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

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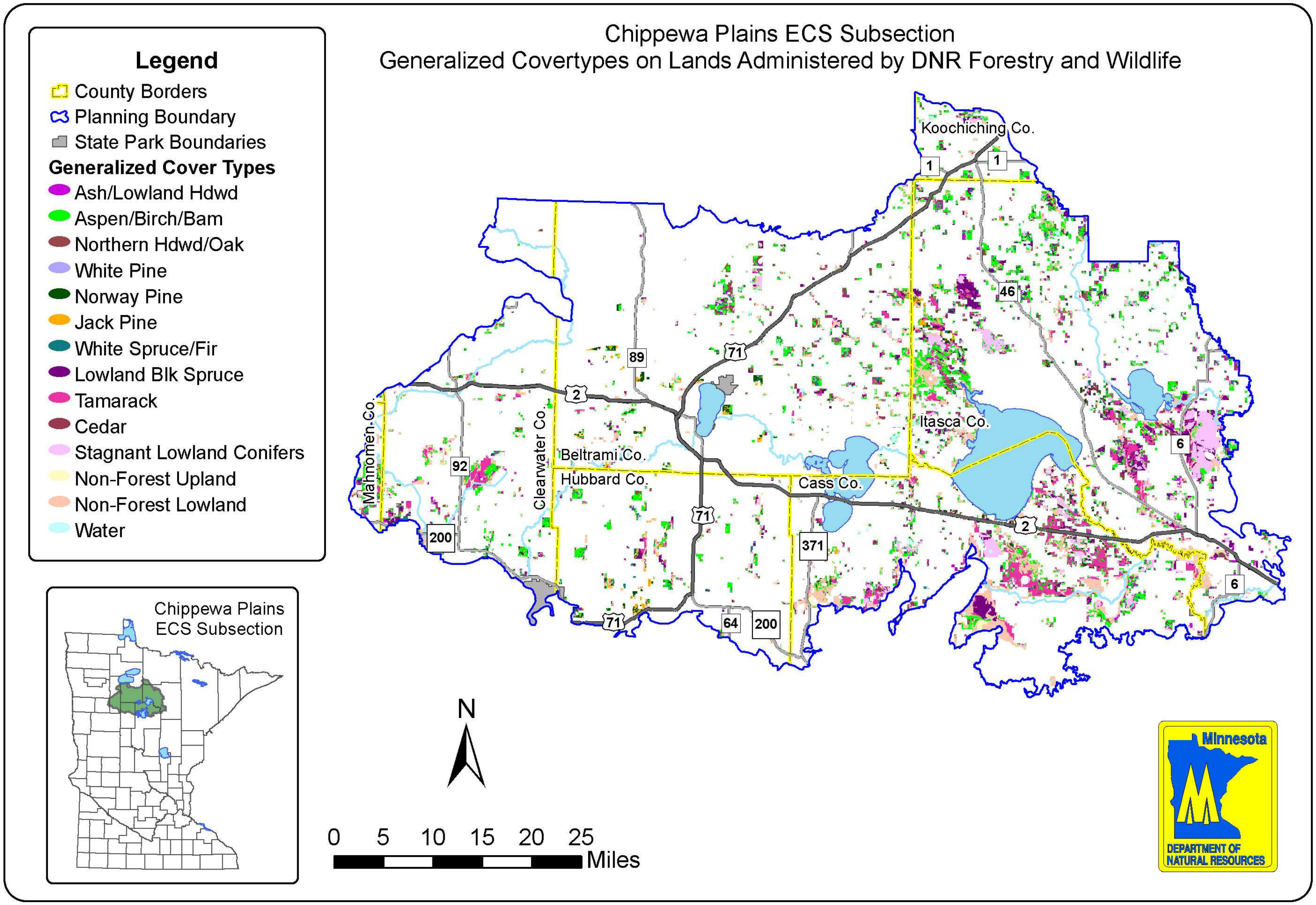
**For all tables, figures, charts, and maps:*
cppm – Chippewa Plains, Pine Moraines and Outwash Plains
cp – Chippewa Plains
pm – Pine Moraines and Outwash Plains

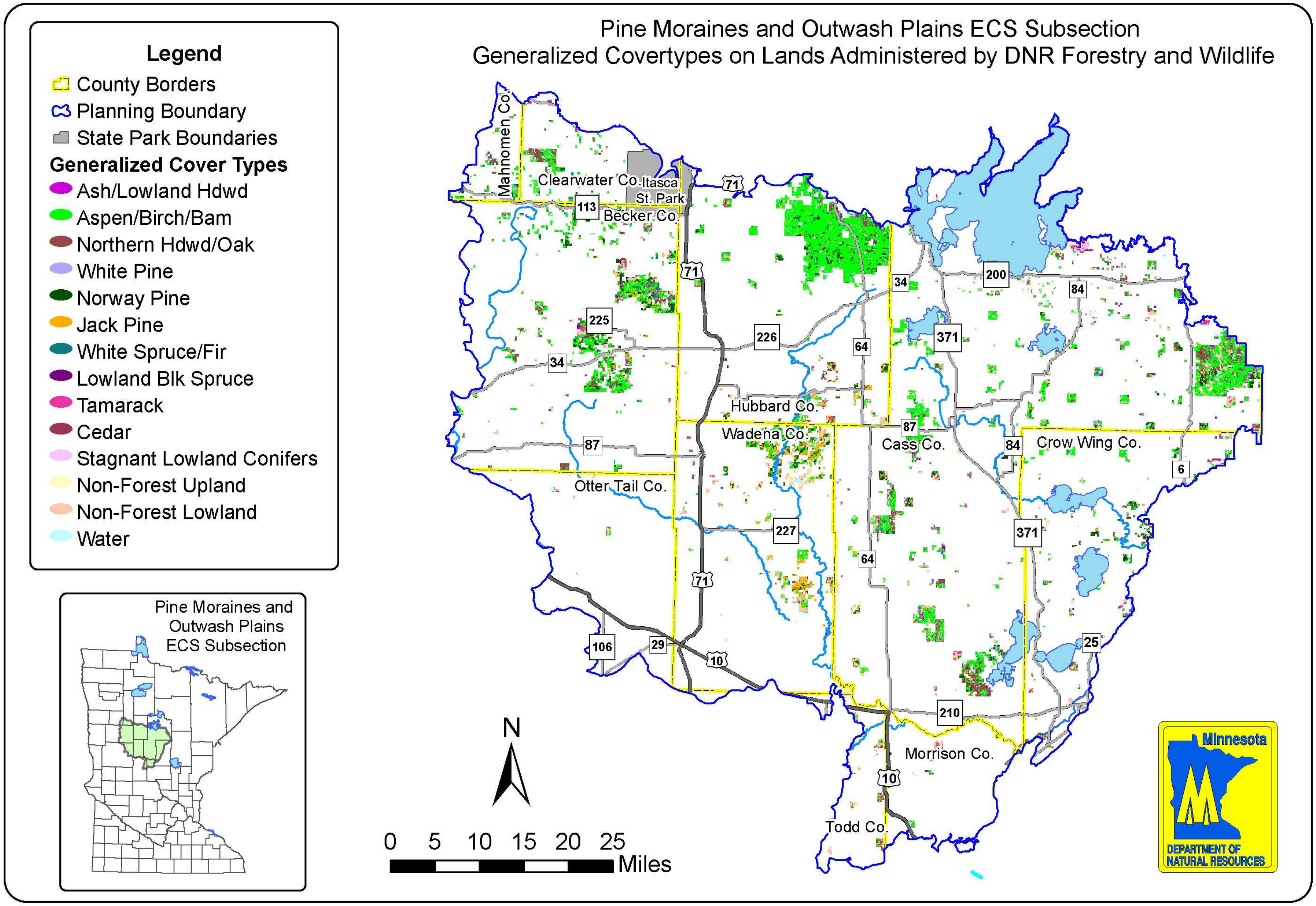
Map i—cp

Chippewa Plains/ Pine Moraines and Outwash Plains



Map i—pm

Pine Moraines and Outwash Plains

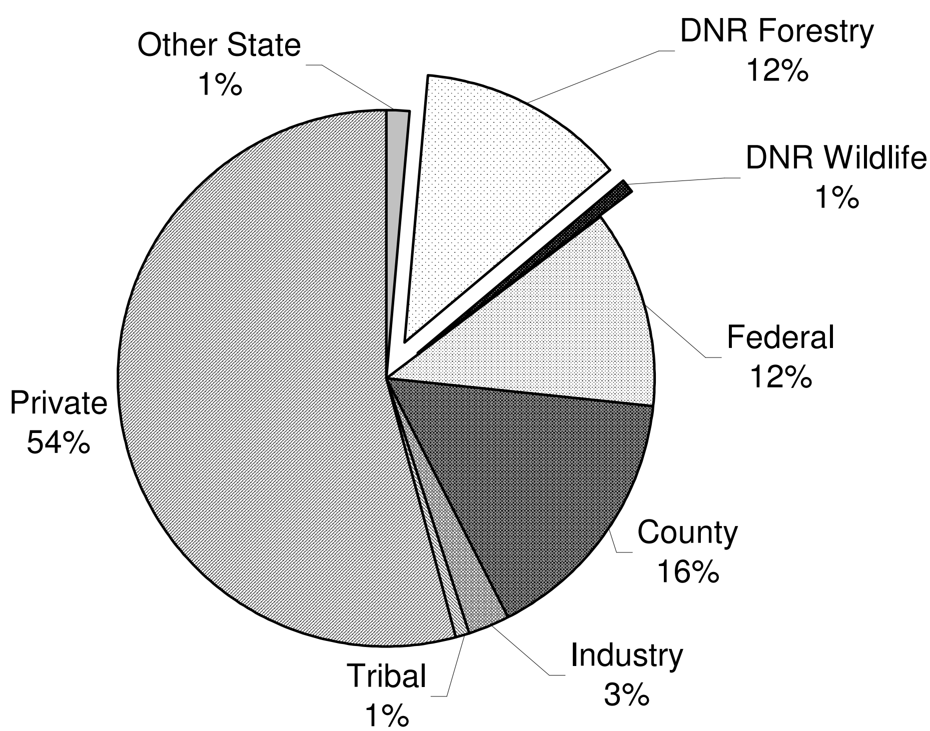


Brief Description of the Planning Area

This Subsection Forest Resource Management Plan (SFRMP) process considers state forest lands administered by the Department of Natural Resources (DNR), Divisions of Forestry and Fish and Wildlife in the *Chippewa Plains and Pine Moraines and Outwash Plains* subsection landscape units. These two units cover approximately 4.6 million acres in an area from near Deer River on the east to Detroit Lakes on the west, and from Camp Ripley on the south to Kelliher on the north. (See *Map i—cp and Map i—pm.*) For more detailed land descriptions, refer to chapters 1 through 3.

Recreation, forestry, and tourism are major uses of land in these two subsections. Public agencies administer 42 percent of the land with the state potion being 682,986 acres or 14 percent. Approximately 401,160 acres (9 percent) 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 include state parks and non-timberlands such as bogs and brush lands that will not be considered. In addition, the federal government owns 560,314 acres (12 percent) that are managed by the U.S. Forest Service as part of the Chippewa National Forest. Becker, Beltrami, Cass, Clearwater, Crow Wing, Hubbard, Itasca, Koochiching, and Wadena counties own and manage 732,079 acres (16 percent). Private owners control 2,526,459 acres (58 percent). Of that, industry owns 3 percent and tribal governments own 1 percent. For more details about land ownership, refer to Chapter 2.

Chart i
Land Ownership
Chippewa Plains/Pine Moraines and Outwash Plains
4,656,749 Acres



See Maps 2.1 cp and 2.1 pm—Land Ownership in the Chippewa Plains/Pine Moraines and Outwash Plains Subsections

Based on the recent Gap Analysis Program (GAP) classification completed by the DNR Division of Forestry using satellite imagery of all lands in the subsection, 52 percent of the land area (nonwater) is covered by forest. Aspen and birch cover types comprise 54 percent of this forest. Sixteen percent of the subsection land area is cropland. Based on the DNR forest inventory of state lands in the subsections, 34 percent of state timberlands is comprised of the aspen, birch, and balm of Gilead cover types. Twenty percent of state lands are nonforested lowlands. For details about cover types, refer to Chapter 3.

In most cases, assessment information is provided for the two 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- to10-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 and Fish and Wildlife. 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 subsection 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 and Fish and Wildlife, as well as the section of Ecological Services 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 Chippewa Plains and the Pine Moraines and Outwash Plains subsections, the goals, strategies, and coordination efforts of the Minnesota Forest Resources Council (MFRC) Northeast Landscape Committee 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 Services 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 seven-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 North Central Regional Landscape encompasses much of the Chippewa Plains and Pine Moraines/Outwash Plains subsections. Recommended “desired outcomes, goals, and strategies” for the North Central Regional Landscape were completed in March 2003. 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 Services	●●●○○	●●●●●	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 Services	●●○○○	●●●○○	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 Services	●●●○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use
MCBS H/O Biodiversity	Eco Services	●●○○○	●●●○○	Consider if site conditions differ from FIM
ECS Field Guide Interps.	Eco Services/Forestry	●●●○○	●●○○○	Field appraiser w/ documentation
MCBS Rare NPC	Eco Services	●●○○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use
Red-Shouldered Hawk	Eco Services	●○○○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use
Four-toed Salamander	Eco Services	●○○○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use
Black-throated Blue warblers	Eco Services	●○○○○	●●○○○	Document use
Seasonal ponds	Eco Services	●○○○○	●●○○○	Document use
Boreal owl guidelines	Eco Services	●○○○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use
Botrychium guidelines	Eco Services	●○○○○	●●○○○	Known locations: Area - Interdisciplinary Otherwise, document use

Figure i (continued)

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.

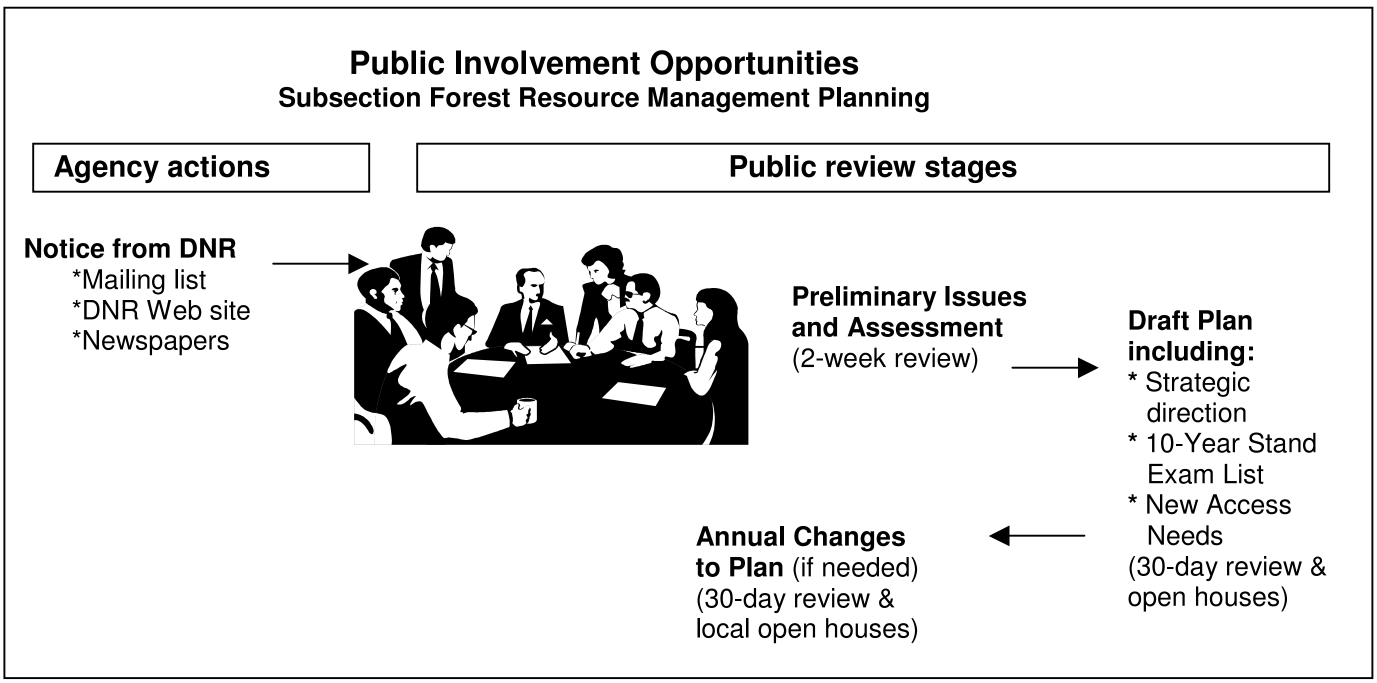
4. Minnesota Forest Resource Council's (MFRC) Voluntary Site-level Forest Management Guidelines

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.). The DNR forestry/wildlife/ecological services 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.
- Public open houses and a comment period to review the draft plan and strategic direction (i.e., general direction, forest management strategies, and 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/chippewaplains/index.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., Trails and Waterways, Parks, etc.), making this a department-wide plan that is not limited to Forestry and Wildlife land.

SFRMP Process Table

The Chippewa Plains/Pine Moraines and Outwash Plains 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	Intended Length of Step†
I. Prepare to begin the planning process • Assemble initial assessment information and data sets. • Designate team and facilitator, and conduct team training.	• Develop mailing list of public/ stakeholders. • Establish Web site for subsection.	n/a	Complete before official start of process
II. Prepare Assessment information and identify issues ***(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. • Receive and consider public input.	2 weeks	300 days (10 mos.)
III. Develop strategies to address issues, desired future forest composition (DFFC), and stand-selection criteria	• Mail summary to mailing list. • Provide complete maps and documents in key locations and on Web/CD. • Hold open houses in subsection and Twin Cities Metro area. • Receive and consider public input.	30 days (Provide 30-day notice of open houses)	120 days (4 mos.)
IV. Draft stand examination list and road access needs			60 days (2 mos.)
V. Finalize plan • Planners summarize public comments and DNR responses. • Present revised plan to department for commissioner's approval. • Commissioner approves final plan.	• Inform public of final plan. • Provide summary of public comments and how DNR responded. • Provide final plans in key locations and on Web/CD. • Mail plan summaries to mailing list.	None	90 days (3 mos.)
Total			**570 days (19 mos.)**

† 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 issue be addressed by vegetation management 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 Chippewa Plains/Pine Moraines and Outwash Plains (CP/PMOP) 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 two 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 CP/PMOP 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: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html . It is available upon request from the northwest regional forest planner:

Northwest Region Forestry Planner
DNR Forestry
6603 Bemidji Avenue N
Bemidji, MN 56601
Phone: (218) 755-2895
Email: CP-PMOP@dnr.mn.state.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?
Both 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?

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C H A P T E R 1

Land Use and Cover

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

1.1 … Land Use and Cover
Charts 1.1 cppm
Maps 1.1 cppm

1.2 … Wetlands Inventory
Charts 1.2 cppm
Maps 1.2 cppm

1.3 … GAP Analysis
Tables 1.3 cppm,cp,pm
Maps 1.3 cppm,cp,pm

How graphics are labeled:

Graphics (i.e., Tables, Charts, and Maps) referring to both subsections combined (Chippewa Plains/Pine Moraines and Outwash Plains) are indicated by a "cppm" after the chart designation (e.g., *Table 1.2 cppm*).

Graphics referring to the Chippewa Plains Subsection *only* are indicated by a "cp" after each chart designation (e.g., *Chart 1.1 cp*).

Graphics referring to the Pine Moraines and Outwash Plains Subsection *only* are indicated by a "pm" after each chart designation (e.g., *Map 1.3 pm*).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: *www.dnr.state.mn.us/forestry /subsection/chippewaplains/index.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. These maps can be easily recognized by "squared off" areas along the eastern boundary.

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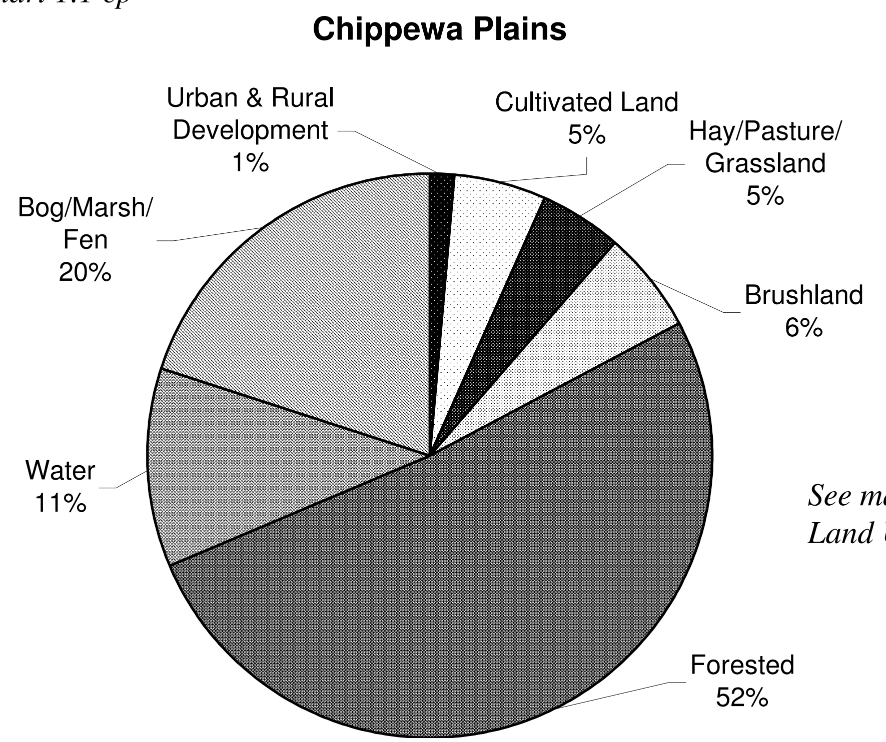
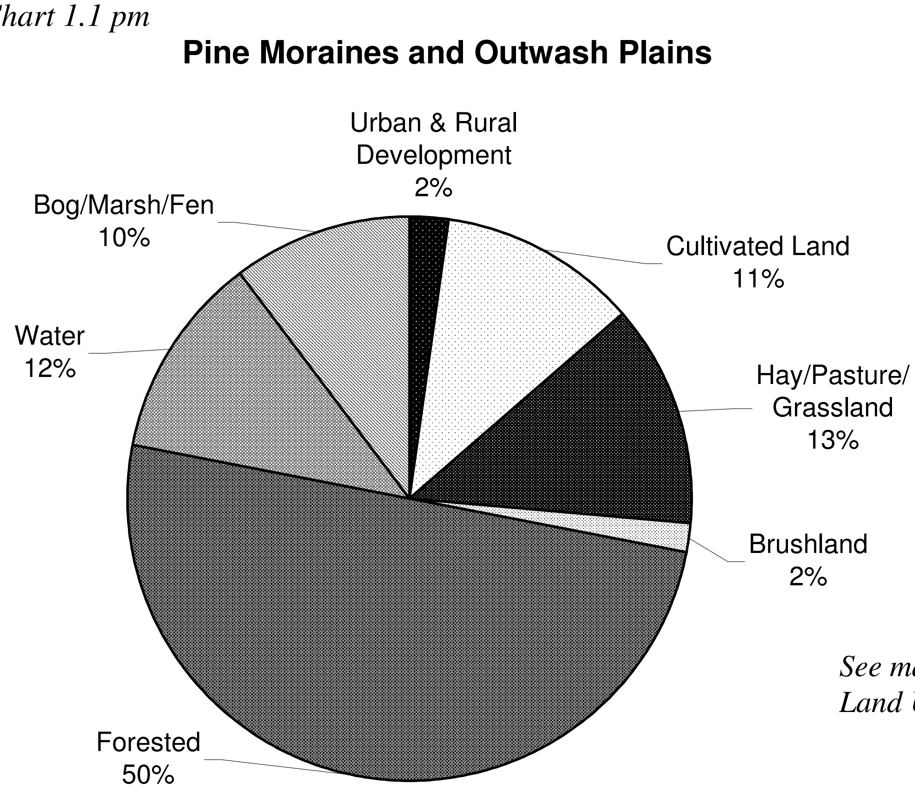
1.1 Land Use and Cover

Chart 1.1 cp



See map 1.1a – Land Use and Cover

Chart 1.1 pm



See map 1.1 b – Land Use and Cover

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.

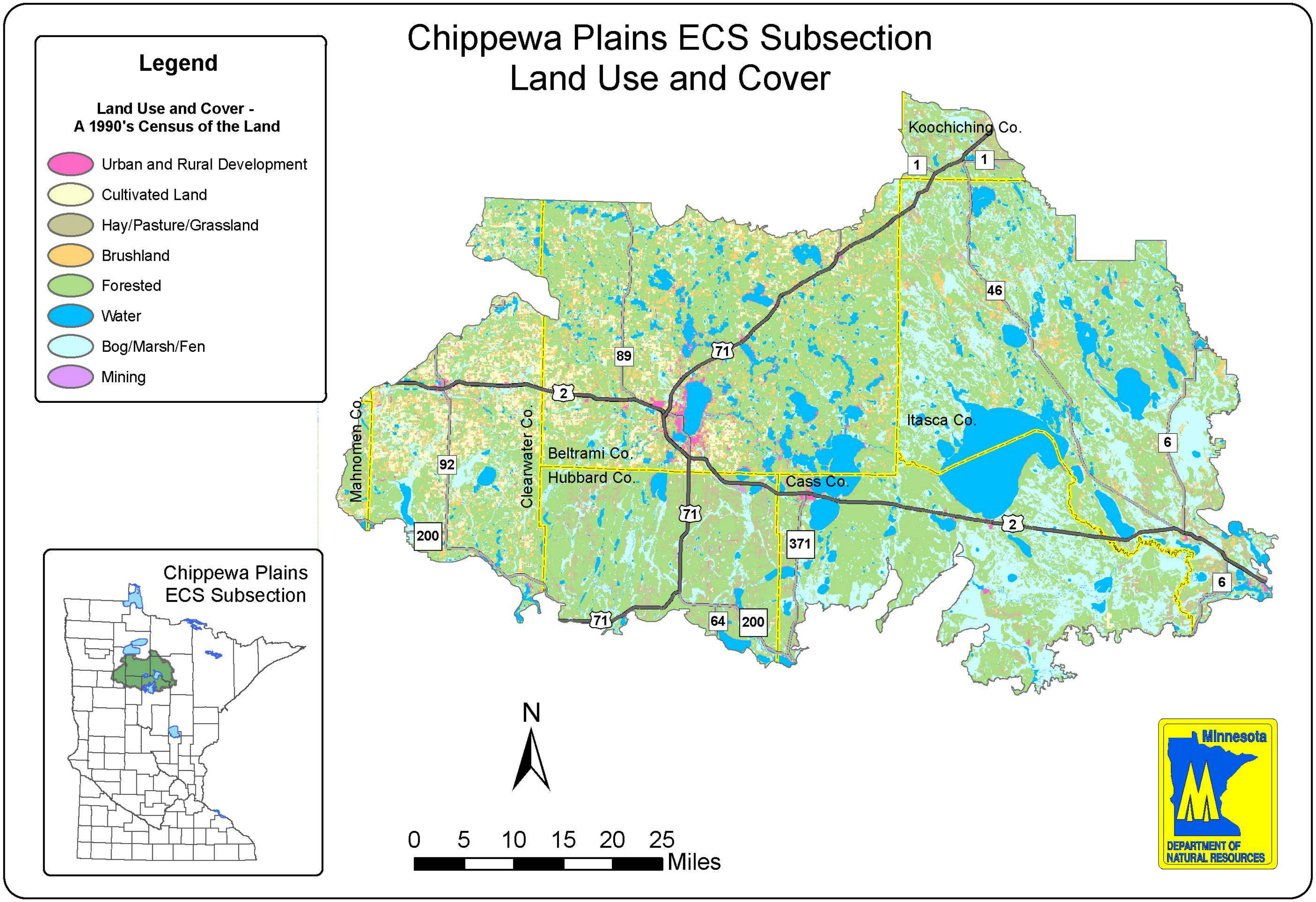
Mining: Areas stripped of topsoil revealing exposed substrate such as sand/gravel. Included are gravel quarry operations, mine tailings, borrow pits, rock quarries, and natural beaches/sand dunes.

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: www.iic.state.mn.us.*

Color maps found in this document may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry /subsection/chippewaplains/index.html

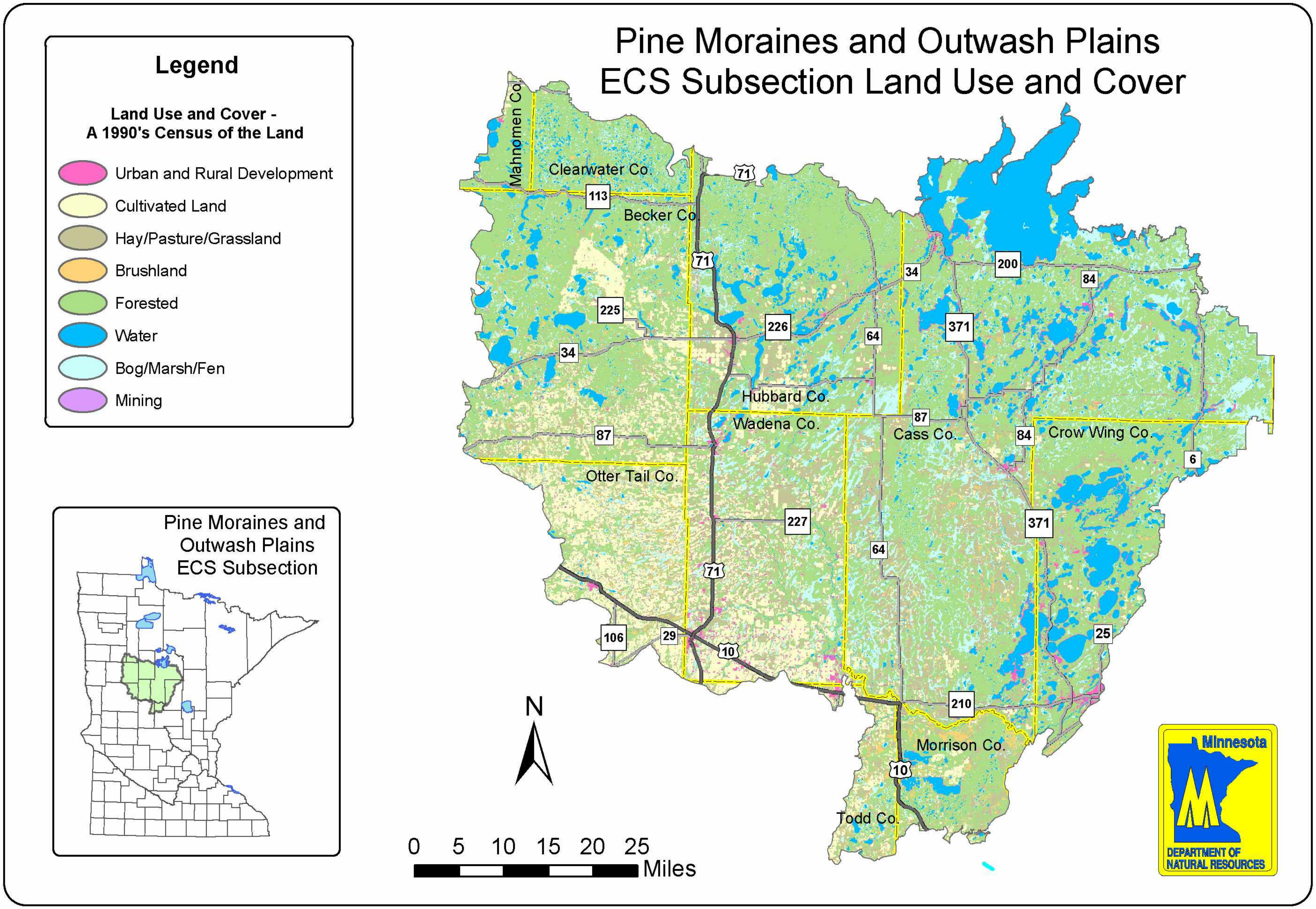
Map 1.1cp

Land Use and Cover—Chippewa Plains



Map 1.1 pm

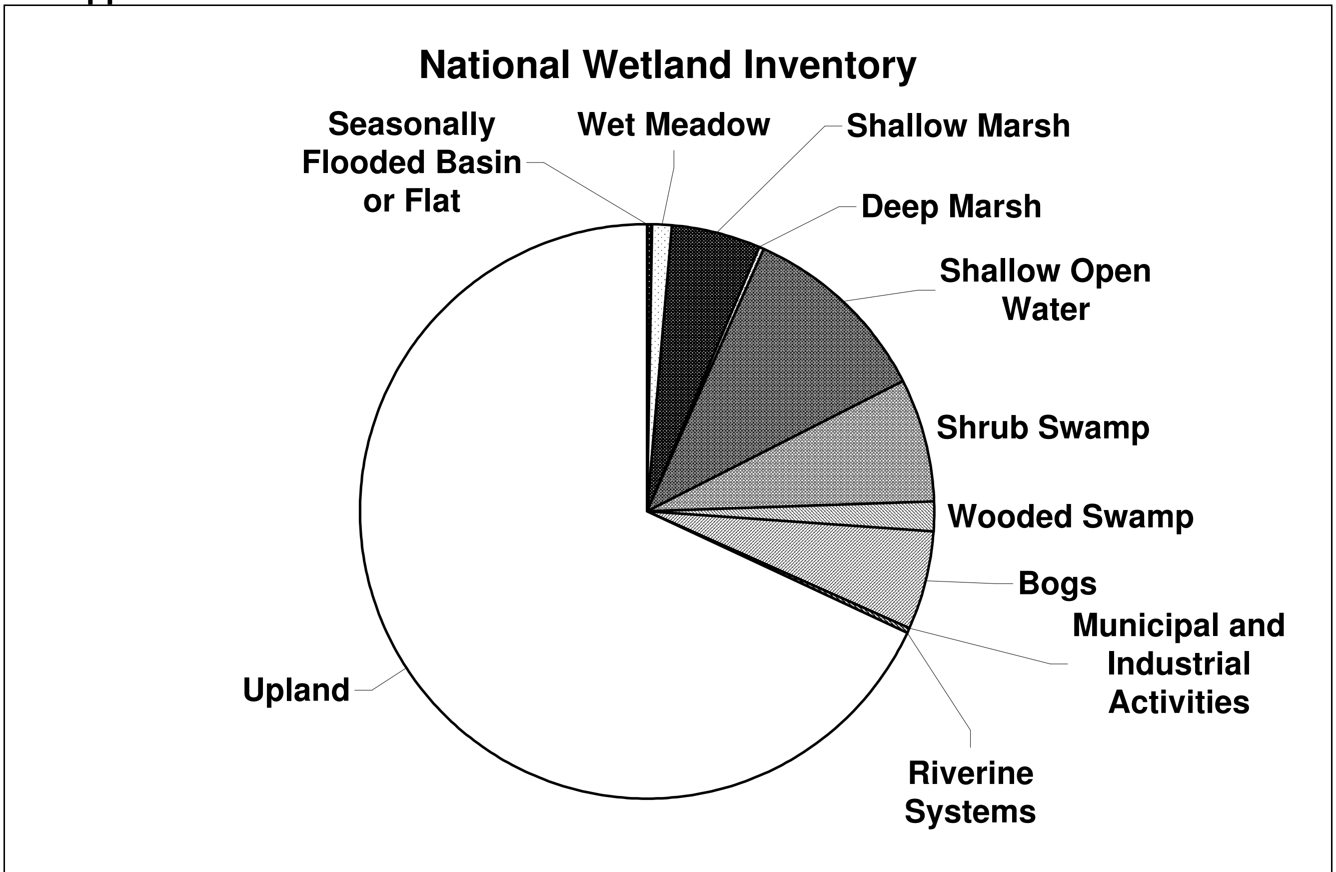
Land Use and Cover—Pine Moraines and Outwash Plains



