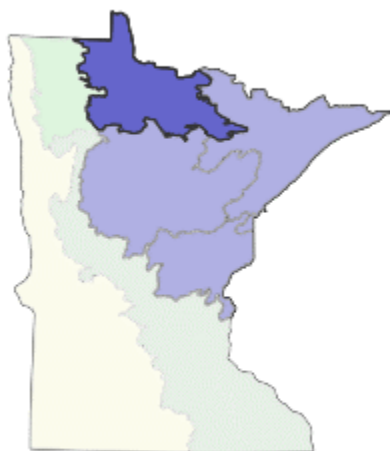


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# Northern Minnesota and Ontario Peatlands

Section Forest Resources Management Plan Narrative  
Guidance

February 2026





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## List of Abbreviations

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<b>Abbreviation</b>	<b>Description</b>
APA	Annual plan addition
Con-Con	Consolidated-conservation land
CSA	Common stand assessment
DFC	Desired future condition
DNR	Department of Natural Resources
ECS	Ecological classification system
ELB	Eastern larch beetle
ETS	Endangered, threatened, and special concern species
EWR	Ecological and Water Resources Division
FAW	Fish and Wildlife Division
FIA	Forest inventory and analysis
FIM	Forest inventory module
FRIT	Forest resources issues team
FSC	Forest Stewardship Council
GDS	General direction statement
GIS	Geographic information system
HCVF	High conservation value forest
LUP	Land utilization program
MBS	Minnesota Biological Survey
MFRC	Minnesota Forest Resources Council
MOA	Management opportunity area
NHIS	Natural heritage information system
NMOP	Northern Minnesota and Ontario Peatlands
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 [Northern Minnesota and Ontario Peatlands \(NMOP\) 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 NMOP Section. This SFRMP replaces the narrative guidance in two plans that formerly covered the NMOP Section: the Agassiz Lowlands SFRMP and the portion of the “North-4” SFRMP that overlapped the Littlefork-Vermillion Uplands Ecological Subsection.

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 DNR directions, guidelines, and policies.
- 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 NMOP Section.
- Consider and incorporate tribal and public input in the planning process.

## Planning Outcomes and Summary

- This plan calls for increasing within-stand compositional and structural diversity appropriate to native plant communities to address habitat objectives and increase resilience to climate change.

- The plan also recognizes the importance of managing stands according to requirements tied to the acquisition and specific purposes of the land being managed. For example, within the NMOP Section, the DNR Division of Fish and Wildlife administers approximately 86,000 acres of land that are leased from the federal government or that the federal government has granted to Minnesota. These lands are called Land Utilization Project (LUP) lands. Because this land status is unique to the NMOP Section in Minnesota, this plan provides strategies that align with the Beltrami Island LUP Comprehensive Conservation Management Plan to help ensure vegetation management of LUP lands complies with lease and land grant terms and requirements associated with federal Pittman-Robertson and Dingell-Johnson Act funding.
- The plan provides that young and older forest for all cover types will continue to be represented on DNR-administered land, with amounts based on the SFRMP strategic direction. This plan recommends strategies aimed at providing older forest characteristics within stands, especially on LUP lands; in management opportunity areas such as old forest management complexes and older forest patches; on Division of Fish and Wildlife administered lands; in riparian areas; and in natural-origin pine stands.
- 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 the age of some stands and stand components, and applying [Minnesota Forest Resource Council Voluntary Site-Level Forest Management Guidelines](#) in riparian areas.
- As part of this planning process, management opportunity areas in the Section that were included in the 10-year stand exam list development process 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.
- Forest cover type conversion goals in this plan emphasize decreasing the aspen cover type by approximately 1% and increasing acres of lowland hardwoods, jack pine, balsam fir, white spruce, red pine, northern hardwoods, and white pine cover types. Aspen, lowland black spruce, and tamarack will continue to be the most abundant cover types in the Section.
- Additional topics addressed in the plan include limiting damage from insects, disease, and non-native species; producing forest conditions that support a range of wildlife habitats; managing for endangered, threatened, and rare species; managing areas of high and outstanding biodiversity significance; minimizing forest management impacts on visual quality; protecting cultural resources; 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](#)). The Department's *Operational Order 121: Management of School Trust Lands* contains more information about how we operationalize this constitutional and statutory directive. Investment income is distributed to the state's public school districts annually to fund operations. There are approximately 934,000 acres of school trust lands in the NMOP Section.

**University trust lands** are managed to generate revenue for the Permanent University Fund. Investment income is distributed to the University of Minnesota annually, which is used to fund professorial chairs, scholarships for students from the Iron Range, mineral and mineral-related research, a mining-related degree program offered through the University at the Mesabi Range Community and Technical Program, and scholarships for students to attend that program. There are approximately 340 acres of university trust land in the NMOP Section.

## State Non-trust Lands

The DNR manages non-trust lands according to their applicable statutory purposes. In the NMOP Section, these lands primarily include consolidated conservation lands (1.55 million acres), land utilization project lands (86,000 acres), Volstead lands (31,500 acres), and acquired lands (1.49 million 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 1.55 million acres of Con-Con lands in the NMOP 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 Mahnommen counties
- Laws of MN 1933, Chapter 402 (Minn. Stat., secs. [84A.31](#) to 84A.42), which addressed a reforestation project in Marshall County

**Land utilization project lands** (“LUP lands”) include land leased from the federal government and land where the title was granted to the state from the federal government. As part of the New Deal, a federal law passed in 1933 authorized the purchase of sub-marginal agricultural land, including over 200,000 acres in Minnesota. Since the 1940s, Minnesota has leased approximately 86,000 acres from the federal government, and the DNR is to manage them primarily for wildlife purposes. All LUP lands managed by the DNR are in the NMOP Section. In some cases, LUP lands have goals that are different from those of other statuses in the Section. These LUP land goals are expressed in the [Beltrami Island LUP Comprehensive Conservation Management Plan \(CCMP\)](#). Because of the unique relevance of LUP lands to this plan, specific strategies that also address goals in the CCMP are noted in Chapter 3.

**Volstead lands** were purchased from the federal government with funds appropriated by the Minnesota Legislature. These lands carried unpaid county liens for drainage ditches that were intended to make the land suitable for farming but were not successful. 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 31,500 acres of Volstead lands in the NMOP 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 1.5 million acres in the NMOP Section are acquired lands.

## State Land Administration

The guidance in this SFRMP narrative applies to lands of the various statuses listed above that are administered by the DNR Divisions of Forestry and Fish and Wildlife in state forests and WMAs.

**Wildlife Management Areas (WMAs)** are DNR-managed lands primarily administered by the DNR Division of Fish and Wildlife 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 school trust lands, which are managed to maximize long-term economic return to the trust while also incorporating WMA goals. WMAs cover approximately 491,545 acres in the NMOP Section.

**State forest lands** are DNR-managed lands administered by the DNR Division of Forestry, as described in chapter [89](#). They are managed 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 1,713,172 acres in the NMOP 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 *Forest Habitat Management on Lands Administered by the Fish and Wildlife Division Procedure*.
- 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 other requirements, including DNR policies and procedures, and consider additional relevant guidance, including 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 Ash management 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

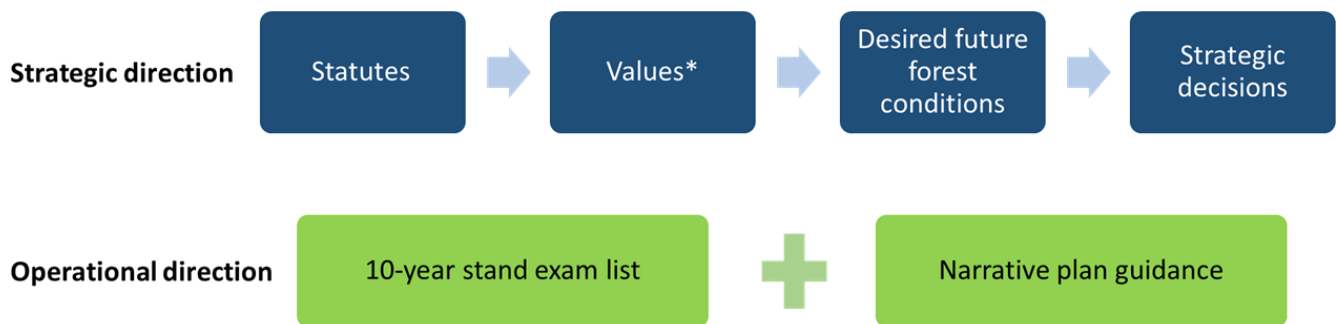
Section Forest Resource Management Plans guide forest management activities on state-administered forest lands, primarily in state forests and WMAs, at the ecological section scale. SFRMPs have both strategic and operational components designed to advance long-term (50+ year) landscape scale goals over 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 NMOP Section on the stand exam list for potential management. After receiving comments from internal staff, tribes, and the public, DNR staff visit the sites on the annual stand exam list to evaluate them for potential management. 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.

## Section Forest Resource Management Plan (SFRMP) Scope

This SFRMP provides guidance for vegetation management on DNR-administered forest lands in the Northern Minnesota and Ontario Peatlands (NMOP) Ecological Section, which contains the Agassiz Lowlands and Littlefork-Vermilion Uplands Subsections (Map 1.1; a detailed explanation of DNR’s ecological classification system (ECS), including sections and subsections, is [available on the DNR ECS webpage](#)). Vegetation management includes actions that affect the composition and structure of forest lands, such as timber harvesting, thinning, prescribed burning, biomass harvest, and reforestation. 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 NMOP 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 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 that was used to develop stand exam lists for this planning period (see [Appendix A](#) for the full forest inventory query for managed acres and managed timberland acres).

This SFRMP provides direction and guidance for managed acres in the NMOP ecological section. Approximately 2,168,000 acres, or 95 percent, of DNR-administered forest lands in this Section are managed acres, representing approximately 40 percent of the total forest land across all ownerships in the NMOP Section.

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).

## SFRMP Goals

This SFRMP document includes goals and direction for resource managers in the NMOP Section, including:

- **Desired Future Condition (DFC) Goals**
  - These are long-term (50+ years) and short-term (10 years) changes in vegetation structure and composition.
  - DFCs are achieved through management activities, including no action, 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.
- **Guidance and prioritization of Management Opportunity Areas (MOAs)**
  - MOAs identify good opportunities to address particular values on DNR-administered lands that can be difficult to achieve at the stand level. See [Section 3.13 in Chapter 3](#) for more information on MOAs.
  - MOAs include old forest management complexes (OFMCs), ruffed grouse management areas, older forest patch MOAs, open landscape priority areas, and deer yards, among others.
  - Management guidance documents developed for MOAs through SFRMP are included as appendices in this plan.

## Staff Involved in Developing SFRMPs

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 co-managed the NMOP SFRMP planning effort. Additional staff, such as Geographic Information System (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, DNR staff prepared information to assess the current forest resource conditions in the Section and prepared for the planning process. In Step 2, the SFRMP team updated the issues and the general directions, strategies, and cover type recommendations to address the issues. In Step 3-4, the plan was shared first with tribal natural resource agency staff and then with the public. In step 5, the plan is finalized and distributed.

The NMOP SFRMP process started in 2014, and steps 1, 2, and parts of step 3 were subsequently completed. Those steps included requesting public comment on timber harvest in the Section, among other topics. In 2016, the NMOP SFRMP process was paused while the SFRMP strategic direction was evaluated and updated. Planning the NMOP SFRMP resumed in 2019 to complete this plan in alignment with the updated strategic direction. Other aspects of SFRMP related to management opportunity areas, cover type conversions, and goals for within-stand diversity, among others, were determined through the process to produce this narrative plan document.

**Table 1.1: Summary of the planning process for the NMOP SFRMP.**

Steps	SFRMP Process Description
<p><b>Step 1</b></p>	<p><b>Initiating the Planning Process</b></p> <ul style="list-style-type: none"> <li>• Form an interdisciplinary team for the Section.</li> <li>• Assemble baseline assessment information.</li> <li>• Prepare draft SFRMP template.</li> <li>• Establish a web page on the DNR website.</li> <li>• Update the mailing list of stakeholders.</li> </ul>
<p><b>Step 2</b></p>	<p><b>Develop Draft Plan</b></p> <ul style="list-style-type: none"> <li>• Review and update the list of issues to be addressed in the plan.</li> <li>• Update general direction statements (GDSs) in response to the final list of issues.</li> <li>• Review and update strategies and desired future condition (DFC) goals consistent with the general direction statements and policy.</li> <li>• Prioritize, develop, and revise Management Opportunity Area (MOA) guidance documents.</li> </ul>
<p><b>Step 3</b></p>	<p><b>Tribal Input</b></p> <ul style="list-style-type: none"> <li>• Make the draft plan available for tribal input.</li> <li>• Review comments received, respond to them, and incorporate them into the draft plan as appropriate.</li> </ul>
<p><b>Step 4</b></p>	<p><b>Public Input</b></p> <ul style="list-style-type: none"> <li>• Make the draft plan available for public input.</li> <li>• Review comments received, respond to them, and incorporate them into the draft plan as appropriate.</li> </ul>
<p><b>Step 5</b></p>	<p><b>Final Plan</b></p> <ul style="list-style-type: none"> <li>• Present a summary of comments, responses, and plan revisions for the Commissioner’s approval.</li> <li>• Commissioner approves final plan.</li> <li>• Distribute the final plan.</li> <li>• Provide plan implementation training to DNR staff involved in forest management and coordination.</li> </ul>
<p><b>Step 6</b></p>	<p><b>Monitoring</b></p> <ul style="list-style-type: none"> <li>• After implementation, plans are periodically monitored to assess their implementation and effectiveness.</li> </ul>

## Forest Planning Efforts Related to the NMOP SFRMP

### Beltrami Island LUP Comprehensive Conservation Management Plan

Within the NMOP Section, the DNR Division of Fish and Wildlife administers approximately 86,000 acres of land that are leased from the federal government or that the federal government has granted to Minnesota (Land Utilization Project or LUP lands). Because this land status is unique to the NMOP Section in Minnesota, this plan provides strategies that align with the Beltrami Island LUP Comprehensive Conservation Management Plan to help ensure vegetation management of LUP lands complies with lease and land grant terms and requirements associated with federal Pittman-Robertson and Dingell-Johnson Act funding.

### Red Lake Wildlife Management Area Master Plan

The Red Lake WMA covers approximately 325,000 acres in the NMOP Section. The Red Lake WMA Master Plan was completed in 2023 and provides additional guidance for management within the WMA.

### MFRC Regional Landscape Planning

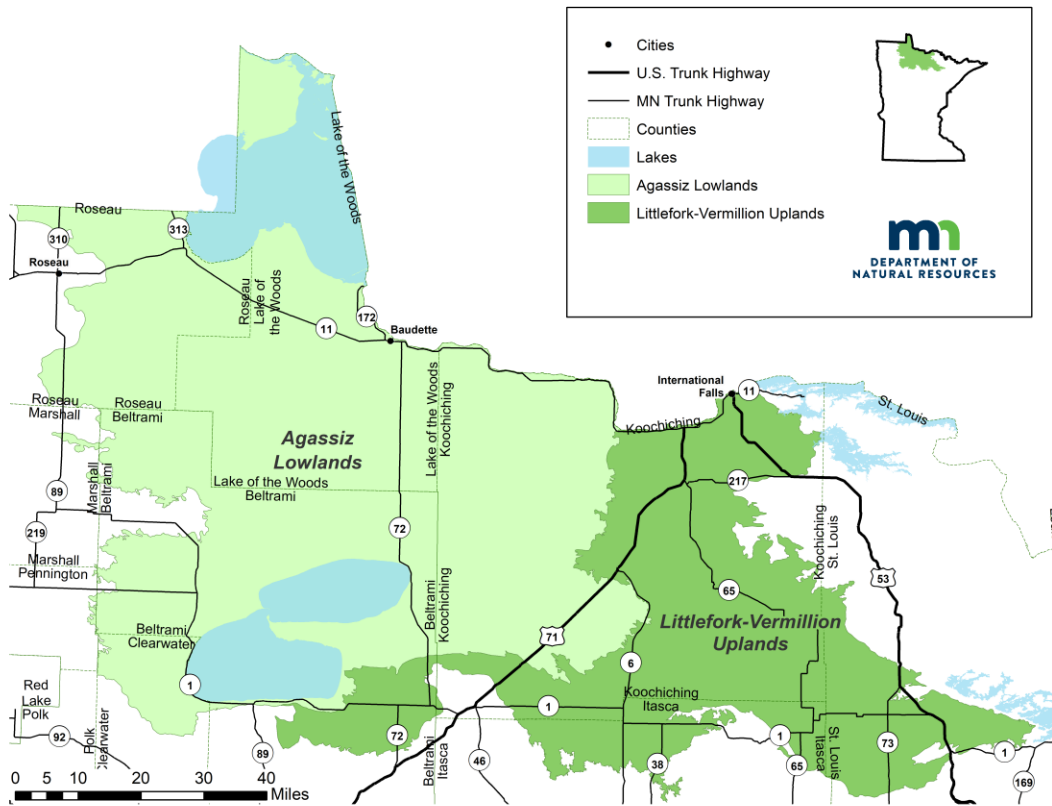
This plan aligns with the goals and strategies related to vegetation management in the Minnesota Forest Resources Council (MFRC) [Northern Landscape Forest Resource Management Plan](#). By aligning with this MFRC plan, the management guidance for DNR-administered lands in this SFRMP incorporates recommendations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

## Planning Area Description

The NMOP Section consists of a total land area of approximately 5.3 million acres, including all or parts of the following counties: Roseau, Lake of the Woods, Clearwater, Beltrami, Koochiching, Itasca, and St. Louis (Map 1.1). Forestry, agriculture, and recreation/tourism are major economic activities in this Section. Red Lake, Lake-of-the-Woods, and Rainy River are important aquatic resources. Excluding water, over half of the Section's land area (approximately 61%) is covered by forest (Gap Analysis Program (GAP) classification completed by the Division of Forestry). Lowland conifer forest, upland hardwood forest, and swamps and wetlands are the dominant land cover classes in the Section (Table 1.2). Based on the DNR forest inventory of timberland considered in this plan, aspen, black spruce (lowland), tamarack, and jack pine are the most abundant timber species (Table 1.2).

Over half of the land in the Section (over 2.9 million acres; 55%) is in public ownership, with the state administering approximately 2.3 million acres (Table 1.3). Other major landowners in the Section include private landowners, tribes, counties, industry, and the federal government (Table 1.3). Most state-administered land in the NMOP Section is administered by the DNR Division of Forestry (73%), followed by the Division of Fish and Wildlife (21%; Table 1.4). Just under half, approximately 47%, of state-administered forest land available for management is school trust land (Table 1.5). For more detailed descriptions of the planning area, refer to the NMOP SFRMP Preliminary Issues and Assessment document on the [NMOP SFRMP Website](#).

**Map 1.1:** Location of the Northern Minnesota and Ontario Peatlands Section.



**Table 1.2:** Generalized cover type composition of DNR-administered lands in the NMOP Section based on DNR forest inventory updated January 2014.<sup>1</sup>

Cover Type Group	Acres	Percent
Lowland conifers (black spruce, tamarack, and white cedar)	647,600	54.5
Aspen, birch, and balm-of-Gilead	371,918	31.3
Pine (red pine, white pine, and jack pine)	66,275	5.5
Lowland hardwoods (ash, elm, and silver maple)	60,054	5.1
White spruce, balsam fir, and upland black spruce	39,737	3.3
Northern Hardwoods, including oak	2,774	0.6
<b>Totals</b>	<b>1,188,358</b>	<b>100</b>

<sup>1</sup> Source: NMOP SFRMP Preliminary Issues and Assessment, October, 2014

**Table 1.3:** Land ownership in the NMOP Section (acres).<sup>2</sup>

Ownership	Acres	Percent
State-administered <sup>3</sup>	2,330,000	44%
Private	1,360,000	25%
Tribal	780,000	15%
County	410,000	8%
Industry	260,000	5%
Federal	140,000	3%
Undifferentiated	60,000	1%
<b>Totals</b>	<b>5,340,000</b>	<b>100%</b>

**Table 1.4:** State-administered acres in the NMOP Section from the DNR's forest inventory data.<sup>5</sup>

State administration	Non-School Trust Land	School Trust Land	Total
Division of Forestry	775,998	937,174	1,713,172
Division of FAW - Section of Wildlife	406,596	286	406,883
Scientific and Natural Areas	97,049	22,878	119,927
Division of FAW - Section of Wildlife - LUP	84,662	-	84,662
State Parks	15,472	-	15,472
Mean Water*	541	-	541
Division of FAW - Section of Fisheries	60	-	60
Trails and Waterways	13	-	13
<b>Grand Total</b>	<b>1,380,391</b>	<b>960,338</b>	<b>2,340,729</b>

\*Stands in the inventory that are underwater.

<sup>2</sup> Source: 1976 to 1998 Minnesota GAP Stewardship – “All Ownership Types” Data

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

**Table 1.5:** Acreages of state-administered forest lands in the NMOP. Managed acres are those in the management pool.

School Trust Status	Forest Land	Timberland	Managed Forest Land	Managed Timberland
Trust	858,153	556,395	835,272	551,948
Non-Trust	861,681	640,247	806,142	623,010

## 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

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## 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 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 seeks to balance addressing these issues while following Department policies and direction and state and federal laws.

Some issues relevant to DNR-administered forest lands are outside the scope of the SFRMP process. For example, SFRMPs do not address recreation trail system issues or planning. However, aesthetic concerns along existing recreational trail corridors can be considered when determining forest 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 developing the strategic direction and the 10-year stand exam list, including:

- Amount, type, and distribution of old and young forest
- Desired age class distributions
- Timber harvest levels
- Landscape patterns of harvested stands

Issues in this plan are addressed through management depending on the opportunities available, given a variety of factors, including current natural resource conditions, managing to address various forest values, state and federal statutes, and Department direction and policy.

The guidance for future direction in Chapter 3 was developed to address the issues in 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 team used assessment information<sup>4</sup>, DNR policies and guidelines, local knowledge, existing plans, and external input to identify the final issues relevant to the scope of this plan. The SFRMP team began with a

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<sup>4</sup> MN DNR July 2014 Preliminary Issues and Assessment, Section Forest Resource Management Plan.

common set of issues developed from previous SFRMPs. These common issues were refined and supplemented based on section-specific conditions and considerations and public comments.

## Issues

### A. Forest Age and Growth Stages

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

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

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

- a supply of vegetation conditions that supports many species
- greater potential to provide a sustainable yield of timber
- ecological values, including healthier, diverse forests that are more resilient to insect and disease outbreaks and negative effects of climate change

**What are the likely consequences of not addressing this issue?**

- increased risk of epidemic insect and disease outbreaks
- decreased population abundance of species with age-specific habitat requirements
- long-term decrease in forest productivity
- decreased forest diversity
- boom and bust supply for forest industries that depend on an even supply of forest products over time

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

Mature to old forest is represented on DNR-administered land in a variety of ways. Examples include stands that exceed the standard rotation age for their cover type, old forest characteristics like large old trees and snags within younger stands, and designated old growth forests, which are high-quality representations of forests in later successional stages.

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

- later successional growth stages associated with animal, plant, and fungi species' habitats
  - Examples within NMOP include woodpeckers, spruce grouse, broad-winged hawk, owls, Blackburnian warbler, pine warbler, ovenbird, black-and-white warbler, blue-headed vireo, brown creeper, wood duck, common goldeneye, chimney swift, eastern wood peewee, least flycatcher, scarlet tanager, gray jay, thrushes, kinglets, pine marten, fisher, black bear, flying squirrel, the taiga alpine butterfly, and several species of bats.

- Old, large-diameter aspen is particularly important to woodpeckers, fisher, bats, and pine marten.
- development of late-successional native plant community (NPC) growth stages
- stable hydrology and groundwater in relatively undisturbed older forests, especially lowland forests
- overall structural and species diversity on the forest landscape
- traditional uses associated with older forests

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

**What are the likely consequences of not addressing this issue?**

- fewer individuals or populations of species with old forest-specific habitat associations
- reduced diversity and complexity
- reduced recreational and economic opportunities associated with the loss of old forest conditions
- reduced ecological services associated with old forest conditions, such as maintaining water quality, natural disturbance regimes, and biodiversity
- reduced opportunity for traditional use of the natural resources associated with older forests

**A3. Managing for young, early successional forest.**

Young, early successional forest is defined as the 0-30 age class of aspen, balsam poplar, birch, and jack pine cover types. Currently, an estimated 14.5% of DNR-administered forested, managed acres in the NMOP Section are young forest.

