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This report is available on the DNR Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north4/preliminary.html

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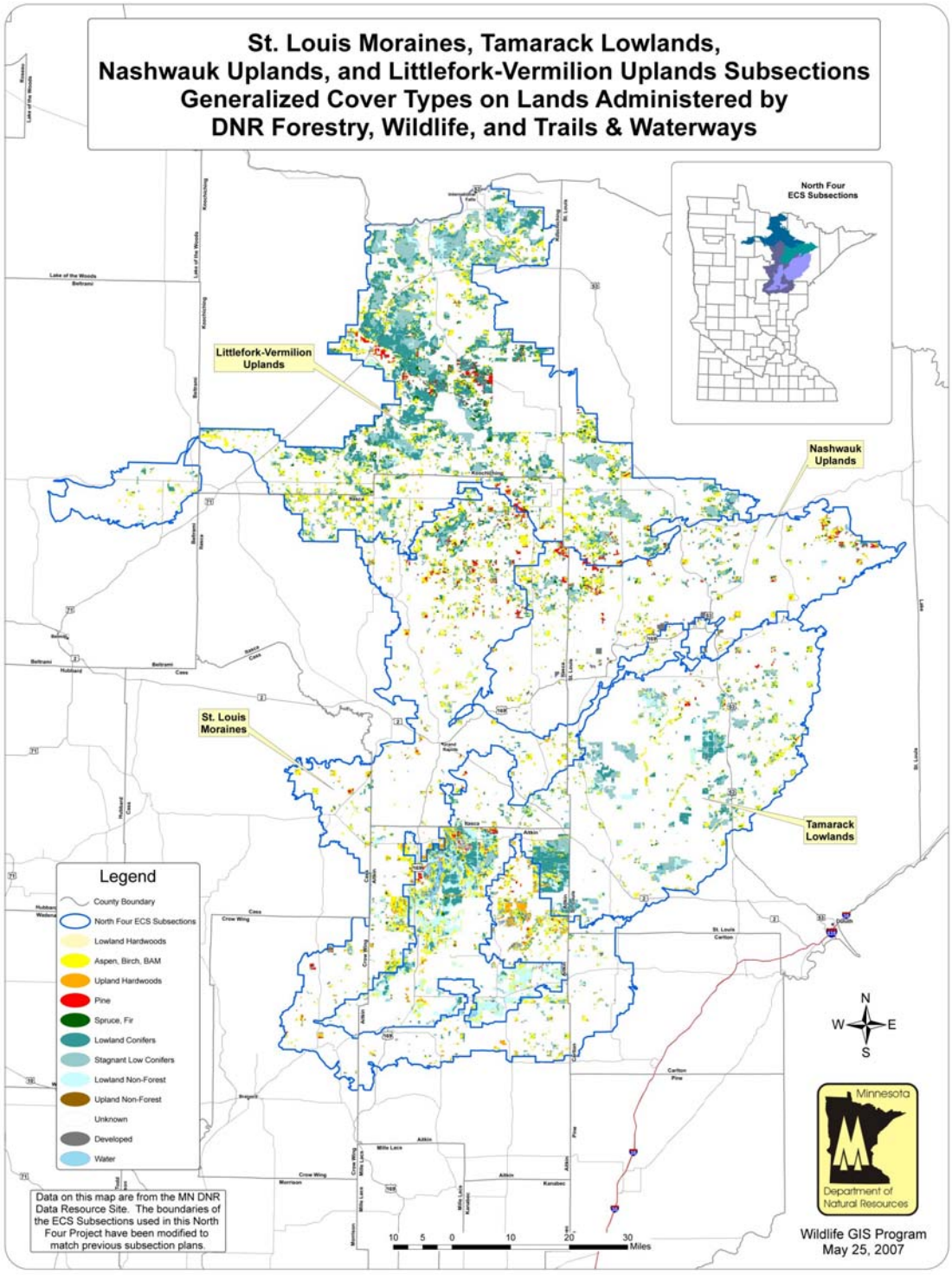
North-4 Subsections – St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands
slm -St. Louis Moraines; tl -Tamarack Lowlands; nu -Nashwauk Uplands; lvu -Littlefork-Vermilion Uplands

Map i—North-4 Subsections Generalized Forest Cover Types on DNR-Administered Lands Covered by This Plan



Brief Description of the Planning Area

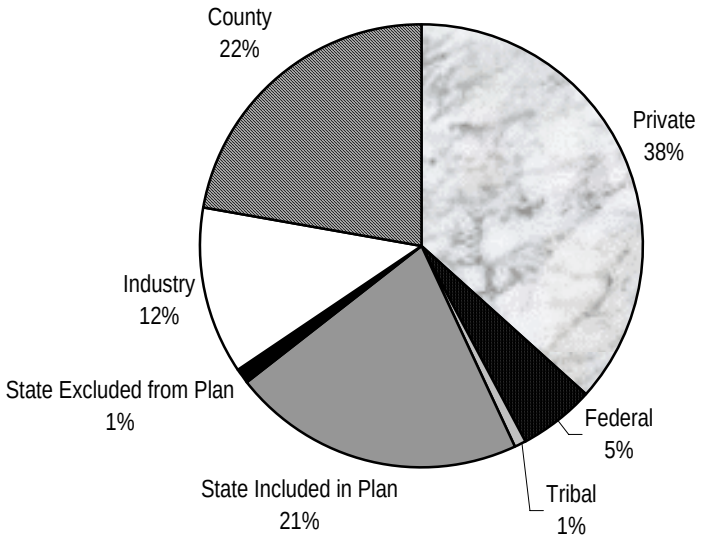
This Subsection Forest Resource Management Plan (SFRMP) process considers state forest lands administered by the Department of Natural Resources (DNR), Divisions of Forestry, Trails and Waterways, Fish and Wildlife – Wildlife Section in the *North-4 Subsections* subsection landscape units (*St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands*). These four units cover approximately 5.5 million acres in an area from near Tower on the east to Blackduck on the west, and from Aitkin on the south to International Falls on the north. (See *Map i—slm, Map i—tl, Map i—nu, and Map i—lvu*.) For more detailed land descriptions, refer to chapters 1 through 3.

Recreation, forestry, and tourism are major uses of land in these four subsections. Public agencies administer 50 percent of the land with the state portion being 1.24 million acres or 22 percent. Approximately 1.17 million acres of the state land is timberland that will be considered for wood products production and other resource management objectives in this plan. Other state lands totaling 70,000 acres include State Parks and Scientific and Natural Areas, which will not be considered under this plan.

In addition, the federal government owns 300,000 acres (5.5 percent) that are managed by the U.S. Forest Service as part of the Chippewa and Superior National Forests. Aitkin, Crow Wing, Cass, Itasca, Beltrami, Koochiching, St. Louis, and Carlton counties own and manage 1.23 million acres (22 percent). Private owners control 2.7 million acres (49 percent). Of that, industry owns 700,000 acres. For more details about land ownership, refer to Chapter 2.

Chart i
Land Ownership
North-4 Subsections Total
5,522,474 Acres

St. Louis Moraines / Tamarack Lowlands /
Nashwauk Uplands / Littlefork-Vermilion Uplands



Source: 1976 1998 Minnesota DNR GAP Stewardship <Updated 2007>

Based on the Gap Analysis Program (GAP) classification completed by the DNR Division of Forestry using satellite imagery of all lands in the subsection, 66 percent of the land area (non-water) is covered by forest. Aspen and birch cover types comprise 49 percent of this forest. 3 percent of the subsection land area is cropland. Based on the DNR forest inventory of timberland that will be considered in this plan; aspen, birch, and balm of Gilead comprise 271,000 acres and non-forested lowlands comprise 225,000 acres. For details about cover types, refer to Chapter 3.

In most cases, assessment information is provided for the four subsections combined, as well as for each individually.

Subsection Forest Resource Management Planning

Introduction

For many years, the Minnesota Department of Natural Resources (DNR) directed timber harvesting on lands it administered through five- to 10-year forest resource management plans developed for each of its administrative forestry areas. Opportunities for public involvement were limited in the development and review of these timber management plans.

In response to growing public interest in DNR timber management planning, the DNR Subsection Forest Resource Management Plan (SFRMP) process was designed to provide a more standardized, formal process and opportunities for increased public involvement. In addition, it is based at the subsection level of the DNR's ecological classification system (ECS) rather than DNR administrative areas as in the past (i.e., DNR area forestry boundaries).

The SFRMP process is divided into two phases. In Phase I, the subsection team will identify important forest resource management *issues* that need to be addressed in the subsection plan and *assess* the current forest resource conditions in the subsection. In Phase II, the subsection team will develop recommended strategies to address these issues and help shape the desired future forest composition goals and stand-selection criteria. The DNR will seek public input during each phase.

Currently, during Phase I, the DNR seeks public input on the issues and assessments contained in this Preliminary Issues and Assessment document.

Goals for the Planning Effort

SFRMP will constitute DNR planning for *vegetation management* on state forest lands administered in the subsections by the Divisions of Forestry, Fish and Wildlife, and Trails and Waterways. The focus of this effort will be:

- **Identifying a desired future forest composition (DFFC)** for 50 years or more. Composition could include the amount of various cover types, age-class distribution of cover types, and their geographic distribution across the subsection. The desired future forest composition goals for state forest lands in the subsections will be guided by assessment information, key issues, general future direction in response to issues, and strategies to implement the general future direction.

- **Identifying forest stands to be treated over the next 10-year period.** SFRMPs will identify forest stands on DNR Forestry- and Wildlife-administered lands that are proposed for treatment (e.g., harvest, thinning, regeneration, and re-inventory) over the 10-year planning period. Forest stands will be selected using criteria developed to begin moving DNR forest lands toward the long-term DFFC goals. Examples of possible criteria include stand age and location, soils, site productivity, and size, number, and species of trees. Many decisions and considerations go into developing these criteria and the list of stands proposed for treatment. Examples include:

1) identifying areas to be managed as older forest or extended rotation forest (ERF),
2) identifying areas to be managed at normal rotation age,
3) identifying areas for various sizes of patch management,
4) management of riparian areas and visually sensitive travel corridors,
5) age and cover-type distributions, and 6) regeneration, thinning, and prescribed burning needs.

The DNR will select management activities (including "no action") that best move the forest landscape toward the DFFC goals for state forest lands.

Consistent with state policy (Minnesota Statutes 89A), the SFRMP process will pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals.

Process
The objectives of the DNR SFRMP process are:

- To effectively inform and involve the public and stakeholders.
- To complete the process in each ecological classification system (ECS) subsection within a reasonable amount of time (the target is to complete a SFRMP plan in 12 months).
- To conduct a process that is reasonable and feasible within current staffing levels and workloads.
- To develop plans that are credible to most audiences and enable good forest management.

Experience, new information, new issues, changing conditions, and the desire to broaden the focus of SFRMP in the future will demand a flexible and adaptable process. The plans will need to be flexible to reflect changing conditions. The SFRMP process will provide for annual reviews by DNR planning teams for the purpose of monitoring implementation and determining whether plans need to be updated to respond to unforeseen substantial changes in forest conditions.

DNR subsection teams will include staff from the DNR Divisions of Forestry, Fish and Wildlife, and Ecological Resources and other agency staff as needed. These subsection teams will have primary responsibility for the work and decision-making involved in crafting subsection plans.

The subsection team will invite managers of adjacent county, federal, tribal, and industrial forest lands to provide information about the condition of their forest lands and future management direction. This information will help the DNR make better decisions on the forest lands it administers. In the North-4 Subsections, the goals, strategies, and coordination efforts of the Minnesota Forest Resources Council (MFRC) Northeast, North Central, and Northern Landscape Committees will be considered and/or incorporated into the SFRMP.

In the first phase of the SFRMP process, the subsection team will 1) identify important forest resource management issues that will need to be addressed in the subsection plan and 2) develop an assessment of the current forest resource conditions in the subsection. The assessment document developed by the team will consider at least eight basic elements (i.e., chapters in this document):

- Land use and cover
- Administration and ownership
- Forest composition and structure
- Historic harvest and silvicultural practices
- Ecological information
- Forest insects and disease
- Wildlife species and trends
- Forest and habitat fragmentation (preliminary analysis completed but not included in this assessment; this information will be included in the next step of the plan).

In Phase II of the SFRMP process, the subsection team will 1) finalize the issues, 2) determine general future direction in response to the issues, 3) develop strategies to implement the general future direction, 4) identify DFFC goals, and 5) develop the stand-selection criteria for determining the stands and acres to be treated over the next 10 years.

Relationship of SFRMP to Other DNR Planning Efforts

While the SRFMP process focuses on developing vegetation management plans for state-administered forest lands within the subsection, it does not operate in a vacuum. SFRMP teams do their best to stay connected to other state, federal, and even local planning efforts affecting the subsection, particularly as they relate to management direction, decisions, and products that can assist in determining appropriate vegetation management direction on DNR lands. The following sections highlight a number of efforts that that SFRMP teams need to be aware of in order to incorporate relevant information, management direction, and products in the SFRMP process.

1. Off-Highway Vehicle (OHV) Planning Process

The DNR is currently in the midst of a major OHV planning process that will not be completed until 2008 at the earliest. The process began with a statewide road and trail inventory effort on DNR and county lands in the state. This inventory process was completed in 2005 and the resulting road/trail inventory maps are available for consideration in the SFRMP process. This road/trail inventory is most useful when SFRMP teams work to identify new access needs for proposed vegetation management.

The remaining work to be done in the OHV planning process is the OHV Forest Classification and Road/Trail Designation process. These OHV system plans are being developed for each state forest within DNR Division of Forestry administrative areas. During the OHV system planning process, area OHV system planning teams classify state forests for OHV use and identify roads, trails, and areas open to OHV use. Area

planning teams are responsible for leading a separate public input process for each OHV system plan.

While the SFMRP process does not include OHV system planning, SFRMP teams need to consider existing OHV trails and OHV system plans (where available), as well as other recreational trails and facilities, in making decisions on forest stand management next to these facilities and in determining new access needs. Likewise, OHV system plans should consider management direction and the results of stand selection (e.g., large patch areas, areas where temporary access is preferred, areas where new access is needed) developed through the SFRMP process.

For more information about the OHV planning process, visit the DNR Web site at http://www.dnr.state.mn.us/input/mgmtplans/ohv/designation/index.html.

2. Minnesota State Park Unit Planning Process

The SFRMP process will not address the management of DNR forest lands within the boundaries of state parks. The management of state parks (i.e., facilities and natural resources) is established via a separate state park planning process. Individual state park management plans address a park's ecological and recreational role in the context of the surrounding ecological community subsection(s) and its role in furthering Conservation Connection objectives. Park plans document existing natural and cultural resource conditions, and future management objectives. Existing recreational use and recreation trends are assessed, and a balance of sustainable recreational opportunities is recommended.

State park plans are developed through an open public process. The plan recommendations are developed through extensive involvement by interested citizens, recreation, and resource management professionals, and elected officials with local, regional, and statewide responsibilities. Usually this involvement is coordinated through a series of advisory committee meetings, area team meetings, public open houses, news releases, Internet Web site information, and review opportunities.

The SFRMP process should consider state park plans in making decisions on forest stand management adjacent to state parks. Likewise, state park plans need to consider the vegetation management direction and objectives in SFRMPs. Additionally, the SFRMP process should consider the role of state parks in the subsection in meeting desired future compositions and associated goals (e.g., biodiversity, wildlife habitat, community types, etc.).

For more information on state park management planning, contact the Division of Parks and Recreation Planning, Public Affairs and MIS manager at 651-259-5578 or toll free at 1-888-646-6367.

3. Incorporating Biodiversity Considerations in SFRMP

Biological diversity is defined in statute as the "variety and abundance of species, their genetic composition, and the communities and landscapes in which they occur, including the ecological structure, function, and processes occurring at all of these levels." Protecting areas of significant biodiversity is consistent with state policy

(Minnesota Statutes 89A) to pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals.

The DNR SFRMP process provides an immediate opportunity to incorporate biodiversity considerations in planning for forest systems on DNR lands. Ecological Resources staff provides ecological information pertinent to managing for biodiversity to each of the subsection forest management teams (e.g. Minnesota County Biological Survey data, Natural Heritage information, Scientific and Natural Area biodiversity management techniques experience). SFRMP direction in addressing issues and developing strategies, desired future forest compositions, and ten-year lists of stands to be treated will reflect consideration of this information and the current, best understanding of how to manage for biodiversity.

In the future, the DNR will enhance and expand in partnership with affected stakeholders, biodiversity management planning efforts. However, the DNR's immediate focus is to incorporate biodiversity consideration into the SFRMP process.

4. Wildlife Plans and Goals

SFRMP plans are not wildlife habitat plans. Their implementation, however, affects forest habitats and consequently, wildlife distribution and abundance. Because state forest management under a multiple-use policy requires the consideration of wildlife habitat, several wildlife plans are considered during the SFRMP process.

a) Division of Fish and Wildlife Strategic Plan

The Minnesota DNR's Division of Fish and Wildlife Strategic Plan has recently established population and or harvest objectives for many of the state's wildlife species that are hunted and trapped. These objectives have been determined by a variety of processes that involve some level of stakeholder involvement and public review. Population objectives consider both biological and social carrying capacities tempered by economic needs or constraints (e.g., crop depredation). Among other tools, the division establishes annual harvest levels to meet desired population goals. During SFRMP, wildlife managers work toward the development of a plan that facilitates achievement of the wildlife population and/or harvest goals for key wildlife species outlined in the division's strategic plan.

b) Division of Fish and Wildlife "Fall Use Plan"

The Division of Fish and Wildlife's *Restoring Minnesota's Wetland and Waterfowl Heritage Plan*, also know as the Fall Use Plan, identifies harvest goals for waterfowl. This plan was consulted for determining extended forest management (ERF) needs with these subsections, as the amount of ERF influences cavity-nesting waterfowl populations.

c) Bird Plans

Several bird plans under the umbrella of the North American Bird Conservation Initiative provide a continental synthesis of priorities and objectives that can guide bird conservation actions. These plans identify species of continental importance, give a continental population objective, identify issues, and

recommend actions. Similarly, the North American Waterfowl Management Plan provides long-term trend information and population objectives for waterfowl species. Wildlife managers involved in SFRMP use this information to form their planning recommendations and decisions, particularly as they relate to desired future forest conditions and age-class composition.

d) Comprehensive Wildlife Conservation Strategy

The Minnesota Comprehensive Wildlife Conservation Strategy (CWCS) plan identifies wildlife species that are considered "species in greatest conservation need" because they are rare, their populations are declining, or they face serious threats of decline. The U.S. Congress has mandated that partnerships within states develop a CWCS to manage their "species in greatest conservation need."

This plan identifies problems, threats, and opportunities that face the species; it develops 10-year objectives for species populations, habitats, and priority research and information needs, and develops conservation actions that address the 10-year objectives. Wildlife managers use this information to form SFRMP recommendations and decisions.

5. Minnesota Forest Resource Council (MFRC) Landscape Planning Efforts

The 1995 Sustainable Forest Resources Act (Minn. Stat. Chapter 89A) directed the MFRC to establish a landscape-level forest resources planning and coordination program to assess and promote forest resource sustainability across ownership boundaries in large forested landscapes.

Volunteer, citizen-based regional forest resource committees are central to carrying out the general planning process. Within each landscape region, committees of citizens and representatives of various organizations work to:

- Gather and assess information on a region's current and future ecological, economic, and social characteristics
- Use information about a region to identify that region's key forest resource issues
- Plan ways to address key issues in order to promote sustainable forest management within the region
- Coordinate various forest management activities and plans among a region's forest landowners and managers in order to promote sustainable forest management

The MFRC Northeast, North Central, and Northern Regional Landscapes encompass portions of the North-4 Subsections. Recommended “desired outcomes, goals, and strategies” for these MFRC Landscapes have been completed. These recommendations will be considered and incorporated into the SFRMP process. This information will help the DNR make better decisions on DNR-administered lands and assist in cooperating with management in the larger landscape.

For more information on the MFRC landscape planning and coordination program, visit the MFRC Web site at: http://www.frc.state.mn.us/Landscp/Landscape.html.

Application of Statewide Plans and Guidelines

The DNR uses a variety of written vehicles (e.g., policies, guidelines, recommendations, memos, operational orders, agreements) to communicate direction to DNR staff on a range of forest management issues including old-growth forests, inter-divisional coordination, site-level mitigation, rare habitats and species, and accelerated management. Interdisciplinary and external involvement has varied in the development of these direction documents, as have the expectations for their implementation (i.e. must follow, follow in most cases, follow when possible). *Figure i* places a number of DNR direction documents within a defined policy hierarchy that clarifies decision authority and expected actions. This can serve as a useful reference for the public in understanding the array of forest management guidance available to staff and serve as a starting place for DNR staff to help provide more consistent application across the state.

Figure i

Grouping of DNR Direction Documents by 3-level Hierarchy

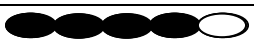
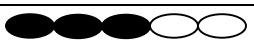
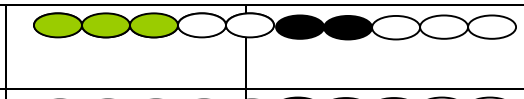
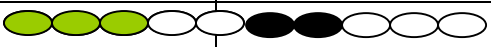
Nomenclature	Who Developed	Level of Review	Expectations	Departure Authority
Policies				
Old Growth Forest Guideline	DNR			No departures allowed
ERF Guideline	DNR			No departures allowed
Forest/Wildlife Coordination Policy	DNR			No departures allowed
WMA Policy	Wildlife			Region - Interdisciplinary
SNA Est. & Admin. Op. Order	Eco Resources			No departures allowed
MFRC Site-Level Guidelines	MFRC			Field appraiser w/ documentation
ID and Mgmt of EILC	CO/FRIT			Region - Interdisciplinary
Guidelines				
Rare Species Guides	Eco Resources			Known locations: Area ID Otherwise: field appraiser w/ doc.
Covertype Mgmt. Recommendations	SFRMP Teams			Field appraiser w/ documentation
NE Region Wood Turtle	NE Region (For, Wild, Trails)			Region - Interdisciplinary
Decorative Tree Harvest Guidelines	Forestry			Area - Interdisciplinary
Accelerated Management	Forestry			Area - Interdisciplinary
Gypsy Moth Mgmt. Guidelines	Forestry/Dept. of Agr.			Field appraiser w/ documentation
For/Wild Habitat Guidelines	Wildlife/Forestry			Area - Interdisciplinary
Integrated Pest Management	Forestry			Field appraiser w/ documentation
Silvicultural Mgrs. Handbooks	NCES, Forestry			Field appraiser w/ documentation
NE R. Grouse Mgmt. Areas	Wildlife			Area - Interdisciplinary

Figure i (continued)

Recommendations			
Goshawk Considerations	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use
MCBS H/O Biodiversity	Eco Resources		Consider if site conditions differ from FIM
ECS Field Guide Interps.	Eco Resources/Forestry		Field appraiser w/ documentation
MCBS Rare NPC	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use
Red-Shouldered Hawk	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use
Four-toed Salamander	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use
Black-throated Blue warblers	Eco Resources		Document use
Seasonal ponds	Eco Resources		Document use
Boreal owl guidelines	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use
Botrychium guidelines	Eco Resources		Known locations: Area - Interdisciplinary Otherwise, document use

KEY	
	Must follow; no departures
	Expected to follow; documented & approved departures OK
	Expected to follow to the degree possible
	Recommended in usual circumstances; departures OK based on site conditions
	Recommended when opportunities and conditions suitable
	Incorporate if possible
	Broad external technical & public
	Broad public/stakeholder
	Limited public/stakeholder
	Department ID review
	Local ID team review
	Division review w/ peer technical input
	Division review

The following sections highlight several of the more prominent direction documents and their relation to the SFRMP process.

1. DNR Strategic Conservation Agenda 2003–2007 and DNR Directions 2000.
The department's strategic planning documents, *DNR Strategic Conservation Agenda 2003–2007* and *DNR Directions 2000*, provide broad goals, strategies, and performance indicators for forest resources in Minnesota (see DNR Directions 2000, Forest Resources Section in Appendix A and DNR Strategic Conservation Agenda, Forests Section at *http://www.dnr.state.mn.us/conservationagenda/index.html)*. This broad statewide direction will be used as a platform from which to develop additional complementary/supplemental goals and strategies specific to each subsection.

2. Old-Growth Forest Guidelines
The 1994 DNR Old-Growth Forest Guideline was developed via a stakeholder involvement process that led to consensus on old-growth forest goals by forest type by ECS subsection for DNR lands. Following the completion of the guideline, the DNR undertook and completed an old-growth nomination, evaluation and designation process for DNR lands. The latest information on old-growth forest policy and results can be found at *http://www.dnr.state.mn.us/forests/oldgrowth/policy.html*.

Old-growth stand designation has been completed statewide and additional old-growth designation is not part of the SFRMP process. The primary significance of old growth in the SFRMP process is determining how DNR forest stands adjacent to and connecting adjacent old growth stands will be managed (e.g., as extended rotation forests, part of large patches, scheduling of harvest, conversion to other forest types, etc.). If not done prior to the SFRMP process, old forest management complexes (see Old-Growth Guideline Amendment #5) will be identified in conjunction with the SFRMP process.

3. Extended Rotation Forest Guideline
The 1994 DNR Extended Rotation Forest (ERF) Guideline was developed through a previous public and stakeholder input process. The primary purpose of the ERF Guideline is to provide adequate acreages of forest older than its normal rotation age to provide for species and ecological processes requiring older forests. During the SFRMP process, the ERF Guideline is to be applied to landscapes by designating particular areas of forest or stands for ERF management. An area designated for ERF management will include all cover types and age classes within that designated ERF area.

Normal rotation ages will be established for each forest type managed primarily under even-aged silvicultural systems within the subsection based on site-quality characteristics related primarily to timber production (e.g., site index, growth rates, soils, insect and diseases, etc.). Maximum rotation ages for these forest types will also be established based on the maximum age at which a stand will retain its biological ability to regenerate to the same forest type and remain commercially viable as a marketable timber sale. Final harvest of an ERF stand will occur sometime between the normal rotation age for the cover type and the maximum rotation age. A forest

stand is considered to be old forest whenever its age exceeds the normal rotation age for that cover type and is considered "effective ERF."

According to the statewide ERF Guideline, a minimum of 10 percent of the DNR Forestry- and Wildlife-administered timberlands within a subsection are to be managed as ERF. No maximum amount is identified in the guideline, although the guideline states it may be appropriate to designate 50 percent or more of DNR timberlands as ERF in some subsections. Determining the amount of DNR timberlands to be managed as ERF within each subsection involves consideration of wildlife habitat needs, visual and riparian corridors, and implications for timber production (both quantity and quality). The condition and future management of other forest lands in the subsection (i.e., other DNR and non-DNR lands) are considered to the extent possible in determining the amount of designated ERF on DNR timberlands.

4. Minnesota Forest Resource Council's (MFRC) Voluntary Site-level Forest Management Guidelines

The MFRC's *Voluntary Site-Level Forest Management Guideline*s establish integrated forest resource management practices intended to provide cultural resource, soil productivity, riparian, visual, water quality, wetlands, and wildlife habitat protections in a balanced approach. These guidelines were developed through a collaborative statewide effort and received extensive input during development from stakeholders, DNR staff, and other agency staff. The DNR adopted and strongly endorses the *Voluntary Site-Level Forest Management Guidelines* developed through that collaborative process. These guidelines are the standard in managing DNR lands, i.e., they are not voluntary on DNR-administered lands. As the department standard, departures from the guidelines will not be proposed in SFRMPs for entire subsections or geographic areas within subsections. There is flexibility and various options are available in application of the guidelines, but departures from the guideline standards need to be documented on a site-by-site basis. If departures above or below guideline recommendations (e.g., recommended minimums for riparian management zone [RMZ] width and residual basal area in the RMZ) are made, they will be documented during the timber sale appraisal and forest development processes.

5. DNR Forest-Wildlife Habitat Management Guidelines

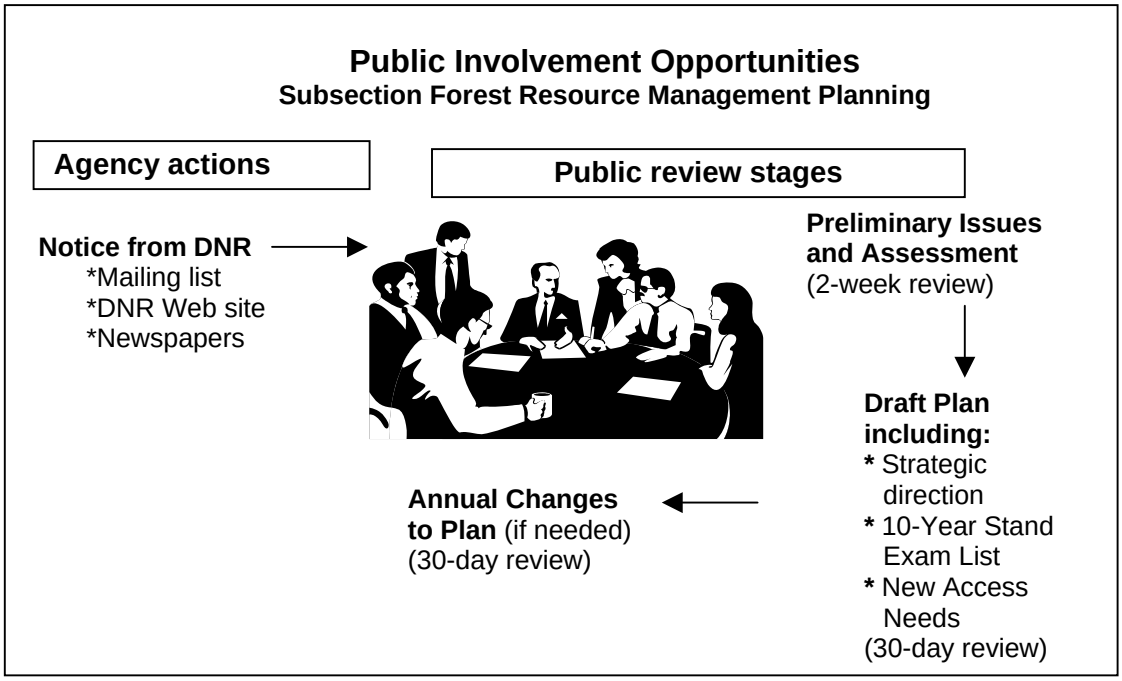
DNR forest-wildlife habitat management guidelines provide direction to DNR wildlife and forestry staff for integrated management on state-administered lands. The guidelines were last revised in 1985. As such, some portions of the guidelines are out-of-date. Some areas of the guideline overlap with the MFRC site-level forest management guidelines. MFRC site-level guidelines will prevail when they overlap with DNR forest-wildlife habitat management guidelines. Species-specific sections of the guidelines that are still considered current are relevant in the SFRMP process in determining management around known species locations (i.e., eagles nests) or in the management of areas for particular types of habitat (e.g., open landscapes, ruffed grouse management areas, deer yards, etc.).

6. DNR Forestry/Wildlife/Ecological Resources Coordination Policy

DNR Forestry/Wildlife/Ecological Resources Coordination Policy is currently in the process of being revised. Following revision of the coordination policy, the forest wildlife habitat management guidelines will be reviewed and updated as needed.

Public Involvement

Figure ii



Public involvement will, at a minimum, occur through:

- Distribution of the initial assessment information (mailings and Web site).
- A public comment period to help identify key forest management issues and solicit public opinion of preferred management direction.
- A public comment period to review the draft plan and strategic direction (i.e., general direction, forest management strategies, and desired future forest conditions (DFFCs) proposed by the DNR to address identified issues) along with the 10-year list of stands proposed for treatment and associated new access needs.
- Public review and comment on proposed plan revisions.

SFRMP planning documents will be available at DNR area forestry offices, selected public locations, and the DNR Web site
www.dnr.state.mn.us/forestry/subsection/north_4/assessment.html
Summary information will be available upon request.

Looking Toward the Future

While the initial focus of SFRMPs is on forest composition and vegetation management, the intention is for its scope to broaden in the future. Changes in this direction will likely be incremental as the process becomes more familiar to DNR staff

and the public. The likely progression in future years will be to include other aspects of forest land management on DNR lands (e.g., recreation facilities/systems, land acquisition/sales) and other DNR Forestry programs including private forest management and fire management. A subsequent step may be to include lands administered by other units of DNR (i.e., Fisheries, Parks, etc.), making this a department-wide plan that is not limited to Forestry, Wildlife, and Trails and Waterways land.

SFRMP Process Table

The North-4 Subsections team is in the initial stages of the SFRMP process. The team has developed the preliminary issues and assessment information and is now requesting public input, the first of three such opportunities in the SFRMP process.

Table i Public Involvement and Process Timelines

Subsection Forest Resource Management Planning Steps	Public Notification/Participation	Public Comment Period	Length of Step†
I. Preparation to Begin the Planning Process • Assemble initial assessment information and data sets. • Designate team and facilitator, and conduct team training.	• DNR develops mailing list of public/ stakeholders. • Establish web-site for subsection.	n/a	Complete prior to official start of process
II. Assessment and Issue Identification ***(CURRENT STAGE)***	• Inform the public of planning efforts, schedule, and how and when they can be involved. • Mail Assessment and Issues Summary to mailing list. • Provide complete maps and documents in key locations and on Web/CD.	2 Weeks	60 days
III. Develop Draft Plan a. Strategic Direction (GDSs, Strategies, DFFCs to address issues and Stand Selection Criteria) **b.** Draft Stand Examination List and New Access Needs	• Mail summary to mailing list. • Provide complete maps and documents in key locations and on Web/CD. • Identify SFRMP contacts for questions. • Offer meetings by appointment	30 days	225 days (7½ months)
IV. Finalize Plan • Planners summarize public comments and DNR responses. • Present revised plan to Department for Commissioner's approval. • Commissioner approves final plan & posts written notice in state register.	• Inform public of final plan. • Provide summary of public comments and how DNR responded. • Provide final plans in key locations and on Web/CD and in. • Mail plan summaries to mailing list.	None	75 days
Total*			360 days (12 months)

† Time frames for process steps include public review/comment period

Issue Identification

One of the first steps in the SFRMP process is to identify issues that the plans will address. SFRMP teams will use assessment information; local knowledge; existing plans, policies, and guidelines; and public input to help identify issues relevant to the scope of the plans. Subsection teams will begin with the common set of issues developed from previous SFRMP plans. These common SFRMP issues will then be refined and supplemented based on subsection-specific conditions and considerations.

What Is an SFRMP Issue?

A SFRMP issue is a natural resource-related concern or conflict that is directly affected by, or directly affects, decisions about the management of vegetation on lands administered by the Minnesota DNR Division of Forestry and Division of Fish and Wildlife. Relevant issues will likely be defined by current, anticipated, or desired forest vegetation conditions and trends, threats to forest vegetation, and vegetation management opportunities. The key factor in determining the importance of issues for SFRMP will be whether the issue can be addressed in whole or substantial part by vegetation management decisions on DNR-administered lands.

What Is Not a SFRMP Issue?

Issues that cannot be addressed in whole or substantial part by vegetation management decisions on DNR-administered lands are outside the scope of the SFRMP process. For example, SFRMP will not address recreation trails system issues or planning. However, aesthetic concerns along existing recreational trail corridors can be a consideration in determining forest stand management direction in these areas. Another example is wildlife populations; the plan will establish wildlife habitat goals but not goals for wildlife population levels.

Each issue needs to consider four pieces of information:

- What is the issue?
- Why is this an issue? (i.e., What is the specific threat, opportunity or concern?)
- What are the likely consequences of not addressing this issue?
- How can this is sue be addressed b y vegetation m anagement decisions on DNR-administered lands?

Public Review

The assessment document and preliminary issues for the subsection will be distributed for a two-week public review and comment period. The assessment will be available at DNR area offices and selected public libraries in the subsection, as well as electronically through the DNR Web site. There are no public open houses for this step in the process.

After public review, the subsection team will finalize the list of issues by considering public comments. The final list of issues will be made available on the SFRMP Web site and included in the public review draft of the DFFC, Strategies, and Stand-Selection Criteria document.

The following pages contain the preliminary issues identified by the subsection team. These issues were developed based on the common issues from previous SFRMP

plans, general field knowledge of department staff, and by reviewing forest resource information for the subsections. The next step of the SFRMP process will determine how vegetation management on DNR-administered lands will address these issues. Comments on the preliminary issues and identification of additional issues by the public are welcome.

Preliminary Issues

The North-4 Subsections team has begun identifying important issues in these subsections that should guide forest planning. A preliminary issues list was developed to stimulate thought on issues that may impact forest planning in these four subsections. The team is asking four critical questions for each of the issues it identified:

1) What is the issue?
2) Why is it an issue?
3) How might DNR vegetation management address the issue?
4) What are possible consequences for not addressing the issue?

This plan will provide guidance for forest management on state lands for the next 10 years and establish goals for the next 50 to 100 years. The North-4 Subsections team is looking for additional issues that affect our forests and could be mitigated or avoided by forest planning and vegetation management. The team invites the public to submit issues and comment on those that follow, and requests that issues be submitted following the same format and addressing the same four questions listed above. A form on which to submit issues and amend those already outlined is located on the Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north-4subsections/assessment.html.
It is available upon request from the North-4 Subsections Forest Planner:

North-4 Subsections Forest Planner
DNR Forestry
1200 Minnesota Avenue South
Aitkin, MN 56431
Phone: (218) 927-7511
Email: lynn.mizner@dnr.state.mn.us

See cover letter or Web site for comment deadline!!

Preliminary Issues

A. How should the age classes of forest types be represented across the landscape?

- **Why is this an issue?**

Representation of all age classes and growth stages, including old-forest types, provides a variety of wildlife habitats, timber products, and ecological values over time.

- **How might DNR vegetation management address this issue?**

Vegetation management can provide for a balance of all forest types and age classes.

- **What are possible consequences of not addressing this issue?**

A forest without representation of all age classes and growth stages exposes itself to increased insect and disease problems, loss of species with age-specific habitat requirements, and loss of forest-wide diversity. Such a forest would also provide a boom-and-bust scenario for forest industries that depend on an even supply of forest products.

- **Other considerations?**

What other factors ought to be considered with this issue?

B. In your opinion, what are appropriate mixes of vegetation composition, structure, spatial arrangement, growth stages, and plant community distribution on state lands across the landscape?

- **Why is this an issue?**
  These subsections have experienced decreased ecological diversity over time. Since European settlement, forest composition and structure have been simplified, e.g., mature, diverse pine stands were harvested and replaced by early sucessional and less diverse forest types such as aspen, birch, and jack pine. Certain important component tree species and forested communities have declined, such as paper birch, mixed pine, lowland conifers, and jack pine. Existing landscape patterns do not reflect natural disturbance patterns and the composition, structure, and function of native plant community complexes that developed historically over long periods of time. Current vegetation management often does not replicate the characteristics of natural disturbance events. Forest fragmentation results in a loss of ecologically intact landscapes as forests are converted to other uses, e.g., residential development.

- **How might DNR vegetation management address this issue?**
  DNR can develop vegetation management strategies that produce effects similar to natural disturbances and can begin to restore certain species and conditions that were once more prevalent.

- **What are possible consequences of not addressing this issue?**
1) Loss of wildlife habitat and associated species; 2) increase in invasive exotics; 3) loss of biodiversity; 4) simplification of stand and landscape communities; 5) loss of ecologically intact landscapes; and 6) loss of the ability to produce a diversity of forest products, e.g., saw timber, balsam boughs and other nontimber products, and tourism.

- **Other considerations?**
What other factors ought to be considered with this issue?

C. How can we address the impacts of forest management on riparian and aquatic areas?

• Why is this an issue?
Riparian areas are critical to fish, wildlife, and certain forest resources.

• How might DNR vegetation management address this issue?
The Minnesota Forest Resources Council (MFRC) site-level guidelines are the DNR's standard for vegetation management in riparian areas. At the site level, managers may want to exceed those guidelines. When planning vegetation management adjacent to aquatic and riparian areas, managers can consider specific conditions associated with each site such as soils, hydrology, desired vegetation, and consider enhancements to the MFRC guidelines.

• What are possible consequences of not addressing this issue?
Failure to consider vegetation management that affects riparian and aquatic areas could result in increased run-off and erosion; more conspicuous run-off events; less stable stream flows; and negative impacts to water quality, fisheries, and wildlife habitat.

• Other considerations?
What other factors ought to be considered with this issue?

D. How can DNR develop new forest management access routes that minimize damage to other forest resources?

• Why is this an issue?
Routes are necessary to access forest stands identified for management during the 10-year planning period. These routes provide access for a variety of forest management activities and recreation. Negative impacts include costs, land disturbance, losses to the timberland base, increased spread of invasive exotic species, potential for user-developed trails, and habitat fragmentation.

• How might DNR vegetation management address this issue?
Using existing access routes or closing access routes after forest management activities have been completed might meet needs while minimizing negative impacts.

• What are possible consequences of not addressing this issue?
Not planning for access needs could result in unfulfilled management goals; poorly located access routes; negative impacts on wildlife habitat; and excessive costs for development, maintenance, and road closure.

• Other considerations?
What other factors ought to be considered with this issue?

E. How might we maintain or enhance biodiversity, native plant community composition, and retain within-stand structural complexity on actively managed stands where natural succession pathways are cut short?

- **Why is this an issue?**

Areas of biodiversity significance provide reference areas to help us evaluate the effects of management on biodiversity. Forest management has altered the rate and direction of natural change. Some current practices tend to reduce within-stand structural complexity and diversity of vegetation.

- **How might DNR vegetation management address this issue?**

DNR will incorporate management techniques that maintain or enhance biological diversity and structural complexity into vegetation management plans. The Minnesota Forest Resources Council, which was established by the Minnesota Sustainable Forest Resources Act, is mandated to "encourage appropriate mixes of forest cover types and age classes within landscapes to promote biological diversity and viable forest-dependent fish and wildlife habitats."

- **What are possible consequences of not addressing this issue?**

1) Degradation of existing biodiversity and ecosystem function; 2) fewer opportunities for maintaining or restoring ecological relationships; 3) reduction of species associated with declining habitat; and 4) social and economic losses resulting from a decline in recreational activity associated with wildlife viewing and hunting.

- **Other considerations?**

What other factors ought to be considered with this issue?

F. How might we provide habitat for all wildlife and plant species and maintain opportunities for hunting, trapping, and nature observation?

• **Why is this an issue?**
Forest wildlife species are important to society. A wide range of factors, from timber harvest to development, influences wildlife species and populations.

• **How might DNR vegetation management address this issue?**
DNR can select vegetation management techniques that provide a variety of wildlife habitats.

• **What are possible consequences of not addressing this issue?**
1) Reduction of some types of wildlife habitat; 2) reductions of species associated with declining habitats; and 3) economic and social losses resulting from a decline in recreational activity associated with wildlife viewing, hunting, and aesthetics.

• **Other considerations?**
What other factors ought to be considered with this issue?

G. How might we address the impacts on forest ecosystems from forest insects and disease, invasive species, nuisance animals, herbivory, global climate change, and natural disturbances such as fires and blowdowns?

- **Why is this an issue?**

All of the above-mentioned processes can impact the amount of forest land harvested and regenerated during the 10-year planning period. They can also influence the long-term desired future forest composition (DFFC) goals of the subsection plans.

- **How might DNR vegetation management address this issue?**

DNR can design flexibility into the plan to deal with specific stands that are affected by these processes.

- **What are possible consequences of not addressing this issue?**

1) Reduced timber volume and recreational enjoyment of the forest; 2) long-lasting change to native plant and animal communities; and 3) increased fire danger.

- **Other considerations?**

What other factors ought to be considered with this issue?

H. What are sustainable levels of harvest for timber and nontimber forest products?

- **Why is this an issue?**

Some cover types have pronounced age-class imbalances. Demand for nontimber forest products, e.g., balsam boughs and decorative trees, have been increasing.

