refer to the basal area at which a stand is eligible for treatment in the model. Parameters that do not apply to a given cover type or section are denoted "NA".

AP Standard DNR Uneven-Aged Regimes

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

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

AP 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
White Pine	All	>= 60	NA	25
White Pine Plantation	All	>= 30	NA	15
White Spruce	All	>= 55	NA	20
White Spruce Plantation	All	>= 55	NA	20

AP 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
White Pine	All	>= 60	NA	20
White Spruce	All	>= 55	NA	20

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

AP 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

AP HCVF and G1/G2 Medium Harvest Uneven-Aged Regimes

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

AP 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 Plantation	All	>= 30	NA	20
Central Hardwoods	<= 55	>= 30	>= 110	20

Thinning Regimes

AP Standard DNR Thinning Regimes

Cover Type	Site Index	Thin Number	Min.Thin Age	Max. Thin Age
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	All	Unthinned	25	90
Red Pine	All	Thin1	35	90
Red Pine	All	Thin2	45	90
Red Pine	All	Thin3	55	90
Red Pine	All	Thin4	65	90
Red Pine	All	Thin5	75	90
Red Pine Plantation	All	Unthinned	25	90
Red Pine Plantation	All	Thin1	35	90
Red Pine Plantation	All	Thin2	45	90
Red Pine Plantation	All	Thin3	55	90
Red Pine Plantation	All	Thin4	65	90
Red Pine Plantation	All	Thin5	75	90
White Pine Plantation	All	Unthinned	25	90
White Pine Plantation	All	Thin1	35	90
White Pine Plantation	All	Thin2	45	90
White Pine Plantation	All	Thin3	55	90
White Pine Plantation	All	Thin4	65	90
White Pine Plantation	All	Thin5	75	90
White Spruce Plantation	All	Unthinned	30	60

AP 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	All	Unthinned	25	35
White Spruce	All	Thin1	40	50
White Spruce	All	Thin2	55	65
White Spruce Plantation	All	Unthinned	50	65
White Spruce Plantation	All	Thin1	70	85

AP 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

AP 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	All	Unthinned	25	80
White Spruce	All	Thin1	40	80
White Spruce	All	Thin2	55	80
White Spruce Plantation	All	Unthinned	30	60

Appendix E: 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 forest lands 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

Adaptive Capacity: The capacity of systems to adjust to change, to take advantage of opportunities, or to respond to consequences with minimal disruptions.

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

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

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

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

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

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

Aspen opening: Sparsely treed, herb- and shrub-dominated communities on medium-fine to medium-textured loamy soils. Quaking aspen is the dominant tree, but bur oak is typically present, and balsam poplar may be occasional. Aspens tend to occur in clumps (usually root-connected clones), with some older trees present among the shrub- and sapling-size root suckers. See NPC factsheet for UPn24 Northern Mesic Savanna.

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 or without management actions.

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). Note: FIM is in the process of being replaced with a system containing similar data.

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

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

Cover type: Expressed as the tree species having the greatest presence (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 ten years).

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

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

Forest Inventory and Analysis (FIA): A statewide forest survey of timber lands jointly conducted by the Minnesota Department of Natural Resources and the U.S. Department of Agriculture—Forest Service that periodically, through a system of permanent plots, assesses the 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-need basis. Recreational users may use them, but the roads are not promoted or maintained for recreation. The roads will be open to all motorized vehicles but not maintained to the level where low clearance licensed highway vehicles can travel routinely on them. The roads will be graded and graveled as needed for forest management purposes. Major damage, such as culvert washouts or other conditions that may pose a safety hazard to the public, will be repaired as reported and 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 historic native plant community.

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): 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: Forests that have 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): This represents an area of land made up of several to many stands that are managed for old growth, their special management zones (SMZ), and stands 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 DNR's Old Growth Forest Policy and related reference documents.

Overstory: The canopy in a stand of trees.

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

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

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

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

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

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

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

Rare animal: All animal species that are listed as Federally endangered or threatened, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened, or special concern. Several rare species are also tracked which currently have no legal status but need further

monitoring to determine their status. For example, some Species 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 conditions, 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 ten years of age for aspen and jack pine stands. An uneven-aged stand is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

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

Stand density: The number of trees per unit area. Density is usually 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, 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 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.