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

- vegetation conditions that support associated plant and animal (game and non-game) species
  - Examples of species within NMOP associated with young or early successional forest for at least part of their life cycle include ruffed grouse, whip-poor-will, American woodcock, red-tailed hawk, golden-winged warbler, chestnut-sided warbler, mourning warbler, white-throated sparrow, song sparrow, rose-breasted grosbeak, white-tailed deer, black bear, and snowshoe hare.
- cover from predation and/or food supply for species that depend on dense young forest
- edges between young and more mature forest that some species depend on
- depending on distribution, young forest in larger blocks provides an opportunity to create contiguous habitat of uniform age

**What are the likely consequences of not addressing this issue?**

- reduced populations of important game species, particularly ruffed grouse, deer, moose, and American woodcock
- reduced populations of associated non-game species, particularly songbirds
- reduced social, economic, and ecological value of these species

- reduced opportunity for traditional use of the natural resources associated with young forests (e.g., berry picking)

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

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

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

**Why is this issue important?** Current conditions deviate significantly from historical ecological diversity pre-European settlement in many ways. Although a return to historical patterns of diversity across the ecological Section from a particular period in time is not a goal of the DNR or SFRMPs, historical conditions can be a useful reference for evaluating conditions today in the context of forest management. Compared to Minnesota forest land pre-European settlement:

- forest composition and structure have been simplified
- white pine, white spruce, tamarack, and upland white cedar have declined, while aspen has increased
  - fewer conifers particularly affect riparian zones because conifers provide more shade and retain snow longer in spring than deciduous species
- within-stand diversity has decreased
- non-native invasive species have increased
- more of the forest is in younger age classes and less in older age classes<sup>5</sup>
- patch size has decreased and fragmentation has increased
- connectivity of vegetation patches used by wildlife has decreased

### **What are the likely consequences of not addressing this issue?**

- reduction of species associated with specific declining habitats
- increase in non-native invasive species
- increase in populations of desirable species to the point where they reach undesirable levels
- reduced biodiversity
- reduction of ecologically intact landscapes

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<sup>5</sup> Note: DNR forest resource planning, through stand exam list development for SFRMP in the past and the strategic direction for this planning period, has long sought to balance acres between age classes up to the standard rotation age for even-aged cover types. Although balanced age class distributions may not reflect historical distributions of forest ages and growth stages, they do ensure a sustainable supply of forest benefits, including older forest, across the landscape over time from state-administered land.

- reduced ability to produce a diversity of forest products (e.g., sawtimber, aesthetics, non-timber forest products, recreation, and tourism)
- reduced ability to respond to climate change
- reduced public confidence in DNR’s sustainable management of forest resources

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?**

- Past harvests, insect infestations, disease, drought, and browsing by wildlife have resulted in changes in forest age structure and composition. The consequences of this include:
  - reduced regenerative capacity for tree species due to factors such as lack of large downed trees, insect and disease, and a lack of seed trees
  - change in mycorrhizal relationships necessary for healthy soils and trees
  - changes to the composition and structure necessary to sustain associated species
- Climate change is expected to impact which cover types will grow well on sites and will inform which cover types are most appropriate for future vegetation management decisions.

**What are the likely consequences of not addressing this issue?**

Changes to:

- native tree species diversity within forest communities
- native plant community composition, structure, and function
- associated wildlife and warming of cold-water trout streams
- the social, economic, and ecological values provided by these species

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

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

- global or statewide rarity
- limited occurrence in the Section
- known association with rare species
- significant changes in composition as compared to historical conditions

Examples of these types of communities in the Section are FDn12 S2-rank, FDn32 (S1-S3 rank), FDn33 (S2-S5 rank), FDn43 (S2-S5 rank) (see the [DNR NPC website](#) and DNR field guides to native plant communities for more information).

**What are the likely consequences of not addressing this issue?**

- fewer examples of high-quality, intact native plant communities used as controls to compare and monitor the effects of management
- continued forest stand and landscape simplification
- reduced habitat for native and rare species, some of which may be threatened or endangered

- reduced overall forest biodiversity, sustainability, and resiliency

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

**Why is this issue important?**

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

**What are the likely consequences of not addressing this issue?**

- increased simplification of forest stand and landscape communities
- fragmentation of native plant communities and forest cover types
- reduced hydrologic buffering with more intensive management in wetland systems

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.
- Large patches and older growth stages are much less frequent in managed forest landscapes than they were pre-European settlement. This change has resulted in:
  - fragmentation and simplification of forest ecosystems at the landscape scale
  - change in the spatial arrangement of vegetation patches used by plants and animals

**What are the likely consequences of not addressing this issue?**

- increasing isolation of wildlife and plant populations
- reduced species abundance
- reduced resilience of forest ecosystems to disturbance events and climate change
- increases of certain populations to undesirable levels, resulting in negative impacts to forest communities

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

**Why is this issue important?** In this Section, there is less fragmentation than in other parts of the state. However, harvesting and other factors such as road and trail construction, residential development, and ongoing sales of large tracts of land by private corporations have resulted in:

- reduced forest patch size
- altered forest composition, structure, and age
- increased forest fragmentation and simplification

### **What are the likely consequences of not addressing this issue?**

- continued reduction in forest patch size
- decreased interior forest habitat, and increased edge disturbance, which can promote invasive species
- reduced biodiversity and the ability of the forest to produce a range of forest products
- reduced habitat connectivity and ecologically intact landscapes

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

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 planning.

C1. Contributing to sustainable forest management that meets the Department direction 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?**

- Some cover types in the Section have pronounced age class imbalances, which, if not corrected, decreases our opportunity to provide a consistent supply of forest resource benefits over time.
- 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 products 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 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).

**What are the likely consequences of not addressing this issue?**

- inability to provide a consistent harvest level over time, which affects the DNR's ability to manage state forest lands for a sustained yield, decreases economic stability in the forest products sector, and may jeopardize our ability to rely on timber harvest as an important forest management tool
- reduced diversity in vegetation types throughout the Section
- reduction of certain animal species in the Section due to reductions of associated vegetation conditions
- changes to soils and hydrology in wet forests
- reduced revenue for the Permanent School Fund

**C2. Managing non-timber forest products.**

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

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

- diversify local economies and support traditional harvest activities (e.g., maple syrup tapping)
- are particularly important in areas where employment opportunities are limited
- support local individuals, families, and cottage industries in an expanding worldwide market

**What are the likely consequences of not addressing this issue?**

- unsustainable harvest of these resources
- inadvertent harvest of rare species
- negative effects on local cottage industries and economics
- reduction in traditional uses of non-forest products
- change in forest composition or structure due to harvest activities

**D. Biological Diversity**

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

**Why is this issue important?** Larger areas with biodiversity significance provide:

- reference areas to improve our understanding of ecosystems and help us evaluate the effects of vegetation management
- opportunities for large patch management and the maintenance, enhancement, or restoration of native plant communities at landscape scales
- potential for addressing biodiversity-related goals of the DNR and other landowners
- ecosystem services that support human health, safety, and welfare

**What are the likely consequences of not addressing this issue?**

- degradation of existing biodiversity and ecosystem function
- reduced opportunities for maintaining or restoring ecological relationships at landscape scales
- reduced capacity for ecosystem resilience in a changing climate

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

**Why is this issue important?**

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

**What are the likely consequences of not addressing this issue?**

- changes to composition and vertical structure necessary to sustain native plant and animal species
- fewer regeneration sites for some species
- reduced native tree species diversity within forest communities
- reduced native plant community composition, structure, and function
- changes to associated wildlife populations
- decreases in soil complexity and health

**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.
- Habitat loss and degradation are identified as primary conservation challenges in the lowland coniferous and upland deciduous forest. Key Habitats were identified for NMOP in [Minnesota's Wildlife Action Plan](#).
- Department-wide direction acknowledges 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 protect endangered, threatened, and special concern (ETS) species and their habitats.
- The DNR is required by third-party certification to ensure that any management within high conservation value forest (HCVF) sites enhances or maintains the high conservation value(s) associated with the site.

**What are the likely consequences of not addressing this issue?**

- rare species extirpation at the local and state level
- rare species declines, leading to listing status changes
- rare species habitat loss or degradation
- reduced diversity at the species (genetic), community, and/or landscape level

**F. Wildlife**

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

**Why is this issue important?**

- Forest change affects forest wildlife; populations of some species have increased while others have decreased in the Section.
- Several species listed by the state as endangered, threatened, or of special concern live in forested areas in the Section.
- Forest wildlife is important to society and depends on healthy forest ecosystems.
- Legal mandates, stakeholder expectations, and DNR internal policies require the ecological integrity of the forest to be maintained and enhanced.
- Practical reasons to maintain ecological integrity related to wildlife include:
  - economic vitality of forest and tourism industries
  - maintenance of recreation opportunities for the public
  - health of wildlife species and populations
  - public health
  - control of forest insects and disease
- Reduced availability of important habitats is a concern for several species, including listed and special concern species.
  - For example, in the NMOP Section, reduced conifer cover affects several species, including white-tailed deer, black bear, pine marten, fisher, spruce grouse, ruffed grouse, songbird species, and the taiga alpine butterfly.
  - As another example, many wildlife species depend on open landscapes or brushland habitats within or near the forest, including sharp-tailed grouse, yellow rail, sandhill crane, and bobolink.
- In the NMOP Section, historical and more recent changes have affected wildlife species and their habitat, including:
  - changes in the abundance of tree species, age structure, and structural and species diversity.

- loss of larger patches of older forest and connections between such patches
- increased habitat fragmentation from land use change
- alteration of natural fire disturbance events
- a warming climate which has caused a decrease in populations of animals at their most southerly range (such as moose) and an increase in the number of animals from the south (such as gray fox)
- The abundance of public forest land in the NMOP 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 Big Bog Important Bird Area, which encompasses a large part of the Agassiz Lowlands Subsection within the NMOP Section, was designated by Audubon Minnesota in recognition of the large number of boreal bird species that this area holds that are rare elsewhere within the continental United States.
  - The Section provides unique wildlife viewing and photography opportunities for sought-after species, including boreal chickadee, Connecticut warbler, pine grosbeak, red crossbill, white-winged crossbill, great gray owl, gray jay, gray wolf, northern hawk owl, black-backed woodpecker, three-toed woodpecker, pine marten, sharp-tailed grouse, spruce grouse, and a large number of warbler species.
- The NMOP Section supports viable populations of most species in the Section due to its wide range of habitats that often occur in large intact blocks.

**What are the likely consequences of not addressing this issue?**

- changes to wildlife habitat
- fewer populations associated with declining habitats
- change in ecosystem services provided by wildlife species
- economic losses resulting from a decline in recreational activity associated with wildlife
- social losses because of a decline in enjoyment of cultural values associated with wildlife

**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 protecting, maintaining, or enhancing aquatic habitat types, corridors and connectivity for plant and animal species, aesthetics, recreation, water quality, and forest products.

- Several rare insects (e.g., caddisflies) and plants (e.g., small white water lily) are affected by changes to these factors.
- Management activities may affect permanent wetlands adjacent to upland stands. For example, young forest in the adjacent landscape may lead to faster and increased water runoff.
- Seasonal ponds are particularly important for maintaining populations of amphibians, which have limited ability to disperse long distances.
- Red Lake, Lake of the Woods, and the Rainy River are among the prime fisheries in MN that draw tourism, benefitting local economies. Good water quality is essential for cool water fish like walleye and northern pike.
- 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.
- Applying Minnesota Forest Resource Council site-level guidelines without considering site-specific conditions may not be adequate to protect surface waters.

**What are the likely consequences of not addressing this issue?**

- degradation of communities associated with wetlands, streams, and lakes
- reduced abundance of associated fish, other wildlife, and plants, especially coldwater and sensitive game and non-game animals
- negative impacts on other values, including water quality, ecosystem function, and recreation opportunities

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

**Why is this issue important?**

- The NMOP Section contains all or parts of 12 major watersheds, including the six highest-ranked watersheds in Minnesota for overall watershed health.
- Vegetation management activities and the amount of forest cover on the landscape affect watershed and sub-watershed hydrology.

**What are the likely consequences of not addressing this issue?**

- Increased run-off and stream bank erosion, more conspicuous run-off events, less stable flows, changes in ecosystem function and stability, and less habitat for aquatic organisms, including cold-water fish.

Note: A description of this issue is included here because of its relevance to forest management. However, because we do not currently have the data or scientific methodology to fully evaluate cumulative impacts across ownership and time, this plan does not include specific future direction related to cumulative impacts to aquatic resources. Instead, this plan and DNR forest management focus on addressing water quality issues and impacts on aquatic resources by applying MFRC site-level guidelines and guidance for site-level decisions (see [Chapter 3 Section 3.5](#)).

## H. Timber Productivity

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

#### Why is this issue important?

- Minnesota's forests provide a range of environmental and economic services. Healthy growing trees provide many ecosystem benefits from habitat to carbon sequestration.
- Timber sales are how the DNR accomplishes much of the vegetation management activities covered under SFRMPs.
- A robust forest industry is a critical component of our ability to manage forests.

#### What are the likely consequences of not addressing this issue?

- reduction in timber products available in the Section
- reduced ability to sustainably provide forest products over time
- reduced revenues to the Permanent School Fund
- fewer forest product businesses throughout the state due to a reduction in forest product quality and availability
- reduced availability of commercial timber harvest as a tool for managing forests due to a decline in the forest products industry

## I. Disturbance Impacts on Forest Ecosystems

### I1. Addressing disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.

#### Why is this issue important?

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

#### What are the likely consequences of not addressing this issue?

- degradation of forest products or regeneration due to forest insects, disease outbreaks, or herbivory
- change in important ecosystems or ecosystem processes
- increased occurrence of non-native invasive species

- negative impacts on native plant communities
- reduction in carbon storage and sequestration in forests

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

### Why is this issue important?

- Non-native invasive species can displace native species, carry or cause diseases, or disrupt natural community functions. They can change ecosystem function, simplify natural processes and plant communities, and reduce resiliency.
- It is the DNR’s policy, through its 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.

### What are the likely consequences of not addressing this issue?

- permanent changes to native communities through invasion or displacement
- negative economic impacts, including increased control costs, decreased timber revenue, and decreased property values
- negative effects on populations of sensitive and rare species and communities

## 13. Considering 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.
- They may affect this plan’s short-term and long-term desired future condition (DFC) goals.
- The timing and location of catastrophic events are difficult to predict.

### What are the likely consequences of not addressing this issue?

- less marketable timber available for sale
- increased fire danger in the vicinity of a catastrophic event
- disruption of opportunities to implement plan goals

## J. Climate Change

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

#### Why is this issue important?

- Minnesota is one of the fastest-warming states in the U.S., and temperatures are projected to continue increasing through the end of this century.
- Effects of climate change may include:
  - changes in the frequency and intensity of precipitation events
  - 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
  - negative effects on some tree species due to soil warming and decreased soil moisture
  - expansion of habitat for some tree species, such as American basswood and northern red oak
- Forests with lower species and structural diversity are projected to be less resilient to climate change impacts.
- Communities thought to be most vulnerable to changing climate include peatlands, priority cold-water cisco lakes, cool and cold-water streams, and lowland conifer forests.
- Climate change will affect future management options and decisions on site-appropriate cover types.
- Carbon sequestration by forests and wetlands, including soils, may be affected.

**What are the likely consequences of not addressing this issue?**

- acceleration and exacerbation of climate change effects on forest communities
- less opportunity to begin directing management toward mitigating climate change effects on the most vulnerable species and native plant communities
- reduced timber production and access to winter management sites
- reduced ecosystem resilience
- reduced habitat for native wildlife and plants

**K. Visual Quality**

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

**Why is this issue important?**

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

**What are the likely consequences of not addressing this issue?**

- a negative experience for the vacationing and recreating public in forested areas of the state
- negative public perception of DNR forest management activities
- increased regulations for vegetation management activities
- reduced vegetation management opportunities due to public opposition

## 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.

#### What are the likely consequences of not addressing this issue?

If not managed properly, forest road development, construction, and maintenance can result in negative impacts, including:

- permanent land disturbance
- forest fragmentation and loss of timberland acres
- increased spread of non-native invasive species and undesirable native plants and animals
- potential conflicts with adjacent private landowners
- potential for user-developed trails
- degradation of water quality, changes to hydrology, and destruction of fish habitat
- increased soil compaction
- negative effects on rare species and rare species habitats

## M. Cultural Resources

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

A cultural resource is an archaeological site, cemetery, historical structure, historical area, or traditional use area that is of spiritual, traditional, scientific, or educational value. Examples include the archaeological remains of a 2,000-year-old American Indian village, an abandoned logging camp, a portage trail, a cemetery, food-gathering sites such as wild rice harvesting and maple sugaring camps, or a pioneer homestead.

#### Why is this issue important?

- Cultural resources are scarce, nonrenewable features that provide physical links to our past or the ability to continue to practice cultural traditions.
- They often possess spiritual, traditional, scientific, or educational values and should be treated as assets.
- 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.

#### What are the likely consequences of not addressing this issue?

- Loss of opportunities for Minnesotans to connect with their cultural heritage.
- Permanent loss of or damage to a cultural resource may violate federal or state law.

## 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 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 wildlife habitat.
- Federal Land Utilization Project (LUP) lands are managed in accordance with the lease agreement for the land and the congressionally-mandated comprehensive conservation management plan developed for these lands.
- The DNR must comply with federal and state endangered species acts.

**What are the likely consequences of not addressing this issue?**

- failure to follow mandates and legislative intent may be a violation of federal or state law
- corrective action requests from third-party certifiers or loss of the DNR's forest certification due to failure to comply with legal requirements
- loss of the DNR's authority to manage certain lands

# Chapter 3: Forest Types and Management Direction

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## Introduction

Managing for sustainability requires that we address the issues identified in Chapter 2 to balance multiple forest benefits. Sustainably managed forests support wildlife habitat, biodiversity, wood supply and healthy natural resource economies, carbon storage, forest health, recreation, and water quality and quantity. The “optimal balance” of these forest benefits varies across the different lands managed by the DNR. This chapter provides future direction to forest managers that aims to balance the issues identified in this plan while adhering to DNR policy.

Interdisciplinary DNR staff members helped refine general direction statement (GDS) strategies in response to the list of issues in Chapter 2 and defined desired future condition (DFC) goals where appropriate (see below for definitions of GDSs and DFCs). An issue may be addressed through one or more GDSs, and some GDSs address multiple issues ([Appendix B](#)). Goals and strategies for state-administered forest lands in this plan are consistent with the MFRC Northern Regional Landscape Committee's long-term goals and strategies for forest lands and ecosystem types in the northern landscape 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 E](#) for more information on MOAs.

## General Direction Statements (GDS)

- follow direction provided in 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 forest lands in the Section
- were identified where we currently have the ability to measure and quantify progress

## Role of Department Guidance Documents, Policy, and Management Recommendations

In addition to DFCs, GDSs, and strategies identified in this document, a vast array of planning documents, guidelines, policies, objectives, and initiatives direct vegetation management on state-administered land. DNR employees must consider these directives when making individual site-level decisions. The DNR's internal 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 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?)
- Does the planned management meet MFRC site-level guidelines?
- Is the management activity appropriate to the NPC? Is it consistent with the ECS silvicultural interpretation?
- Does the stand present a good opportunity to contribute to SFRMP conversion goals?
- Do planned actions account for ETS species and species in greatest conservation need?
- 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 agreements been documented and followed?
- 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?
- Has the management objective been documented prior to treatment?

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 NMOP 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 of the major cover types within the NMOP 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 does not provide a comprehensive discussion of these cover types, and field staff should rely on the current management direction provided on the DNR's internal Intranet Forest Management Direction Documents page and WMA plans where applicable. Those directions are updated to reflect current management guidance and policy.

Some cover types include conversion goals (desired trends, not exact targets), 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

Conversion goals in this plan equate to an approximate 7% change from aspen/balm-of-Gilead/birch cover types over 50 years, or about 540 acres per year across the Section.

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

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

**Table 3.1:** General management strategies 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 plantation	✓	✓	
Black spruce-lowland		✓		White pine natural			✓
Black spruce-upland		✓		White pine plantation	✓	✓	✓ (FAW)

## Ash/Lowland Hardwoods

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

These cover types are managed using uneven-aged treatments. The current age class distribution of these cover types in the NMOP Section includes little acreage in younger age classes ([Appendix C](#)).

**Current Acres:** 55,200 acres in the NMOP Section (approximately 3% of state-managed forest acres)

- acres are roughly equal between the Agassiz Lowlands and Littlefork-Vermilion Uplands

### Future Direction and Goals

- 10-year DFC: 55,500 acres (0.5% increase)
- 50-year DFC: 56,700 acres (2.7% increase)
- Increase within stand diversity.
- Increase resilience of sites to emerald ash borer (EAB).
- Maintain forested conditions of ash and lowland hardwood sites in the wake of EAB.

### Strategies

- Convert approximately 300 acres (1,500 acres total over 50 years) of the aspen/balm-of-Gilead/birch cover type to the lowland hardwood cover type. This conversion goal only applies to the lowland hardwood cover type.
- 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 number of ash
  - Promote non-ash species appropriate to NPC
- LUP lands: Identify yellow birch on the north shore of Upper Red Lake on LUP-status land to retain as seed trees and increase yellow birch abundance.

### Special Considerations

- Emerald ash borer (EAB)

## Aspen/Balm-of-Gilead

Aspen and balm-of-Gilead (A/BG) cover types are combined because they are commonly associated with each other and are managed similarly. Aspen/BG-dominated native plant communities in the NMOP Section are typically mesic to wet-mesic forests with a mixture of hardwood species and some conifers in the canopy and understory.

The current A/BG age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). This imbalance may be due to past settlement history, distance from pulp and paper markets, lack of disturbance, and relatively recent emergence of markets.

**Current Acres:** 364,400 acres in the NMOP Section (approximately 22.5% of state-managed forest acres)

### Future Direction and Goals

- 10-year DFC: 360,800 acres (1.3% decrease)
- 50-year DFC: 340,700 acres (6.5% decrease)
- Move toward a balanced age class distribution.
- Increase within-stand diversity.

### Strategies

- Use clearcut with reserves method to regenerate aspen.
- Convert approximately 4,840 acres (24,200 acres over 50 years) of aspen, balm-of-Gilead, and birch utilizing NPC-suitable species, including jack and red pine.
  - In this planning period, convert 1% of the A/BG cover type to other cover types to increase cover type diversity to reflect more of the natural variation in NPCs and increase species projected to gain habitat as the climate changes.
  - Prioritize low-density, over-mature stands that are far from markets for conversion, as well as stands within old forest management complexes (OFMCs), old growth special management zones (SMZs), and riparian management zones (RMZs).
  - Determine sites and species appropriate for conversion by field visits and NPC.
- Maintain upland cedar and tamarack where they occur in aspen stands.
- Increase northern hardwoods, including birch and oak, or conifers, including white pine, white spruce, red pine, balsam fir, and upland white cedar, as appropriate to NPC.
- Sustainable timber harvest model parameters included retaining a minimum of 2.5% of the aspen cover type 60 years old and older statewide to provide habitat associated with older aspen.

### Special Considerations

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

- *Hypoxylon* cankers and *Saperda* stem borer mortality in low-density stands or stand edges
- preferred host for gypsy moth, which was not documented in the Section as of 2020
- Long distances to markets may challenge regeneration efforts for low-density, over-mature stands.
- All age classes of aspen provide wildlife habitat. To ensure the availability of older aspen habitat, the DNR decided to retain at least 2.5% of the aspen cover type in age classes at least 60 years old statewide in this planning period.

## Birch

The birch (Bi) cover type includes paper birch and, to a limited extent, yellow birch in NMOP. Birch-dominated NPCs in the NMOP Section are typically mesic to wet-mesic forests with a mixture of hardwood species and some conifers in the canopy and understory.