- **How might DNR vegetation management address this issue?**

The DNR can develop a 10-year harvest plan for state lands in these subsections that promotes a balance of all age classes for all cover types and propose regulations to protect some nontimber species.

- **What are possible consequences of not addressing this issue?**

1) Possible unsustainable harvest of these resources; 2) adverse impact to wildlife habitat and native plant communities; and 3) unintended harvest of rare species.

- **Other considerations?**

What other factors ought to be considered with this issue?

I. How can we increase the quantity and quality of timber products on state lands?

• Why is this an issue?
The demand for timber has increased, while demand for other forest values has also increased. Minnesota's forest industry requires a sustainable and predictable supply of wood.

• How might DNR vegetation management address this issue?
Vegetation management planning can identify forest stands for treatments that will increase timber productivity (e.g., harvesting at desired rotation ages, thinning, control of competing vegetation, and reforestation to desired species and stocking levels).

• What are possible consequences of not addressing this issue?
A less-predictable or unsustainable supply of timber would be available for logging and the forest products industry, likely resulting in higher procurement, chemical, and waste management costs. Alternatively, wood and wood product imports might increase from countries that have fewer environmental controls, effectively exporting U.S. environmental issues.

• Other considerations?
What other factors ought to be considered with this issue?

J. How can we implement forest management activities and minimize impacts on visual quality?

- **Why is this an issue?**

Scenic beauty is the primary reason people choose to live or use their recreation and vacation time in or near forested areas.

- **How might DNR vegetation management address this issue?**

DNR managers will continue to follow Best Management Practices (BMPs) for visual quality and identify areas that may need additional mitigation strategies**.**

- **What are possible consequences of not addressing this issue?**

Not addressing this issue may result in a negative experience for the public living, vacationing, and recreating in our forests.

- **Other considerations?**

What other factors ought to be considered with this issue?

K. How will land managers achieve desired results and continue to uphold various state and federal statutes?

- **Why is this an issue?**

Divisions within the DNR must follow legal mandates, while fulfilling both department and division missions. For example, State Trust Fund lands must generate income for various trust accounts under state law, and timber sales are currently the primary tool for this process. Wildlife habitat management and preservation, not timber sales, is the mandate for acquired Wildlife Management Area (WMA) lands.

- **How might DNR vegetation management address this issue?**

Vegetation management will take administrative land status and relevant statutes into consideration during the planning process.

- **What are possible consequences of not addressing this issue?**

Failure to follow these mandates and legislative intent may be a violation of federal or state law.

- **Other considerations?**

What other factors ought to be considered with this issue?

L. How will cultural resources be protected during forest management activities on state- administered lands?

- **Why is this an issue?**

Cultural resource sites possess spiritual, traditional, scientific, and educational values. Some types of sites are protected by federal and state statutes.

- **How might DNR vegetation management address this issue?**

DNR managers will continue to have all vegetation management projects reviewed for known cultural resources. They will survey unidentified sites and if cultural resources are found, modify the project to protect the resource. If cultural resources are discovered during a project, the project will be modified to protect the resource.

- **What are possible consequences of not addressing this issue?**

Loss or damage to cultural resources.

- **Other considerations?**

What other factors ought to be considered with this issue?

M. How can we ensure that rare plants and animals, their habitats, and other rare features are protected in these subsections?

- **Why is this an issue?**

Protecting rare features (endangered, threatened, and special concern species) is a key component of ensuring species, community, and forest-level biodiversity in these subsections.

- **How might DNR vegetation management address this issue?**

The Minnesota County Biological Survey (MCBS) has been completed in some counties, is in progress in other counties, and has not started in a few counties within the two subsections. DNR managers will check the Rare Features Database for the location of known rare features in these two subsections. The needs of rare features will be addressed in the management plan.

- **What are possible consequences of not addressing this issue?**

1) Loss of rare species at the local and state level; 2) rare species declines leading to status changes; 3) rare habitat loss or degradation; and 4) loss of biodiversity at the species, community, and/or landscape level.

- **Other considerations?**

What other factors ought to be considered with this issue?

C H A P T E R 1

Land Use and Cover

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands

1.1 … Land Use and Cover
Chart 1.1 slm
Chart 1.1 tl
Chart 1.1 nu
Chart 1.1 lvu

1.2 … GAP Analysis
Table 1.2 North-4 Subsections
Map 1.2 North-4 Subsections

How graphics are labeled:

Graphics (i.e., Tables, Charts, and Maps) referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

Graphics referring to the St. Louis Moraines Subsection only are indicated by a "slm" after each chart designation (e.g., Chart 3.2 slm).

Graphics referring to the Tamarack Lowlands Subsection only are indicated by a "tl" after each chart designation (e.g., Map 3.2 tl).

Graphics referring to the Nashwauk Uplands Subsection only are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands Subsection only are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands ("North-4") Subsection Forest Resource Management Plan (SFRMP) Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

Maps in this chapter depict information for an area within a " planning boundary." This boundary closely approximates the subsection(s) while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

Printed documents will be available for review at the Minnesota DNR Grand Rapids Region Headquarters at 1201 E Hwy 2, Grand Rapids, Minnesota, and on compact disk by request.

1.1 Land Use and Cover

Chart 1.1 slm

St Louis Moraines

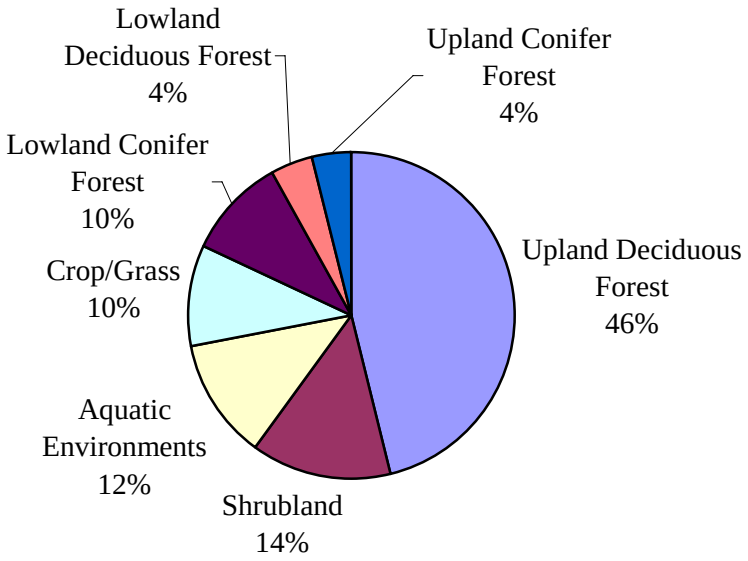


Chart 1.1 tl

Tamarack Lowlands

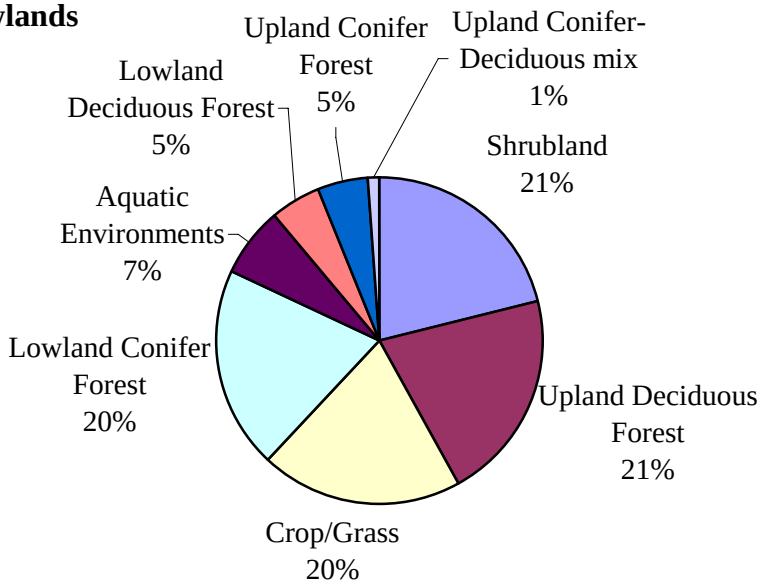


Chart 1.1 nu

Nashwauk Uplands

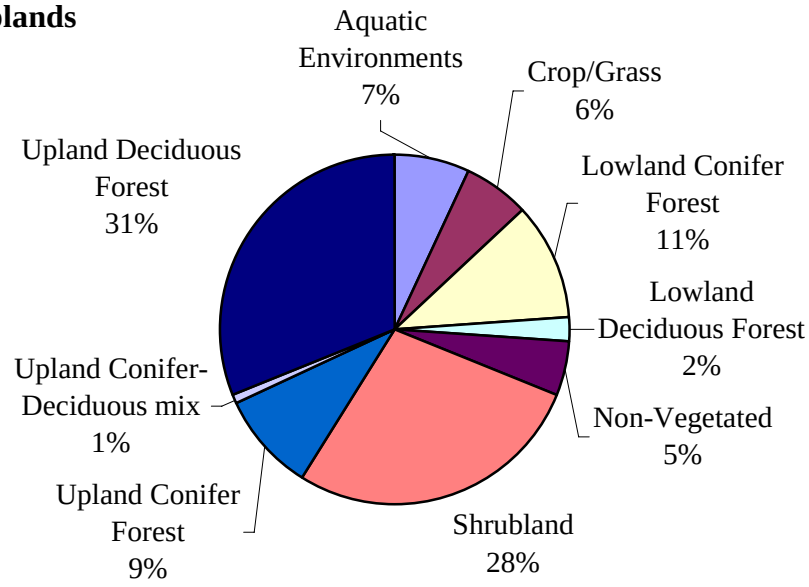
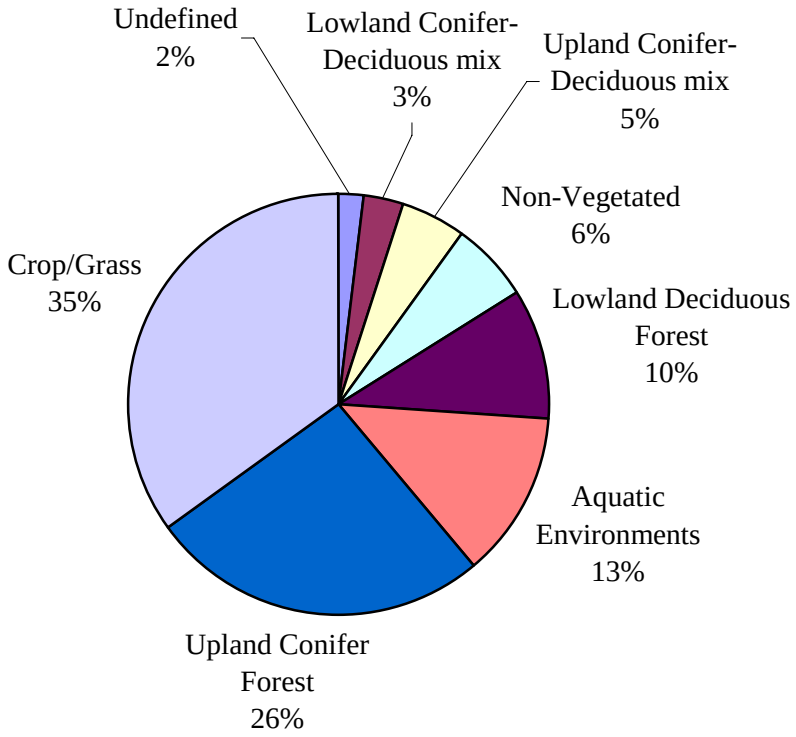


Chart 1.1 lvu

Littlefork-Vermilion Uplands



Land Use and Cover Classification Descriptions

Forested: Areas with at least two-thirds of the total canopy cover composed of deciduous forest, coniferous forest, or mixed deciduous/conifer forest. Forest stands may be either natural origin or planted.

Cultivated land: Areas under intensive cropping or rotation, fallow fields, and fields seeded with forage and cover crops. Fields exhibit linear or other patterns associated with current or recent tillage.

Hay/pasture/grassland: Areas covered by grasslands and herbaceous plants. May contain up to one-third shrubs and/or tree cover. Areas range in size (small to extensive) and shape (regular to irregular). These areas often exist between agricultural land and more heavily wooded areas, and along rights-of-way and drains. Some areas may be used as pastures or mowed or grazed, and range in appearance from smooth to mottled. Included are fields that show evidence of past tillage but are retired and planted to a cover crop or appear abandoned and occupied by native vegetation.

Water: Areas of permanent water bodies—such as lakes, rivers, reservoirs, stock ponds, ditches, and permanent and intermittently exposed palustrine (marshy) open water areas—where photo evidence indicates that water covers the area most of the time.

Urban-rural development: Areas that are used for urban and industrial purposes (e.g., cities).

Bog/marsh/fen: Peat-covered or peat-filled depressions with a high water table. Bogs are carpeted with sphagnum moss and ericaceous (heath) shrubs and may be treeless or tree-covered with black spruce and/or tamarack. Bogs, marshes, and fens may be grassy and contain standing or slowly moving water. Vegetation consists of grass, sedge sods, or common hydrophytic (i.e., water-loving) vegetation such as cattail and rushes. Areas are often interspersed with channels or pools of open water.

Brushland: Areas with combinations of grass, shrubs, and trees in which deciduous and/or coniferous tree cover comprises one-third to two-thirds of the area, and/or the shrub cover comprises more than one-third of the area. This complex often exists next to grassland or forested areas but may be found alone. Brushland areas vary in shape (i.e., irregular) and size.

Mining: Areas stripped of topsoil revealing exposed substrate such as sand/gravel. Included are gravel quarry operations, mine tailings, borrow pits, rock quarries, and natural beaches/sand dunes.

Source: *Land-cover data set derived from classified 30-meter resolution Thematic Mapper satellite imagery. Landsat images between 1991 and 1996 were classified by Manitoba Remote Sensing Centre. Detailed metadata can be found at the Interagency Information Cooperative's Web site at: http://iic.gis.umn.edu/*

Color maps found in this document may be viewed as PDF files on the North-4 Subsections Forest Resource Management Plan (SFRMP) Web site at: http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

1.2 GAP Classification of the North-4 Subsections

What Is a GAP Classification?
The Gap Analysis Program (GAP) was project sponsored and coordinated by the Biological Resources Division of the U.S. Geological Survey. The Minnesota DNR participated in this nationwide project. Coordination of GAP activities with neighboring states is done to ensure the development of regionally compatible information.

The GAP Web site defines the project as "… a scientific method for identifying the degree to which native animal species and natural communities are represented in our present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation 'gaps.'" The purpose of GAP is to provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists, and policy makers with the information they need to make better-informed decisions. Further information is available at www.gap.uidaho.edu/default.htm.

The basic statewide geographic information systems (GIS) datasets of GAP include land cover, distributions of native vertebrate species, major land-ownership patterns, and land management. Gap analysis is conducted by overlaying vegetation and species richness maps with ownership and management maps so that gaps in the management for biodiversity can be identified. The data layers are developed, displayed, and analyzed using GIS techniques.

Land-Cover Classification
The GAP classification of current vegetation (land cover map), which is a part of the larger project, was produced by computer classification of satellite imagery (Landsat 5 Thematic Mapper imagery [draft} by the Resource Assessment Unit of the DNR Division of Forestry. Units of analysis are divided by Ecological Classification System (ECS) subsections. The minimum mapping unit is one acre.

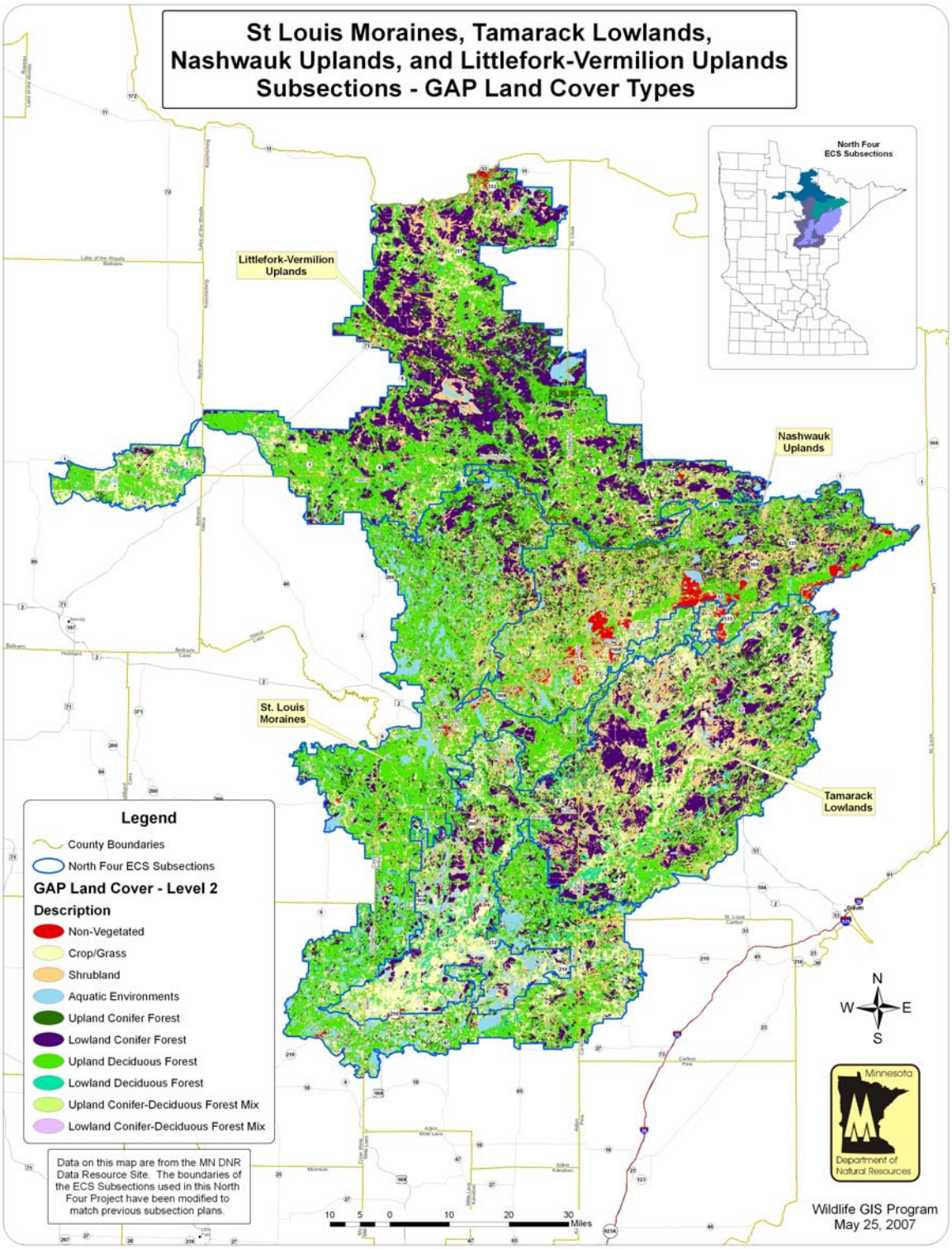
The following table and map show the GAP land-cover classification of the subsections in this plan.

Table 1.2 North-4 Subsections GAP Covertype Acres and Percentages

North-4 Subsections GAP Covertypes		
Cover Type	Acres	Percent[1]
Unknown	13	<1
Aquatic Environments	430,824	8
Crop/Grass	654,209	11
Lowland Conifer Forest	967,200	17
Lowland Conifer-Deciduous mix	1,064	<1
Lowland Deciduous Forest	187,438	6
Non-Vegetated	97,262	2
Shrubland	992,123	21
Upland Conifer Forest	317,082	12
Upland Conifer-Deciduous mix	17,316	1
Upland Deciduous Forest	1,857,857	21
All Four Subsections Total	5,522,388	100

[1]Decimal percentages are rounded to the nearest one percent.

Map 1.2 GAP Land Cover Classification of the North-4 Subsections



C H A P T E R 2

Land Ownership and Administration

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsections

2.1 … Land Ownership

Table 2.1	*North-4 Subsections Land Ownership*
Chart 2.1 slm	*St. Louis Moraines Land Ownership*
Chart 2.1 tl	*Tamarack Lowlands Land Ownership*
Chart 2.1 nu	*Nashwauk Uplands Land Ownership*
Chart 2.1 lvu	*Littlefork-Vermilion Uplands Land Ownership*
Map 2.1	*North-4 Subsections Land Ownership*
Map 2.2	*North-4 Subsections Management Units*

Graphics (i.e., Tables, Charts, and Maps) referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

Graphics referring to the St. Louis Moraines Subsection *only* are indicated by a "slm" after each chart designation (e.g., Chart 3.2 slm).

Graphics referring to the Tamarack Lowlands Subsection *only* are indicated by a "tl" after each chart designation (e.g., Map 3.2 tl).

Graphics referring to the Nashwauk Uplands Subsection *only* are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands *only* are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsection Forest Resource Management Plan (SFRMP) Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

Maps in this chapter depict information for an area within a "planning boundary." This boundary is designed to closely approximate the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

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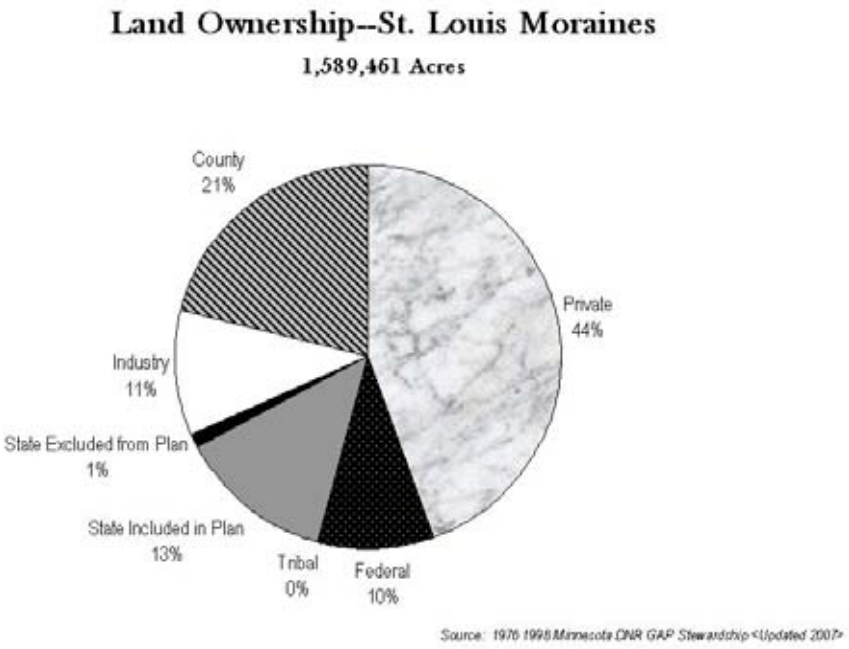
2.1 Land Ownership

Table 2.1 North-4 Subsections Land Ownership[1]

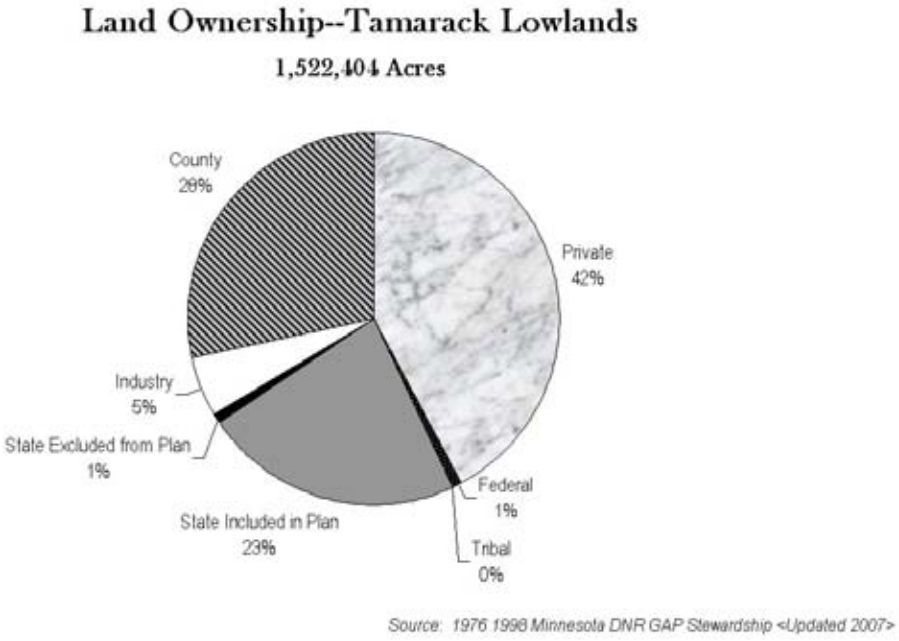
	St. Louis Moraines	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands	Four Subsections Total
Private	704,410	641,424	264,277	418,426	2,028,537
Federal	157,413	12,477	92,401	39,126	301,417
Tribal	627	113	0	54,279	55,019
State Included in Plan[2]	203,903	344,426	76,903	541,539	1,166,771
Forestry	196,010	293,776	76,864	540,704	1,107,354
Wildlife	7,813	47,096	39	835	55,783
Trails and Waterways	80	3,554	0	0	3,634
State Excluded from Plan	19,292	10,843	8,724	31,231	70,090
Industry	168,346	80,341	231,908	193,767	674,362
County	335,470	432,780	129,249	328,779	1,226,278
Total	1,589,461	1,522,404	803,462	1,607,147	5,522,474

[1]Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.
[2]SFRMP only covers DNR Divisions of Forestry, Trails and Waterways, and Fish and Wildlife –Wildlife Section - administered lands.

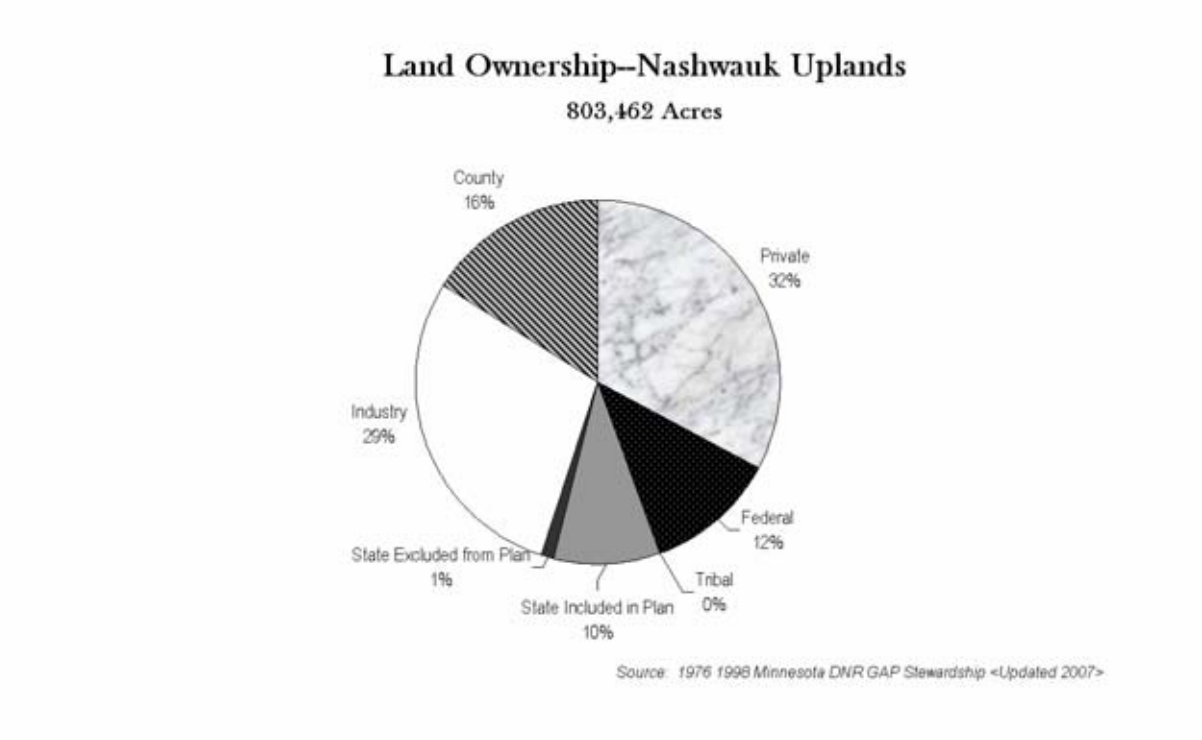
Chart 2.1slm St. Louis Moraines Land Ownership



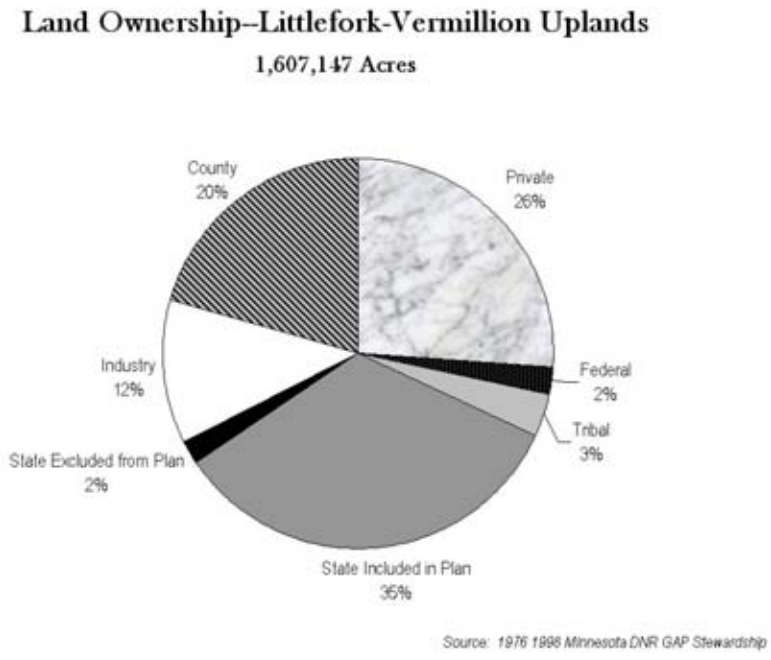
Map 2.1tl Tamarack Lowlands Land Ownership



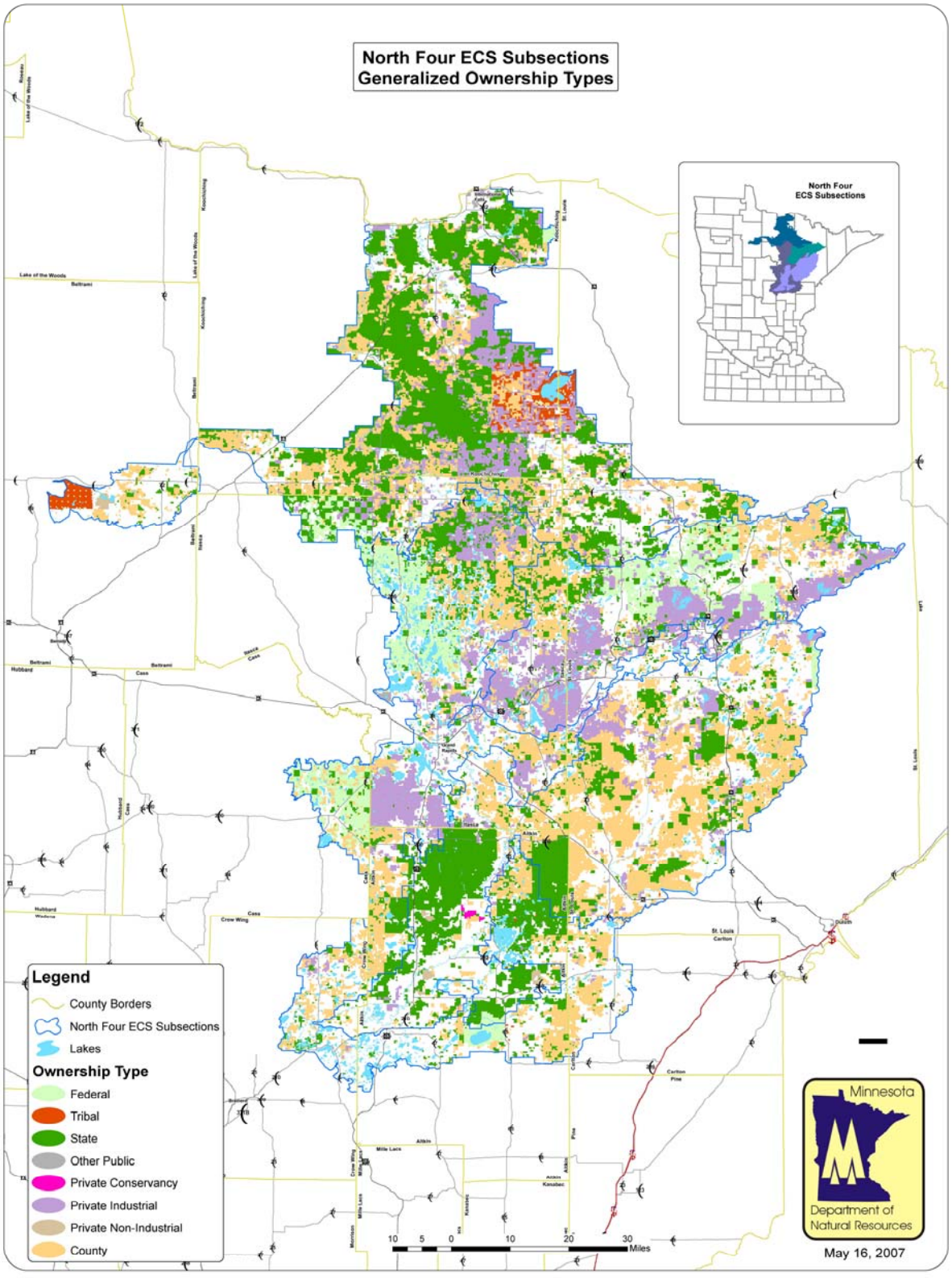
Map 2.1nu Nashwauk Uplands Land Ownership



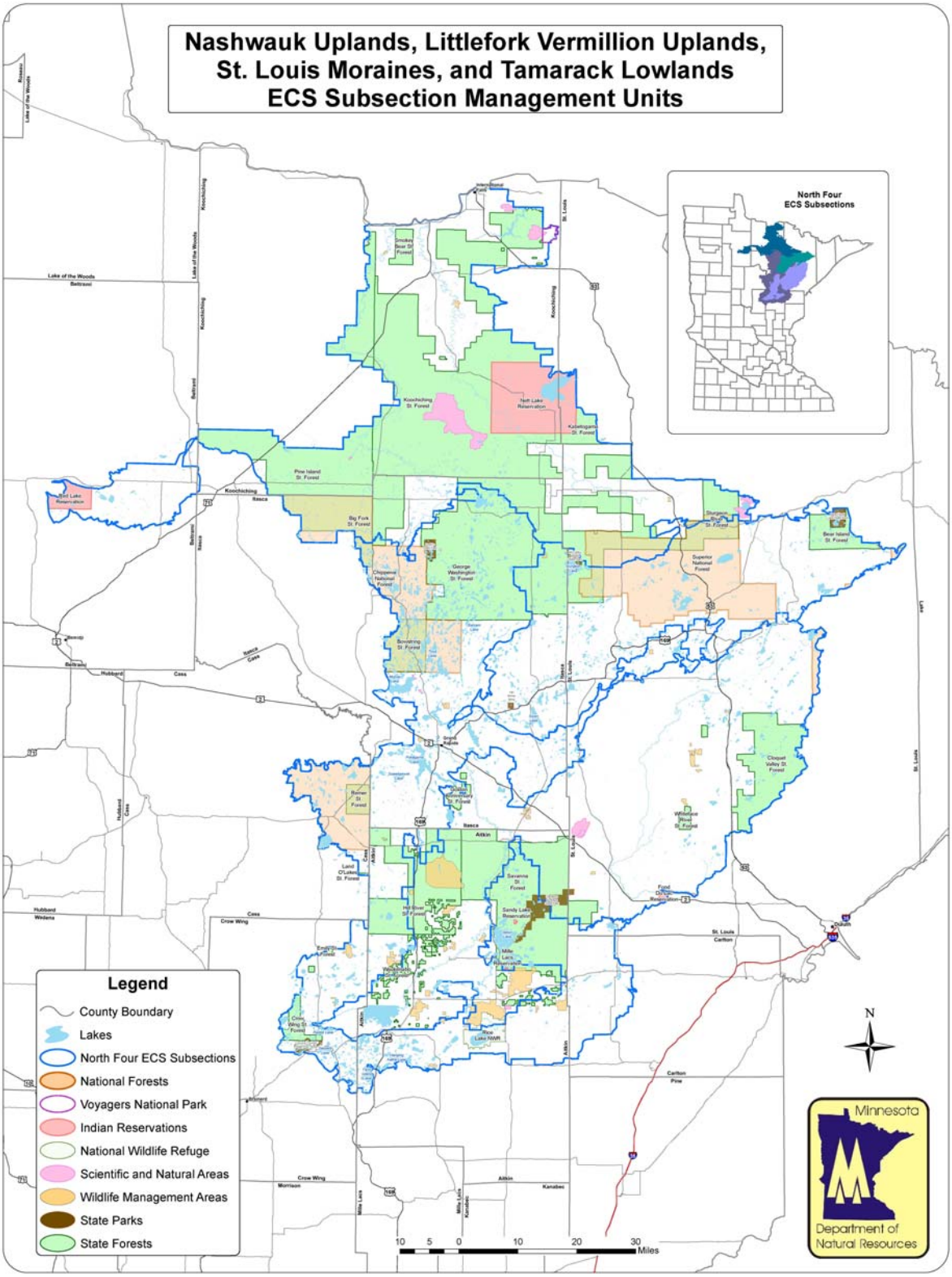
Map 2.1lvu Littlefork-Vermilion Uplands Land Ownership



Map 2.1 North-4 Subsections – Land Ownership



Map 2.2 North-4 Subsections – Management Units



C H A P T E R 3

Forest Composition and Structure

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsections

Part 1

3.1 … Forest Cover-Type Acres on State Land Administered by DNR Forestry, Trails and Waterways, Fish and Wildlife – Wildlife Section, -North-4 Subsections
Map 3.1 slm
Map 3.2 tl
Map 3.3 nu
Map 3.4 lvu
Table 3.1 North-4 Subsections

3.2 … Timberland Acres and Forest Cover-Type Age Classes—North-4 Subsections
Charts 3.2-1 through 3.2-15 North-4 Subsections

Part 2

3.3 … Old-Growth Forests
Tables 3.3-1 through 3.3-4 North-4 Subsections

3.4 … An Estimate of Historical Forest Composition Compared to Today's Forest
Table 3.4 North-4 Subsections

Graphics (i.e., Tables, Charts, and Maps) referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

Graphics referring to the St. Louis Moraines Subsection only are indicated by a "slm" after each chart designation (e.g., Chart 3.2 slm).

Graphics referring to the Tamarack Lowlands Subsection *only* are indicated by a "tl" after each chart designation (e.g., Map 3.2 tl).