1.2 National Wetlands Inventory

Chart 1.2 cppm

National Wetlands Inventory Classification
Chippewa Plains/Pine Moraines and Outwash Plains



See maps 1.2 cppm—1.2 pm, "Riparian Areas National Wetlands Inventory" and "Waterways for the Chippewa Plains/Pine Moraines and Outwash Plains Subsections

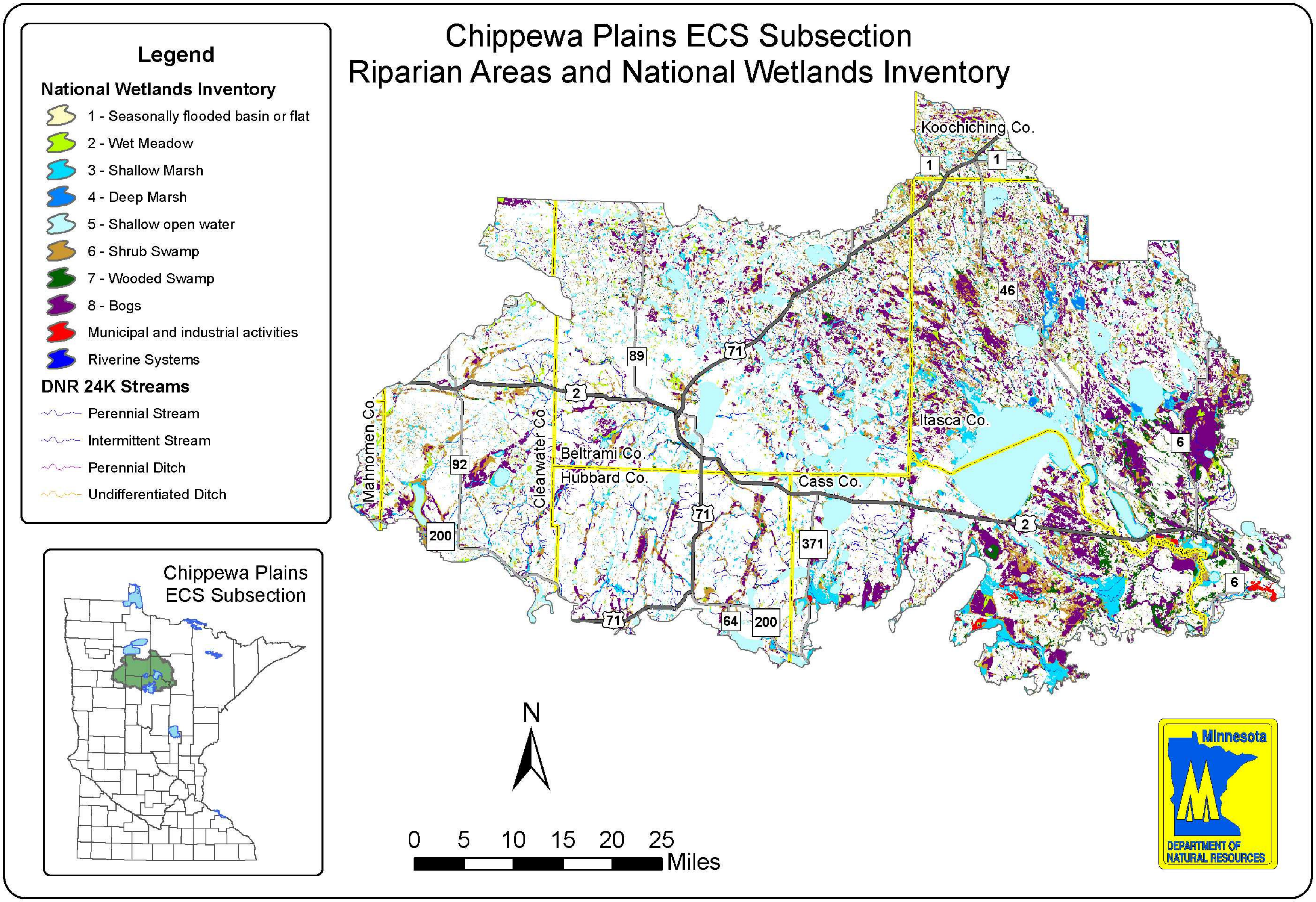
Table 1.2 cppm

National Wetlands Inventory-Chippewa Plains/Pine Moraines

Wetland Classification	Percent in subsection (percentage)
Seasonally flooded basin or flat	0.26
Shallow marsh	1.22
Deep marsh	4.86
Open water	0.39
Shrub swamp	10.63
Wet meadow	7.02
Wooded swamp	1.68
Bog	5.71
Municipal/Industrial	0.06
Riverine system	0.16
Uplands	68.00
TOTAL	100.00

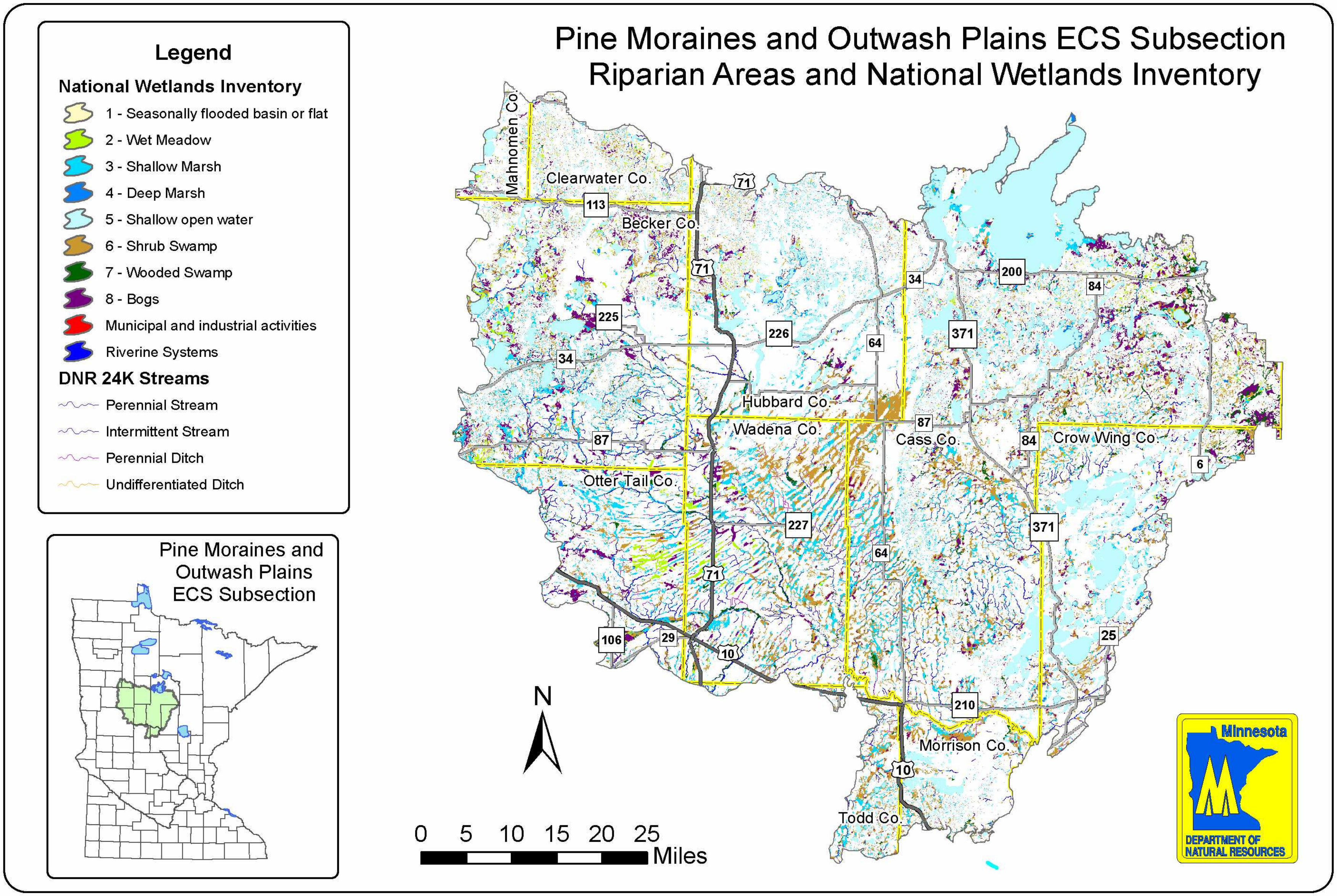
Map 1.2 cp

Riparian Areas and National Wetlands Inventory—Chippewa Plains



Map 1.2pm

Riparian Areas and National Wetlands Inventory—Pine Moraines and Outwash Plains



2.1 National Wetlands Inventory Classification Descriptions

How the classifications were developed:
The National Wetlands Inventory (NWI) program (sponsored by the U.S. Fish and Wildlife Service) mapped wetland area features. Base data was developed through interpreting National Aerial Photography Program (NAPP) imagery (approximately 1:50,000 scale, typically color-infrared) and limited field verification studies. Source aerial photography dates from 1979-1988. Twenty wetland classifications were developed for the wetland basins of the United States. Minnesota contains 10 classes, which are defined as follows:

Seasonally flooded basin or flat: Soils are covered with water or soils are waterlogged during variable seasonal periods but are usually well drained during much of the growing season. Vegetation (bottomland hardwoods to herbaceous plants) varies greatly according to season and duration of flooding.

Wet meadow: Soils usually lacking standing water during most of the growing season but waterlogged within at least a few inches of the surface. Wet meadows may fill shallow basins, sloughs, or farmland sags, or may border shallow marshes toward land. Vegetation includes grasses, sedges, rushes, and various broad-leaved plants. Other wetland plant community types include low prairies, sedge meadows, and calcareous fens.

Shallow marsh: Soils usually waterlogged during the early growing season and may be covered with six inches or more of water. Shallow marshes may nearly fill shallow lake basins or sloughs, or may border deep marshes towards land. Shallow marshes are common as seep areas on irrigated lands. Vegetation includes grass, bulrush, spikerush, and other marsh plants such as cattail, arrowhead, pickerelweed, and smartweed.

Deep marsh: Soils usually covered by six to 36 inches of water during the growing season. Deep marshes may completely fill shallow lake basins, potholes, and limestone sinks and sloughs, or they may border open water in such depressions. Vegetation includes cattail, reed, bulrush, spikerush, and wild rice. Open areas may contain pondweed, naiad, coontail, water milfoil, waterweed, duckweed, water lily, or spatterdock.

Open water: Areas of *shallow open water* (water less than 10 feet deep) and *deep-water habitats or lakes* (water six feet deep or more). Shallow open water like shallow ponds and reservoirs may be fringed by a border of emergent vegetation similar to open areas of deep marsh. Deepwater habitats or lakes lack aquatic surface vegetation.

Shrub swamp: Soils usually waterlogged during the growing season and often covered with as much as six inches of water. Shrub swamps occur mostly along slow-moving streams and occasionally on flood plains. Vegetation includes alder, willow, buttonbush, dogwood, and swamp-privet.

Wooded swamp: Soils waterlogged at least a few inches below the surface during the growing season and often covered with as much as one foot of water. Wooded swamps occur mostly along slow-moving streams, riverine oxbows, flat uplands, and in ancient lake basins. Forest vegetation includes tamarack, arborvitae, black spruce, balsam fir, red maple, and black ash. Deciduous wooded swamps frequently support beds of duckweed and smartweed. Wooded swamps may contain wetland plant community types common to lowland hardwood and coniferous swamps.

Bog: Soils usually waterlogged. Bogs occur mostly in ancient lake basins, on flat uplands, and along slow-moving streams. Vegetation is woody or herbaceous or both, usually growing on a spongy covering of mosses. Typical plants are heath shrub, sphagnum moss, and sedge. In northern Minnesota, leatherleaf, Labrador tea, cranberry, and cottongrass are often present. Scattered and often stunted black spruce and tamarack may occur.

Areas of municipal and industrial activities: Areas that are used for municipal and industrial activities.

Riverine system: Wetlands and deepwater habitats contained within natural and artificial river channels. Riverine systems contain periodically or continuously flowing water. Upland islands or palustrine (marshy) wetlands may occur in the channel, but they are not part of the riverine system.

Uplands: Non-wetland areas.

Sources

1. *Wetland Types and Definitions in Minnesota*, Minnesota Department of Natural Resources, Division of Waters
2. *Minnesota Wetlands and Surface Water Resources*, Minnesota Department of Natural Resources, Division of Waters

Detailed metadata can be found at the Interagency Information Cooperative's Web site at www.iic.state.mn.us. Posters of Minnesota wetlands are available by calling the Minnesota Department of Natural Resources Information Center at 651-296-6157 or toll free at 1-888-646-6367.

1.3 GAP Classification of the Chippewa Plains/Pine Moraines and Outwash Plains 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 pages include tables and maps of the GAP land-cover classification of the subsections in this plan.

Table 1.3 cppm

Gap Classification Table of the Chippewa Plains/Pine Moraines and Outwash Plains Subsections

Cover type	Acres	% All Classes	% Vegetated Classes	% Forested Classes
Aspen/White Birch	1,460,951	28	32	54
Balsam Fir mix	30,889	1	1	1
Barren	1,007	0	0	0
Black Ash	43,009	1	1	2
Broadleaf Sedge/Cattail	168,842	3	4	0
Bur/White Oak	47,266	1	1	2
Cropland	786,879	15	17	0
Floating Aquatic	16,151	0	0	0
Grassland	251,103	5	5	0
High Intensity Urban	9,178	0	0	0
Jack Pine	184,416	4	4	7
Jack Pine-Deciduous Mix	7,249	0	0	0
Low intensity urban	11,350	0	0	0
Lowland Black Spruce	82,826	2	2	3
Lowland Conifer-Deciduous Mix	40,726	1	1	2
Lowland Deciduous	64,133	1	1	2
Lowland Deciduous Shrub	326,240	6	7	0
Lowland Evergreen Shrub	7,300	0	0	0
Lowland Northern White Cedar	35,581	1	1	1
Maple/Basswood	88,936	2	2	3
Mixed Developed	71	0	0	0
Prairie	92	0	0	0
Red Oak	164,805	3	4	6
Red Pine	59,233	1	1	2
Red/White Pine	68,204	1	1	3
Red/White Pine-Deciduous Mix	5,906	0	0	0
Sedge Meadow	170,212	3	4	0
Spruce/Fir-Deciduous Mix	1,301	0	0	0
Stagnant Black Spruce	110	0	0	0
Stagnant Conifer	387	0	0	0
Stagnant Northern White Cedar	4	0	0	0
Stagnant Tamarack	3,655	0	0	0
Tamarack	58,609	1	1	2
Transportation	7,579	0	0	0
Upland Conifer	1,1936	0	0	0
Upland Deciduous	208,289	4	5	8
Upland Northern White Cedar	12,833	0	0	0
Upland Shrub	204790	4	4	0
Water	560,174	11	0	0
White Pine Mix	7,444	0	0	0
White Spruce	2,974	0	0	0
Total	**5,213,000**	99	99	98

See Map 1.3cppm GAP Classification of the Chippewa Plains/Pine Moraines and Outwash Plains

Percent (%) decimals rounded to nearest 1 percent.

Table 1.3 cp

Gap Classification Table of the Chippewa Plains

Cover Type	Acres	% All Classes	% Vegetated Classes	% Forested Classes
Aspen/White Birch	535,610	25	28	43
Balsam Fir Mix	24,970	1	1	2
Barren	35	0	0	0
Black Ash	8,001	0	0	1
Broadleaf Sedge/Cattail	95,828	4	5	0
Bur/White Oak	741	0	0	0
Cropland	304,681	14	16	0
Floating Aquatic	209	0	0	0
Grassland	6,955	0	0	0
High Intensity Urban	3,734	0	0	0
Jack Pine	56,581	3	3	5
Jack Pine-Deciduous Mix	7,027	0	0	1
Low Intensity Urban	4,888	0	0	0
Lowland Black Spruce	68,543	3	4	6
Lowland Conifer-Deciduous Mix	40,595	2	2	3
Lowland Deciduous	62,495	3	3	5
Lowland Deciduous Shrub	199,950	9	10	0
Lowland Evergreen Shrub	7,238	0	0	0
Lowland Northern White Cedar	30,699	1	2	2
Maple/Basswood	54,634	3	3	4
Mixed Developed	71	0	0	0
Red Oak	14,158	1	1	1
Red Pine	253	0	0	0
Red/White Pine	66,915	3	3	5
Red/White Pine-Deciduous Mix	5,568	0	0	0
Sedge Meadow	28,118	1	1	0
Spruce/Fir-Deciduous Mix	1,283	0	0	0
Stagnant Black Spruce	26	0	0	0
Stagnant Conifer	237	0	0	0
Stagnant Tamarack	32	0	0	0
Tamarack	25,847	1	1	2
Transportation	7,407	0	0	0
Upland Conifer	11,557	1	1	1
Upland Deciduous	203,824	9	11	17
Upland Northern White Cedar	12,613	1	1	1
Upland Shrub	54,199	3	3	0
Water	220,697	10	0	0
White Pine Mix	122	0	0	0
White Spruce	1,071	0	0	0
Total	**2,167,412**	98	99	99

See Map1.3cp GAP Classification of the Chippewa Plains

Percent (%) decimals rounded to the nearest 1 percent.

Table 1.3 pm

Gap Classification Table of the Pine Moraines and Outwash Plains

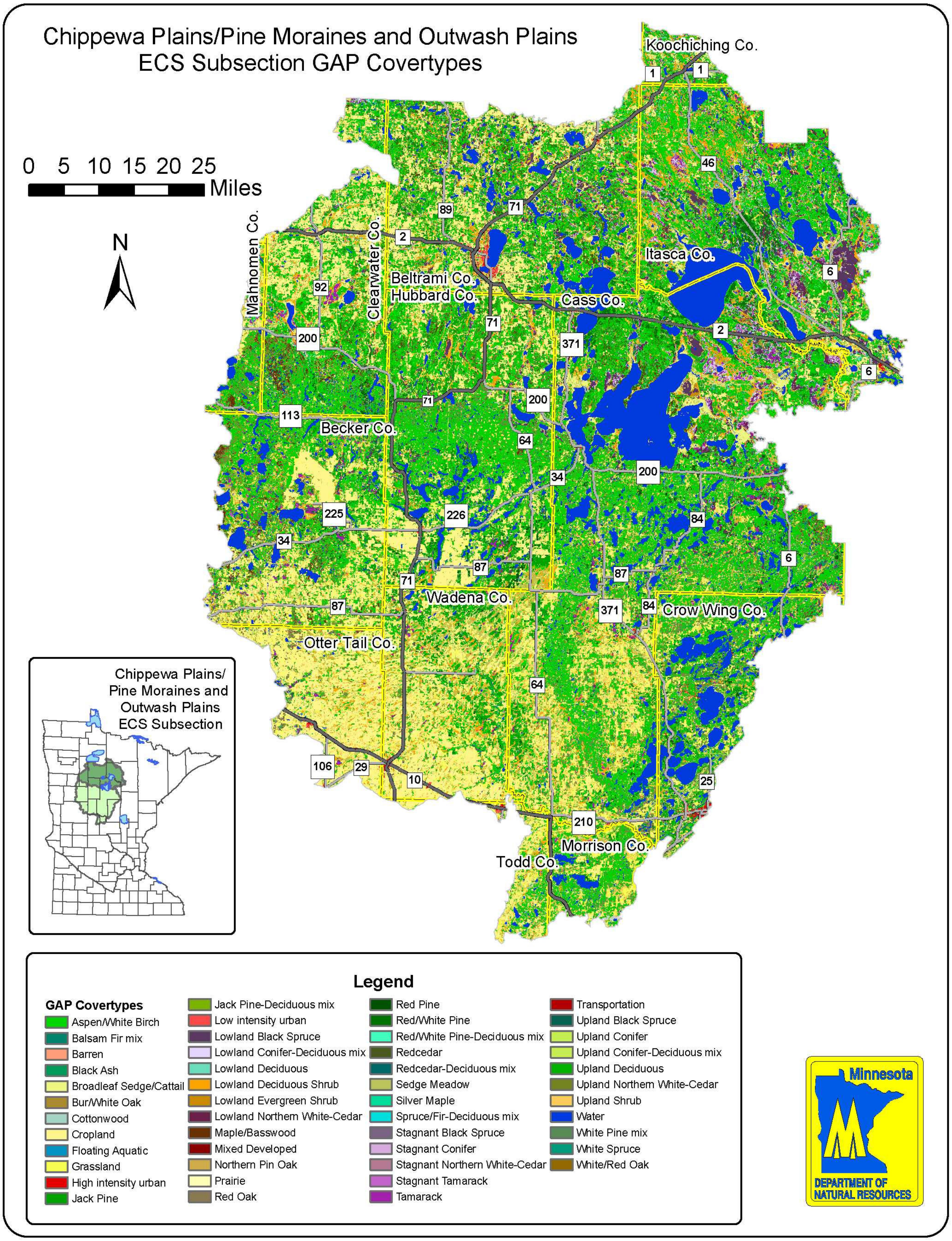
Cover Type	Acres	% All classes	% Vegetated Classes	% Forested Classes
Aspen/White Birch	925,341	30	35	63
Balsam Fir Mix	5,919	0	0	0
Barren	972	0	0	0
Black Ash	35,007	1	1	2
Broadleaf Sedge/Cattail	73,014	2	3	0
Bur/White Oak	46,525	2	2	3
Cropland	482,198	16	18	0
Floating Aquatic	15,941	1	0	0
Grassland	244,148	8	9	0
High Intensity Urban	5,444	0	0	0
Jack Pine	127,835	4	5	9
Jack Pine-Deciduous Mix	221	0	0	0
Low Intensity Urban	6,462	0	0	0
Lowland Black Spruce	14,284	0	1	1
Lowland Conifer-Deciduous Mix	132	0	0	0
Lowland Deciduous	1,638	0	0	0
Lowland Deciduous Shrub	126,290	4	5	0
Lowland Evergreen Shrub	62	0	0	0
Lowland Northern White Cedar	4,881	0	0	0
Maple/Basswood	34,302	1	1	2
Prairie	92	0	0	0
Red Oak	150,647	5	6	10
Red Pine	58,980	2	2	4
Red/White Pine	1,289	0	0	0
Red/White Pine-Deciduous Mix	338	0	0	0
Sedge Meadow	142,094	5	5	0
Spruce/Fir-Deciduous Mix	18	0	0	0
Stagnant Black Spruce	84	0	0	0
Stagnant Conifer	150	0	0	0
Stagnant Northern White Cedar	4	0	0	0
Stagnant Tamarack	3,623	0	0	0
Tamarack	32,761	1	1	2
Transportation	172	0	0	0
Upland Conifer	379	0	0	0
Upland Deciduous	4,465	0	0	0
Upland Northern White Cedar	220	0	0	0
Upland Shrub	150,591	5	6	0
Water	339,477	11	0	0
White Pine Mix	7,322	0	0	1
White Spruce	1,903	0	0	0
Total	**3,045,225**	98	100	97

See Map 1.3pm GAP Classification of the Pine Moraines and Outwash Plains

Percent (%) decimals rounded to the nearest 1 percent.

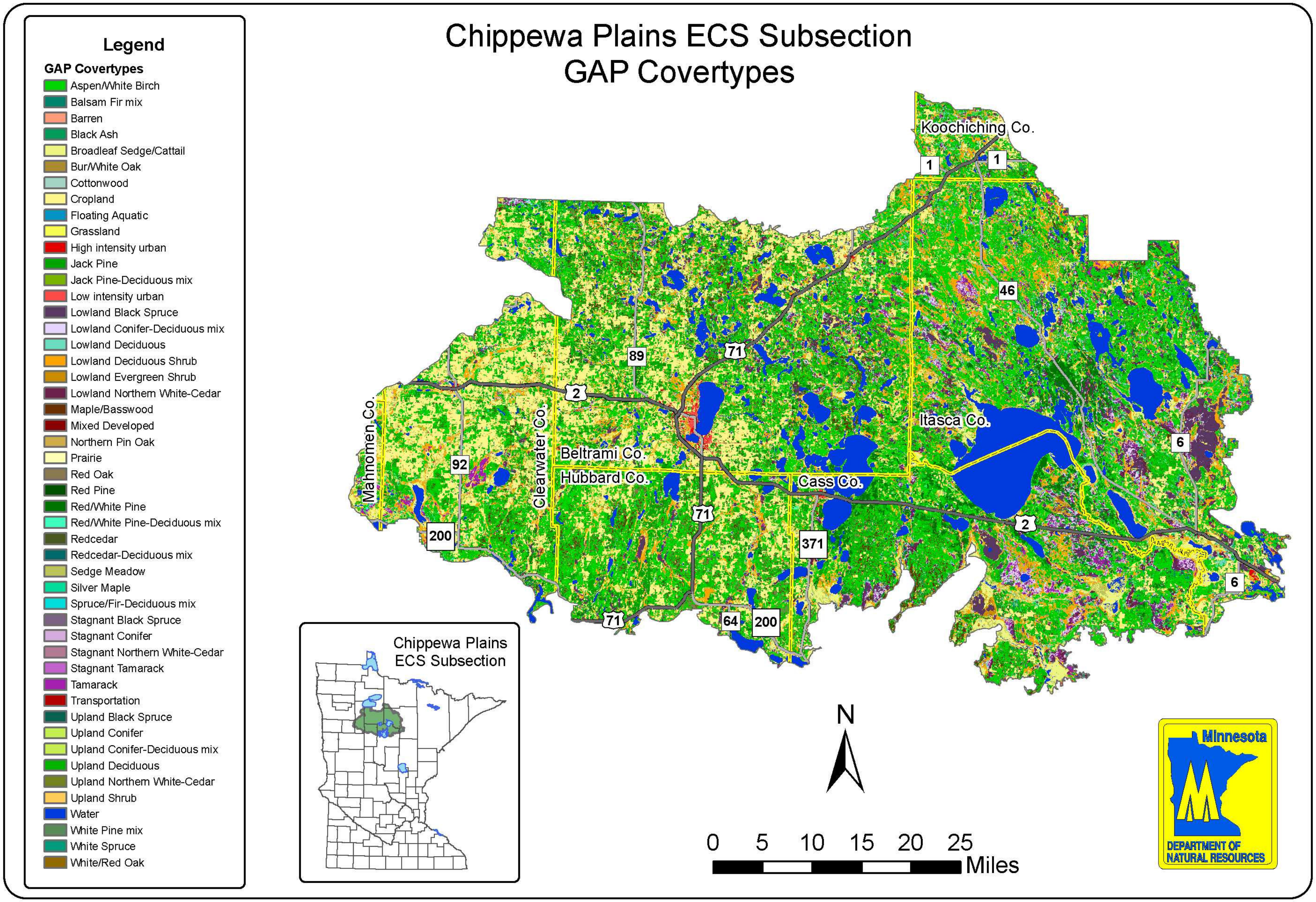
Map 1.3cppm

GAP Classification of the Chippewa Plains/Pine Moraines and Outwash Plains Subsections



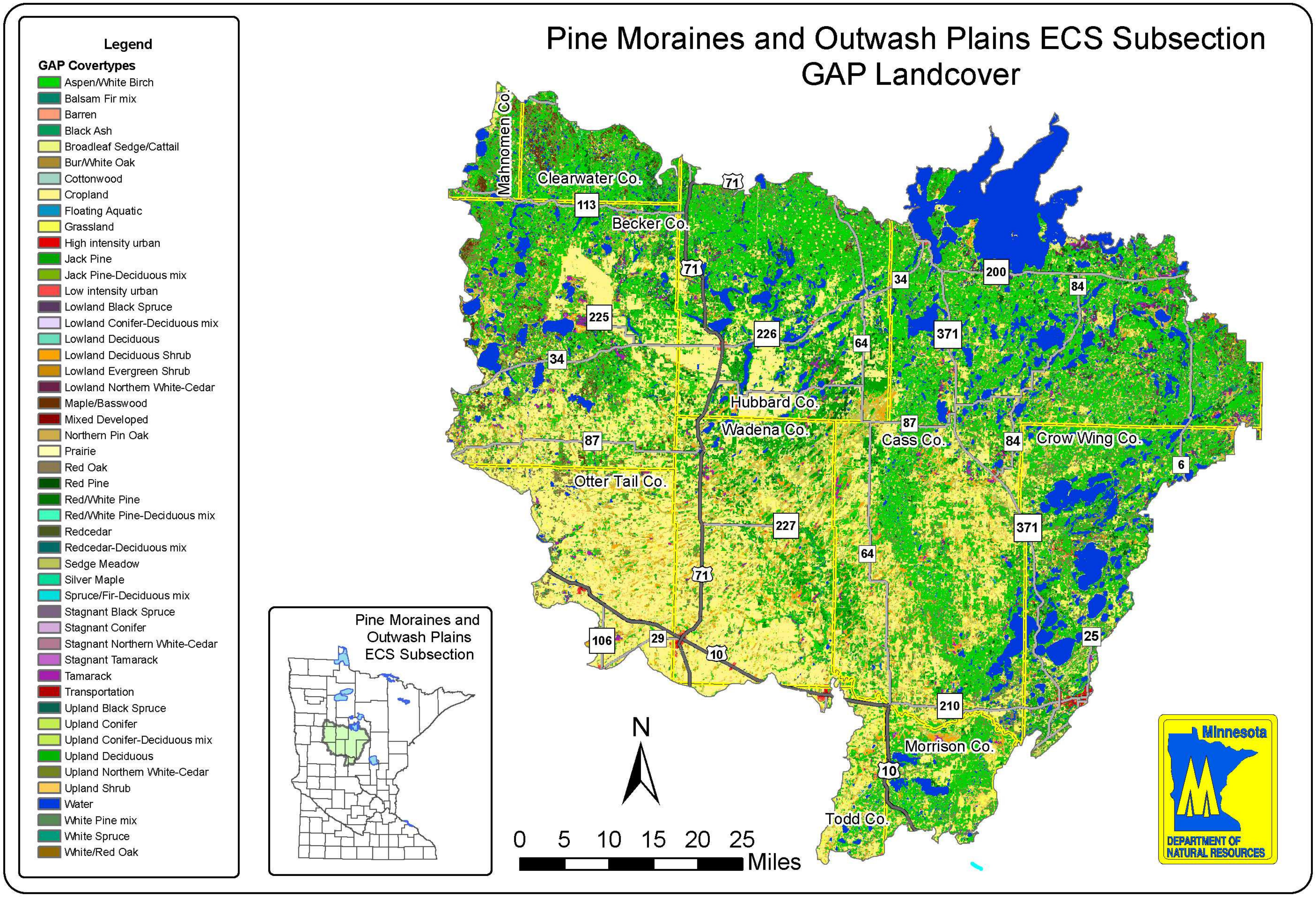
Map 1.3 cp

GAP Classification of the Chippewa Plains



Map 1.3 pm

GAP Classification of the Pine Moraines and Outwash Plains



Full-color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines - Subsection Forest Resource Management Plan (SFRMP) Web site at www.dnr.state.mn.us/forestry /subsection/chippewaplains/index.html.

CHAPTER 2

Land Ownership and Administration

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

2.1 … Land Ownership
Table 2.1 cppm
Charts 2.1 cppm, cp, pm
Maps 2.1 cp, pm

How graphics are labeled:

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Printed documents will be available for review at Area DNR offices within the planning area, public libraries, and on compact disk by request.