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

**Current Acres:** 6,100 acres in the NMOP Section (approximately 0.4% of state-managed forest acres)

### Future Direction and Goals

- 10-year DFC: maintain at approximately 6,100 acres
- 50-year DFC: maintain at approximately 6,100 acres
- Move toward balanced age class distribution to the extent possible.
- Increase within stand diversity.

### Strategies

- Use the clearcut with reserves method to regenerate paper birch.
- Manage stands selected for harvest that contain yellow birch for yellow birch regeneration.
  - Identify yellow birch on the north shore of Upper Red Lake to retain as seed trees and increase yellow birch abundance as recommended in the LUP Comprehensive Conservation Management Plan.
  - A variety of methods can be used to regenerate yellow birch; however, seeds require decaying coniferous nurse logs, tip-up mounds, or exposed mineral soil to sprout.
- Consider opportunities in Bi cover type to contribute to A/BG conversion goals (see Strategies for A/BG above)
- Increase northern hardwoods, including birch and oak, or conifers, including white pine, white spruce, red pine, and upland white cedar, where they already occur or in appropriate NPCs.

### Special Considerations

- Balancing Bi age classes may not be attainable due to the small number of cover type acres.
- Birch is an iconic species with particular aesthetic value on the Northwest Angle shore of Lake of the Woods.
- Live birch is an important food for yellow-bellied sapsucker. Dead birch is important for chickadee and nuthatch nest sites.
- Birch is also used for non-timber forest products, including chaga, birch bark, and poles.

## Northern Hardwoods

Northern hardwood (NH) dominated plant communities in the NMOP Section usually occur on upland sites with moist soils in settings protected from fire. Natural, mature NH stands are comprised of mixed species.

Current age class distributions for the NH cover type differ by subsection within the NMOP Section. In the Agassiz Lowlands, there are more acres in the 71-130 age class and fewer acres in the younger and older age classes. In the Littlefork-Vermilion Uplands Subsection, acres are distributed across all age classes from 11 to 130. Most acres across the NMOP Section are in 51-130-year age classes ([Appendix C](#)). Northern hardwoods are managed as an uneven-aged cover type, so balancing age class distributions is not a goal for this cover type.

**Current Acres:** 2,300 acres in the NMOP Section (approximately 0.1% of state-managed forest acres)

- Most acres are in the Littlefork-Vermilion Uplands Subsection

### Future Direction and Goals

- 10-year DFC: 3,300 acres (43% increase)
- 50-year DFC: 7,300 acres (217% increase)
- Improve timber quality.
- Enhance or maintain aesthetic values.

### Strategies

- Use uneven-aged and gap management to regenerate NH and manage species composition.
- Convert approximately 1,000 acres (5,000 acres total over 50 years) of the aspen/balm of Gilead cover type to NH cover type.
  - Gradually convert from aspen-dominated stands to more diverse stands with additional hardwood trees.
- Increase the abundance of white pine or white spruce where opportunities exist.
- Increase oak and maintain birch and basswood in mixed stands.

### Special Considerations

- The NH cover type is very limited in the NMOP Section.
- Without larger disturbances such as gaps, shade-tolerant species such as maple and basswood will increase in abundance at the expense of shade-intolerant species such as birch and oak.
- Considering climate change and market forces, some aspen stands may gradually convert to more NH-dominated stands.

## Oak

The oak cover type includes northern pin, red, and bur oak. Natural, mature oak stands range from nearly pure oak to mixed stands. Oak is most likely to occur in the Beltrami-Pine Islands Beach Ridges and river and stream riparian corridors. Oak species are commonly found as a component of other cover types, such as aspen, birch, northern hardwoods, and lowland hardwoods (bur oak).

The oak acres in the NMOP Section are distributed unevenly across all age classes ([Appendix C](#)), and age class distributions differ between subsections. In the Littlefork-Vermilion Uplands Subsection, more acres are in younger age classes, few in middle age classes, and some in the 10-year age classes between 91-100 and 131-140. In Agassiz Lowlands, most acres are in the age classes between 51-110.

**Current Acres:** 350 acres in the NMOP Section (less than <0.1% of state-managed forest acres)

### Future Direction and Goals

- 10-year DFC: 350 acres (no change)
- 50-year DFC: 350 acres (no change)
- Maintain age and species composition within stands.

### Strategies

- Consider the amount of advanced regeneration when planning regeneration methods.

### Special Considerations

- Oak as a cover type is very limited in the NMOP Section.
- 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.

## Balsam Fir

Natural, mature balsam fir (BF) stands are typically mixed stands. Native plant communities favorable for BF cover type maintenance are FDn33, FDn43, and MHn44. Balsam fir is best suited to wet-mesic sites where adequate soil moisture is available throughout the growing season.

The current balsam fir age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). Most acres occur in the 41-50 age class in both subsections.

**Current Acres:** 20,000 acres in the NMOP Section (approximately 1% of state-managed forest acres)

- acres are roughly equal between the Agassiz Lowlands and Littlefork-Vermilion Uplands

### Future Direction and Goals

- 10-year DFC: 20,600 acres (3% increase)
- 50-year DFC: 23,000 acres (15% increase)
- The desired within-stand composition is mixed, including long-lived conifers and upland hardwoods appropriate to NPC.
- Move toward a balanced age class distribution.
- Manage balsam fir as a component of other mixed species cover types.

### Strategies

- Convert approximately 1,200 acres (6,000 acres over 50 years total) of A/BG/Bi cover types to WS/BF cover types in appropriate sites.
- Manage BF primarily as even-aged for pulpwood and bolts.
- Use intermediate treatments to control species composition and speed up stand development.
  - best results from release treatments in young, vigorous stands (approx. 6-10 feet tall)

### Special Considerations

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

## Black Spruce (Lowland)

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

The current BSL age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). However, BSL's age class distribution is more balanced than the age class distributions of other even-aged managed cover types in the NMOP Section.

**Current Acres:** 293,300 acres in the NMOP Section (approximately 18% of state-managed forest acres)

### Future Direction and Goals

- 10-year DFC: 293,300 acres (no change)
- 50-year DFC: 293,300 acres (no change)
  - Although maintaining current acres is the goal, inventory updates will cause minor changes.
- Move toward a balanced age class distribution.
- Maintain species diversity within BSL stands.

### Strategies

- Maintain secondary component species such as tamarack, white cedar, balsam fir, and paper birch.
- Where opportunities exist on Fish and Wildlife-administered or LUP land:
  - consider alternative prescriptions for wildlife habitat
  - feather stand edges
  - maintain corridors with forest cover for wildlife

### Special Considerations

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

## Black Spruce (Upland)

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

In the NMOP Section, the current age class distribution of BSU does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). The majority of BSU acres are in the 21-100 year age classes, with most acres in the 21-40 and 81-100 age classes. Because of the limited acres of BSU, balancing the age class distribution for this cover type is not a goal for this cover type.

**Current Acres:** 1,600 acres in the NMOP Section (<1% of state-managed forest acres)

- The majority of BSU acres are in the Agassiz Lowlands

### Future Direction and Goals

- 10-year DFC: 1,600 acres (no change)
- 50-year DFC: 1,600 acres (no change)
- Maintain acres of BSU and increase upland black spruce abundance in other cover types.

### Strategies

- Use small-gap strategies to perpetuate advanced regeneration of BSU, take advantage of seed trees, and reduce aspen competition.

### Special Considerations

- Reduced seed sources and aspen competition challenge our ability to maintain and increase this cover type.

## Jack Pine

The jack pine (JP) cover type is managed primarily as an even-aged cover type for pulpwood and bolts and to support wildlife habitat and biodiversity. Mature JP stands are often nearly pure but can include other conifers, birch, and possibly red maple. Most JP stands occur as woodland NPC classes and are found on dry, sandy upland sites. They can also be located along narrow beach ridges formed by the former glacial Lake Agassiz. Jack pine in the [central and northern floristic regions](#) are adapted to different disturbance regimes. Central floristic region jack pine is adapted to more frequent fire, has a shorter life span, and few serotinous cones.

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

**Current Acres:** 44,600 acres in the NMOP Section (approximately 4% of state-managed forest acres)

- Most acres are in the Agassiz Lowlands

### Future Direction and Goals

- 10-year DFC: 45,300 acres (1.5% increase)
- 50-year DFC: 48,300 acres (8% increase)
- Move toward a more balanced age class structure.
- The desired within-stand composition is relatively pure jack pine in younger growth stages. As stands mature, other species may increase depending on NPC.

### Strategies

- Convert approximately 740 acres (3,700 acres over 50 years total) of A/BG/Bi cover types to the JP cover type in appropriate sites, including FDn12, FDn32, and FDn33.
- Perpetuate and increase black spruce when found in JP stands where opportunities are identified for reserved upland black spruce expansion. Sites classified as FDn32 may be suitable.
- Consider local seed zones and [ECS floristic region](#) in reforestation plans.

### Special Considerations

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

## Red (Norway) Pine – Natural Origin

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

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

Most red pine acres, including natural origin and planted, in the NMOP Section are in the 21-60 age classes, with generally declining acres to 150 years ([Appendix C](#)). In the Agassiz Lowlands, most red pine is in the 21-60 age classes, while in the Littlefork-Vermilion Uplands, most acres are in the 1-10 age class, and total acres generally decline to 140 years. Balancing the age class distribution is not a goal for natural origin red pine.

**Current Acres:** 2,230 acres in the NMOP Section (12% of total red pine acres; planted and natural origin red pine together represent approximately 5% of state-managed forest acres)

- acres are roughly equal between the Agassiz Lowlands and Littlefork-Vermilion Uplands

### Future Direction and Goals

- 10-year DFC: increase – see below
- 50-year DFC: increase – see below
- The desired structure within red pine ranges from predominantly single-canopied, even-aged stands to multi-canopied, mixed-aged stands with red pine, other conifers, and deciduous species as co-dominants.

### Strategies

- Convert approximately 900 acres (4,500 acres over 50 years total) of A/BG/Bi types to a RP cover type.
  - Where possible, take opportunities to mimic the qualities and characteristics of natural origin stands.
- Thinning in natural origin stands should maintain or increase within-stand diversity, retaining red pine as the main cover type, by the following methods:
  - Reserve individual trees or patches of other species appropriate to the site, where possible.
  - Consider creating or maintaining variable densities within stands when thinning.
  - Protect advanced regeneration of desirable understory species, where possible.
  - Higher stand densities (basal area) are recommended along stand edges exposed to wind and along high visual quality corridors, such as major roads and lakes.
  - Consider underplanting shade-tolerant species where seed sources or advanced regeneration for these are lacking. For suggestions on species, refer to the *Field Guide to Native Plant Communities of Minnesota* and [NPC silviculture strategies](#).
- Consider the following recommendations when regenerating red pine:
  - Use natural regeneration in natural origin stands when opportunities arise.

- Evaluate and prepare an adequate seedbed or planting site for red pine regeneration while retaining areas of undisturbed ground layer.
- Maintain or enhance within-stand diversity during site preparation and release treatments considering the desired future condition and NPC.
- Prescribed fire in mature red pine stands can be an effective management tool for eliminating shrub competition, reducing thick duff layers, and preparing seedbeds. Summer fires conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil.
- Evaluate the presence of *Diplodia* tip blight and canker (*Sphaeropsis sapinea*) and shoot blight (*Sirococcus conigens*) in understory pine.
- Consider the potential impacts of bark beetles during intermediate harvest in red pine (see below).

#### Special Considerations

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

## Red (Norway) Pine – Planted

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

Most RP acres, including natural and planted, in the NMOP Section are in the 21-60 age classes, with generally declining acres to 150 years ([Appendix C](#)). In the Agassiz Lowlands, most RP is in the 21-60 age classes, while in the Littlefork-Vermilion Uplands, most acres are in the 1-10 age class, and total acres generally decline to 140 years.

**Current Acres:** 16,900 acres in the NMOP Section (88% of total red pine acres; planted and natural origin red pine together represent approximately 5% of state-managed forest acres)

- Most acres are in the Agassiz Lowland Subsection

### Future Direction and Goals

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

### Strategies

- Convert approximately 900 acres (4,500 acres over 50 years total) of A/BG/Bi cover types to a RP cover type.
  - Where possible, take opportunities to mimic the qualities and characteristics of natural origin stands.
- For final harvests, consider using a regeneration strategy that mimics the creation of a natural origin stand (i.e., with associated species, especially jack and white pine, and structural diversity). Use thinning to reduce stand density to increase future tree growth, quality, and vigor and to obtain the desired composition of the stand. Recommendations are:
  - Conduct normal rotation stand thinnings in merchantable stands at approximately 10-year intervals, depending on site quality.
  - Older stands may have longer intervals between thinnings to compensate for slower growth rates and to facilitate the growth of desirable understory species.
  - Consider incorporating variable density thinning or other techniques to meet biodiversity or habitat objectives.

- Large gaps (~3 acres) may be produced during early thinnings in mixed red pine/jack pine stands to encourage jack pine seeding, thereby ensuring that the species is not eliminated from the stand during later thinnings or due to early mortality.
- To regenerate RP, use clearcut or clearcut with reserves. Use the following considerations:
  - Maintain or enhance within-stand diversity during site preparation and release treatments considering the desired future condition and NPC.
  - Evaluate and prepare an adequate seedbed or planting site for red pine regeneration while retaining areas of undisturbed ground layer.
  - Prescribed surface fire in mature red pine stands can be an effective management tool for eliminating shrub competition, reducing thick duff layers, and preparing mineral seedbeds. Summer fires conducted over several growing seasons are most effective at controlling dense shrub competition and exposing mineral soil. This may be done before harvesting to prepare seedbeds unless charred bark on harvested trees poses a problem ([“Red Pine Handbook”](#)).
  - Consider the risk of *Diplodia* tip blight and canker (*Sphaeropsis sapinea*) and shoot blight (*Sirococcus conigens*) infection on sites where taller infected red pine or jack pine are left on or next to sites being regenerated to red pine.
  - Retain cavity trees or snags as recommended in the MFRC site-level guidelines.
- Reserve biological legacies such as large, healthy, live trees, decadent trees, snags, logs, and other coarse woody debris.
- Continue to monitor the results of Adaptive Forest Management Projects as needed.
- Manage some stands for large-diameter, high-quality products (e.g., the size of poles needed to support the electrical grid has increased to 40’ tall poles that are 14” in diameter).

#### Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
  - *Diplodia* tip blight and canker (*Sphaeropsis sapinea*)
  - Shoot blight (*Sirococcus conigens*)
  - Bark beetles (*Ips* and *Dendroctonus* spp.)
- Red pine is at the edge of its range in the western portion of this planning area. Climate change effects may increase the negative impacts of deer browse, drought, *Diplodia*, and bark beetles.
- Refer to the LUP Comprehensive Conservation Management Plan for management guidance on LUP lands.
- Many RP-dominated FDn communities have elevated conservation status ranks (state critically imperiled, imperiled, and/or vulnerable).

## Stagnant Spruce

Stagnant spruce (Sx) is not considered a commercial cover type; however, some harvests occur for non-timber forest products, such as decorative spruce tops. Tree tops from 1 ½ to 6 feet in length are cut from selected trees, which typically grow new tops from lateral branches over time. Harvest level varies with tree size and quality and industry product specifications. In most stands, selection harvest ranges from 5-10 percent to as high as 20 percent of trees. Harvesting in higher quality stands has occurred periodically on a 10-15-year cycle.

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

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

**Current Acres:** 168,185 acres in the NMOP Section

### Future Direction and Goals

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

### Future Direction and Goals

- Consider the hydrologic effects of management activities within or adjacent to this cover type.
- When managing around stagnant spruce stands, use reserves to maintain corridors for plant and animal species.

### Special Considerations

- Forest inventory analysis (FIA) and cooperative stand assessment (CSA) inventory data disagree on the amount of stagnant spruce on the landscape.
  - Consider assessing the site index on some stagnant stands that may be productive.

## Tamarack

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

The current T age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types ([Appendix C](#)). However, T's age class distribution is more balanced than the age class distributions of other even-aged managed cover types in the NMOP Section. Most T acres are in the 31-50 year age class in the Agassiz Lowlands and in the 91-100 year age class in the Littlefork-Vermilion Uplands.

**Current Acres:** 251,000 acres in the NMOP Section (approximately 16% of state-managed forest acres)

- Most acres (88%) are in the Agassiz Lowlands

### Future Direction and Goals

- 10-year DFC: 251,000 acres (no change)
- 50-year DFC: 251,000 acres (no change)
- Move toward a balanced age class distribution
- Maintain T acres on the landscape and increase upland tamarack

### Strategies

- Harvest, leaving seed trees, in advance of Eastern larch beetle (ELB). Leaving approximately 10 tamarack per acre is recommended for successful seeding.
- Increase tamarack within other cover types and on upland sites as appropriate
- Maintain or increase secondary component species of T stands where possible by:
  - reserving seed trees, reserve islands, clumps of mature trees, or advanced regeneration
  - include other species such as black spruce and cedar when artificial seeding

### Special Considerations

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

## White Cedar

White cedar (WC) is long-lived and is the climax species in most NPCs in which it occurs (primarily WFn53, FPn63). Natural, mature WC stands range from pure to mixed stands. White cedar occurs on a wide range of site conditions.

Balancing WC's age class distribution is not a goal for this cover type. Most WC acres are in the 111-150 age classes, with relatively few acres in the 1-90 age classes ([Appendix C](#)).

**Current Acres:** 99,000 acres in the NMOP Section (approximately 8% of state-managed forest acres)

### Future Direction and Goals

- 10-year DFC: 99,000 acres (no change)
- 50-year DFC: 99,000 acres (no change)
- Increase the abundance of white cedar as a component of other cover types
- Emphasize retaining WC in deer wintering areas.

### Strategies

- Maintain acreage of WC stands used as thermal cover areas by deer.
- Maintain or increase white cedar as a component of other forest cover types.
- Manage stands as multi-age and mixed-species stands.
- Consider increasing the amount of strip and patch cuts in WC stands to increase age class diversity.

### Special Considerations

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

## White Pine

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

The WP age class distribution includes most acres in the 1-20 age classes, relatively even distributions in the 21-60 age classes, and additional acres in the 111-160 age classes ([Appendix C](#)). In the Agassiz Lowlands Subsection, most WP acres are in the 1-20 and 111-140 age classes. In the Littlefork-Vermilion Uplands Subsection, WP acres are more evenly distributed across all age classes. WP stands receive uneven-aged management, so balancing age class distributions is not a goal for this cover type.

**Current Acres:** 1,000 acres in the NMOP Section (<1% of state-managed forest acres)

- Acres are roughly even between the Agassiz Lowlands and Littlefork-Vermillion Uplands Subsections

### Future Direction and Goals

- 10-year DFC: 1,700 acres (52% increase)
- 50-year DFC: 4,500 acres (260% increase)
- Maintain age and species composition within stands.

### Strategies

- Convert approximately 700 acres (3,500 acres over 50 years total) of A/BG/Bi cover types to WP cover type.
  - Assess the suitability of stands that include white pine for capacity to convert to the WP cover type considering NPC.
- Manage white pine stands to maximize the potential for white pine regeneration in the understory.
  - White pine abundance can be encouraged by selective thinning in appropriate stands.
- Increase the amount of white pine occurring as a component in mixed stands as appropriate to NPC.

### Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
  - White pine blister rust
- Deer herbivory is a challenge for white pine recruitment.
- There is no designated future old growth white pine in the Agassiz Lowlands Subsection. While there is no current Department goal for future old growth white pine acres, if good opportunities for future old growth white pine are identified, they may be considered through the normal process of designating future old growth stands.

## White Spruce

White spruce (WS) stands vary from planted monotypic stands of nearly pure white spruce to natural-origin stands that include other canopy tree species. White spruce occurs as mixed stands in the FD, MH, and WF native plant communities and is considered an excellent competitor in FDn43 and MHn44 NPCs. Natural origin white spruce is managed as an uneven-aged cover type, while plantation white spruce is managed as an even-aged cover type.

The current combined age class distribution of natural and plantation white spruce is not balanced. Most WS acres fall within the 21-60 year age classes, with the majority in the 21-40 year classes ([Appendix C](#)). Most acres in the Littlefork-Vermilion Uplands Subsection are in the 31-40-year age class. Working toward balancing the age class distribution of plantation WS is a goal for this cover type; however, this is not a goal for natural-origin WS.

**Current Acres:** 14,100 acres in the NMOP Section (approximately 1% of state-managed forest acres)

- Slightly more acres are in the Agassiz Lowlands than in the Vermillion Uplands Subsection

### Future Direction and Goals

- 10-year DFC: 14,700 acres (4% increase)
- 50-year DFC: 17,100 acres (21% increase)
- Increase species and structural diversity in planted WS stands.
- Move toward balanced age class distribution for planted WS.

### Strategies

- Convert approximately 1,200 acres (6,000 acres over 50 years total) of A/BG/Bi cover types to WS/balsam fir cover types in appropriate sites.
- Manage natural-origin WS as multi-age and mixed-species stands. Recommendations include:
  - Retain some supercanopy trees in patches or clumps at each treatment.
  - Encourage multi-layered understory development
  - Emphasize regenerating white spruce in the understory
  - Use single-tree and group selection harvest methods for stands that are already multi-aged.
  - For even-aged stands, use shelterwood, seed tree with reserves, or group selection harvest methods to move the stand toward becoming multi-aged.
- Manage planted WS as normal rotation stands on an even-aged basis for pulpwood, bolts, and sawtimber products.
- After final harvest, convert plantation WS stands to mixed species, structurally diverse stands using NPC information to select the most appropriate species.
  - Expedite conversion of plantations to mixed conditions on WMA and LUP lands.

### Special Considerations

- Insect and disease concerns - see current management guidelines or consult a Forest Health Specialist:
  - Spruce budworm and yellow-headed spruce sawfly
  - Needlecast diseases and other insects (e.g., spruce weevil, spruce beetle, etc.)

- Thinning damage to the shallow root system of WS
  - Thin only when the ground is frozen and snow is present.
  - Conduct the first thinning before the plantation is 30 years old.
  - Consider forgoing intermediate treatments in lieu of final harvest, as WS may decline as a result of multiple stand entries.

## 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 the NMOP 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:** 388,500 acres in the NMOP Section (approximately 24% of state-managed forest acres)

- 349,100 acres (90%) brushland (UB/LB) cover type
- 39,400 acres (10%) openland (UG/LG) cover type

### Future Direction and Goals

- 10-year DFC: 388,500 brushland and openland acres (no change)
- 50-year DFC: 388,500 brushland and openland acres (no change)
- Maintain species diversity and abundance appropriate to NPC

### Strategies

- Coordinate on open landscape projects designed to enhance open landscape conditions in sharp-tailed grouse habitat:
  - Identify open landscape projects within the NMOP Section using available information and review by field staff.
  - Allow selection of hardwood stands younger than rotation age for even-aged management.
  - Use prescriptions that enhance open landscape habitat conditions (e.g., creating larger blocks of even-aged cover types managed with a clearcut prescription, minimizing leave trees in the interior of harvest blocks, discouraging conifer planting).
  - Consider swapping upland stands over or approaching rotation age and merchantable lowland conifer stands with stands within or adjacent to open landscapes on stand exam lists.
  - Encourage biomass removal on timber sales and promote brushland biomass harvest when feasible.
  - Enhance and maintain open habitat landscapes by increasing patch size and connectivity, especially within two miles of a sharp-tailed grouse lek.
  - Discourage tree planting in open landscape areas.
  - Coordinate across divisions on projects designed to set back or maintain successional stages (e.g., prescribed fire, mechanical winter shearing, or mowing).
- Prescribed fire or mechanical surrogates should be used for management every year, where possible, including burning, shearing, or mowing approximately 200 acres of brushlands per year on LUP lands.