Graphics referring to the Nashwauk Uplands Subsection *only* are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands *only* are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsection Forest Resource Management Plan (SFRMP) Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

Maps in this chapter depict information for an area within a "planning boundary." This boundary is designed to closely approximate the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

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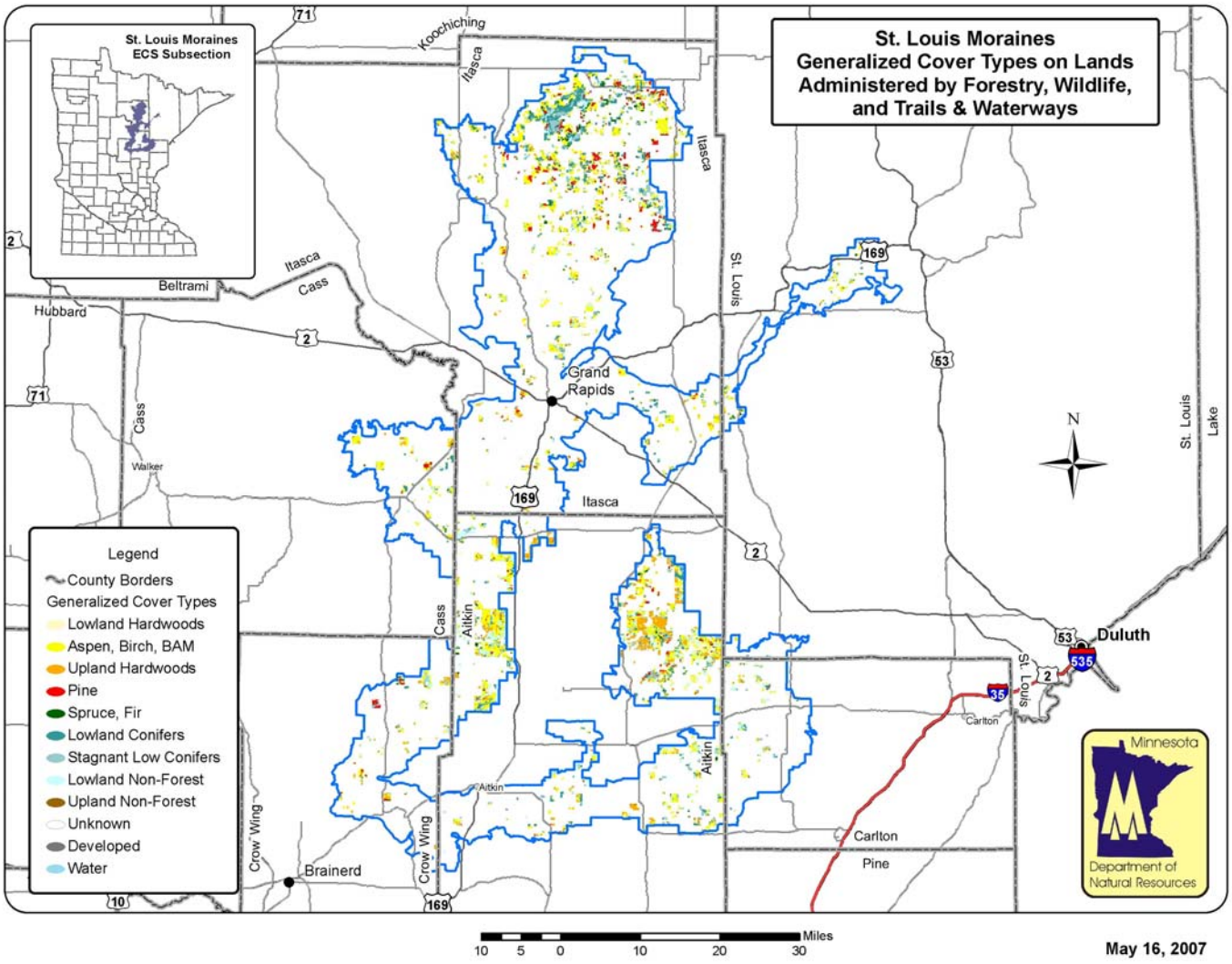
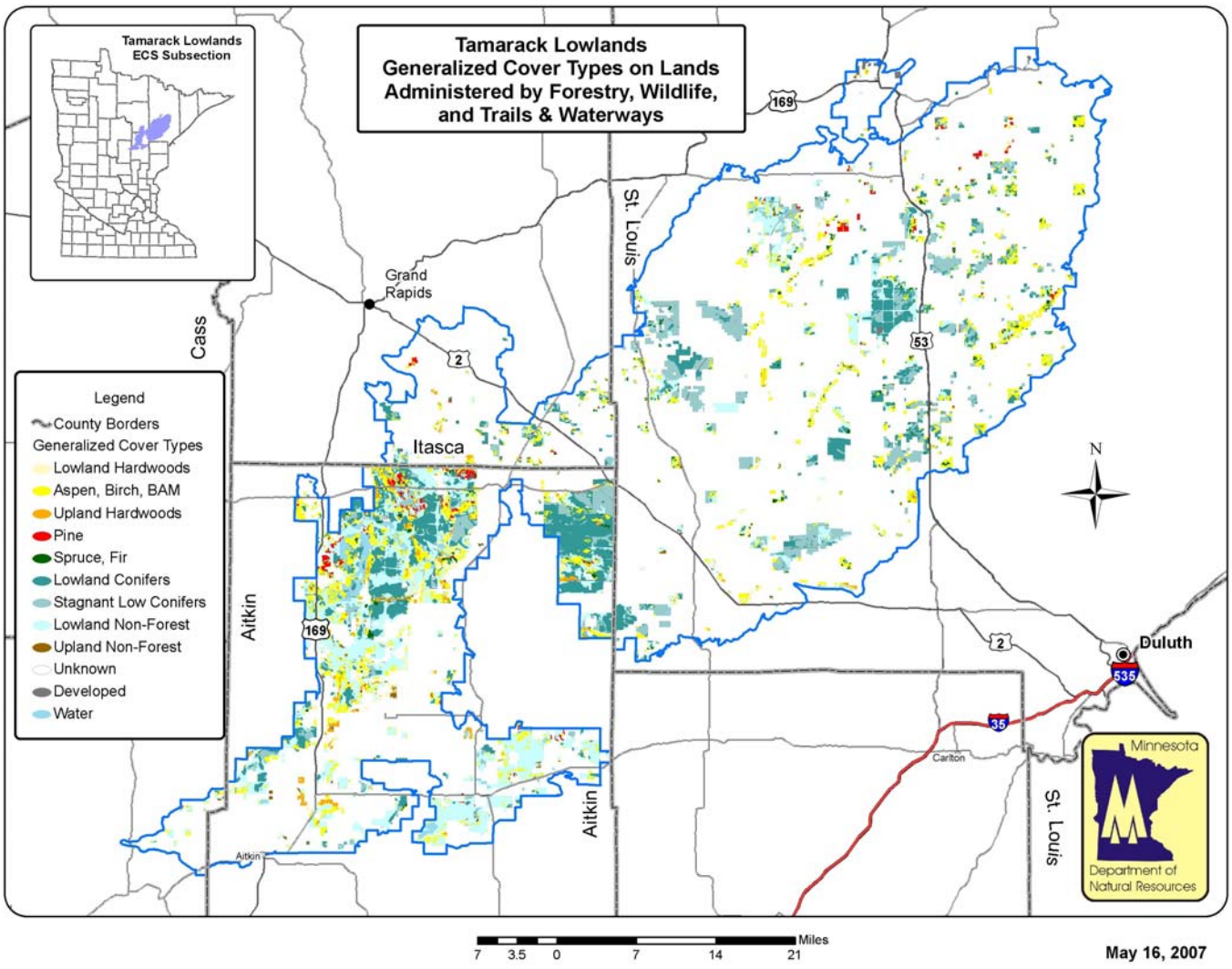
3.1 Forest Cover-Type Acres on State Land Administered by DNR Forestry, Trails and Waterways, Fish and Wildlife – Wildlife Section, - North-4 Subsections

Map 3.1 slm



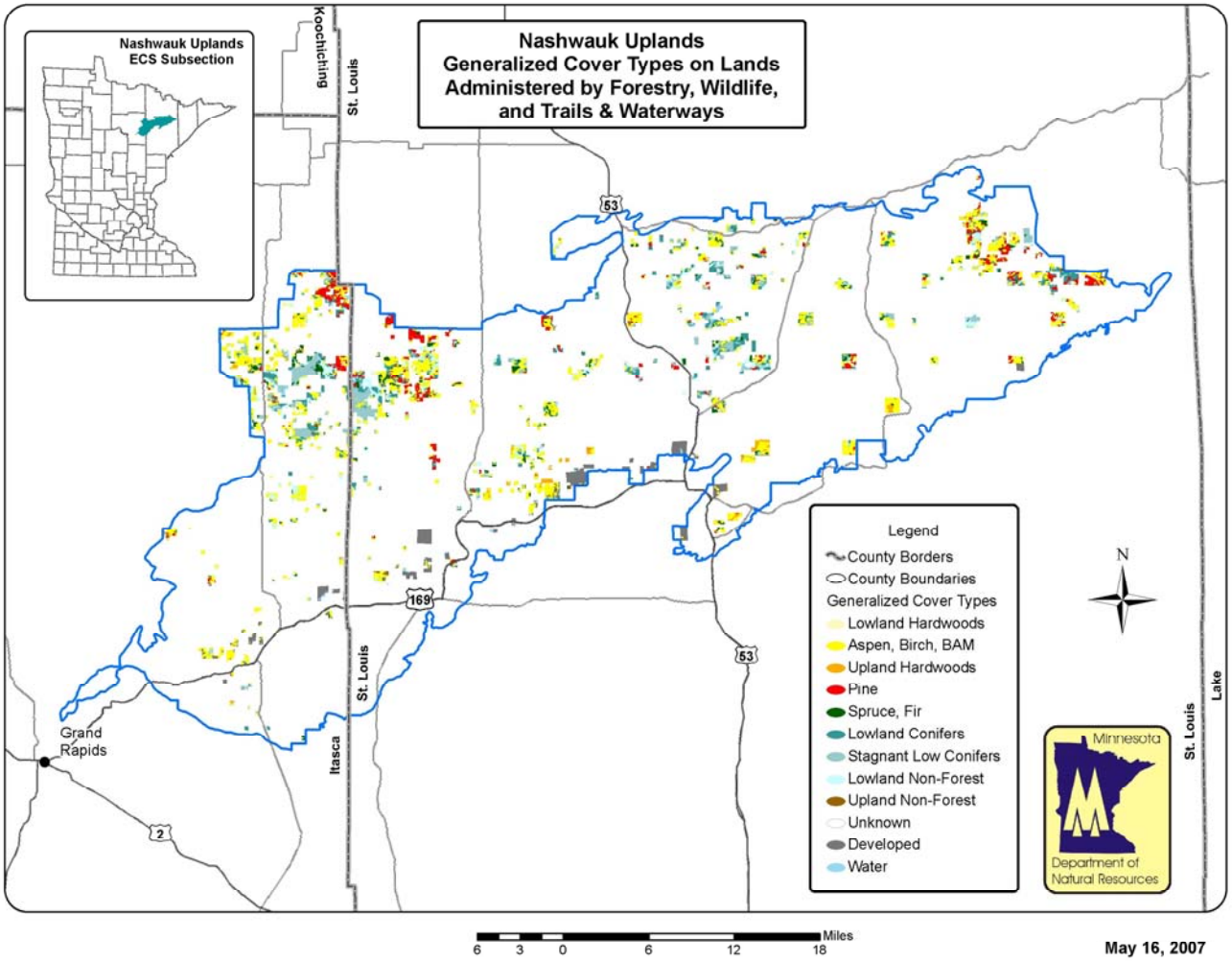
Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Map 3.1 tl



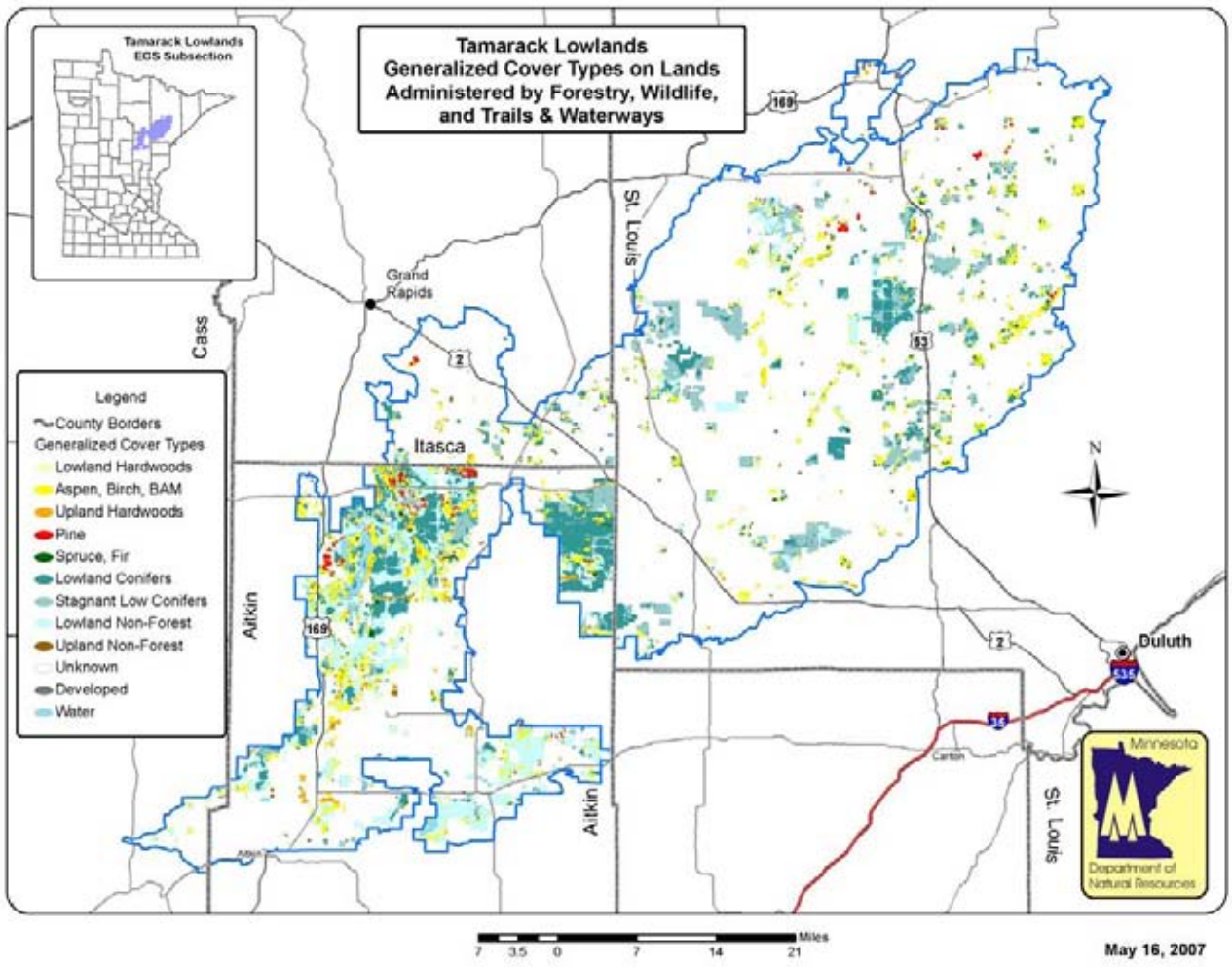
Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Map 3.1 nu



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Map 3.1 tlu



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Table 3.1 North-4 Subsections

	AGE CLASS														
COVER TYPE	**0-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**101-110**	**111-120**	**120+**	**TOTAL**	**% OF GRAND TOTAL**
Ash/Lowland Hardwoods															
Total	**199**	**834**	**1297**	**1033**	**496**	**742**	**2302**	**4353**	**6487**	**7147**	**7637**	**6198**	**13889**	**52614**	**7.39%**
Littlefork-Vermilion Uplands	154	497	944	763	359	488	1166	1479	2359	2730	2954	3163	8865	**25921**	
Nashwauk Uplands	7	111	28	48	0	12	23	24	252	400	398	427	794	**2524**	
St. Louis Moraines	0	70	88	92	20	101	460	742	1386	1867	2107	1447	2318	**10698**	
Tamarack Lowlands	38	156	237	130	117	141	653	2108	2490	2150	2178	1161	1912	**13471**	
Aspen/Balm of Gilead															
Total	**39944**	**63990**	**43342**	**28439**	**16137**	**21254**	**24019**	**17408**	**5146**	**621**	**195**	**34**	**26**	**260555**	**36.62%**
Littlefork-Vermilion Uplands	18197	26429	17169	11834	7499	10374	11128	8102	1519	300	115	11	22	**112699**	
Nashwauk Uplands	3767	8067	4253	2352	570	1106	1242	2084	637	76	43	0	0	**24197**	
St. Louis Moraines	9694	17034	13968	8593	4487	3715	5886	3614	1526	114	21	23	0	**68675**	
Tamarack Lowlands	8286	12460	7952	5660	3581	6059	5763	3608	1464	131	16	0	4	**54984**	
Balsam Fir															
Total	**833**	**628**	**992**	**3345**	**2459**	**1610**	**2868**	**3127**	**1826**	**845**	**301**	**44**	**46**	**18924**	**2.66%**
Littlefork-Vermilion Uplands	391	293	647	1921	1880	868	1749	1723	986	587	244	0	40	**11329**	
Nashwauk Uplands	12	68	105	274	77	45	130	143	95	17	11	0	0	**977**	
St. Louis Moraines	205	163	136	759	404	472	411	508	385	69	8	3	6	**3529**	
Tamarack Lowlands	225	104	104	391	98	225	578	753	360	172	38	41	0	**3089**	
Birch															
Total	**653**	**177**	**160**	**353**	**181**	**995**	**1705**	**2693**	**2226**	**1185**	**248**	**78**	**44**	**10698**	**1.50%**
Littlefork-Vermilion Uplands	17	55	0	142	92	111	268	241	177	126	140	32	34	**1435**	
Nashwauk Uplands	188	35	27	6	3	111	431	672	950	481	55	7	10	**2976**	
St. Louis Moraines	331	51	133	14	86	436	703	1199	901	426	48	14	0	**4342**	
Tamarack Lowlands	117	36	0	191	0	337	303	581	198	152	5	25	0	**1945**	
Black Spruce, Upland															
Total	**385**	**134**	**281**	**87**	**111**	**184**	**93**	**137**	**22**	**52**	**3**	**11**	**37**	**1537**	**0.22%**
Littlefork-Vermilion Uplands	111	70	189	5	47	179	70	9	9	44	0	11	37	**781**	
Nashwauk Uplands	144	28	10	58	21	0	18	64	13	0	0	0	0	**356**	
St. Louis Moraines	67	36	22	0	43	5	5	27	0	0	3	0	0	**208**	
Tamarack Lowlands	63	0	60	24	0	0	0	37	0	8	0	0	0	**192**	

COVER TYPE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	120+	TOTAL	% OF GRAND TOTAL
Black Spruce, Lowland															
Total	**15664**	**12883**	**10574**	**17068**	**10754**	**6933**	**8765**	**12018**	**13291**	**13494**	**14674**	**12770**	**29916**	**178804**	**25.13%**
Littlefork-Vermilion Uplands	12804	10747	9053	11161	6080	5159	6414	7880	8727	9254	10158	8635	22404	**128476**	
Nashwauk Uplands	747	453	107	404	516	168	326	610	692	1015	460	378	688	**6564**	
St. Louis Moraines	1327	956	812	1916	1367	407	651	1433	1618	1190	1085	1984	2812	**17558**	
Tamarack Lowlands	786	727	602	3587	2791	1199	1374	2095	2254	2035	2971	1773	4012	**26206**	
Cedar															
Total	**32**	**296**	**208**	**530**	**262**	**208**	**373**	**883**	**1194**	**2639**	**5510**	**5387**	**25414**	**42936**	**6.03%**
Littlefork-Vermilion Uplands	32	296	167	530	234	107	373	614	715	1226	2870	2955	19797	**29916**	
Nashwauk Uplands	0	0	14	0	0	0	0	0	45	96	55	172	824	**1206**	
St. Louis Moraines	0	0	10	0	3	12	0	154	145	477	602	883	2523	**4809**	
Tamarack Lowlands	0	0	17	0	25	89	0	115	289	840	1983	1377	2270	**7005**	
Northern Hardwoods															
Total	**175**	**129**	**499**	**143**	**480**	**1175**	**3793**	**6585**	**4200**	**2231**	**1166**	**1322**	**999**	**22897**	**3.22%**
Littlefork-Vermilion Uplands	49	4	0	0	37	46	93	442	155	34	99	29	109	**1097**	
Nashwauk Uplands	38	9	5	28	114	50	240	291	227	102	9	15	0	**1128**	
St. Louis Moraines	88	116	436	105	212	490	2563	4060	2697	1490	828	1268	525	**14878**	
Tamarack Lowlands	0	0	58	10	117	589	897	1792	1121	605	230	10	365	**5794**	
Oak															
Total	**102**	**138**	**0**	**64**	**30**	**139**	**304**	**1284**	**1664**	**360**	**155**	**99**	**216**	**4555**	**0.64%**
Littlefork-Vermilion Uplands	15	39	0	0	0	0	0	0	24	0	0	0	0	**78**	
Nashwauk Uplands	11	0	0	0	0	0	0	0	83	68	0	0	0	**162**	
St. Louis Moraines	72	91	0	25	27	131	231	1074	1226	277	5	99	125	**3383**	
Tamarack Lowlands	4	8	0	39	3	8	73	210	331	15	150	0	91	**932**	
Red Pine															
Total	**2545**	**2279**	**4571**	**1540**	**3384**	**599**	**1263**	**850**	**770**	**1182**	**955**	**582**	**222**	**20742**	**2.92%**
Littlefork-Vermilion Uplands	1086	443	1045	356	662	134	406	267	230	343	212	50	104	**5338**	
Nashwauk Uplands	1036	898	660	483	258	16	304	383	307	214	122	165	26	**4872**	
St. Louis Moraines	334	842	2015	608	1111	265	446	179	209	522	566	323	79	**7499**	
Tamarack Lowlands	89	96	851	93	1353	184	107	21	24	103	55	44	13	**3033**	

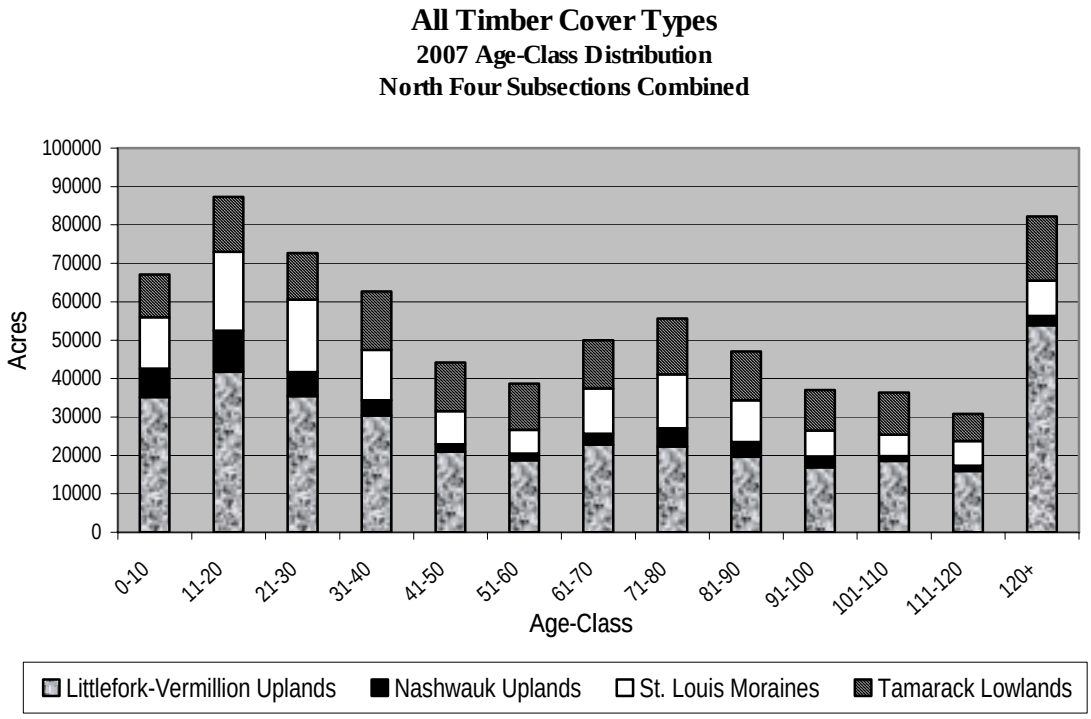
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	120+	TOTAL	% OF GRAND TOTAL
Jack Pine															
Total	**1279**	**2540**	**3195**	**1141**	**802**	**572**	**874**	**996**	**277**	**121**	**7**	**0**	**9**	**11813**	**1.66%**
Littlefork-Vermilion Uplands	0	1206	1754	739	464	154	538	470	157	0	0	0	0	**5482**	
Nashwauk Uplands	454	566	380	169	96	80	64	180	77	115	7	0	0	**2188**	
St. Louis Moraines	588	640	445	124	188	55	86	280	19	6	0	0	9	**2440**	
Tamarack Lowlands	237	128	616	109	54	283	186	66	24	0	0	0	0	**1703**	
White Pine															
Total	**606**	**234**	**41**	**0**	**51**	**34**	**41**	**14**	**36**	**43**	**151**	**144**	**162**	**1557**	**0.22%**
Littlefork-Vermilion Uplands	232	105	8	0	0	0	0	0	0	6	42	11	60	**464**	
Nashwauk Uplands	84	52	8	0	10	0	24	9	7	12	0	0	17	**223**	
St. Louis Moraines	163	39	5	0	0	18	13	5	17	16	49	26	44	**395**	
Tamarack Lowlands	127	38	20	0	41	16	4	0	12	9	60	107	41	**475**	
Tamarack															
Total	**2957**	**1692**	**3723**	**14575**	**7331**	**4002**	**3434**	**5139**	**9739**	**6967**	**5343**	**4188**	**11204**	**80294**	**10.28%**
Littlefork-Vermilion Uplands	1379	1152	2457	1867	2776	978	548	1048	4505	2103	1707	1101	2397	**24018**	
Nashwauk Uplands	107	44	30	71	147	130	10	284	458	266	83	103	47	**1780**	
St. Louis Moraines	396	127	123	769	364	83	261	714	724	299	297	379	762	**5298**	
Tamarack Lowlands	1075	369	1113	4705	4044	2811	2615	3093	4052	4299	3256	2605	7998	**49198**	
White Spruce															
Total	**1670**	**1369**	**3798**	**1504**	**1738**	**211**	**117**	**143**	**121**	**91**	**15**	**0**	**19**	**10796**	**1.52%**
Littlefork-Vermilion Uplands	709	438	1991	1085	799	134	67	50	96	91	5	0	19	**5484**	
Nashwauk Uplands	796	353	607	46	154	15	11	24	0	0	0	0	0	**2006**	
St. Louis Moraines	155	423	747	114	268	31	33	9	12	0	0	0	0	**1792**	
Tamarack Lowlands	10	155	453	259	517	31	6	60	13	0	10	0	0	**1514**	
All Cover types															
Total	**67044**	**87323**	**72681**	**62659**	**44216**	**38658**	**49951**	**55630**	**46999**	**36978**	**36360**	**30857**	**82203**	**711559**	
Littlefork-Vermilion Uplands	35176	41774	35424	30403	20929	18732	22820	22325	19659	16844	18546	15998	53888	**352518**	
Nashwauk Uplands	7391	10684	6234	3939	1966	1733	2823	4768	3843	2862	1243	1267	2406	**51159**	
St. Louis Moraines	13420	20588	18940	13119	8580	6221	11749	13998	10865	6753	5619	6449	9203	**145504**	
Tamarack Lowlands	11057	14277	12083	15198	12741	11972	12559	14539	12632	10519	10952	7143	16706	**162378**	

1 Includes only Forestry, Trails and Waterways , Fish and Wildlife – Wildlife Section, —North-4 Subsections administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2007 Cooperative Stand Assessment (CSA) forest inventory.

2 Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix D: Glossary

3.2 State Timberland Cover-Type Acres 2007 North-4 Subsections

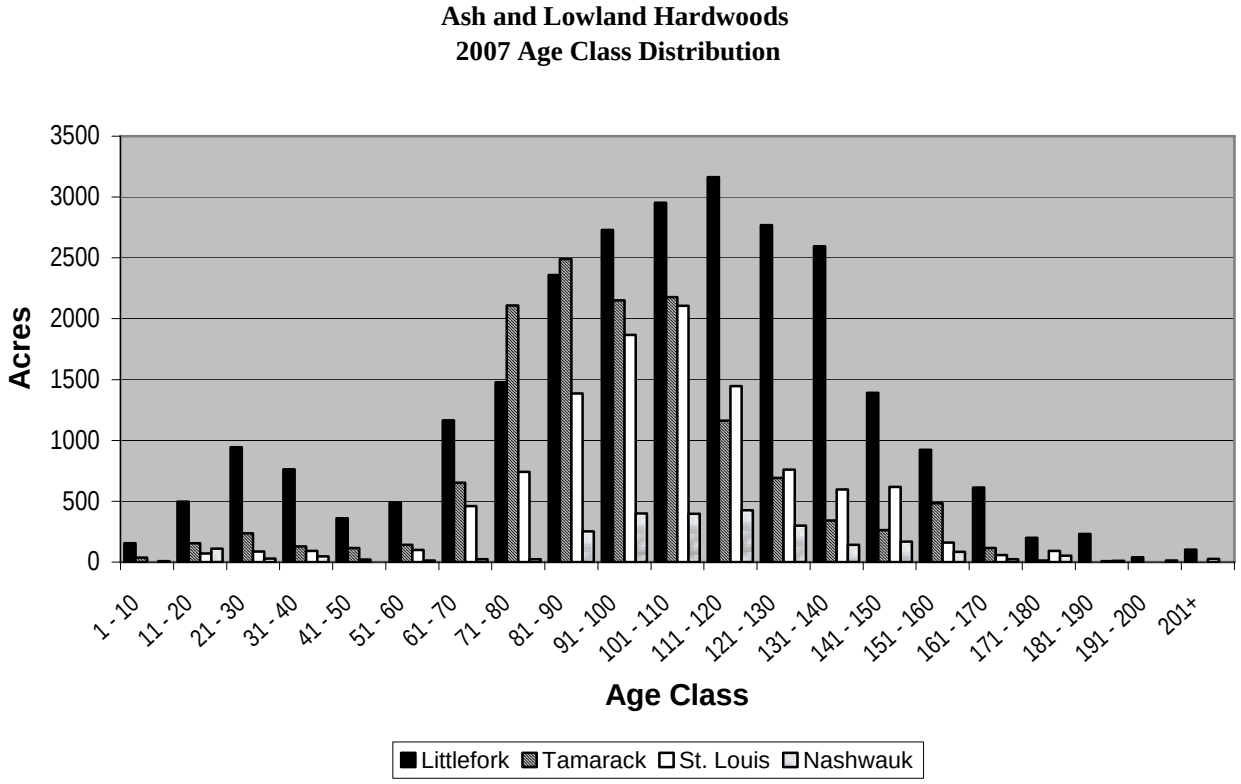
Chart 3.2.1 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

This chart shows the acreage of all state timberland cover types in 2007 in the four subsections.

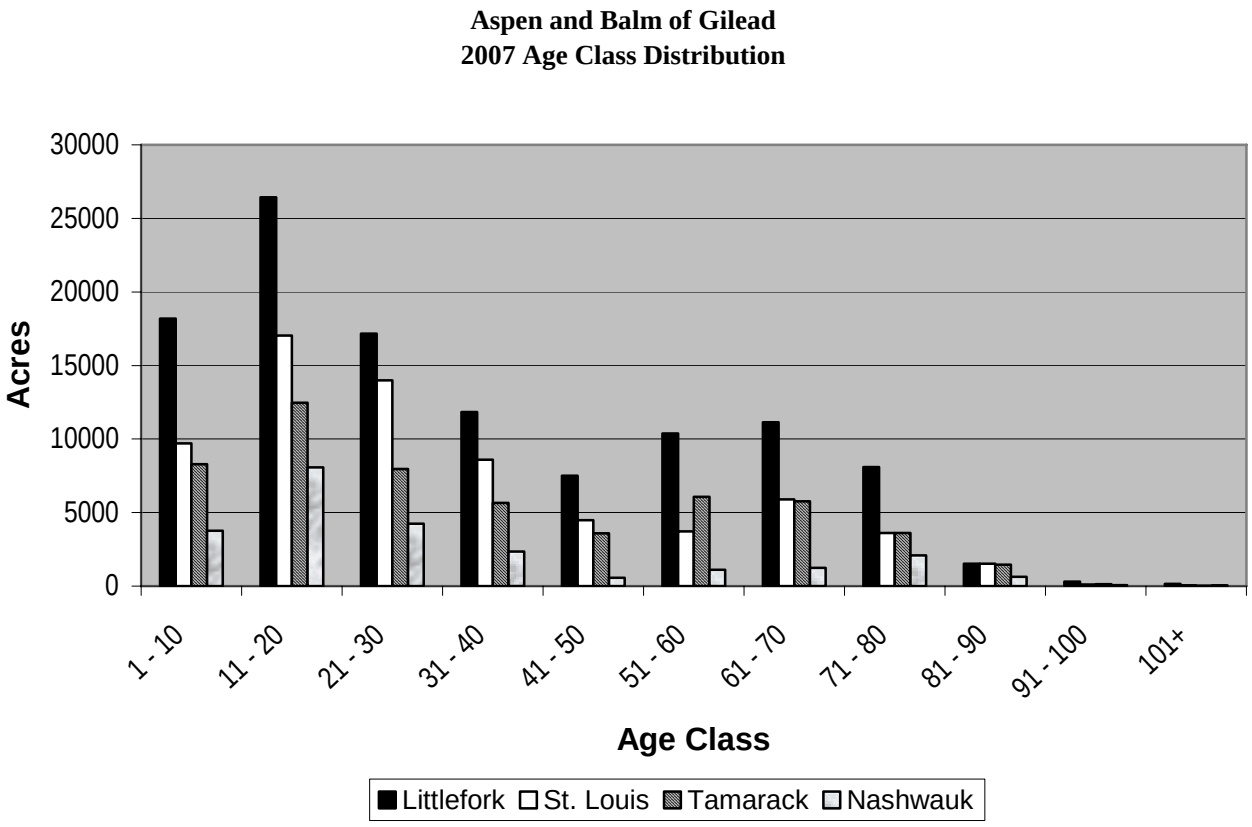
Chart 3.2. 2 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the ash/lowland hardwood cover type amounted to 7.39 percent (52,614 acres) of the state timberlands in the four subsections.

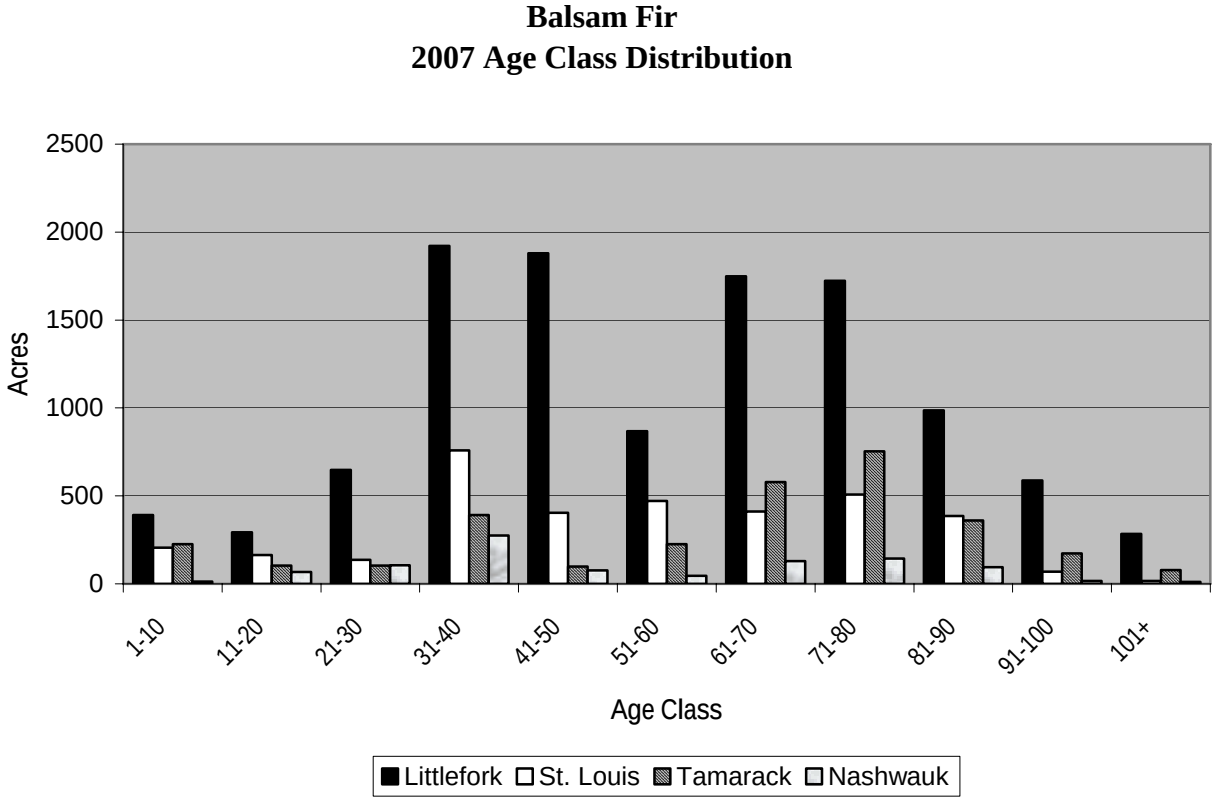
Chart 3.2.3 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the aspen and balm of Gilead cover types occupied 36.62 percent (260,555 acres) of state-administered timberlands in the four subsections.

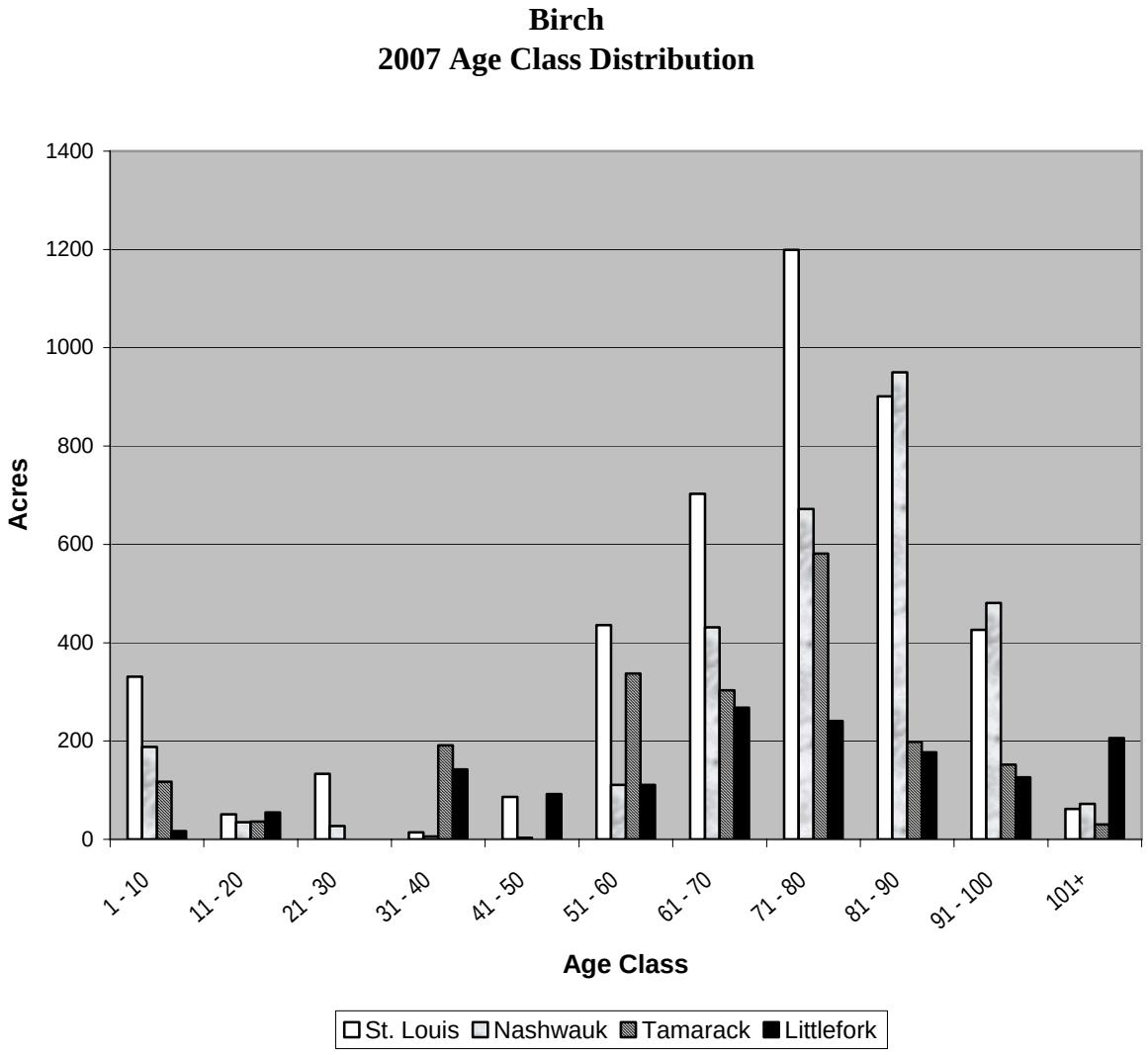
Chart 3.2.4 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the balsam fir cover type occupied 2.66 percent (18,924 acres) of state administered timberlands in the four subsections.

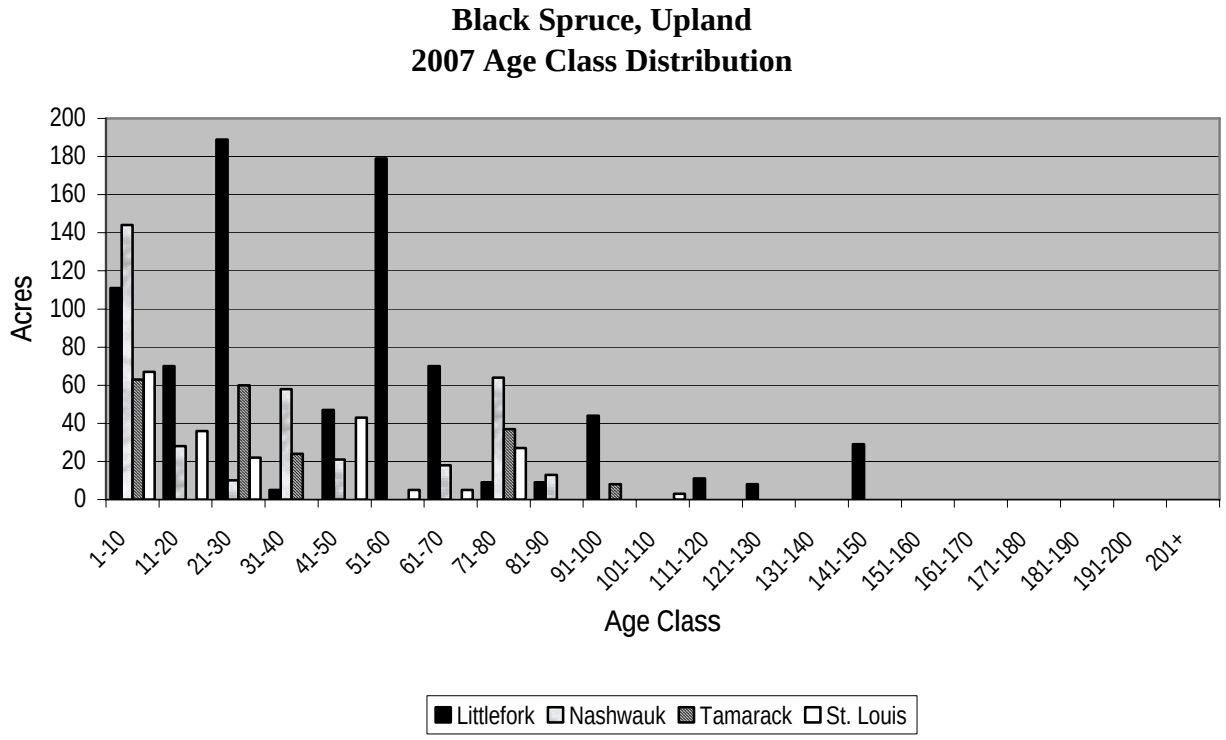
Chart 3.2.5 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the birch cover type occupied 1.50 percent (10,698 acres) of state-administered timberlands in the four subsections.

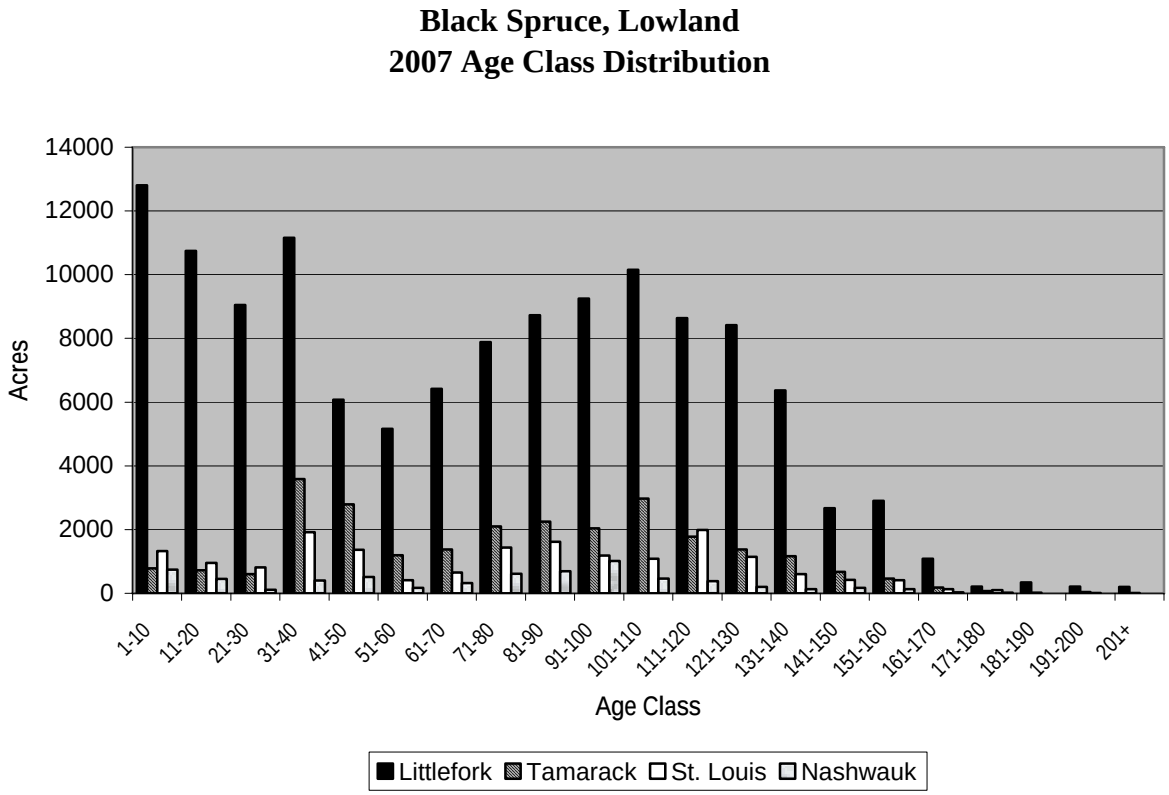
Chart 3.2.6 North-4 Subsections



Source:2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the black spruce, upland cover type occupied .22 percent (1,537 acres) of state-administered timberlands in the four subsections.