2.1 Land Ownership

Table 2.1 cppm

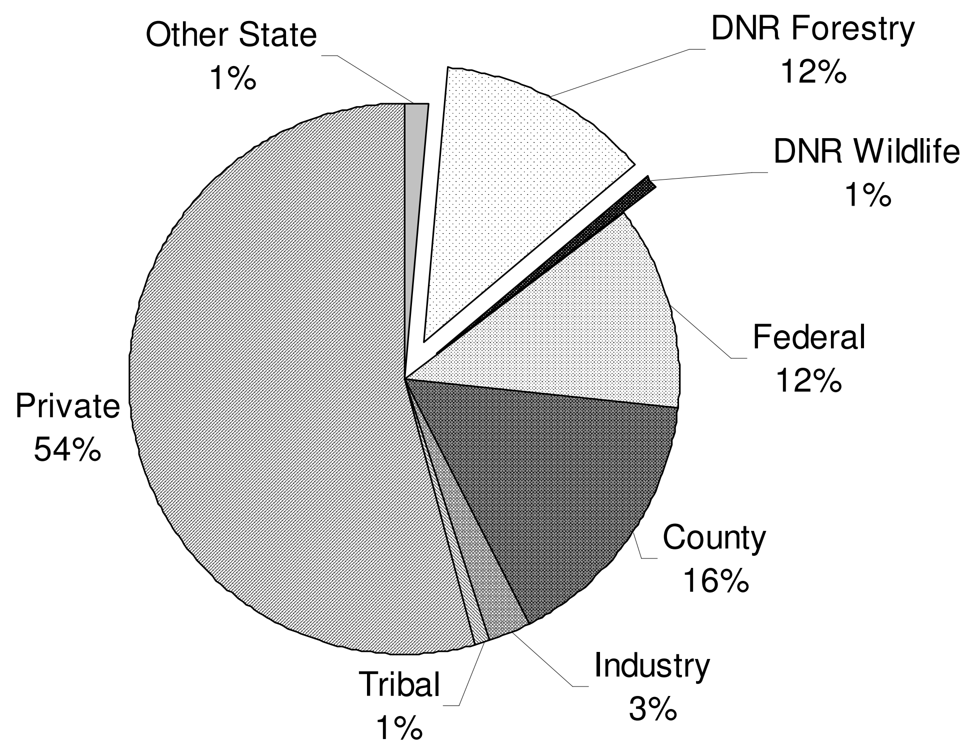
Land Ownership by Subsection (Acres)[1]

	Chippewa Plains	Pine Moraines and Outwash Plains	Two Subsections Total
Private	**854,295**	**1,672,164**	**2,526,459**
Federal	**427,607**	**132,707**	**560,314**
Tribal	**4,979**	**26,742**	**31,721**
State – All[2]	**340,001**	**342,985**	**682,986**
Forestry	314,265	264,546	578,811
Wildlife	6,031	30,238	36,269
Industry	**33,856**	**89,334**	**123,190**
County	**288,051**	**444,028**	**732,079**
Total	**1,948,789**	**2,707,960**	**4,656,749**

1 Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.
2 Includes all lands administered by units of DNR including Forestry, Wildlife, Fisheries, Parks, Trails and Waterways, and Ecological Services. SFRMP only covers Forestry- and Wildlife-administered lands.

Chart 2.1cppm

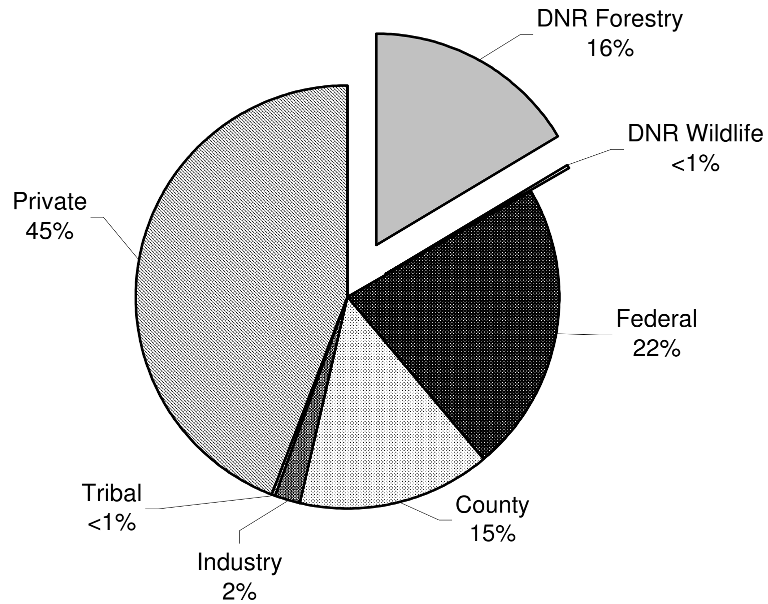
Land Ownership—Two Subsections Total
Chippewa Plains/Pine Moraines and Outwash Plains
4,656,749 Acres



Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.

Chart 2.1cp

Land Ownership in the Chippewa Plains Subsection
1,948,789 Acres

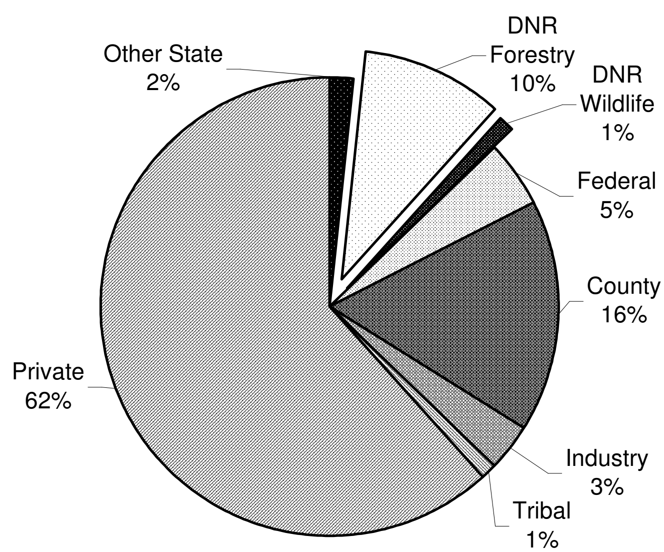


Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.

See Map 2.1cp—Land Ownership in the Chippewa Plains Subsection

Chart 2.1 pm

Land Ownership in the Pine Moraines and Outwash Plains Subsection
2,707,960 Acres

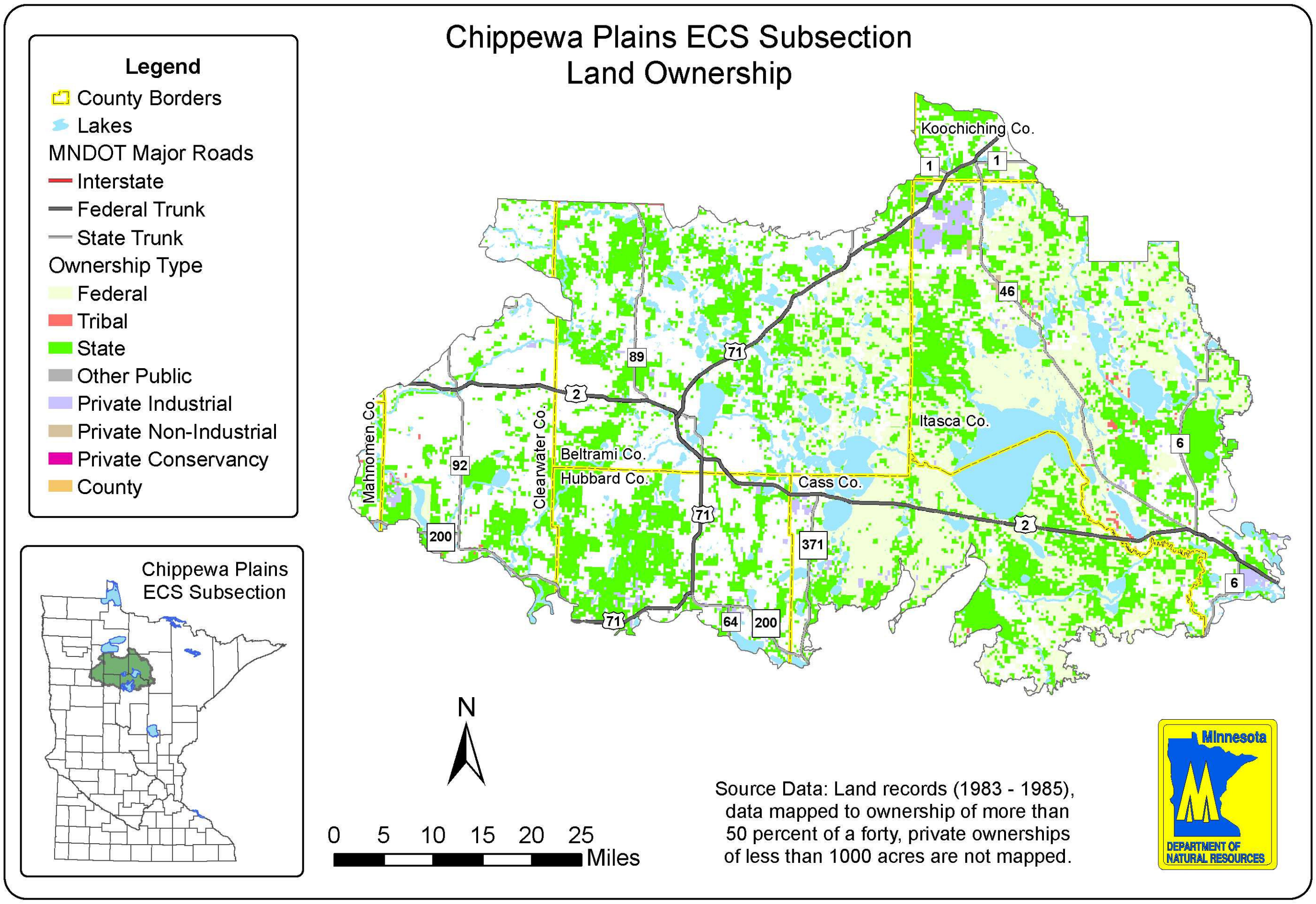


Source: 1976 to 1998 Minnesota DNR GAP Stewardship---"All Ownership Types" data.

See Map 2.1 pm—Land Ownership in Pine Moraines and Outwash Plains Subsection

Map 2.1cp

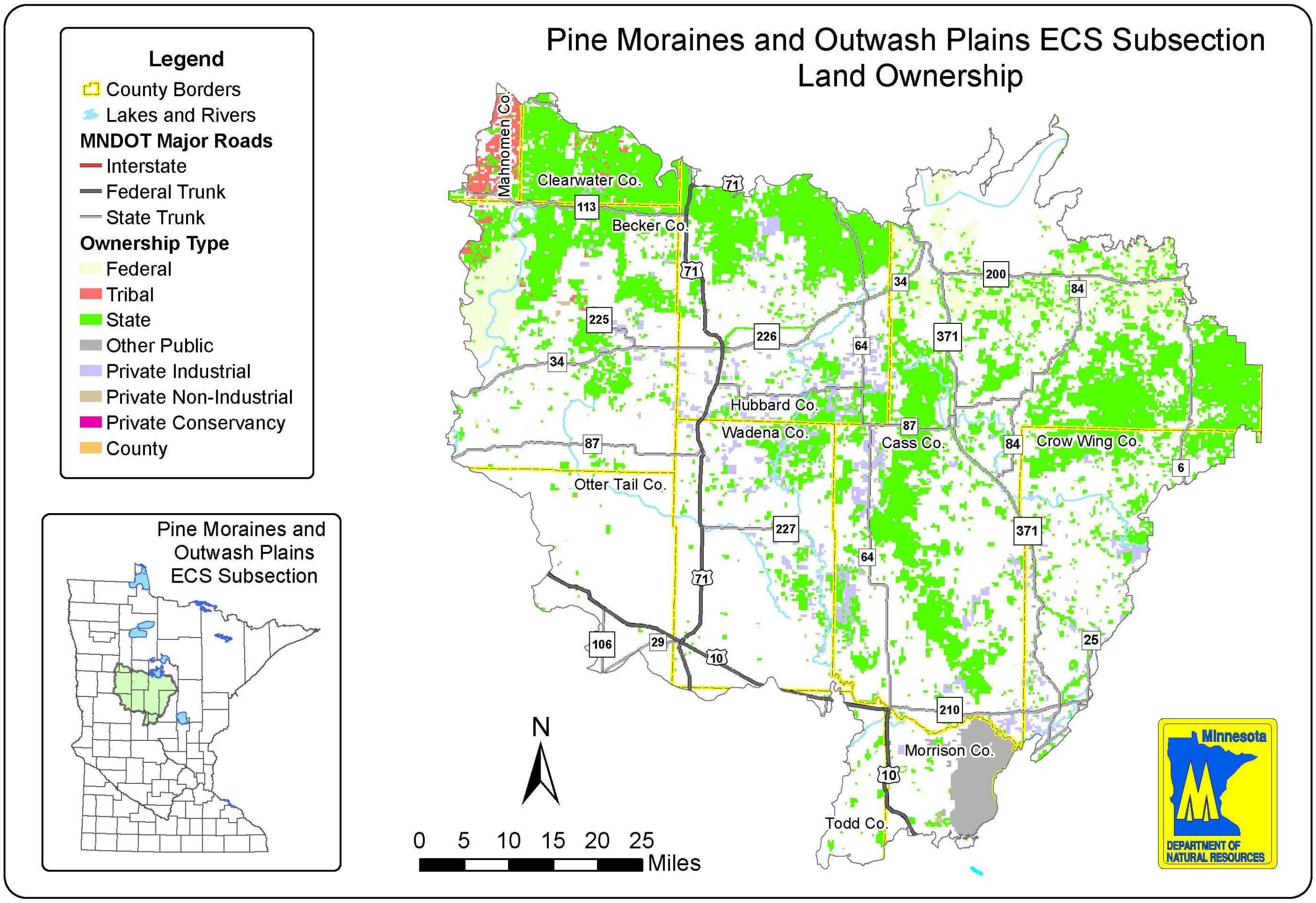
Land Ownership in the Chippewa Plains Subsection



Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Map 2.1pm

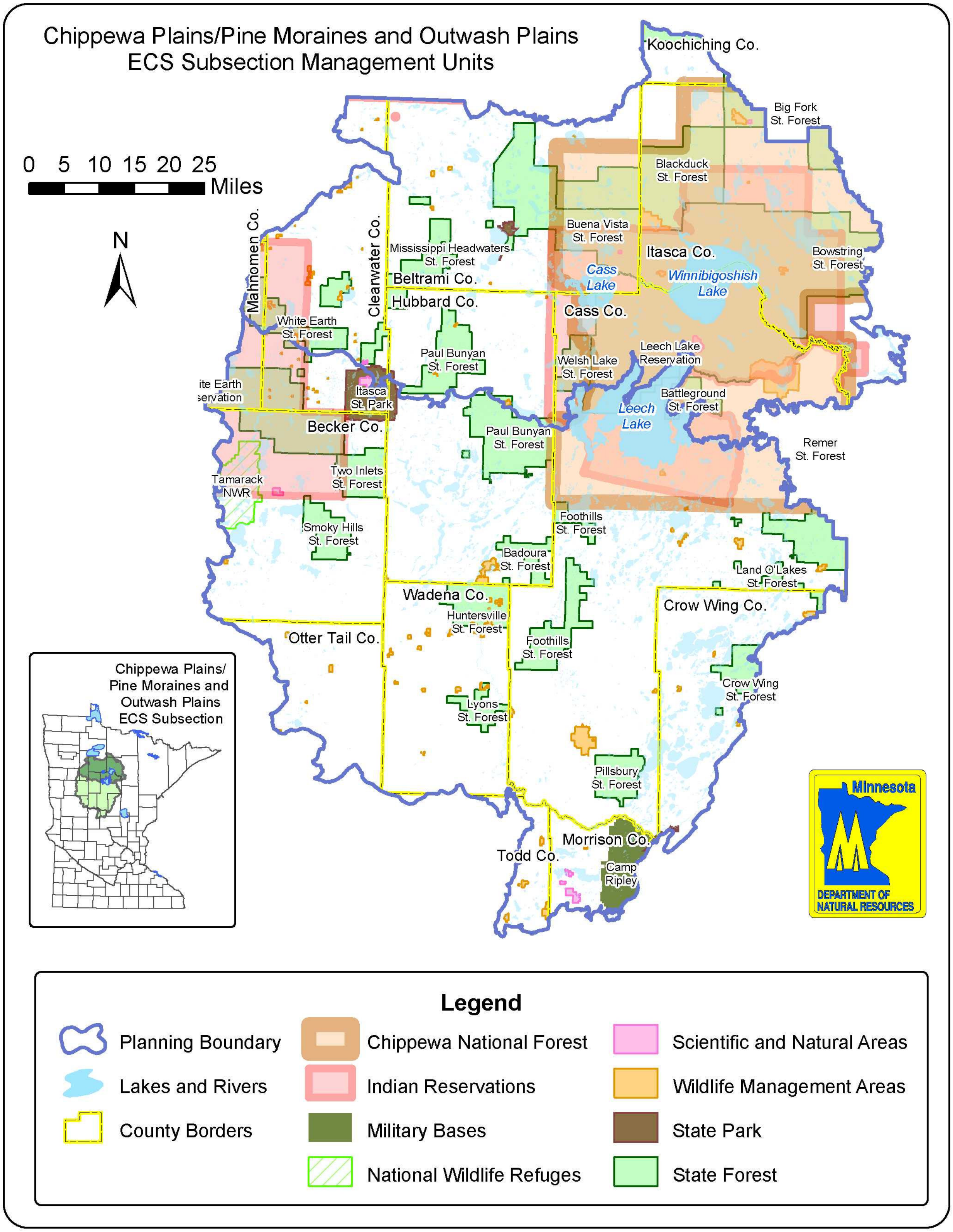
Land Ownership in the Pine Moraines and Outwash Plains Subsection



Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Map 2.2 cppm

Chippewa Plains/Pine Moraines and Outwash Plains Management Units



Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains - Subsection Forest Resource Management Plan (SFRMP) Web site at www.dnr.state.mn.us/forestry /subsection/chippewaplains/index.html.

C H A P T E R 3

Forest Composition and Structure

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

<u>Part 1</u>

3.1 … Forest Cover-Type Acres on State Land Administered by DNR Forestry and Wildlife—Chippewa Plains/Pine Moraines and Outwash Plains Subsections
Map 3.1

3.2 … Comparison of Timberland Acres and Cover-Type Age Classes Between 1989 and 2004—Chippewa Plains/Pine Moraines and Outwash Plains Subsections Combined
Table 3.2 cppm
Charts 3.2 cppm l—3.2 cppm 15

3.3 … Comparison of Timberland Acres and Cover-Type Age Classes Between 1989 and 2004—Chippewa Plains Subsection
Table 3.3 cp
Charts 3.3 cp 1—3.3 cp 15

3.4 … Comparison of Timberland Acres and Cover-Type Age Classes Between 1989 and 2004—Pine Moraines and Outwash Plains Subsection
Table 3.4 pm
Charts 3.4 pm 1—3.4 pm 15

<u>Part 2</u>

3.5 … Stand Origin
Tables 3.5 cppm—3.5 pm

3.6 … Old-Growth Forests
Tables 3.6 cppm—3.6 pm

3.7 … An Estimate of Historical Forest Composition Compared to Today's Forest
Maps 3.7 cp—3.7 pm *Table 3.7 cppm*
Maps 3.7 cppm—jp through 3.7 cppm—ash *Tables 3.7 cppm—jp through 3.7 cppm—ash*

How graphics are labeled:

Graphics (i.e., Tables, Charts, and Maps) referring to <u>both subsections combined</u> (Chippewa Plains/Pine Moraines and Outwash Plains) are indicated by a "cppm" after the chart designation (e.g., Table 3.2 cppm).

Graphics referring to the <u>Chippewa Plains Subsection</u> *only* are indicated by a "cp" after each chart designation (e.g., Chart 3.2 cp).

Graphics referring to the <u>Pine Moraines and Outwash Plains Subsection</u> *only* are indicated by a "pm" after each chart designation (e.g., Map 3.2 pm).

Notes relating to this chapter:
Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Charts and tables in this chapter that depict trend information (i.e., 1989–2004) are based on data within the subsection boundary. This is a departure from the graphics in other chapters, which are based on a planning boundary. This approach was necessitated by a change in the methods for managing forest inventory data that occurred during the period and would have made direct acreage comparisons unreliable.

Maps in this chapter depict information for an area delineated by 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. These maps can be easily recognized by "squared off" areas along the eastern boundary.

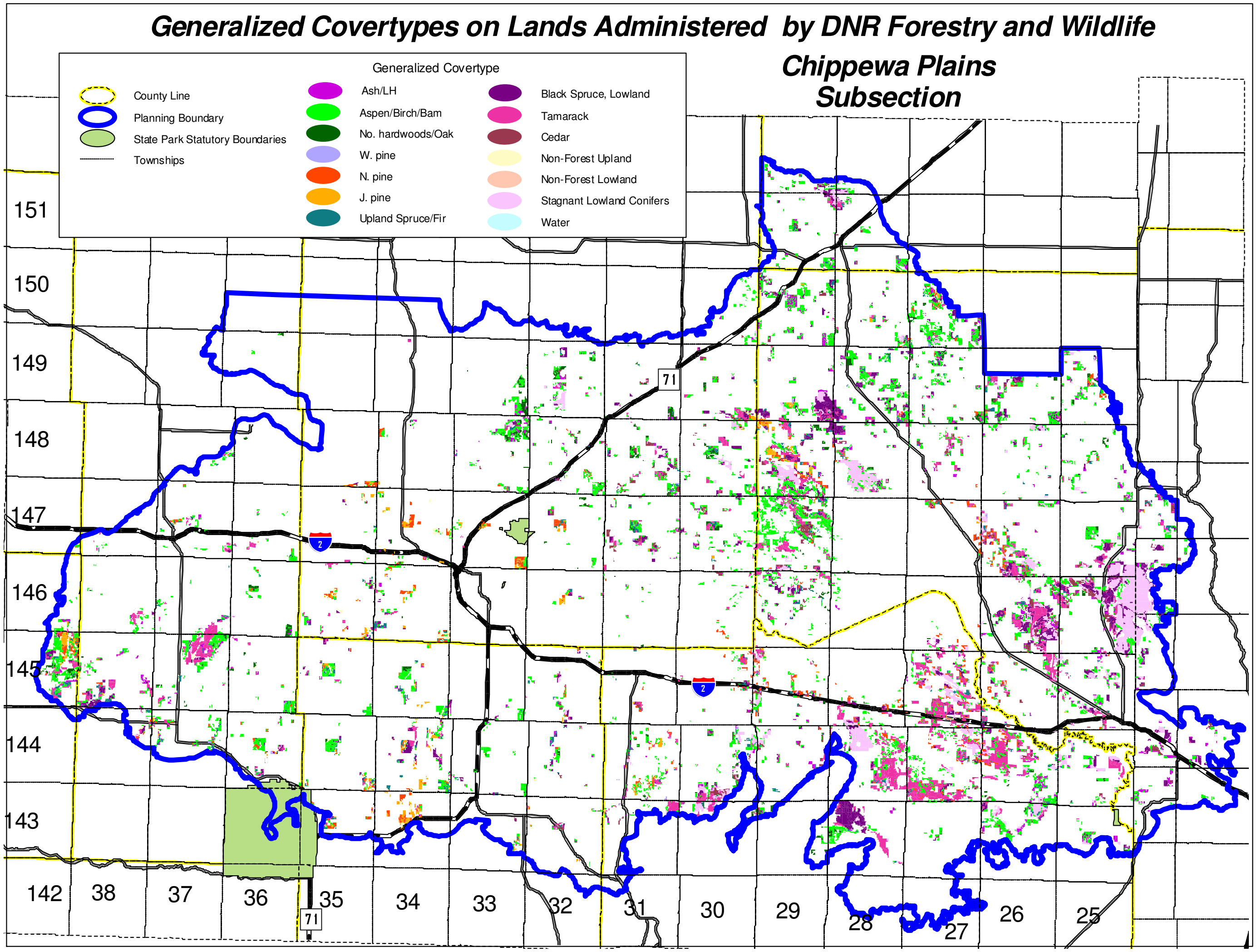
Most of the charts and tables in this chapter summarize acres of "timberland." Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix D: Glossary). Since old-growth stands were designated between 1989 and 2004, 4,427 acres of these stands (1.1 percent of total acreage) have been included in the 2004 data to more accurately depict the change over time and the current range of age classes on the landscape.

Printed documents will be available for review at Area DNR offices within the planning area, public libraries, and on compact disk by request.

Part 1

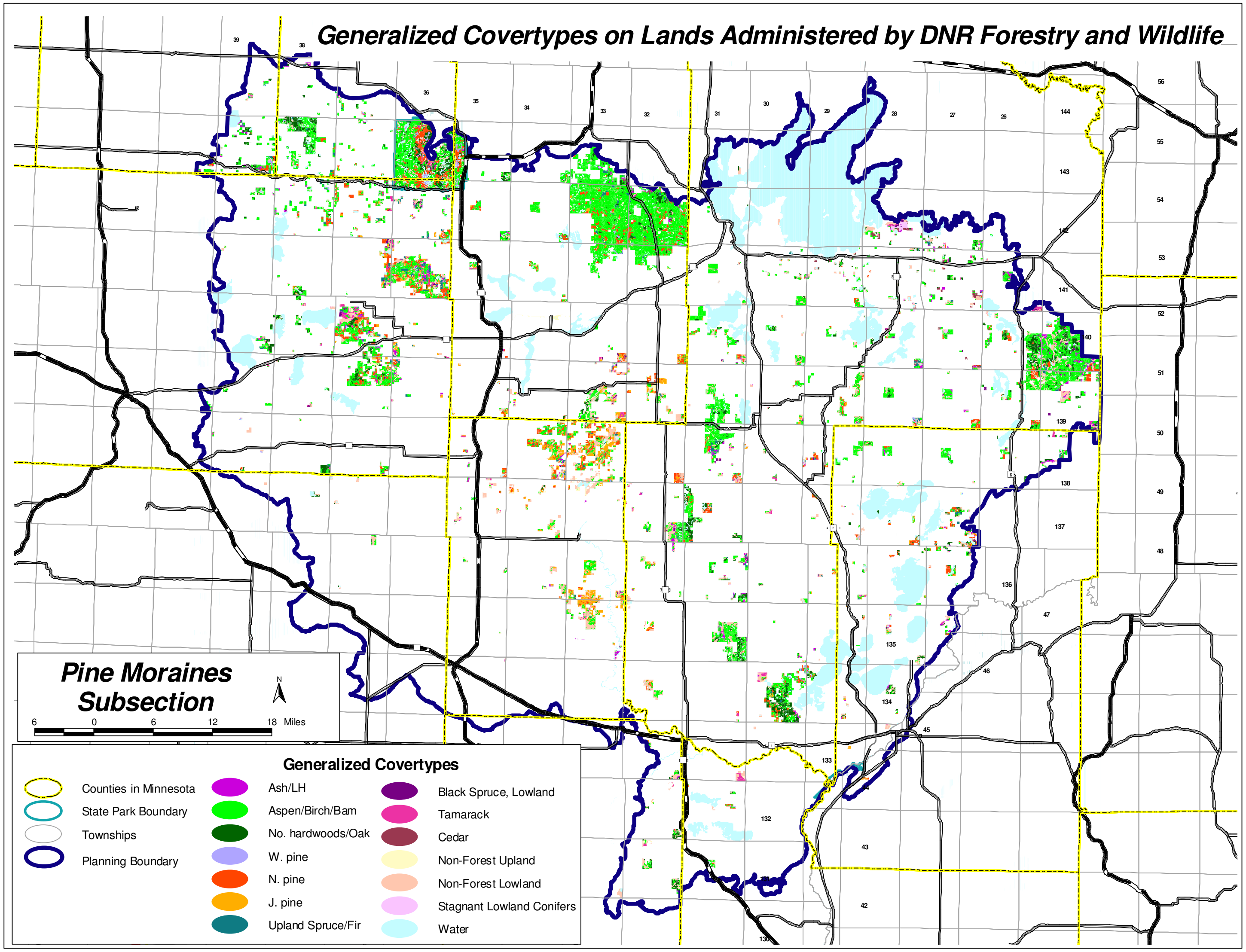
3.1 Forest Cover-Type Acres on State Land Administered by DNR Forestry and Wildlife

Map 3.1 cp



Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains–Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Map 3.1pm



Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains–Subsection Forest Resource Management Plan (SFRMP) Web site at: [*www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.*](http://www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html)

Table 3.1 cppm

Chippewa Plains/Pine Moraines and Outwash Plains State[1] Timberland[2] Cover-Type Acres by Age-Class (2004)

Cover Type	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121 +	TOTAL
Ash/Lowland Hdwds.	90	191	507	280	355	426	1,210	2,366	2,852	2,795	3,176	2,279	16,520
Aspen/Balm	36,419	47,127	28,309	14,755	6,413	11,867	19,624	15,803	4,514	45	39	321	181,231
Balsam Fir	213	232	819	1,232	1,261	1,032	1,367	1,529	420	333	57	0	8,494
Birch	236	177	176	177	342	1,210	3,906	3,197	1,671	616	225	170	12,102
Black Spruce Upland	0	66	28	0	0	0	12	0	0	0	0	0	106
Black Spruce Lowland	1,081	1,618	1,952	3,250	1,121	1,088	1,450	2,129	3,020	2,845	5,643	2,527	27,721
Cutover Area[3]	3,044	721	200	7	24	11	0	0	0	0	0	19	4,025
Jack Pine[4]	1,483	1,546	1,750	662	2,902	5,453	2,403	1,477	375	27	9	0	18,088
Northern White Cedar	4	90	119	85	203	76	213	390	959	1,796	4,644	3,909	12,487
Northern Hardwoods[5]	308	615	508	726	131	720	3,040	3,983	2,287	2,626	839	1,029	16,809
Red Pine	4,533	5,478	7,500	5,081	1,748	1,017	1,099	715	1,739	2,466	1,923	1,428	34,726
Oak	125	155	294	180	148	540	4,827	4,891	2,592	945	469	435	15,598
Tamarack	1,354	713	3,806	3,256	4,712	2,839	2,371	2,843	4,015	4,517	9,774	3,691	43,889
White Pine	572	86	38	106	215	185	844	51	113	75	254	144	2,683
White Spruce	664	2,035	1,966	1,028	480	146	278	60	5	9	13	0	6,681
Total	50,126	60,850	47,972	30,825	20,055	26,610	42,644	39,434	24,562	19,095	27,065	15,952	401,160

1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 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). However, 4,427 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually, the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.
4 Contains 13 acres of Scotch pine forest that will be planned and managed along with the jack pine type.
5 Contains six acres of Central Hardwoods forest that will be planned and managed along with the Northern Hardwoods type.

Table 3.1 cp

Chippewa Plains State[1] Timberland[2] Cover-Type Acres by Age-Class (2004)

Cover Type	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121 +	Total
Ash/Lowland Hardwoods	86	166	433	254	253	259	701	1,173	1,614	1,684	2,111	1,918	10,648
Aspen/Balm	10,012	18,707	12,715	7,006	2,789	4,260	6,970	3,332	714	22	16	21	66,562
Balsam Fir	210	216	633	853	737	321	812	1,015	362	222	41	0	5,422
Birch	197	124	113	158	211	348	1,010	1,156	1,028	536	225	31	5,136
Black Spruce Upland	0	0	17	0	0	0	12	0	0	0	0	0	28
Black Spruce Lowland	1,075	1,549	1,733	3,154	809	885	1,284	1,975	2,818	2,482	5,342	2,474	25,578
Cutover Area[3]	2,151	597	200	7	24	3	0	0	0	0	0	19	3,000
Jack Pine	853	499	645	266	599	821	1,116	821	69	0	0	0	5,689
Northern White Cedar	4	90	119	42	203	76	184	342	626	1,429	4,419	3,266	10,800
Northern Hardwoods	52	34	91	32	60	344	1,208	1,834	1,152	1,076	502	725	7,108
Red Pine	1,163	2,190	2,285	1,170	742	278	683	216	400	602	862	494	11,084
Oak	28	8	49	31	35	44	176	317	93	123	86	56	1,045
Tamarack	1,293	663	3,580	2,810	4,284	2,343	1,987	2,243	3,319	4,013	8,425	3,365	38,324
White Pine	212	4	8	6	25	3	57	15	13	42	134	45	565
White Spruce	350	996	1,168	233	120	17	213	48	5	9	13	0	3,171
Total	**17,686**	**25,843**	**23,789**	**16,022**	**10,891**	**10,002**	**16,413**	**14,487**	**12,213**	**12,240**	**22,176**	**12,414**	**194,160**

1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 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). However, 2,160 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually, the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.

Table 3.1 pm

Pine Moraines and Outwash Plains State[1] Timberland[2] Cover-Type Acres by Age-Class (2004)

Cover Type	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121 +	Total
Ash/Lowland Hardwoods	4	25	74	26	102	167	509	1,193	1,238	1,111	1,065	361	**5872**
Aspen/Balm	26,407	28,420	15,594	7,749	3,624	7,607	12,654	12,471	3,800	23	23	300	**114669**
Balsam Fir	3	16	186	379	524	711	555	514	58	111	16	0	**3,072**
Birch	39	53	63	19	131	862	2,896	2,041	643	80	0	139	**6,966**
Black Spruce Upland	0	66	11	0	0	0	0	0	0	0	0	0	**78**
Black Spruce Lowland	6	69	219	96	312	203	166	154	202	363	301	53	**2,143**
Cutover Area[3]	893	124	0	0	0	8	0	0	0	0	0	0	**1,025**
Jack Pine[4]	630	1,047	1,105	396	2,303	4,632	1,287	656	306	27	9	0	**12,399**
Northern White Cedar	0	0	0	43	0	0	29	48	333	367	225	643	**1,687**
Northern Hardwoods[5]	256	581	417	694	71	376	1,832	2,149	1,135	1,550	337	304	**9,701**
Red Pine	3,370	3,288	5,215	3,911	1,006	739	416	499	1,339	1,864	1,061	934	**23,642**
Oak	97	147	245	149	113	496	4,651	4,574	2,499	822	383	379	**14,553**
Tamarack	61	50	226	446	428	496	384	600	696	504	1,349	326	**5,565**
White Pine	360	82	30	100	190	182	787	36	100	33	120	99	**2,118**
White Spruce	314	1,039	798	795	360	129	65	12	0	0	0	0	**3,510**
Total Acres	**32,439**	**35,006**	**20,181**	**14,801**	**9,177**	**16,608**	**26,229**	**24,952**	**12,348**	**6,855**	**4,887**	**3,537**	**207,018**

1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 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). However, 2,267 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.
4 Contains 13 acres of Scotch pine forest that will be planned and managed along with the jack pine type.
5 Contains six acres of central hardwoods forest that will be planned and managed along with the northern hardwoods type.