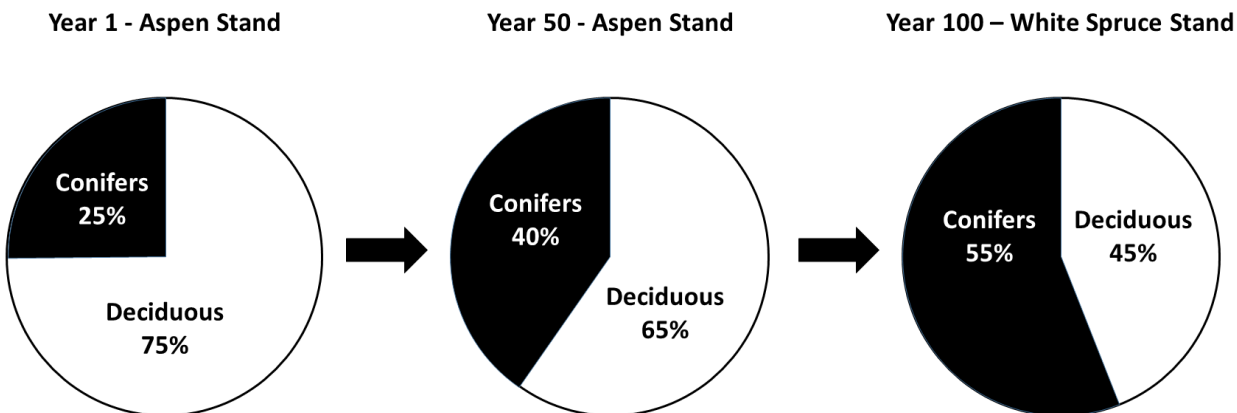
- Encourage communication and coordination within DNR, with private landowners, and with other agencies and organizations to ensure awareness of open landscapes and recommended management.

## 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 NMOP Section, including habitat suitability projections for those species under climate change, refer to the [NPC Silviculture Strategies for forest stand prescriptions](#) webpage.
- Convert cover types where appropriate (Table 3.2a and b; see Fig. 3.1 for example and Cover Type accounts for more detail).
  - Determine sites and species appropriate for conversion during site visits and native plant community evaluations.
  - Increase the acreage of white pine, jack pine, white spruce, and northern hardwoods. These cover types have either declined compared to historical (i.e., pre-European settlement) conditions, or their habitat is projected to expand due to climate change. Options available include:
    - Allow some stands to convert through succession with or without harvest (e.g., aspen to white spruce or balsam fir). The applicability of this option depends on land administration and status, the ability to offer the annual planned volume, and operability and marketability, among other considerations.
    - Artificially convert some stands using a variety of tools such as mechanical site preparation, prescribed burning, planting, or seeding.
    - Selectively harvest some stands to facilitate movement toward the desired cover type and within-stand composition.
    - Target LUP lands in the Roseau River Watershed MOA for increases in conifer coverage through cover type conversion.

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



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

Cover Type	Current Cover Type Acres	Conversion Acres (first plan decade)	Conversion Acres (50-year DFC)	Final Cover type Acres (current + 50-year DFC)
Aspen/balm-of-Gilead/birch	370,500	-4,840	-24,200	346,300
Black Spruce - lowland	293,300	0	0	293,300
Tamarack	251,000	0	0	251,000
White cedar	99,000	0	0	99,000
Ash/lowland hardwoods <sup>6</sup>	55,200	+300	+1,500	56,700
Jack pine	44,600	+740	+3,700	48,300
White spruce/Balsam fir	34,100	+1,200	+6,000	40,100
Red (Norway) pine	19,100	+900	+4,500	23,600
Northern hardwoods	2,300	+1000	+5,000	7,300
Black Spruce - upland	1,600	0	0	1,600
White pine	1,000	+700	+3,500	4,500
Oak	350	0	0	350

**Table 3.2b:** Average annual conversion goals (desired trends in DNR managed lands acres) for aspen/balm-of-Gilead/birch cover types by Forestry Area in the NMOP Section.

Target Cover Type	NPC Target(s)	Forestry Area (RAN)							Total
		111	121	131	221	234	245	261	
Lowland hardwoods	WFn55	4	7	16	1	1	0	1	30
Northern hardwoods	MHn35, MHn44, MHn46	33	20	20	19	5	0	4	101
Jack pine	FDn12, FDn32, FDn33	4	12	37	1	8	0	13	75
Red (Norway) pine	FDn33	12	19	19	3	35	0	2	90
White pine	FDn43, MHn44, MHn46	10	10	10	11	14	2	13	70
White spruce/balsam fir	MHn44, WFn53, WFW54	10	41	41	13	10	0	6	121

Note: 111=Bemidji Forestry Area; 121=Warroad; 131=Baudette; 221=Deer River; 234=Hibbing; 245=Tower; 261=Littlefork

<sup>6</sup> Conversion acres reported for ash/lowland hardwoods apply to the lowland hardwoods cover type only.

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

### GDS-1B Strategies

- Use the *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province* and associated ECS [silvicultural strategies](#) to classify stands to NPC type and subtype and inform silvicultural prescriptions.
- Retain or incorporate components, such as species and structure, characteristic of various NPC growth stages in stands.
- Use the most up-to-date 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 and use the best-available information (e.g., [MN Forest Ecosystem Vulnerability Assessment and Synthesis](#), [Climate Change Field Guide for Northern Minnesota Forests: Site-level considerations and adaptation](#), [NIACS climate change projections for tree species in the NMOP Section](#)).  
[NIACS climate change projections for tree species in the NMOP Section](#))
- Retain biological legacies through the incorporation of MFRC site-level guidelines.

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

### GDS-1C Strategies

- Provide structural diversity characteristics, including:
  - sizes (diameter and height), abundance, and distribution of overstory trees
  - understory vegetation
  - arrangement (scattered or clumped) of vegetation in the stand
  - distribution, size, and decay class of snags and coarse woody debris
- Use selection harvesting to encourage diversity of species, ages, and stand structures.
- Meet or exceed the MFRC site-level guidelines designed to maintain tree species diversity within a stand.
- Retain tree species, stand structure, and ground layer diversity within stands when prescribing release and timber stand improvement rather than managing for one species.
- Take advantage of opportunities to diversify stands when prescribing intermediate treatments.
- Use harvest systems or methods that protect advanced regeneration. Retain conditions that favor regeneration and understory initiation.
  - When it is desirable to protect the existing seedlings and saplings in a stand, timber sale regulations should specify outcomes to protect these regenerating trees. In some cases, portions of the stand may be delineated to protect regeneration by restricting harvest activity in those areas. To enhance seedling recruitment of some species, a partial canopy may be retained to meet the needed moisture and light requirements of the seedlings.

- Identify some stands where succession is allowed to occur to encourage the development of within-stand diversity. Movement to the next successional stage may be achieved with or without harvest.
- Increase or maintain target species, including white pine, white spruce, upland cedar, upland tamarack, upland black spruce, yellow birch, and oak, as components within appropriate cover types. Silvicultural practices that may increase the presence of these target species include planting, inter-planting, artificial or natural seeding, and leave tree selection.
  - Target LUP lands in the Roseau River Watershed MOA for increases in conifer coverage within cover types.
- Manage planted and seeded stands to represent the array of NPCs and variation within NPCs. This may be accomplished by:
  - accepting lower stocking levels of planted species in younger planted stands if other desirable species are present 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 and nuts) for wildlife benefits as well as to encourage natural regeneration.
- Recognize that some plant communities naturally have low species diversity due to site conditions and regular disturbance events. This low species diversity occurred historically in peatlands and in association with large-scale disturbances, such as fire.
- All of the above-listed methods to maintain or enhance species diversity apply to these NPCs, but for a smaller set of species than would be found in 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 planning period (See [the DNR 10-year stand exam list report](#) for more information and Tables 3.3-3.4, Fig. 3.2, and [Appendix D](#) for acre and volume summaries for the 10-year stand exam list in the NMOP Section). Note that the DNR plans to visit more stand acres that contain more volume than necessary, based on model estimates, to ensure that the DNR will offer as much volume annually as planned. Thus, the estimated volume from planned stand exam acres is not equivalent to the volume harvested and removed from the landscape.

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 deferred to later in the planning period or to another planning period.

### GDS-2A Strategies

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

- Emphasize treating stands older than normal rotation age and visiting the oldest stands first.
- Consider SFRMP goals when proposing annual plan additions (APAs) and follow 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 issues, operational considerations, or to adhere to policy) and are not on the stand exam list.
- Consider potential biomass harvest consistent with MFRC guidelines.
  - Biomass could be available as tops and limbs from timber harvests.
  - Non-commercial forest and brushlands may have the potential for biomass harvest.

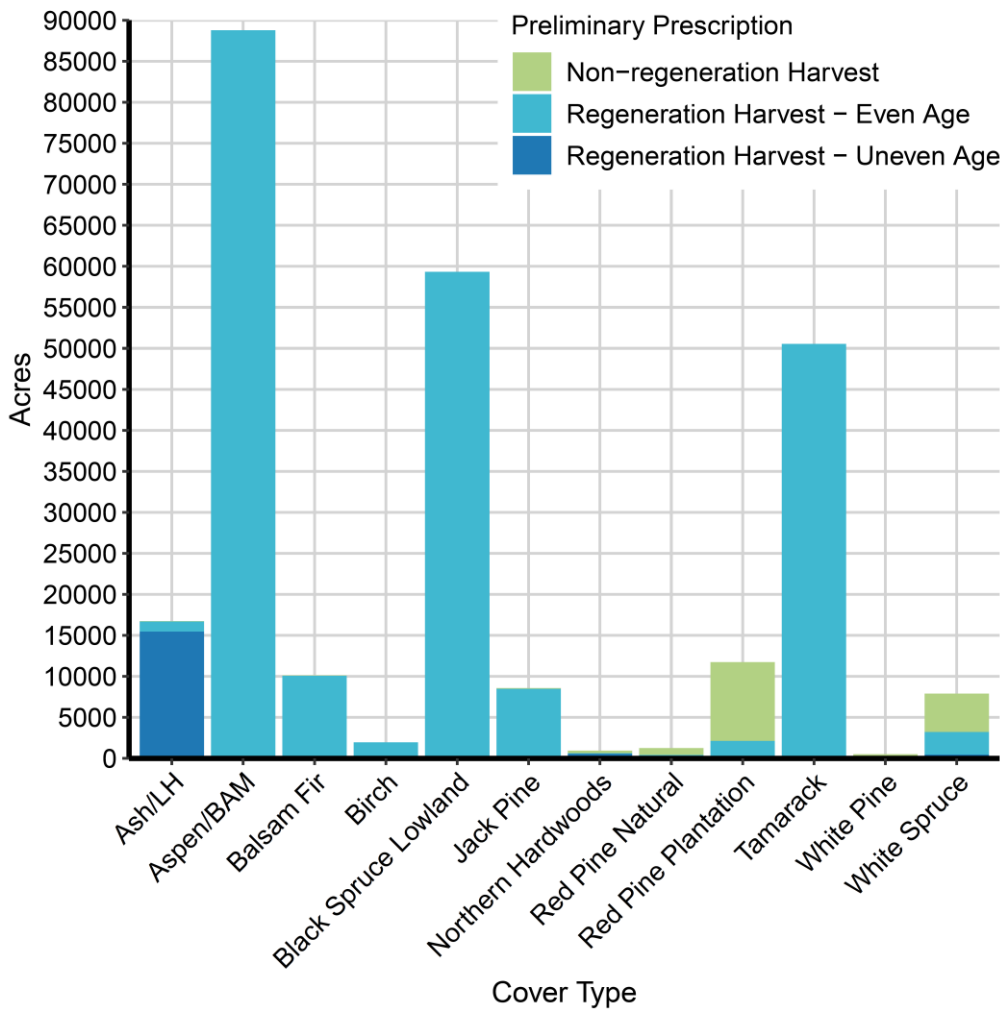
**Table 3.3:** Planned stand exam list acres by cover type and land administrator on the 10-year stand exam list in the NMOP Section (FY 2021-2030). SI = Site Index.

<b>Modeled Cover Type</b>	<b>Forestry Acres Planned</b>	<b>Fish and Wildlife Acres Planned</b>	<b>Total Acres Planned</b>
Ash/Lowland hardwoods	16,228	493	16,720
Aspen/Balm of Gilead SI < 65	30,598	6,688	37,286
Aspen/Balm of Gilead SI > 64	49,664	1,837	51,501
Balsam fir	8,435	1,666	10,101
Birch	1,208	735	1,944
Black spruce lowland SI < 30	15,912	1,634	17,546
Black spruce lowland SI 30-39	29,679	2,175	31,854
Black spruce lowland SI 40+	9,484	425	9,909
Northern hardwood	932	0	932
Oak	48	21	69
Offsite aspen	15	0	15
Jack pine	7,105	1,466	8,571
Red pine natural origin	1,220	28	1,247
Red pine plantation	10,860	879	11,739
White pine	447	65	512
Stagnant black spruce lowland	49	0	49
Stagnant cedar	198	0	198
Tamarack SI < 40	20,680	12,576	33,256
Tamarack SI > 39	13,832	3,439	17,271
Upland black spruce	368	60	428
White cedar	291	0	291
White spruce	7,228	668	7,895
Non-forest (grass or brush)	218	0	218
<b>Total</b>	<b>224,698</b>	<b>34,856</b>	<b>259,553</b>

**Table 3.4:** Model-estimated volume (cords) for acres on the FY 2021-2030 stand exam list by land-administering DNR division and treatment groups in the NMOP 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	2,952,305	413,674	<b>3,365,979</b>
Thinning	144,244	8,591	<b>152,835</b>
Uneven-aged harvest	117,446	3,280	<b>120,726</b>
<b>Total</b>	<b>3,213,994</b>	<b>425,546</b>	<b>3,639,540</b>

**Figure 3.2:** Acres on the 10-year stand exam list by cover types and preliminary prescription in the NMOP Section (for cover types with at least 500 acres planned).



## 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 or informal timber sales 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.
- Supervise and enforce special product permit regulations to ensure resource sustainability.
- Consider managing or using some forest stands for non-timber forest products.
- Consider known locations of important wildlife habitats, rare native plant communities, or rare species before issuing special product permits.
- Maintain non-timber forest products projected to be negatively impacted by climate change.

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

The GDSs and Strategies in this section address Issues: [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. In the NMOP Section, historical drainage ditches continue to impact hydrology, forest productivity, and overall access to forests.

**Natural succession:** As some 20th-century forests have matured beyond the maximum age for early successional tree species, there have been moderate declines in quaking aspen, balm-of-Gilead, and paper birch

cover type acreages and corresponding increases in cover types dominated by mid- and late-successional tree species such as northern hardwoods and long-lived conifers.

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

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

**Climate Change:** The [2014 Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis](#), a report from the Northwoods Climate Change Response Framework project, predicts that over the next 150 years, habitat for many common species will decline. However, habitat for some species is projected to increase. Forests with lower species and structural diversity are predicted to be less resilient to climate change impacts. In addition, fragmented landscapes will provide less opportunity for desired native species to migrate in response to climate change.

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

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

- Designation of [old growth forests](#).
- Incorporating older forest values in the forest management strategic direction and stand exam list development:
  - Older forest across ownerships is accounted for during DNR planning (see below).
  - Model results show that, at the current level of volume offered, older forest will be retained, and for many forest types, will continue to accumulate.
  - Management regimes on Division of Fish and Wildlife- administered lands and in some management opportunity areas are designed to promote more older forest.
  - The strategic direction ensures that at least 2.5% of the aspen cover type on DNR-managed forest lands is 60 years old or older statewide.
- Some forest stands on DNR-administered lands that are not in the management pool (e.g., state parks and SNAs, inoperable stands, most representative sample areas (RSAs), and stagnant conifers) provide additional older forest.
- On average, approximately 30% of acres on DNR annual stand exam lists don’t result in timber sales. A portion of these represent or will become older forests.
- Application of site-level guidelines to riparian management zones.
- Management for High Conservation Values.
- Conversions from shorter to longer-lived species (e.g., aspen to pine).

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

1. The SFRMP original desired age class distribution is applied as a benchmark across all ownerships (Table 3.5).
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.

Through this SFRMP process, the team assessed FIA data at the section scale and found that the current percentage of older forest over rotation age meets the SFRMP benchmark (Table 3.5). When FIA data were uncertain, DNR forest inventory data were used as a proxy.

**Table 3.5:** Benchmark compared to current old forest percentage by cover type across all ownerships in NMOP, based on FIA age class data. Benchmarks are from the 2000 Agassiz Lowlands SFRMP and 2008 Littlefork-Vermillion Uplands SFRMPs. Whether benchmarks are met was determined by comparing the average proportion of estimated acres over MN DNR rotation age using FIA estimates from Evalidator (FIA plot data from 2014 through 2018) with 95% confidence intervals.

Cover Type	Agassiz Lowlands (AL) % Older Forest Benchmark	Littlefork-Vermillion Uplands (LVU) % Older Forest Benchmark	Benchmarks met across section (average % over rotation age, 95% confidence interval)?
Aspen	13	11.5	Meet (24%; 19-29%)
Birch	(included with Aspen for AL)	12	Meet (43%; 23-63%)
Black spruce	14	13 (average across all site index benchmarks)	Meet (10%; 5-14%)
Jack pine	10	12	Meet (12%; 0-27%)
Tamarack	15	15	Meet (19%; 12-26%)
White spruce	10	10	Meet (25%, 0-51%)

### GDS-3A Strategies

- Communicate any discrepancies between old forest benchmarks and current old forest across ownerships that are found during monitoring or plan preparation work to managers with recommendations on how to address them.
- Allow some stands, especially those with old forest characteristics, to succeed to long-lived cover types or under-represented NPC growth stages (e.g., FdN32c, d).
- Manage designated old-growth stands (Table 3.6) and SMZs according to DNR policy and OFMCs according to old growth policy and MOA guidance documents ([Appendix E](#)).
- Use silvicultural treatments that retain old forest components in some stands, such as OFMCs, FAW-administered lands, LUP lands, riparian areas, relevant MOAs, and natural origin red pine stands.
  - When making decisions to add and offer unplanned wood for harvest, consider the habitat values of old forest in the area.
- Use silvicultural prescriptions or reserves to create corridors that connect older stands.
- Target long-lived tree species to leave as legacies.

**Table 3.6:** Old growth forest acres within NMOP by cover type. In addition, candidate lowland conifer old growth acres are pending designation in the NMOP Section as of the writing of this plan.

Old growth type	Candidate	Designated	Future Old Growth	Grand Total
Ash	454	1,176		1,630
Upland cedar	12	1,141		1,153
Lowland hardwoods	312	1,321		1,633
Northern hardwoods	57	16		73
Oak		67		67
Red pine	29	567	101	697
White pine		369		369
White spruce		211		211
<b>Grand Total</b>	864	4,867	101	5,833

**GDS-3B: Maintain or enhance vegetation conditions associated with known occurrences of species in greatest conservation need.**

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](#) at the DNR website.

**GDS-3B Strategies**

- Apply SGCN data and Wildlife Action Plan guidance in vegetation management.
- Incorporate new SGCN locations and data into coordination and management as they are collected.
- Manage some MOAs consistent with their association with SGCN.
  - MOAs identified in this plan address specific SGCN (either directly or indirectly), including American woodcock, spruce grouse, black-backed woodpecker, olive-sided flycatcher, boreal chickadee, golden-winged warbler, and Connecticut warbler.
- Maintain or enhance SGCN habitat using our interdisciplinary forest management processes.
  - Consider managing some lowland conifers on WMAs and LUP lands for the benefit of spruce grouse, boreal chickadees, Connecticut warblers, and black-backed and three-toed woodpeckers.
- Consider climate change adaptation strategies in the [Wildlife Action Plan](#).

**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.**

Providing a diverse distribution of patch sizes and ages for wildlife and other values has long been an SFRMP goal. Patches are made up of one or more adjoining stands that are relatively homogenous in structure, primarily in height and density, and are similar in vegetation cover and age. Patches may be formally recognized as patch management opportunity areas (MOAs), but patches of forest vegetation can also be created,

maintained, or enhanced outside of MOAs through stand exam list development and decisions made during stand management.

In this plan, patches:

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

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

In addition, five patch MOAs were adopted through this planning process, including four old lowland conifer patches and one intermediate-aged upland deciduous patch. The list of all MOAs, including patch MOAs, and links to their guidance documents is in [Appendix E](#).

#### GDS-3C Strategies

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

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

Minnesota Biological Survey (MBS) sites of biodiversity significance may contain intact native plant communities and populations and concentrations of rare species, critical animal habitat, and functional landscapes (Table 3.7).

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 or 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](#).

**Table 3.7:** Sites of biodiversity significance acres in the NMOP Section summarized by ranking as of June 2020.

Rank	Number of Sites	Total Acres	Total state stand acres	Total state-managed acres
<b>Sites of Biodiversity Significance</b>				
Outstanding	8	75,357	56,677	42,453
High	10	94,061	81,585	74,828
Moderate	57	137,764	122,255	119,764
Below	54	29,862	8,270	7,829
<b>Preliminary Sites of Biodiversity Significance</b>				
Outstanding	22	604,577	-	-
High	90	901,848	36,994	12,647
Moderate	116	949,999	150,273	19,736
Below	25	59,146	4,156	0

### GDS-3D Strategies

Forest management activities such as timber harvesting, site preparation, access route construction and maintenance, and tree planting will occur on Forestry- and 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. SFRMP strategies to help minimize the loss of the factors on which the MBS sites of biodiversity significance were ranked, include:

- Work within interdisciplinary teams to clarify which MBS sites are of greatest concern or importance during management planning.
- Consider the broader context and significance of the MBS site as a whole when assigning management objectives and designing silvicultural prescriptions. For example:
  - Emulate the within-stand composition, structure, and function of NPC growth stages when managing stands in MBS sites.
  - Apply variable density thinning or variable retention during harvest or reforestation where appropriate.
  - Increase the use of prescribed fire as a silvicultural technique in managing fire-dependent NPCs.
  - Locate roads and trails to minimize fragmentation of high and outstanding MBS sites and Watershed Protection Areas of Peatland SNAs.
- 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) identifies plants and animals at risk of disappearing from Minnesota. Special regulations apply to endangered and threatened species. Species listed as special concern are not statutorily protected but are considered in management decisions. Up-to-date information on the state ETS list can be found on the DNR's [ETS website](#). Vegetation management decisions will comply with federal laws, including the Endangered Species Act, state laws, and department listed species directions.

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 access to the Natural Heritage Information System (NHIS).
- Incorporate new rare features inventory information as it becomes available.
- Consult the rare features database (NHIS) prior to all management activities (i.e., appraisal, harvesting, and stand development work).
- Follow Department rare species guidelines as they become available.
- Implement rare species guidance from the *Rare Species Guide* or DNR specialists to the extent possible when planning management activities.
- Protect rare features during management activities.
- Where possible, incorporate management options to mitigate the effects of climate change on ETS species, using resources such as the [NIACS Adaptation Menu for Terrestrial Wildlife Management](#).

### **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 – rare or uncommon
- S4 – widespread, abundant, and apparently secure, but with cause for long-term concern
- S5 – demonstrably widespread, abundant, and secure

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

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

#### GDS-3F Strategies

- Maintain or enhance the characteristics that contribute to a C or greater condition rank for S1 through S3 NPCs.
- Apply special management to stands identified as the highest quality examples of rare NPCs (rank B or above, depending on NPC).
  - Coordination between Divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources staff will determine treatments needed to protect, maintain, or enhance the ecological integrity of rare NPCs.
  - Consider swapping stands when possible to protect, maintain, or enhance high-quality examples of rare NPCs.
- 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 or develop characteristics of under-represented growth stages.
- Consider the contribution of inoperable stands and reserved areas (e.g., old growth, SNAs, state parks) in providing representations of growth stages when developing prescriptions.

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

The 0-30 year age group of aspen, balm-of-Gilead, birch, and jack pine cover types represents young, early successional forest in this plan. The goal of balancing age class distributions in even-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 NMOP Section through the implementation of the strategic direction and the 10-year stand exam list. Management opportunity areas that are a part of this plan provide further direction for the management of some young, early successional forest for

wildlife species (e.g., ruffed grouse management areas). Management opportunity areas are summarized, with links for their management guidance documents, in [Appendix E](#).

### 3.4 Wildlife Habitat

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

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

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

- **Some species associated with older forest** are provided for in statutory preserves, old growth stands and old forest complexes, inoperable or unmerchantable stands, management regimes that allow older rotation ages and greater reserve amounts on Fish 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.
- **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, as well as department policies and guidelines.