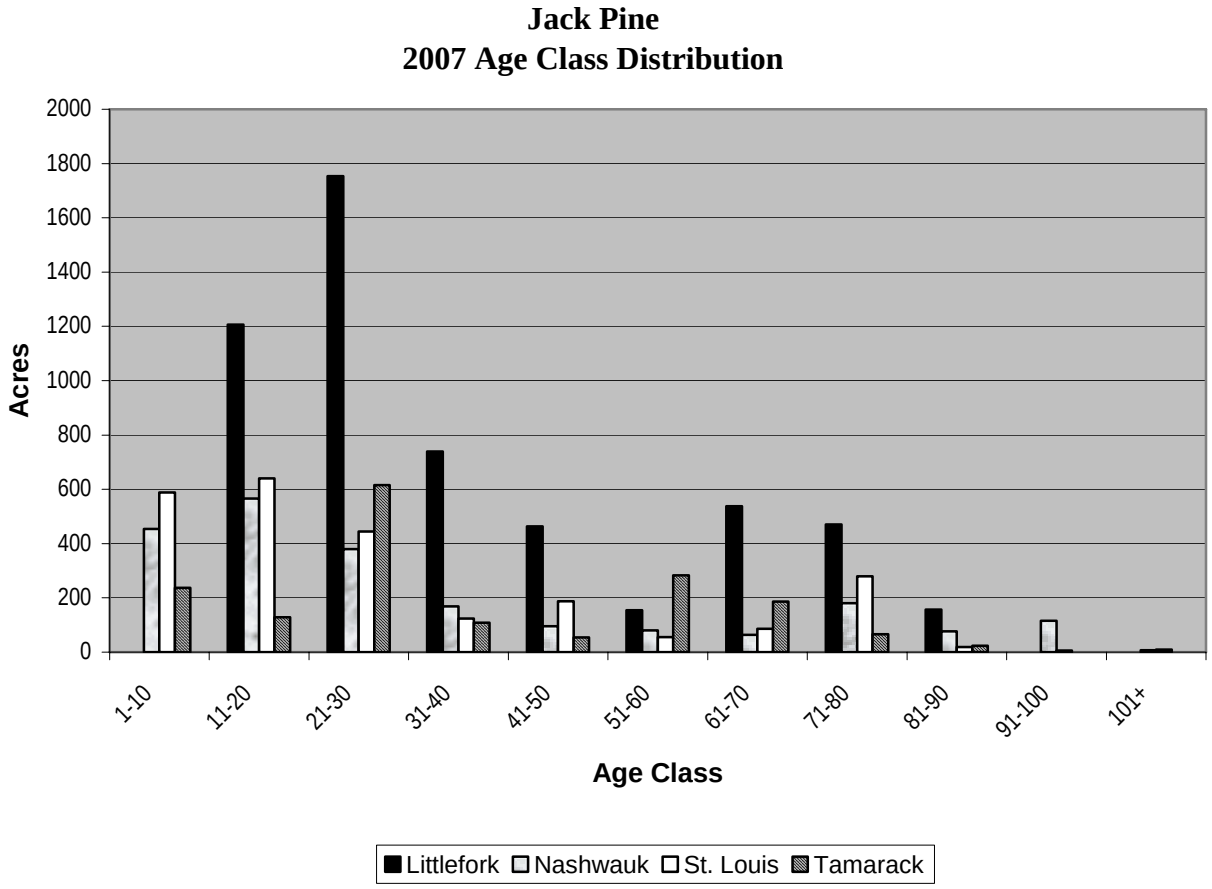
Chart 3.2.7 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the black spruce, lowland cover type occupied 25.13 percent (178,804 acres) of state-administered timberlands in the four subsections.

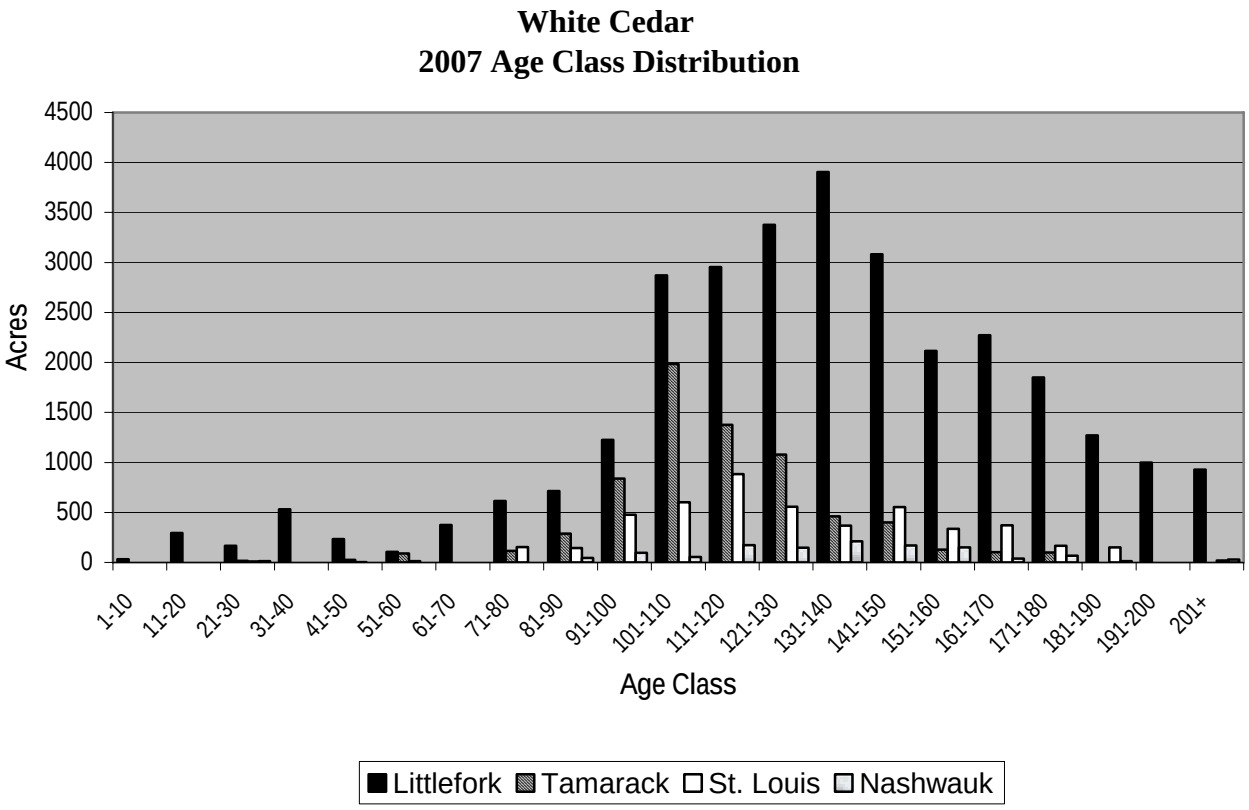
Chart 3.2.8 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the jack pine cover type occupied 1.66 percent (11,813 acres) of state-administered timberlands in the four subsections.

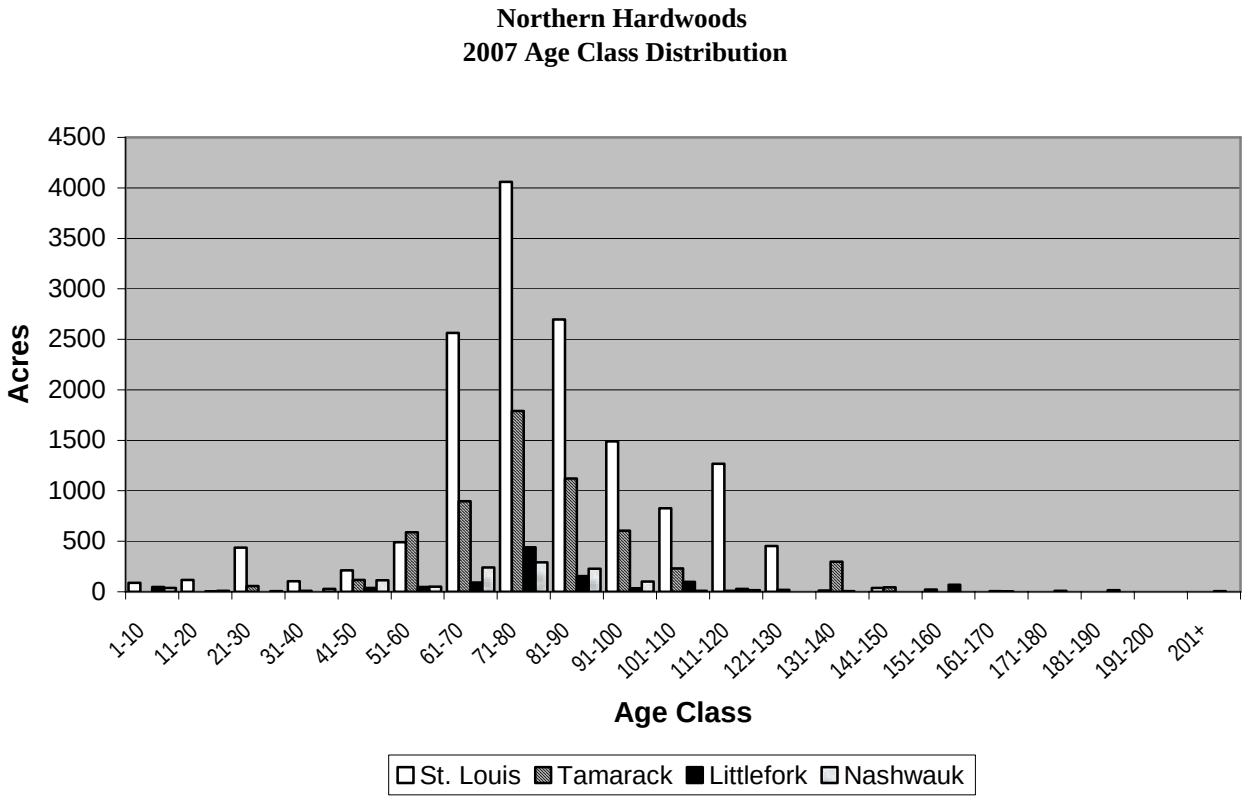
Chart 3.2.9 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the northern white cedar cover type occupied 6.03 percent (42,936 acres) of state-administered timberlands in the four subsections.

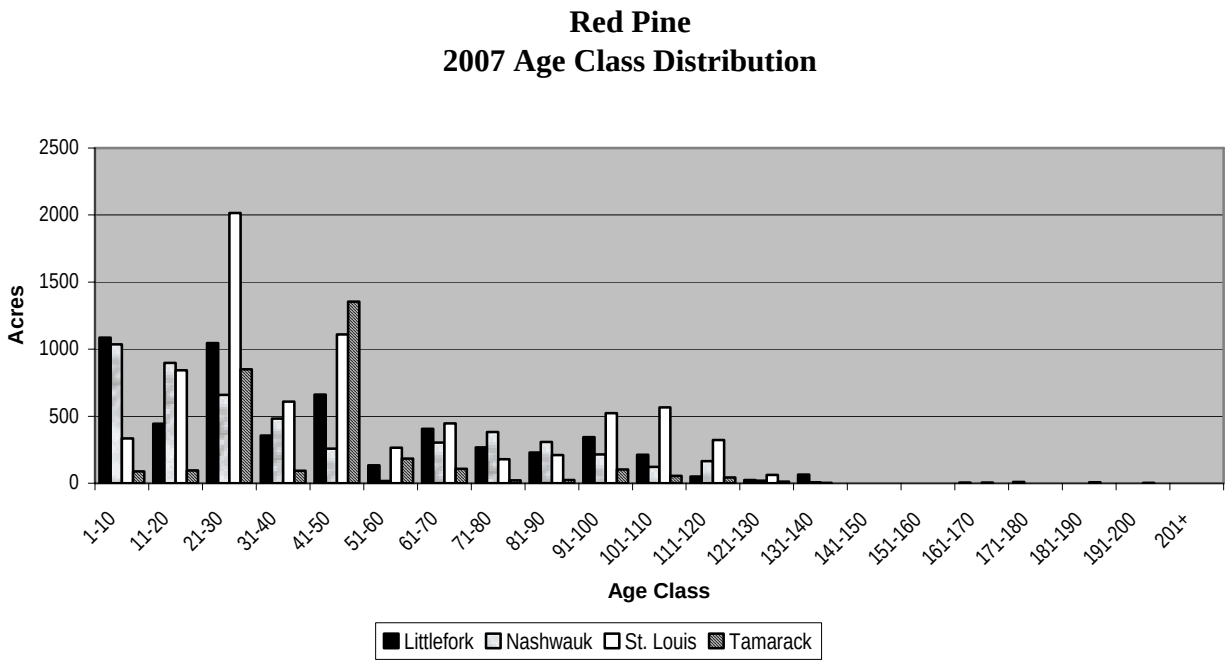
Chart 3.2.10 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the northern hardwoods cover type occupied 3.22 percent (22,879 acres) of state-administered timberlands in the four subsections.

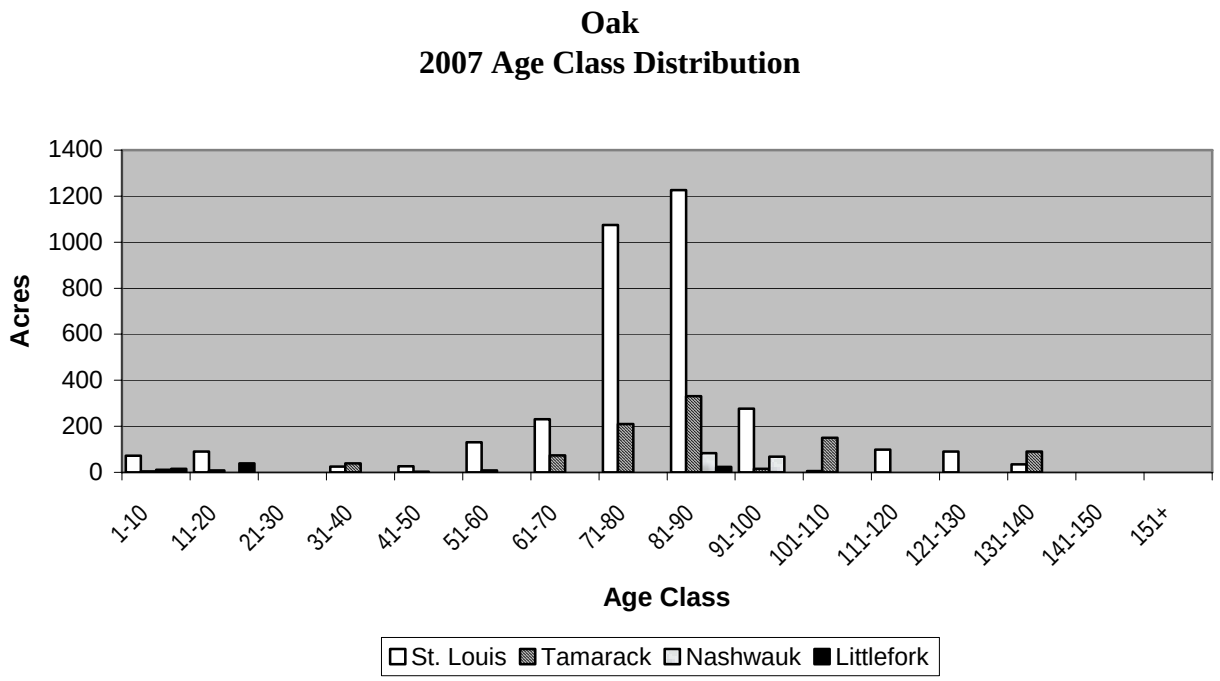
Chart 3.2.11 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the red pine cover type occupied 2.92 percent (20,742 acres) of state-administered timberlands in the four subsections.

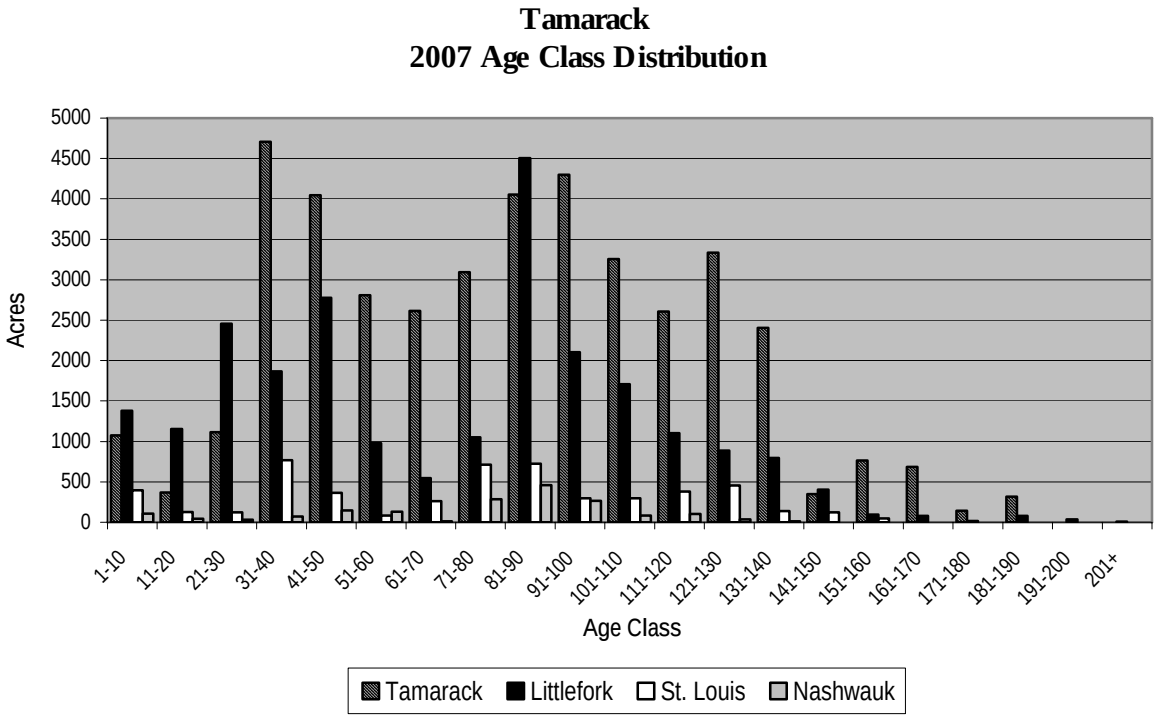
Chart 3.2.12 North-4Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the oak cover type occupied .64 percent (4,555 acres) of state-administered timberlands in the four subsections.

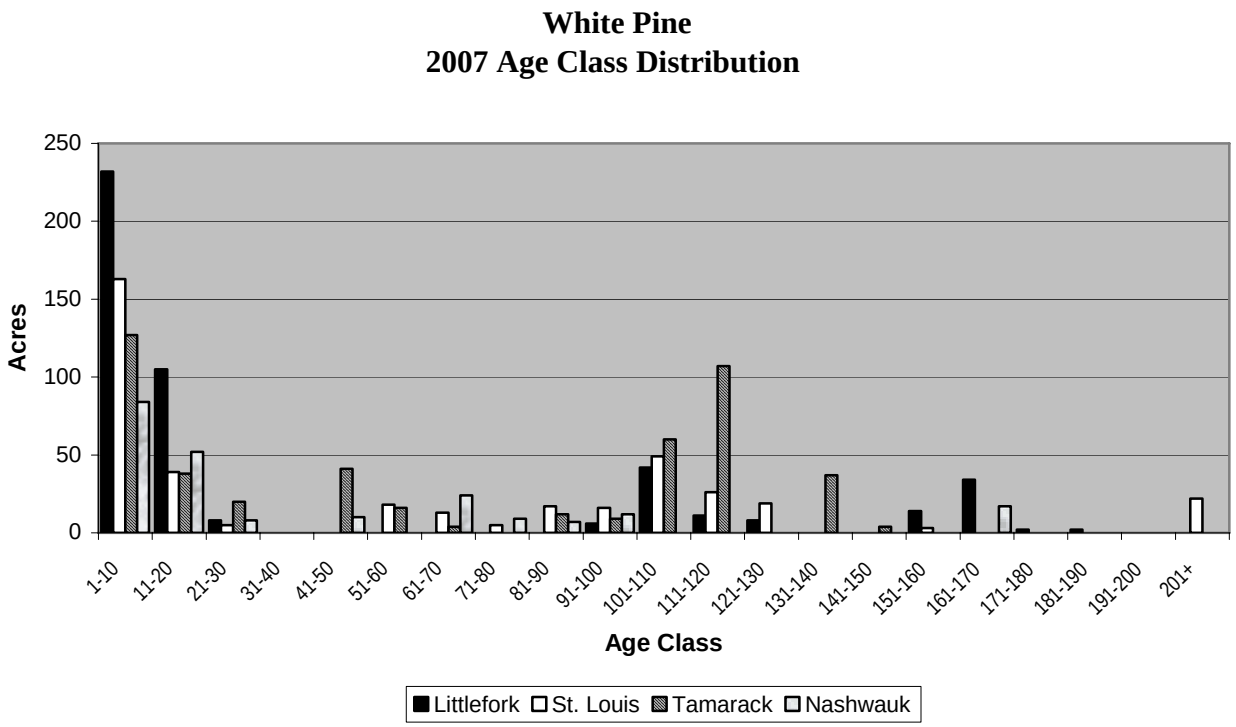
Chart 3.2.13 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the tamarack cover type occupied 10.28 percent (73.131 acres) of state-administered timberlands in the four subsections.

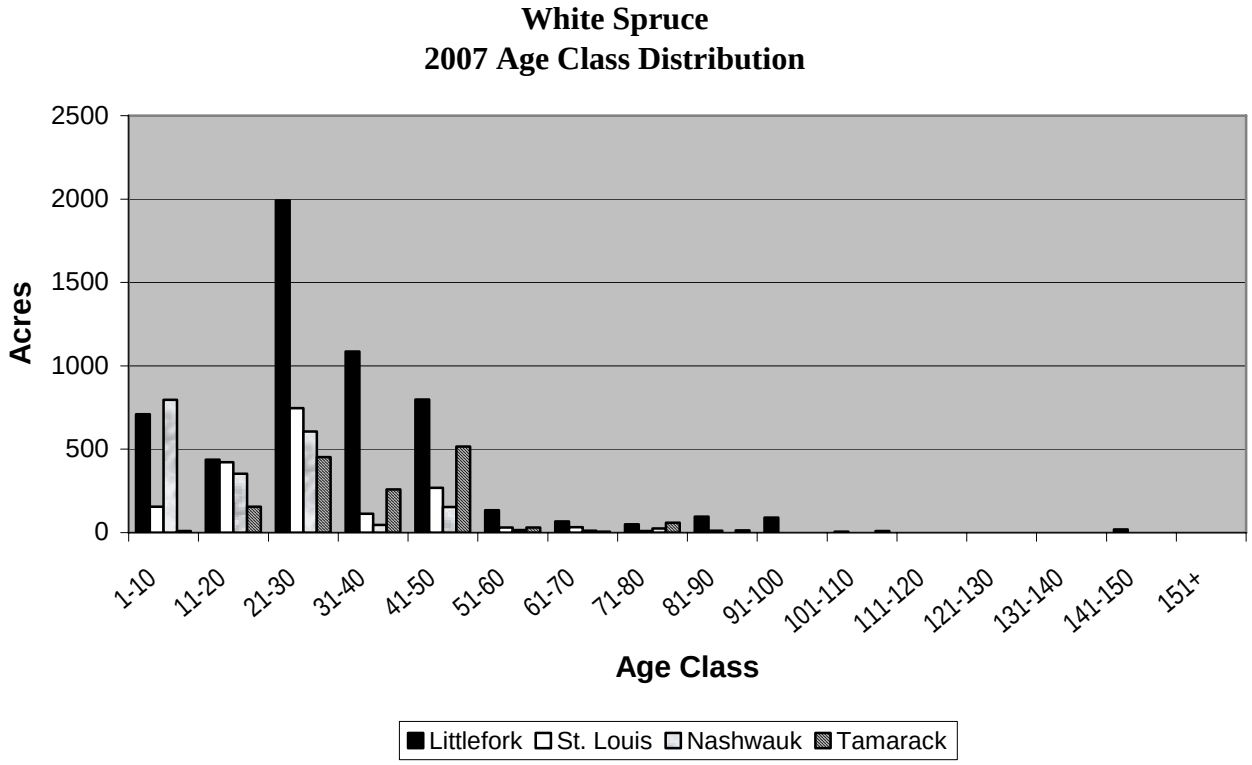
Chart 3.2.14 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the white pine cover type occupied less than .22 percent (1,557 acres) of state-administered timberlands in the four subsections.

Chart 3.2.15 North-4 Subsections



Source: 2007 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 2007, the white spruce cover type occupied 1.52 percent (10,796 acres) of state-administered timberlands in the four subsections.

3.3 Old-Growth Forests

The DNR's old-growth management goal is to identify and protect the highest quality remaining natural old-growth forest communities on state-administered lands. Old-growth forest stands are defined by age, structural characteristics, and relative lack of human disturbance. These forests are essentially free from catastrophic disturbances and contain old trees (generally more than 120 years old), large snags, and downed trees.

Old-growth forest represents the latter stages of succession in forested ecosystems. Remaining old-growth forests are important for their scientific and educational values, as well as their aesthetic and spiritual appeal. Old-growth forests provide special habitats for native plants, important habitat features for wildlife, and examples of the maximum limits of individual tree and stand production. Because old-growth ecosystems developed for a long time without large-scale disturbance, the study of plants, animals, soils, and ecosystem processes in old-growth stands provides important insights into the natural function of forest ecosystems. Such insights can be crucial for future forest management and for maintenance of biological diversity.

Old-growth designations are based on the 1994 DNR Old-Growth Guidelines. Designation of old-growth stands in the North-4 Subsections was completed in 2000. Some of the subsection boundaries have changed since the 1994 goals were set due to revisions made in 1999. **The goals and designated acres provided in this assessment are based on the 1994 subsection boundaries.**

In some cases the 1994 old-growth goals for certain forest communities were not met because an adequate number of stands meeting old-growth criteria simply did not exist in the subsection. In other cases more high quality old growth was found than originally expected, so the designated acreage exceeded the target.

The 1994 goals for acreage and number of sites may be adjusted in the future. If new information becomes available on the extent, quality, and distribution of potential old-growth stands meeting prescribed selection criteria, the goals may be adjusted. If individual stands that appear to meet requirements are discovered on state land during the SFRMP process or in subsequent years, they may be evaluated and given official old-growth status if they qualify.

The following tables provide information on the 1994 goals and the designated acres in the subsections covered in this plan.

Table 3.3 slm

Designated old-growth acres in the St. Louis Moraines Subsection. From a candidate pool of 2,523 acres, 1,669 acres were designated as old growth (i.e., given official protection) and 854 acres were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	85	167
White Cedar	170	185
Lowland Hardwoods	115	153
Northern Hardwoods	340	605
Oak	20	47
Red Pine	205	272
White Pine	230	236
White Spruce	25	4
Total	1190	1669

Table 3.3 tl

Designated old-growth acres in the Tamarack Lowlands Subsection. From a candidate pool of 5,480 acres, 4,289 acres were designated as old growth (i.e., given official protection) and 1,191 were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	150	1216
White Cedar	210	145
Lowland Hardwoods	390	601
Northern Hardwoods	1615	1973
Oak	40	130
Red Pine	305	133
White Pine	185	91
White Spruce	25	0
Total	2920	4289

Table 3.3 nu

Designated old-growth acres in the Nashwauk Uplands Subsection. From a candidate pool of 1,575 acres, 1,193 acres were designated as old growth (i.e., given official protection) and 382 were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	65	63
White Cedar	85	219
Lowland Hardwoods	80	83
Northern Hardwoods	115	211
Oak	0	0
Red Pine	205	254
White Pine	90	206
White Spruce	25	172
Total	665	1193

Table 3.3 lvu

Designated old-growth acres in the Littlefork-Vermilion Uplands Subsection. From a candidate pool of 4,331 acres, 2,504 acres were designated as old growth (i.e., given official protection) and 1,827 acres were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	125	254
White Cedar	375	543
Lowland Hardwoods	425	488
Northern Hardwoods	0	0
Oak	0	0
Red Pine	615	746
White Pine	375	385
White Spruce	70	88
Total	1985	2504

3.4 Historical Forest Composition Compared to Today's Forest – An Estimate

Table 3.4 North-4 Subsections

	Littlefork-Vermilion Uplands		Nashwauk Uplands		St. Louis Moraines		Tamarack Lowlands	
Species	BT	FIA	BT	FIA	BT	FIA	BT	FIA
Ash	2.2	7	1.4	3.7	1.9	7.5	1.9	9
Aspen	17.7	28.1	8.4	31	9.7	31.9	10.7	26
Balm of Gilead	1.8	6.3	0.1	2.2	0.1	3.2	0.1	4
Balsam Fir	7.9	14.5	8.8	11.9	8.4	8.3	3.7	11
Paper Birch	8.3	5.7	17.2	16	16.9	11.1	9.1	6.6
Black Spruce	15	14	8.3	8.3	6	4.2	9.7	10.5
Bur Oak	0	0.2	0	0.1	0.6	1.2	0.6	2
White Cedar	9.9	10.6	7.2	5.3	4.9	3.4	5.5	3.7
Elm	1.1	1.4	0.2	0.3	1.1	2	1.1	2.5
Jack Pine	4	1.9	9	4.6	1.9	1.8	4	4.6
Basswood	0.2	0.9	0.4	2.1	1.5	4.7	0.5	1.9
Maple	0.4	0	1.6	0	2.8	0	1	0
Pine	0.9	0	1.6	0	1.4	0	1.6	0
Red Maple	0	0.9	0.3	4.3	0.6	4.6	2.7	4
Red Oak	0	0	0.1	0.7	0.6	3	0.1	1.3
Red Pine	1.3	1.9	4.5	2.3	4.3	2.5	3.4	1.5
Sugar Maple	0	0.6	1.5	2.1	5.2	4.9	0.8	0.5
Tamarack	18.4	2.8	12.4	2.3	17.8	3.3	35.3	9.1
White Pine	1.9	0.6	8	1	7.9	0.6	3.4	0.5
White Spruce	7	2	7.1	1.5	5.4	1	3.8	0.8
Yellow Birch	0	0.1	1	0.3	0.6	0.4	0.1	0.2

Table Explanation

This table shows the relative abundance of public land survey (PLS) bearing tree (BT) species marked as witness trees in the mid-1800s compared to 1990 Forest Inventory and Analysis (FIA) tree species. It provides an estimate by subsection of the abundance of certain kinds of tree species before the land was logged and settled, compared to today's forest.

Methodology

Relative abundance of BT trees is the percent by tree species identified as BTs in the original land survey records in the subsection. FIA data were modified to mimic the establishment of a survey corner by recording only one tree in each quadrant of the FIA sampling point similar to the selection of BT trees in the past. The relative abundance of FIA tree species is based on this estimate. Relative abundance data have been produced at subsection and the LTA (land type association) levels. This assessment includes only the subsection data. The LTA level data can provide land managers more detailed information on where in the larger subsection the composition changes are greater. LTA data can be used to assist in determining where it would be appropriate to attempt restoration of a species, if that is desired, within a subsection.

Summary of Table 3.4

Based on data at the subsection level, species showing a significant increase since the mid-1800s are ash, aspen, balm of Gilead, red maple, and balsam fir. Species showing a significant decline are white pine, white spruce, and tamarack. As can be seen in the table, relative abundance of a species often varies between subsections and so does the amount of change between BT and FIA data. *Note: Where a species is rare in the BT data, the data may not be as reliable.*

C H A P T E R 4

Timber Harvest

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsections

4.1 ... Acres of Timber Sold on DNR Lands
Chart 4.1 North-4 Subsections
Table 4.1 North-4 Subsections

4.2 … Volume of Timber Sold From DNR Lands
Chart 4.2 North-4 Subsections

4.3 … Total Value of Timber Sold From DNR Lands
Chart 4.3 North-4 Subsections

4.4 … Average Stumpage Price Paid Per Cord for Timber From DNR Lands
Chart 4.4 North-4 Subsections

4.5 … Average Volume Sold Per Fiscal Year by Species From DNR Lands
Chart 4.5 North-4 Subsections

How graphics are labeled:

Graphics (i.e., Tables, Charts, and Maps) referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

Graphics referring to the St. Louis Moraines subsection only are indicated by a "slm" after each chart designation (e.g., Chart 3.2 slm).

Graphics referring to the Tamarack Lowlands Subsection only are indicated by a "tl" after each chart designation (e.g., Map 3.2 tl).

Graphics referring to the Nashwauk Uplands Subsection only are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands only are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:

Color maps may be viewed as PDF files on the St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsection Forest Resource Management Plan (SFRMP) Web site at:

http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

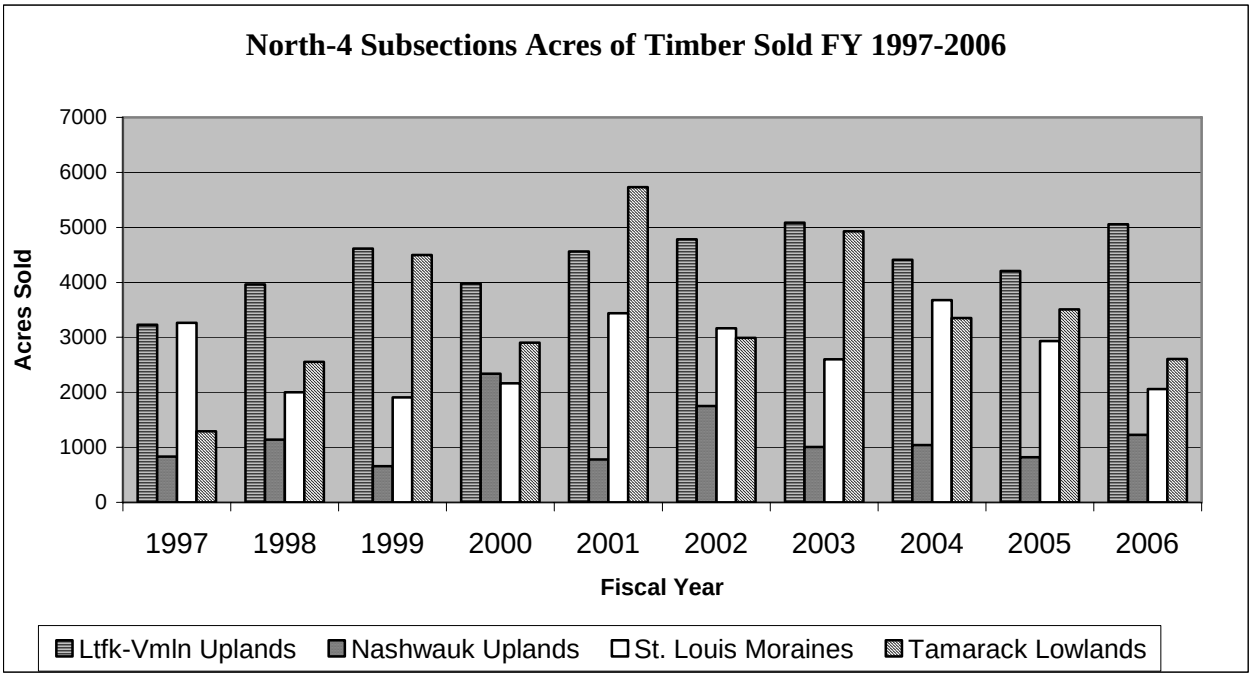
Maps in this chapter depict information for an area within a "planning boundary." This boundary is designed to closely approximate the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

Printed documents will be available for review at the Minnesota DNR Grand Rapids Region Headquarters at 1201 E Hwy 2, Grand Rapids, Minnesota, and on compact disk by request to Lynn Sue Mizner at (218) 927-7511 or lynn.mizner@dnr.state.mn.us.

4.1 Acres of Timber Sold on DNR Lands in the Subsections

The annual harvest on DNR lands is allocated and tracked in acres. One reason for differences in the yearly harvest level is the variation in timber markets and the resulting amount sold each fiscal year (i.e., July 1–June 30).

Chart 4.1 North-4 Subsections



Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

An average of 11,708 acres per year was sold from DNR lands in the North-4 Subsections during FY1997 – FY2006.

Table 4. 1 North-4 Subsections

North-4 Subsections
Acres of Timber Sold FY 1997 - 2006

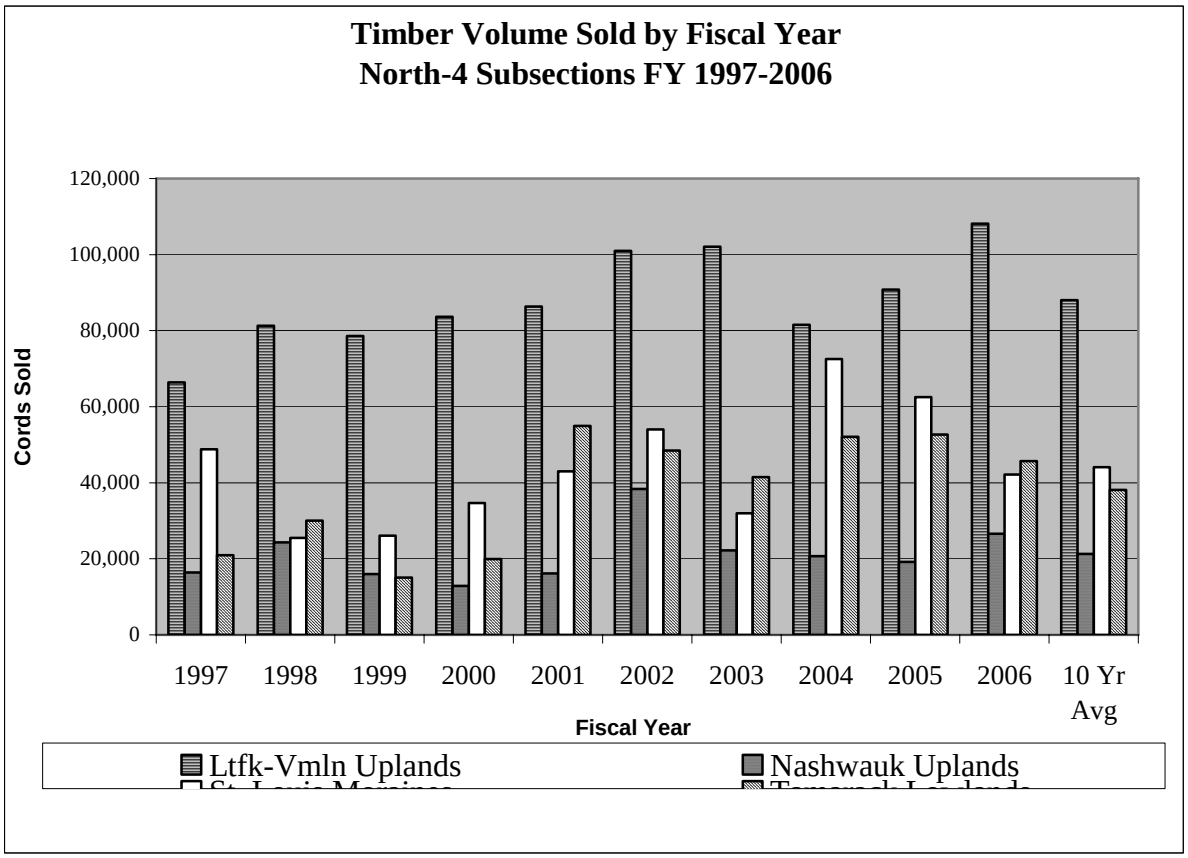
Fiscal Year	Ltfk-Vmln Uplands	Nashwauk Uplands	St. Louis Moraines	Tamarack Lowlands
1997	3231	830	3267	1293
1998	3964	1143	1999	2556
1999	4614	657	1911	4499
2000	3979	2337	2167	2901
2001	4561	780	3441	5732
2002	4784	1753	3168	2990
2003	5083	1004	2602	4931
2004	4411	1041	3680	3353
2005	4207	821	2935	3506
2006	5054	1230	2058	2609

Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

4.2 Volume of Timber Sold From DNR Lands in the Subsections

The annual harvest on DNR lands is allocated and tracked in acres. The following chart shows the total ***volume*** sold per year in cords for the four subsections.

Chart 4.2 North-4 Subsections

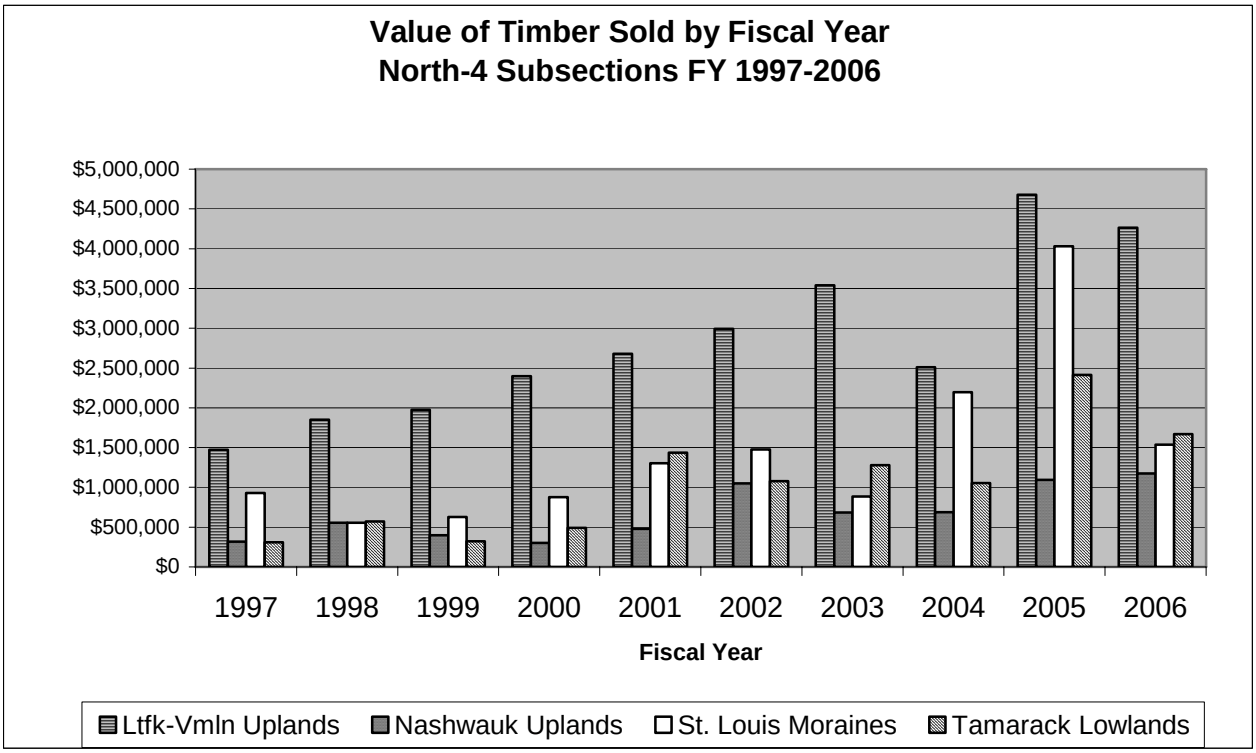


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.
An average of 191,555 cords per year were sold from DNR lands during FY 1997 – 2006 in the North-4 Subsections combined.

4.3 Total Value of Timber Sold From DNR Lands Per Fiscal Year in the North-4 Subsections

The following chart shows the ***value*** of timber sold from DNR lands in the subsections during the past 10 fiscal years.