3.2 Comparison of State Timberland Cover-Type Acres Between 1989 and 2004—Chippewa Plains/Pine Moraines and Outwash Plains Subsections (Combined)

Table 3.2 cppm

Comparison of State[1] Timberland[2] Cover-Type Acres Between 1989 and 2004 Chippewa Plains/Pine Moraines and Outwash Plains (Combined)

Cover Type	1989 Acres	1989 Percent	2004	2004 Percent	Percent Change 1989-2004
Ash/Lowland Hardwoods	15,012	4%	16,520	4%	**10%**
Aspen/Balm	177,908	44%	181,231	45%	**2%**
Balsam Fir	12,705	3%	8,494	2%	**-33%**
Birch	18,637	5%	12,102	3%	**-35%**
Black Spruce Upland	506	0%	106	0%	**-79%**
Black Spruce Lowland	32,164	8%	27,721	7%	**-14%**
Cutover Area[3]	5,778	1%	4,025	1%	**-30%**
Jack Pine	25,740	6%	18,088	5%	**-30%**
Northern White Cedar	12,444	3%	12,487	3%	**0%**
Northern Hardwoods	14,462	4%	16,809	4%	**16%**
Red Pine	28,038	7%	34,726	9%	**24%**
Oak	14,288	4%	15,598	4%	**9%**
Tamarack	43,524	11%	43,889	11%	**1%**
White Pine	1,116	0%	2,683	1%	**140%**
White Spruce	4,277	1%	6,681	2%	**56%**
Total Acres	**406,606**	**100%**	**401,160**	**100%**	**-1%**

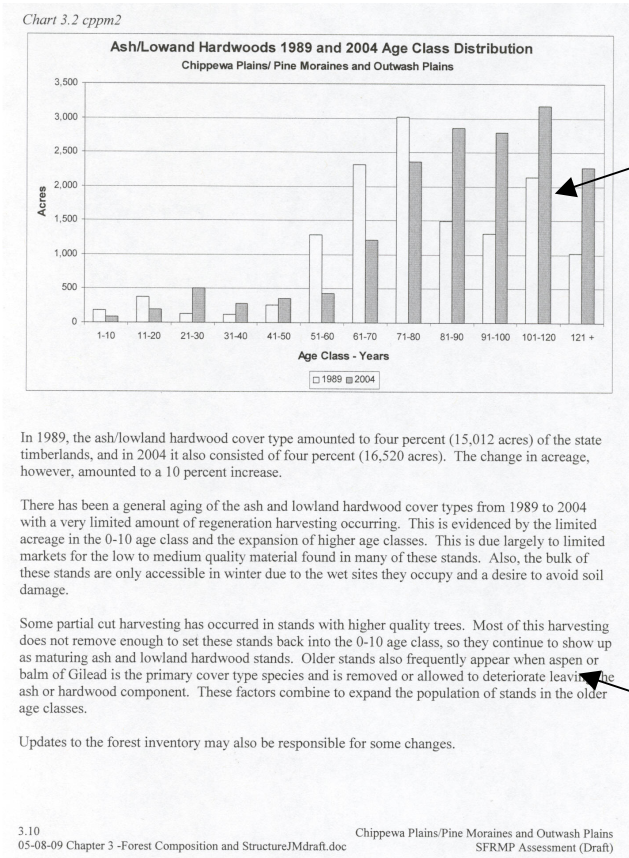
1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 Cooperative Stand Assessment (CSA) forest inventory.
2 Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix D: Glossary). However, 4,427 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.

Based on forest inventory, there was a 1 percent decrease in Forestry- and Wildlife-administered timberland acres between 1989 and 2004 in the two subsections. This is likely due to a change in the way some acres have been classified, partly because of an update in inventory systems. It may also be due to accuracy limits of the inventory data.

The cover-type acreage changes are most likely due to harvesting, planting, or seeding to a different cover type, loss due to insects or disease (e.g., spruce budworm damage to balsam fir, drought effects on birch), updates in the CSA forest inventory, and natural succession of old-age stands.

Charts 3.2 cppml—3.4 cppm-13 compare age-class distribution by cover type for state-administered timberlands (i.e., Forestry and Wildlife) for the years 1989 and 2004.

Reader's Guide to the Following Assessment Pages



In 1989, the ash/lowland hardwood cover type amounted to four percent (15,012 acres) of the state timberlands, and in 2004 it also consisted of four percent (16,520 acres). The change in acreage, however, amounted to a 10 percent increase.

There has been a general aging of the ash and lowland hardwood cover types from 1989 to 2004 with a very limited amount of regeneration harvesting occurring. This is evidenced by the limited acreage in the 0-10 age class and the expansion of higher age classes. This is due largely to limited markets for the low to medium quality material found in many of these stands. Also, the bulk of these stands are only accessible in winter due to the wet sites they occupy and a desire to avoid soil damage.

Some partial cut harvesting has occurred in stands with higher quality trees. Most of this harvesting does not remove enough to set these stands back into the 0-10 age class, so they continue to show up as maturing ash and lowland hardwood stands. Older stands also frequently appear when aspen or balm of Gilead is the primary cover type species and is removed or allowed to deteriorate leaving the ash or hardwood component. These factors combine to expand the population of stands in the older age classes.

Updates to the forest inventory may also be responsible for some changes.

3.10 Chippewa Plains/Pine Moraines and Outwash Plains
05-08-09 Chapter 3 -Forest Composition and StructureJMdraft.doc SFRMP Assessment (Draft)

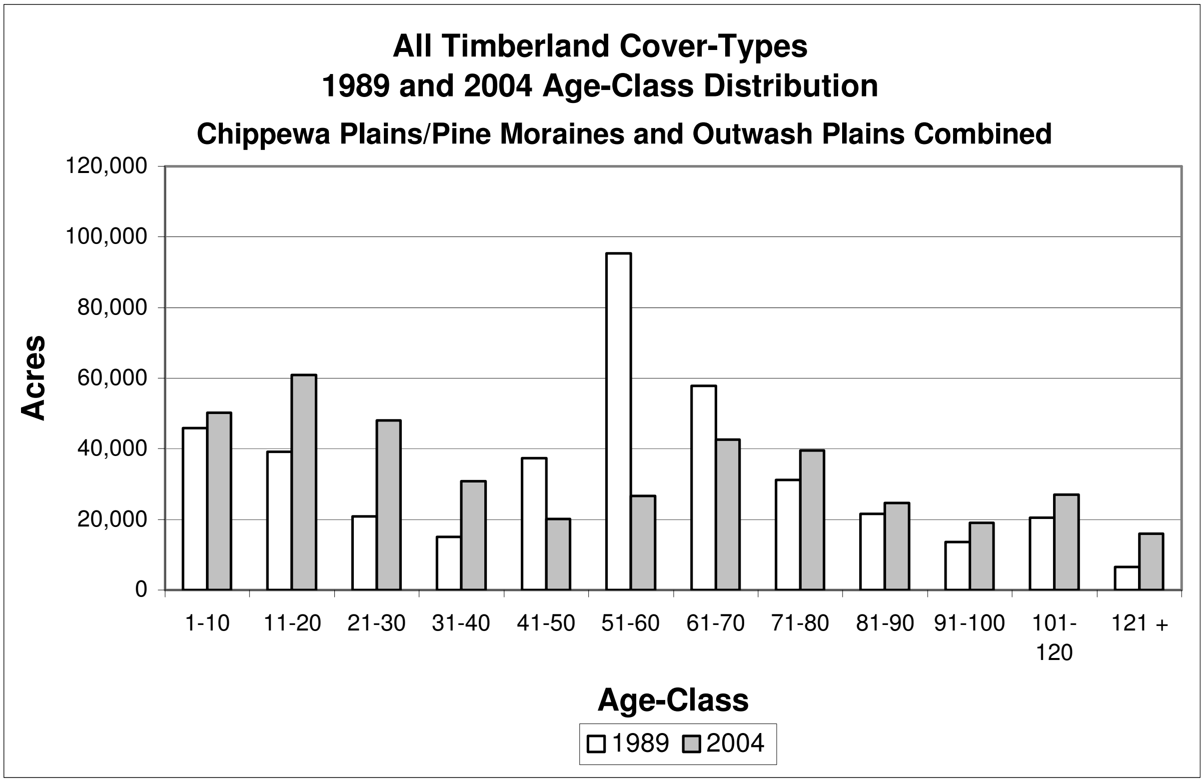
Charts: The charts on the following pages illustrate the age structure of forest cover types today and 15 years ago. These comparisons provide some perspective on how forests have been changing in recent years.

Commentary: The commentary sections beneath the charts suggest some of the factors that influence trends in forest age structure and composition. In each case, the first paragraph provides trend information and the following paragraphs describe some of the forces influencing these trends.

Readers should note that the commentary section is *not* intended to be a wholly science-based assessment, but rather, is based on a forestry assessment of conditions and forces influencing the cover types. While the commentary is intended to suggest some likely forces acting on the cover types in these subsections, it should by no means be considered an extensive account of forces acting on these complex forest systems. For example, historic events and practices—such as logging at the turn of the century, ongoing fire suppression, and the 1930s drought—have influenced the forest landscape in these subsections, but have not been discussed in depth here.

Finally, please note that there may be some unresolved professional debates between different natural resource disciplines about the significance of some of the factors influencing the forest cover types described on these pages. These debates are not addressed in the commentary sections. The SFRMP team is seeking public and professional input throughout the plan development process to better inform debaters and enhance management of these subsections in the coming years. The SFRMP planning process is designed to be annually adaptive so additional information and science can be incorporated as it becomes available.

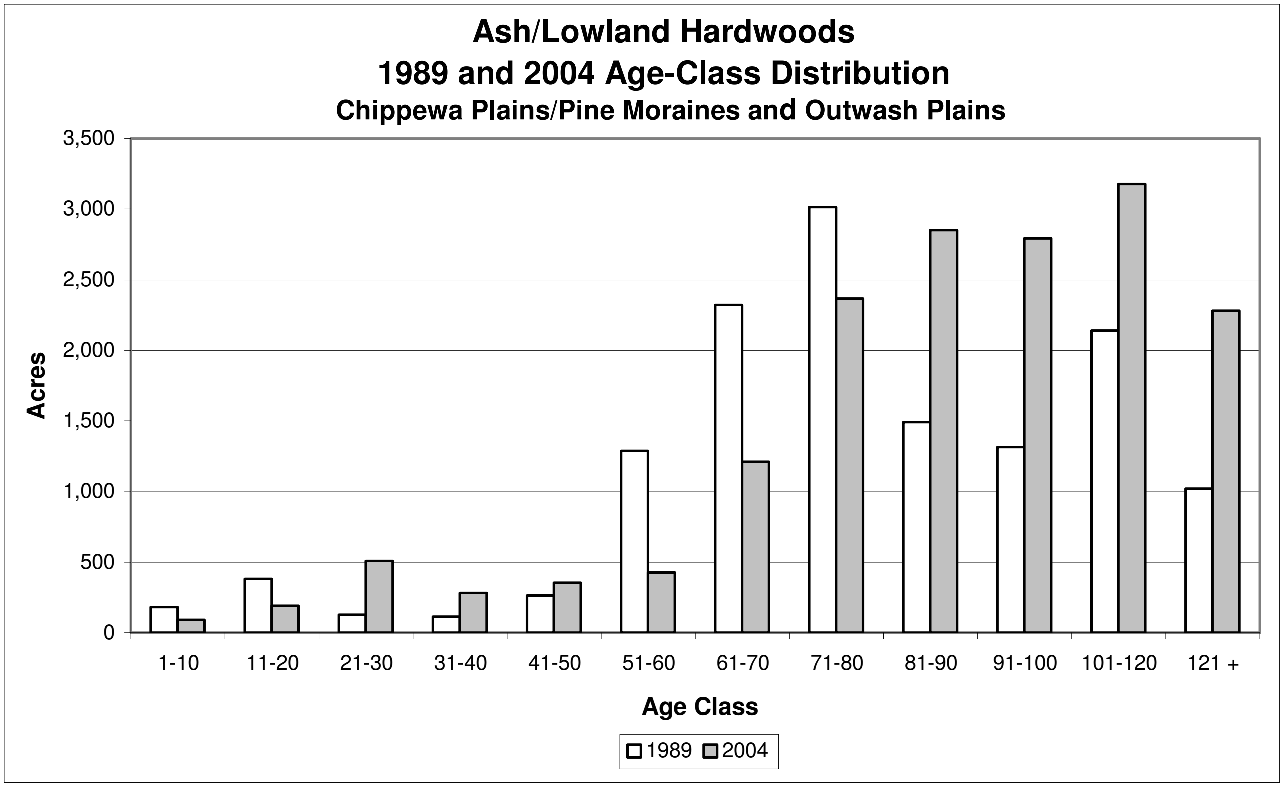
Chart 3.2 cppm1



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

This chart shows the acreage of all state timberland cover types in 1989 and 2004 in the two subsections combined. Based on the forest inventory, there was a 1 percent decrease (from 406,606 to 401,160 acres) in total state-administered timberland between 1989 and 2004 in these subsections. Changes in the acreage of individual age classes are likely due to the continued aging of forest stands, harvesting, planting/seeding, and updates to the forest inventory.

Chart 3.2 cppm2



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

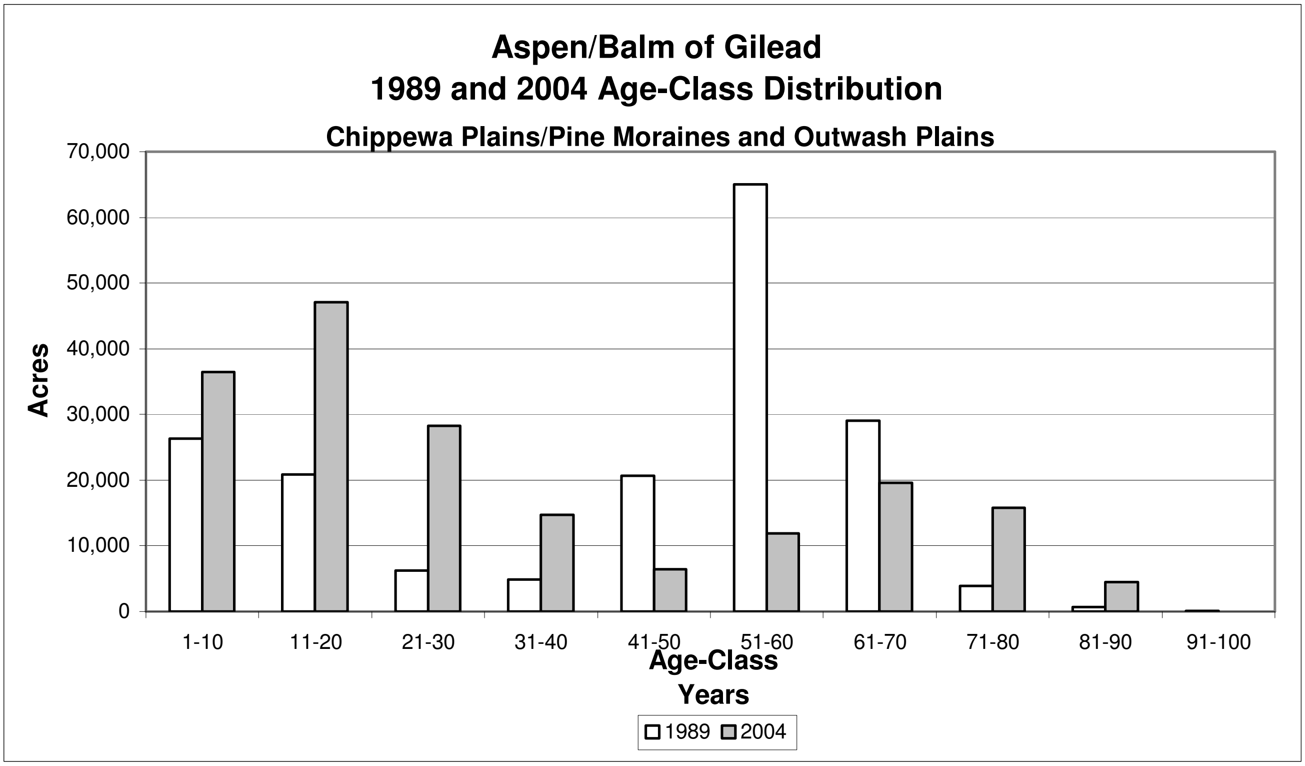
In 1989, the ash/lowland hardwood cover type amounted to 4 percent (15,012 acres) of the state timberlands and in 2004 also represented 4 percent (16,520 acres). The change in acreage, however, amounted to a 10 percent increase.

There has been a general aging of the ash and lowland hardwood cover types from 1989 to 2004, with a very limited amount of regeneration harvesting occurring. This is evidenced by the limited acreage in the zero- to 10-year age class and the expansion of higher age classes. This is largely due to limited markets for the low- to medium-quality material found in many of these stands. Also, the majority of these stands are only accessible in winter due to the wet sites they occupy and a desire to avoid soil damage.

Some partial-cut harvesting has occurred in stands with higher-quality trees. Most of this harvesting does not remove enough to set these stands back into the zero to 10 year age class, so they continue to show up as maturing ash and lowland hardwood stands. Older stands also frequently appear when aspen or balm of Gilead is the primary cover-type species and is removed or allowed to deteriorate, leaving the ash or hardwood component. These factors combine to expand the population of stands in the older age classes.

Updates to the forest inventory may also be responsible for some changes.

Chart 3.2 cppm3



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

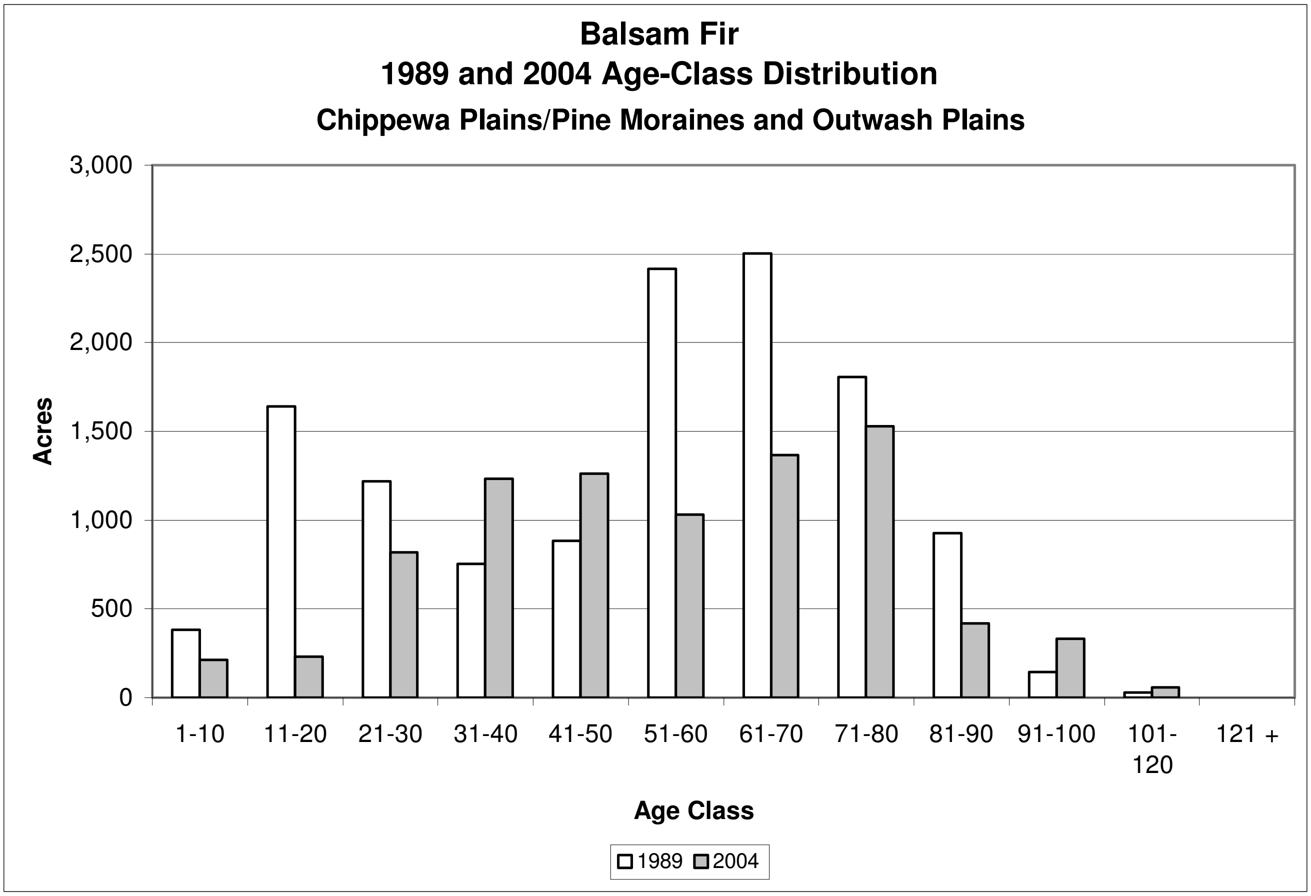
In 1989, the aspen and balm of Gilead cover types occupied 44 percent (177,908 acres) of state-administered timberlands and in 2004 occupied 45 percent (181,231 acres). The change in acreage amounts to a 2 percent expansion in these types.

Increases in overall type acreage are likely due to natural aspen and balm of Gilead regeneration coming in following the harvest of another cover type and updates to the forest inventory.

The expansion of younger age classes is due to the increase in harvesting that has occurred. Over the past 20 years markets have changed, and these species have come to be heavily used in the production of paper and structural panels.

The chart shows an increase in the number of acres in age classes beyond 70 years. These likely represent the last of the stands that were regenerated following fires in the 1930s. The chart also depicts an impending decrease in available harvest acres due to the limited number of stands entering maturity in the 41- to 60-year age class. This is the legacy of meager aspen markets prior to the 1970s.

Chart 3.2 cppm4

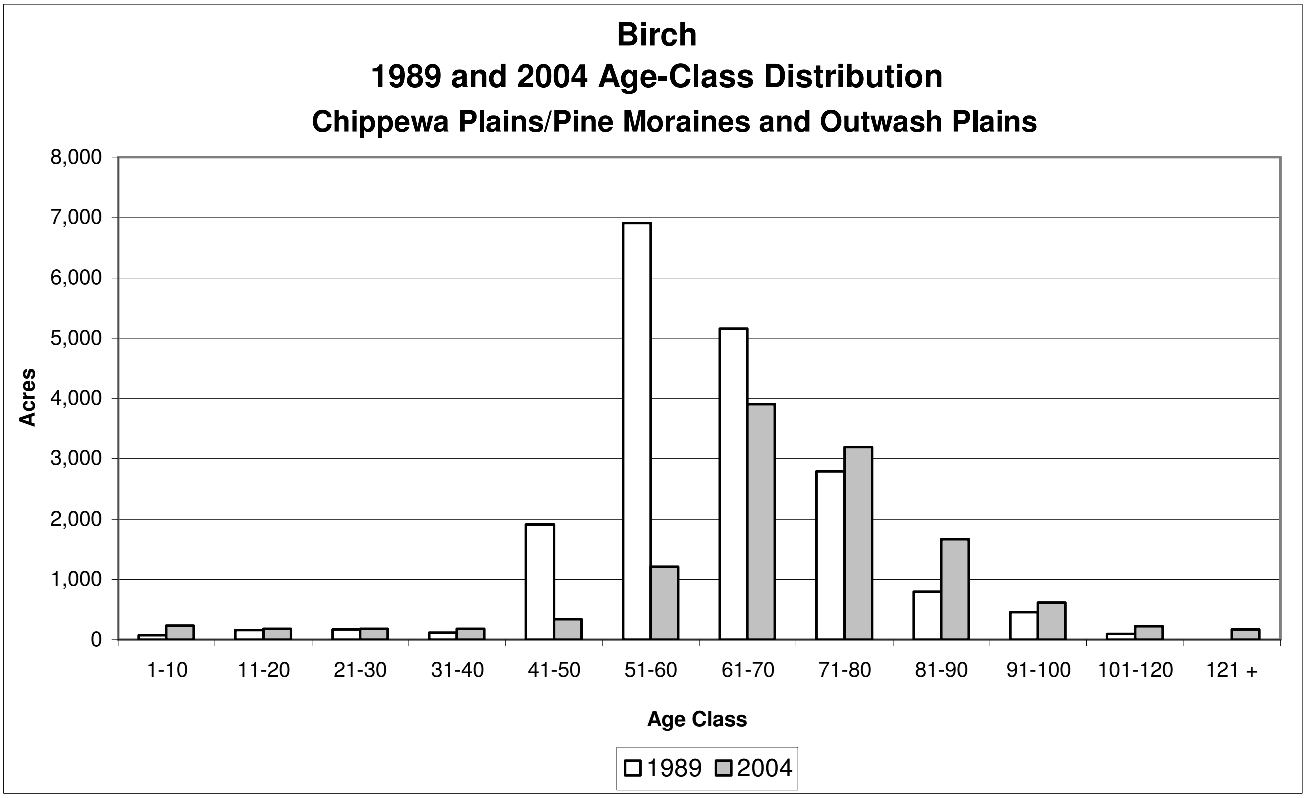


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the balsam fir cover type occupied 3 percent (12,705 acres) of state-administered timberlands and in 2004, occupied 2 percent (8,494 acres). This amounts to a 33 percent decrease in the acreage of this type.

The 33 percent decrease in cover type acres is primarily due to the aging of stands and mortality from forest pests (e.g., spruce budworm). Re-inventory of stands where the balsam fir component has died due to spruce budworm attack is likely to result in reclassification to another cover type. Also, balsam fir that is harvested for regeneration or salvage is commonly replaced by natural aspen reproduction or planted to pine or spruce. It is important to recognize that balsam fir continues to be a common understory species or component in other cover types.

Chart 3.2 cppm5



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

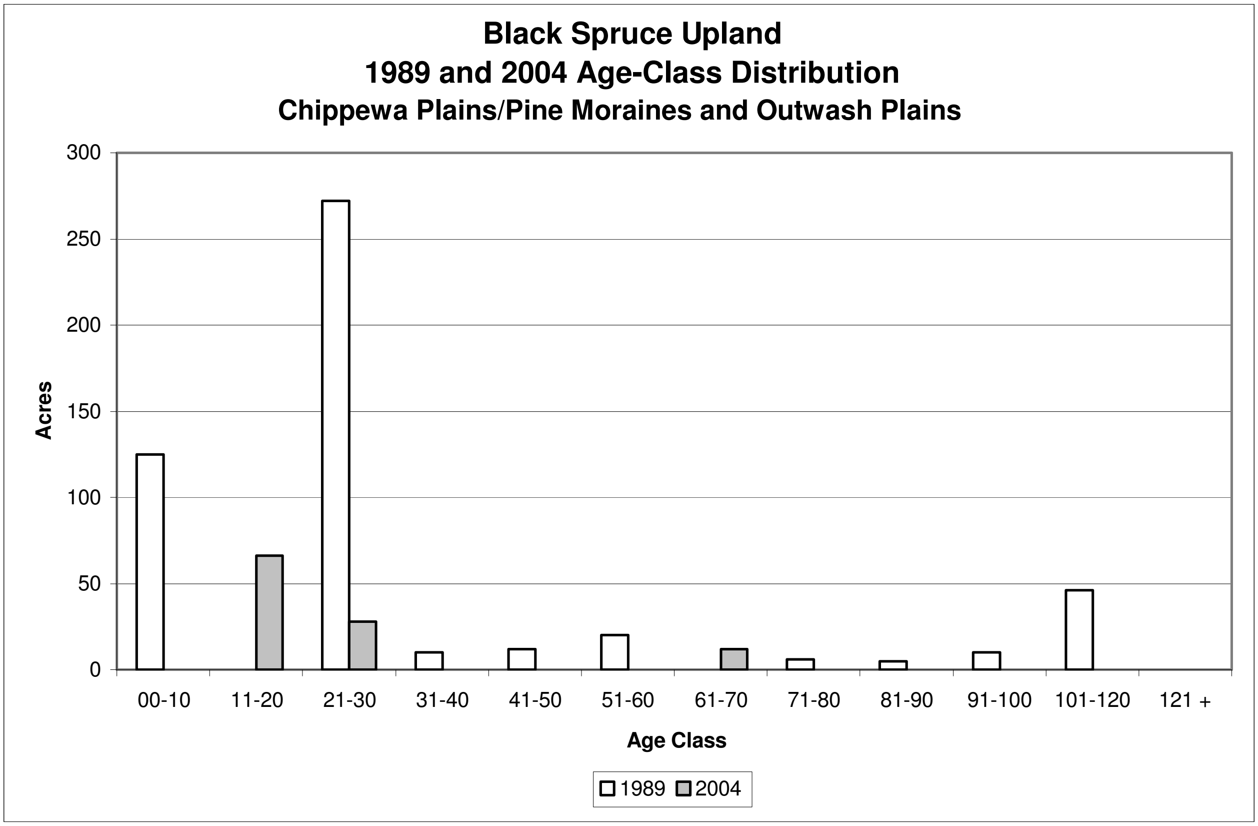
In 1989, the birch cover type occupied 5 percent (18,637 acres) of state-administered timberlands and in 2004 occupied 3 percent (12,102 acres). This amounts to a 35 percent reduction in the acreage of this type.

A significant portion of the birch cover type originated after forest fires in the early 1900s and drought in the 1930s. This is implied by the large acreage 60 years old and older. Low acreage in the younger age class likely stems from limited regeneration of harvested stands back to the birch type.

The reduction in the total type acreage is likely due to a number of factors. The late 1980s to early 1990s drought period resulted in mortality from "birch decline" and bronze birch borer damage, which caused some stands to succeed to other types. In addition, merchantable stands that were harvested in conjunction with aspen were often overtaken by aspen due to its aggressive sprouting characteristics. In some cases, birch stands have also been converted to other species such as white spruce and pine reducing the cover-type acreage further.

Updates to the Cooperative Stand Assessment (CSA) forest inventory may have also resulted in some acreage changes.

Chart 3.2 cppm6

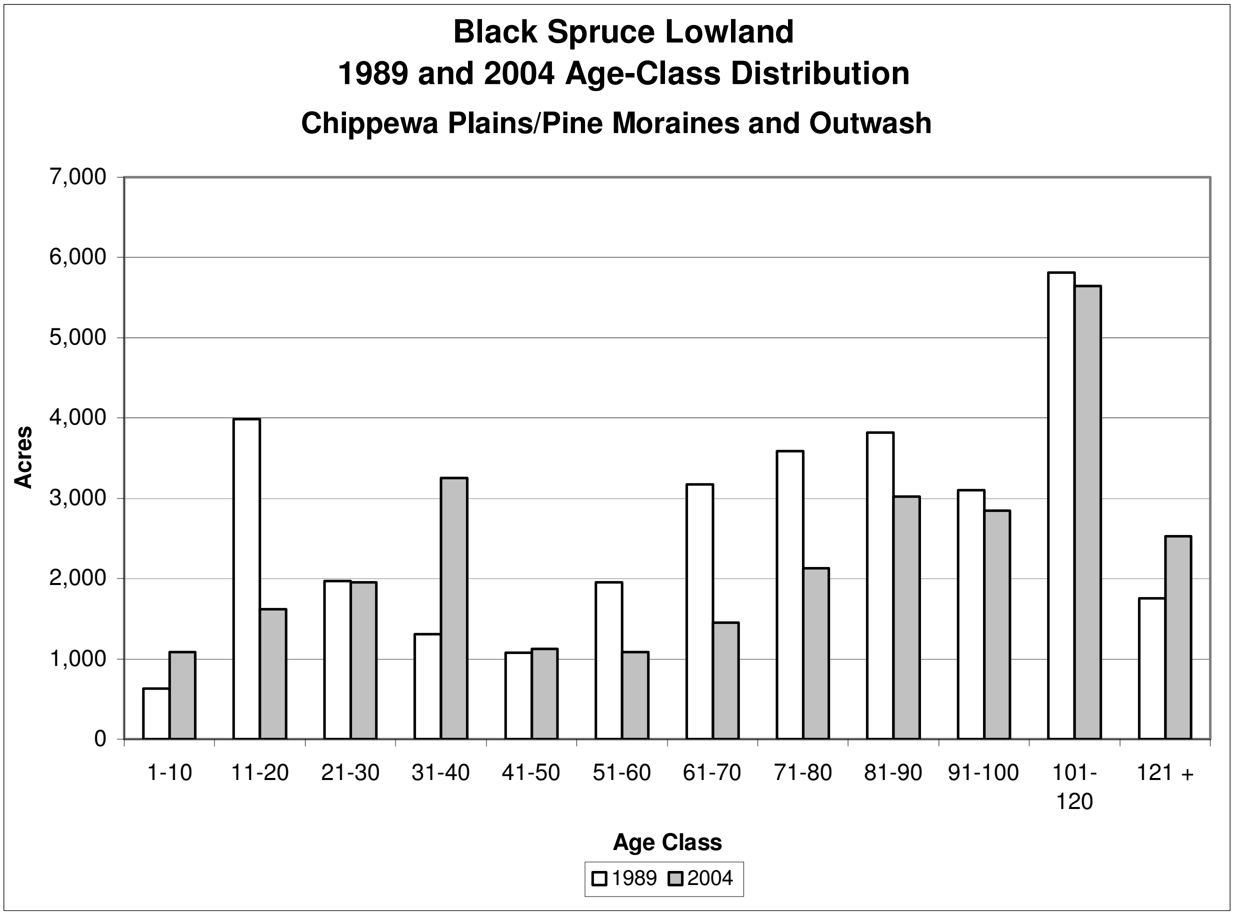


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

The black spruce upland cover type is uncommon in these subsections. The stands that exist are likely upland fringes of lowland spruce types and upland plantations.

The limited acreage makes it difficult to draw conclusions regarding the dynamics of change; however, it appears that significant portions of the older lowland fringes and the younger plantations were harvested between 1989 and 2004.