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

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

The strategies below provide additional, specific guidance related to wildlife habitat in the NMOP Section.

Through this planning process, management opportunity areas (MOAs) focused on providing wildlife habitat at sub-landscape spatial scales were adopted. These include ruffed grouse management areas, deer management

areas (aimed at providing winter habitat), the Littlefork-Vermillion Priority Open Landscapes Area, and the Northern Forest Owl MOA. Summary information for all MOAs and links to their guidance documents are in [Appendix E](#).

#### GDS-4 Strategies

- Manage to retain the integrity of riparian areas and protect wetlands.
- Provide for 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 the DNR’s Wildlife Management Leave Tree and Snag Guidelines.
- Apply management recommendations for wildlife species’ habitats in DNR guidelines and policies.
- Consult WMA plan guidance on WMA lands and LUP Comprehensive Conservation Management Plan guidance on leased federal lands in the Beltrami Island State Forest.
- Provide for the needs of species associated with conifer stands and mixed conifer/hardwood stands. Opportunities include:
  - Selection harvesting and reducing basal area on some red pine stands on WMAs and LUP land
  - Increasing acres of long-lived conifer cover types through active management or allowing some stands to naturally succeed to conifer types
  - Increasing mixed forest conditions in some stands through selection harvesting
- Provide site-specific benefits for game and nongame species through Management Opportunity Areas.
- Manage the Littlefork-Vermillion Priority Open Landscape Area and other relevant areas within open landscape cover types (see [Open Landscape cover type](#)) for the benefit of 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 a portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs.

The DNR meets or exceeds MFRC site-level guidelines to protect riparian and aquatic areas during forest resource management, depending on land status. Management of riparian areas on LUP lands exceeds MFRC guidelines as stipulated under an agreement with the U.S. Fish and Wildlife Service that allows LUP lands to be included under forest certification. Monitoring is conducted to check the implementation of these applications.

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

### GDS-5A Strategies

- Retain a relatively continuous forest cover for the protection and maintenance of aquatic habitat types, aesthetics, recreation, and forest products.
- Manage to maintain or increase old forest characteristics in riparian areas.
- Emphasize conifers to maintain shade, where appropriate, and discourage species beavers prefer, such as aspen and birch, in the RMZ of designated trout streams.
- Increase conifer cover and stand age on LUP lands in the Roseau River and Warroad River watershed.
- 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, rivers, or permanent open-water ponds.

### GDS-5B Strategies

- Meet or exceed MFRC site-level guidelines to emphasize the protection of water quality and wetland health.
  - Verify that landing locations are appropriate (e.g., avoid wetlands) based on the cover type.
- Check the application of wetlands and seasonal pond guidelines as a part of stand exam review, timber sales supervision, and inspections.
- Maintain canopy cover around seasonal ponds.
- Favor reserves in locations around wetland habitats to maintain ecosystem functions.

## **3.6 Timber Productivity**

The GDS and Strategies in this section address Issues: [B1](#), [B4](#), [H1](#)

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

### GDS-6 Strategies

- Move toward harvesting stands in even-aged managed cover types at their rotation ages ([Appendix E](#)).
- Use site preparation, inter-planting, release from competition (e.g., herbicide application or mechanical or hand release), and tree protection.

- Consider alternative approaches to minimize the use of pesticides (herbicides, insecticides, etc.).
  - Consider mechanical site prep (i.e., roller chopping) and release (i.e., brush saw) to control competition where feasible.
  - Follow operational standards to control competing vegetation or forest insects and diseases on state lands.
- Apply selection harvest treatments and thinning to increase tree quality and forest health.
- Continue to improve, implement, supervise, and enforce current DNR timber sale regulations to protect and minimize damage to sites or residual trees from treatment activities.
- Manage certain stands for large-diameter, high-quality products by retaining adequate stocking and basal area.

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

The GDSs and Strategies in this section address Issues: [B1](#), [H1](#), [I1](#), [I2](#)

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

Forest management will not attempt to eliminate native insects and diseases or their processes from the landscape but rather 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 and document their occurrence on state-managed lands.
- Involve private landowners and local units of government in gathering and disseminating information.
- Consider the least intensive site preparation, release, and timber stand improvement methods possible to ensure success.
- Apply recommended strategies from DNR forest health specialists as appropriate.
- Provide information and training to operators and contractors regarding techniques that minimize damage to retained trees (e.g., leave trees or crop trees) and minimize the spread of invasive insects, diseases, and plants.
- Consider implementing prescribed burning to improve stand health as a tool to prevent or control the effects of insect and disease outbreaks.

## **GDS-7B: Reduce adverse impacts of wildlife on forest vegetation on state forest lands.**

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

### GDS-7B Strategies

- Consider the potential for wildlife impacts on planted or naturally regenerating trees before damage occurs.
  - Work with area wildlife staff to identify sites where significant damage may occur before forest management activities occur. Where necessary, incorporate plans for post-sale damage mitigation into forest regeneration and development plans.
- Favor conifer species in riparian areas to discourage beaver activity.
- Use mitigation techniques on sites where damage from wildlife is anticipated.
  - Seed or plant more heavily to account for expected mortality.
  - Seed or plant a mix of species rather than a single species.
  - Plant less palatable species along site edges and susceptible species away from surrounding vegetation types preferred by herbivores.
  - Use protective measures such as fenced enclosures, bud capping, repellents, tree shelters, etc.

## **3.8 Climate Change**

The GDS and Strategies in this section address Issues: [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](#), including information on species affinity for warmer or drier site conditions, and [NIACS climate change projections for tree species in the NMOP Section](#).

- Maintain refugia for species that cannot migrate.
- Maintain connectivity of islands of habitat that allows the migration of plants and animals.
- Enhance genetic diversity in planting and seeding. Evaluate site conditions with respect to climate change when selecting tree species for regeneration or conversion.
- Maintain or increase conifers adjacent to coldwater streams to provide a cooling effect in warm weather and retain snowpack longer, slowing discharge in the spring.

## 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.
  - Consider species, wind-firmness, and retention style (i.e., clumped) to maintain long-lasting visual quality along identified high-visual-quality roadways.

## 3.10 Access to State Land

The GDS and Strategies in this section address Issues: [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.
  - Control access to limit conflicts with recreation.
  - Eliminate unnecessary access routes.
  - Minimize forest land area lost to road development.

- Cooperate with other landowners to retain existing access to state land and coordinate new road access.
- Close access routes at the conclusion of management activities when appropriate.
  - Road closure is required for any new access created for management on LUP lands following the completion of management activities.
- Evaluate if 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.**

Cultural resources are objects or areas that have spiritual, traditional, scientific, or educational value. Examples of cultural resources that may interact with forest management include archaeological sites, cemeteries, historic structures, and traditional harvest locations. 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.

The LUP Cultural Resource Plan guides the handling of cultural resources on LUP lands. Hard copies of the plan are available at Red Lake WMA and Baudette Wildlife offices.

#### GDS-11 Strategies

- Continue annual stand exam list review by DNR archeologists. Implement recommendations for mitigation as part of sale design.
- Follow the LUP Cultural Resource Plan on LUP lands for all other activities, including timber access and habitat management.

### 3.12 Natural Disturbance Events

The GDS and Strategies in this section address Issues: [I1](#), [I2](#), [I3](#)

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

By promptly evaluating known disturbance events (e.g., fire, wind, or insects and disease) on DNR-administered lands, DNR land managers will be able to quickly assess what, if any, forest management activities are necessary to mitigate the impacts of the event. Where quick action is needed to salvage harvest timber from damaged

stands, the DNR will use the annual plan addition process, including interdisciplinary coordination and public notice.

#### GDS-12 Strategies

- The Department will evaluate large-scale (hundreds to thousands of acres) disturbance events that affect DNR-administered lands to determine appropriate action.
  - Assess the extent and significance of the event on DNR forest lands in the NMOP Section.
  - Recommend forest management actions.
  - Analyze effects on how disturbances might interact with how much volume is offered to advance desired future conditions.
  - When possible, cooperate with other agencies and landowners to assess and implement management actions in response to disturbances.
  - Communications protocol:
    - Initial notification and call to action: The responsible DNR land manager calls a meeting of DNR decision-makers of all affected divisions within the first few days after the initial assessment.
    - Follow-up and evaluation: complete a multi-discipline after action review at the request of the regional manager.
  - Region 1 FRIT developed a response process flowchart for large natural disturbances on state land that can serve as a reference.
- 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.

### 3.13 Management Opportunity Areas

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

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

The preliminary MOAs included in stand exam list modeling in the NMOP Section were vetted 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 management guidance documents were adopted in the NMOP Section.

Management within adopted MOAs will be designed to meet the MOA's intent and strategies as described in the guidance documents to the extent possible while balancing other forest resource goals and adhering to DNR policies. However, it is important to remember that not all MOA objectives are achievable on every stand within a MOA. Rather, 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. Therefore, there is flexibility in how MOAs are implemented. This is necessary because 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.

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 NMOP](#) is available on the [DNR's NMOP SFRMP webpage](#). Individual MOA guidance documents can be downloaded from the links in the tables for each MOA type in [Appendix E](#).

## Appendix A: DNR Forest Inventory Managed Acres Query

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This appendix describes how the DNR's forest inventory data apply to this plan, including the acres that are considered "managed acres," which this SFRMP document applies to, and the acres that are considered timberland acres, which apply to the stand exam list development process (for more information, see the [10-year stand exam list report](#) on the [DNR forest planning webpage](#)).

**Total DNR Administration with inventory data (in Forest Inventory Module) in the NMOP Section = 2.3 million acres**

Source: DNR forest inventory (FIM) April 2017

- **Total managed acres = 2.2 million acres**

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

- **Total timberland forested cover types assigned managed acres = 1.2 million acres**

*Excludes non-forest (lowland brush, marsh, lowland grass, muskeg, upland grass, water, flooded, others) and forested stagnant and offsite cover types (stagnant spruce, tamarack, cedar and offsite aspen and oak). Non-forest cover types assigned managed acres = 1.4 million acres, stagnant and off-site forest cover types assigned managed acres = 0.7 million acres.*

*Forest cover type query: "MN\_CTYPE" <> 0 AND "MN\_CTYPE" < 75 OR "MN\_CTYPE" = 81*

*Non-forest FIM query: "MN\_CTYPE" = 0 OR "MN\_CTYPE" > 81*

*Stagnant and offsite cover types FIM query: "MN\_CTYPE" >= 75 AND "MN\_CTYPE" <= 79*

## Appendix B: Summary of Issues and General Direction Statements

**Table B.1:** General direction statements (GDSs) that address each issue. 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.

Issue	GDS																									
	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						X	
I3																									X	
J1	X	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, Growth Stages, and Native Plant Communities

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

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

[B3. Maintaining or enhancing imperiled and highly imperiled native plant communities in the Section.](#)

[B4. Retaining characteristics of natural stand-replacement disturbance events while applying intensive management of forest communities.](#)

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

[B6. Reducing forest fragmentation to maintain connectivity among habitat types.](#)

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

[C1. Contributing to sustainable forest management that meets the Department direction 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](#)

[C2. Managing non-timber forest products.](#)

### D. Biological Diversity

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

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

### E. Rare Features

[E1. Protecting rare plants and animals \(including species in greatest conservation need\), their habitats, and other rare features in the Section.](#)

**F. Wildlife**

[F1. Addressing the needs of game and nongame species through vegetation management.](#)

**G. Watersheds including Riparian and Aquatic Areas**

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

[G2. Addressing cumulative impacts to aquatic resources of vegetation management on a watershed or sub-watershed level.](#)

**H. Timber Productivity**

[H1. Maintaining or increasing timber productivity on state lands.](#)

**I. Disturbance Impacts on Forest Ecosystems**

[I1. Addressing disturbances, such as harmful forest insects, disease, and herbivory, on forest ecosystems.](#)

[I2. Addressing non-native invasive species threats and invasions.](#)

[I3. Considering catastrophic natural disturbances in vegetation management decisions.](#)

**J. Climate Change**

[J1. Managing vegetation to prepare for and respond to the effects of climate change.](#)

**K. Visual Quality**

[K1. Minimizing the effects of vegetation management activities on visual quality.](#)

**L. Access to State Land**

[L1. Providing access to stands identified for management.](#)

**M. Cultural Resources**

[M1. Protecting cultural resources during vegetation management activities on state-administered lands.](#)

**N. Balancing Vegetation Management Needs with Legal Requirements**

[N1. Including various state and federal legal requirements in the SFRMP planning process.](#)

# Summary of General Direction Statements

## 1. Forest Composition and Within-stand Diversity

[GDS 1A: Maintain diversity of cover types.](#)

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

[GDS-1C: Maintain or increase the diversity of species, ages, and structure within stands.](#)

## 2. Harvest Levels

[GDS-2A: Provide a sustainable supply of timber.](#)

[GDS-2B: Manage availability of non-timber forest products.](#)

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

[GDS-3A: Ensure older forest stands and older forest characteristics within stands are distributed across the landscape.](#)

[GDS-3B: Maintain or enhance vegetation conditions associated with known occurrences of species in greatest conservation need.](#)

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

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

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

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

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

[GDS-3H: Ensure young, early successional forest is distributed across the landscape over time.](#)

## 4. Wildlife Habitat

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

## 5. Riparian and Aquatic Areas

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

[GDS-5B: Protect wetlands and seasonal ponds during forest management.](#)

## **6. Timber Productivity**

[GDS-6: Increase timber productivity and quality on state timberlands.](#)

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

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

[GDS-7B: Reduce adverse impacts of wildlife on forest vegetation on state forest lands.](#)

## **8. Climate Change**

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

## **9. Visual Quality**

[GDS-9: Minimize forest management impacts on visual quality in sensitive areas.](#)

## **10. Access to State Land**

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

## **11. Cultural Resources**

[GDS-11: Protect cultural resources on state-administered lands.](#)

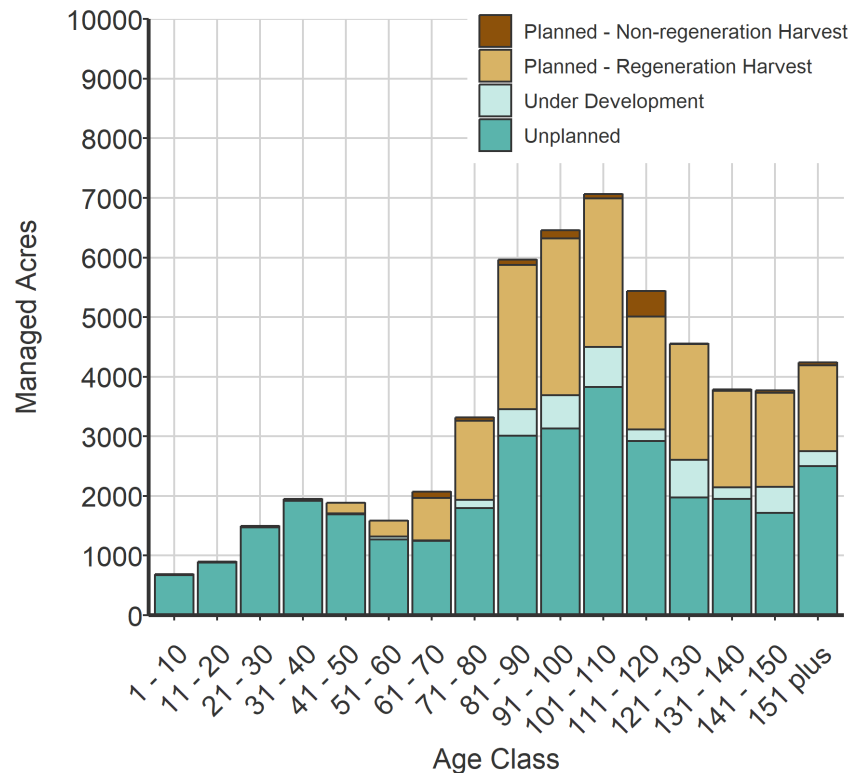
## **12. Natural Disturbance Events**

[GDS-12: Promptly evaluate and determine appropriate response to natural disturbance events on state land.](#)

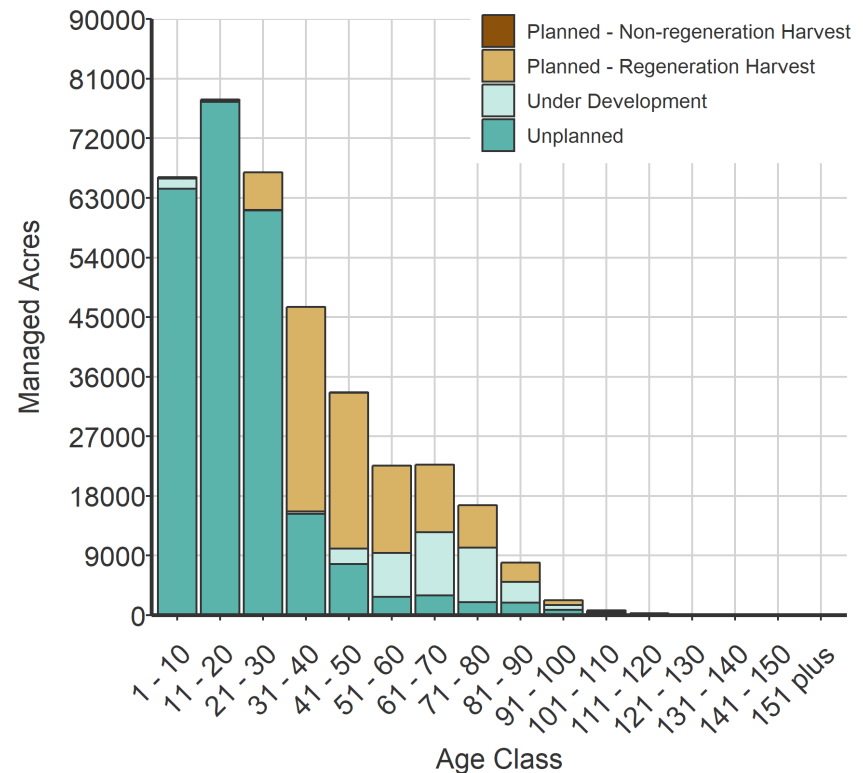
## Appendix C: Cover Type Age Class Distributions

The charts in this appendix show the current age class distributions of managed acres as of 2019 for cover types listed in this plan in the Northern Minnesota and Ontario Peatlands. Acres under development (that are in the process of some management action) at the time of plan writing are indicated in each chart, as are stand exam acres that are planned to be visited through 2030. Acres planned on the 10-year stand exam list are further broken out by generic preliminary prescriptions of Non-regeneration Harvest (e.g., thinning) or Regeneration Harvest (e.g., primarily clearcut with reserves for even-aged managed cover types and selection harvest for uneven-aged managed cover types). Decisions on whether or how to manage stands are made after stand exams. “Planned” acres in the charts below will not necessarily be harvested or treated according to their preliminary prescription.