Chart 4.3 North-4 Subsections

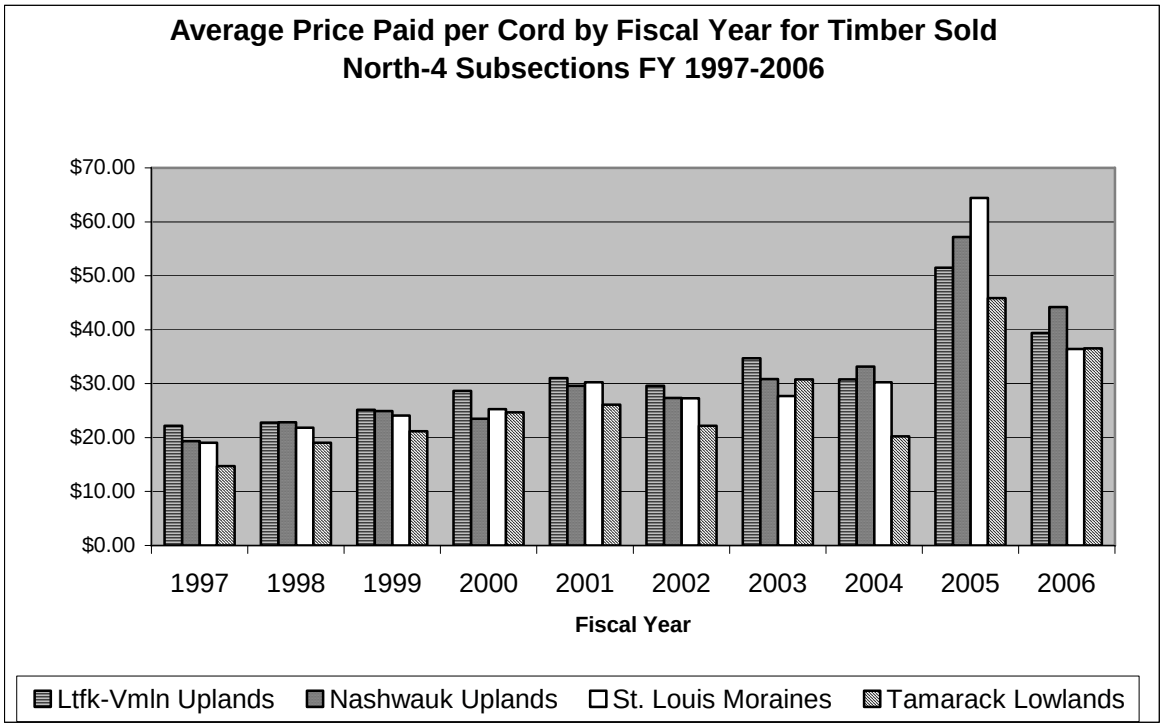


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

4.4 Average Stumpage Price Paid Per Cord for Timber From DNR Lands in the Subsections

The following chart shows how the stumpage value of timber sold from DNR lands in the subsections has changed from FY1997 to FY2006.

Chart 4.4 North-4 Subsections

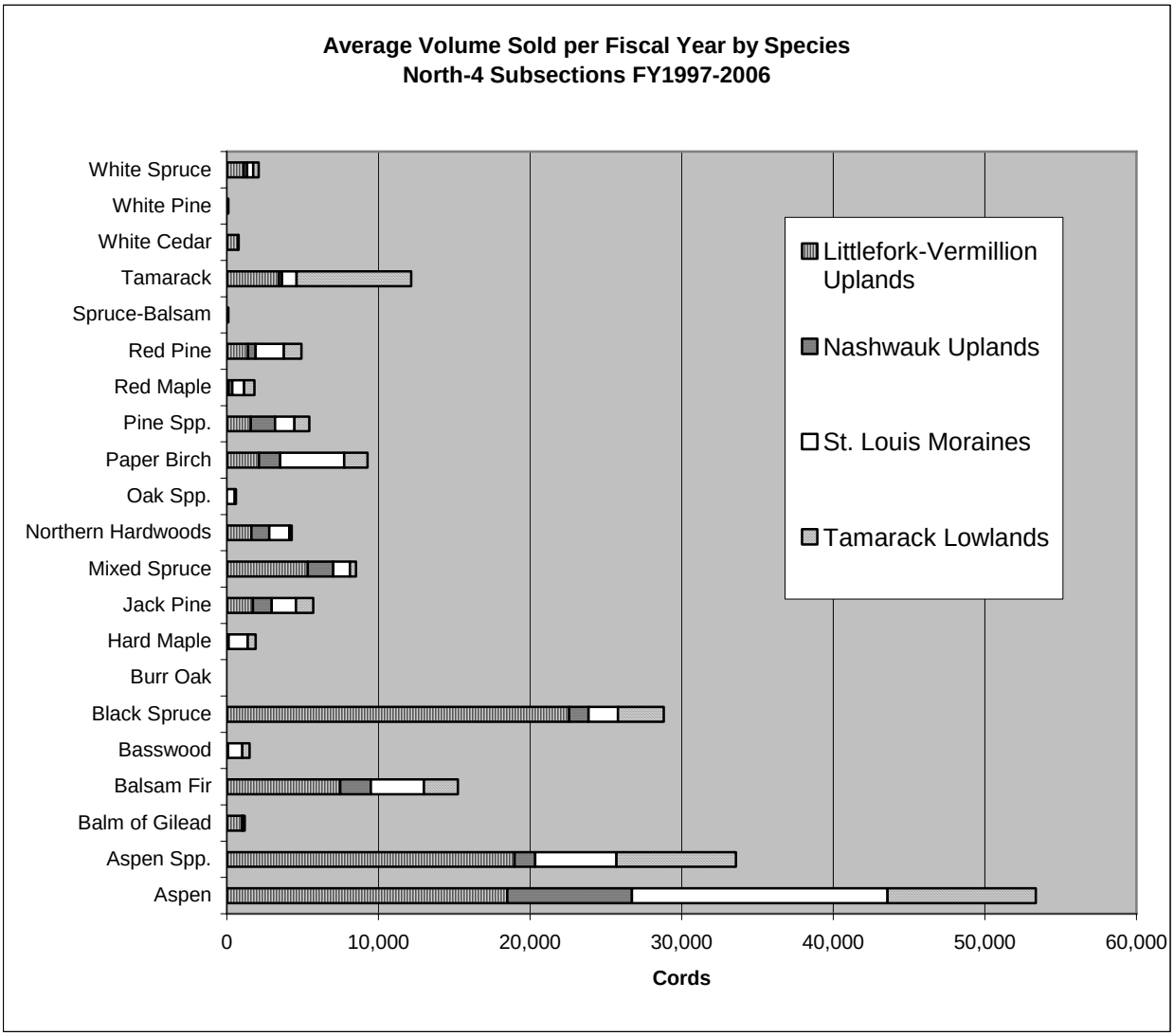


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

4.5 Average Volume Sold Per Fiscal Year by Species From DNR Lands in the Subsections

Forest cover types normally consist of a variety of species, while the name of the cover type is based on the predominant species. The DNR bases harvest levels on cover type ***acres***, but timber is sold by tree ***species volume and value***. The following graph shows volumes sold by species.

Chart 4.5 North-4 Subsections



Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

During the period of FY1997 to FY2006, an average of 191,555 cords were sold per year from DNR forestlands in the four subsections combined.

CHAPTER 5

Ecological Information

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsections

5.1 … Summary Descriptions of the North-4 Subsections

5.2 … Native Plant Communities of the North-4 Subsections

5.3 … Minnesota's List of Endangered, Threatened, and Special Concern Species
Table 5.1 North-4 Subsections: Minnesota Listed Species – Animals
Table 5.2 North-4 Subsections: Minnesota Listed Species – Plants
Table 5.3 North-4 Subsections: Minnesota "NONs" – Animals
Table 5.4 North-4 Subsections: Minnesota "NONs" – Plants

5.4 … Minnesota County Biological Survey (MCBS)
Table 5.5 North-4 Subsections: MCBS Status

How graphics are labeled:

Graphics referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

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Graphics referring to the Nashwauk Uplands Subsection only are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands only are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:
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5.1 Summary Description of Each of the Four Subsections

St. Louis Moraines Subsection

Rolling to steep slopes characterize much of this subsection. End moraines are the dominant landform. The underlying topography was formed by the Rainy lobe. It was later overridden by the St. Louis sublobe of the last glaciation period. Northern hardwood forests were common in the southern portion of the region, south of Grand Rapids. North of Grand Rapids, white pine, sugar maple, basswood, and balsam fir were common tree species. Presently, forestry and tourism are the major land uses.

Landform

This subsection consists of distinct end moraines associated with the St. Louis and Koochiching Sublobes and a pitted outwash plain (Hobbs and Goebel 1982). These sublobes overrode Rainy Lobe moraines, which formed the framework of landform characteristics. The cap of calcareous gray sediment varies from 1 to 10-plus feet in depth. Coarse loamy Rainy Lobe sediments underlie the cap. Portions of this unit, both north and south of Grand Rapids, have very steep topography. These areas are ice disintegration features. Topography on the rest is gently rolling to rolling.

Bedrock geology

The glacial drift in this subsection ranges from 100 to 200 feet in depth (0lsen and Mossler 1982). Lower Precambrian undivided granites, metavolcanics, and metasedimentary rocks underlie the glacial drift (Sims et al. 1970c).

Soils

Loamy calcareous soils make up about 75% of the soils in this subsection (Dept. of Soil Science, Univ. of Minnesota 110-1971). Excessively well-drained outwash sands account for another 10 to 15% and poorly drained soils account for about 3%. The soils are classified as Boralfs (well drained soils developed under forest vegetation), Aqualfs (wet soils developed under forest vegetation), Hemists (moderately decomposed organic soils), and Psamments (sandy, poorly developed well-drained soils), with Boralfs most common (Cummins and Grigal 1981).

Climate

Total annual precipitation ranges from 24 inches in the northwest to 27 inches in the southeast, with about 40% occurring during the growing season. Only 12 to 16% of the annual precipitation falls during winter months (based on Midwest Climate Center 1992). Growing season length varies from 111 to 131 days.

Hydrology

The Mississippi River cuts this subsection virtually in half. The river flows northwest to southeast close to the north-south midpoint of the subsection. Several small, relatively short rivers are present. They include the Prairie, Willow, Hill, and Moose rivers. The drainage network is poorly developed due to landform characteristics. Lakes are numerous. In fact, there are over 66 lakes that have a surface area greater than 160 acres; lakes account for over 10% of the surface area.

Pre-settlement vegetation

White pine-red pine forest covered large portions of the steep moraines and portions of the pitted outwash along the eastern edge of the subsection. South of Grand Rapids was an area of moraine dominated by northern hardwoods. Aspen-birch forests also grew on the moraines, but were more common on the outwash, which had excessively well drained sandy soils. Mixed hardwood-pine forest was locally present on the moraines, generally near large lakes. Conifer swamp and bogs were scattered throughout the subsection, occupying both kettles and linear depressions in the pitted outwash and moraines (Albert 1993).

Present vegetation and land use

The most important land uses in this subsection are forestry and recreation. This area is heavily forested and timber harvesting is extensive. Quaking aspen is the primary species harvested. Recreation is primarily associated with the subsection's lakes and the areas around them. Fishing, hunting, snowmobiling, and skiing are popular.

Natural disturbance

Fire and windthrow were the most common natural disturbances. Fire was an important agent in maintaining fairly pure red and white pine stands.

Tamarack Lowlands Subsections

The boundaries of this subsection coincide with the boundaries of the Glacial Lake Upham Plain and the Aurora Till Plain. This is a unique area topographically and climatically. The till plain is included because it forms a relatively flat plain ecologically similar to the adjacent lacustrine plain.

Level to gently rolling topography are characteristic of this region. The largest landform is a lake plain. Around the edges of the old glacial lake is a till plain (Aurora Till Plain) formed in Superior lobe sediments. There is also a small piece of end moraine north of Sandy Lake that is related to the St. Louis moraines. Lowland hardwoods and conifers were the most common forest communities. Northern hardwood and aspen-birch forests were common on the other portions of this region. Presently, much of the land is in public ownership. Forestry and tourism, along with some agriculture are the most common land uses.

Landform

Glacial lacustrine (lake deposited) sediments occupy much of the subsection. Beach ridges are not well defined. The lake was probably not present at one level long enough to form distinct beach ridges (as are found in the Glacial Lake Agassiz basin, to the west). There is a ground moraine along the northern and southern borders of the Glacial Lake Upham basin. Low drumlin ridges are present locally.

Bedrock geology

Glacial drift within the lake beds ranges from 100 to 300 feet thick, with some of the thickest sediments at the northern edge of the Glacial Lake Upham basin, where it meets the Mesabi Range (0lsen and Mosslet, 1982). The bedrock beneath Lake Upham is Middle Precambrian (Early Proterozoic) argillite, siltstone, quartzite, or graywacke, weakly metamorphosed (Morey 1976, Morey et al. 198~). There is also Cretaceous shale, sandstone, and clay near the southwest end of the basin and along the border with the Mesabi Range.

Soils

Soils include extensive areas of histosols (peats) over both fine-textured (silt and clay-rich) and sandy lacustrine deposits. Other soil orders present are entisols and alfisols. Soils are classified by Grigal and Anderson (1984) as primarily Ochrepts, Hemists, Aquents, and Boralfs. Alluvial soils are present along major rivers.

Climate
Total annual precipitation ranges from 24 inches in the northwest to 27 inches in the east, with about 40% occurring during the growing season. The growing season is short, from 92 to 115 days, as the low-lying subsection forms a frost pocket with late spring frosts and early fall frosts.

Hydrology

Several major rivers flow through this subsection. These include the Mississippi, St. Louis, Whiteface, East Swan, Savannah, and Willow rivers. Rivers and streams meander extensively across the subsection due to the predominately level landscape. There are few lakes present in the lake plain. The largest lake is Sandy Lake, which is a reservoir created by a dam on the Savannah River.

Pre-settlement vegetation

Vegetation in the lowlands was dominated by lowland conifers (black spruce, tamarack, and white cedar) and lowland hardwoods (black ash). Sedge meadows were also extensive. Uplands supported aspen-birch and upland conifer forest. White pine-red pine forests were located on the ground moraine at the edges of the lake plain, but were not extensive.

Present vegetation and land use

Forestry is the most important land use within the Tamarack Lowlands. There are some areas in the lake plain where agriculture is important, although most of the subsection is marginal for agriculture. Locally, tourism is important around Sandy Lake in Aitkin County.

Natural disturbance

Fire was probably important, both on the hardwood-conifer dominated uplands and in wetlands. Windthrow was probably important in the conifer swamps. In this type of flat, lacustrine setting, natural water-level fluctuations and flooding behind beaver dams often causes extensive tree mortality (Albert 1993).

Nashwauk Uplands Subsection

The southern boundary of this subsection is formed by Giant's Range, a prominent feature on the land. The western and part of the northern boundary is formed by the limit of the Nashwauk Moraine. The Nashwauk Uplands Subsection covers 810,000 acres (1,265 square miles) in northeast Minnesota.

Brown glacial sediments form the parent material for much of this subsection. Landforms include end moraines, outwash plains, and lake plains. Soils are varied and range from medium to coarse textures. One unique aspect of this region is the Giants Range, where the majority of iron mining in Minnesota takes place. It is a high narrow ridge trending northeast to southwest and caused by bedrock. This region consisted of forest communities dominated by white pine, red pine, balsam fir, white spruce, and aspen-birch. Forestry and mining are the most important land uses presently.

Landform

The subsection includes rolling till plains and moraines and flat outwash plains formed by the Rainy Lobe glacier. Most striking is the Giants Range, a narrow bedrock ridge towering 200 to 400 feet above the surrounding area. It trends southwest to northeast. Bedrock is locally exposed in the end moraines. Small bogs and potholes are common.

Bedrock geology

Thickness of glacial drift is quite variable across the subsection. On moraines, till plains and outwash plains drift is commonly greater than 100 feet over Precambrian (Late Archean and Early Proterozoic) bedrock that includes gneiss, undifferentiated granite, and metamorphosed mafic to intermediate volcanic and sedimentary rocks. Giants Range has a thin blanket of drift over granite. Immediately to the south is the iron-formation of the Iron Range, which has been heavily mined, first for "soft" iron ore and later for taconite.

Soils

Soils are formed in sandy to fine-loamy glacial till and outwash sand. Soils on the Nashwauk Moraine have a loamy cap with dense basal till below at depths of 20 to 40 inches. They are classified as boralfs (cold, well-drained soils developed under forest vegetation). Other areas north of Giants Range have coarse-loamy to sandy soils classified as boralfs, orthents, and ochrepts.

Climate

Precipitation averages between 24 and 27 inches, with the lowest amount at the western edge of the subsection. About half of the precipitation arrives during the summer months. The growing season ranges from 106 to 121 days.

Hydrology

There are over 63 lakes greater than 100 acres in size in this subsection. Many are found on the Nashwauk Moraine. The Continental Divide follows the summit of Giant's Range. Water flowing north eventually goes into Hudson Bay. On the west side, waters flow into the Mississippi River watershed. To the south, water flows into Lake Superior.

Presettlement Vegetation

Presettlement vegetation was a mixture of deciduous and coniferous trees. White pine-red pine forest and jack pine barrens were common on outwash plains. Aspen-birch forest and mixed hardwood-pine forest were present on moraines and till plains. Wetland vegetation included conifer bogs and swamps.

Present Vegetation and Land Use

Land ownership is roughly equal between public and private in St. Louis County and mostly public or forest industry in Itasca County. Quaking aspen is the dominant tree species presently. Forest management and recreation are the most important land use in this subsection. Mining is also an important land use.

Natural disturbance

Windthrow had the strongest impact on the moraines. Fire had a lesser impact overall but was more prominent on the outwash plains.

Littlefork – Vermilion Uplands Subsection

The western edge of the subsection lies just west of the Littlefork River. This river is a natural boundary between the extensive peatlands to the west and predominately clayey till and lake-laid mineral sediments to the east. The southern boundary is the southeastern corner of Glacial Lake Agassiz. To the east, the boundary is the Vermilion River up to the point where it turns east and enters Crane Lake. This boundary marks the division between bedrock-controlled uplands with shallow soils and glacial lake plain with bedrock knobs present but not dominant.

This is a level to gently rolling lake plain and transition zone to the Border Lakes region to the east. Soils are clayey to loamy and formed from lake-laid sediments and glacial till. Topographic relief is less than 50 feet on most of the lake plain, becoming greater to the east in the transition zone.

Landform

This subsection is transitional between extensive peatlands to the west and bedrock controlled landscape to the east. The major landform on the west side is lake plain. On the east side, the glacial lake had a very irregular shoreline. It squeezed between bedrock outcrops, depositing sediments like fillings in teeth. The elevation grades from 1100 feet in the northwest corner to 1500 feet in the southeastern corner around Lake Vermilion.

Bedrock geology

Glacial drift depth grades from shallow at the northern and eastern edges of the subsection to moderately thick in the western portion. Bedrock outcrops are common in the transition zone to the Border Lakes Subsection. Drift is up to 300 feet thick on the western side of the subsection. The underlying bedrock is Precambrian (Late Archean) in age, and includes gneiss, amphibolite, undifferentiated granite, and metamorphosed mafic to intermediate volcanic and sedimentary rocks. There are also iron formation, metasediments, and metamorphosed felsic volcanic rocks (Morey 1976).

Soils

Soils in this subsection are primarily moderately well to poorly drained mineral soils formed from clayey lake-laid sediments or loamy to clayey glacial till. Organic soils are common, but do not dominate the landscape (as they do to the west in the Agassiz Lowlands). Peat depths vary from shallow to deep (1 to 15 feet thick). Soils are classified primarily as Aqualfs (wet forested soils), Aquents (wet undeveloped soils), Boralfs (well to moderately

well drained forested soils), and Hemists (moderately decomposed peat) (Anderson and Grigal 1984).

Climate

The total annual precipitation ranges from 21 inches in the west to 25 inches in the east, with 40-50% occurring during the growing season. Average annual snowfall varies from 60 to 75 inches, with the greatest amounts occurring in the central portion of the subsection. The average daily maximum temperature during July is 80 degrees. The growing season is short, from 98 to 111 days, with the shortest growing season near the eastern edge of the subsection.

Hydrology

This subsection is framed by the Littlefork River on the west side and the Vermilion River on the east side. Topography is level to gently rolling throughout most of the subsection. The drainage network is undeveloped, with rivers and streams meandering extensively, especially in the western part. Major rivers flowing through include the Littlefork, Vermilion, Ash, Blackduck, Lost, Rat Root, and Rainy. Lakes are concentrated in the southeastern part. Larger ones include a portion of Vermilion Lake, Pelican Lake, and Net Lake. There are very few lakes in the western part of the subsection.

Presettlement vegetation

Marschner (1974) mapped much of the subsection as aspen-birch forest that would eventually become conifer dominated (white pine, white spruce, and balsam fir). The eastern portion was dominated by white pine, red pine, and jack pine forest. Lowlands were occupied by sedge fen, black spruce-sphagnum bog, and white cedar-black ash swamp. There were also low moraines and beach ridges dominated by jack pine forest or trembling aspen-paper birch forest.

Present vegetation and land use

Quaking aspen is the most common species of tree in this subsection. It is found in both pure and mixed stands. It is heavily harvested for pulp (Grigal, personal communication). Aspen is probably the best developed forest type on the uplands, and it probably was similarly common before settlement. Logging of conifer forests also occurs. In the past, attempts were made to farm portions of the peatlands. (Heinselman 1963). Ditches were dug along section lines, but were not effective. The other important land use is recreation, particularly in the southeastern section where there are several prominent lakes and reservoirs.

Natural disturbance

Fire occurred in the peatlands. Insect infestations, such as spruce budworm probably lead to fires. Water level fluctuation, caused by short-term climatic changes and by beaver dams, contributed to tree mortality. Windthrow was common on poorly drained mineral soils (Albert 1993).

References

Albert, D.A. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification. GT Report NC-178. USDA Forest Service North Central Forest Experiment Station, St. Paul, MN. 250 pp.

Anderson, J.L., and D.F. Grigal. 1984. Soils and Landscapes of Minnesota. Agricultural Extension Service, University of Minnesota.

Cummins, J.F. and D.F. Grigal. 1981. Soils and Land Surfaces of Minnesota. Department of Soil Science, Univ. of Minn. Agricultural Experiment Station, St. Paul, Minnesota. Soil Series No. 110, Miscellaneous Publication 11. 59 pp. + map (1:1,000,000).

Heinselman, M.L. 1963. Forest sites, bog processes, and peatland types in the Glacial Lake Agassiz Region, Minnesota. Ecological Monographs 33: 327372.

Hobbs, H. C., and J. E. Goebel. 1982. Geologic Map of Minnesota; Quaternary Geology. 1:500,000. Minnesota Geological Survey, Univ. of Minnesota.

Marschner, F.J. 1974. The Original Vegetation of Minnesota, a map compiled in 1930 by F.J. Marshner from U.S. General Land Office Survey Notes and published in 1974 under the direction of M.L. Heinselman of the U. S. Forest Service. Cartography Laboratory of the Department of Geography, University of Minnesota, St. Paul. 1 map (1:500,000).

Midwest Climate Center. 1992. Mean 1961-1990 Temperature and Precipitation over the Upper Midwest. Research Report 92-01. SWS Miscellaneous Publication 136.

Morey, G.B. 1976. Geologic Map of Minnesota: Bedrock Geology. Minnesota Geological Survey, University of Minnesota. Miscellaneous Map Series, Map M-24

Morey, G.B., B.M. Olsen, and D.L. Southwick. 1981. Geologic Map of Minnesota, East-Central Minnesota, Bedrock Geology. 1 map (1:250,000).

Olsen, B.M. and J.H. Mossler. 1982. Geologic Map of Minnesota: Depth To Bedrock. Map S-14. Minnesota Geological Survey. University of Minnesota, St. Paul. 1 map, 1:1,000,000.

Sims, P.K., G.B. Morey, R.W. Ojakangas, and S. Viswanathan. 1970c. Geologic Map of Minnesota, Hibbing Sheet, Bedrock Geology. State of Minnesota, University of Minnesota. 1 map (1:250,000).

5.2 Native Plant Communities of Each Subsection

Minnesota's Native Plant Community Classification
The process of revising the Minnesota Department of Natural Resources' native plant community classification began in 1996 as a collaborative project among the Division of Ecological Resource's Natural Heritage and Nongame Research Program (NHNRP), the Minnesota County Biological Survey (MCBS), and the Division of Forestry's Ecological Land Classification Program (ELCP). The revised community classification is integrated with the ELCP's ecological land classification of Minnesota and is based on extensive analyses of vegetation plot data. The new classification replaces the plant community classification presented in *Minnesota's Native Vegetation: A Key to Natural Communities, Version 1.5*. The first volume of the new classification, *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province,* was published in 2003 and includes the North-4 Subsections addressed in this plan. The field keys to Minnesota's forested plant communities contained within this field guide are being used with other ECS and native plant community (NPC) information to assist forest management decisions on state lands.

Classification of Wooded Plant Communities
The delineation of wooded plant communities in the new classification is based on statistical analyses of vegetation plot data, (the relevé plot method was used), which are housed in the DNR's Natural Heritage Information System Relevé Database. Most of these relevés were done by ecologists with the MCBS and NHNRP or by contractors working with ELCP in the Chippewa National Forest. During the classification project, relevés were also acquired from other sources, including research projects, environmental review projects, and conservation inventories. A total of 2,756 relevés were analyzed to develop the classification of wooded communities. These plot data reflect much of the variation in wooded plant communities across Minnesota, although there are some areas of the state for which few relevés exist.

Analyses of the vegetation plot data were organized within the framework of ecologically defined land units developed by ELCP (see Ecological Classification System map of Minnesota in Appendix A). The result is a classification of wooded plant communities that relates more deliberately to variation in physical features of the landscape than the previous classification and has an ecologically based hierarchy. The hierarchy of Minnesota's wooded plant community classification is:

Ecological System (such as Fire-Dependent Forest/Woodland System)
Floristic Region (such as Northern Floristic Region)
Native Plant Community Class (such as Dry-Sand Pine Woodland)
Native Plant Community Type (such as Dry-Sand Jack Pine Woodland)
(Sometimes with subtypes)

Native plant community classifications differ from forest cover types (such as those used in cooperative stand assessment forest inventory) in that they are based on all vascular plant species, not just the dominant canopy tree species.

Following is a list of the wooded native plant community systems, classes, types and subtypes known to occur in the North 4 subsections. Both the codes and their associated names are provided. Much more detailed information about each plant community in the two subsections, including distribution maps, can be found in *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province.* A copy of this publication will be available at sites where hard copies of this Issues and Assessment document are available for public viewing. In addition, the field guide is available through the Minnesota Bookstore at http://www.comm.media.state.mn.us/bookstore.

Wooded Native Plant Community Systems, Classes, Types, & Subtypes documented in the North-4 Subsections

FIRE-DEPENDENT FOREST/WOODLAND SYSTEM
- FDn12 NORTHERN DRY– SAND PINE WOODLAND CLASS
  - FDn12a Jack Pine Woodland (Sand) Type
  - FDn12b Red Pine Woodland (Sand) Type
- FDn22 NORTHERN DRY–BEDROCK PINE (OAK) WOODLAND CLASS
  - FDn22a Jack Pine Woodland (Bedrock) Type
- FDn32 NORTHERN POOR DRY-MESIC MIXED WOODLAND CLASS
  - FDn32c Black Spruce – Jack Pine Woodland Type
    - *FDn32c1 Jack Pine – Balsam Fir Subtype*
- FDn33 NORTHERN DRY- MESIC MIXED WOODLAND CLASS
  - FDn33a Red Pine-White Pine Woodland Type
    - *FDn33a1 Balsam Fir Subtype*
    - *FDn33a2 Mountain Maple Subtype*
- FDn43 NORTHERN MESIC MIXED FOREST CLASS
  - FDn43a White Pine – Red Pine Forest Type
  - FDn43b Aspen – Birch Forest Type
    - *FDn43b1 Balsam Fir Subtype*
- FDc24 CENTRAL RICH DRY PINE WOODLAND CLASS
- FDc24a Jack Pine - (Bush Honeysuckle) Woodland Type
  - *FDc24a1 Bracken Subtype*
- FDc25 CENTRAL DRY OAK-ASPEN (PINE) WOODLAND CLASS
  - FDc25b Oak – Aspen Woodland Type
- FDc34 CENTRAL DRY-MESIC PINE-HARDWOOD FOREST CLASS
  - FDc34a Red Pine-White Pine Forest Type

MESIC HARDWOOD FOREST SYSTEM
- MHn35 NORTHERN MESIC HARDWOOD FOREST CLASS
  - MHn35a Aspen-Birch-Basswood Forest Type
  - MHn35b Red Oak – Sugar Maple – Basswood – (Bluebead Lily) Forest Type
- MHn44 NORTHERN WET-MESIC BOREAL HARDWOOD-CONIFER FOREST CLASS
  - MHn44a Aspen-Birch-Red Maple Forest MHn44c Aspen-Fir Forest Type
  - MHn44b White Pine – White Spruce – Paper Birch Forest Type
  - MHn44c Aspen – Fir Forest Type
- MHn45 NORTHERN MESIC HARDWOOD (CEDAR) FOREST CLASS

MHn46 NORTHERN WET-MESIC HARDWOOD FOREST CLASS
MHn46a Aspen-Ash Forest MHn46b Black Ash-Basswood Forest Type
MHn46b Black Ash – Basswood Forest Type
MHn47 NORTHERN RICH MESIC HARDWOOD FOREST CLASS
MHn47a Sugar Maple-Basswood-(Bluebead Lily) Forest Type
MHn47b Sugar Maple-Basswood-(Horsetail) Forest Type
MHc26 CENTRAL DRY-MESIC OAK-ASPEN FOREST CLASS
MHc26a Oak-Aspen-Red Maple Forest Type
MHc26b Red Oak-Sugar Maple-Basswood (Large-Flowered Trillium) Forest Type
MHc36 CENTRAL MESIC HARDWOOD FOREST (EASTERN) CLASS
MHc36a Red Oak-Basswood Forest (Noncalcareous Till) Type
MHc36b Red Oak-Basswood Forest (Calcareous Till) Type
MHc47 CENTRAL WET-MESIC HARDWOOD FOREST CLASS
MHc47a Basswood – Black Ash Forest Type

FLOODPLAIN FOREST SYSTEM
FFn57 NORTHERN TERRACE FOREST CLASS
FFn57a Black Ash-Silver Maple Terrace Forest Type
FFn67 NORTHERN FLOODPLAIN FOREST CLASS
FFn67a Silver Maple-(Sensitive Fern) Floodplain Forest Type

WET FOREST SYSTEM
WFn53 NORTHERN WET CEDAR FOREST CLASS
WFn53b Lowland White Cedar Forest (Northern) Type
WFn55 NORTHERN WET ASH SWAMP CLASS
WFn55a Black Ash-Aspen-Balsam Poplar Swamp (Northeastern) Type
WFn55b Black Ash – Yellow Birch – Red Maple – Basswood Swamp (Eastcentral) Type
WFn55c Black Ash-Mountain Maple Swamp (Northern) Type
WFn64 NORTHERN VERY WEST ASH SWAMP CLASS
WFn64a Black Ash-Conifer Swamp (Northeastern) Type
WFn64c Black Ash-Alder Swamp (Northern) Type
WFn74 NORTHERN WET ALDER SWAMP CLASS

FORESTED RICH PEATLAND SYSTEM
FPn63 NORTHERN CEDAR SWAMP CLASS
FPn63b White Cedar Swamp (Northcentral) Type
FPn71 NORHTERN RICH SPRUCE SWAMP (WATER TRACK) CLASS
FPn73 NORTHERN ALDER SWAMP CLASS
FPn73a Alder Swamp Type
FPn81 NORTHERN RICH TAMARACK SWAMP (WATER TRACK) CLASS
FPn81a Rich Tamarack (Sundew – Pitcher Plant) Swamp Type
FPn82 NORTHERN RICH TAMARACK SWAMP (WESTERN BASIN) CLASS
FPn82a Rich Tamarack – (Alder) Swamp Type
FPn82b Extremely Rich Tamarack Swamp Type

ACID PEATLAND SYSTEM
- APn80 NORTHERN SPRUCE BOG CLASS
  - APn80a Black Spruce Bog Type
    - *APn80a1 Treed Subtype*
    - *Apn80b2 Semi-Treed Subtype*
- APn81 NORTHERN POOR CONIFER SWAMP CLASS
  - APn81a Poor Black Spruce Swamp Type
  - APn81b Poor Tamarack-Black Spruce Swamp Type
    - *APn81b1 Black Spruce Subtype*
    - *APn81b2 Tamarack Subtype*

5.3 Minnesota's List of Endangered, Threatened, and Special Concern Species

Rare Features Information

Assessment products have been prepared by staff of the Division of Ecological Resources, Natural Heritage and Nongame Research Program (NHNRP), Minnesota Department of Natural Resources (DNR).

Additional information about rare features assessment products is available by contacting the Minnesota DNR.

Purpose, Scope, and Relationships to Federal Laws

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota DNR to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern (ETS). The resulting List of Endangered, Threatened, and Special Concern Species (http://www.dnr.state.mn.us/ets/index.html) is codified as Minnesota Rules, Chapter 6134. The Endangered Species Statute also authorizes the DNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300.

Minnesota's Endangered Species Statute and the associated rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. A person may not take, import, transport, or sell any portion of an endangered or threatened species. However, these acts 1) may be allowed by permit issued by the DNR, 2) exempt plants on certain agricultural lands and plants destroyed in consequence of certain agricultural practices, and 3) exempt the accidental, unknowing destruction of designated plants. Minnesota's Endangered Species Statute or the associated rules do not protect species of special concern. Persons are advised to read the full text of the statute and rules in order to understand all regulations pertaining to species that are designated as endangered, threatened, or species of special concern.

Note that the federal Endangered Species Act of 1973, as amended (16 USC 1531 _ 1544; see http://www.fws.gov/endangered/policies/index.html) requires the U.S. Department of the Interior to identify species as endangered or threatened according to a separate set of

definitions, and imposes a separate set of restrictions for those species. Three species on the federal list of endangered or threatened species occur in the North 4 subsections: gray wolf, bald eagle, and Canada lynx. See: http://www.fws.gov/midwest/endangered/lists/minnesot-spp.html

For more information on listed species, contact:
Natural Heritage and Nongame Research Program
Minnesota Department of Natural Resources
500 Lafayette Rd, Box 25
St. Paul, MN 55155
651-259-5090
1-888-646-6367 (toll free)

Minnesota Heritage Information System

Records of known locations of listed species are maintained in the Minnesota Heritage Information System. All DNR offices have this information available for review prior to forest management activities to determine if a known location of a rare species is in the vicinity of a stand. When reviewing forest stands for management activities during the planning process, this information will be available when assigning stand prescriptions. If an ETS species is known to exist or found on a site, management activities are modified to protect, promote, or enhance the ETS species on the site.

Survey Methods

Much of the information about rare features in the Minnesota Heritage Information System is the result of rare features survey work done since the 1970s by the NHNRP and Minnesota County Biological Survey (MCBS) (starting the 1980s), and contained within historic records and collections. While survey process and protocols for plants and animals are necessarily different in some ways, methods common to both include:

- Review of existing information
- Selection of targeted species and survey sites
- Field survey using techniques appropriate to the species
- Information management

A more detailed description of rare plant and animal survey procedures can be found in the MCBS page of the Minnesota DNR Web site at:
http://www.dnr.state.mn.us/ecological_services/mcbs/procedures.html.

Minnesota Listed Species

The rare feature products prepared for the North-4 subsection plan include information on species of plants and animals listed as endangered, threatened, and special concern (ETS). *Minnesota's List of Endangered, Threatened, and Special Concern Species* was created in 1984 and was last revised in 1996. The list, created under Minnesota's Endangered and Threatened Species Statute, draws attention to species that are at greatest risk of extinction within the state and applies special regulations to species listed as endangered or threatened. By alerting resource managers and the public to species in jeopardy, activities can be reviewed and prioritized to help preserve the diversity and abundance of Minnesota's flora and fauna. Because the list influences resource use and management activities in Minnesota, it is critical that it reflect the most current information regarding the distribution, abundance, and security of species within the state. Consequently, Minnesota law requires periodic revisions to the list. The DNR submitted a set of proposed revisions to *Minnesota's List of Endangered, Threatened, and Special Concern Species* to the 2006-07 Minnesota Legislature that await legislative action at the time of this report. The proposed revisions are not reflected in the following tables.

Table 5.1 North-4 Subsections: Minnesota Listed Species – Animals

MINNESOTA LISTED SPECIES - ANIMALS St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork Vermilion Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**SM**	**TL**	**NU**	**LFV**	**MN RANK[2]**	**NPC SYSTEM[3]**
Acipenser fulvescens	Lake Sturgeon		O		O	SPC	AR, AL
Ammodramus henslowii	Henslow's Sparrow		O			END	O
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	O	O			SPC	AP,WM, OP
Asio flammeus	Short-eared Owl		O			SPC	MR, OP, AP, WM
Buteo lineatus	Red-shouldered Hawk	O				SPC	MH, FF, MR
Cicindela denikei	Laurentian Tiger Beetle				O	THR	
Clemmys insculpta	Wood Turtle		O			THR	RV, MH, FD
Coturnicops noveboracensis	Yellow Rail	O	O			SPC	MR, WM
Cygnus buccinator	Trumpeter Swan	O	O			THR	A
Emydoidea blandingii	Blanding's Turtle	O	O			THR	AR, FD
Etheostoma microperca	Least Darter	O				SPC	AR, AL
Falco peregrinus	Peregrine Falcon		O	O		THR	LK
Haliaeetus leucocephalus	Bald Eagle	O	O	O	O	SPC	U
Hemidactylium scutatum	Four-toed Salamander	O	O			SPC	MH, FP (shrub swamp)
Ichthyomyzon fossor	Northern Brook Lamprey			O	O	SPC	AR
Lasmigona compressa	Creek Heelsplitter	O	O	O	O	SPC	AR
Lasmigona costata	Fluted-shell	O				SPC	AR
Ligumia recta	Black Sandshell	O	O	O	O	SPC	AR
Marpissa grata	A Jumping Spider	O	O			SPC	O, WM, AP
Notropis anogenus	Pugnose Shiner	O	O			SPC	AR, AL
Oxyethira itascae	A Caddisfly				O	SPC	A
Phalaropus tricolor	Wilson's Phalarope		O			THR	A, WM, FD,MR
Polycentropus milaca	A Caddisfly	O				SPC	A

Table 5.2 North-4 Subsections: Minnesota Listed Species – Plants

MINNESOTA LISTED SPECIES - PLANTS St. Louis Morianes, Tamarack Lowlands, Nashwauk Uplands, and Littlefork Vermilion Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**SM**	**TL**	**NU**	**LV**	**MN RANK[2]**	**NPC SYSTEM[3]**
Adoxa moschatellina	Moschatel		O			SPC	MH
Botrychium campestre	Prairie Moonwort	O	N	O		SPC	O
Botrychium lanceolatum	Triangle Moonwort	O	O	O		THR	MH
Botrychium minganense	Mingan Moonwort	P		O		SPC	O, MH, RO
Botrychium mormo	Goblin Fern	O	O	O	O	SPC	MH
Botrychium oneidense	Blunt-lobed Grapefern	O	O	O		END	MH
Botrychium pallidum	Pale Moonwort	O	O	O		END	O
Botrychium rugulosum	St. Lawrence Grapefern	O	O	O		THR	O, MH
Botrychium simplex	Least Moonwort	O	O	O		SPC	O, WF, MH
Caltha natans	Floating Marsh-marigold	P	O	O	O	END	AR, RV, A,
Carex exilis	Coastal Sedge		O		O	SPC	RF
Carex garberi	Garber's Sedge		O			THR	RF
Carex sterilis	Sterile Sedge		N		O	THR	RF
Cetraria aurescens	Eastern candlewax lichen		O			SPC	FP,FD
Cladium mariscoides	Twig-rush				O	SPC	RF, LK
Cypripedium arietinum	Ram's-head Lady's-slipper	O		O	P	THR	FD, FP
Drosera anglica	English Sundew			O	O	SPC	RF
Drosera linearis	Linear-leaved Sundew				O	SPC	RF
Eleocharis nitida	Neat Spike-rush		O			THR	WM, O
Eleocharis olivacea	Olivaceous Spike-rush	O				THR	LK, AP, FP
Eleocharis quinqueflora	Few-flowered Spike-rush			O		SPC	RF, LK, O
Eleocharis rostellata	Beaked Spike-rush				O	THR	RF
Fimbristylis autumnalis	Autumn Fimbristylis	O				SPC	O, LK
Juglans cinerea	Butternut	O	N	N	N	SPC	MH
Juncus stygius var. americanus	Bog Rush	O	P		O	SPC	RF, AP
Littorella uniflora	American Shore-plantain	O		O		SPC	AL, LK
Lobaria quercizans	Smooth lungwort	O	O	O		SPC	WF, MH
Malaxis monophyllos var. brachypoda	White Adder's-mouth	O	O		O	SPC	FP
Najas gracillima	Thread-like Naiad	O	O	O	O	SPC	AL

MINNESOTA LISTED SPECIES - PLANTS (cont)
St. Louis Morianes, Tamarack Lowlands, Nashwauk Uplands, and Littlefork Vermilion Uplands Subsections

		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**SM**	**TL**	**NU**	**LV**	**MN RANK[2]**	**NPC SYSTEM[3]**
Nymphaea leibergii	Small White Water-lily	O				THR	AL, AR
Panax quinquefolius	American Ginseng	O	N	N	N	SPC	MH
Phacelia franklinii	Franklin's Phacelia	P	O			SPC	C, FD, O
Platanthera clavellata	Club-spur Orchid	O	O	O	P	SPC	FP, AP
Platanthera flava var. herbiola	Tubercled Rein-orchid	O	N	O		END	WM
Polemonium occidentale ssp. lacustre	Western Jacob's Ladder		O		O	END	FP
Potamogeton bicupulatus	SnaiLKeed Pondweed	O				END	AL
Potamogeton vaginatus	Sheathed Pondweed		O			SPC	AL
Potamogeton vaseyi	Vasey's Pondweed	O	O	O		SPC	AL
Ranunculus lapponicus	Lapland Buttercup	O	P	O	O	SPC	FP, WF
Rhynchospora fusca	Sooty-colored Beak-rush		O	O	O	SPC	RF, AP
Salix maccalliana	Mccall's Willow	N	N	N	O	SPC	WM
Sparganium glomeratum	Clustered Bur-reed	O	O	O	O	SPC	WM, AR, LK, WF, O
Sticta fuliginosa	Peppered moon lichen			O		SPC	WF, FP, MH
Subularia aquatica	Awlwort	O				THR	AL
Torreyochloa pallida	Torrey's Manna-grass	P	P	O	O	SPC	RV, LK, MR
Tsuga canadensis	Eastern Hemlock		O		O	SPC	MH
Utricularia purpurea	Purple-flowered Bladderwort	O				SPC	AL
Utricularia resupinata	Lavendar Bladderwort	O		O		SPC	AL
Waldsteinia fragarioides	Barren Strawberry		O	O		SPC	FD
Xyris montana	Montane Yellow-eyed Grass	O	O			SPC	RF, AP

Additional Species Data

In addition to information on listed species, the North-4 subsections plan includes information on species labeled as "NONs." "NONs" are defined as a plant or animal species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories:

- The species is being considered for addition to the state list.
- The species was removed from the state list but records for the species are still entered and maintained as a precautionary measure.
- The species has been recently discovered in the state.
- The species is presumed extirpated from the state.