Chart 3.2 cppm7



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

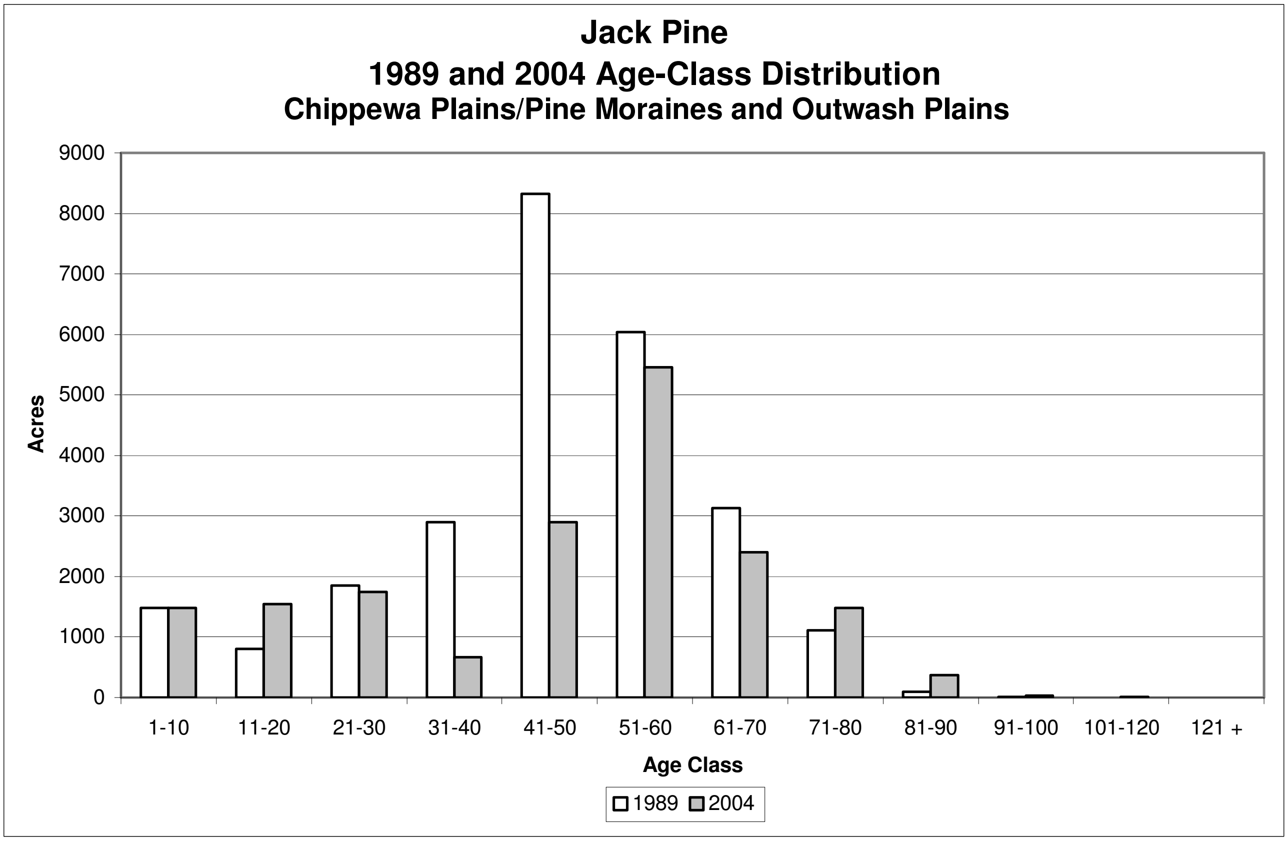
In 1989, the black spruce lowland cover type occupied 8 percent (32,164 acres) of state-administered timberlands and in 2004 occupied 7 percent (27,721 acres). This amounts to a 14 percent decrease in the acreage of this type.

Black spruce has had markets and been harvested for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested lowland spruce sites regenerate naturally or through artificial seeding to black spruce.

It is important to understand that black spruce occupies sites having broad range of productivity. Trees on the poorer sites take many years to produce marketable products in harvestable quantities. This characteristic is reflected in the large acreages in the 100-year-plus age classes.

Other changes in age-class distribution are likely due to the continued aging of forest stands, limited access to some stands, and updates to the forest inventory.

Chart 3.2 cppm8



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

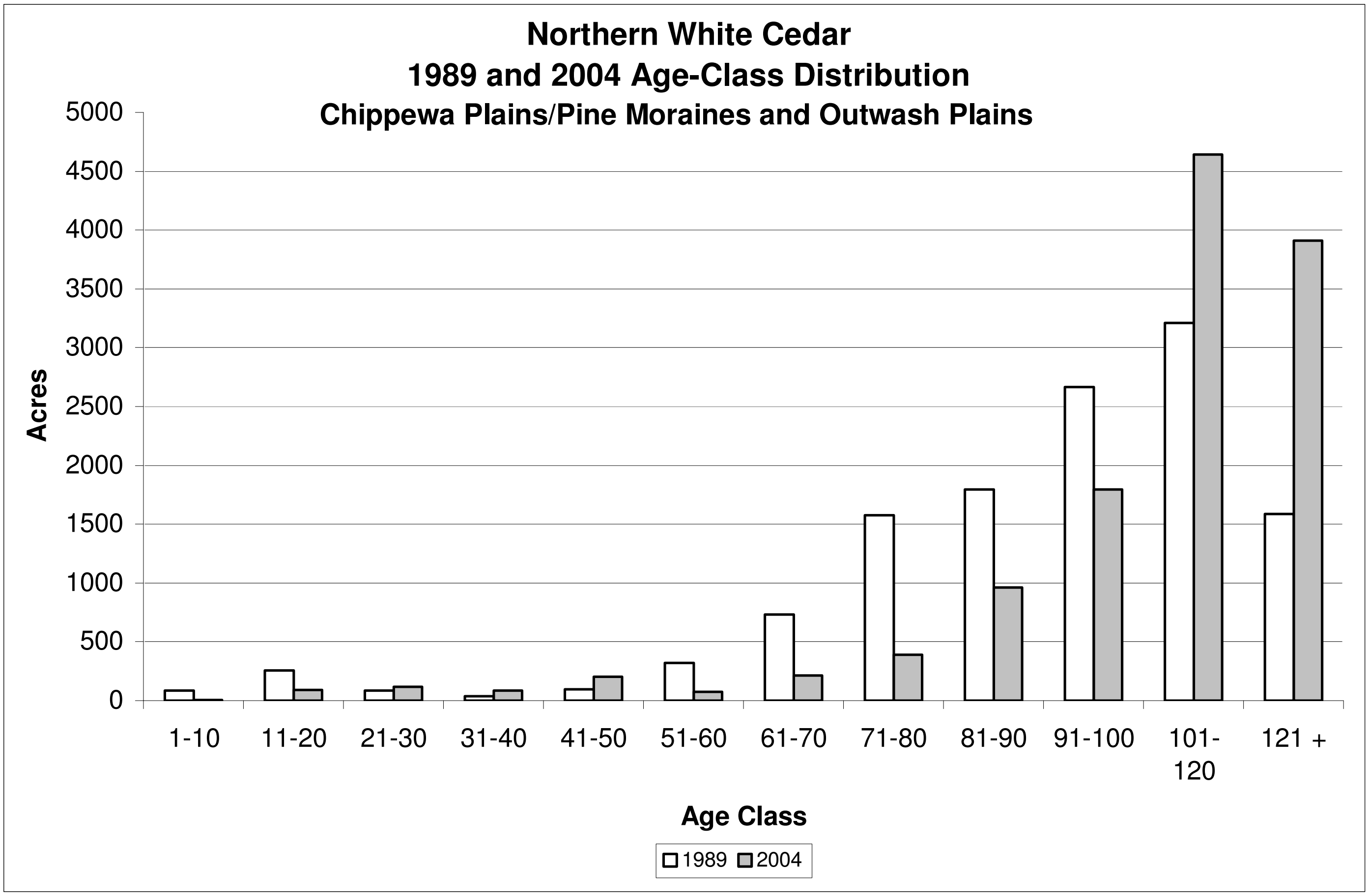
In 1989, the jack pine cover type occupied 6 percent (25,740 acres) of state-administered timberlands and in 2004 occupied 5 percent (18,088 acres). This amounts to a 30 percent decrease in the acreage of this type.

The decrease in jack pine cover-type acreage is due in part to mortality in aging stands that are susceptible to jack pine budworm and bark beetle attacks. These attacks may reduce the jack pine volume in some stands to where it no longer represents the predominant species, resulting in a cover-type change.

The reduction in jack pine acreage is also due in part to the choice to replace jack pine on better quality sites with red pine or white spruce. Reasons for this may include insect and disease resistance, value potential and lower susceptibility to animal damage. Still, some planting and seeding to jack pine have been successful, resulting in a significant acreage in the one- to 10-year age class.

Some changes are may also be due to updates in forest inventory.

Chart 3.2 cppm9

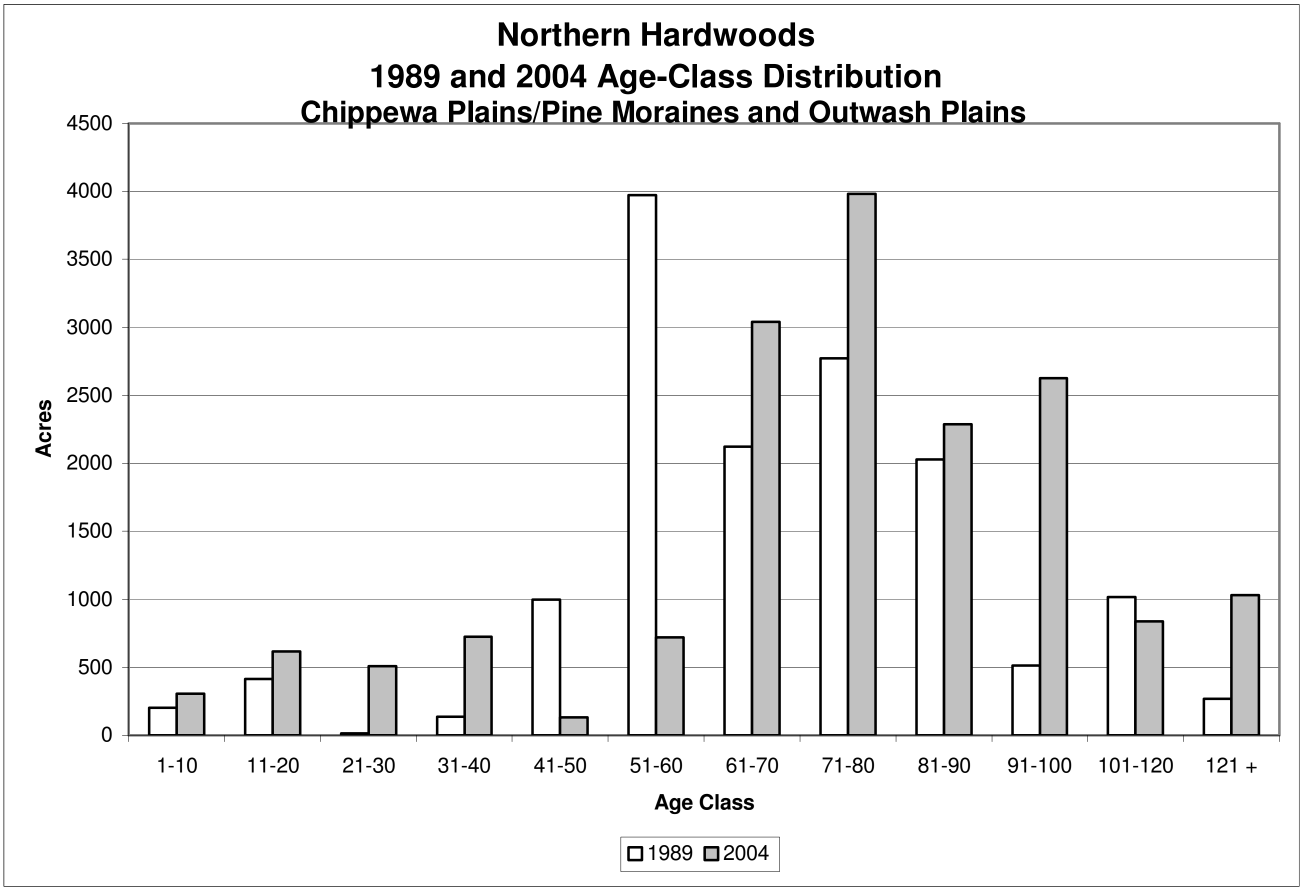


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the northern white cedar cover type occupied 3 percent (12,444 acres) of state-administered timberlands and in 2004 occupied 3 percent (12,487 acres). This amounts to virtually no change in the acreage of the type.

Harvesting of white cedar has been all but suspended on state land for some time. This is due to its significant value for wintering cover for deer and the difficulty experienced in regenerating cedar. Little or no harvesting has resulted in a substantial portion of the type in older age classes, with a limited number of younger stands.

Chart 3.2 cppm10



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

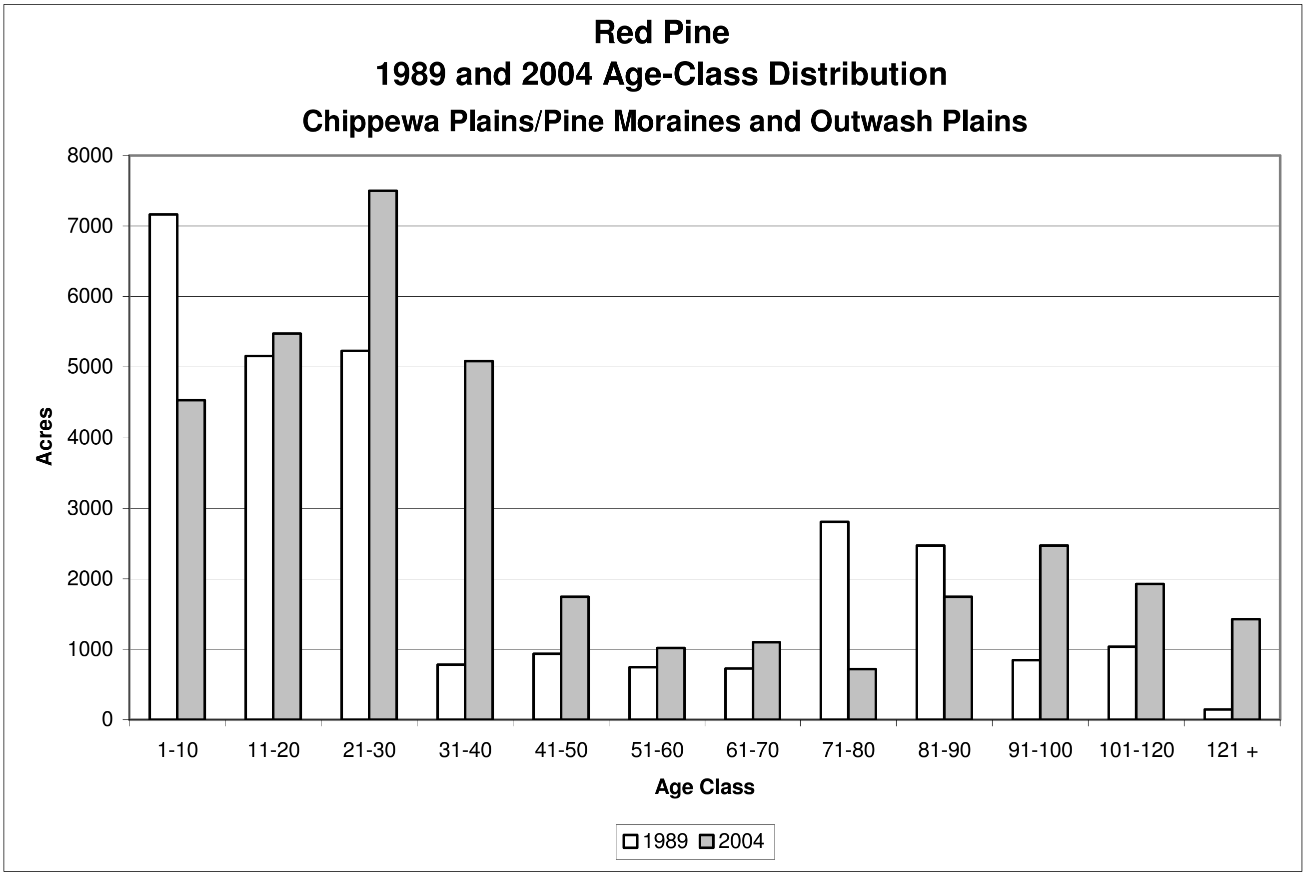
In 1989, the northern hardwoods cover type occupied 4 percent (14,462 acres) of state-administered timberlands and in 2004 occupied 4 percent (16,809 acres). This represents a 16 percent reduction in the extent of this type.

Many northern hardwood stands originated following the drought and fires of the 1930s. This is evidenced by the concentration of stands in the 71- to 80-year age class. A limited amount of regeneration harvesting has occurred since 1989, as indicated by the limited acreage in the zero- to 10-year age class.

Some partial cut harvesting has occurred in stands with higher-quality trees. Most of this harvesting does not remove enough to set these stands back into the zero- to 10-year age class, so they continue to show up as maturing northern hardwood. Older stands also frequently appear when aspen is the primary cover type species and is either removed or allowed to deteriorate, leaving the hardwood component. These factors combine to expand the population of stands in the older year age classes.

Other primary reasons for changes are likely to include the continued aging of forest stands and updates to the forest inventory.

Chart 3.2 cppm11



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

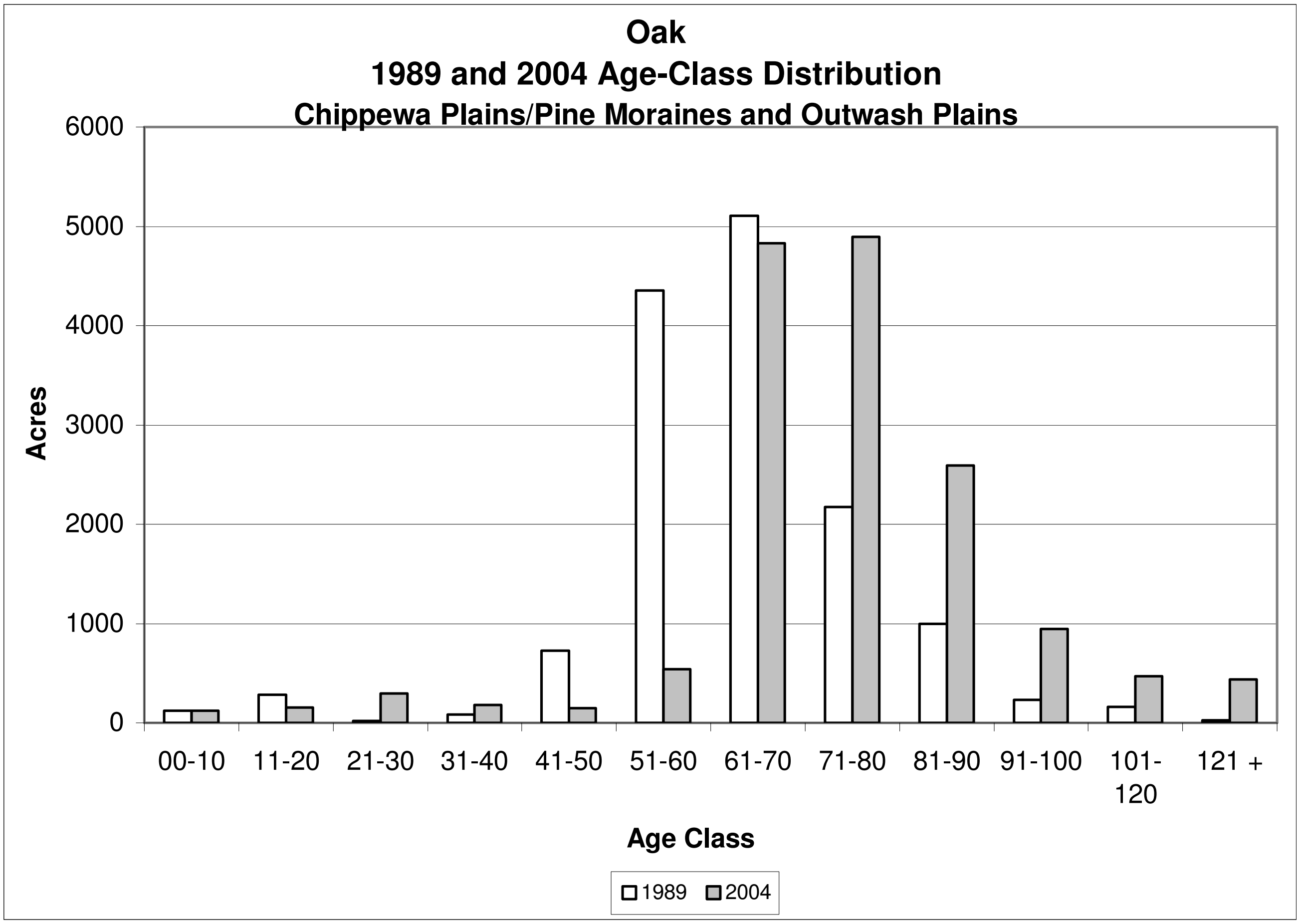
In 1989, the red pine cover type occupied 7 percent (28,038 acres) of state-administered timberlands and in 2004 occupied 9 percent (34,726 acres). This amounts to a 24 percent increase in the acreage of this type.

The primary reason for the large increase in the zero- to 40-year age classes is a long-standing effort to plant red pine. Some of this has been done on natural red/white pine sites that had become occupied by other cover types (e.g., aspen and hardwoods). In other instances, a choice has been made to replace jack pine on better sites due to red pine's pest resistance, product potential, and lower susceptibility to animal damage.

Limited regeneration harvesting has occurred in this cover type in the past 10 years, as indicated by the slight reductions in the older age classes. Much of the harvest in the red pine cover type occurs through periodic thinning of stands, which would not have a significant effect on changes in cover-type age classes. Additionally, red pine stands that are clear-cut are usually restored using red pine, which tends to maintain the acreage.

Other changes are likely due to the continued aging of forest stands and updates to the forest inventory.

Chart 3.3 cppm12



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

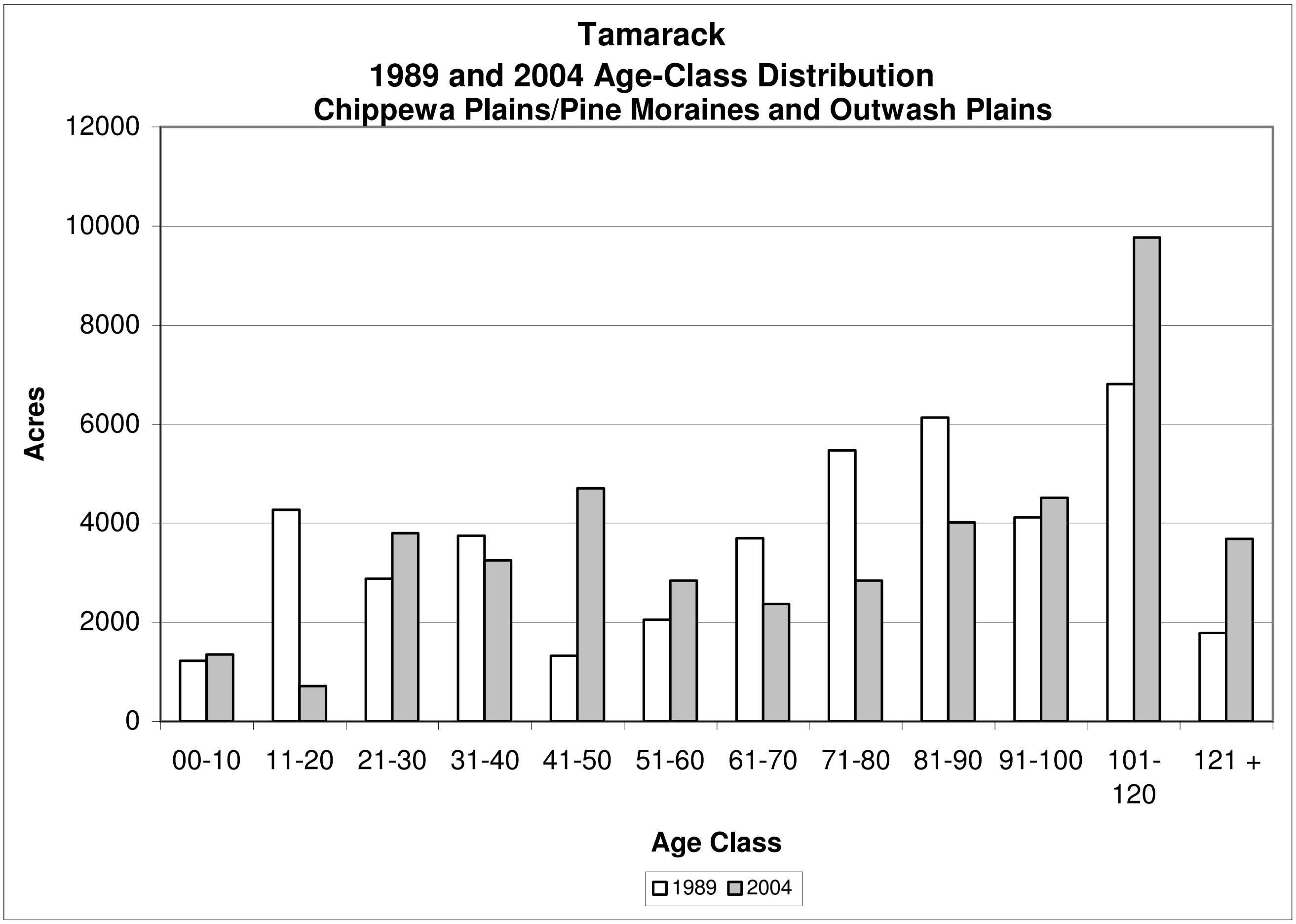
In 1989, the oak cover type occupied 4 percent (14,288 acres) of state-administered timberlands and in 2004 occupied 4 percent (15,598 acres). This amounts to a 9 percent increase in the acreage of this type.

A significant portion of the oak resource grows as a component of cover types such as jack pine and aspen that became more common following the fires of the early 1900s. It occurs as individual scattered trees or small clumps that were not classified as separate stands during the original inventory. During the period from 1989 through 2004, much of the oak included in timber sales was reserved for its wildlife value and to maintain diversity. These retained trees and/or clumps were sometimes reclassified as oak cover type, contributing to an increase in acreage.

In high site index stands, oak is commonly managed through thinning, which removes volume but does not alter the type designation. This likely has contributed to increased acreage in the older age classes.

One other primary reason for change is the continued aging of the cover type, damage from forest pests (e.g., larch sawfly, tamarack beetle, beaver flooding), and updates to the forest inventory.

Chart 3.2 cppm13

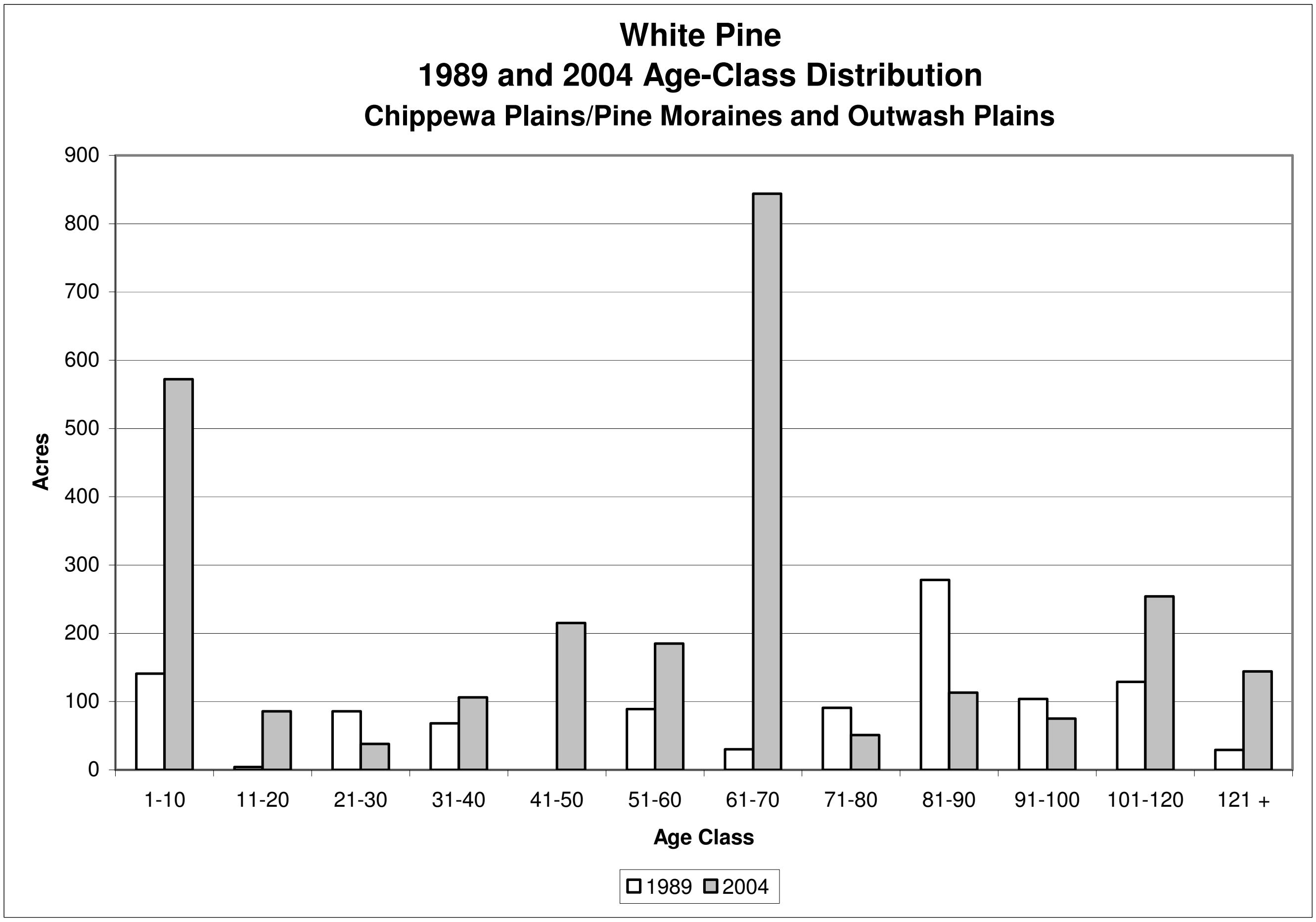


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the tamarack cover type occupied 11 percent (43,524 acres) of state-administered timberlands and in 2004 occupied 11 percent (43,889 acres). Although the tamarack constitutes the same percentage of timberland, there was a 1 percent increase in the acreage of this type.

Tamarack has had markets and experienced harvesting for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested tamarack sites regenerate naturally to tamarack. Markets have been poor recently, however, so the zero- to 10-year-old age class is significantly below average.

Chart 3.2 cppm14



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

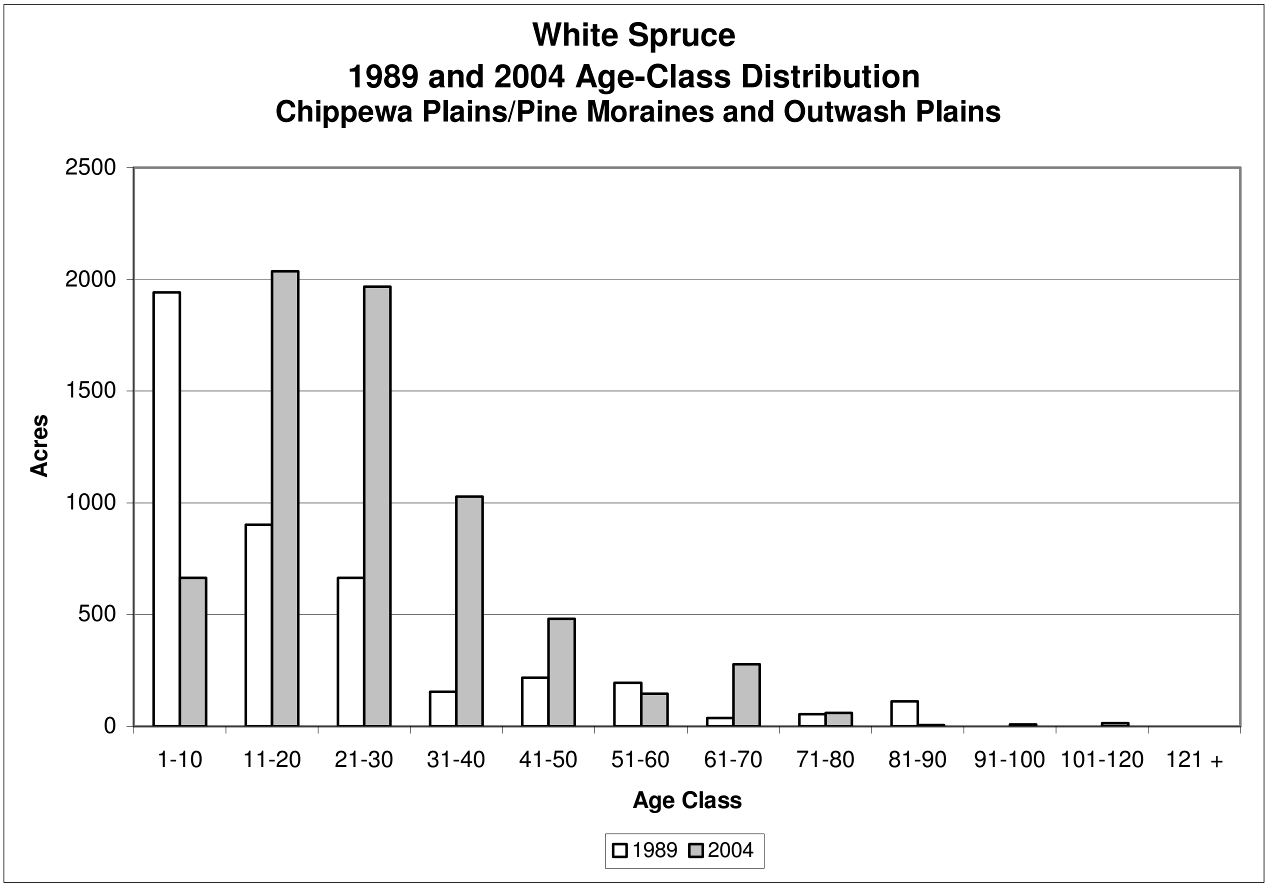
In 1989, the white pine cover type occupied less than 1 percent (1,116 acres) of state-administered timberlands and in 2004 occupied 1 percent (2,683 acres). This amounts to a 140 percent increase in the acreage of this type.

An effort to more fully identify white pine cover-type acres in the forest inventory has increased the total type acreage. Older stands also frequently appear when aspen is the primary cover-type species and is either removed or allowed to deteriorate leaving the white pine component. This is particularly apparent in the 61- to 70-year age class.

A very limited amount of regeneration harvesting has occurred in the white pine cover type over the past 10 years. Consequently, most of the increase in acreage of young stands has resulted from planting or seeding areas that were previously other cover types, such as balsam fir and paper birch.

One other primary reason for change is the continued aging of the cover type.