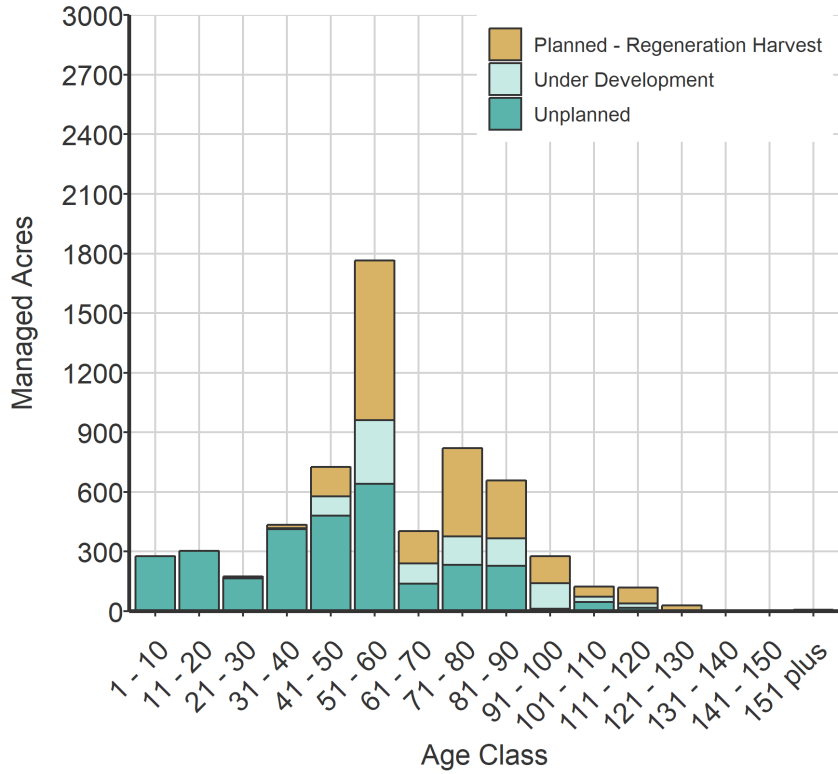
### Ash/Lowland Hardwoods



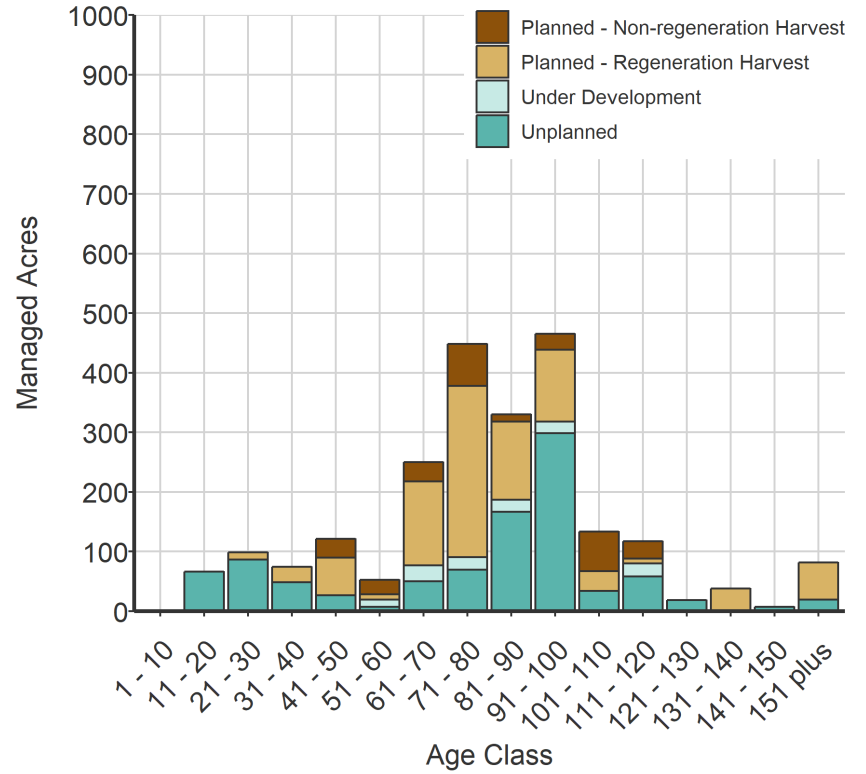
### Aspen



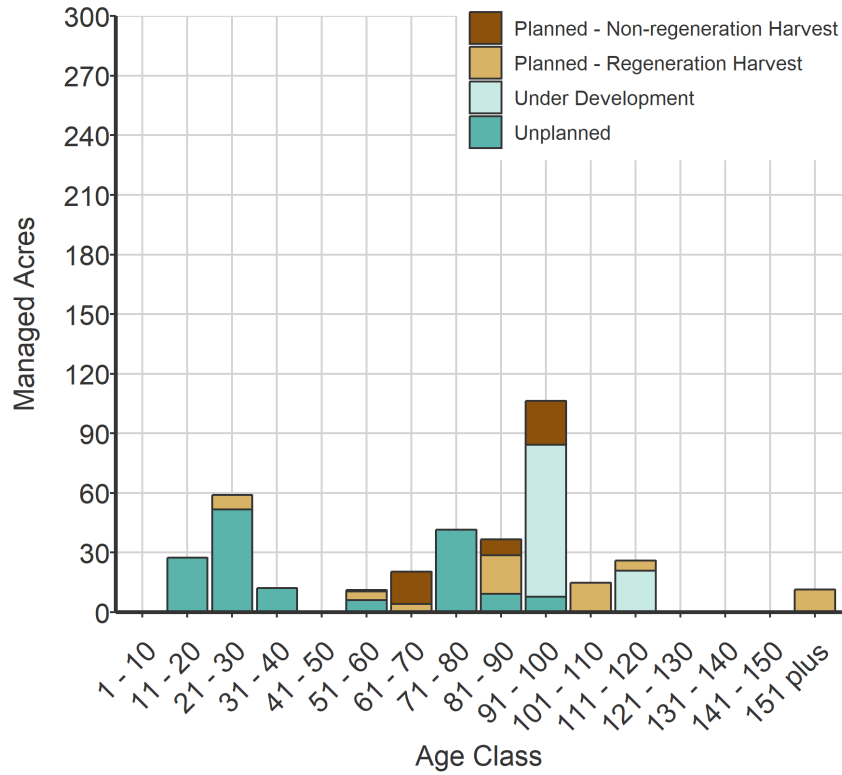
### Birch



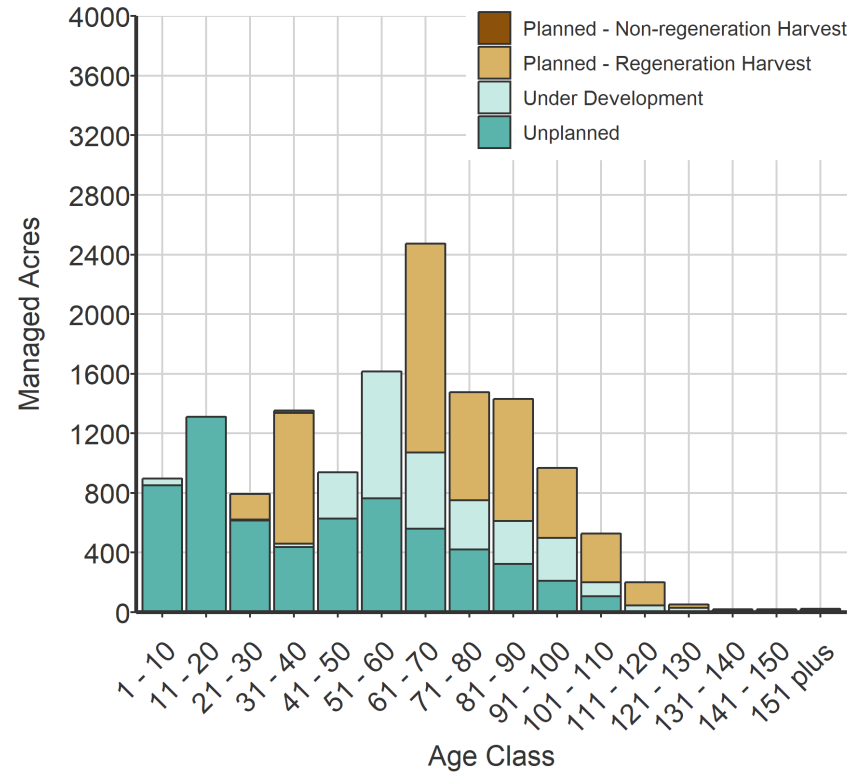
### Northern Hardwoods



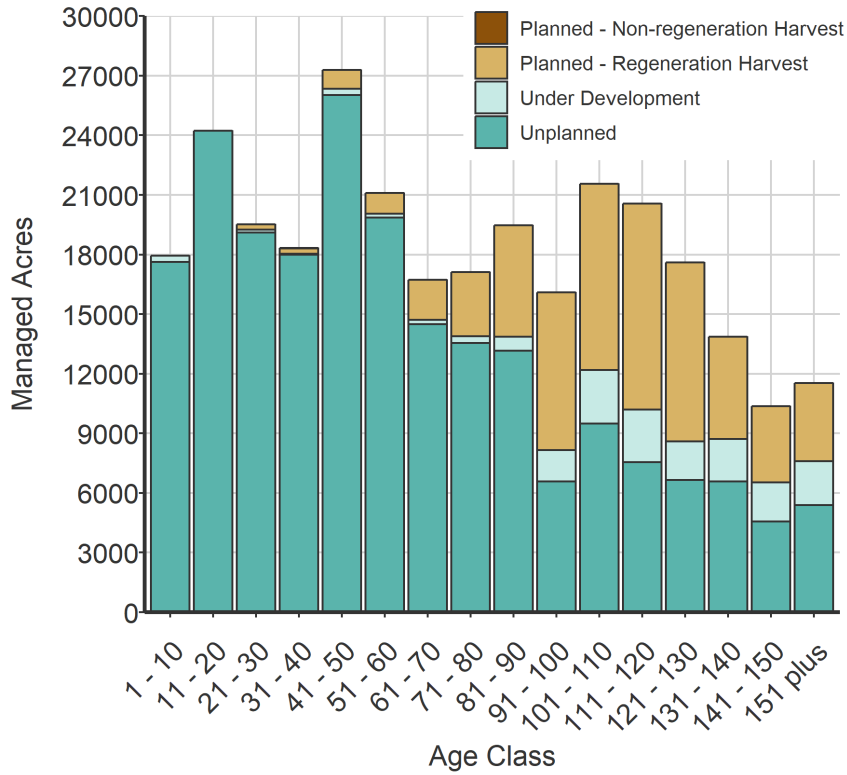
## Oak



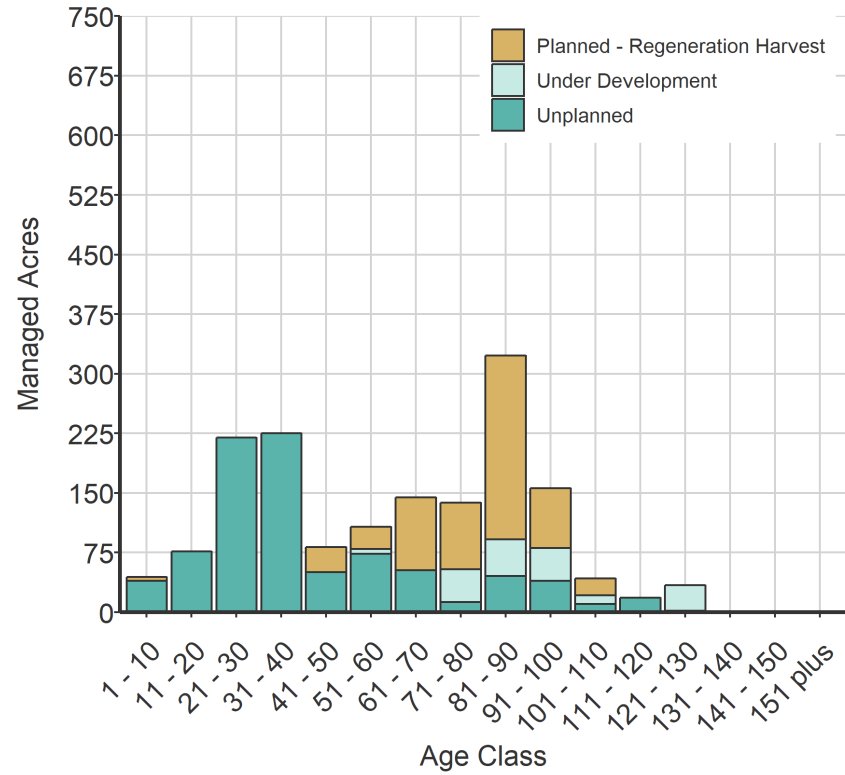
## Balsam Fir



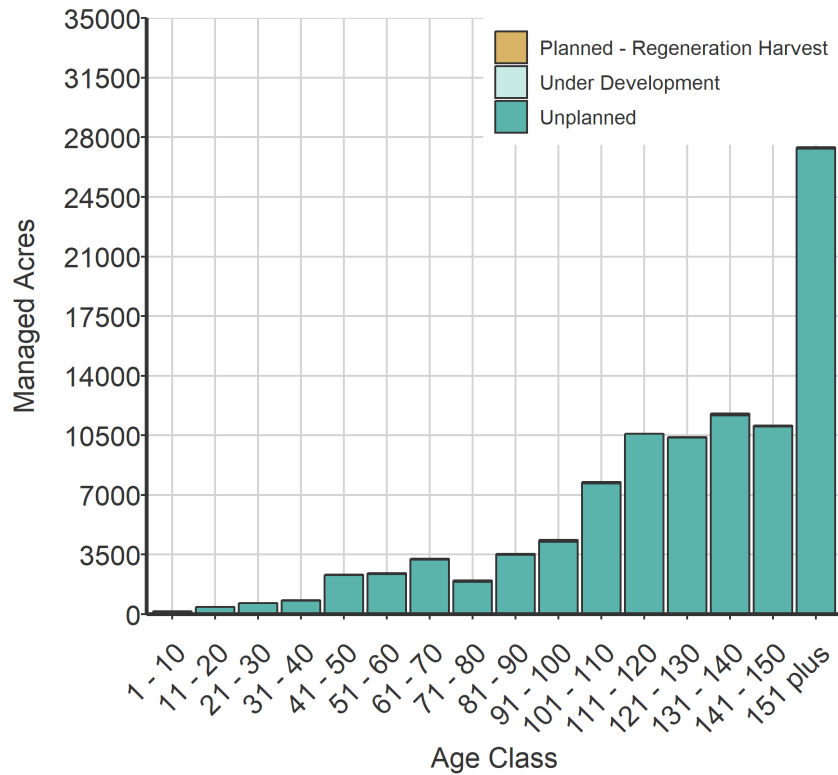
### Black Spruce Lowland



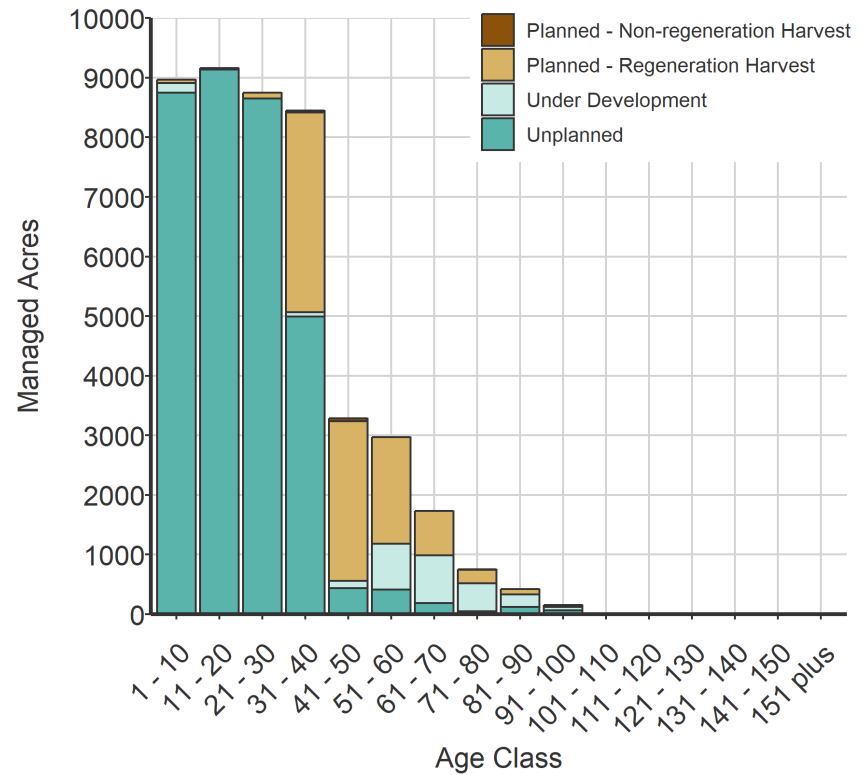
### Black Spruce Upland



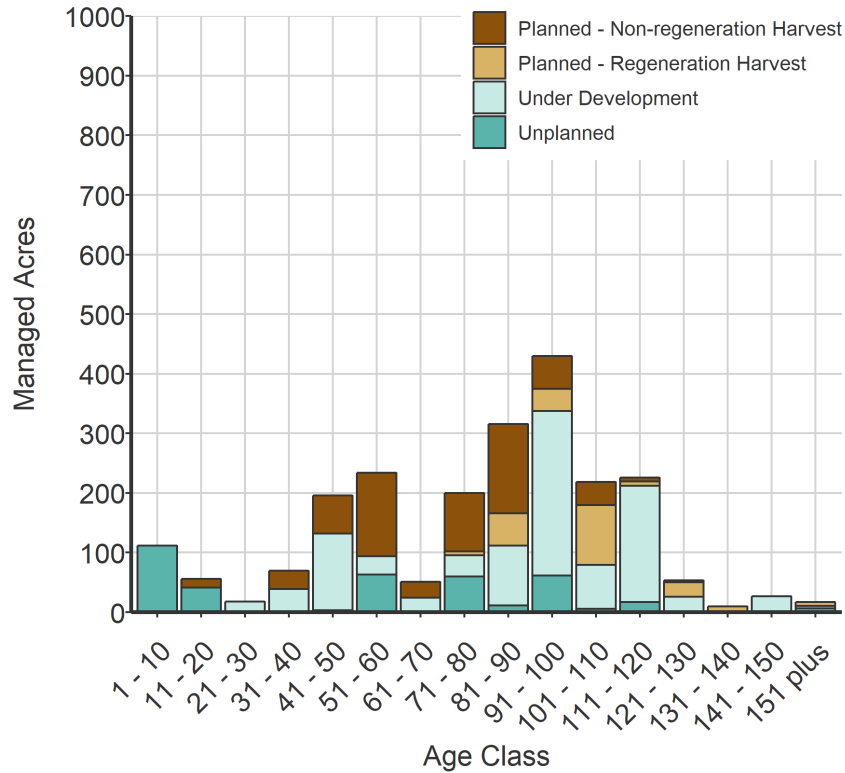
## White Cedar



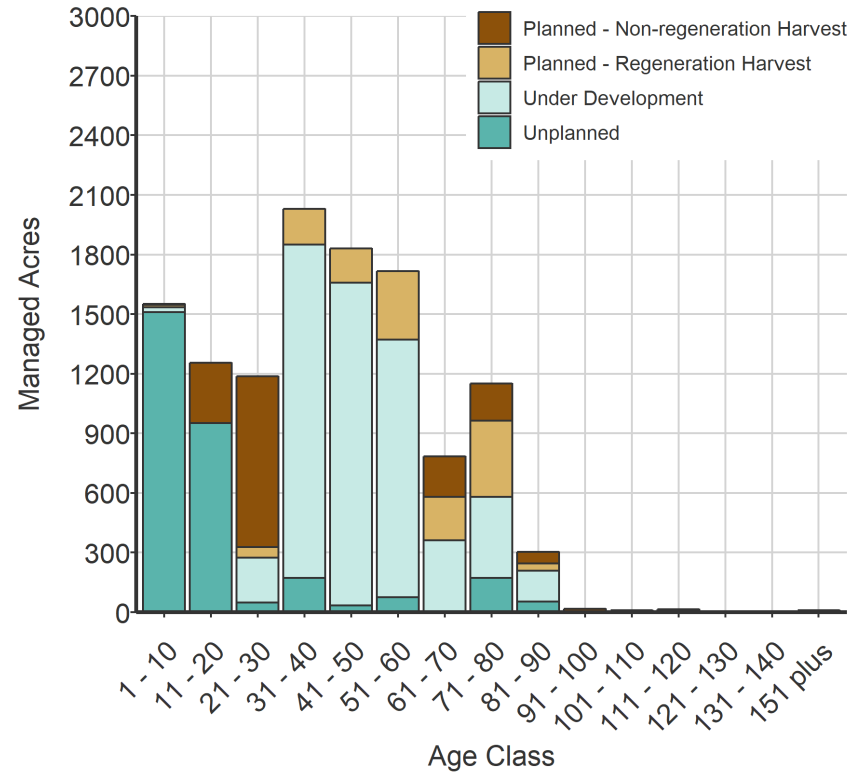
## Jack Pine



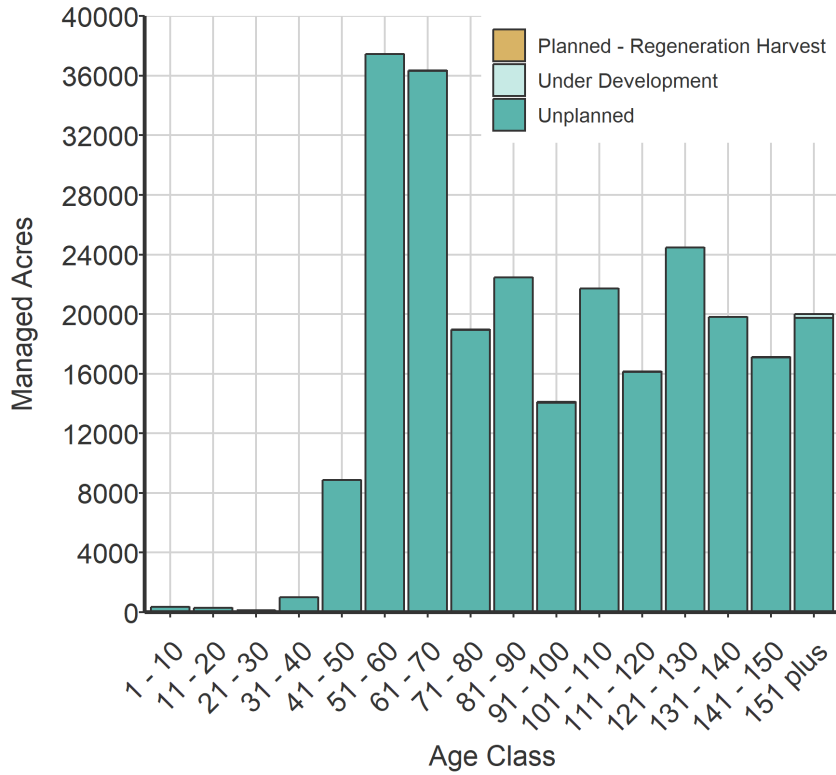
### Red Pine Natural Origin



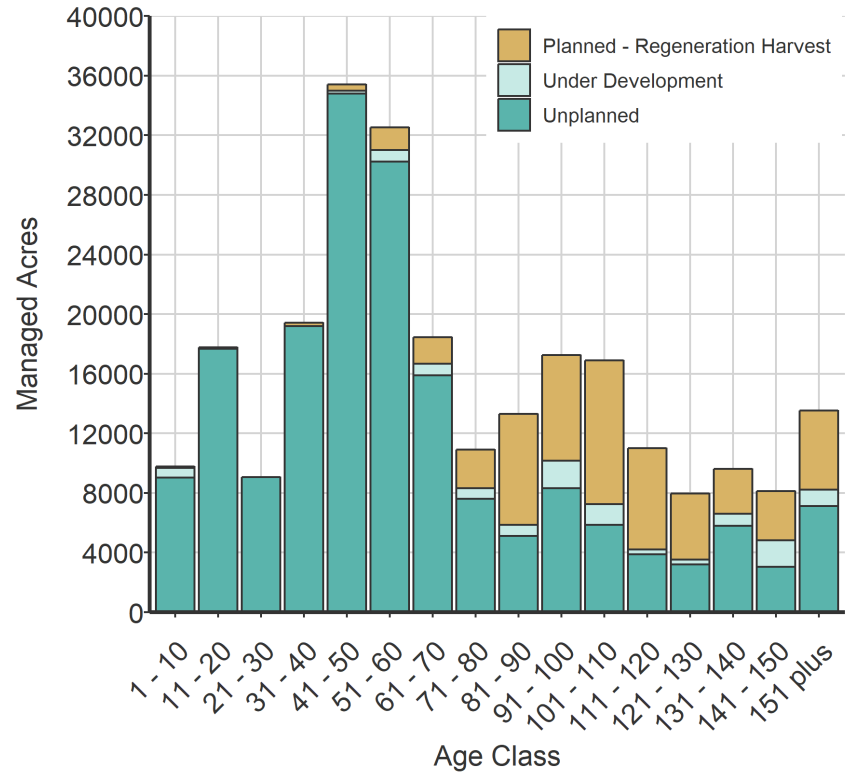
### Red Pine Plantation



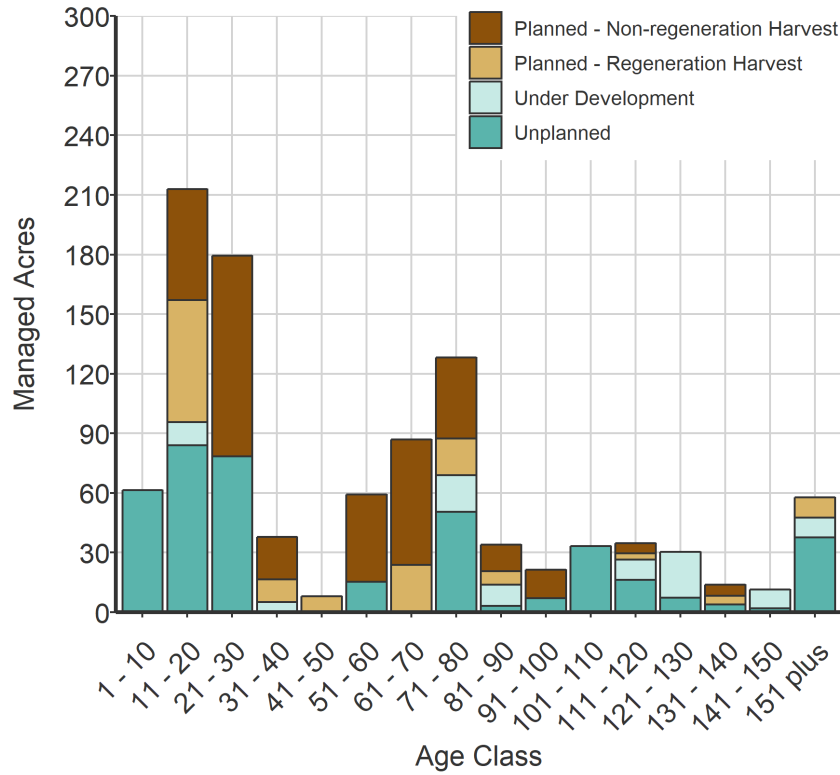
## Stagnant Spruce



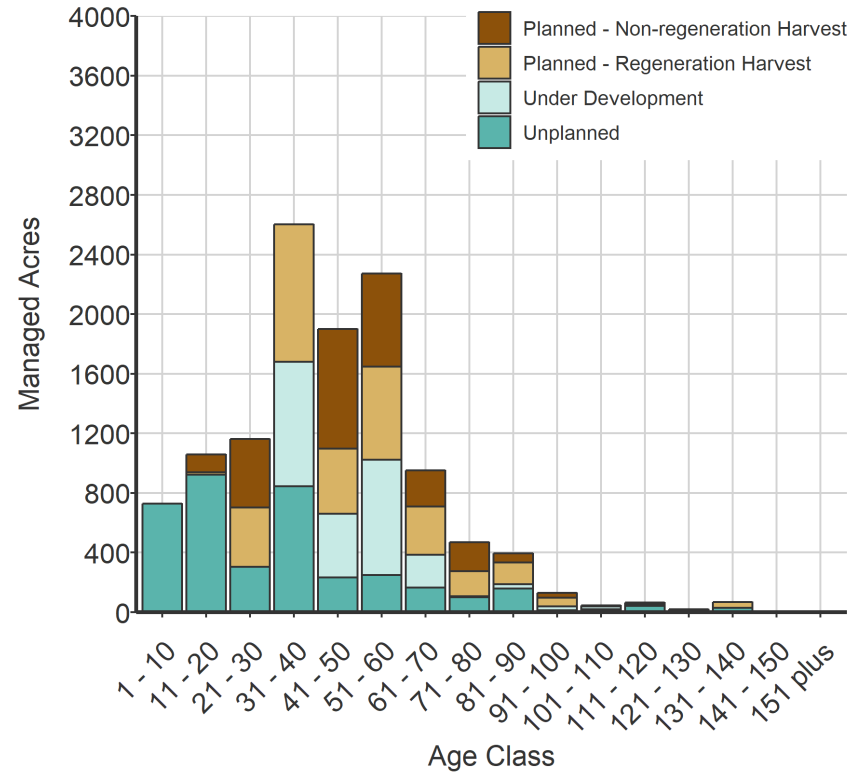
## Tamarack



### White Pine



### White Spruce



## Appendix D: Planned Acre and Volume Summary Tables

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This appendix includes summary tables for volume estimates and planned acres from the 10-year stand exam list for the NMOP Section.