Table 5.3 North-4 Subsections: Minnesota "NONs" – Animals

MINNESOTA "NONs" - ANIMALS St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork Vermilion Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**SM**	**TL**	**NU**	**LFV**	**MN RANK[2]**	**NPC SYSTEM[3]**
Accipiter gentilis	Northern Goshawk	O	O	O	O	NON	FD, MH
Aegolius funereus	Boreal Owl		O			NON	FD, MH, WF, AP
Bartramia longicauda	Upland Sandpiper		O			NON	O
Botaurus lentiginosus	American Bittern	O	O	O	O	NON	MR, WM
Colonial Waterbird Nesting Area	Colonial Waterbird Nesting Site	O	O	O	O	NON	A, MR, WF, FF, FD, LK
Dendroica caerulescens	Black-throated Blue Warbler	O				NON	MH
Grus canadensis	Sandhill Crane	O	O			NON	MR, WM
Lycaena epixanthe michiganensis	Bog Copper	O	O			NON	AP
Strix nebulosa	Great Gray Owl		O			NON	FP, AP

Table 5.4 North-4 Subsections: Minnesota "NONs" – Plants

MINNESOTA "NONs" - PLANTS
St. Louis Morianes, Tamarack Lowlands, Nashwauk Uplands, and Littlefork Vermilion Uplands Subsections

		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**SM**	**TL**	**NU**	**LV**	**STATE RANK[2]**	**NPC SYSTEM[3]**
Actaea pachypoda	White Baneberry			O	O	NON	MH
Alisma gramineum	Narrow-leaved Water Plantain	O				NON	A
Arethusa bulbosa	Dragon's-mouth	O	O	O	P	NON	RF, P
Botrychium ascendens	Upward-lobed Moonwort	O	N			NON	O
Botrychium lineare	Narrowleaf Grape Fern	O	N			NON	O
Botrychium matricariifolium	Matricary Grapefern	O	O	O	P	NON	MH, FD, O
Botrychium michiganense	Michigan Moonwort	O	O	O		NON	O, RO
Botrychium spathulatum	Spathulate Moonwort	O	N			NON	O
Cardamine pratensis var. palustris	Cuckoo Flower		O			NON	OP, FP, RV
Carex ormostachya	Necklace Spike Sedge	O	P	O		NON	MH
Ceratophyllum echinatum	Spiny Hornwort	O			O	NON	A
Elatine triandra	Three Stamened Waterwort	O				NON	A
Eleocharis robbinsii	Robbin's Spike-rush	O				NON	AL, LK
Geocaulon lividum	Northern Comandra	O	P	P	O	NON	FP, AP
Liparis liliifolia	Lilia-leaved Twayblade		N	O	N	NON	MH, FD
Lycopus virginicus	Virginia Water Horehound	O	N	N	N	NON	FF
Myriophyllum tenellum	Leafless Water Milfoil	O	O	O		NON	AL
Poa sylvestris	Woodland Bluegrass		O			NON	MH
Polygonum arifolium	Halberd-leaved Tearthumb	O	O			NON	WM, WF
Polygonum hydropiperoides	Mild Water Pepper		O			NON	WM, O
Potamogeton oakesianus	Oakes' Pondweed		O			NON	AL
Ranunculus gmelini	Small Yellow Water Crowfoot	P	O	P	P	NON	LK, O, RV, WF
Scirpus pedicellatus	Woolgrass	P	P	O	P	NON	LK, WM, RV
Spiranthes casei	Case's Ladies'-tresses	O		O		NON	O
Triglochin palustris	Marsh Arrow-grass			O	O	NON	RF, AP, FP
Utricularia gibba	Humped Bladderwort	O	O	O	O	NON	AL

Key to Rare Features Codes

[1]Occurrence

O – Documented occurrence in the subsection
P – Highly likely to occur in the subsection (plants only)
N – Not likely to occur in the subsection (plants only)

[2] MN Rank

END – Endangered. A species is considered **endangered** if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.
THR – Threatened. A species is considered **threatened** if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.
SPC – Special Concern. A species is considered a species of **special concern** if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range not listed as threatened may be included in this category, along with those species that were once threatened or endangered but now have increasing or protected, stable populations.
NON – Plant or animal species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories:

- The species is being considered for addition to the state list.
- The species was removed from the state list but records for the species are still entered and maintained as a precautionary measure.
- The species has been recently discovered in the state; the species is presumed to be extirpated from the state.

[3] NPC (Native Plant Community) System

Most of the following codes were adapted from native plant community systems in *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province*. Exceptions to this, created for the North-4 SFRMP and not part of the field guide, include the codes A, AL, AR, U, and O.

A – Aquatic general
AL – Aquatic (lake)
AR – Aquatic (river)
FD – Fire dependent forest
FF – Floodplain forest
LK – Lakeshore
MR – Marsh
MH – Mesic hardwood forest
FP – Forested/treed peatland (includes both rich and acid forested/treed

peatlands)
OP – Open rich peatland (includes rich fens)
AP – Acid peatland (includes open bogs)
RV – River shore
WF – Wet forest
WM – Wet meadow/carr (patchy graminoid and deciduous shrub on permanently wet, organic soil.)
U – Wide-ranging and/or associated with a wide variety of habitats
O – Openings (natural and anthropogenic)

Listed Species Status Sheets

A supplemental document, *Statement of Need and Reasonableness (SONAR) and Species Status Sheets*, is available by contacting the DNR. This document addresses listed species in Minnesota for which a change in status was prosed during the 1996 list revision. The *Species Status Sheets* provide some information on the species and describe the rationale for the 1996 proposed change in Minnesota status.

Natural Heritage and Nongame Research Program Rare Species Fact Sheets

The Natural Heritage and Nongame Reseearch Program is in the process of preparing and publishing rare species fact sheets. This effort will not be completed for this round of subsection planning although it will be completed and the fact sheets will become available for use in vegetation management during the implementation phase of the North-4 SFRMP.

The goal of the rare species fact sheet project is to update and publish information on Minnesota's rare species. It is both an informational and technological update to the 1988 publication, *Minnesota's Endangered Flora and Fauna*, by Coffin and Pfannmuller. Species information will be web-based and will use an interactive database approach that allows users to search on selected fields and create customized reports. Users will also be able to perform alphabetical searches and generate standard printouts of rare species accounts.

In total, the rare species fact sheet project will provide published accounts of about 200 endangered and threatened species and about 240 species of special concern.

Information Resources

The Minnesota (DNR) Natural Heritage Information System (NHIS) rare features database was the primary source for species occurrences information presented in tables 5.1 – 5.4. These data were supplemented by input and review by Natural Heritage and Nongame Research Program staff.

Sources for Additional Rare Species Information

1. The Nature Conservancy. *Element Occurrence Abstracts*

2. NatureServe. A network connecting science with conservation that includes an online encyclopedia of rare plants and animals. http://www.natureserve.org/

3. U.S. Department of Agriculture – Forest Service Region 9. Regional Forester *Sensitive Species Conservation Assessment Documents* (also on the Web at: http://www.fs.fed.us/r9/wildlife/tes/ca-overiew/index.htm)

References

Coffin B. and L. Pfannmuller, eds. 1988. *Minnesota's Endangered Flora and Fauna.* University of Minnesota Press, Minneapolis, Minnesota. 473 pp.

Crow G.E. and C.B. Hellquist. 2000. *Aquatic and Wetland Plants of Northeastern North America; Pteridophytes, Gymnosperms,* and *Angiosperms: Dicotolydens.* Volume 1. University of Wisconsin Press. Madison. 480 pp.

Crow G.E. and C.B. Hellquist. 2000. *Aquatic and Wetland Plants of Northeastern North America; Angiosperms: Monocotyledons.* Volume 2. University of Wisconsin Press. Madison. 400 pp.

Flora of North America Editorial Committee. 1993. *Flora of North America, Ferns and Gymnosperms.* Volume 2. Oxford University Press. 320 pp.

Flora of North America Editorial Committee. 2002. *Flora of North America, Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in part), and Zingiberidae.* Volume 22. Oxford University Press. New York.

Flora of North America Editorial Committee. 2002. *Flora of North America, Magnoliophyta: Commelinidae (in part): Cyperaceae.* Volume 23. Oxford University Press. New York.

Flora of North America Editorial Committee. 2003. *Flora of North America, Magnoliophyta: Commelinidae (in part): Poaceae, part 2.* Volume 25. Oxford University Press. New York.

Flora of North America Editorial Committee. 2003. *Flora of North America, Magnoliophyta: Liliidae: Liliales and Orchidales.* Volume 26. Oxford University Press. New York.

Gleason, H.A. and A.C. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada.* 2nd edition. New York Botanical Garden. Bronx, New York. 910 pp.

MN DNR. 2003. *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province.* Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MN DNR St. Paul, MN. 352 pp.

MN DNR. 2006. *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife,* Comprehensive Wildlife Conservation Strategy. Division of Ecological Resources, MN DNR. St. Paul, MN.

Oldfield, B. and J. Moriarty. 1994. *Amphibians and Reptiles Native to Minnesota*. University of Minnesota Press. Minneapolis. 237 pp.

Ownbey G. B. and T. Morley. *Vascular Plants of Minnesota; A Checklist and Atlas.* University of Minnesota Press. Minneapolis. 306 pp.

Sietman, B.E. 2003. *Field Guide to the Freshwater Mussels of Minnesota.* State of Minnesota, Department of Natural Resources. St. Paul.

Smith, W.R. 1993. *Orchids of Minnesota.* University of Minnesota Press. Minneapolis. 172 pp.

Voss, E.G. 1978. Michigan Flora, *Part I. Gymnosperms and Monocots.* Cranbrook Institute. Science Bulletin 55 and the University of Michigan Herbarium. 488 pp.

_____. 1985. Michigan Flora, *Part II. Dicots (Saurruraceae-Cornaceae).* Cranbrook Institute. Science Bulletin 55 and the University of Michigan Herbarium. 724 pp.

_____. 1996. Michigan Flora, *Part III. Dicots (Pyrolaceae-Compositae).* Cranbrook Institute. Science Bulletin 55 and the University of Michigan Herbarium. 622 pp.

5.4 Minnesota County Biological Survey

Process for Conducting Minnesota County Biological Survey (MCBS) Landscape Assessments

Minnesota County Biological Survey (MCBS) fieldwork has been completed in some counties and is in progress in other counties and regions within the North-4 subsections (http://www.dnr.state.mn.us/ecological_services/mcbs/index.html). See *Table 5.5 North-4 Subsections* below for the status of the MCBS in the North-4 subsections and, where available, the location of associated data. The SFRMP team will include in its assessment package MCBS survey information available in the DNR rare features database, the DNR data deli, and from other sources. Where MCBS survey work is in progress, the SFRMP team will incorporate information into the planning process as it becomes available.

MCBS Site Delineation Process

MCBS ecologists analyze survey areas (a county or ECS subsection) using historic and current ecological information, including remotely sensed data, to identify and delineate areas that appear to have some level of biodiversity significance. These locations are considered MCBS **sites**. A site can be isolated from other sites or it can be part of a **landscape study area** (LSA), and therefore contiguous with other sites. In either case, the site is the primary unit around which most MCBS data (such as field evaluations, native plant community records, and ecological evaluations) are organized.

MCBS Procedures – site and native plant community surveys

1. Review existing information
Within each county or ecological subsection, site and native plant community surveys begin with a review of existing records and information about areas of native vegetation.

Among the sources consulted are:

- Climate, geomorphology, soils data.
- Museum and herbarium records.
- Existing records in the Natural Heritage Information System and other historical records such as the public land surveys Bearing Tree Data Base conducted in Minnesota from 1847 to 1907.
- Other inventories, such as timber stand inventories and the National Wetlands Inventory.
- Knowledgeable individuals.

2. Site selection

Sites that appear to contain important areas of native vegetation are digitized in a Geographic Information System (GIS) or delineated on topographic maps using aerial photography, satellite imagery, and other related resource maps and data. These sources

of information are used to determine boundaries and provide a preliminary determination of the types of native plant communities that are present within each site.

MCBS has developed guidelines for determining which sites to map within each county or ecological unit. These include guidance for site evaluation based on size, current condition (including type and extent of human disturbance), landscape context, spatial distribution of native plant communities, and availability of critical rare plant or rare animal habitat. A site most often contains several different kinds of native plant communities (for example, oak forests, sedge meadows, and tamarack swamps); the boundaries of each community type are usually delineated within the site.

3. Field surveys of selected sites

For sites that appear to be of good quality with little evidence of disturbance, the ecologist conducts a field survey, recording notes about the type and structure of vegetation present, the most common plants, and evidence of disturbance such as cut stumps, soil erosion, and abundant weedy or exotic plant species.

If there are good quality examples of native plant communities at the site, the ecologist will often do a vegetation plot sample, or relevé, within one or more of the communities.

4. Information management

After site and native plant community surveys are completed, the ecologist determines which sites and locations of native plant communities meet minimum MCBS standards for size and quality. Poor-quality sites are eliminated from further consideration. For good-quality sites the ecologist enters data into the Natural Heritage Information System (NHIS) that include:

- Descriptive summaries of the site (landforms, soils, hydrology, plant community types, kinds of disturbance, etc.)
- Descriptive records on good-quality plant community locations.
- Relevé samples.

5. Final Steps

1. Refine the boundaries of the sites and native plant communities on topographic maps or GIS files and the final boundaries and associated data reside in the NHIS.
2. Write ecological evaluations for selected high-quality sites. These are used to guide conservation activity, such as special vegetation management or acquisition as a park or natural area.

MCBS Procedures – Rare Species Surveys

MCBS field biologists also conduct surveys for rare plants and rare animals. Data gathered during these surveys inform decisions about the biodiversity importance of MCBS sites in the survey area. Detailed descriptions of methods can be found at the following MN DNR websites:

Plants: http://www.dnr.state.mn.us/ecological_services/mcbs/procedures_plants.html

Animals: http://www.dnr.state.mn.us/ecological_services/mcbs/procedures_animals.html

Status of MCBS in the North-4 Subsections

Table 5.5 North-4 Subsections: MCBS Status

County	Field Data Collection Scheduled	Notes on Sites and NPCs
Aitkin	Completed	Draft sites are digital, NPC mapping in-progess
Beltrami	No	None
Carlton	Completed	Draft sites are digital, NPC mapping in-progess
Cass	Completed	Draft sites are digital, need revisions
Crow Wing	Completed	Draft final sites are digital, need revisions
Itasca	In progress	Preliminary survey sites digitized, prioritized for survey
Koochiching	No	None
St. Louis	NSH: complete TU: complete LU: complete TL: no NU: no BL: no	NSH: complete, available on the DNR Data Deli; TU: in progress; LU: in progress; TL: no NU: no BL: no

Contact: Carmen Converse carmen.converse@dnr.state.mn.us (651) 296-9782
NSH – North Shore Highlands Subsection
TU – Toimi Uplands Subsection
LU – Laurentian Uplands Subsection
TL – Tamarack Lowlands Subsection
NU – Nashwauk Uplands Subsection
BL – Border Lakes Subsection

DNR Data Deli – Department of Natural Resources Data Deli (http://deli.dnr.state.mn.us/)

CHAPTER 6

Stand Damage and Mortality

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsections

6.1… Introduction

6.2… Role of Insects and Diseases

6.3… Damage and Mortality Tables
Table 6.3 Insects and Diseases Known to Cause Quality Reductions or Mortality by Cover Type

6.4… Insects and Diseases Common to Each Cover Type
All
Aspen
Map 6.4a Forest Tent Caterpillar Defoliation 2000-2002
Ash
Oak
Map 6.4b Risk Assessment for Mortality Caused by Gypsy Moth
Birch
Tamarack
Map 6.4c Larch Beetle Mortality 2001-2006
Jack pine
Map 6.4d Jack Pine Budworm Defoliation in Northeastern Minnesota 1983-2006
Table 6.4 Occurrence of Rust Fungi on Jack Pine in the N-4 Subsections
White pine
Map 6.4e White Pine Blister Rust-Hazard Zone
Red pine
Balsam fir
Chart 6.4 Spruce Budworm: 1954-2006
Map 6.4f Spruce Budworm Defoliation 2006
White spruce
Black spruce

6.5… Additional Information Sources

6.6… Literature Cited

How graphics are labeled:

Graphics (i.e., Tables, Charts, and Maps) referring to all four subsections combined (St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands) are indicated by a "North-4 Subsections" after the chart designation (e.g., Table 3.2 North-4 Subsections).

Graphics referring to the St. Louis Moraines subsection *only* are indicated by a "slm" after each chart designation (e.g., Chart 3.2 slm).

Graphics referring to the Tamarack Lowlands Subsection *only* are indicated by a "tl" after each chart designation (e.g., Map 3.2 tl).

Graphics referring to the Nashwauk Uplands Subsection *only* are indicated by a "nu" after each chart designation (e.g., Map 3.2 nu).

Graphics referring to the Littlefork-Vermilion Uplands *only* are indicated by a "lvu" after each chart designation (e.g., Map 3.2 lvu).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands Subsection Forest Resource Management Plan (SFRMP) Web site at:
http://www.dnr.state.mn.us/forestry/subsection/north_4subsections/assessment.html

Maps in this chapter depict information for an area within a "planning boundary." This boundary is designed to closely approximate the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.

Printed documents will be available for review at the Minnesota DNR Grand Rapids Region Headquarters at 1201 E Hwy 2, Grand Rapids, Minnesota, and on compact disk by request to Lynn Sue Mizner at (218) 927-7511 or lynn.mizner@dnr.state.mn.us.

6.1 Introduction

This an assessment of forest insects and diseases known to cause tree mortality, growth loss, and quality reduction in forest stands in the Tamarack Lowlands, Nashwauk Uplands, St Louis Moraines, and Littlefork-Vermilion Uplands Subsections. The presence of forest insect and disease agents, as well as animal and abiotic agents, have been documented in reports by the Minnesota Department of Natural Resources (MN DNR), Forest Health Team; University of Minnesota; USDA Forest Service, State and Private Forestry; and North Central Forest Experiment Station.

6.2 Role of Insects and Disease

Native forest insects and disease organisms influence forest ecosystem dynamics as pests and agents of stress, but also play a beneficial role in the natural processes. Many native insects and diseases are an essential natural component of healthy forests and may contribute to compositional, structural, and functional diversity. By selectively affecting tree growth and mortality rates, they alter forest composition, structure, and succession. They thin and prune host populations, reducing density and competition. They can slow or stall the process of succession, or they can accelerate it. Through decay and biomass decomposition, they contribute significantly to carbon cycling, nutrient cycling, and energy flow in forest ecosystems. Insect and disease organisms serve as food for many invertebrates and vertebrates. Of vertebrates, birds consume the most tree-feeding insects, but many mammals consume insects to some degree as well. Insects and diseases create structural habitat for shelter and nesting. Many species of woodpeckers are attracted to trees with decay where they excavate cavities for nesting. Many animals use dead wood to roost, nest, or forage.

These same native forest insect and diseases are perceived as problems or pests when occurring at a level or on a site where they interfere with human goals, plans, and desires for trees and forests. Native insects and diseases can reduce timber productivity, lumber grade, site aesthetics, wildlife habitat, and water quality, and can increase the hazard of falling trees and branches and the occurrence of fire hazards, etc. Data from the 1990 Forest Inventory and Analysis for Minnesota indicate that 37 percent of the wood volume produced by all tree species annually is lost due to mortality. Insects and disease organisms account for more than 53 percent of this loss or more than 143 million cubic feet of wood. (Miles, Chen, Leatherberry, 1995). Surveys conducted by the MN DNR, Division of Forestry of oak and birch mortality triggered by drought and attacks by boring insects and root rot organisms, found in excess of 300,000 oaks and 200 million birch dying during the late 1980s and early 1990s (Albers, 1998). More than 40 percent of the birch type in Minnesota was affected.

What is perceived to be beneficial from one perspective may be viewed as detrimental from another. A very low level of decay would be required on a site being managed for high timber productivity, a higher level of decay may be acceptable on a site being managed under extended rotation, while any level may be acceptable on an old-growth site. Some level of decay will occur on every site regardless of the level of management. A forest tent caterpillar outbreak might be viewed as both beneficial and detrimental. The outbreak may benefit some birds that eat them but, be detrimental to others by leaving nests exposed to predators and bright sunlight, which can overheat, dehydrate, and kill young birds in nests. A forest tent caterpillar outbreak may increase the growth of shade-tolerant understory trees

due to increased nutrients from insect droppings and dead caterpillars, and due to increased sunlight getting through the defoliated overstory canopy. The same outbreak is detrimental to the overstory aspen due to slower growth and increased mortality caused by the loss of leaves.

While native insect and disease organisms have co-evolved with native trees and forests, exotic insects and disease organisms have not. Exotics do not have a natural "role" in our native ecosystems and have and will continue to alter forest ecosystem diversity, function, and productivity. Exotics historically have caused intensive and severe disturbances over large areas. In extreme cases they have virtually eliminated their host species. The elm resource has been devastated by introduction of the Dutch elm disease fungus and its bark beetle vector. The white pine blister rust fungus, accidentally introduced near the start of the 20th century, has played an important role in reducing the amount of white pine in Minnesota. Gypsy moth, while not yet established in Minnesota, is established in Wisconsin and Michigan and will become established here. While future impacts of gypsy moth in Minnesota are difficult to predict, especially in the northern aspen-birch forest, the insect has the potential to cause widespread mortality and will alter the composition and structure of the forest.

An ecosystem perspective requires that strategies to maintain the health of individual stands consider the beneficial, as well as the detrimental effects of insects and disease organisms. Forests must be considered as an ecosystem and manipulation to one part of that ecosystem affects the other parts. Pests have long influenced forest management, but forest management also affects pest populations. Vigorous trees tend to suffer less damage from these agents. Forest management aims to promote stand vigor and productivity by matching tree species to the planting site; manipulating rotation age, stand density, and species composition; avoiding wounding and root damage during thinning and harvesting; removing diseased and infested trees during harvesting operations, etc. Forest management does not attempt to eliminate native insect and diseases or their processes, but rather to control their activity and impact to a level that allows goals for timber production, water quality, aesthetics, recreation, wildlife, etc. to be realized.

In contrast, a much more aggressive approach is needed with exotic (non-native) organisms. It is important to avoid the introduction of exotics and attempt to contain and eradicate them when first found. Often it is not possible to eradicate or contain exotics once they are established. Attempts to slow their spread and management techniques to minimize their damage are then needed. Dutch elm disease and white pine blister rust are exotics that have become permanent components of the ecosystem. This will also happen with gypsy moth and Emerald ash borer after they become established in Minnesota.

Table 6.3

Insects and Diseases Known to Cause Quality Reductions or Mortality by Cover Type		
Cover Type	**Agents Known To Cause Mortality**	**Agents Known To Cause Quality Reductions**
All cover types	*Armillaria* root rot	Stem decay fungi
Aspen	*Hypoxylon* canker	White trunk rot
	Gypsy moth*	Forest tent caterpillar
		Poplar borer
Ash (all species)	Emerald ash borer*	
Black ash	Ash decline	
Oak	Gypsy moth*	
	Two-lined chestnut borer	
	Oak wilt	
Birch	Birch decline	
Tamarack	Eastern Larch beetle	
Jack pine	Jack pine budworm	Red rot
	Ips bark beetles	Stem rusts
White pine	White pine blister rust	White pine weevil
Red pine	*Ips* bark beetles	*Diplodia* shoot blight and canker
		Sirococcus shoot blight
Balsam fir	Spruce budworm	
White spruce	Spruce budworm	
	Spruce beetle	
Black spruce	Eastern dwarf mistletoe	

*Currently not known to be established but eventually will be and need to be considered in this planning period

6.4 Insects and Diseases Common to Each Cover Type

The following assessment is organized by cover types. Each cover type includes a description of the Damage Agent(s) followed by a discussion of Management Implications that can both increase and decrease populations of damage agents as well as their impacts. Decisions on which pests and information to include in this assessment are based on literature, surveys, and reports of state and federal agencies and university forest pathologists and entomologists, and on personal experience.

ALL SPECIES

Damage Agents

- **Stem decay—**Many species of fungi.

  All tree species are subject to stem decay by an array of fungi. Stem decay in all species increases as tree age increases. Wounds such as dead branch stubs, fire scars, and logging injuries serve as sites where decay can enter the trees. Wounds that occur to residual trees during a partial harvest or other management activities can be critically important. Minimizing wounding during logging, maintaining a level of stocking to promote natural branch shedding, and rotation age management can be keys to controlling the amount of stem decay. The older a tree becomes, the more wounds it accumulates and the greater

potential for volume losses due to decay. Many tree species have the ability to confine decay fungi to the wood present at the time of wounding, but with multiple wounds, decay columns tend to coalesce and the total amount of decay in the stem increases significantly. Also some decay fungi such as *Phellinus pini* and *P tremulae* have the ability to overcome the trees defenses and are able to decay wood formed both before and after wounding. As the stand ages, the proportion of trees in the stand with decay will increase and the volume of decay in each tree will increase. Stem decay does not kill trees outright, but it does lead to more stem breakage from wind and does reduce merchantable volume.

- **Root disease—***Armillaria* spp. and others
  Many species of fungi invade, decay and kill tree roots. Some attack only a few species of trees, while other have a very broad host range. Damage and death from root diseases are likely very common, but impact is not well documented since the damage is hidden below ground. Root diseases reduce the growth of trees and, if severe, can result in death or wind throw. All tree species are susceptible to root disease caused by *Armillaria spp.* *Armillaria* spp. are present on all forested sites. Hardwood and softwood trees weakened by drought, defoliation, wounding, soil compaction, or old age are predisposed to Armillaria root disease. This is especially a concern when hardwood sites are converted to softwoods. The fungus is able to use stumps as a food base and extend its rhizomorphs through the soil, infecting live roots of the planted softwoods. Partial cutting has also been shown to increase Armillaria root disease.

Management Implications

As a general rule, as stands of trees are allowed to age, the incidence and impact of stem decay and root rot increase. The presence of stem decay and root rot decreases stand productivity. Stem decay is the primary defect of most species, and as such, has been dealt with in this plan by managing the rotation age of each tree species. Root rot is a concern when hardwood sites are converted to softwoods. Partial cutting has also been shown to increase Armillaria root rot. Trees weakened by drought, defoliation, wounding, soil compaction, and old age can be predisposed to Armillaria root disease.

ASPEN

Damage Agents

- **Hypoxylon canker—***Entoleuca mammata (Hypoxylon mammatum)*
  A common disease of aspen, Hypoxylon canker causes mortality and is the most destructive pathogen of young aspen in the Lake States. However, it also plays a beneficial role of thinning young dense stands of aspen. It is estimated that Hypoxylon canker infects 12 percent and kills 1 percent to 2 percent of the aspen in the Lake States each year (Schipper and Anderson, 1976). Hypoxylon canker is primarily a disease of quaking aspen, but bigtooth aspen is also occasionally infected. Aspen of all age classes is susceptible; however, mortality is usually greatest in young trees. The fungus kills the trees by girdling the stem, which leads to stem breakage. Some clones appear to be much more susceptible to Hypoxylon canker than others, and mortality in susceptible clones

may approach 100 percent. Infection levels are not strongly correlated to site characteristics, but do appear to be related to stand density. Insect wounds made by cicadas, poplar-gall saperdas, and tree hoppers serve as infection courts for the fungus causing Hypoxylon canker. These insects prefer open-grown stands and stand edges. Because of this preference, there tends to be a greater amount of insect wounding and Hypoxylon canker incidence in the more open-grown stands and along stand edges (Ostry, et al., 1989).

- **Stem Decay (White trunk rot)—***Phellinus tremulae*
  White trunk rot is the major cause of decay in aspen. It starts to show up in stands at about 20 years of age and increases as the stands age. There does not seem to be a strong correlation between amount of decay and site factors the genetic susceptibility to decay of individual clones seems to override any observable correlations between decay and site factors. The best external indicator of decay is the presence of conks (Jones and Ostry, 1998). However, only about 50 percent of the trees with decay have visible conks, and lack of conks generally leads to an underestimation of decay. For example if 50% of the trees in a stand have conks then close to 100% of the trees contain some decay. Wounds serve as infection sites. Stands with a larger incidence of wounds from such things as equipment scrapes, fire, hail, and storm breakage may have higher levels of decay. Studies have indicated that the pathological rotation age (the age at which the loss of wood volume from decay begins to exceed the annual increment of sound wood) is from 40 to 50 years of age (Schmitz and Jackson, 1927). Others indicate that in many parts of the Lake States, aspen stands begin to deteriorate rapidly when they reach 50 to 60 years of age (Ostry and Walters, 1984). Some stands (or clones) may have relatively little decay even when they exceed 50 years of age, while others may suffer high losses before 50 years. (Christensen et. al., 1951)

- **Forest tent caterpillar—***Malacosoma disstria*
  Forest tent caterpillar (FTC) is a native defoliator that has likely caused outbreaks for hundreds or thousands of years. These outbreaks occur about once a decade and usually last about three to four years, although some have lasted for five to eight years. Outbreaks result in defoliation of most hardwood tree species especially aspen, birch, basswood, and oaks within the outbreak area. Significant growth loss is widespread during the outbreak. The latest outbreak began in 2000, peaked at 7.5 million acres in 2002, and collapsed in 2004. Aspen decline and mortality occurred on 47,000 acres in 2004 across the northern half of the state because defoliation was concurrent with a severe drought. Birch decline (3,200 acres) and oak mortality (15,000 acres) also occurred but were limited geographically. See map of FTC defoliation 2000-2002.

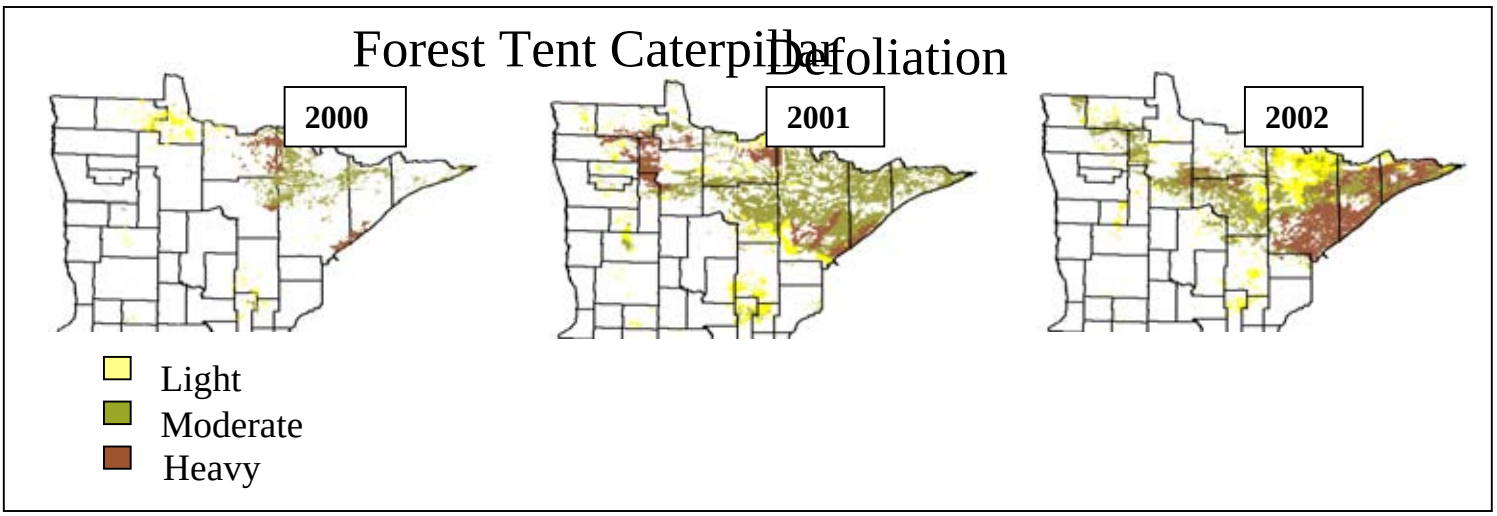
- **Poplar borer—***Saperda calcarata*
  Poplar borer occurs wherever aspen grow but are usually concentrated in a few trees per acre. Larvae bore into sapwood and heartwood, and trees that have been attacked have swollen scars and holes in the trunk and larger branches. Moisture bleeds out of the holes, producing varnished-looking streaks running down the trunk. Extensive tunneling can girdle small trees and makes large trees susceptible to wind breakage. Attack is often concentrated in brood trees that are usually the larger and faster-growing trees in stands. Damage in forest stands can be severe. Infestations tend to increase with a decrease in

stand density. The best management practice is to maintain well-stocked stands that are clear-cut at maturity.

Gypsy moth ----*Lymantria dispar*
Gypsy moth (GM) is an exotic insect pest spreading across the United States and Canada. Gypsy moth is currently not established in the state, but was included in this assessment because of its occurrence in Wisconsin and because it will spread and become established here. A 640-acre site east of Tower in the Nashwauk Uplands was treated in 2005 to eradicate GM. Follow-up trapping indicates the treatment was successful. In 2004, Lake and Cook Counties were added the Federal Slow the Spread Program due to a large increase in moths captured in pheromone traps during the summer. This lead to 138,000 acres in Cook County being treated with pheromone flakes in 2006.

Aspen is a preferred host of GM. Outbreaks may build and decline faster in aspen dominated stands than in oak stands according to observations in Michigan (Program Staff, GM Education Program, 1997). The impact of GM on aspen stands is not yet well known. The combination of back-to-back defoliations by GM and FTC would likely have substantial impacts especially if coupled with drought and over mature aspen. Additional information can be found in the oak section of this assessment.

Map 6.4a



Management Implications

As aspen stands are set aside to meet extended-rotation and old-growth targets, or as aspen clumps are left behind to meet leave-tree guidelines, white trunk rot is expected to increase as the ages of these aspen stands increase. Harvesting strategies that reduce the number of acres of older aspen will decrease the amount of decay. Partial harvesting or thinning of aspen stands will wound the residual trees. An increase in wounding will increase decay incidence and volume of decay. If wounding is done early in the life of the stand, time will become an enemy in producing sound wood volume. The longer the decay is present in aspen, the less

sound volume there will be since white trunk rot has the ability to breach the defenses of the trees and continue to grow at will throughout the infected trees.

The prevalence and severity of Hypoxylon canker and poplar borer are likely to be increased by management practices such as creating irregular stand shapes or aspen thinning. To reduce poplar borer and Hypoxylon canker occurrence and impact, larger clear-cuts, which produce fully stocked stands and minimal edge, are preferred. If clones have greater than 25 percent of the basal area infected with Hypoxylon canker, it has been recommended to convert those clones to other species or other clones more resistant to Hypoxylon canker (Schipper and Anderson, 1976). When selecting aspen stands to convert to other species, choose the aspen stands with the highest amounts of Hypoxylon canker first and maintain the stands with lower amounts of canker as aspen stands.

Defoliator occurrence and impacts are difficult to predict and to influence by management practices. The amount of topkill or mortality during outbreaks depends on the severity and frequency of defoliation and on tree health. Vigorous trees can usually withstand severe defoliation for a few years. Subsequence stress including additional defoliation, drought, or frost injury may kill the tree. Defoliated trees become more susceptible to attack by secondary pests such as Armillaria root rot. If defoliation and drought are simultaneous, expect decline and mortality in aspen, birch, and oaks that occur on light soils and ridge tops where defoliation was prolonged.

ASH

Damage Agents

Emerald ash borer – *Agrilus planipennis*

Emerald ash borer (EAB) is an exotic insect first found in Michigan in 2002. It is now found in Illinois, Indiana, Ohio, Michigan, Maryland and Ontario. It attacks and kills all species of *Fraxinus*, which includes white, black and green ash. The borer attacks healthy as well as stressed trees and trees of all sizes. Since it is an exotic, it has no native parasites or predators in North America. Control in the forest to date has involved cutting and chipping all infested trees as well as a ½ mile buffer of un-infested trees around the infested trees. Individual trees can be protected by injecting them with insecticides. Quarantines have been enacted to control the possible movement of EAB from infested states to un-infested states. However it is easily moved on firewood. It is assumed EAB will eventually be transported into Minnesota.

Black Ash decline – Interacting biotic and abiotic factors

Black ash stands showing signs of branch dieback, declining crowns, epicormic shoots and tree death is a common sight along roads. Periodically the amount of ash showing signs of decline increases. This was apparent in the early 1990's and again in 2004. Aerial survey, in 2004 identified 27,000 acres of declining black ash. While the majority of the acreage was centered in Aitkin, Carlton and southwestern St Louis counties, declining ash can be found throughout its range. Additional but decreasing acreages of decline were identified by aerial survey in 2005 and 2006. An analysis of Forest Inventory and Analysis (FIA) and Forest

Health Monitoring (FHM) data by the Northern Research Station (NRS) in St Paul was recently conducted. Findings included:

-Trees growing on wetter plots had greater decline symptoms than trees growing on drier plots.
-Severity of decline was greater in older trees than in younger trees.
-Black ash regeneration was greater on better-drained plots.
-Trees growing closer to roads had more decline symptoms than those farther from roads.

In field studies conducted by the NRS and the MN DNR Forest Health Unit, no biotic agent was found to be responsible for the decline. Further study is needed and will continue. It appears the decline is caused by a number of interacting factors. Different combinations may be involved on different sites. Some of the factors likely involved include tree age, proximity to roads likely involving changes in hydrology, droughts and above normal precipitation causing fluctuations in water tables, open winters possibly injuring roots, defoliation, soil type, etc.

Management Implications

At the present time there are no management options to control EAB in forests. It is assumed it will spread to Minnesota but no one knows how soon that might happen. When it does arrive it is expected that a lot of the ash trees will eventually be killed. In the mean time ash will likely be managed much as it has been in the past. However if there are opportunities to encourage other species in order to increase diversity on sites dominated by black ash they should be pursued. This will be difficult to do on the wetter sites but might be possible around the edges of wet stands where the ash is growing onto drier sites.

Black ash decline is a periodic recurring problem especially on the wetter sites in closed drainages. Management on these sites is difficult and it is very easy to degrade the site. Black ash management is more likely to be possible where it is growing onto drier sites and may need some help such as thinning to help it compete with other species growing on the sites. Keeping EAB in mind, any management efforts should try for good species diversity.

OAK

Damage Agents

- **Two-lined chestnut borer—***Agrilus bilineatus*

This insect is an opportunistic insect that attacks weakened oak trees. It is a native beetle known to attack all oak species found in Minnesota, red oak being its preferred host. When trees and stands are healthy, two-lined chestnut borer (TLCB) confines its attack to low-vigor trees or broken branches. When drought stress and/or forest tent caterpillar defoliation have reduced tree and stand vigor, oaks are predisposed to TLCB attack. Under severe stress and/or defoliation conditions, widespread outbreaks of TLCB can occur. Oak mortality due to (TLCB) following drought and FTC defoliation was widespread in 2002 and 2003. Mortality was mapped on 12,500 acres in Itasca, Cass, Aitkin and Crow Wing counties in 2003 (Anonymous, 2003). In many stands 80-90% of the red oaks died. Damage was more

severe in portions of stands thinned during the FTC outbreak than in unthinned portions. Trees being attacked by TLCB generally were also being attacked by Armillaria as well.

- **Gypsy moth—***Lymantria dispar*

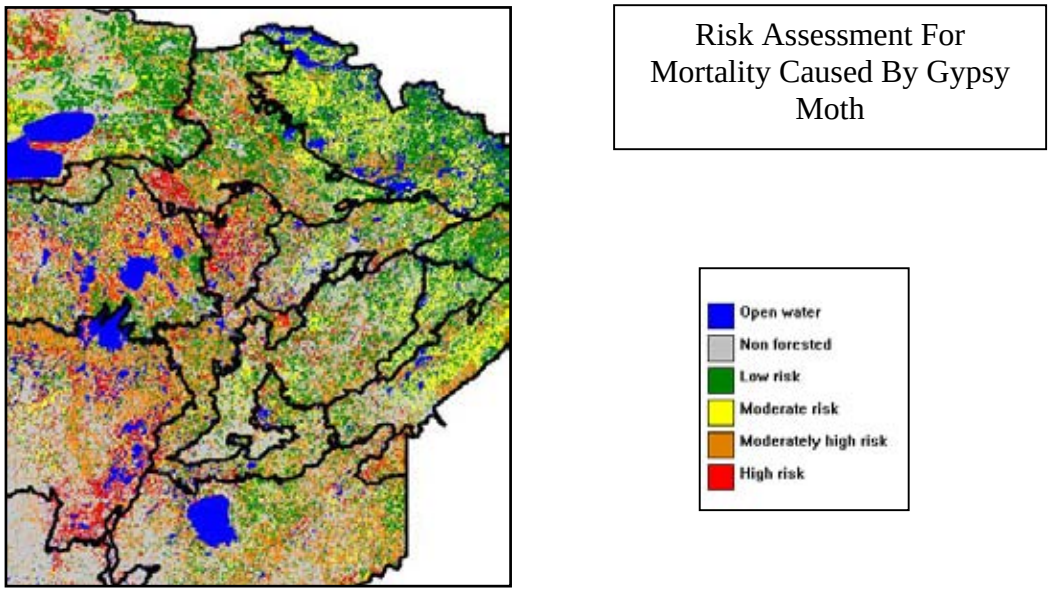
Gypsy moth (GM) is an exotic insect pest spreading across the United States and Canada. While GM is currently not established in the state, it was included in this assessment because of its occurrence in Wisconsin and because it will spread and become established here. GM is invading Minnesota from the east. The invasion pressure will increase as the populations in Wisconsin get closer to Minnesota. GM trapping identified a GM infestation in the Nashwauk Uplands subsection east of Tower in 2004. Two applications Btk were aerially applied to 640 acres to eradicate GM from the site in June 2005. The treatment appears to have been successful according to trapping results in 2006. Lake and Cook County were added to the Federal Slow the Spread Program in 2004 as a result of increased numbers of moths being trapped. The goal in these counties is to reduce the spread of GM rather than eradicating them when populations are found. Pheromone flakes were aerially applied to 138,000 acres in Cook County to slow the spread of GM in 2006.

Natural spread of GM is slow, but the unintentional spread by humans can be very rapid. Egg masses are transported on cars, recreational vehicles, logs, firewood, nursery stock, etc. Gypsy moth caterpillars feed on most hardwood trees and shrubs and in heavy infestations will also feed on conifers. Repeated defoliations lead to tree decline and death. Trees under stress suffer higher levels of mortality. Oaks, aspen, birch, basswood, tamarack, willows, hazelnut, and ironwood- are among the gypsy moth's preferred trees.

Pheromone traps are the primary method used to detect and monitor GM populations. The DNR is a member of the Gypsy Moth Program Advisory Council and cooperates with the Minnesota Department of Agriculture in its pheromone-trapping program and the federal Slow-the-Spread program.

The extent and severity of impact in this area is unknown at this time; however, GM will cause changes in the forest composition once it is established. According to the latest analysis of GAP data, when GM arrives, hardwood stands will have different vulnerabilities to the effects of multi-year defoliation. A risk potential map (see map) was developed in 2003.

Map 6.4b North-4 Subsections



Risk Potential Map Developed in 2003

Oak wilt —*Ceratocystis fagacearum*

Oak wilt is not known to occur at this time in these 4 subsections. It does exist to the south in the Mille Lacs Upland Subsection in Kanabec, Mille Lacs, and Pine Counties. Also in the early 1980's oak wilt was found at a cabin on Big Sandy Lake in the St Louis Moraine subsection. The cabin owner moved infected firewood from his home in the Twin Cities to the site resulting in mortality of red oaks. Oak wilt is no longer believed to be active on this site. Thousands of oaks in woodland and urban settings die from oak wilt every year. Widespread in Minnesota (currently in the central region and southeastern counties) and most of Wisconsin, the disease is caused by a fungus that invades the tree's water conducting system, resulting in wilting and oak tree death. Oaks vary in their susceptibility to the disease; red oaks are very susceptible and white oaks are moderately resistant. Oak trees become infected by (1) beetles carrying the oak wilt fungal spores to fresh wounds or (2) the spread of the fungus in grafted roots of a diseased tree. In the first case, a beetle carrying spores to a fresh wound would usually travel less than 1,500 feet from the infected tree or woodpile. In the second case, tree root systems must be grafted together, usually less than 75 feet between the healthy and infected tree.

Two precautions can decrease the chance of spreading oak wilt. Do not move wood with bark attached (logs or firewood) from infected trees into un-infested parts of the state or un-infested stands. Do not harvest, prune, or otherwise wound oak trees from budbreak to three

weeks past full-leaf development (generally from April 1 to July 15) in parts of the state where oak wilt occurs.