Chart 3.2 cppm15



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the white spruce cover type occupied 1 percent (4,277 acres) of state-administered timberlands and in 2004 occupied 2 percent (6,681 acres). This amounts to a 56 percent increase in the acreage of this type.

Very little clear-cut harvesting has occurred in this cover type during the past 10 years as only small amounts of it have reached maturity. The large acreage increase in the zero to 30-year age classes is due to planting white spruce on sites that were previously other cover types. In recent years, planting spruce has been favored over planting pine in part due to the susceptibility of the pines to animal damage. Other changes are likely due to the continued aging of forest stands and updates to the forest inventory. It should be recognized that white spruce is often an important component of pine and aspen stands.

3.3 Comparison of State Timberland Cover-Type Acres Between 1989 and 2004 Chippewa Plains

Table 3.3 cp

Comparison of State[1] Timberland[2] Cover-Type Acres Between 1989 and 2004 Chippewa Plains

Cover Type	1989		2004		Percent Change 1989-2004
	Acres	Percent	Acres	Percent	
Ash/Lowand Hardwoods	10,152	5%	10,648	5%	5%
Aspen/Balm	66,753	33%	66,562	34%	0%
Balsam Fir	9,534	5%	5,422	3%	-43%
Birch	8,594	4%	5,136	3%	-40%
Black Spruce Upland	107	0%	28	0%	-74%
Black Spruce Lowland	29,305	15%	25,578	13%	-13%
Cutover Area[3]	3,299	2%	3,000	2%	-9%
Jack Pine	7,450	4%	5,689	3%	-24%
Northern White Cedar	10,373	5%	10,800	6%	4%
Northern Hardwoods	6,682	3%	7,108	4%	6%
Red Pine	8,657	4%	11,084	6%	28%
Oak	1,426	1%	1,045	1%	-27%
Tamarack	36,382	18%	38,324	20%	5%
White Pine	174	0%	565	0%	225%
White Spruce	1,856	1%	3,171	2%	71%
Total	**200,744**	**100%**	**194,160**	**100%**	**-3%**

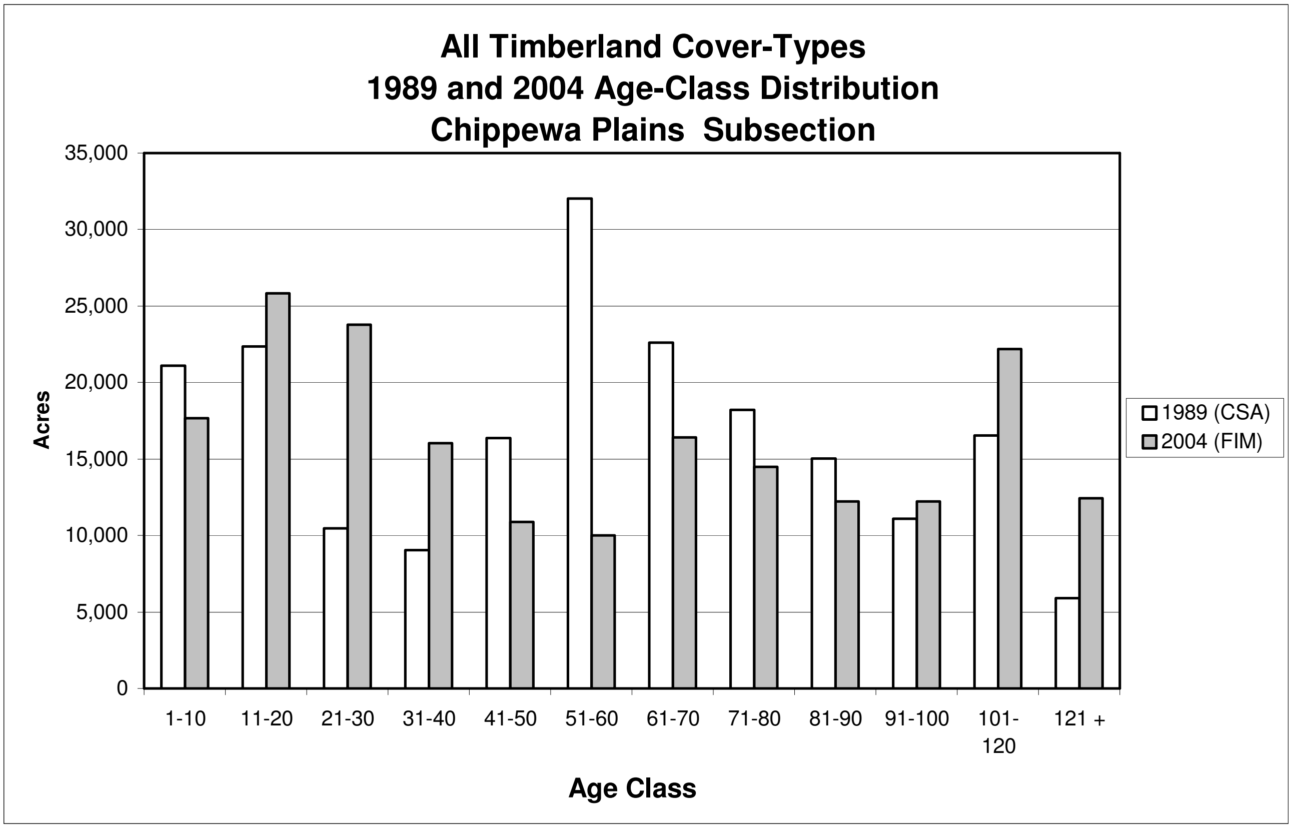
1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 Cooperative Stand Assessment (CSA) forest inventory.
2 Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix D: Glossary). However, 2,160 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.

Based on the forest inventory, there was a 3 percent decrease (from 200,744 to 194,160 acres) in total state-administered timberland acres between 1989 and 2004 in the Chippewa Plains Subsection.

The cover-type acreage changes are likely due to harvesting, planting, or seeding to a different cover type; loss due to insects or disease (e.g., spruce budworm damage to balsam fir, drought effects on birch); updates in the CSA forest inventory, and natural succession of old-age stands. Forest pests (e.g., spruce budworm damage to balsam fir, early 1990s drought effects on birch, jack pine budworm, beaver flooding) also had significant impacts on stands during the 1989 to 2004 period.

The following charts 3.3 cp1—3.3 cp 14 compare age-class distribution by cover type for state-administered (i.e., Forestry and Wildlife) timberlands in this subsection for the years 1989 and 2004.

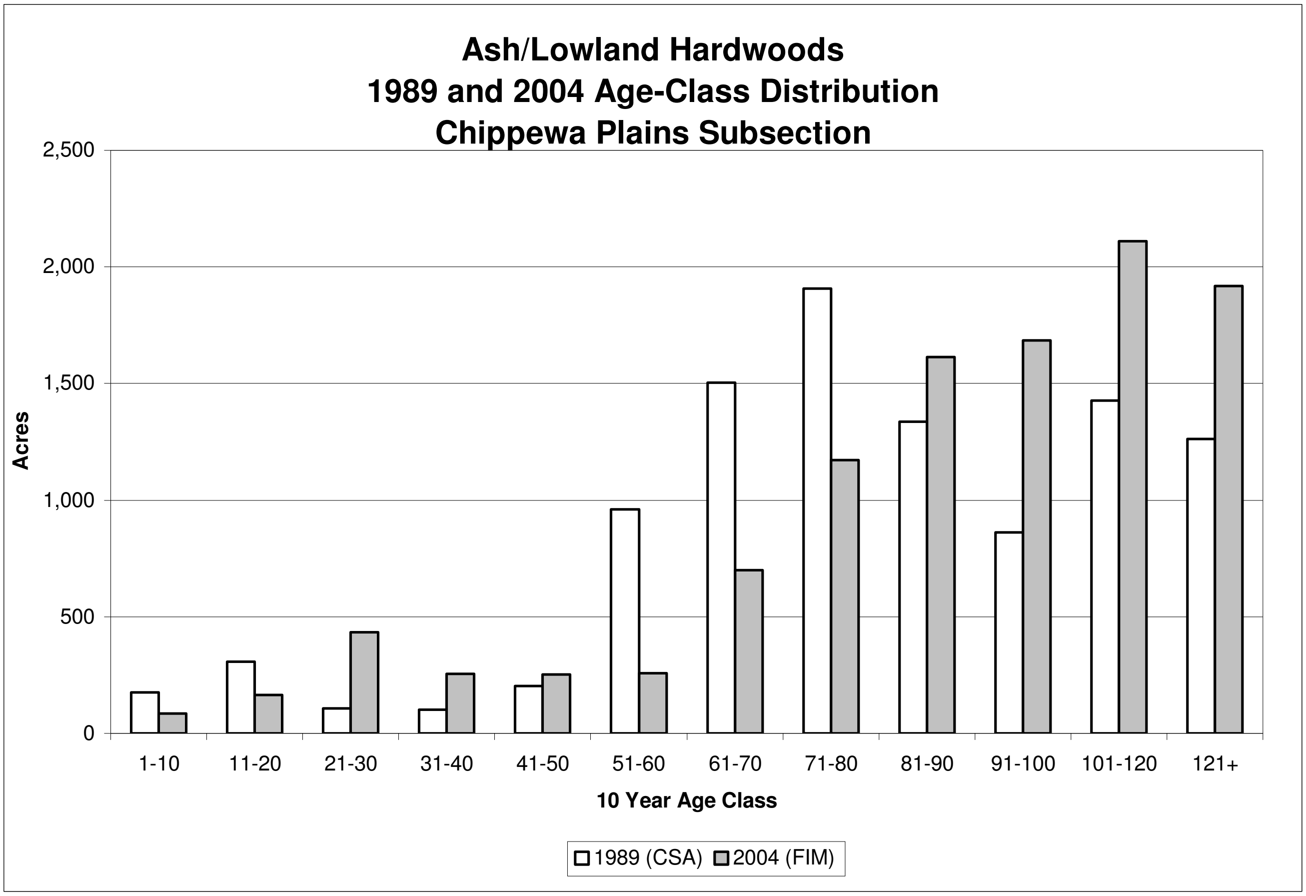
Chart 3.3 cp1



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

This chart shows the acreage of all state timberland cover types combined in 1989 and 2004 in the Chippewa Plains Subsection. Based on the forest inventory, there was a 3 percent decrease in total state-administered timberland acres (from 200,744 acres to 194,160 acres) between 1989 and 2004. Changes in the acreage of individual age classes are likely due to the continued aging of forest stands, harvesting, planting/seeding, and updates to the forest inventory.

Chart 3.3 cp2



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

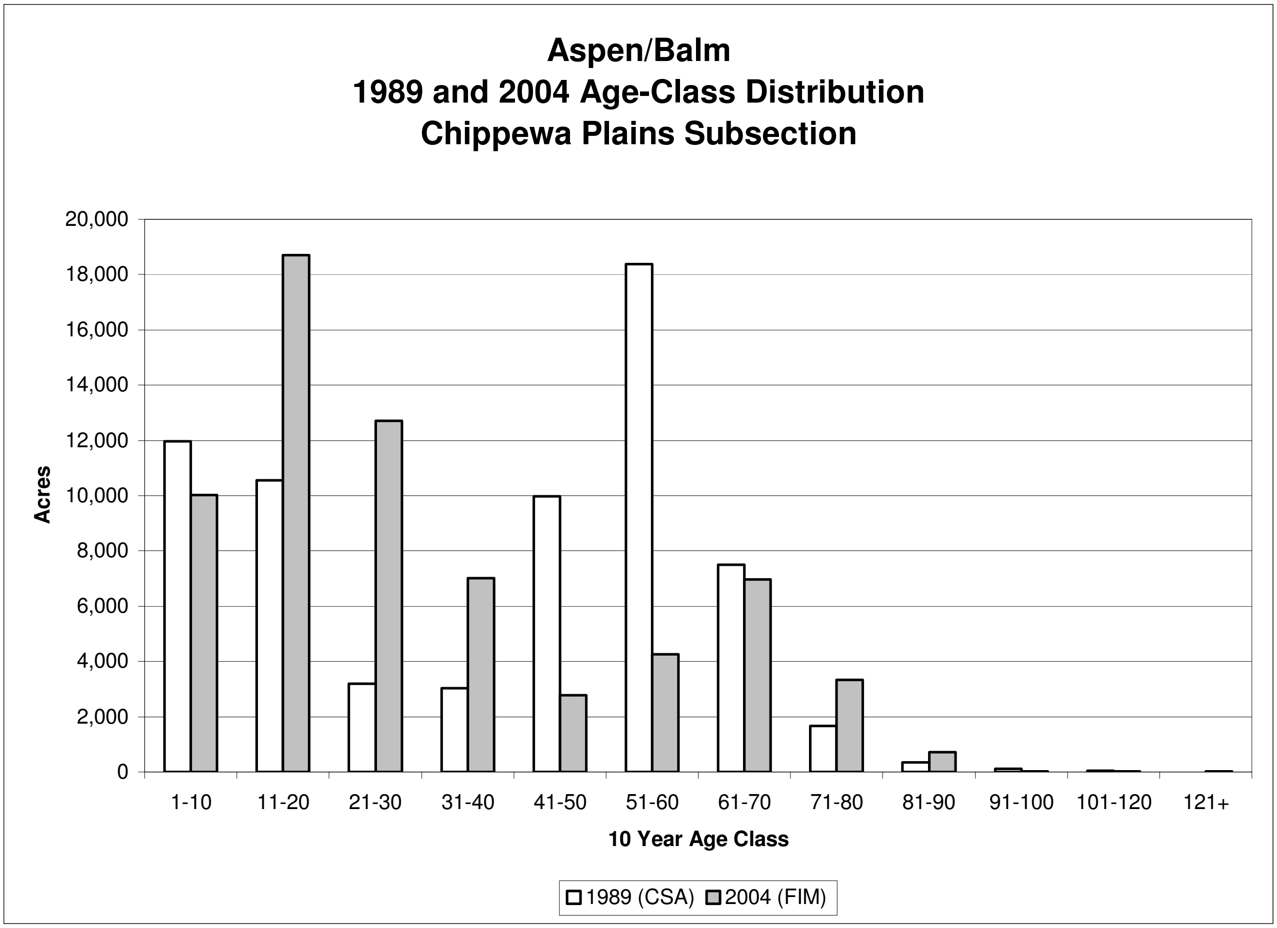
In 1989, the ash/lowland hardwood cover type amounted to 5 percent (10,152 acres) of the state timberlands in the Chippewa Plains and in 2004 also consisted of 5 percent (10,648 acres). The change in acreage, however, amounted to a 5 percent increase.

There has been a general aging of the ash/lowland hardwood cover type from 1989 to 2004, with a very limited amount of regeneration harvesting occurring. This is evidenced by the limited acreage in the zero- to 10-year age class and the expansion of higher age classes. This is due largely to limited markets for the low- to medium-quality material found in many of these stands. Also, the bulk of these stands are only accessible in winter due to the wet sites they occupy and a desire to avoid soil damage.

Some partial-cut harvesting has occurred in stands with higher-quality trees. Most of this harvesting does not remove enough to set these stands back into the zero- to 10-year age class, so they continue to show up as maturing ash/lowland hardwood stands. Older stands also frequently appear when aspen or balm of Gilead is the primary cover-type species and is removed or allowed to deteriorate leaving the ash or hardwood component. These factors combine to expand the population of stands in the older age classes.

Updates to the forest inventory may also be responsible for some changes.

Chart 3.3 cp3



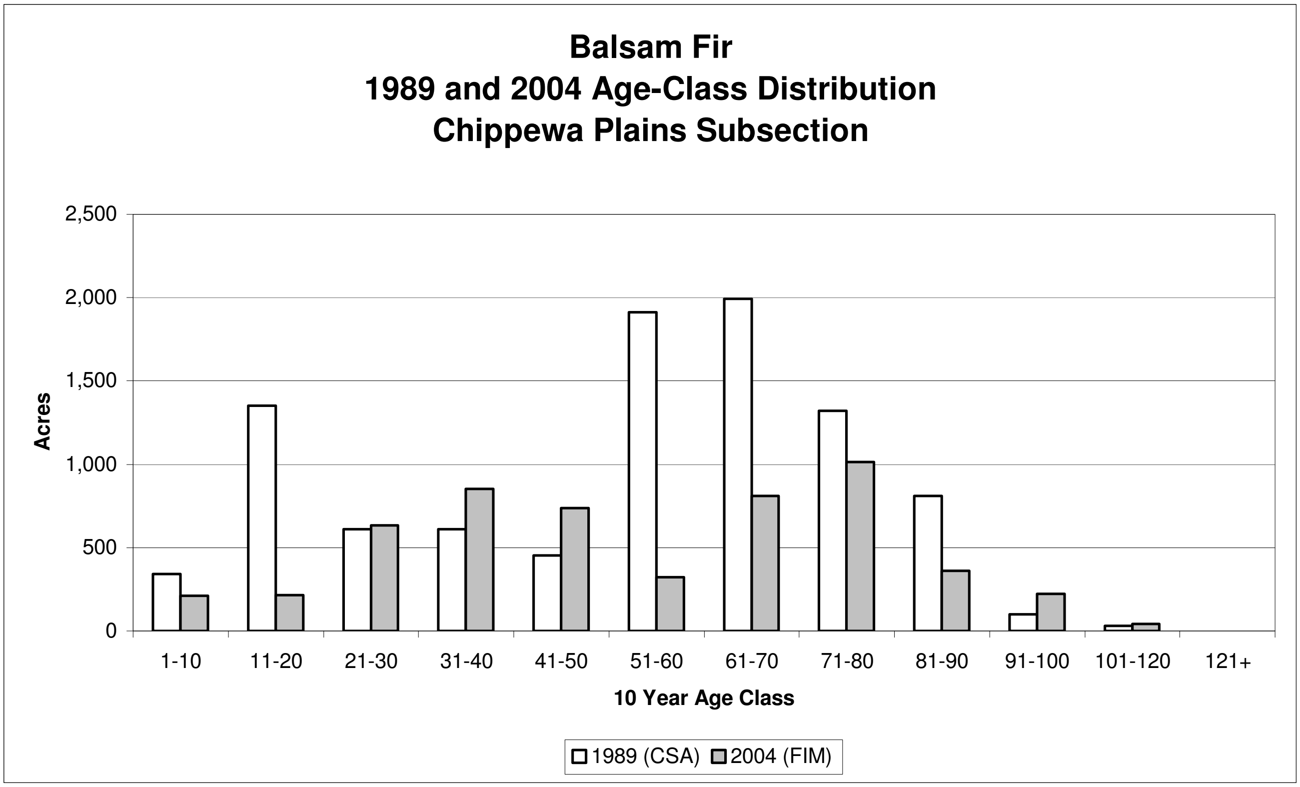
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the aspen and balm of Gilead cover types occupied 33 percent (66,753 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 34 percent (66,562 acres). The total acreage of these types remained virtually unchanged during the period.

The expansion of younger age classes is due to the increase in harvesting that has occurred. Over the past 20 years, markets have changed and these species have come to be heavily used in the production of paper and structural panels.

The chart shows an increase in the number of acres in age classes beyond 70 years. These likely represent the last of the stands that were regenerated following fires in the 1930s. The chart also depicts an impending decrease in available harvest acres due to the limited number of stands entering maturity in the 41- to 60-year age class. This is the legacy of meager aspen markets prior to the 1970s.

Chart 3.3 cp4

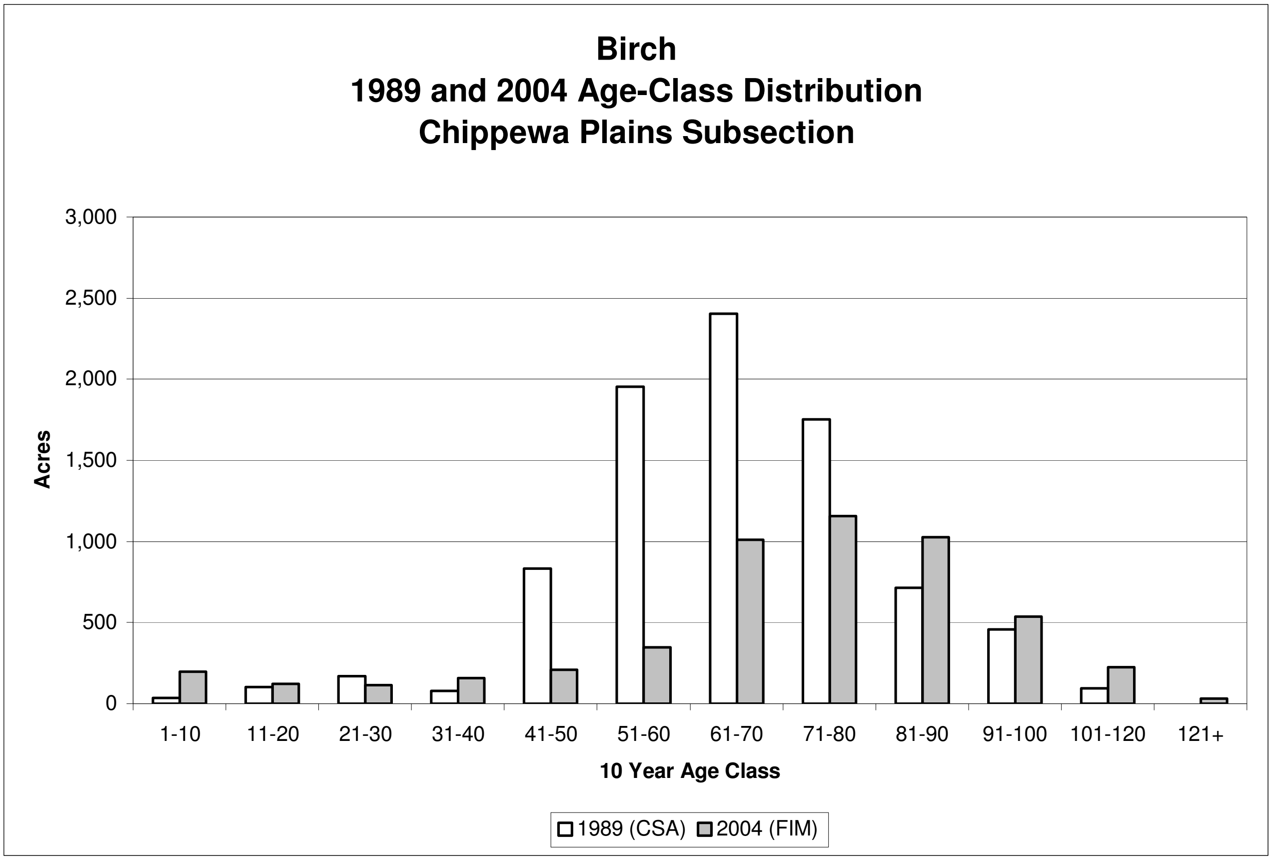


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the balsam fir cover type occupied 5 percent (9,534 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 3 percent (5,422 acres). This amounts to a 43 percent decrease in the acreage of this type.

The 43 percent decrease in cover type acres is primarily due to the aging of stands and mortality from forest pests (e.g., spruce budworm). Re-inventory of stands where the balsam fir component has died due to spruce budworm attack is likely to result in reclassification to another cover type. Also, balsam fir that is harvested for regeneration or salvage is commonly replaced by natural aspen reproduction or planted to pine or spruce. It is important to recognize that balsam fir continues to be a common understory species or component in other cover types.

Chart 3.3 cp5

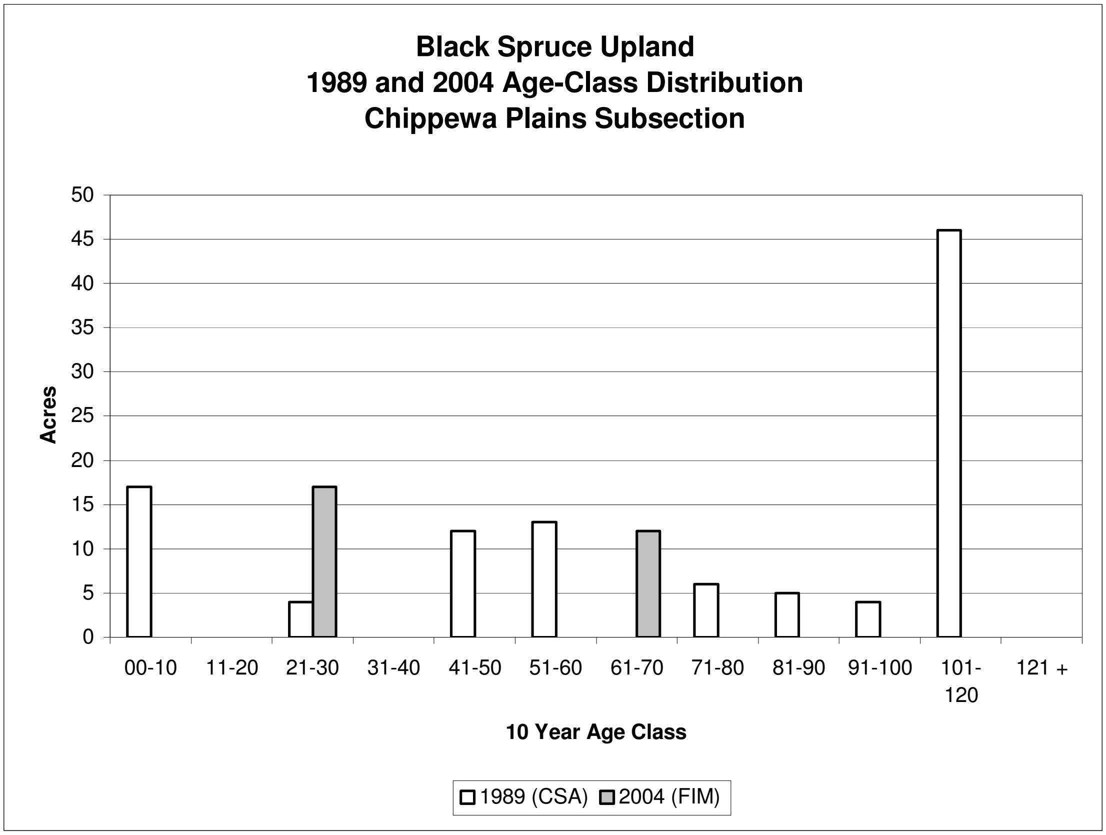


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the birch cover type occupied 4 percent (8,594 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 3 percent (5,136 acres). This amounts to a 40 percent reduction in the acreage of this type.

Much of the birch cover type originated after forest fires in the early 1900s, which can be seen by the relatively large acreage greater than 70 years old. Low acreage in the younger age classes stems partly from limited markets and levels of harvest.

Chart 3.3 cp6

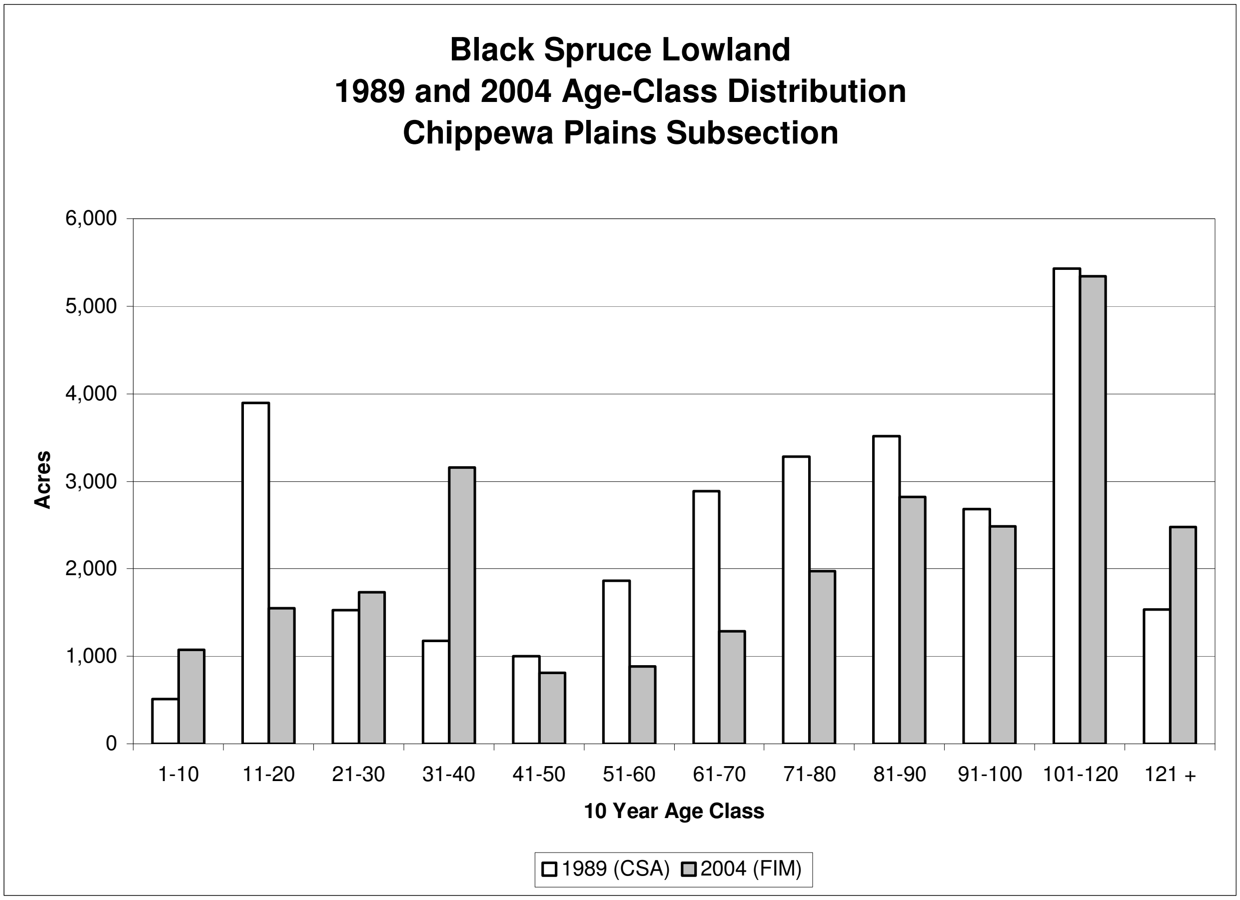


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

The black spruce upland cover type is not common in this subsection. The stands that exist are likely upland fringes of lowland spruce types or upland plantations.

The limited acreage makes it difficult to draw conclusions regarding the dynamics of change; however, it appears that a significant portion of the older lowland fringes were harvested between 1989 and 2004.

Chart 3.3 cp7



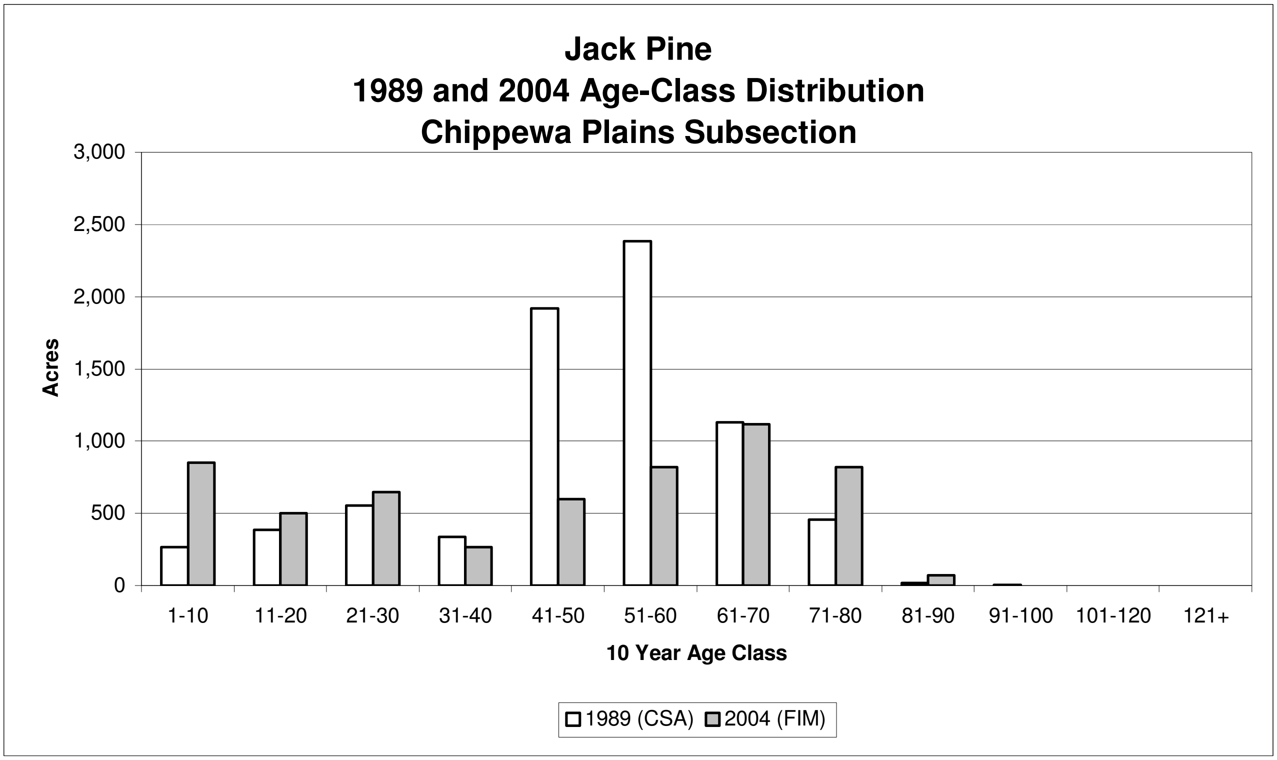
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the black spruce lowland cover type occupied 15 percent (29,305 acres) of state-administered timberlands in the Chippewa Plains and in 2004 - it occupied 13 percent (25,578 acres). This amounts to a 13 percent decrease in the acreage of the type.

Black spruce has had markets and been harvested for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested lowland spruce sites regenerate naturally or through artificial seeding to black spruce.

It is important to understand that black spruce occupies sites that have a broad range of productivity. Trees on the poorer sites take many years to produce marketable products in harvestable quantities. This characteristic is reflected in the large acreages in the 100-year-plus age classes.