The DNR’s sustainable forest management strategic direction is designed to create a balance of young, intermediate, and older forest and a mix of tree species. As the forest ages, the DNR commonly uses timber harvesting to disturb forests and provide diverse forest benefits sustainably over time. Timber harvest is accomplished through offering volume for sale on timber harvest permits. Thus, timber volume offered is a key metric in assessing the DNR’s progress toward creating and maintaining our desired landscape-scale forest age class and diversity objectives. These objectives are the foundation for providing the range of benefits for which the DNR manages forests, including wildlife habitat, biodiversity, timber productivity, forest health, wood supply and healthy natural resource economies, recreation, carbon sequestration and storage, and water quality and quantity. Using information generated during the STHA project, the DNR determined the amount of timber volume that should be offered from lands administered by the Divisions of Forestry and Fish and Wildlife to achieve the forest management objectives specific to each DNR land administrator.

The 10-year stand exam list for the NMOP Section was created at the same time as the 10-year stand exam lists for all other ecological planning sections in a statewide process. Additional details on SFRMP modeling, stand selection criteria, and stand exam list results are available in the [Sustainable Timber Harvest: Development of the DNR 10-year Stand Exam List report](#).

**Table D.1:** Total acres on the 10-year stand exam list (“Acres Planned”) and model-estimated volume (“Modeled Volume” in cords) for those acres by administrator within NMOP on the FY 2021-2030 stand exam list.

Administrator	Acres Planned	Modeled Volume (based on acres planned)
Forestry	224,698	3,213,994
Fish and Wildlife	34,856	425,546
Total	259,553	3,639,540

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

Cover Type	111 FAW	111 FOR	121 FAW	121 FOR	131 FAW	131 FOR	221 FOR	234 FOR	245 FOR	261 FOR	Total
Ash/Lowland hardwoods	105	2,195	71	799	317	1,623	6,823	409	224	4,155	<b>16,720</b>
Aspen/Balm of Gilead SI < 65	236	2,323	4,695	8,757	1,757	6,815	4,351	763	1,778	5,811	<b>37,286</b>
Aspen/Balm of Gilead SI > 64	15	5,560	762	4,884	1,060	9,651	8,382	4,461	3,285	13,442	<b>51,501</b>
Balsam fir	6	1,006	600	1,088	1,060	1,335	701	164	239	3,901	<b>10,101</b>
Birch	126	158	92	293	517	306	149	36	130	137	<b>1,944</b>
Black spruce lowland SI < 30	130	621	1,136	254	368	2,558	1,499	653	1,176	9,151	<b>17,546</b>
Black spruce lowland SI 30-39	81	2,899	687	823	1,406	5,206	4,496	1,301	1,286	13,668	<b>31,854</b>
Black spruce lowland SI 40+	42	435	154	1,273	229	1,580	1,136	110	225	4,725	<b>9,909</b>
Northern hardwood	0	280	0	0	0	81	270	37	80	184	<b>932</b>
Oak	0	22	1	16	20	0	0	0	0	10	<b>69</b>
Offsite aspen	0	15	0	0	0	0	0	0	0	0	<b>15</b>
Jack pine	0	143	991	2,881	475	2,188	123	346	52	1,373	<b>8,571</b>
Red pine natural origin	0	145	2	14	26	311	83	403	30	233	<b>1,247</b>
Red pine plantation	0	655	273	4,204	606	2,439	236	1,174	381	1,772	<b>11,739</b>
White pine	0	35	55	41	10	74		104	41	152	<b>512</b>
Stagnant black spruce lowland	0	11	0	0	0	0	38	0	0	0	<b>49</b>
Stagnant cedar	0	131	0	0	0	0	67	0	0	0	<b>198</b>
Tamarack SI < 40	875	4,124	7,446	2,455	4,255	2,921	2,556	80	143	8,402	<b>33,256</b>
Tamarack SI > 39	90	1,640	2,144	2,897	1,205	1,904	1,847	212	112	5,220	<b>17,271</b>
Upland black spruce	0	8	16	52	44	192		39	33	45	<b>428</b>
White cedar	0	195	0	19	0	35	20	0	0	22	<b>291</b>
White spruce	7	321	459	1,774	202	999	411	477	902	2,344	<b>7,895</b>
Non-forest (grass or brush)	0	208	0	10	0	0	0	0	0	0	<b>218</b>
<b>Total</b>	<b>1,713</b>	<b>23,131</b>	<b>19,587</b>	<b>32,533</b>	<b>13,556</b>	<b>40,218</b>	<b>33,187</b>	<b>10,769</b>	<b>10,114</b>	<b>74,746</b>	<b>259,553</b>

Note: RAN 111=Bemidji Forestry Area; 121=Warroad; 131=Baudette; 221=Deer River; 234=Hibbing; 245=Tower; 261=Littlefork

## Appendix E: Management Opportunity Areas

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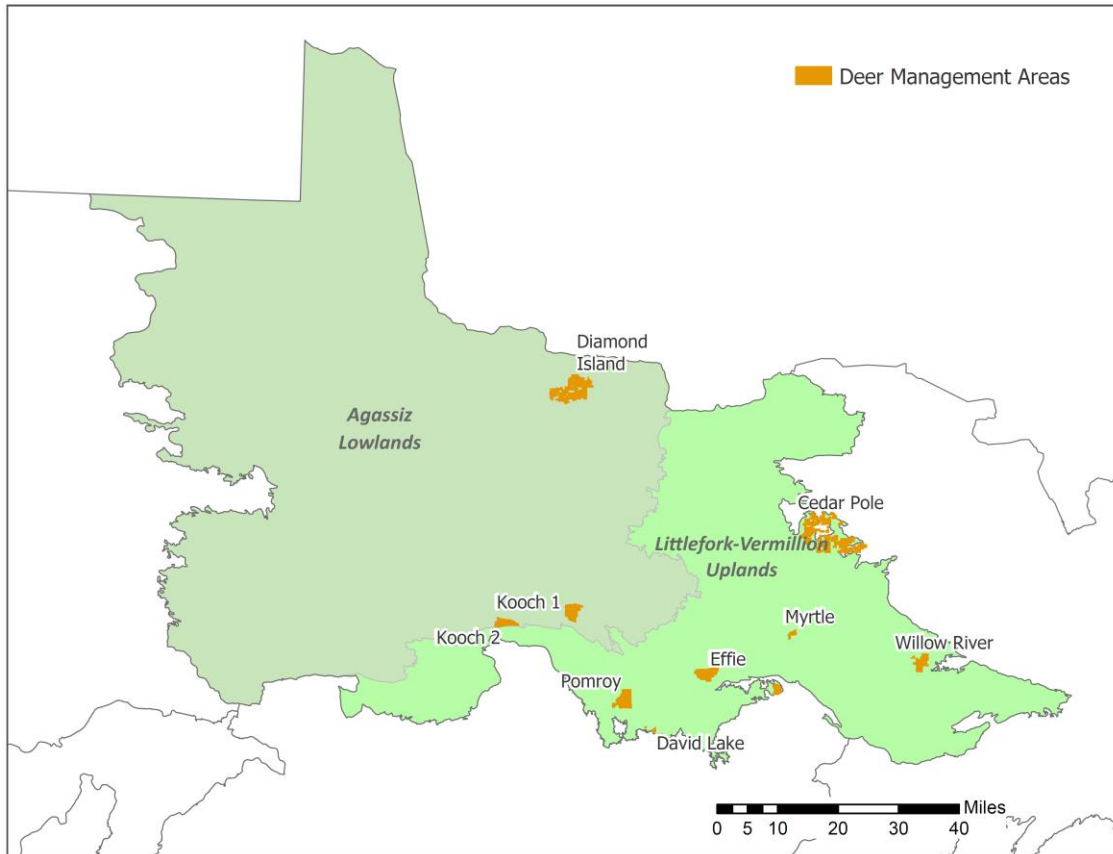
Management opportunity areas (MOAs) are areas on DNR-administered lands that offer an opportunity to maintain or create spatial patterns to address natural resource values that are difficult to achieve at the stand level or through the normal stand development process. They contribute toward meeting 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 NMOP](#) is available on the [DNR's NMOP SFRMP webpage](#). Individual MOA guidance documents can be downloaded from the links in the tables for each MOA type below.

## Deer Management Areas

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

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



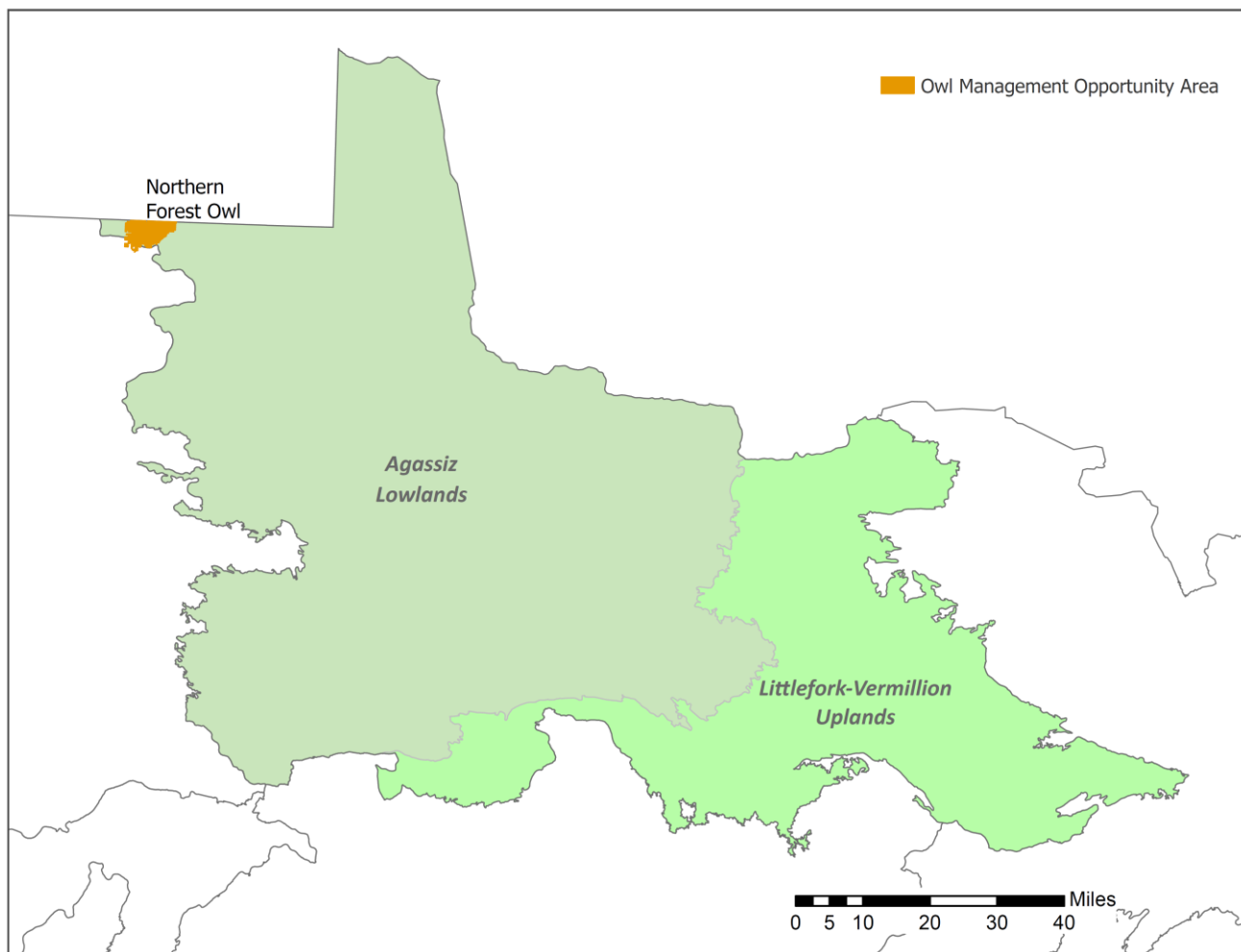
**Table E.1:** Deer management/winter habitat areas in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
<a href="#">Cedar Pole Deer Yard</a>	Littlefork, Tower	13,305
<a href="#">David Lake Winter Habitat</a>	Deer River	209
<a href="#">Diamond Island Deer Yard</a>	Baudette	9,768
<a href="#">Effie Winter Habitat</a>	Deer River	1,136
<a href="#">Kooch 1 Winter Habitat</a>	Deer River	2,560
<a href="#">Kooch 2 Winter Habitat</a>	Deer River	1,610
<a href="#">Myrtle Winter Habitat</a>	Deer River	511
<a href="#">Pomroy Winter Habitat</a>	Deer River	1,918
<a href="#">Willow River Winter Habitat MOA</a>	Tower	2,709

## Northern Forest Owl MOA

The Northern Forest Owl MOA is designed to consistently provide all habitat needs for rare boreal owl species, using timber harvest to rotate areas that provide various nesting and prey-production habitat elements over time. This MOA recognizes where great gray and northern hawk owl concentrations occur continually and cannot simply be created elsewhere on the landscape.

**Map E.2:** Location of the Northern Forest Owl MOA in the NMOP Section.



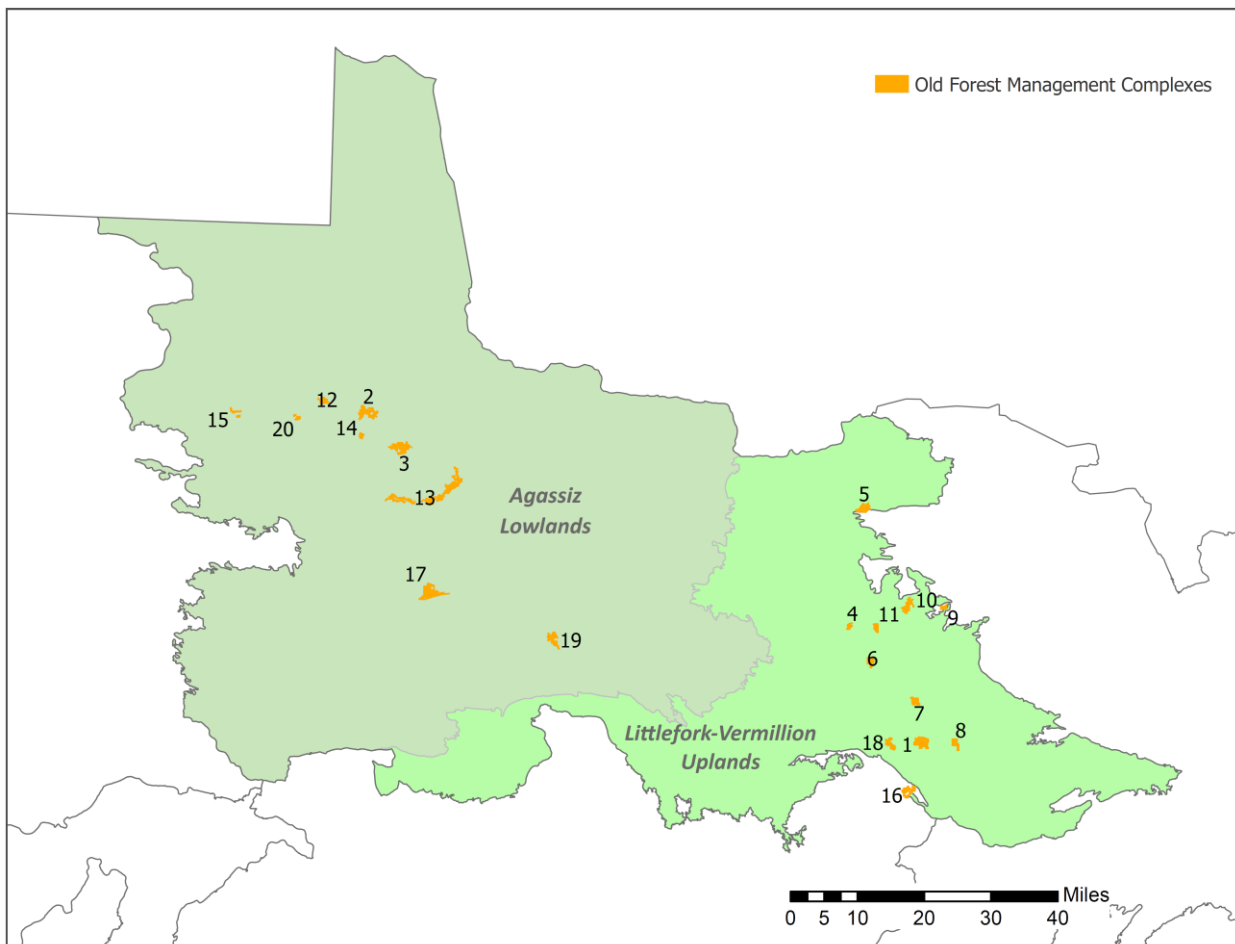
**Table E.2:** Northern Forest Owl MOA in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
<a href="#">Northern Forest Owl</a>	Warroad	14,418

## 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 policy for more information.

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



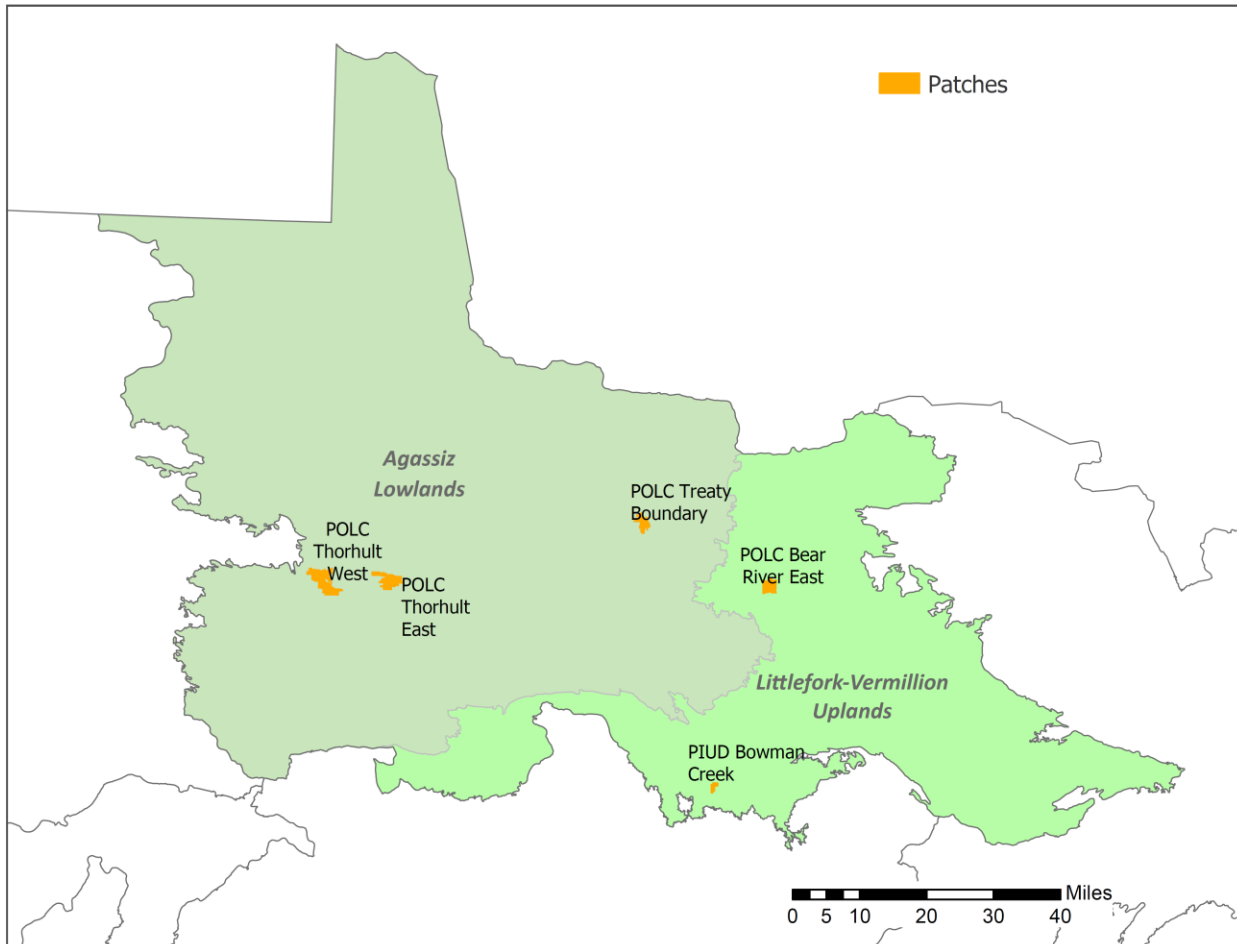
**Table E.3:** Old forest management areas in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Map Number	Name	Forestry Area	Total Stand Acres
1	<a href="#">Bramble OFMC</a>	Hibbing	1644
2	<a href="#">Brown's Bog East OFMC</a>	Baudette	1246
3	<a href="#">Gustafson's Camp OFMC</a>	Baudette	1537
4	<a href="#">Highway 65 OFMC</a>	Littlefork	202
5	<a href="#">Hwy217 (Littlefork) OFMC</a>	Littlefork	854
6	<a href="#">Little Fork River North OFMC</a>	Deer River, Littlefork	504
7	<a href="#">Little Fork River South OFMC</a>	Hibbing	566
8	<a href="#">Nass OFMC</a>	Hibbing	611
9	<a href="#">Nett Lake North Boundary East OFMC and Cedar Pole Deer Yard</a>	Tower	193
10	<a href="#">Nett Lake North Boundary West OFMC and Cedar Pole Deer Yard</a>	Littlefork	778
11	<a href="#">Nett Lake West Boundary - Littlefork River OFMC</a>	Littlefork	379
12	<a href="#">Norris Camp South OFMC</a>	Baudette	338
13	<a href="#">Rapid River East OFMC</a>	Baudette	3077
14	<a href="#">Rapid River West OFMC</a>	Baudette	192
15	<a href="#">Stotts OFMC</a>	Warroad	213
16	<a href="#">Thistledew Lake OFMC</a>	Hibbing	902
17	<a href="#">Upper Red Lake North Shore OFMC</a>	Bemidji	2025
18	<a href="#">Valley River Headwaters OFMC</a>	Hibbing	643
19	<a href="#">Waskish Little Tamarack River OFMC</a>	Bemidji	907
20	<a href="#">West Hogsback OFMC</a>	Warroad	199

## Patch MOAs

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

**Map E.4:** Location of patch MOAs in the NMOP Section. (PIUD = patch intermediate upland deciduous; POLC = patch old lowland conifer)



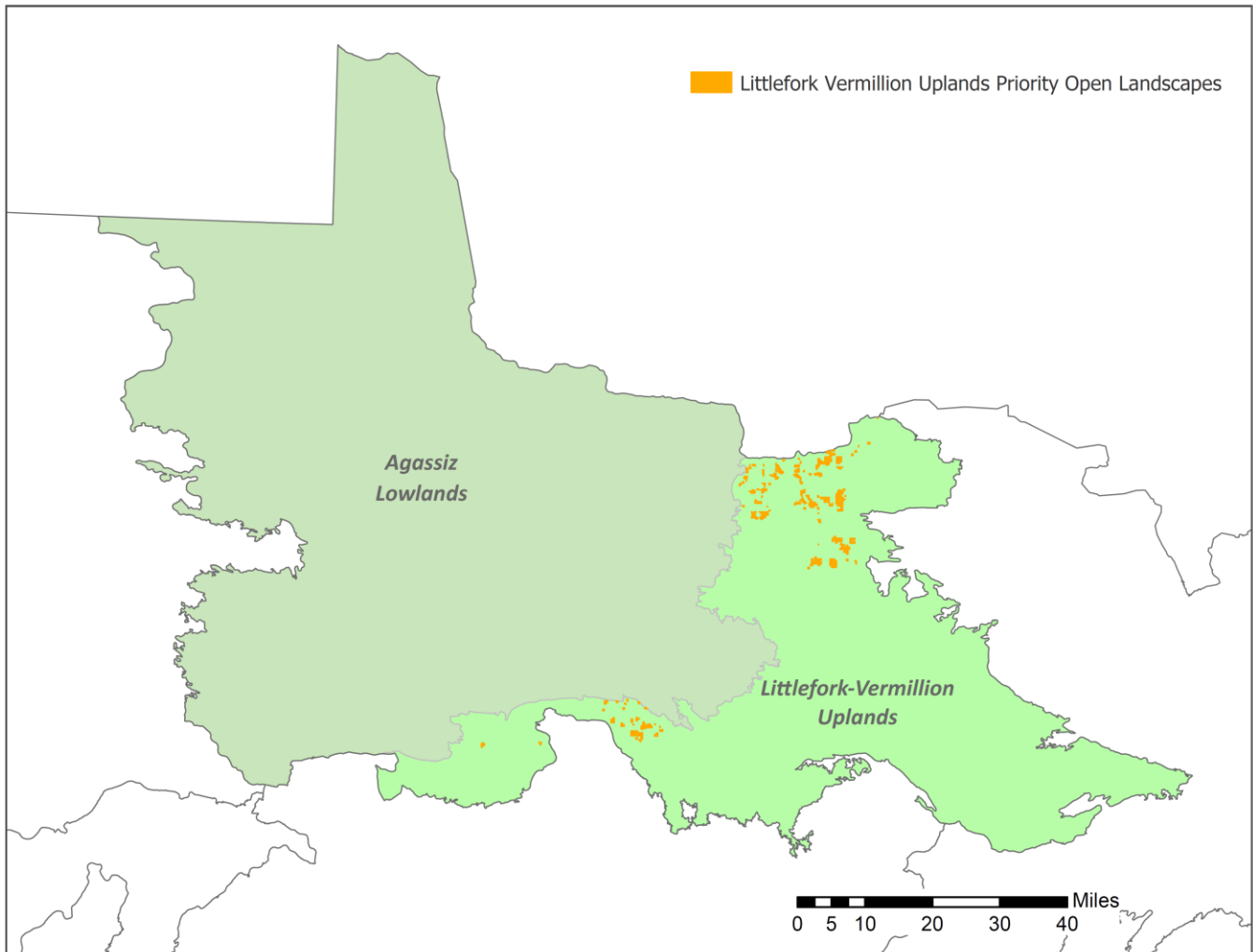
**Table E.4:** Patch MOAs in the NMOP Section. Click on the name of a MOA to view or download its management guidance document (PIUD = patch intermediate upland deciduous; POLC = patch old lowland conifer).