Management Implications

FTC outbreaks affect trees in these subsections averaging two to three years of defoliation each 8-10 years. The beginnings of FTC outbreaks usually coincide with droughty weather. A goal in oak management should be to promote stand vigor by manipulating stocking in order to prevent and minimize TLCB-caused oak mortality. Once the damage from a population of TLCB becomes evident, management options include postponement of any activity in the stand, salvage, or sanitation. However, thinning during FTC outbreaks and droughts should be avoided because it places additional stress on trees resulting in increased mortality due to TLCB. Trees killed by TLCB usually produce no stump sprouts when harvested. This emphasizes the importance of manipulating stands to develop advanced regeneration prior to outbreaks if oaks are to be maintained on the sites.

Oak wilt may be unwittingly introduced into the subsection by bringing in infested oak firewood. It may be established for a time without detection. Fortunately, its spread is slow and there is proven techniques that can eradicate infestations. The spread of oak wilt through root grafts can be controlled by severing roots around the perimeter of an oak wilt infection center with a vibratory plow. Overland spread can be controlled by cutting and treating all the wilting and recently dead red oaks inside the plow line perimeter to prevent spore production and further spread of the disease.

When it arrives, GM defoliation and mortality will make forest management and planning more difficult, as well as having an adverse impact on tourism and real estate values. Recreational areas in wood lots, parks, and along lakeshores are the most likely sites for GM introduction and establishment. Strategies include:

- Enhance hardwood stand and tree vigor.
- Encourage crop-tree management when thinning stands with oak and basswood in them.
- Clear-cut aspen and birch at rotation age to retain sprouting ability. Alternately, plan to pre-salvage the stands and spray with biopesticides to protect the foliage on the regeneration.
- Spraying to control defoliation will only be fruitful in recreation areas (public or private) along lakeshores or in high-value, high-risk stands.
- Encourage species diversification, especially pines, spruce, maples, and ash which will slowly make the stands less vulnerable to GM. And FTC defoliation.
- Avoid thinning stands in years of defoliation by GM, FTC or other defoliators as this increases stress and can lead t high levels of mortality associated with TLCB.

When GM outbreaks coincide or are closely timed to FTC outbreaks, there is a high risk of oak, basswood, aspen, and birch mortality due to prolonged defoliation. Due to the recurring FTC outbreaks, treating either or both FTC and GM caterpillars with biopesticides would prevent mortality.

BIRCH

Damage Agents

- **Birch decline—**

Birch decline is a complex disease caused by a combination of factors including stress from drought, high temperatures, site or stand disturbance, insect defoliation, and the bronze birch borer, *Agrilus anxius*. Birch decline starts as a thinning of the crown with dieback of branches. As the stress continues, the bronze birch borer begins to make successful attacks on the birch and mortality often results. The amount of mortality due to birch decline can increase dramatically as a result of severe and lengthy drought in combination with FTC defoliation. A study of the effects of the drought in the early 1990s estimated that 40 percent of the birch on FIA plots died in Minnesota from 1988 to 1992 as a result of birch decline. Based on the findings on the FIA plots, it was estimated that 228 million birch trees died during this period (Anonymous, 1992).

Management Implications

Birch decline depends on stress such as drought, defoliation, and disturbance. This makes it difficult to predict a trend in birch decline over the life of the subsection plan. Older, decadent birch stands will reflect stress conditions and resultant dieback and decline before younger, thriftier stands do so. If stands of birch are set aside or rotations are extended, the vulnerability of these stands to birch decline will increase. Partial harvesting birch stands can create stress to the residual trees from an increase in soil temperatures as the stands are opened up. Partially harvesting birch and using birch to provide leave-tree clumps will likely lead to significant mortality of these stands and residuals.

TAMARACK

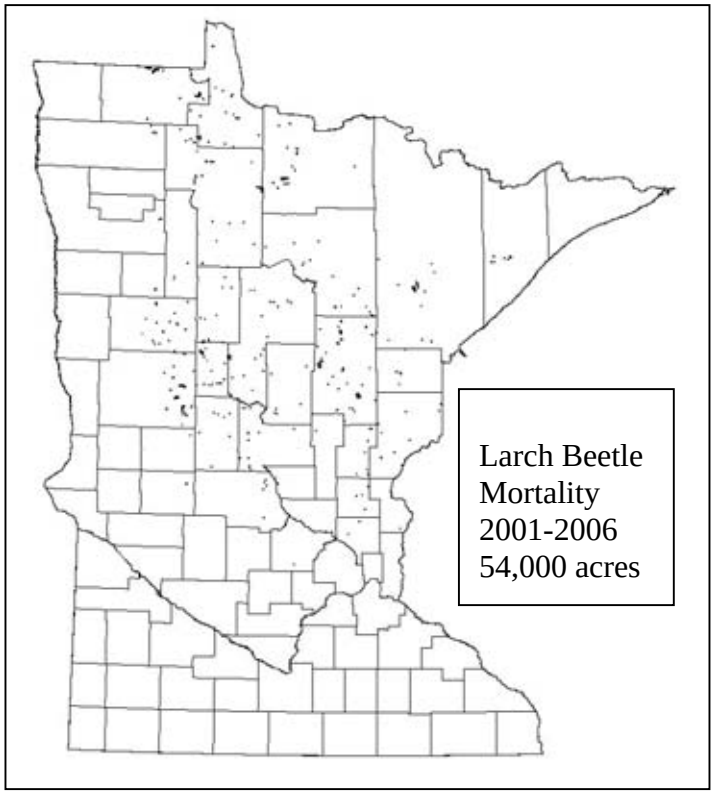
Damage Agents

- **Larch beetle—***Dendroctonus simplex*

This is a native bark beetle that attacks tamarack and exotic larches. Beetles over-winter in attacked trees. Adults emerge in the spring and seek live trees or fresh slash to attack. Eggs are laid, larvae construct galleries under the bark, and adults are produced. Some of the adults stay in the tree until the following year while others fly to nearby healthy trees to overwinter. Flooding, droughts, defoliation by larch casebearers, and old age have been associated with larch beetle attacks in the past. These have usually been limited to relatively small pockets of mortality. Recently, however larch beetle appears to be able to develop widespread outbreaks and kill healthy trees as well (Seybold, et .al., 2002). This apparent change in behavior may be caused by warm winters that allow larger populations of larvae, pupae and adults to overwinter. The large population of beetles is then able to overwhelm and kill even healthy tamarack. The current outbreak started about 2000. Aerial survey has identified mortality on approximately 54,000 acres since then (See Map). Aerial survey in eastern Koochiching, northeastern Itasca and northern St Louis, Lake and Cook counties was done by another agency that did not map the tamarack mortality.) Trees of all ages and sizes from 4” DBH and up growing on a range of sites from wet lowlands to drier uplands have been killed. In some stands small

scattered pockets of trees have died while in others close to 100% mortality has occurred. The current outbreak is showing no signs of ending, but it eventually reverts to endemic levels.

Map 6.4c North-4 Subsections



Management Implications

Apparent healthy trees can be successfully attacked when there are high populations of larch beetles. Seed trees left after harvest are often attacked and quickly killed by the larch beetle. Whether these seed trees are able to produce a crop of viable seeds before dying from larch beetle attack is not known. Leaving seed trees is still recommended even though they are likely be attacked and killed by the larch beetle because they are not likely to increase the larch beetle problem Because larch beetles are killing trees throughout the range of tamarack, sanitation cuts to reduce beetle populations and tree mortality are unlikely to be effective. Most harvesting plans are salvage operations due to larch beetle caused mortality.

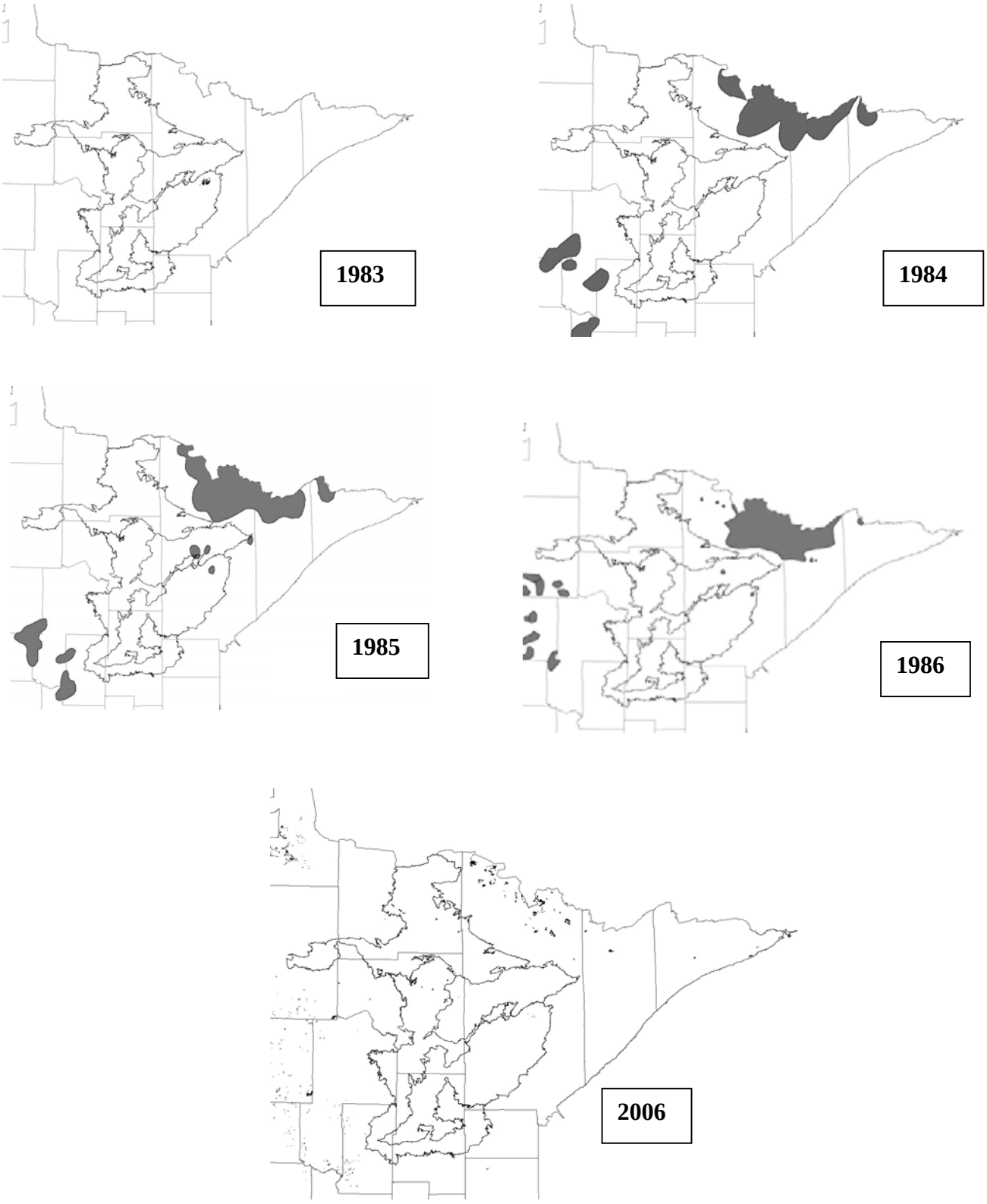
JACK PINE

Damage Agents

- **Jack pine budworm—***Choristoneura pinus pinus*

  Jack pine budworm (JPBW) larvae eat the needles of jack pine causing defoliation, which can lead to top kill and mortality. In west central Minnesota, JPBW outbreaks tend to occur at roughly six- to 12-year intervals and persist for two to four years and then decline (Albers, et. al., 1995). In Canada to the north of Minnesota they have experienced 5 to 6 outbreaks of JPBW in the past 50 years. In NE Minnesota however, including these 4 subsections, jack pine budworm outbreaks appear to be occurring on about 20 year intervals. However, there are no known factors to prevent NE Minnesota from having more frequent outbreaks even though we have not been experiencing them in the recent past. JPBW populations will build up in poorly stocked stands, overstocked stands, over-mature stands, and stands with low-vigor trees. These stand are also the most vulnerable stands for tree mortality to occur as a result of a JPBW outbreak. The most recent outbreak in west central Minnesota occurred from 2002 through 2006. An outbreak started in northeastern Minnesota in 2006 and is expected to continue for one or two more years.

Map 6.4d North-4 Subsections Jack Pine Budworm Defoliation in NE Minnesota



- **Bark beetle** (pine engraver beetle) - *Ips pini* and other species

  Many species of bark beetles exist in Minnesota. The pine engraver beetle is very common and sometimes very abundant. Bark beetles feed and reproduce in the moist cambium of freshly cut, recently killed, or blown down red pine, jack pine, and occasionally white pine. In Minnesota up to three generations of *Ips pini* can develop during a growing season. After developing in the dead material, the new adults may attack standing live trees nearby. Successful attacks are made on trees under stress, but massive attacks often are able to overwhelm and kill healthy trees. Dead trees generally occur in patches or pockets because emerging beetles tend not to fly far but attack trees adjacent to where they emerged. Attacks often begin in tree tops and progress downward. Stress from JPBW defoliation, drought, overcrowding, equipment and fire scarring, and weather events such as hail, snow, and ice breakage can reduce tree vigor and predispose the trees to bark beetle attack. Stressed trees cannot defend themselves against bark beetle attacks and they become easy prey for beetles. In the forest, significant bark beetles problems generally only develop when there is both drought and a supply of fresh brood material for the bark beetles to build up on. Fresh brood material can be created by such things as fires, storms, or thinning and logging operations.

- **Stem decay (red rot)** - *Phellinus pini*

  This organism attacks most softwoods and causes significant decay. It is a “canker rot” organism. This type of decay organism cannot be walled off and confined to the portion of the stem present at the time infection takes place. This organism will grow and cause decay throughout the stem as the stem increases in size. In this way, it is similar to the decay fungus that causes white trunk rot of aspen. It is difficult to predict occurrence and extent of red rot in jack pine stands. External indicators of red rot are difficult to detect. Fruiting bodies that would predict red rot are not prominent and are easily missed during inventory and cruising and they often do not develop until after the tree has died. Often red rot is not discovered until harvesting takes place. Red rot increases with increasing age of the trees. Research has not correlated, with any degree of confidence, decay with site characteristics. Foresters have observed that jack pine stands grown on relatively droughty soils will have a higher incidence and more extensive decay loss due to red rot. Red rot is usually considered a problem of older trees but it is also a problem in young trees where *P pini* has infected sweetfern cankers. For more details see the discussion of stem decay for aspen.

Stem and gall rusts of jack pine – *Cronartium quercuum, Endocronartium harknessii, Cronatium comptoniae, Cronartium comandrae, Cronatium coleosponoides*

Stems and branches of jack pine can be infected by five different rust fungi. Gall rust infections on seedlings and saplings often lead to wind breakage and mortality. Stem and branch infections by stem rust fungi on older trees commonly lead to losses in growth (sweetfern rust volume losses average 20%), formation of cankers (cankers can make basal log unmerchantable), and create entryways for decay fungi and insects. When rust cankers and decay fungi are present, volume losses increase dramatically. Trees infected with rust commonly are stunted in height growth and die earlier than their cohorts due to suppression. In the eastern side of the George Washington State Forest, scattered plantations have been observed with up to 40% of the stems deformed by sweetfern blister rust cankers.

Based on work by Dietrich (1985) and Mital (1982), the distribution of rust fungi in these subsections can be found in the table below.

Table 6.4 North-4 Subsections

Occurrence of Rust Fungi on Jack Pine in the North-4 Subsections				
	Littlefork Vermilion Uplands	St. Louis Moraines	Nashwauk Uplands	Tamarack Lowlands
Pine-pine gall rust Endocronartium harknessii	+	+	+	+
Pine-oak gall rust Cronartium quercuum	–	+	+	–
Sweetfern blister rust Cronartium comptoniae	+	–	+	–
Commandra rust Cronartium comandrae	+	+	–	–
Stalactiform rust Cronartium coleosponoides	+	+	+	–

Management Implications

In subsections to the west, the occurrence and impact of JPBW outbreaks forces managers to decrease jack pine rotation age to 40-45 years. Because outbreaks in the subsections covered by this plan, have been less frequent, it may not be necessary to be as restrictive with rotation ages based solely on the risk of JPBW. However there are no guarantees outbreaks won't occur more frequently in the future than they have in the past especially with the pressure of moth influxes from outbreaks to the north and west. Managers should use local knowledge about the incidence of stem decay and stand breakup in determining appropriate rotation ages. It remains important to maintain age class diversity at the landscape level to avoid loosing all your older jack pine at one time during outbreaks, whatever their frequency.

In jack pines approximately 90% of the stem decay is due to *P. pini* (red rot). This is generally not a significant problem when jack pine is managed under a normal rotation age. As tree age increases the amount of stem decay increases and the amount of decay in stands should be considered when selecting stands for extended rotation.

Stem rusts are usually not a significant problem in jack pine stands. Occasionally gall rust reach high enough levels to affect stocking levels in regenerating stands. There are occasional sites in eastern George Washington State Forest where high levels of sweetfern rust develop. At the current time there are no site characteristics, other than lots of sweetfern, to identify these sites. Where local knowledge identifies these sites regeneration to another tree species is advisable. In thinning, trees with stem rust cankers and galls should be removed because these trees grow slower, are prone to wind breakage and higher amounts of decay.

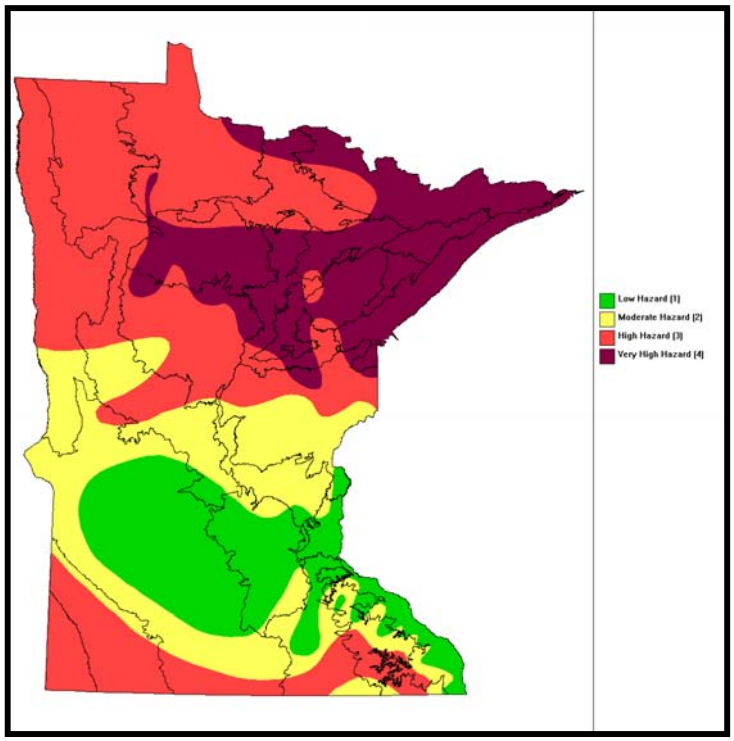
WHITE PINE

Damage Agents

- **White pine blister rust** - *Cronartium ribicola*

  White pine blister rust is an exotic fungus, first found in Minnesota in 1916. Blister rust is found throughout Minnesota wherever white pine is grown. This disease has changed where and how white pine is grown in northern Minnesota. The fungus requires both white pine and the alternate host species of *Ribes* to complete its life cycle. Disease-caused injury to infected trees includes dead branches, stem cankers, and mortality. Levels of infection of 80 percent or more of the trees in a stand or plantation have been reported in northern Minnesota. The Littlefork-Vermilion Uplands subsection is mostly in hazard zone 3 (High Hazard) while the St Louis Moraines, Nashwauk Uplands and Tamarack Lowlands subsections are mostly in hazard zone 4 (Very High Hazard). Within these zones the levels of infection can vary greatly from site to site due to micro-site climate differences, age of trees, presence and abundance of *Ribes*, topography, and, forest-stand structure. No major gene for resistance has been found in eastern white pine, but breeding efforts continue to try to produce a more resistant tree..

Map 6.4e White Pine Blister Rust-Hazard Zone



White pine weevil---*Pissodes strobe*

White pine weevil is considered the most important insect pest of eastern white pine. Weevil larvae feed under the bark of the previous years terminal. This feeding girdles the stem,

killing everything above the injury. With the death of the terminal leader, lateral shoots compete to become the new terminal leader resulting in multiple stems and deformed stems. Weevils prefer open-growing, vigorous trees less than 30 feet tall. In addition to white pine, the white pine weevil will attack all species of spruce and pine in Minnesota although attacks on red pine and black spruce are rare.

Management Implications

Choosing planting sites based on microclimatic factors is critical to success (Jones, 1989). Plant white pine on slopes, hilltops or shoulders of hills. Avoid potholes, bases of slopes, v-shaped valleys or small openings in dense forest that favor the collection of cool moist air. Such conditions favor infection by blister rust. Establishing white pine as an understory tree will mitigate the impacts from both blister rust and white pine weevil. Pruning to remove the lower branches, which are the most likely to become infected, is beneficial in reducing mortality. It is best to start when the trees are small, 2 to 3 feet, and continue until all branches on at least the lower 9 feet of the tree are removed. Pruning should be done during the dormant season, fall or winter. Avoid the spring and early summer when bark is easily damaged. Don't remove too many branches at one time in order to maintain good height growth. Try to leave at least 2/3rds of the tree's height with branches (Anonymous, White pine planting and care guide. 2003)

RED PINE

Damage Agents

- **Diplodia tip blight and canker –** *Diplodia pinea*
  Diplodia damage is greatest on red pine seedlings and saplings growing under or within 1 to 2 chains of mature red pines or jack pines. It can infect and kill seedlings up to at least 4 chains away from overstory trees. Air borne and rain splashed spores from fruiting bodies on pine cones are the main source of infection. Diplodia causes a tip blight as well as a canker that can girdle branches and stems and kill trees. It can infect through wounds and result in high levels of infection after hail storms, but this fungus does not require a wound for infection. It spreads most during wet weather and so infections are much more common in some years then in others. *Diplodia* causes both symptomatic and latent infections (Stanosz and Cummings Carlson 1996). In a latent infection, the tree may show no symptoms or signs of infection for years but it remains infected with the fungus. These latent infections can become activated when the host tree become stressed from such things as drought, overcrowding, or "j" rooting.

- **Sirococcus shoot blight -** *Sirococcus conigens*
  Damage from this fungus can be locally high on sites where large infected red pine are left on or next to sites being regenerated to red pine or in uneven-aged stands. This fungus kills only current year shoots, but multiple years of infection will lead to mortality of young trees.

- **Bark beetle** (pine engraver beetle) - *Ips pini*
  See bark beetle discussion under the jack pine cover type.

Stem decay
See stem decay in the jack pine section

Root disease
See root disease in the all species section

Management Implications

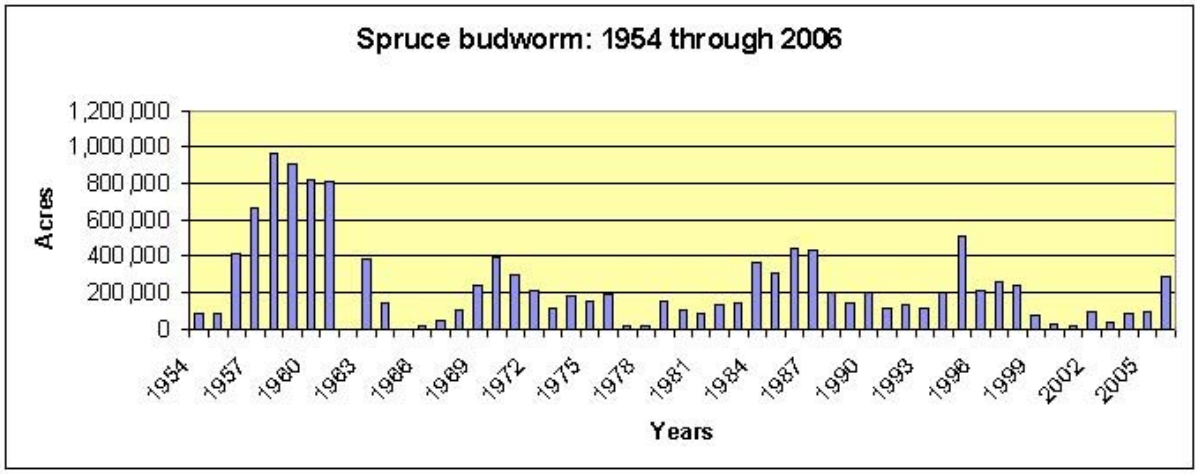
This is a long-lived tree species that is relatively free of potential catastrophic pests problems. Concerns are more directed at young stands regenerating under or next to existing stands of pine (Ostry, et.al., 2002) As management strategies lead to more partial harvesting and attempts to development two-storied or multi-aged stands, understory pines will be susceptible to both shoot blights. In many locations, the presence of one or both of these diseases will preclude natural red pine regeneration under the overstory red pine trees. Mortality will be greatest on seedlings directly under or within 1-2 chains of red pines old enough to produce pine cones. Leaving live residual red pine trees on sites being regenerated back to red pine is not recommended. Note that BMP guidelines allow variance from recommendations where they would lead to increases in insect or disease problems. If some residual trees will be left, choose locations near the edges of the site and group /clump the leave trees. Bark beetle problems will arise in plantations when they're under drought stress and/or slash-creating activities have occurred in the spring or summer especially during droughts. Thinning of plantations is not recommended during the growing season from March 15 to Sept 1st.

BALSAM FIR

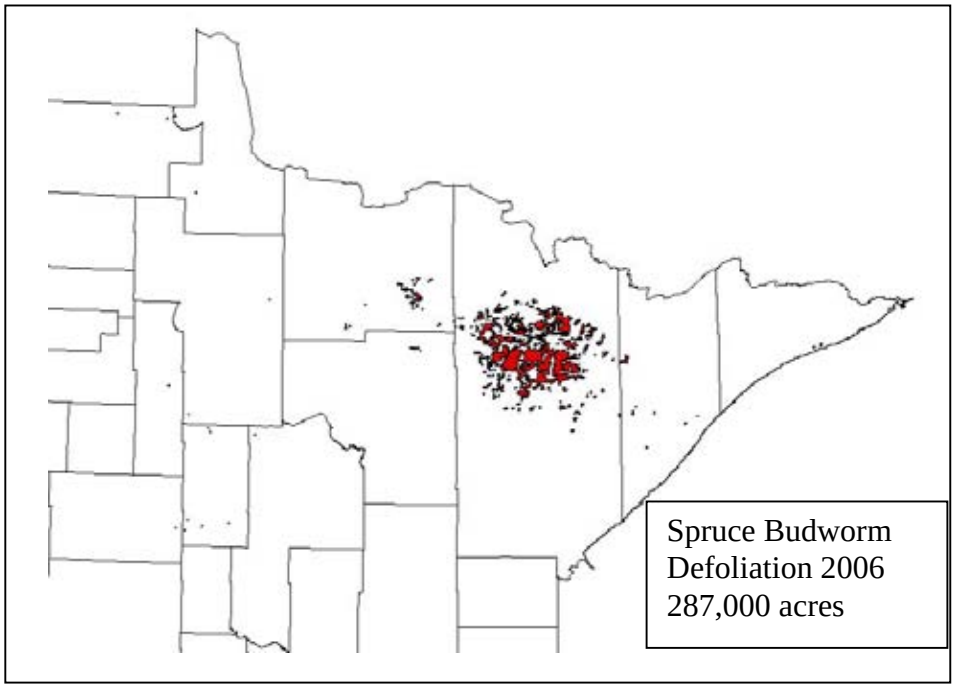
Damage Agents

- **Spruce budworm -** *Choristoneura fumiferana*
  Spruce budworm (SBW) is a native insect defoliator. Outbreaks of this defoliator have occurred periodically for hundreds of years. The larvae prefer the needles of balsam fir and white spruce, causing defoliation, top kill, and mortality. On balsam fir, top kill can begin after two to three years of heavy defoliation and tree mortality after three to five years of feeding. Outbreaks tend to occur when there are extensive and continuous areas of mature and over-mature balsam fir. Losses of balsam fir are highest in stands with the highest abundance of fir and where surrounding stands also contain fir. Mortality in mature and over-mature fir stands may approach 100 percent. Damage tends to be higher in older-age fir, but in outbreaks, fir of all ages can be killed. Stands with multiple ages of fir often experience greater levels of damage to the young fir trees than would normally occur in single-age stands. Spruce budworm has defoliated an average of 250,000 acres per year in northern Minnesota for the past 53 years (personal communications with Mike Albers). Balsam fir is the preferred host, but since 1990 budworm has been causing defoliation, top kill, and mortality in plantations of white spruce that are 25 years and older. Budworm populations are on the rise defoliating 90,000 acres in 2005 and increasing to 287,000 acres in 2006. Based on the pattern of defoliation since 1954, it is likely this increase will continue for the next few years.

Chart 6.4



Map 6.4f



Management Implications

Spruce budworm is a perennial invader of balsam fir and white spruce in these subsections. Balsam fir is a prolific seed producer and has the ability to persist and even increase in the aftermath of an outbreak. Management strategies that increase the component of balsam fir will only lead to more frequent and more severe SBW outbreaks. Since the older stands tend to serve as the niches in which the budworm builds up, strategies to develop extended rotation balsam fir will only add to the potential for stand-destroying budworm populations to develop. When regenerating spruce fir stands, emphasis should be given to regenerating

the white spruce and not the balsam fir. The increased occurrence of spruce budworm in white spruce plantations may be related to the plantations being overcrowded and not managed. Commitments must be made to do periodic thinning in the white spruce plantations.

WHITE SPRUCE

Damage Agents

- **Spruce budworm -** *Choristoneura fumiferana*
  See spruce budworm discussion under the balsam fir cover type.

- **Spruce beetle** – *Dendroctonus rufipennis*

Spruce beetle is a native bark beetle that attacks and kills white spruce. Spruce beetle likes large trees usually 12 inches in diameter and larger. Most trees seem to take 2 or more years to die from attack. Attacked trees often have some other problem such as root rot making them more susceptible to attack and mortality. Outbreaks in the western US usually result when spruce beetles buildup on windthrown trees (Holsten et. al., 1999). In Minnesota most of the problems with spruce beetle have occurred in State Parks within the North Shore Highlands subsection. However, three stands of large old white spruce were attacked by spruce beetle in Pine Island State Forest near the junction of Littlefork-Vermilion and the Agassiz Lowlands subsections. The beetles in these stands appeared to have built up in trees that had fallen over either in a windstorm or possibly a winter storm. Spruce beetles have been captured in bark beetle traps in eastern Itasca County in the St Louis Moraines subsection. So it is likely that they occur through the range of white spruce in MN and have the potential to kill trees where there are concentrations of large diameter trees.

Management Implications

Since there are probably few stands of large diameter white spruce, spruce beetle is not currently a significant problem in these subsections. The best way to avoid problems would be to examine stands following windstorms or in the spring to determine if tops or trees came down over winter. These downed trees should be removed before May 1st if possible. In Minnesota spruce beetle has caused considerable mortality within stands with a concentration of large diameter white spruce trees, however, we have not seen it move into adjacent stands and kill trees. More information on managing spruce beetle can be found on the DNR website.

The increased occurrence of spruce budworm in white spruce plantations may be related to the prevalence of pure stands white spruce with few species of non-host trees. This tends to conserve spruce budworm larvae allowing larger population of budworm to develop and thrive. If white spruce plantations had more non-host tree species, budworm larvae landing on the non-host trees would die reducing the population.

Also it appears that more timely thinning of white spruce plantations is necessary to maintain a good growth rate and prevent mortality. Although research on this subject is lacking it appears that when the live crown ration drops below about 40%, the white spruce trees

respond very slowly if at all after thinning. In some plantations this would require thinning at around age 30 or in some cases even younger. In some plantations over 30 years of age, tree mortality has continued to occur after thinning.

BLACK SPRUCE

Damage Agents

- **Eastern dwarf mistletoe -** *Arceuthobium pusillum*

  Dwarf mistletoe is a disease caused by a parasitic seed plant and is the major mortality agent of black spruce. It primarily affects black spruce, but occasionally is found on white spruce and tamarack. It causes witches brooms on infected trees, and trees of all sizes become infected and killed. Natural fires were the major factor in keeping this disease in check in the past and without fires the amount of eastern dwarf mistletoe infection is believed to be increasing. Dwarf mistletoe can only live on living trees. Once a stand is infected, it remains infected until all of the mistletoe-infected trees are killed by fire, harvesting, shearing or hand cutting. Residual infected trees left behind after harvesting introduce the disease to the regenerating stand. Mistletoe spreads locally by seeds that are explosively discharged and can travel up to 55 feet. Long-distance spread is by birds carrying the sticky seeds on their feet and feathers. When an even-aged stand becomes infected, the large trees are killed, creating openings in the stand. Young trees seed into these openings and become infected. The stand then gradually changes to an all-aged stand with heavy infections of all ages and very little to no merchantable volume (Baker et. al., 2006)

Management Implications

Incidence of this disease is increasing due to the absence of fire and because there is no practical means of killing all infected trees at the time of harvest. Shearing after the harvest has also met with a variety of successes and rarely eradicates mistletoe from the stand. Even young trees that are infected will live long enough to continue the cycle of dwarf mistletoe in the regenerating stand. These young, infected trees are nearly impossible to kill in the absence of fire. A survey of sites, one year or so after harvest, to determine if follow-up treatment is necessary should be done to ensure that all black spruce on the site have been killed. Leaving infected trees standing on or next to harvested sites will ensure that the regenerating stand is infected by mistletoe. If dwarf mistletoe is not aggressively eradicated from black spruce stands when harvesting and regenerating the stands, the total merchantable acreage of this cover type will decline. Refer to the MN DNR Division of Forestry Forest Development manual for more details and suggestions.

6.5 Additional Information Sources

Additional information on these and other insects and diseases of forest trees in Minnesota can be obtained by referring to the Minnesota Forest Health Reports prepared by the MN DNR, Division of Forestry, Forest Health Unit. They can be found in the DNR Library in St. Paul and in various other libraries in the state. They have been printed on an annual basis since at least 1974. The title has varied over the years from the Forest Pest Report, to the

Forest Insect and Disease Report, to the current title of Minnesota Forest Health Annual Report. They contain data on the insect and diseases included in this assessment as well as others. Observations and annual survey results are included. Current information can be found in the Minnesota DNR Forest Insect and Disease Newsletter, which is published four or five times during the growing season and can be accessed online through the DNR Web site at http://www.dnr.state.mn.us/fid/index.html.

Other sources of information include reports from the USDA Forest Service, University of Minnesota, and Minnesota Department of Agriculture.

6.6 Literature Cited

Albers, J., M. Carroll, and A. Jones. 1995. Jack Pine Budworm in Minnesota: Past Trends and Changing Perspectives. P. 11-18. In Volney, W.J.A., et al. Jack Pine Budworm Biology and Management. Proceedings of the Jack Pine Budworm Symposium, Winnipeg, Manitoba, January 24-26, 1995. Canadian For. Serv., Northwest Region. Information Report NOR-X-342. 158 p.

Anderson, R.L. 1973. A Summary of White Pine Blister Rust Research in the Lake States. USDA, For. Serv. Nor. Cen. For. Exp. Stn. Gen. Tech. Rep. NC-6. 12 p.

Anonymous. 1978 to present. Minnesota Forest Health Report. MN DNR. St. Paul, MN.

Anonymous. 2003. White Pine Planting and Care Guide. MN DNR. St Paul, MN

Baker, F.A., J.G. O'Brien, R. Mathiasen, M.E. Ostry. 2006. Eastern Spruce Dwarf Mistletoe. USDA F.S. Forest Insect and Disease Leaflet, NA-PR-04-06. 8p.

Baker, W.L. 1972. Eastern Forest Insects. USDA For. Serv. Misc. Pub. 1175. p. 458.

Christensen, C.M., Anderson, R.L., Hodson, A.C., Rudolf, P.O. 1951. Enemies of Aspen. Lake States Aspen Report No. 22. Processed by USDA For Serv, Lakes States Forest Experiment Station.

Jones, A.C. 1989. MN-DNR Management Practices for White Pine. P. 19-31. In Proceedings of the White Pine Workshop. Chippewa National Forest. 81 p.

Corbett, E. S. and Lynch, J. A. 1987. The gypsy moth - does it affect soil and water resources? In: Coping with the gypsy moth in the new frontier. Fosbroke, S. and Hicks, R. R. Jr. editors. 1987. West Virginia Univ. Books, Morgantown. pp 48-58.

Dietrich, E.A., R.A. Blanchette, C.F. Crogan, S.O. Phillips. 1985. The distribution of Endocronartium harknessii and Cronartium quercuum on jack pine in Minnesota, Can. J. For. Res. Vol. 15. P. 1045-1048.

Eiber, T. G. 1997. An Analysis of Gypsy Moth Damage Potential in Minnesota.. Minnesota DNR publication.

Gottschalk, K. W. 1993. Silvicultural Guidelines for Forest Stands Threatened by the Gypsy Moth. USFS, Gen Tech Rpt NE-171.

Holsten, E.H., R.W. Their, A.S. Munson, and K.E. Gibson. 1999. The Spruce Beetle. USDA FS. Forest Insect and Disease Leaflet 127. 12p.

Jones, A.C., and J.S. Campbell. 1986. Jack Pine Budworm: The Minnesota Situation. P. 7-9. In Jack Pine Budworm Information Exchange, January 14-15, 1986, Winnipeg, Manitoba. Mait. Nat. Resource, For. Prot. Branch, Winnipeg, Manitoba.

Jones, A.C., and M.E. Ostry. 1998. Estimating White Trunk Rot in aspen Stands. Northern Journal of Applied Forestry, Vol. 15, No 1. P. 33-36.

Mitol, J.M. 1982. Distribution and impact of jack pine stem rusts in Minnesota. M.S. thesis, University of Minnesota, St Paul, MN

Ostry, M.E., J.O'Brien, and M. Albers. 2002. Disease considerations in red pine management. In *Proceedings of the Red Pine SAF Region V Technical Conference*, eds,. Gilmore, D.W., and L.S. yount, 107-111. Staff Paper no.157. St Paul, MN: University of Minnesota, College of Natural Resources, Department of Forest Resources.

Ostry, M.E., and J.W. Walters. 1983. How to Identify and Minimize White Trunk Rot of Aspen. USDA, For. Serv. HT-63. 5 p.

Ostry, M.E., L.F. Wilson, H.S. McNabb, Jr., L.M. Moore. 1989. A Guide to Insect, Disease, and Animal Pests of Poplars. USDA, For. Serv. Ag. Handbook 677. 118 p.

Program Staff, 1997. Gypsy Moth and Oak Silviculture in the North Central Region. Northern Hardwood Notes, Gypsy Moth Education Program. http://www.ent.msu.edu/gypsyed/docs/forest.html

Schipper, Jr., A.L., and R.L. Anderson. 1976. How to Identify Hypoxylon Canker of Aspen. USDA, For. Serv. NC For. Exp. Sta., St. Paul, MN. 5 p.

Seybold, S.J., M.A. Albers, and S.A. Katovich. 2002. Eastern Larch beetle. USDA FS, Forest Insect and Disease Leaflet 175, 10p.

Schmitz, H., and L.W.R. Jackson. 1972. Heartrot of Aspen. With Special Reference to Forest Management in Minnesota. Univ. of Minn. Agric. Exp. Sta. Tech. Bull. 50. 43 p.

Stanosz, G.R., D.R. Smith, M.A. Guthmiller, and J.C. Stanosz. 1997. Persistence of *Sphaeropsis sapinea* on or in asymptomatic shoots of red and jack pine. *Mycologia* 89: 525-530.

White, W. B. and Schneeberger, N. F. 1981. Socioeconomic impacts. In: The gypsy moth: Research toward integrated pest management. Doane, C. C., and McManus, M. L. editors. USDA For. Serv. Tech. Bulletin 1584. pp 681-694.

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CHAPTER 7

Wildlife Species Status & Trends

St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and Littlefork-Vermilion Uplands ("North-4 Subsections")

Table 7.1 North-4 Subsections Terrestrial, Vertebrate Species List . . . . . page 7.2

Table 7.2 North-4 Subsections Mammal habitat relationships by Minnesota . . . . . page 7.12
Gap Analysis Project (MN-GAP) land cover type

Table 7.3 North-4 Subsections Bird habitat relationships by Minnesota . . . . . .page 7.15
Gap Analysis Project (MN-GAP) land cover type

Table 7.4 North-4 Subsections Amphibian and Reptile habitat relationships . . . . . page 7.31
by Minnesota Gap Analysis Project (MN-GAP) land cover type.

Chapter 7 provides information on the occurrence, legal status and the population trends of wildlife species in these four subsections. Species presence information is summarized from data collected by the Minnesota Gap Analysis Project (MN-GAP), a project organized to provide a state assessment on the conservation status of native vertebrate species and natural land covertypes.

A recent initiative, *Minnesota's Comprehensive Wildlife Conservation Strategy*, is a strategic plan to better manage populations of "species in greatest conservation need (SGCN)". Species of greatest conservation need (SGCN) are defined as "animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability".

MN DNR was a partner in development of this plan, and is committed to working towards it's implementation, both internally and with external partners. The plan includes goals and targets for stabilizing and increasing populations of species in greatest conservation need, improving knowledge about these species, and enhancing people's appreciation and enjoyment of them.

In this assessment, select information is presented on SGCN species presence in the four subsections covered by this forest resource management plan. A copy of the full plan may be viewed on the MN DNR public website at this location:
http://www.dnr.state.mn.us/cwcs/strategy.html

Table 7.1 Terrestrial Vertebrate Species List, Status and Trends.

Notes regarding the following four tables:

Species Criteria: Species criteria for MN-GAP includes the following: 1) Be known to breed in Minnesota (evidence of breeding 5 of the past 10 years) and be a regularly occurring non-accidental, 2) Be listed as state endangered, threatened, or special concern or as federally endangered or threatened, 3) Be listed as a furbearer, big game, small game, or migratory bird in Minnesota, and, 4) Be an exotic species in Minnesota that impacts native species or is of management interest.

Species Group: Animals are assigned to one of four major species groups - Amphibians, Birds, Mammals, and, Reptiles.

[a] **Species Common and Scientific Names:** Notes standard MN-GAP protocol based on NatureServe and it's related searchable plant, animal and ecological database called NatureServe Explorer located at www.natureserveexplorer.org

[b] **Minnesota Legal Status:** E = State Endangered; T = State Threatened; SC = State Species of Special Concern; BG = Big Game; SG = Small Game; F = Furbearer; MW = Migratory Waterfowl; UB = Unprotected Bird; PB = Protected Bird; PWA = Protected Wild Animal; UWA = Unprotected Wild Animal. Note: A species may have more than one Minnesota Legal Status notation.

[c] **Federal Legal Status:** T = Federal Threatened; E = Federal Endangered; P = Federal Protection by the Migratory Bird Treaty Act or Bald Eagle Protection Act or CITES.

[d] **Species Occurrence:** For all ECS Subsections, the following codes note a species specific range modifier: B = Breeding; PR = Permanent Resident; a = absent; m = migrant; m/sv = migrant/summer visitor; wv = winter visitor. Also, an (L) may be listed with these range codes if the species has a limited distribution in the Subsection due to specific habitat needs. Note: These range notations by ECS subsections represent the current occurrence of these wildlife species based on ECS subsections. Animal distributions are dynamic and revisions may be made as new information becomes available.