Chart 3.3 cp8

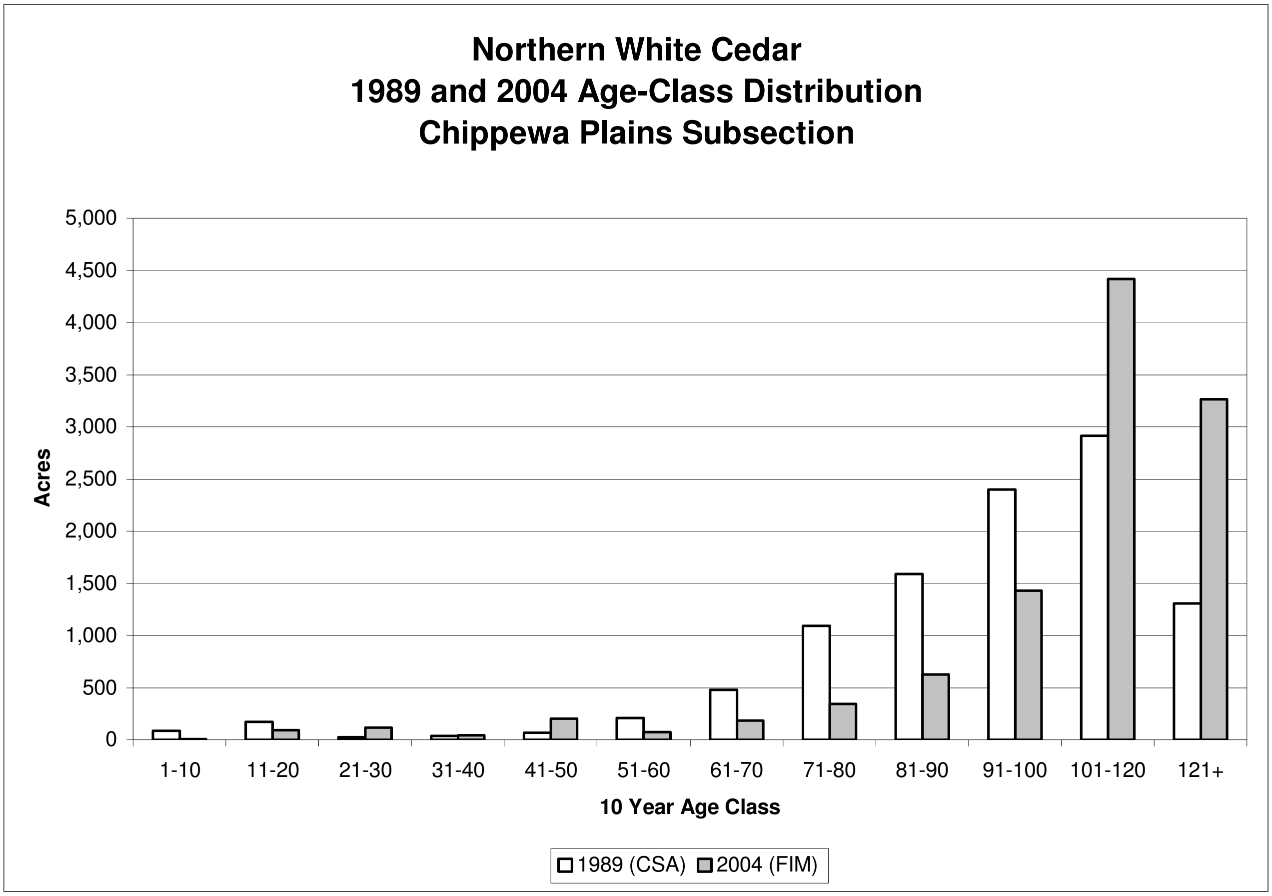


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

In 1989, the jack pine cover type occupied 4 percent (7,450 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 3 percent (5,689 acres). This amounts to a 24 percent decrease in the acreage of the type.

The 24 percent decrease in acreage is due in part to the aging of the cover type and the resulting jack pine budworm and bark beetle attacks. It is also due in part to the choice to replace jack pine on better sites with red pine or white spruce for reasons that include pest resistance, product potential, and lower susceptibility to browsing. Still, some planting and seeding to jack pine have been successful, resulting in a significant acreage in the one- to 10-year age class.

Chart 3.3 cp9

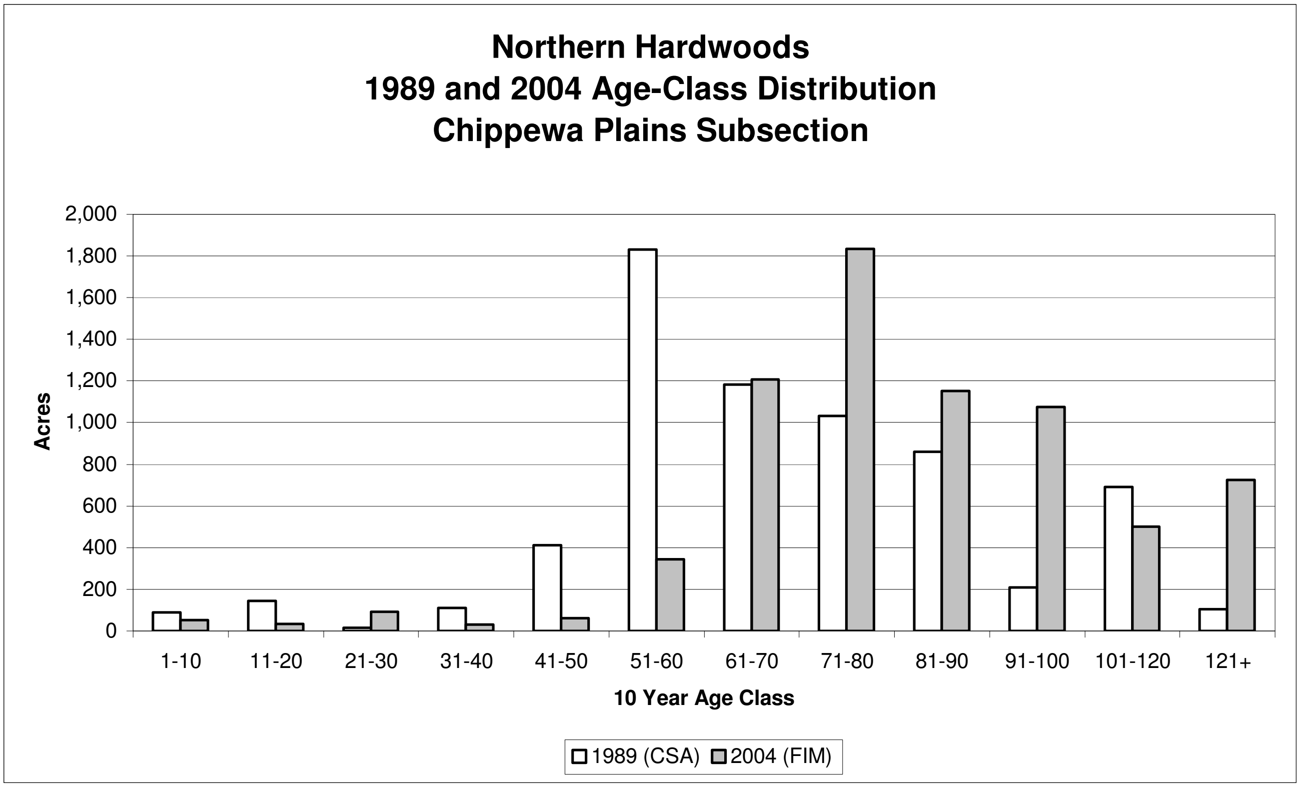


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the northern white cedar cover type occupied 5 percent (10,373 acres) of state-administered timberlands in the Chippewa Plains and in 2004. occupied 6 percent (10,800 acres). This amounts to a 4 percent increase in type acreage.

Harvesting of white cedar has been virtually suspended on state land for some time. This is due to its significant value as wintering cover for deer and the difficulty with its regeneration. This has resulted in a substantial portion of the type in older age classes with a limited number of young stands.

Chart 3.3 cp10



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

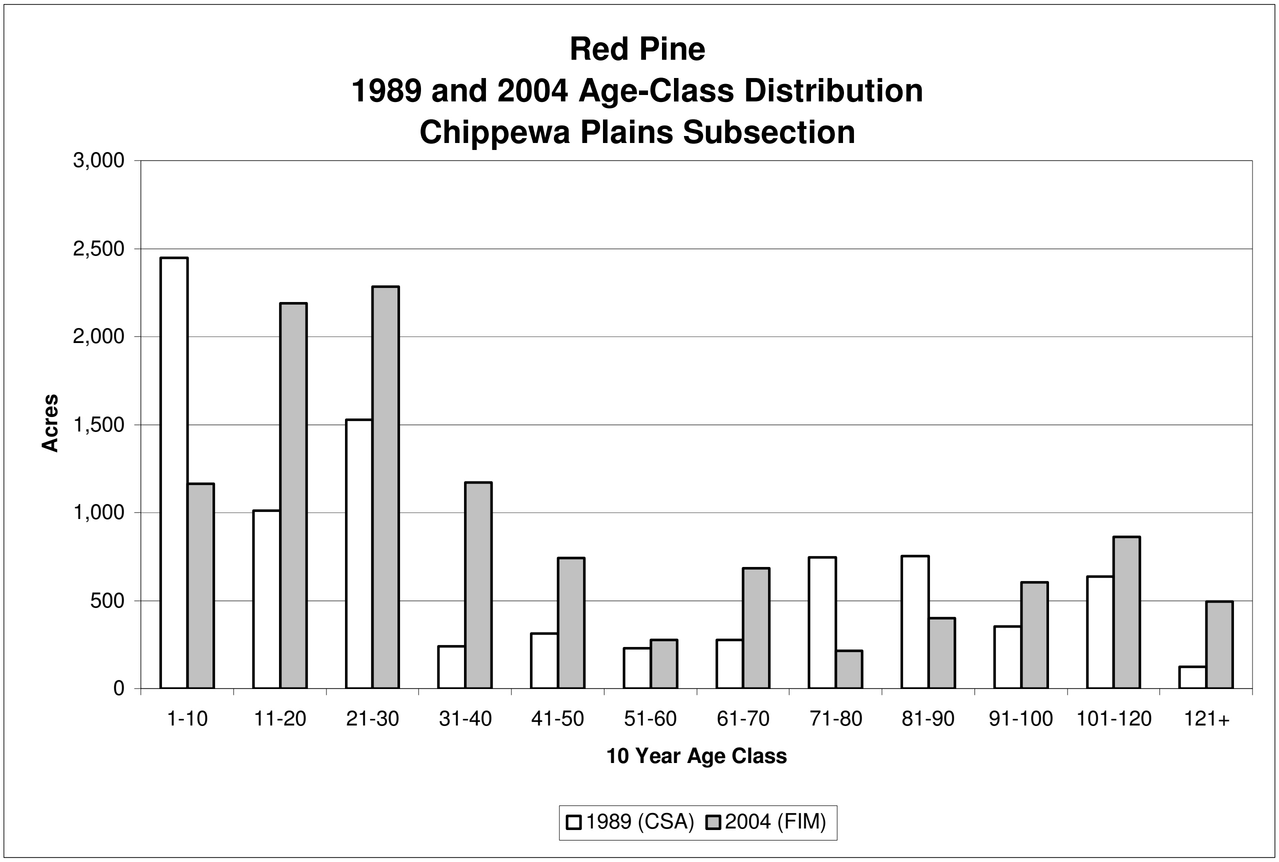
In 1989, the northern hardwoods cover type occupied 3 percent (6,682 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 4 percent (7,108 acres). This represents a 6 percent increase in the acreage of this type.

Many northern hardwood stands originated following the drought and fires of the 1930s. This is evidenced by the concentration of stands in the 71- to 80-year age class. A limited mount of regeneration harvesting has occurred since 1989, as indicated by the limited acreage in the zero- to 10-year age class.

Some partial-cut harvesting has occurred in stands with higher-quality trees. Most of this harvesting does not remove enough to set these stands back into the zero- to 10-year age class, so they continue to show up as maturing northern hardwood. Older stands also frequently appear when aspen is the primary cover-type species and is either removed or allowed to deteriorate, leaving the hardwood component. These factors combine to expand the population of stands in the older age classes.

Other primary reasons for changes are likely to include the continued aging of forest stands and updates to the forest inventory.

Chart 3.3 cp11



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

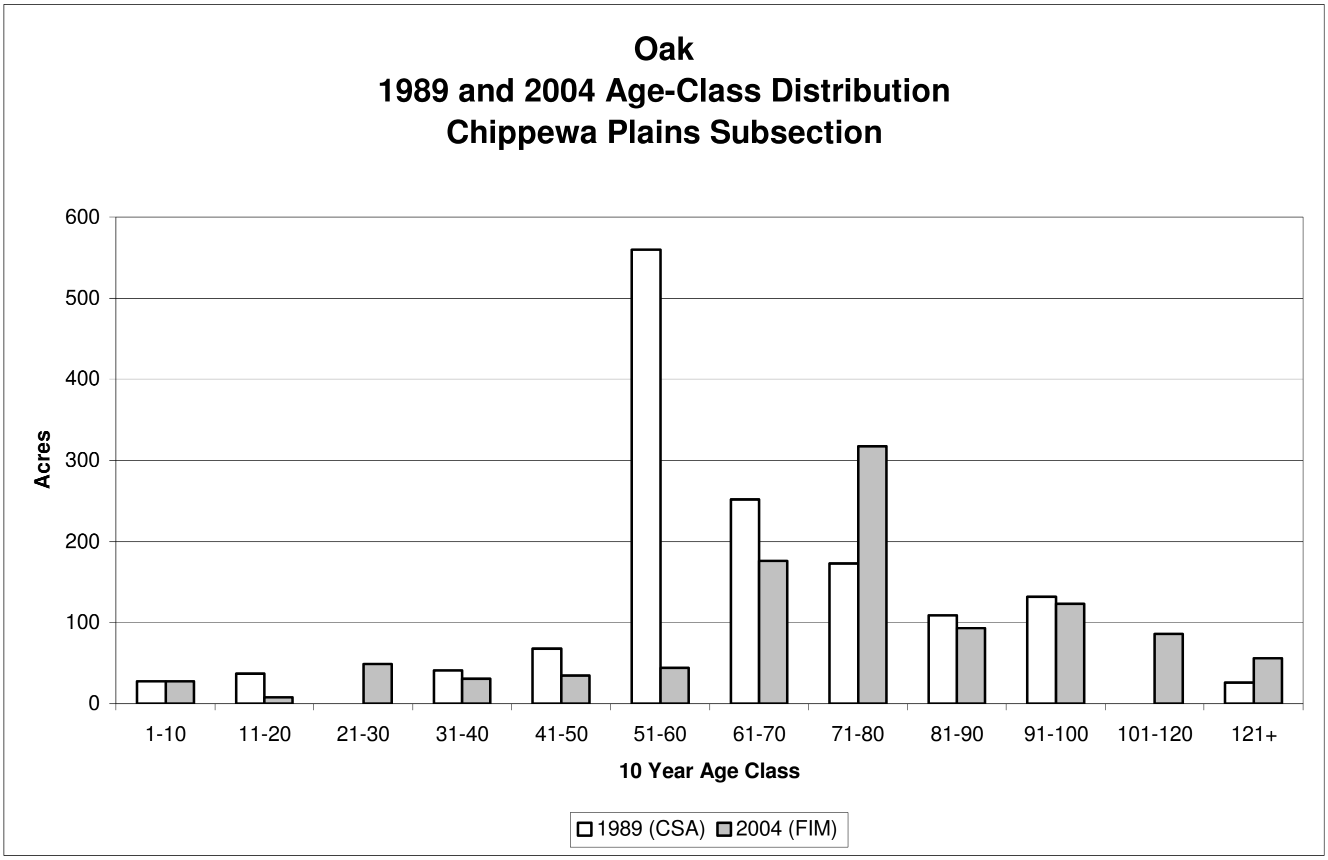
In 1989, the red pine cover type occupied 4 percent (8,657 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 6 percent (11,084 acres). This amounts to a 28 percent increase in the acreage of this type.

The primary reason for the large increase in the zero- to 40-year age classes is a long-standing effort to plant red pine. Some of this has been done on natural red/white pine sites that had become occupied by other cover types (e.g., aspen and hardwoods). In other instances, a choice has been made to replace jack pine on better sites due to red pine's pest resistance, product potential, and lower susceptibility to browsing.

Limited regeneration harvesting has occurred in this cover type in the past 10 years as indicated by the slight reductions in the older age classes. Much of the harvest in the red pine cover type occurs through periodic thinning of stands, which would not have a significant effect on changes in cover-type age classes. Additionally, red pine stands that are clear-cut are usually restored using red pine, which tends to maintain the acreage.

Other changes are likely due to the continued aging of forest stands and updates to the forest inventory.

Chart 3.3 cp12



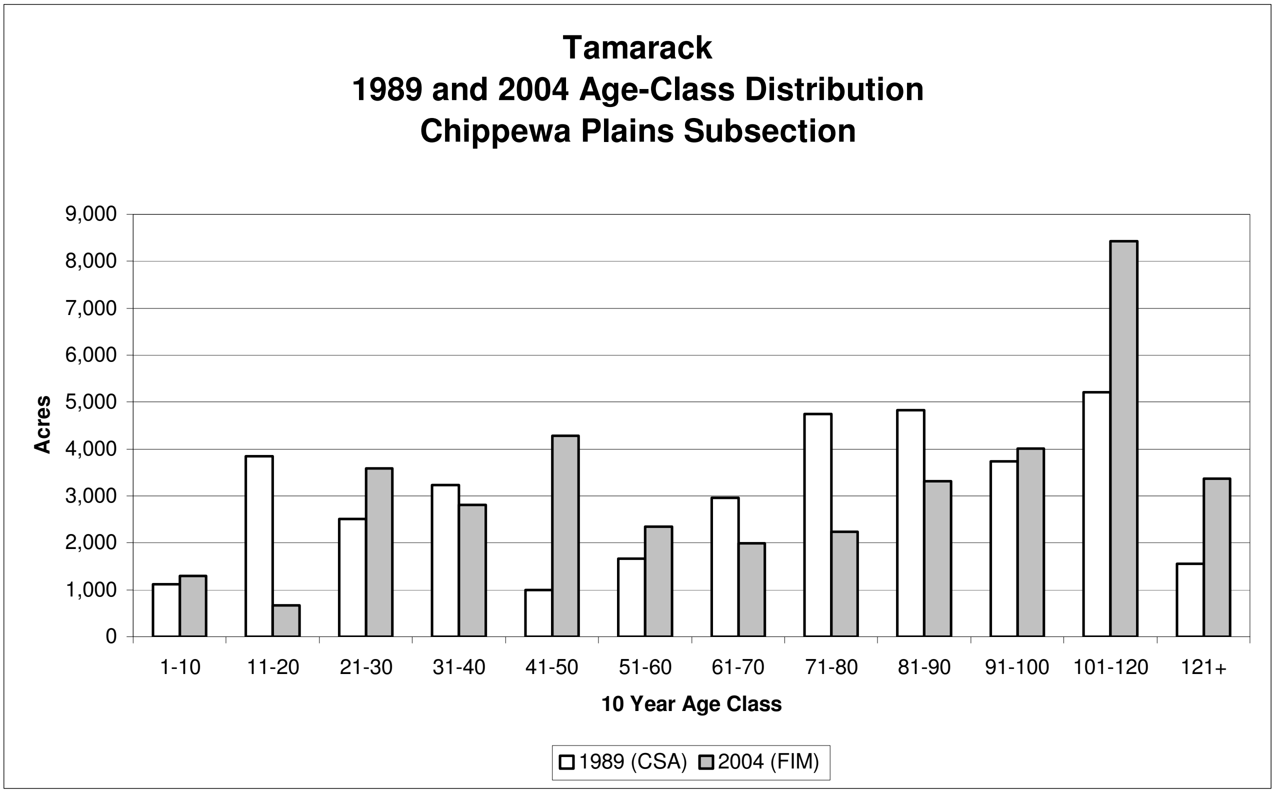
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the oak cover type occupied 1 percent (1,426 acres) of state-administered timberlands and in 2004 occupied 1 percent (1,045 acres). This amounts to a 27 percent decrease in the acreage of this type.

A significant portion of the oak in this subsection grows as a component of cover types such as jack pine and aspen that became more common following the fires of the early 1900s. It occurs as individual scattered trees or small clumps that were not classified as separate stands during the original forest inventory. During the period from 1989 through 2004, it has become common practice to reserve much of the oak included in timber sales for its wildlife value and to maintain diversity. In this subsection, however, it appears that oak is not particularly common or found in dense clumps. This may have resulted in more harvesting and less reclassification to the oak type than may have occurred in other subsections, which caused a reduction in acres.

The relatively small size of the oak cover type in the Chippewa Plains Subsection also means that it is susceptible to significant impact from inventory error, which may inflate the percentage change in acreage.

Chart 3.3 cp13



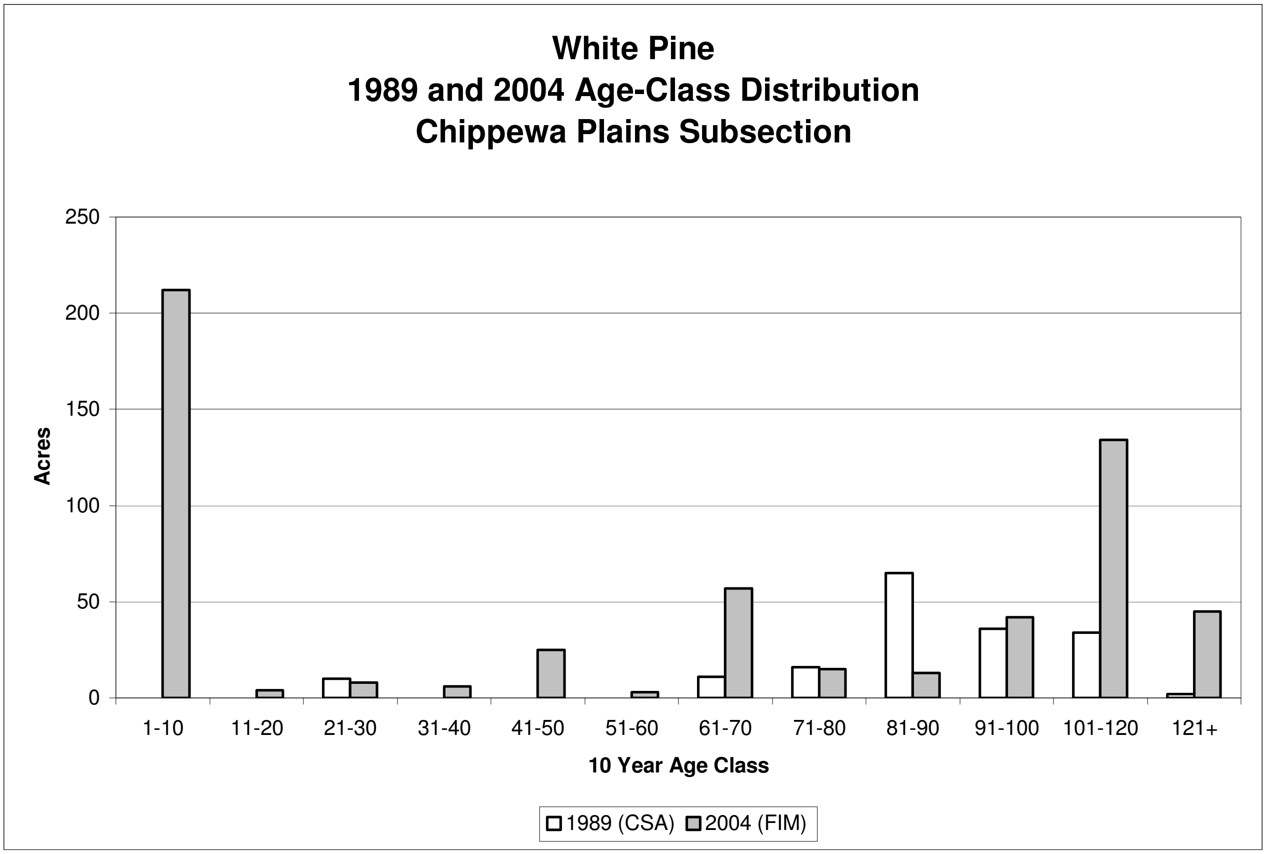
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the tamarack cover type occupied 18 percent (36,382 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 20 percent (38,324 acres). This amounts to a 5 percent increase in the acreage of this type.

Tamarack has had markets and experienced harvesting for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested tamarack sites regenerate naturally to tamarack. Since recent markets have been poor, the acreage in the zero- to 10-year age class is significantly below average.

Other changes are likely due to the continued aging of forest stands, loss of stands to insects and disease (e.g., larch sawfly, tamarack beetle, beaver flooding, etc.), and updates to the forest inventory.

Chart 3.3 cp14



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

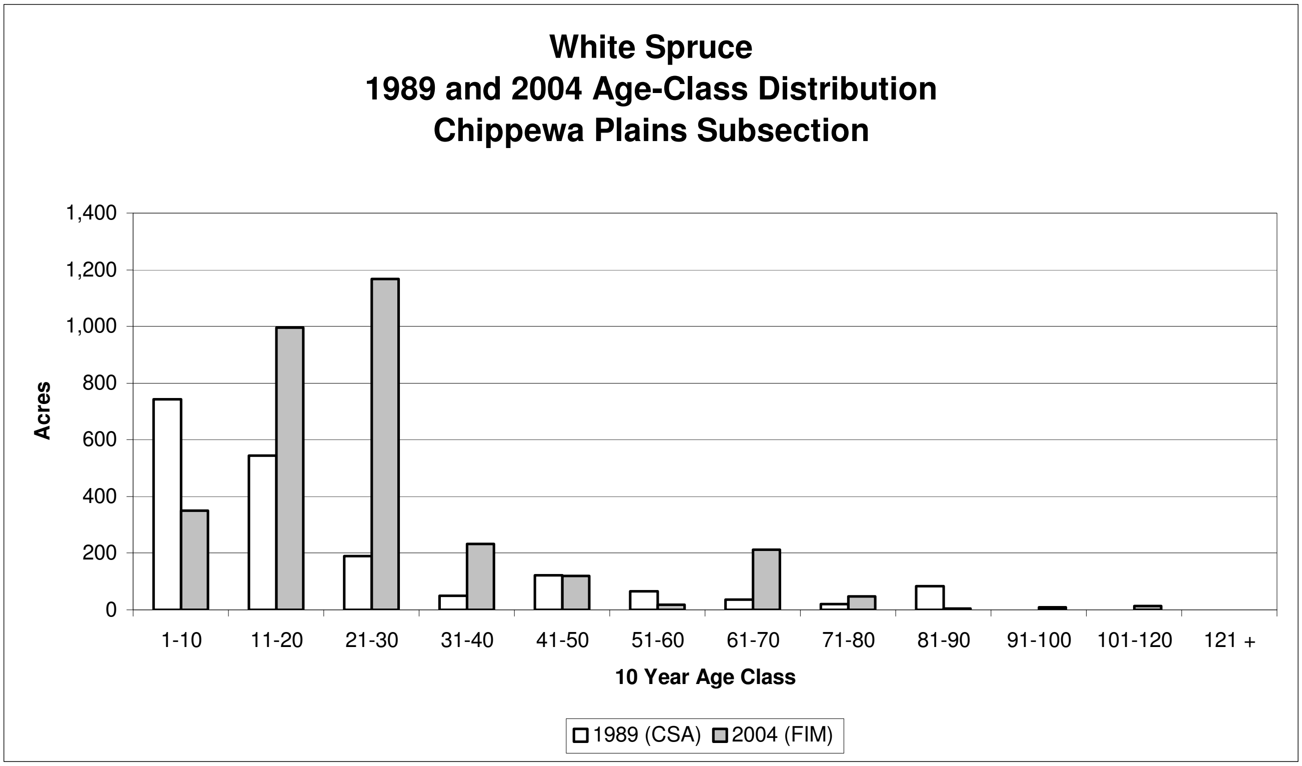
In 1989, the white pine cover type occupied less than 1 percent (174 acres) of state-administered timberlands in the Chippewa Plains and in 2004 still occupied less than 1 percent (565 acres). Although the acreage increase is small, it amounts to a 225 percent increase in the type.

An effort to more fully identify white pine cover-type acres in the forest inventory has increased the total type acreage. Older stands also frequently appear when aspen is the primary cover-type species and is either removed or allowed to deteriorate, leaving the white pine component.

A very limited amount of regeneration harvesting has occurred in the white pine cover type over the past 10 years. Consequently, most of the increase in acreage of young stands has resulted from planting or seeding areas that were previously other cover types such as balsam fir and paper birch.

One other primary reason for change is the continued aging of the cover type.

Chart 3.3 cp15



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the white spruce cover type occupied 1 percent (1,856 acres) of state-administered timberlands in the Chippewa Plains and in 2004 occupied 2 percent (3,171 acres). This amounts to a 2 percent increase in the acreage of the type.

Very little clear-cut harvesting has occurred in this cover type during the past 10 years as only small amounts of it have reached maturity. The large acreage increase in the zero- to 30-year age class is due to planting white spruce on sites that were previously other cover types. In recent years, planting spruce has been favored over planting pine in some areas due to the susceptibility of the pines to animal damage. Other changes are likely due to the continued aging of forest stands and updates to the forest inventory. It should be recognized that white spruce is often an important component of pine and aspen stands.

3.4 Comparison of State Timberland Cover-Type Acres Between 1989 and 2004- Pine Moraines and Outwash Plains

Table 3.4pm

Comparison of State[1] Timberland[2] Cover-Type Acres Between 1989 and 2004 Pine Moraines and Outwash Plains Subsection

Cover Type	1989		2004		Percent Change 1989-2004
	Acres	Percent	Acres	Percent	
Ash/Lowland Hardwoods	4,860	2%	5,872	3%	**21%**
Aspen/Balm	111,155	54%	114,669	55%	**3%**
Balsam Fir	3,171	2%	3,072	1%	**-3%**
Birch	10,043	5%	6,966	3%	**-31%**
Black Spruce Upland	399	0%	78	0%	**-80%**
Black Spruce Lowland	2,859	1%	2,143	1%	**-25%**
Central Hardwoods	0	0%	6	0%	**0%**
Cutover Area[3]	2,479	1%	1,025	0%	**-59%**
Jack Pine	18,290	9%	12,399	6%	**-32%**
Northern White Cedar	2,071	1%	1,687	1%	**-19%**
Northern Hardwoods	7,780	4%	9,701	5%	**25%**
Red Pine	19,381	9%	23,642	11%	**22%**
Oak	12,862	6%	14,553	7%	**13%**
Scotch Pine	7	0%	13	0%	**86%**
Tamarack	7,142	3%	5,565	3%	**-22%**
White Pine	942	0%	2,118	1%	**125%**
White Spruce	2,421	1%	3,510	2%	**45%**
Total Acres	**205,862**	**100%**	**207,018**	**100%**	**1%**

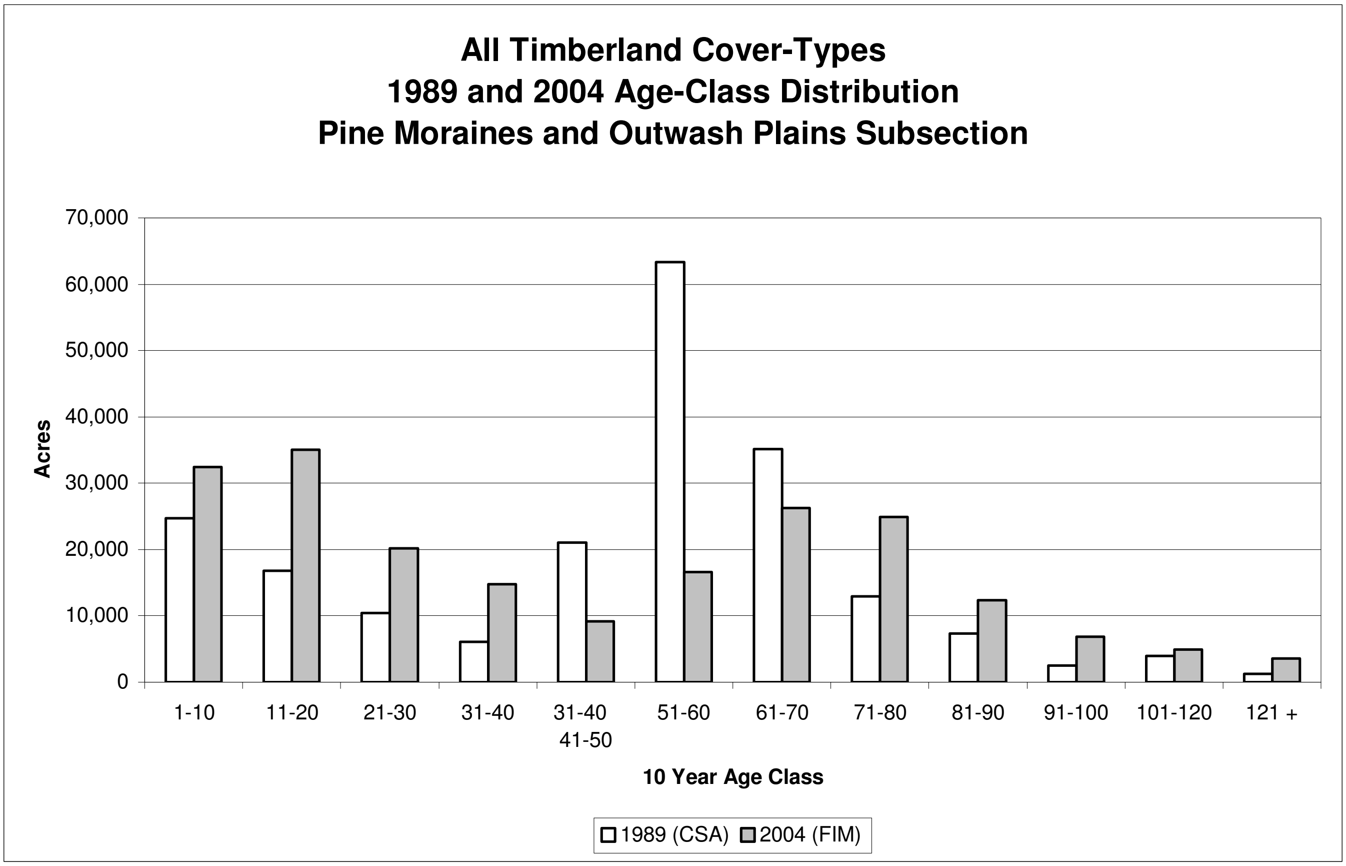
1 Includes only Forestry- and Wildlife-administered lands within the Ecological Classification System (ECS) subsection boundary and based on Minnesota DNR 2004 Cooperative Stand Assessment (CSA) forest inventory.
2 Timberland is defined as forest land capable of producing timber of marketable size and volume at the normal harvest age, not including lands withdrawn from timber utilization by law or statute (see Appendix D: Glossary). However, 2,267 acres of designated old-growth stands have been included in the 2004 data to more accurately depict the change over time and the range of age classes on the landscape.
3 Cutover Area is defined as a site that was harvested within the last three years with no timber species present or visible when the site was last inventoried. Usually the site is in the process of regeneration. This code is used less frequently than in the past. Now, stands are usually classified according to the best estimate of what the regeneration species will be on the site. The inventory data is updated upon completion of the first regeneration field survey, usually one, three, or five years after harvest.