Name	Forestry Area	Total Stand Acres
<a href="#">PIUD Bowman Creek</a>	Deer River	503
<a href="#">POLC Bear River East</a>	Littlefork	2238
<a href="#">POLC Thorhult East</a>	Bemidji, Warroad	3582
<a href="#">POLC Thorhult West</a>	Warroad	5600
<a href="#">POLC Treaty Boundary</a>	Littlefork, Baudette	1933

## Open Landscape Management Area

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

**Map E.5:** Location of DNR-administered stands within Littlefork Vermillion Uplands Priority Open Landscapes.



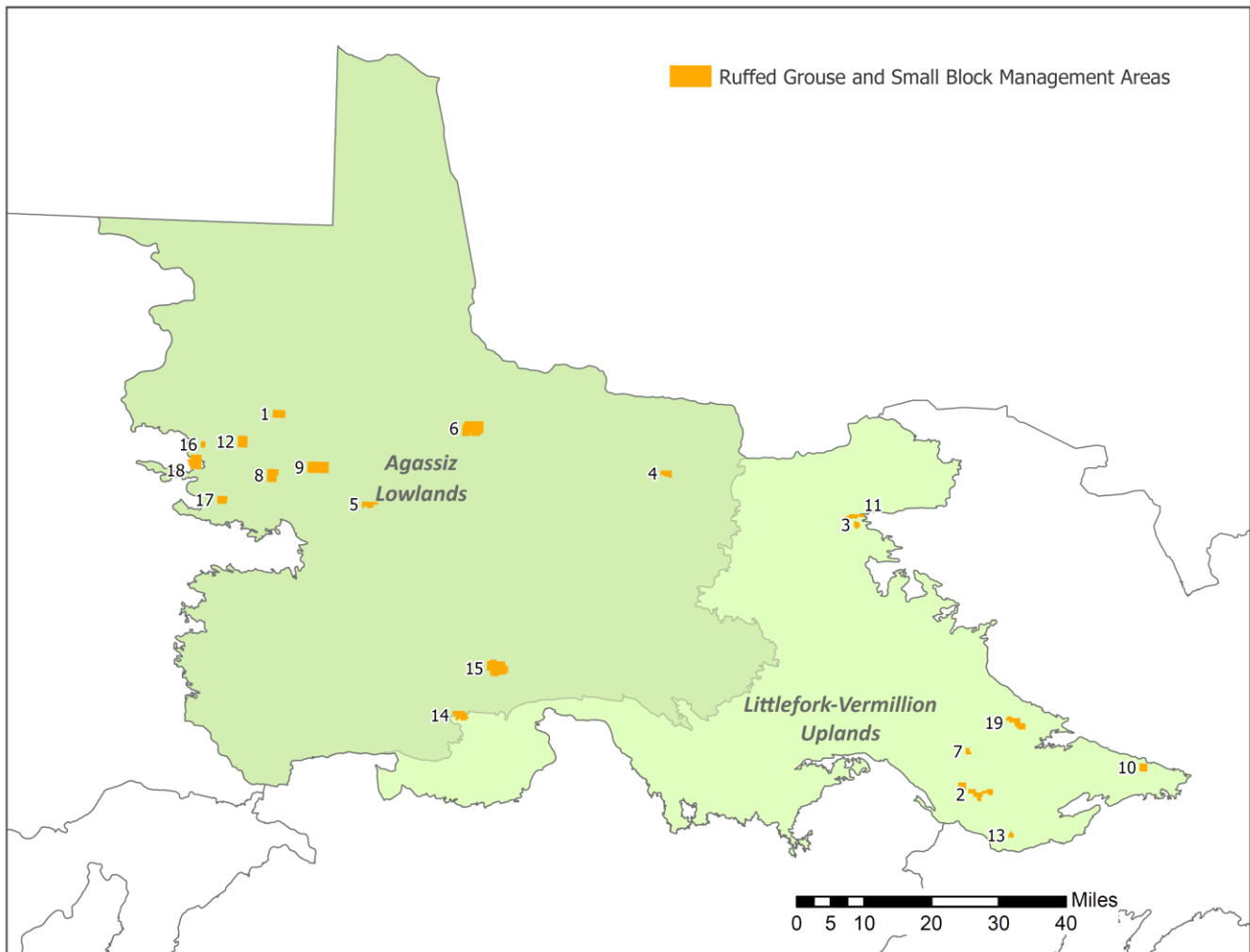
**Table E.5:** Littlefork Vermillion Uplands Priority Open Landscapes MOA in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
<a href="#">Littlefork Vermillion Uplands Priority Open Landscape</a>	Littlefork, Deer River, Bemidji	14,984

## Ruffed Grouse Management Areas (RGMAs) and Small Block Habitat MOAs

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 provide quality hunting experiences around Hunter Walking Trail networks. This category also includes a small-block habitat management area focused on managing for nesting and brood-rearing habitat for golden-winged warblers and American woodcock (Wapiti Young Forest MOA).

**Map E.6:** Location of ruffed grouse and small block management areas in the NMOP Section.



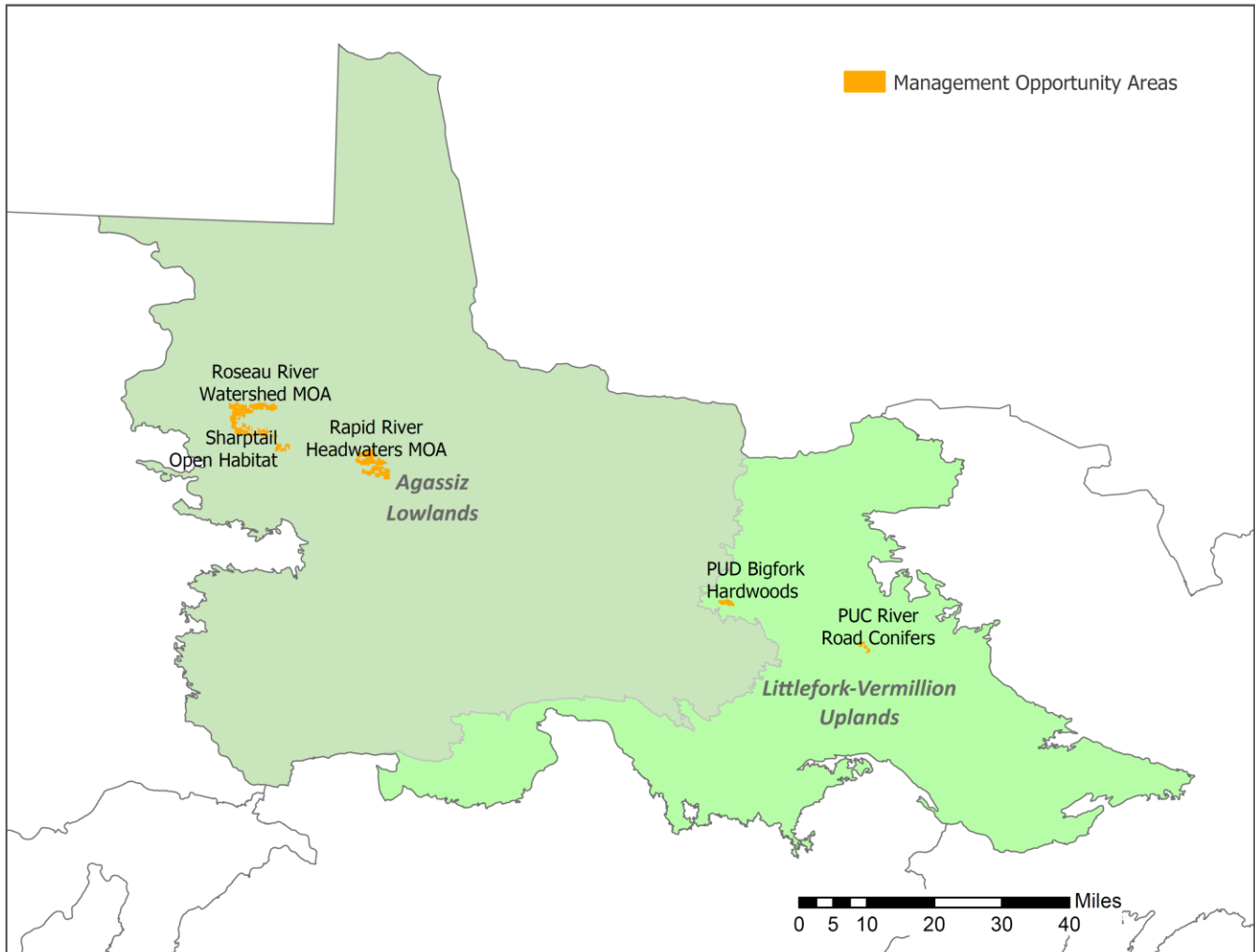
**Table E.6:** Ruffed grouse management areas (RGMA) in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Map Number	Name	Forestry Area	Total Stand Acres
1	<a href="#">7-Mile RGMA</a>	Warroad	1,498
2	<a href="#">Bear River RGMA</a>	Hibbing	1,979
3	<a href="#">Beaver Brook RGMA</a>	Littlefork	360
4	<a href="#">Black River RGMA</a>	Baudette	521
5	<a href="#">Canis Lupus RGMA</a>	Baudette	1,078
6	<a href="#">Carp Swamp RGMA</a>	Baudette	2,942
7	<a href="#">Celina RGMA</a>	Tower	213
8	<a href="#">Gate's Corner RGMA</a>	Warroad	1,599
9	<a href="#">Gladen's Camp RGMA</a>	Baudette	3,394
10	<a href="#">Hwy 115 RGMA</a>	Tower	672
11	<a href="#">Moose Lake RGMA</a>	Littlefork	572
12	<a href="#">Morehouse Road RGMA</a>	Warroad	1,140
13	<a href="#">Mud Hole RGMA</a>	Hibbing	229
14	<a href="#">Saum RGMA</a>	Bemidji	1,166
15	<a href="#">Shotley RGMA</a>	Bemidji	3,203
16	<a href="#">Wapiti North RGMA</a>	Warroad	286
17	<a href="#">Wapiti South RGMA</a>	Warroad	1,173
18	<a href="#">Wapiti Young Forest Small Block</a>	Warroad	1,933
19	<a href="#">Willow River RGMA</a>	Tower	1,223

## Landscape Management Opportunity Areas

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

**Map E.7:** Location of MOAs that address other landscape-scale objectives not captured in other categories.



**Table E.7:** Landscape MOAs in the NMOP Section. Click on the name of a MOA to view or download its management guidance document.

Name	Forestry Area	Total Stand Acres
<a href="#">River Road Conifers</a>	Littlefork	215
<a href="#">Bigfork Hardwoods</a>	Littlefork	592
<a href="#">Rapid River Headwaters MOA</a>	Baudette	4,076
<a href="#">Roseau River Watershed MOA</a>	Warroad	4,414
<a href="#">Sharptail Open Habitat</a>	Warroad	399

## Appendix F. Modeled Management Regimes

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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 NMOP, 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 within areas designated as needing management different from the standard regimes to benefit particular forest resources. Examples include areas with native plant communities that have global conservation ranks, old growth forest special management zones, and management opportunity areas (MOAs).

The modeled management regimes used to develop the 10-year stand exam list for NMOP 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

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

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

Cover Type	Standard DNR		Fish and Wildlife		OG SMZ		OFMC		Patch MOA		HCVF Low		OLMA	
	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%
Ash/Lowland Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Aspen/Balm-of-Gilead - SI 65+	40	5	60	10	40	10	55	10	50	10	50	10	45	10
Aspen/ Balm-of-Gilead - SI < 65	50	5	60	10	50	10	60	10	55	10	55	-	45	10
Birch	50	5	60	15	50	10	65	10	60	10	60	10	50	10
Jack Pine	50	5	55	15	50	5	60	5	55	5	55	5	-	-
Black Spruce Upland	50	5	55	15	50	5	60	5	55	5	55	5	-	-
Balsam Fir	45	5	50	15	45	10	55	15	50	15	50	15	-	-
White Spruce Planted	50	5	45	5	-	-	50	5	50	5	45	5	-	-
White Spruce Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Black Spruce Lowland - SI 40+	80	5	100	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+	70	5	90	5	70	5	70	5	70	5	65	5	-	-
Tamarack - SI < 40	95	5	90	5	95	5	95	5	95	5	90	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	100	5	110	66	100	10	115	10	115	10	110	10	95	5
White Pine Plantation - SI 65+	60	5	UE	UE	-	-	60	-	65	-	60	10	-	-
White Pine Plantation - SI 55 – 60	65	5	UE	UE	-	-	60	-	65	-	60	10	-	-
White Pine Plantation - SI < 50	70	5	UE	UE	-	-	60	-	65	-	60	10	-	-
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-
Oak - SI 75+	60	5	90	15	-	-	-	20	80	20	-	20	90	20
Oak - SI < 75	60	5	90	15	-	-	-	20	80	20	-	20	90	20
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-	-	-

Cover Type	Standard DNR		Fish and Wildlife		RGMA		DMA		MMA		OWMA	
	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%	RA	RES%
Ash/Lowland Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	-
Aspen/Balm-of-Gilead - SI 65+	40	5	60	10	45	10	40	10	40	10	40	10
Aspen/ Balm-of-Gilead - SI < 65	50	5	60	10	10	45	50	10	50	10	50	10
Birch	50	5	60	15	50	10	60	10	60	10	60	10
Jack Pine	50	5	55	15	-	-	55	5	55	5	55	5
Black Spruce Upland	50	5	55	15	-	-	55	5	55	5	55	5
Balsam Fir	45	5	50	15	-	-	50	15	50	15	45	15
White Spruce Planted	50	5	45	5	-	-	50	-	50	-	50	5
White Spruce Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	-
Black Spruce Lowland - SI 40+	80	5	100	10	-	-	80	5	80	5	80	5
Black Spruce Lowland - SI 30-39	100	5	100	10	-	-	100	5	100	5	100	5
Black Spruce Lowland - SI 23-29	120	5	120	10	-	-	120	5	120	5	120	5
Tamarack - SI 40+	70	5	90	5	-	-	-	-	-	-	65	5
Tamarack - SI < 40	95	5	90	5	-	-	-	-	-	-	90	5
Red Pine Plantation - SI 65+	60	5	55	5	-	-	-	-	-	-	60	5
Red Pine Plantation - SI 55-64	65	5	60	5	-	-	-	-	-	-	65	5
Red Pine Plantation - SI < 55	70	5	65	5	-	-	-	-	-	-	70	5
Red Pine Natural	100	5	110	66	-	-	110	10	-	-	-	5
White Pine Plantation - SI 65+	60	5	UE	UE	-	-	-	-	-	-	-	5
White Pine Plantation - SI 55 – 60	65	5	UE	UE	-	-	-	-	-	-	-	5
White Pine Plantation - SI < 50	70	5	UE	UE	-	-	-	-	-	-	-	5
White Pine Natural	UE	UE	UE	UE	-	-	-	-	-	-	-	5
Northern Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	20
Central Hardwoods	UE	UE	UE	UE	-	-	-	-	-	-	-	5
Oak - SI 75+	60	5	90	15	90	20	80	15	80	15	80	15
Oak - SI < 75	60	5	90	15	90	20	80	15	80	15	80	15
Cedar	UE	UE	UE	UE	-	-	-	-	-	-	-	-

## Uneven-Aged Management Regimes

The model used to develop the 10-year stand exam list selected stands for uneven-aged management based on criteria including cover type, site index, stand age, stand basal area, and the time since the last treatment. The following tables show uneven-aged management regimes included in the model used to develop the 10-year stand exam list. The “lock” numbers in each table represent the number of years that must pass after 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.”

### NMOP 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

### NMOP Division of Fish and Wildlife Uneven-Aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
White Spruce	All	>= 70	NA	20
White Spruce Plantation	All	>= 25	NA	10

### NMOP Old Growth Special Management Zone (OG SMZ) Uneven-Aged Regimes

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

## NMOP Old Forest Management Complex (OFMC), HCVF, and G1/G2\* Low Harvest Uneven-Aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	All	>= 40	NA	20
Northern Hardwoods	All	>= 60	NA	20
Oak	All	>= 60	NA	20
White Pine	All	>= 60	NA	25
White Pine Plantation	All	>= 35	NA	20
White Spruce	All	>= 55	NA	20
White Spruce Plantation	All	>= 55	NA	20

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

## NMOP 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

## NMOP 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

### NMOP 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

### NMOP Deer Winter Area MOA Uneven-Aged Regimes

Cover Type	Site Index	Treatment Age	Treatment BA	Lock (years)
Ash/Lowland Hardwoods	>= 55	NA	>= 110	30
Northern Hardwoods	All	NA	>= 130	25
White Pine	All	NA	>= 130	30
White Spruce	All	>= 75	>= 100	25
White Spruce Plantation	All	>= 35	NA	15

## Thinning Regimes

### NMOP 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

### NMOP Division of Fish and Wildlife Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
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

### NMOP 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

### NMOP 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

### NMOP Older Forest Patch MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
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

### Deer Winter Area MOA Thinning Regimes

Cover Type	Site Index	Thin Number	Min. Thin Age	Max. Thin Age
Oak	All	Unthinned	100	115
Oak	All	Thin1	120	135
White Pine Plantation	All	Unthinned	35	50
White Pine Plantation	All	Thin1	55	70

# Glossary

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

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

**Age class:** An interval, commonly 10 years, into which the age range of trees or forest stands is divided for classification or use.

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

**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.

**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).

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

**Corridor:** A defined tract of land connecting two or more areas of similar habitat type 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.

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

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

**Element Occurrence (EO):** An area of land and/or water where a rare feature (plant, animal, natural community, geologic feature, animal aggregation) is or was present. An Element Occurrence Rank provides a succinct assessment of the estimated viability or probability of persistence (based on condition, size, and landscape context) of occurrences of a given Element. An Element Occurrence Record is the locational and supporting data

associated with a particular Element Occurrence. Element Occurrence Records for the State of Minnesota are managed as part of the rare features database by the Natural Heritage and Nongame Research Program. (Adapted from Biotics EO Standards: Chapter 2)

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

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

**Even-aged:** A forest stand composed of trees of primarily the same age or age class. A stand is considered even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years). Examples of even-aged silvicultural treatments, or prescriptions, that promote a stand composition with trees of primarily the same age or age class, include clearcut and shelterwood harvests.

**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:

**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 individual trees or groups of trees' mortality or blowdown. Gap management uses timber harvest methods to emulate this type of forest spatial pattern.

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

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

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

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

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

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

**Intensive management:** Intensity of management refers to the degree of disturbance associated with silvicultural treatments. In this plan, references to it range from less intensive to more intensive management. Examples of more intensive management are: 1) Site preparation techniques such as rock-raking that disrupts the soil profile and leaves coarse woody debris in piles; 2) broadcast herbicide use that eliminates or dramatically reduces herbaceous plant and shrub diversity; 3) Conversions of mixed forest stands through clearcutting and/or site preparation that result in the establishment of a more simplified monotypic stand such as mostly pure aspen regeneration or high-density pine plantations. Examples where more intensive

management may be needed are to regenerate a site successfully to a desired species, control insect or disease problems, and manage wildlife habitats (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 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 in the DNR's forest resource management plan system. 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.

**Management Opportunity Area (MOA):** Groups of stands that provide opportunities to address values (including biodiversity, rare features, diversity of native plant community growth stages, and wildlife needs) through management that can't be addressed through site-level management.

**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 vegetation patches in forested landscapes as determined primarily by natural disturbance and physical factors.

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

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

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

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

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

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

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

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

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

**Overstory:** The canopy in a stand of trees.

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

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

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

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

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

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

**Rare plants:** All species that are listed as federally endangered, threatened, or as candidates for federal listing; all species that are state-listed as endangered, threatened, or of special concern. Several rare species that currently have no legal status but need further monitoring to determine their status are also tracked.

**Rare animal:** All animal species that are listed as Federally endangered or threatened (except the gray wolf), 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 that currently have no legal status but need further monitoring to determine their status are also tracked. For example, some species in greatest conservation need (SGCN) have no legal status, but SGCN include both listed and non-listed species.

**Rare species:** A plant or animal species that is designated as endangered, threatened, or a species of special concern by the state of Minnesota (this includes all species designated as endangered or threatened at the federal level) or an uncommon species that does 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 (i.e., primarily even-aged) receives its final harvest. Rotation age is determined as 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 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.

**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 saw timber.

**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 a unique or highly specific habitat requirement and deserves careful monitoring. Species on the periphery of their ranges may be included in this category, as well as species that were once threatened or endangered but now have increasing or stable and protected populations.

**Special Management Area (SMA):** An area that receives alternate modeling during stand selection and different treatment during management to account for values on the landscape other than timber. 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 cleared at any given time.

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

**Stand:** A contiguous group of vegetation similar in age, species composition, and structure and growing on a site of similar quality to be a distinguishable unit. A forest is comprised of many stands. A pure stand is composed of essentially a single species, such as a red pine plantation. A mixed stand is composed of a mixture of species,

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

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

**Stand density:** The number of trees per unit area. Density 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 desired number for best growth and management, such as well-stocked, overstocked, and partially stocked. A measure of the proportion of an area actually occupied by trees.

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

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

**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 components (e.g., conifer stands such as white cedar, balsam fir, and jack pine) that provide wildlife protection from the cold in the winter and heat in the summer. 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:** Forest land capable of producing timber of a 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 forest lands, this includes stands that can produce at least three cords per acre of merchantable timber at the normal rotation age for that cover type. It does not include very low-productivity sites such as those classified as stagnant spruce, tamarack, and cedar, offsite aspen, or non-forest land.

**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 that results 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 closely 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.