DISCLAIMER: Information and data listed in these tables has been produced by ongoing wildlife species assessment efforts conducted under the MNDNR Division of Wildlife's Minnesota Wildlife Resource Assessment Project (MN-WRAP) and Minnesota Gap Analysis Project (MN-GAP). These efforts and related tables noted here are initial products that are currently in various stages of literature and expert review. Review and comments on these tables and contents is encouraged. Please contact the MNDNR Division of Wildlife at 218-833-8620 for comments or suggestions

7.1 Terrestrial, Vertebrate Species List

St. Louis Moraines/Tamarack Lowlands/Nashwauk Uplands/Littlefork Vermilion Uplands

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
AMPHIBIANS(n=13)							
Blue-spotted Salamander	Ambystoma laterale			PR	PR	PR	PR
Tiger Salamander	Ambystoma tigrinum			PR	PR	PR	a
Four-toed Salamander	Hemidactylium scutatum	SC		PR	a	a	a
Redback Salamander	Plethodon cinereus			PR	PR	PR	PR
Eastern Newt	Notophthalmus viridescens			PR	PR	PR	PR
American Toad	Bufo americanus	PWA		PR	PR	PR	PR

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Gray Treefrog	Hyla versicolor	PWA		PR	PR	PR	PR
Western Chorus Frog	Pseudacris triseriata	PWA		PR	PR	PR	PR
Spring Peeper	Pseudacris crucifer	PWA		PR	PR	PR	PR
Green Frog	Rana clamitans	PWA		PR	PR	PR	PR
Northern Leopard Frog	Rana pipiens	PWA		PR	PR	PR	PR
Mink Frog	Rana septentrionalis	PWA		PR	PR	PR	PR
Wood Frog	Rana sylvatica	PWA		PR	PR	PR	PR
REPTILES (n=6)							
Snapping Turtle	Chelydra serpentina	PWA, SC		PR	PR	PR	PR
Painted Turtle	Chrysemys picta	PWA		PR	PR	PR	PR
Wood Turtle	Clemmys insculpta	PWA, T		a	PR	a	a
Blanding's Turtle	Emydoidea blandingii	PWA, T		PR	a	a	a
Redbelly Snake	Storeria occipitomaculata			PR	PR	PR	PR
Common Garter Snake	Thamnophis sirtalis			PR	PR	PR	PR
BIRDS (n=181)							
Pied-billed Grebe	Podilymbus podiceps	PB	P	B	B	B	B
Red-necked Grebe	Podiceps grisegena	PB	P	B	B	B	B
American White Pelican	Pelecanus erythrorhynchos	PB, SC	P	m/sv	B	m/sv	m/sv
Double-crested Cormorant	Phalacrocorax auritus	UB	P	B	B	B	B
American Bittern	Botaurus lentiginosus	PB	P	B	B	B	B
Least Bittern	Ixobrychus exilis	PB	P	a	B	a	a
Birds n=181							
Great Blue Heron	Ardea herodias	PB	P	B	B	B	B
Green Heron	Butorides virescens	PB	P	B	m	a	a
Trumpeter Swan	Cygnus buccinator	PB, MW, T	P	B	B	B	B
Canada Goose	Branta canadensis	PB, MW	P	B	B	B	B
Wood Duck	Aix sponsa	PB, MW	P	B	B	B	B
Green-winged Teal	Anas crecca	PB, MW	P	B	m	m	B
American Black Duck	Anas rubripes	PB, MW	P	B	B	B	B
Mallard	Anas platyrhynchos	PB, MW	P	B	B	B	B
Blue-winged Teal	Anas discors	PB, MW	P	B	B	B	B

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
American Wigeon	Anas americana	PB, MW	P	B	B	B	m
Redhead	Aythya americana	PB, MW	P	m	B	m	m
Ring-necked Duck	Aythya collaris	PB, MW	P	B	B	B	B
Common Goldeneye	Bucephala clangula	PB, MW	P	B	B	B	B
Hooded Merganser	Lophodytes cucullatus	PB, MW	P	B	B	B	B
Common Merganser	Mergus merganser	PB, MW	P	B	B	B	B
Turkey Vulture	Cathartes aura	PB	P	B	B	B	B
Osprey	Pandion haliaetus	PB	P	B	B	B	B
Bald Eagle	Haliaeetus leucocephalus	PB, SC	P/T	B	B	B	B
Northern Harrier	Circus cyaneus	PB		B	B	B	B
Sharp-shinned Hawk	Accipiter striatus	PB		B	B	B	B
Northern Goshawk	Accipiter gentilis	PB		B	B	B	B
Red-shouldered Hawk	Buteo lineatus	PB, SC		B	a	a	a
Broad-winged Hawk	Buteo platypterus	PB		B	B	B	B
Red-tailed Hawk	Buteo jamaicensis	PB		B	B	B	B
American Kestrel	Falco sparverius	PB		B	B	B	B
Merlin	Falco columbarius	PB		B	B	B	B
Peregrine Falcon	Falco peregrinus	PB, T		m	m	B	m
Spruce Grouse	Falcipennis canadensis	PB, SG		a	PR	a	PR
Ruffed Grouse	Bonasa umbellus	PB, SG		PR	PR	PR	PR
Sharp-tailed Grouse	Tympanuchus phasianellus	PB, SG		PR (L)	PR (L)	a	a
Yellow Rail	Coturnicops noveboracensis	PB, SC		B	B	m	a
Virginia Rail	Rallus limicola	PB, SG		B	B	B	a
Sora	Porzana carolina	PB, SG		B	B	B	B
American Coot	Fulica americana	PB, SG		B	B	m	m
Sandhill Crane	Grus canadensis	PB		B	B	m	m
Piping Plover	Charadrius melodus	PB, E	E&T	m	m / B (L)	m	a
Killdeer	Charadrius vociferus	PB		B	B	B	B
Spotted Sandpiper	Actitis macularia	PB		B	B	B	B
Upland Sandpiper	Bartramia longicauda	PB		B	B	a	a
Wilson's Snipe				B	B	B	B
American Woodcock	Scolopax minor	PB, SG		B	B	B	B
Wilson's Phalarope	Phalaropus tricolor	PB, T		m	B	a	a
Ring-billed Gull	Larus delawarensis	PB		m	B	m	m

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Herring Gull	Larus argentatus	PB		B	B	B	B
Common Tern	Sterna hirundo	PB, T		m	B	m	m
Forster's Tern	Sterna forsteri	PB, SC		m	B	a	a
Black Tern	Chlidonias niger	PB		B	B	m	m
Rock Dove	Columba livia	PB		PR	PR	PR	PR
Mourning Dove	Zenaida macroura	PB		B	B	B	m
Black-billed Cuckoo	Coccyzus erythropthalmus	PB		B	B	B	B
Great Horned Owl	Bubo virginianus	UB		PR	PR	PR	PR
Northern Hawk Owl	Surnia ulula	PB		wv	PR	PR	PR
Barred Owl	Strix varia	PB		PR	PR	PR	PR
Great Gray Owl	Strix nebulosa	PB		PR	PR	PR	PR
Long-eared Owl	Asio otus	PB		B	B	B	B
Short-eared Owl	Asio flammeus	PB, SC		m	B	m	a
Boreal Owl	Aegolius funereus	PB		wv	PR	wv	PR
Northern Saw-whet Owl	Aegolius acadicus	PB		B	B	B	B
Common Nighthawk	Chordeiles minor	PB		B	B	B	B
Whip-poor-will	Caprimulgus vociferus	PB		B	B	B	B
Chimney Swift	Chaetura pelagica	PB		B	B	B	B
Ruby-throated Hummingbird	Archilochus colubris	PB		B	B	B	B
Belted Kingfisher	Ceryle alcyon	PB		B	B	B	B
Red-headed Woodpecker	Melanerpes erythrocephalus	PB		B	B	B	a
Yellow-bellied Sapsucker	Sphyrapicus varius	PB		B	B	B	B
Downy Woodpecker	Picoides pubescens	PB		PR	PR	PR	PR
Hairy Woodpecker	Picoides villosus	PB		PR	PR	PR	PR
Three-toed Woodpecker	Picoides tridactylus	PB		wv	PR	wv	PR
Black-backed Woodpecker	Picoides arcticus	PB		PR	PR	PR	PR
Northern Flicker	Colaptes auratus	PB		B	B	B	B
Pileated Woodpecker	Dryocopus pileatus	PB		PR	PR	PR	PR
Olive-sided Flycatcher	Contopus cooperi	PB		B	B	B	B
Eastern Wood-Pewee	Contopus virens	PB		B	B	B	B
Yellow-bellied Flycatcher	Empidonax flaviventris	PB		B	B	B	B
Alder Flycatcher	Empidonax alnorum	PB		B	B	B	B
Least Flycatcher	Empidonax minimus	PB		B	B	B	B
Eastern Phoebe	Sayornis phoebe	PB		B	B	B	B

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Great Crested Flycatcher	Myiarchus crinitus	PB		B	B	B	B
Eastern Kingbird	Tyrannus tyrannus	PB		B	B	B	B
Horned Lark	Eremophila alpestris	PB		B	m	m	m
Purple Martin	Progne subis	PB		B	B	B	B
Tree Swallow	Tachycineta bicolor	PB		B	B	B	B
Northern Rough-winged Swallow	Stelgidopteryx serripennis	PB		B	B	B	B
Bank Swallow	Riparia riparia	PB		B	B	B	B
Cliff Swallow	Petrochelidon pyrrhonota	PB		B	B	B	B
Barn Swallow	Hirundo rustica	PB		B	B	B	B
Gray Jay	Perisoreus canadensis	PB		PR	PR	PR	PR
Blue Jay	Cyanocitta cristata	PB		PR	PR	PR	PR
Black-billed Magpie	Pica pica	UB		a	PR	a	a
American Crow	Corvus brachyrhynchos	PB		PR	PR	PR	B
Common Raven	Corvus corax	PB		PR	PR	PR	PR
Black-capped Chickadee	Poecile atricapillus	PB		PR	PR	PR	PR
Boreal Chickadee	Poecile hudsonicus	PB		PR	PR	PR	PR
Red-breasted Nuthatch	Sitta canadensis	PB		PR	PR	PR	PR
White-breasted Nuthatch	Sitta carolinensis	PB		PR	PR	PR	PR
Brown Creeper	Certhia americana	PB		B	B	B	B
House Wren	Troglodytes aedon	PB		B	B	B	B
Winter Wren	Troglodytes troglodytes	PB		B	B	B	B
Sedge Wren	Cistothorus platensis	PB		B	B	B	B
Marsh Wren	Cistothorus palustris	PB		B	B	a	a
Golden-crowned Kinglet	Regulus satrapa	PB		B	B	B	B
Ruby-crowned Kinglet	Regulus calendula	PB		B	B	B	B
Eastern Bluebird	Sialia sialis	PB		B	B	B	B
Veery	Catharus fuscescens	PB		B	B	B	B
Swainson's Thrush	Catharus ustulatus	PB		B	B	B	B
Hermit Thrush	Catharus guttatus	PB		B	B	B	B
Wood Thrush	Hylocichla mustelina	PB		B	m	B	B
American Robin	Turdus migratorius	PB		B	B	B	B
Gray Catbird	Dumetella carolinensis	PB		B	B	B	B
Brown Thrasher	Toxostoma rufum	PB		B	B	B	B
European Starling	Sturnus vulgaris	UB		PR	PR	PR	PR
Cedar Waxwing	Bombycilla cedrorum	PB		B	B	B	B
Blue-headed Vireo	Vireo solitarius	PB		B	B	B	B

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Yellow-throated Vireo	Vireo flavifrons	PB		B	B	a	a
Warbling Vireo	Vireo gilvus	PB		B	B	a	a
Philadelphia Vireo	Vireo philadelphicus	PB		m	B	B	B
Red-eyed Vireo	Vireo olivaceus	PB		B	B	B	B
Golden-winged Warbler	Vermivora chrysoptera	PB		B	B	B	B
Tennessee Warbler	Vermivora peregrina	PB		m	B	B	B
Nashville Warbler	Vermivora ruficapilla	PB		B	B	B	B
Northern Parula	Parula americana	PB		B	B	B	B
Yellow Warbler	Dendroica petechia	PB		B	B	B	B
Chestnut-sided Warbler	Dendroica pensylvanica	PB		B	B	B	B
Magnolia Warbler	Dendroica magnolia	PB		B	B	B	B
Cape May Warbler	Dendroica tigrina	PB		m	B	B	B
Black-throated Blue Warbler	Dendroica caerulescens	PB		m/sv	m	m	B
Yellow-rumped Warbler	Dendroica coronata	PB		B	B	B	B
Black-throated Green Warbler	Dendroica virens	PB		B	B	B	B
Blackburnian Warbler	Dendroica fusca	PB		B	B	B	B
Pine Warbler	Dendroica pinus	PB		B	B	m	m
Palm Warbler	Dendroica palmarum	PB		m	B	B	m
Bay-breasted Warbler	Dendroica castanea	PB		m	B	m	B
Black-and-white Warbler	Mniotilta varia	PB		B	B	B	B
American Redstart	Setophaga ruticilla	PB		B	B	B	B
Ovenbird	Seiurus aurocapillus	PB		B	B	B	B
Northern Waterthrush	Seiurus noveboracensis	PB		B	B	B	B
Connecticut Warbler	Oporornis agilis	PB		B	B	B	B
Mourning Warbler	Oporornis philadelphia	PB		B	B	B	B
Common Yellowthroat	Geothlypis trichas	PB		B	B	B	B
Wilson's Warbler	Wilsonia pusilla	PB		m	m	m	B
Canada Warbler	Wilsonia canadensis	PB		B	B	B	B
Scarlet Tanager	Piranga olivacea	PB		B	B	B	B
Rose-breasted Grosbeak	Pheucticus ludovicianus	PB		B	B	B	B
Indigo Bunting	Passerina cyanea	PB		B	B	B	B
Eastern Towhee	Pipilo erythrophthalmus	PB		m	B	m	m
Chipping Sparrow	Spizella passerina	PB		B	B	B	B
Clay-colored Sparrow	Spizella pallida	PB		B	B	B	B
Vesper Sparrow	Pooecetes gramineus	PB		B	B	a	a

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Savannah Sparrow	Passerculus sandwichensis	PB		B	B	B	B
Le Conte's Sparrow	Ammodramus leconteii	PB		B	B	B	B
Nelson's Sharp-tailed Sparrow+A178	Ammodramus nelsoni	PB, SC		B	B	a	a
Song Sparrow	Melospiza melodia	PB		B	B	B	B
Lincoln's Sparrow	Melospiza lincolnii	PB		B	B	B	B
Swamp Sparrow	Melospiza georgiana	PB		B	B	B	B
White-throated Sparrow	Zonotrichia albicollis	PB		B	B	B	B
Dark-eyed Junco	Junco hyemalis	PB		B	B	B	B
Bobolink	Dolichonyx oryzivorus	PB		B	B	B	B
Red-winged Blackbird	Agelaius phoeniceus	UB		B	B	B	B
Eastern Meadowlark	Sturnella magna	PB		B	a	B	B
Western Meadowlark	Sturnella neglecta	PB		B	B	a	a
Yellow-headed Blackbird	Xanthocephalus xanthocephalus	UB		B	B	a	a
Rusty Blackbird	Euphagus carolinus	UB		m	m	m	B
Brewer's Blackbird	Euphagus cyanocephalus	UB		B	B	B	a
Common Grackle	Quiscalus quiscula	UB		B	B	B	B
Brown-headed Cowbird	Molothrus ater	PB		B	B	B	B
Baltimore Oriole	Icterus galbula	PB		B	B	B	B
Purple Finch	Carpodacus purpureus	PB		B	B	B	B
House Finch	Carpodacus mexicanus	PB		PR	PR	PR	a
Red Crossbill	Loxia curvirostra	PB		wv	wv	wv	B
White-winged Crossbill	Loxia leucoptera	PB		wv	wv	wv	B
Pine Siskin	Carduelis pinus	PB		PR	PR	PR	PR
American Goldfinch	Carduelis tristis	PB		B	B	B	B
Evening Grosbeak	Coccothraustes vespertinus	PB		PR	PR	PR	PR
House Sparrow	Passer domesticus	UB		PR	PR	PR	PR

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
MAMMALS (n=56)							
Cinereus Shrew	Sorex cinereus			PR	PR	PR	PR
Water Shrew	Sorex palustris			PR	PR	PR	PR
Smoky Shrew	Sorex fumeus	SC		a	a	a	PR
Arctic Shrew	Sorex arcticus			PR	PR	PR	PR
Pygmy Shrew	Sorex hoyi			PR	PR	PR	PR
Northern Short-tailed Shrew	Blarina brevicauda			PR	PR	PR	PR
Star-nosed Mole	Condylura cristata			PR	PR	PR	PR
Little Brown Bat	Myotis lucifugus			B	B	PR	B
Northern Myotis	Myotis septentrionalis	SC		B	a	B	PR
Silver-haired Bat	Lasionycteris noctivagans			B	B	B	B
Eastern Pipistrelle	Pipistrellus subflavus	SC		a	a	a	PR
Big Brown Bat	Eptesicus fuscus			B	B	PR	B
Eastern Red Bat	Lasiurus borealis			B	B	B	B
Hoary Bat	Lasiurus cinereus			B	B	B	B
Eastern Cottontail	Sylvilagus floridanus	PWA, SG		PR	a	PR	a
Snowshoe Hare	Lepus americanus	PWA, SG		PR	PR	PR	PR
Least Chipmunk	Tamias minimus			PR	PR	PR	PR
Eastern Chipmunk	Tamias striatus			PR	PR	PR	PR
Woodchuck	Marmota monax			PR	PR	PR	PR
Thirteen-lined Ground Squirrel	Spermophilus tridecemlineatus			PR	PR	PR	a
Franklin's Ground Squirrel	Spermophilus franklinii			PR	PR	PR	a
Eastern Gray Squirrel	Sciurus carolinensis	PWA, SG		PR	a	PR	a
Eastern Fox Squirrel	Sciurus niger	PWA, SG		PR	a	a	a
Red Squirrel	Tamiasciurus hudsonicus			PR	PR	PR	PR
Northern Flying Squirrel	Glaucomys sabrinus			PR	PR	PR	PR
American Beaver	Castor canadensis	PWA, SG, F		PR	PR	PR	PR
Woodland Deer Mouse	Peromyscus maniculatus gracilis			PR	PR	PR	PR
White-footed Mouse	Peromyscus leucopus			PR	PR	a	a
Southern Red-backed Vole	Clethrionomys gapperi			PR	PR	PR	PR

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Eastern Heather Vole	Phenacomys ungava	SC		a	a	a	PR
Meadow Vole	Microtus pennsylvanicus			PR	PR	PR	PR
Rock Vole	Microtus chrotorrhinus			a	a	a	PR
Muskrat	Ondatra zibethicus	PWA, SG, F		PR	PR	PR	PR
Southern Bog Lemming	Synaptomys cooperi			PR	PR	PR	PR
Northern Bog Lemming	Synaptomys borealis	SC		PR (L)	PR	a	a
Meadow Jumping Mouse	Zapus hudsonius			PR	PR	PR	PR
Woodland Jumping Mouse	Napaeozapus insignis			PR	PR	PR	PR
North American Porcupine	Erethizon dorsatum	UWA		PR	PR	PR	PR
Coyote	Canis latrans	UWA		PR	PR	PR	PR
Gray Wolf	Canis lupus	SC	T	PR	PR	PR	PR
Red Fox	Vulpes vulpes	PWA, SG, F		PR	PR	PR	PR
Gray Fox	Urocyon cinereoargenteus	PWA, SG, F		PR	PR	a	a
American Black Bear	Ursus americanus	PWA, BG		PR	PR	PR	PR
Northern Raccoon	Procyon lotor	PWA, SG, F		PR	PR	PR	PR
American Marten	Martes americana	PWA, SG, F		PR	PR	PR	PR
Fisher	Martes pennanti	PWA, SG, F		PR	PR	PR	PR
Ermine	Mustela erminea	UWA		PR	PR	PR	PR
Least Weasel	Mustela nivalis	UWA, SC		a	PR	a	a
American Mink	Mustela vison	PWA, SG, F		PR	PR	PR	PR
American Badger	Taxidea taxus	PWA, SG, F		PR	PR	PR	a
Striped Skunk	Mephitis mephitis	UWA		PR	PR	PR	PR
Northern River Otter	Lontra canadensis	PWA, SG, F		PR	PR	PR	PR
Canada Lynx	Lynx canadensis	PWA, SG, F	T	PR	PR	PR	PR
Bobcat	Lynx rufus	PWA, SG, F		PR	PR	PR	a
White-tailed Deer	Odocoileus virginianus	PWA, BG		PR	PR	PR	PR

Terrestrial Vertebrate Species List February 2007							
				Species Occurrence by ECS subsection[d]			
Common Name [a]	Scientific Name [a]	MN legal status [b]	Federal legal status[c]	St. Louis Moraine	Tamarack Lowlands	Nashwauk Uplands	Littlefork-Vermilion Uplands
Moose	Alces alces	PWA, BG		a	PR	PR	PR

Table 7.2 Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

		Forest land cover types																														
			Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					**Forest size class**				
SPECIES GROUP Species common name	**Habitat feature**		Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Spruce	spruce	Tamarack	Stagnant tamarack	Cedar	Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	mix	Black Ash	Silver Maple	Cottonwood	mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
INSECTIVORES																																
Northern Short-tailed Shrew	D		Y	Y	Y		Y				Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Arctic Shrew	R											Y	Y	Y	Y	Y	Y	Y										Y	Y	Y	Y	Y	Y
Cinereus Shrew	D		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pygmy Shrew	D				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y				Y		Y			Y	Y	Y	Y	Y	Y	Y
Water Shrew	DR											Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Smoky Shrew	D					Y		Y				Y				Y												Y	Y	Y	Y	Y	Y
Star-nosed Mole	DR											Y	Y	Y	Y	Y	Y	Y						Y	Y		Y	Y			Y	Y	Y
BATS																																	
Big Brown Bat	CRS		Y	Y	Y		Y	Y			Y								Y	Y	Y		Y			Y	Y	Y			Y	Y	
Silver-haired Bat	CRS			Y	Y		Y			Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Eastern Pipistrelle	MCER																		Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Eastern Red Bat	CR						Y	Y											Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Hoary Bat	R		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Little Brown Bat	CRS		Y	Y	Y	Y	Y	Y		Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y		Y	Y	Y				
Northern Myotis	CRS		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y		Y	Y				Y	Y
CARNIVORES																																	
Coyote	M		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Wolf	M		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Fox	CDM																		Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y

SPECIES GROUP Species common name	**Habitat feature**	Forest land cover types: Upland Coniferous Forest: Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Coniferous Forest: Spruce	spruce	Tamarack	Stagnant tamarack	Cedar	Cedar	Stagnant conifer	Upland Deciduous Forest: Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	mix	Lowland Deciduous Forest: Black Ash	Silver Maple	Cottonwood	mix	Low. deciduous/coniferous mix	**Forest size class**: Seedling	Sapling	Pole timber	Saw timber	Uneven
Red Fox		Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bobcat	CD	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y
Canada Lynx		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y			Y	Y	Y	Y	Y	Y	Y
Northern River Otter																																
American Marten	CDS	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
Fisher	CDRS				Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Ermine	DR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Least Weasel		Y	Y	Y		Y				Y									Y													
American Mink	DR																															
American Badger																			Y													
Striped Skunk	DM	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	Y
Northern Raccoon	CMRS	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Black Bear	CDMR		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
EVEN-TOED UNGULATES																																
White-tailed Deer		Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Moose		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y
RODENTS																																
Northern Flying Squirrel	CDMS	Y	Y	Y	Y	Y	Y	Y	Y	Y											Y						Y				Y	Y
Woodchuck																			Y	Y								Y				
Eastern Gray Squirrel	CDM									Y									Y	Y	Y	Y	Y								Y	
Eastern Fox Squirrel	CDM																		Y	Y	Y	Y		Y							Y	Y
Franklin's Ground Squirrel																														Y	Y	

		Forest land cover types																										Forest size class				
		Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mix					
SPECIES GROUP Species common name	**Habitat feature**	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Spruce	spruce	Tamarack	Stagnant tamarack	Cedar	Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	mix	Black Ash	Silver Maple	Cottonwood	mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Thirteen-lined Ground Squirrel																																
Least Chipmunk	DM	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y			Y				Y						Y	Y	Y	Y	Y
Eastern Chipmunk	DM		Y	Y		Y	Y	Y	Y	Y								Y	Y	Y	Y	Y			Y			Y	Y	Y	Y	Y
Red Squirrel	CDMS	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
American Beaver	R																	Y				Y						Y	Y	Y	Y	Y
Woodland Jumping Mouse	DM				Y	Y	Y		Y												Y	Y	Y			Y			Y	Y	Y	Y
Meadow Jumping Mouse		Y	Y	Y	Y	Y	Y		Y																			Y				
Woodland Deer Mouse		Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y		Y		Y	Y	Y	Y	
White-footed Mouse	CDMS	Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Southern Red-backed Vole	DM	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eastern Heather Vole		Y			Y	Y		Y			Y	Y																				
Meadow Vole		Y	Y	Y														Y	Y	Y	Y	Y										
Rock Vole	Ro	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y							Y					Y					Y	Y	Y	Y	Y
Muskrat	R																															
Southern Bog Lemming					Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y		Y	Y	Y			Y	Y
North American Porcupine	CDS	Y	Y	Y	Y	Y	Y		Y	Y											Y	Y					Y			Y	Y	Y
RABBITS AND HARES																																
Eastern Cottontail	E									Y								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y			
Snowshoe Hare	E	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 7.3 Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
LOONS AND GREBES																																														
Common Loon												Y	Y																																	
Pied-billed Grebe												Y	Y	Y	Y																															
Red-necked Grebe												Y	Y		Y																															
PELICANS AND CORMORANTS																																														
American White Pelican												Y	Y	Y																																
Double-crested Cormorant	RS											Y	Y	Y	Y																	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
HERONS AND BITTERNS																																														
American Bittern	R						Y	Y		Y		Y	Y	Y	Y																															
Least Bittern	R									Y		Y	Y	Y	Y																															
Great Blue Heron	RS											Y	Y	Y	Y																	Y	Y	Y		Y	Y	Y	Y	Y	Y				Y	Y
Green Heron	R								Y	Y		Y	Y	Y	Y												Y	Y									Y	Y	Y	Y	Y				Y	Y

		Non-Forested types: Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
VULTURES																																														
Turkey Vulture	S						Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y								Y	Y	
SWANS AND GEESE																																														
Canada Goose	R			Y		Y	Y	Y	Y	Y		Y	Y	Y	Y																															
Trumpeter Swan										Y		Y	Y	Y	Y																															
DUCKS AND MERGANSERS																																														
Wood Duck	CM RS									Y		Y	Y		Y																	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
American Wigeon	R						Y	Y	Y	Y		Y	Y	Y	Y																															
American Black Duck	R						Y	Y	Y	Y		Y	Y	Y	Y																						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mallard	RM			Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																						Y	Y	Y	Y	Y				Y	Y
Blue-winged Teal	R					Y	Y	Y	Y	Y		Y	Y	Y	Y																															
Green-winged Teal	R						Y	Y	Y	Y		Y	Y	Y	Y																															
Redhead												Y	Y	Y	Y																															

SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	us mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	s mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
Ring-necked Duck										Y		Y	Y	Y	Y																															
Common Goldeneye	CR S											Y	Y		Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Hooded Merganser	CR S									Y		Y	Y	Y	Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Common Merganser	CR S											Y																				Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
OSPREYS																																														
Osprey	RS											Y																																Y	Y	
HAWKS AND EAGLES																																														
Bald Eagle	R											Y					Y	Y					Y	Y								Y	Y	Y	Y	Y	Y			Y	Y				Y	Y
Northern Harrier						Y	Y	Y	Y		Y															Y		Y									Y	Y	Y	Y	Y					
Sharp-shinned Hawk																Y	Y	Y	Y	Y	Y		Y	Y	Y																				Y	Y
Northern Goshawk																Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y									Y	Y
Red-shouldered Hawk	R																															Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y

SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	us mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	s mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
Broad-winged Hawk							Y		Y							Y	Y	Y	Y	Y			Y	Y								Y	Y	Y	Y	Y									Y	Y
Red-tailed Hawk							Y	Y						Y		Y	Y	Y						Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
FALCONS																																														
American Kestrel	CS					Y	Y	Y																																						
Merlin							Y	Y	Y		Y			Y		Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Peregrine Falcon	MR K	Y	Y	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y											Y		Y		Y	Y															
GROUSE AND TURKEYS																																														
Ruffed Grouse									Y	Y														Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
Spruce Grouse	D										Y					Y			Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Sharp-tailed Grouse						Y	Y	Y	Y	Y	Y			Y																																
RAILS AND COOTS																																														
Yellow Rail										Y		Y	Y	Y	Y																															
Virginia Rail	R									Y		Y	Y	Y	Y																															
Sora	R									Y		Y	Y	Y	Y																															
American Coot	R											Y	Y	Y	Y																															

SPECIES GROUP Species Common Name	Habitat feature	Non-Forested types: Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
CRANES																																														
Sandhill Crane						Y	Y	Y		Y	Y		Y	Y	Y																															
PLOVERS																																														
Piping Plover		Y										Y																																		
Killdeer	R	Y		Y		Y	Y	Y	Y																																					
SANDPIPERS																																														
Spotted Sandpiper	R	Y		Y			Y	Y	Y		Y	Y		Y	Y																															
Upland Sandpiper						Y	Y	Y	Y	Y				Y	Y																															
Common Snipe										Y	Y	Y		Y	Y											Y		Y		Y	Y															
American Woodcock							Y		Y	Y																						Y	Y	Y	Y	Y						Y				
Wilson's Phalarope							Y	Y				Y	Y	Y	Y																															
JAEGERS, GULLS AND TERNS																																														
Ring-billed Gull	R	Y		Y		Y	Y					Y		Y	Y																															

SPECIES GROUP Species Common Name	Habitat feature	Non-Forested types: Barren	Urban/Dev.: High intensity urban	Low intensity urban	Transportation	Ag./Grass: Cropland	Grassland	Prairie	Shrub: Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Aquatic: Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Forest land cover types: Upland Coniferous Forest: Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	us mix	Lowland Coniferous Forest: Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Upland Deciduous Forest: Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Lowland Deciduous Forest: Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	s mix	Forest size class: Seedling	Sapling	Pole timber	Saw timber	Uneven
Herring Gull	R	Y		Y			Y					Y																																		
Common Tern		Y										Y	Y		Y																															
Forster's Tern												Y	Y	Y	Y																															
Black Tern												Y	Y	Y	Y																															
PIGEONS AND DOVES																																														
Rock Dove							Y																																							
Mourning Dove				Y		Y	Y									Y	Y	Y	Y	Y	Y		Y																			Y		Y	Y	Y
CUCKOOS																																														
Black-billed Cuckoo									Y	Y																																				
OWLS																																														
Great Horned Owl	CS			Y			Y		Y							Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Northern Hawk Owl										Y	Y			Y							Y			Y	Y	Y	Y	Y	Y	Y	Y															
Barred Owl	C															Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Great Gray Owl	S								Y	Y	Y			Y											Y	Y	Y	Y	Y	Y	Y						Y				Y				Y	Y
Long-eared Owl							Y							Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y

		Non-Forested types: Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Short-eared Owl						Y	Y	Y		Y	Y			Y	Y																															
Boreal Owl											Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y										
Northern Saw-whet Owl	C								Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y				Y	
NIGHTJARS																																														
Common Nighthawk		Y	Y	Y		Y	Y	Y																																						
Whip-poor-will	FD						Y		Y							Y								Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
SWIFTS																																														
Chimney Swift	CS	Y	Y	Y																												Y	Y	Y	Y	Y						Y	Y	Y	Y	
HUMMINGBIRDS																																														
Ruby-throated Hummingbird	R			Y			Y		Y																							Y			Y		Y	Y	Y		Y				Y	Y
KINGFISHERS																																														
Belted Kingfisher	B	Y										Y	Y		Y																															
WOODPECKERS																																														
Red-headed Woodpecker	CMS																																Y	Y	Y	Y								Y	Y	

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Yellow-bellied Sapsucker	CMS																							Y								Y	Y	Y	Y	Y									Y	
Downy Woodpecker	CDS																							Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Hairy Woodpecker	CDS															Y	Y	Y						Y	Y		Y		Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Three-toed Woodpecker	CDS															Y			Y	Y	Y			Y	Y		Y																		Y	Y
Black-backed Woodpecker	CDS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
Northern Flicker	CS								Y	Y						Y	Y	Y	Y	Y	Y		Y	Y								Y	Y	Y	Y	Y						Y			Y	Y
Pileated Woodpecker	CDMS																							Y								Y	Y	Y	Y	Y	Y	Y		Y				Y	Y	Y
FLYCATCHERS																																														
Eastern Kingbird	MRS			Y			Y	Y	Y	Y				Y	Y	Y	Y	Y						Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Olive-sided Flycatcher	RS									Y	Y					Y			Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Eastern Wood-Pewee				Y													Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	
Yellow-bellied Flycatcher	D										Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													Y	Y	
Alder Flycatcher	R									Y																																				

SPECIES GROUP Species Common Name		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
	Habitat feature		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Least Flycatcher									Y	Y														Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Eastern Phoebe	R			Y	Y				Y	Y		Y																				Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	
Great Crested Flycatcher	CS			Y						Y	Y													Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	
VIREOS																																														
Yellow-throated Vireo	R			Y					Y	Y														Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Blue-headed Vireo																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													Y	Y	
Warbling Vireo	R			Y					Y																							Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Philadelphia Vireo	ER																															Y			Y	Y									Y	
Red-eyed Vireo																	Y	Y		Y	Y		Y									Y	Y	Y	Y	Y								Y	Y	
JAYS, CROWS AND RAVENS																																														
Gray Jay	M															Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y													Y	Y	
Blue Jay	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black-billed Magpie						Y	Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
American Crow	M			Y		Y	Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common Raven	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

SPECIES GROUP Species Common Name	Habitat feature	Non-Forested types: Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
LARKS																																														
Horned Lark		Y		Y		Y	Y	Y	Y	Y																																				
SWALLOWS																																														
Purple Martin	RS		Y	Y			Y					Y			Y																															
Tree Swallow	CS						Y	Y		Y	Y	Y	Y	Y	Y																	Y	Y	Y	Y	Y	Y	Y	Y	Y						
Northern Rough-winged Swallow	BR	Y		Y								Y																																		
Bank Swallow	BR	Y		Y			Y	Y				Y	Y																																	
Cliff Swallow	R			Y	Y	Y	Y					Y																																		
Barn Swallow				Y	Y	Y	Y					Y	Y	Y	Y																															
CHICKADEES																																														
Black-capped Chickadee	CS			Y					Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Boreal Chickadee	CS								Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
NUTHATCHES																																														
Red-breasted Nuthatch	CS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
White-breasted Nuthatch	CS																															Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y

SPECIES GROUP Species Common Name	Habitat feature	Non-Forested types: Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
CREEPERS																																														
Brown Creeper	CS																																				Y	Y		Y	Y			Y	Y	Y
WRENS																																														
House Wren	CS			Y					Y	Y																						Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			
Winter Wren																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y		Y	Y	Y	Y	Y		Y	Y					
Sedge Wren							Y	Y		Y				Y	Y											Y		Y		Y	Y															
Marsh Wren	R									Y		Y		Y	Y																															
KINGLETS																																														
Golden-crowned Kinglet																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
Ruby-crowned Kinglet																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
THRUSHES																																														
Eastern Bluebird	CS			Y			Y	Y	Y	Y																						Y	Y	Y	Y	Y						Y				
Veery	M															Y								Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Swainson's Thrush	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y									Y			Y	Y	
Hermit Thrush	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													Y	Y	Y
Wood Thrush	M			Y																				Y								Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
American Robin	M			Y			Y		Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MIMICS AND THRASHERS																																														
Gray Catbird	MR			Y					Y	Y	Y															Y		Y		Y	Y	Y	Y	Y	Y	Y						Y	Y			
Brown Thrasher	M			Y					Y																							Y	Y	Y	Y	Y						Y	Y			
WAXWINGS																																														
Cedar Waxwing	MR			Y					Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y	Y	Y	Y	Y	Y
WARBLERS																																														
Golden-winged Warbler	R								Y	Y						Y	Y	Y	Y					Y								Y	Y	Y			Y	Y		Y		Y	Y	Y	Y	
Tennessee Warbler																										Y		Y		Y	Y													Y	Y	
Nashville Warbler									Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Northern Parula																Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y													Y	Y	
Yellow Warbler	R			Y					Y	Y																											Y	Y		Y		Y	Y			
Chestnut-sided Warbler				Y					Y																							Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			
Magnolia Warbler																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y												Y	Y		

SPECIES GROUP Species Common Name		Non-Forested types: Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Forest land cover types: Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
	Habitat feature		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Cape May Warbler																			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y											Y	Y	Y	Y	
Black-throated Blue Warbler	Op																																		Y										Y	Y
Yellow-rumped Warbler																Y	Y		Y	Y	Y		Y		Y	Y	Y	Y			Y										Y			Y	Y	Y
Black-throated Green Warbler																Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y								Y	Y	Y
Blackburnian Warbler																Y	Y	Y	Y	Y	Y		Y	Y																				Y	Y	Y
Pine Warbler																Y	Y	Y					Y	Y																					Y	
Palm Warbler											Y															Y		Y		Y	Y											Y	Y	Y	Y	
Bay-breasted Warbler	Op															Y		Y	Y	Y	Y			Y	Y																				Y	Y
Black-and-white Warbler	D								Y	Y						Y	Y	Y					Y	Y		Y						Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		
American Redstart									Y	Y						Y																Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	
Ovenbird																Y	Y	Y	Y	Y			Y	Y								Y	Y	Y	Y	Y								Y	Y	
Northern Waterthrush	DR									Y															Y	Y	Y	Y	Y	Y	Y						Y	Y		Y	Y			Y	Y	Y
Connecticut Warbler											Y					Y									Y	Y	Y	Y	Y	Y	Y											Y	Y	Y	Y	

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Mourning Warbler									Y	Y						Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y			
Common Yellowthroat	R								Y	Y				Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y											Y	Y			
Wilson's Warbler										Y	Y															Y		Y		Y	Y															
Canada Warbler	D								Y		Y							Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y			Y	Y								Y	Y	
TANAGERS																																														
Scarlet Tanager																Y								Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	
TOWHEES AND SPARROWS																																														
Eastern Towhee	M								Y	Y						Y							Y										Y	Y		Y						Y	Y	Y	Y	
Chipping Sparrow				Y					Y							Y	Y	Y	Y	Y	Y	Y	Y	Y																	Y			Y	Y	
Clay-colored Sparrow							Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		Y			Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			
Vesper Sparrow						Y	Y	Y	Y					Y																		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Savannah Sparrow						Y	Y	Y	Y	Y	Y			Y	Y													Y		Y	Y		Y													
Le Conte's Sparrow						Y	Y	Y		Y	Y			Y	Y																															
Nelson's Sharp-tailed sparrow							Y	Y		Y				Y	Y													Y		Y	Y															

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Song Sparrow									Y	Y				Y		Y																Y					Y	Y	Y	Y		Y	Y	Y		
Lincoln's Sparrow											Y					Y									Y	Y	Y	Y			Y										Y	Y				
Swamp Sparrow							Y			Y	Y			Y	Y																															
White-throated Sparrow									Y	Y						Y			Y	Y	Y		Y	Y	Y		Y		Y												Y	Y	Y	Y		
Dark-eyed Junco									Y							Y			Y	Y	Y		Y	Y												Y						Y	Y	Y	Y	Y
GROSBEAKS																																														
Rose-breasted Grosbeak	M			Y																												Y	Y	Y	Y	Y								Y	Y	
Indigo Bunting									Y	Y																						Y	Y	Y	Y	Y	Y	Y		Y		Y	Y			
BLACKBIRDS AND ORIOLES																																														
Bobolink						Y	Y	Y	Y	Y	Y			Y																																
Red-winged Blackbird	R					Y	Y		Y	Y		Y	Y	Y	Y																															
Eastern Meadowlark						Y	Y	Y		Y				Y	Y																		Y													
Western Meadowlark						Y	Y	Y	Y	Y				Y	Y																															
Yellow-headed Blackbird	R											Y		Y	Y																															

		Non-Forested types														Forest land cover types																														
		Barren	Urban/ Dev.			Ag./Gras s			Shrub			Aquatic				Upland Coniferous Forest								us mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				s mix	**Forest size class**				
SPECIES GROUP Species Common Name	**Habitat feature**		High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
Rusty Blackbird									Y	Y																Y		Y		Y	Y															
Brewer's Blackbird	R			Y		Y	Y	Y	Y	Y	Y			Y	Y											Y		Y		Y	Y	Y	Y						Y							
Common Grackle				Y		Y	Y	Y		Y	Y			Y	Y																															
Brown-headed Cowbird						Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y						Y				
Baltimore Oriole	MR			Y																				Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
FINCHES																																														
Purple Finch	M			Y														Y	Y	Y	Y		Y			Y		Y	Y	Y	Y										Y			Y	Y	Y
House Finch	M		Y	Y																																										
Red-crossbill	M															Y	Y	Y	Y		Y			Y	Y	Y																			Y	Y
White-winged Crossbill	M																		Y	Y	Y			Y	Y		Y																		Y	Y
Pine Siskin	M			Y												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	
American Goldfinch				Y			Y		Y	Y																						Y	Y	Y	Y	Y						Y				
Evening Grosbeak	M															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y													Y	Y	Y	Y	

Table 7.4 Amphibian and Reptile habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type.

		Non-Forest land cover types>>>	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Forest land cover types>>>	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest type size class				
SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven
<u>AMPHIBIANS</u>																																														
TOADS AND FROGS																																														
American Toad	RV		Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Treefrog	DRV									Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Spring Peeper	DRV			Y						Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Western Chorus Frog	RV		Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y
Green Frog	R									Y	Y	Y	Y	Y	Y										Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y					
Northern Leopard Frog	R							Y	Y	Y		Y	Y	Y	Y											Y		Y		Y	Y						Y	Y	Y	Y	Y					
Mink Frog	R										Y	Y	Y		Y										Y	Y	Y	Y	Y	Y	Y										Y					
Wood Frog	DV									Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
SALAMANDERS																																														
Blue-spotted Salamander	DV									Y		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Tiger Salamander	V		Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Four-toed Salamander	DV																								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	
Redback Salamander	D															Y	Y	Y					Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y

SPECIES GROUP Species Common Name		Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
			Non-Forest land cover types>>>	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Forest land cover types>>>	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest type size class				
Eastern Newt	DR												Y				Y	Y	Y					Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
REPTILES																																																
- LIZARDS																																																
Prairie Skink								Y	Y																									Y														
SNAKES																																																
Eastern Hognose Snake	D							Y	Y								Y	Y							Y								Y	Y	Y	Y	Y	Y	Y	Y	Y							
Smooth Green Snake					Y			Y	Y	Y	Y	Y			Y	Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y											
Redbelly Snake	D							Y							Y		Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
Plains Garter Snake					Y			Y	Y						Y	Y																																
Common Garter Snake	D			Y	Y			Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
TURTLES																																																
Snapping Turtle	R												Y	Y		Y																																
Painted Turtle	DR											Y	Y	Y		Y																																
Wood Turtle	DR		Y		Y		Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
Blanding's Turtle								Y	Y				Y	Y	Y	Y																																

		Non-Forest land cover types>>>																						Forest land cover types>>>																						
			Urban/ Dev.			Ag./Grass			Shrub			Aquatic			Upland Coniferous Forest										Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest type size class				
SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mix	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix	Low. deciduous/coniferous mix	Seedling	Sapling	Pole timber	Saw timber	Uneven

Habitat feature: B = Bank, C = Cavity, D = Dead, down woody debris, E = Edge, G = Stand/Gap opening, M = Mast, P = Perch, R = Riparian, Ro = Rock, S = Snag, V = Vernal pool.

DISCLAIMER: Information and data listed in these tables has been produced by ongoing wildlife species assessment efforts conducted under the MNDNR Division of Wildlife's Minnesota Wildlife Resource Assessment Project (MN-WRAP) and Minnesota Gap Analysis Project (MN-GAP). These efforts and related tables noted here are initial products that are currently in various stages of literature and expert review. Review and comments on these tables and contents is encouraged. Please contact the MNDNR Division of Wildlife at 218-833-8620 for comments or suggestions