Based on the forest inventory, there was a 1 percent increase (from 205,862 to 207,018 acres) in total state-administered timberland acres between 1989 and 2004 in the Pine Moraines and Outwash Plains Subsection.

The cover-type acreage changes are likely due to harvesting, planting, or seeding to a different cover type, loss due to insects or disease (e.g., spruce budworm damage to balsam fir, drought effects on birch, etc.), updates in the CSA forest inventory, and natural succession of old-age stands. Damage agents (e.g., spruce budworm damage to balsam fir; early 1990s drought effects on birch, jack pine budworm, beaver flooding, etc.) have also had significant impacts on stands during the 1989 to 2004 period.

The following charts 3.4 pm1—3.4 pm 13 compare age-class distribution by cover type for state-administered (i.e., Forestry and Wildlife) timberlands in this subsection for the years 1989 and 2004.

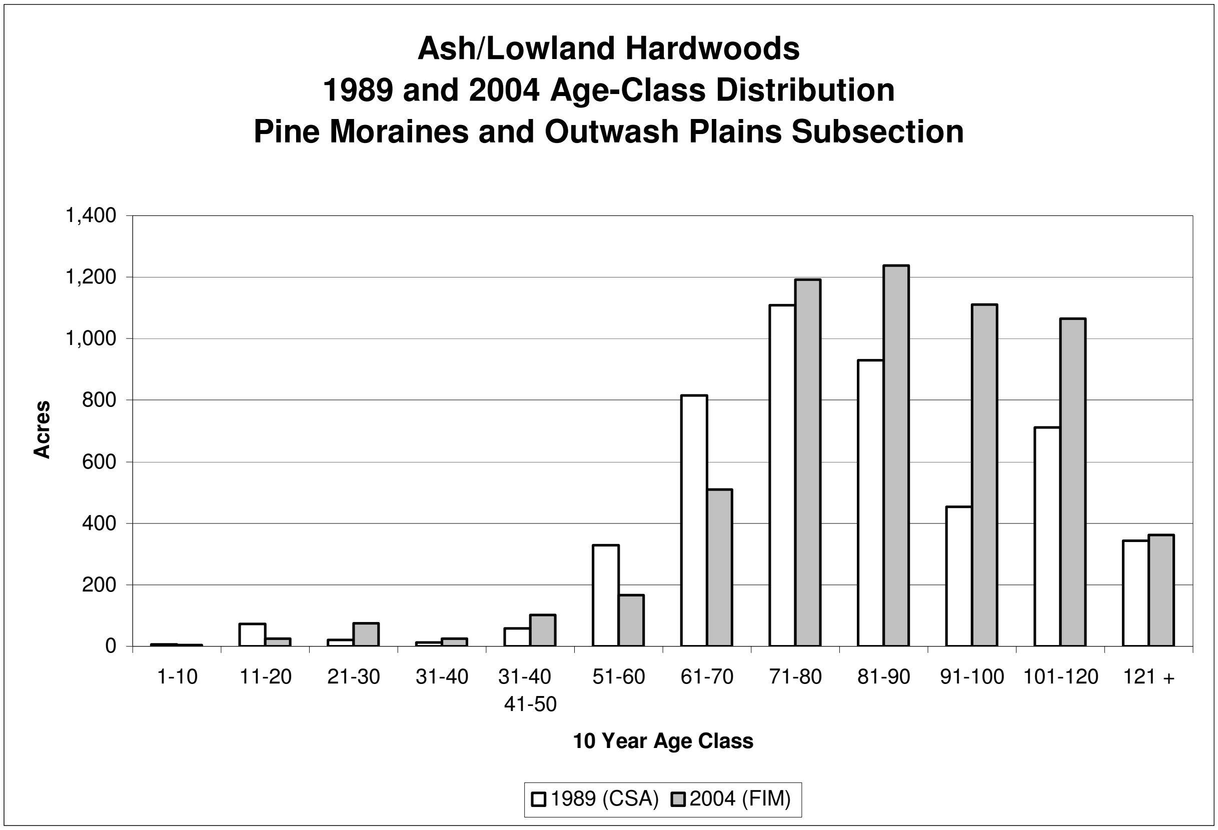
Chart 3.4 pm1



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

This chart shows the acreage of all state timberland cover types combined in 1989 and 2004 in the Pine Moraines and Outwash Plains Subsection. Based on the forest inventory, there was a 3 percent decrease in total state-administered timberland acres (from 200,744 acres to 194,160 acres) between 1989 and 2004. Changes in the acreage of individual age classes are likely due to the continued aging of forest stands, harvesting, planting/seeding, and updates to the forest inventory.

Chart 3.4 pm2



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

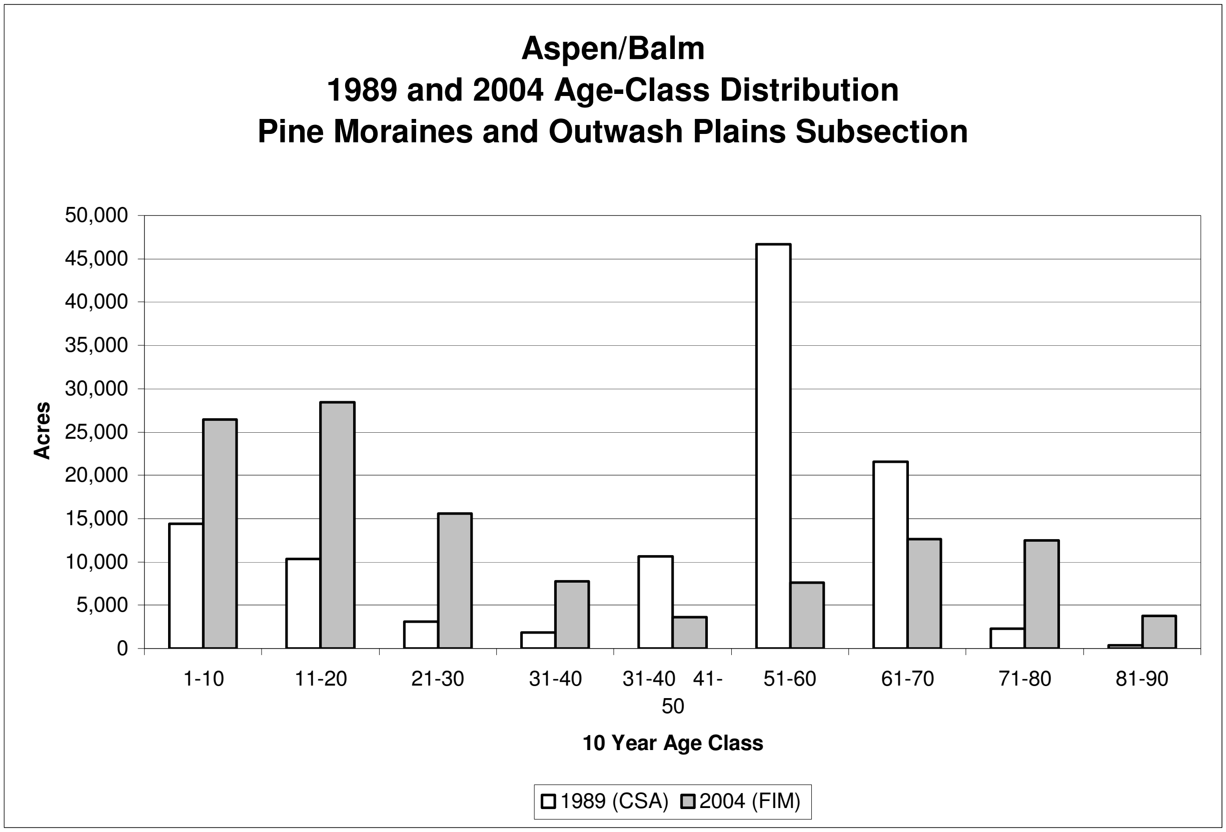
In 1989, the ash/lowland hardwood cover type amounted to 2 percent (4,860 acres) of the state timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 consisted of 3 percent (5,872 acres). The change in acreage, however, amounted to a 21 percent increase.

There has been a general aging of the ash/lowland hardwood cover type from 1989 to 2004 with a very limited amount of regeneration harvesting occurring. This is evidenced by the limited acreage in the zero- to 10-year age class and the expansion of higher age classes. This is due largely to limited markets for the low- to medium-quality material found in many of these stands. Also, the bulk of these stands are only accessible in winter due to the wet sites they occupy and a desire to avoid soil damage.

Some partial-cut harvesting has occurred in stands with higher-quality trees. Most of this harvesting does not remove enough to set these stands back into the zero- to 10-year age class, so they continue to show up as maturing ash and lowland hardwood stands. Older stands also frequently appear when aspen or balm of Gilead is the primary cover-type species and is removed or allowed to deteriorate, leaving the ash or hardwood component. These factors combine to expand the population of stands in the older age classes.

Updates to the forest inventory may also be responsible for some changes.

Chart 3.4 pm3



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

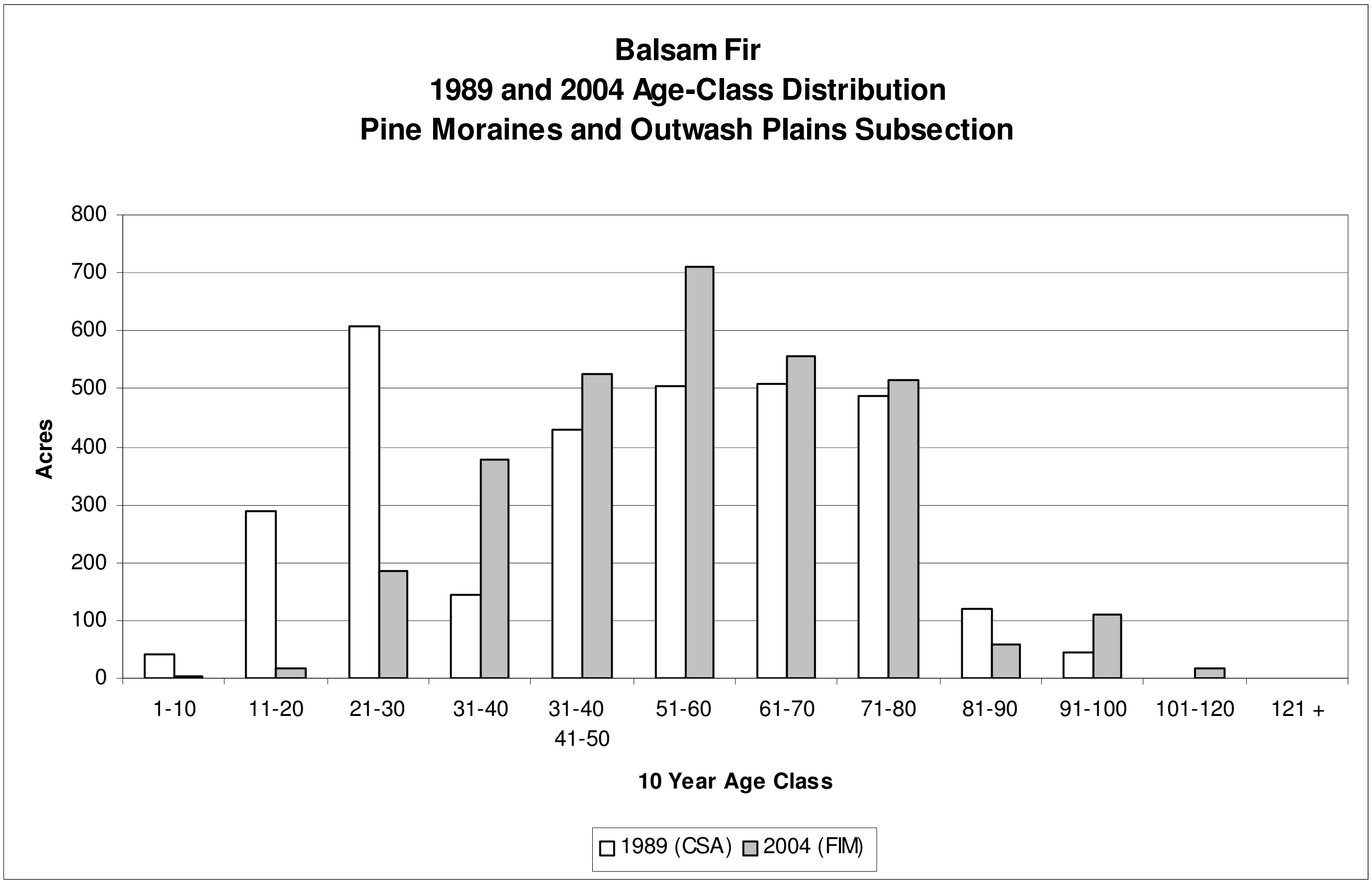
In 1989, the aspen and balm of Gilead cover types occupied 54 percent (111,155 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 55 percent (114,669 acres). The change in acreage amounted to a 3 percent increase over the period.

Increases in overall type acreage are likely due to natural aspen and balm regeneration coming in following the harvest of another cover type and updates to the forest inventory.

The expansion of younger age classes is due to the increase in harvesting that has occurred. Over the past 20 years, markets have changed and these species have become heavily used in the production of paper and structural panels.

The chart shows an increase in the number of acres in age classes beyond 70 years. These likely represent the last stands that were regenerated following fires in the 1930s. The chart also depicts an impending decrease in available harvest acres due to the limited number of stands entering maturity in the 41- to 60-year age class. This is the legacy of meager aspen markets prior to the 1970s.

Chart 3.4 pm4

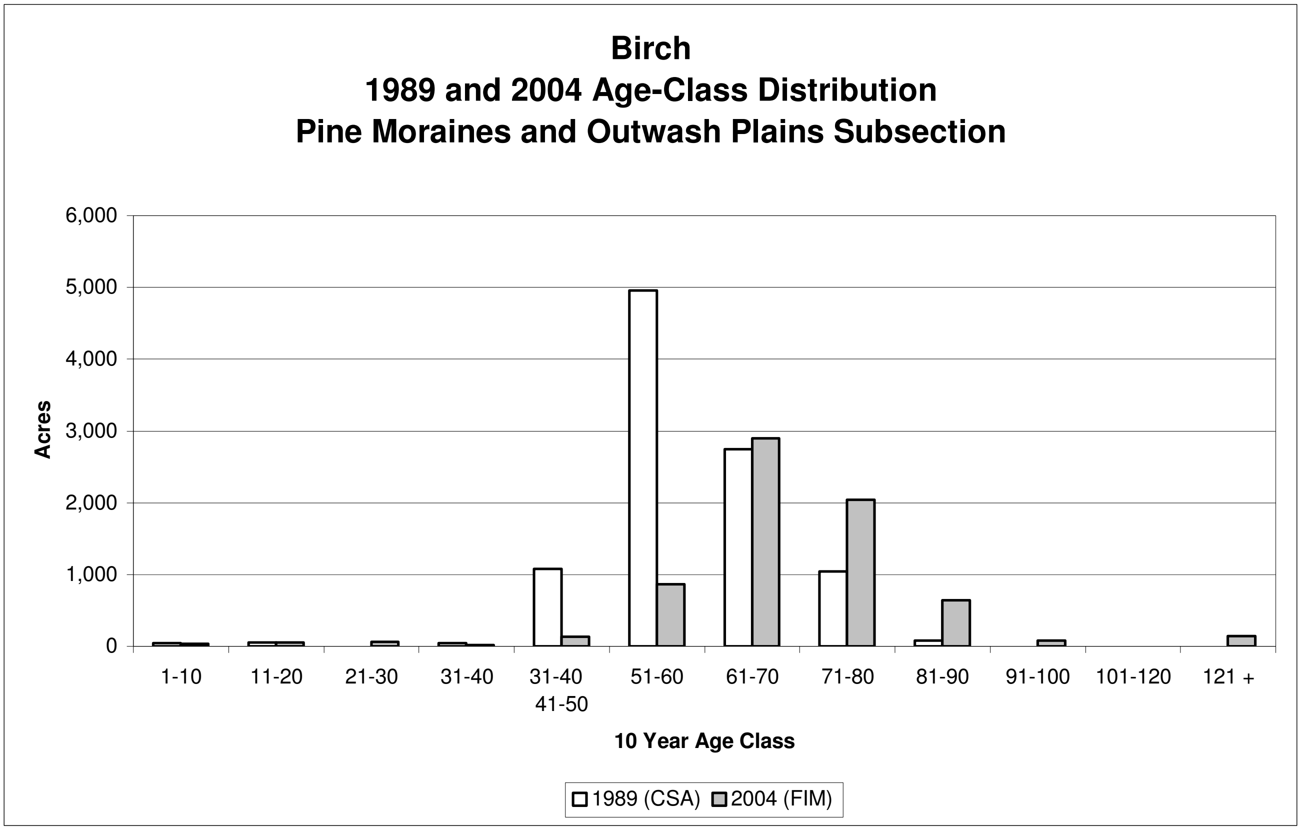


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the balsam fir cover type occupied 2 percent (3,171 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 1 percent (3,072 acres). This amounts to a 3 percent decrease in the acreage of the type.

The 3 percent decrease in cover-type acres is primarily due to the aging of stands and mortality from forest insects (e.g., spruce budworm). Re-inventory of stands where the balsam fir component has died due to spruce budworm attack is likely to result in reclassification to another cover type. Also, balsam fir harvested for regeneration or salvage is commonly replaced by natural aspen reproduction or planted to pine or spruce. It is important to recognize that balsam fir continues to be a common understory species or component in other cover types.

Chart 3.4 pm5



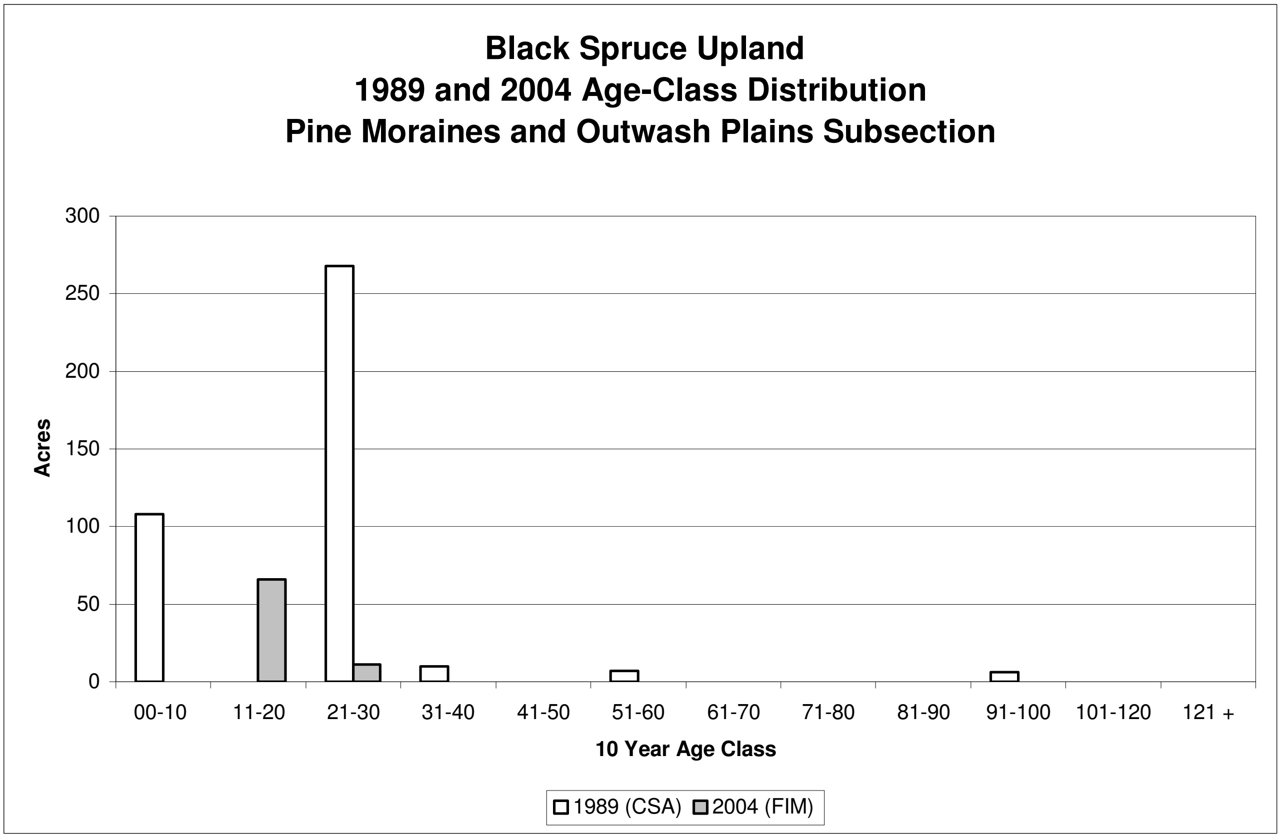
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the birch cover type occupied 5 percent (10,043 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 3 percent (6,966 acres). This amounted to a 31 percent reduction in the acreage of this type.

Much of the birch cover type originated after forest fires in the early 1900s, which can be seen by the relatively large acreage greater than 70 years old. Low acreage in the younger age classes stems partly from limited markets and levels of harvest.

The reduction in the total type acreage is likely due to a number of factors. Recently there have been difficulties in regenerating birch because of the advanced age of the cover type, brush competition, and browsing. Also, the late 1980s to early 1990s drought period resulted in mortality from birch decline and bronze birch borer damage, causing some stands to succeed to other types. In addition, poorly stocked birch stands and merchantable stands have often been converted to other species such as white spruce and pine after harvesting. Updates to the CSA forest inventory may have also resulted in some acreage changes.

Chart 3.4 pm6

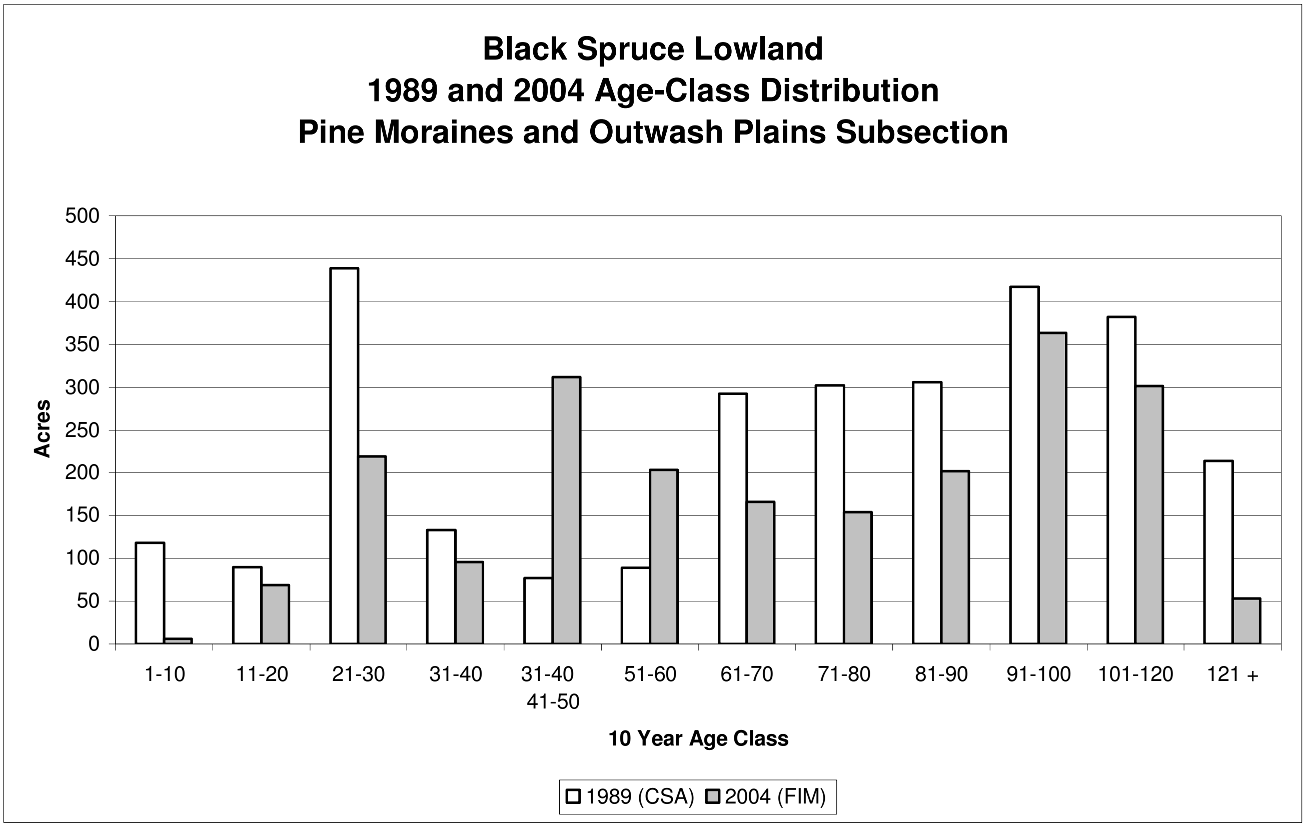


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

The black spruce upland cover type is uncommon in this subsection. The stands that exist are likely upland fringes of lowland spruce types or upland plantations.

The limited acreage makes it difficult to draw conclusions regarding the dynamics of change; however, it appears that significant portions of the younger plantations were harvested between 1989 and 2004.

Chart 3.4 pm7



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

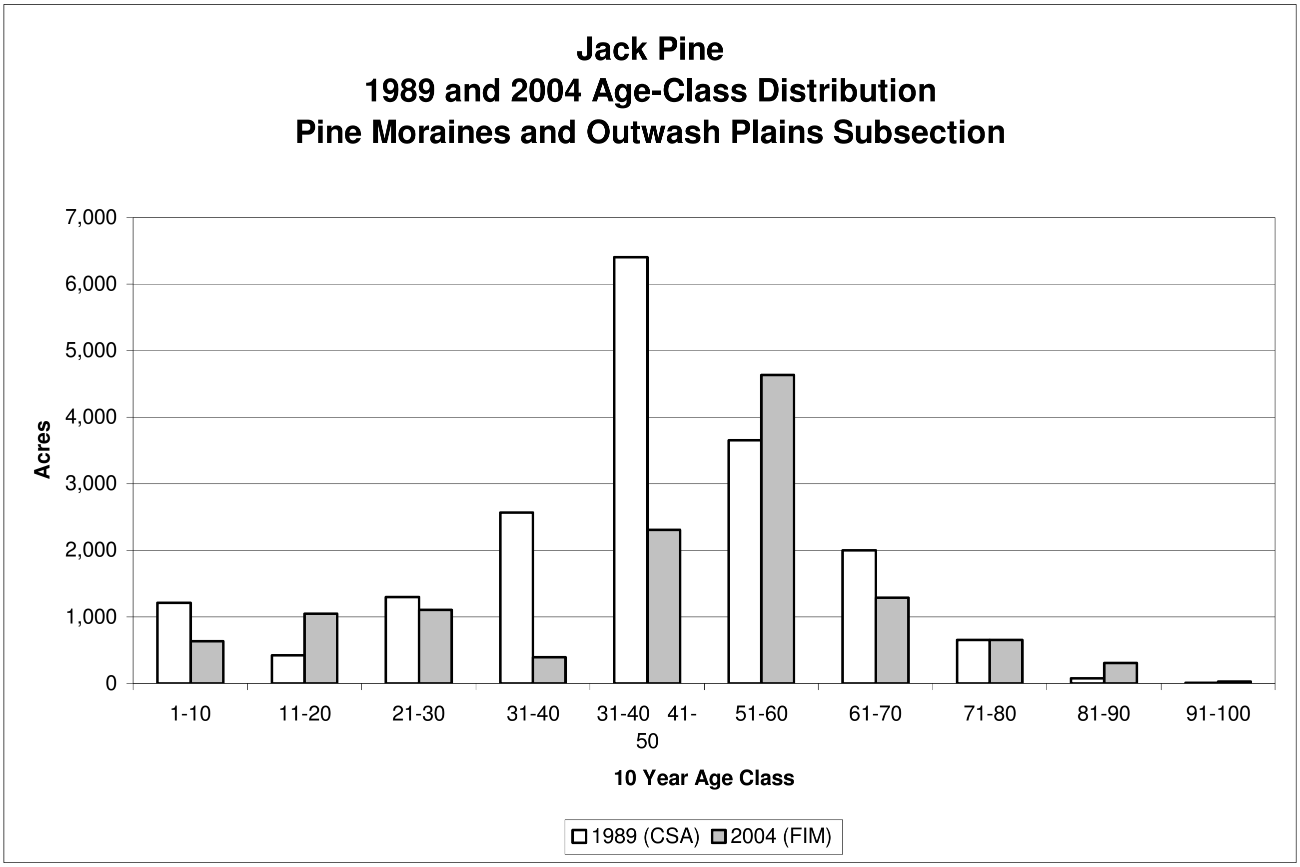
In 1989, the black spruce lowland cover type occupied 1 percent (2,859 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 1 percent (2,143 acres). This amounts to a 25 percent decrease in the acreage of the type.

Black spruce has had markets and been harvested for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested lowland spruce sites regenerate naturally or through artificial seeding to black spruce.

It is important to understand that black spruce occupies sites that have a broad range of productivity. Trees on the poorer sites take many years to produce marketable products in harvestable quantities. This characteristic is reflected in the large acreages in the 100-year- plus age classes.

Other changes in age-class distribution are likely due to the continued aging of forest stands, limited access to some stands, and updates to the forest inventory.

Chart 3.4 pm8



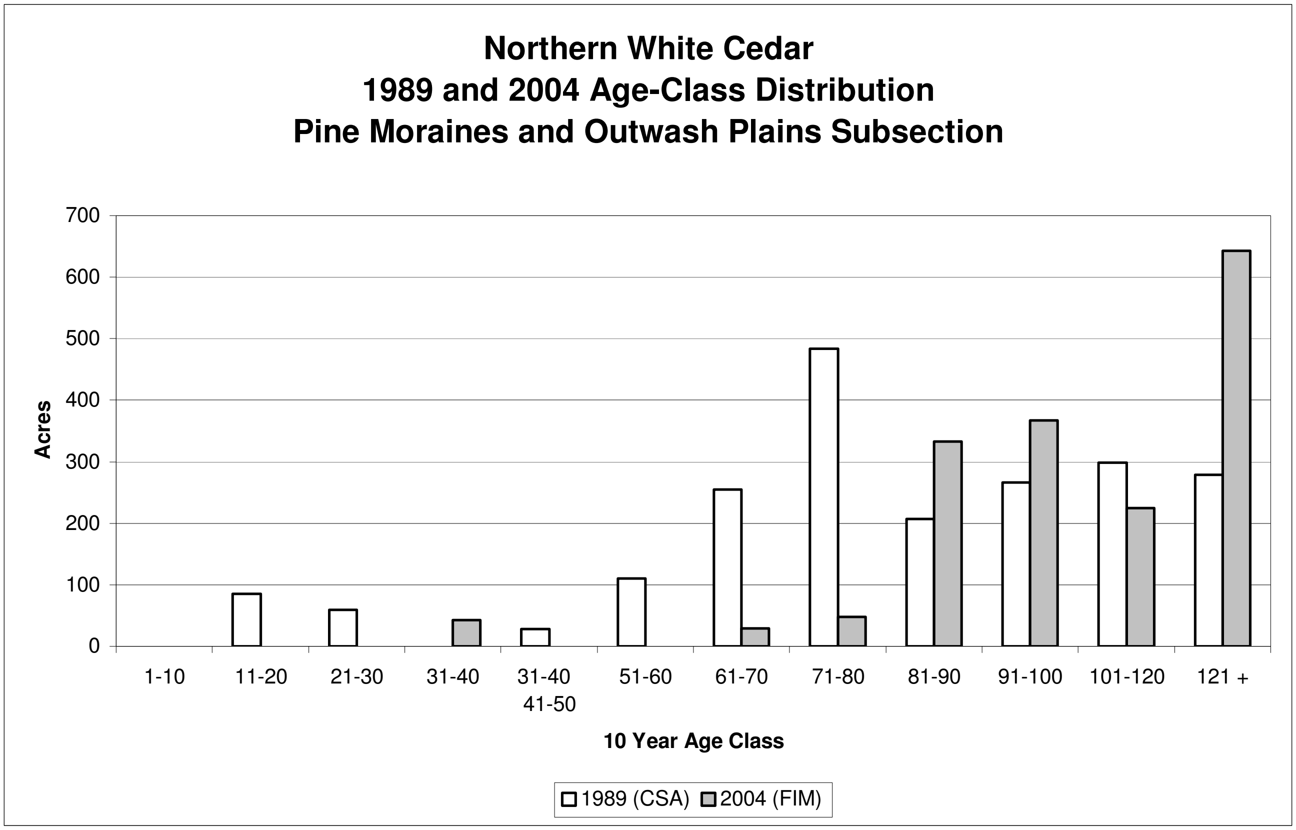
Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the jack pine cover type occupied 9 percent (18,290 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 6 percent (12,399 acres). This amounts to a 32 percent decrease in the acreage of the type.

The 32 percent decrease in acreage is due in part to the aging of the cover type and the resulting jack pine budworm and bark beetle attacks. It is also due in part to the choice to replace jack pine on better sites with red pine or white spruce due for reasons that include pest resistance, product potential, and lower susceptibility to animal damage. This has been particularly true in recent years with high deer populations. Still, some planting and seeding to jack pine have been successful resulting in a significant acreage in the one- to 10-year age class.

Also, some changes are likely due to updates in forest inventory.

Chart 3.4 pm9

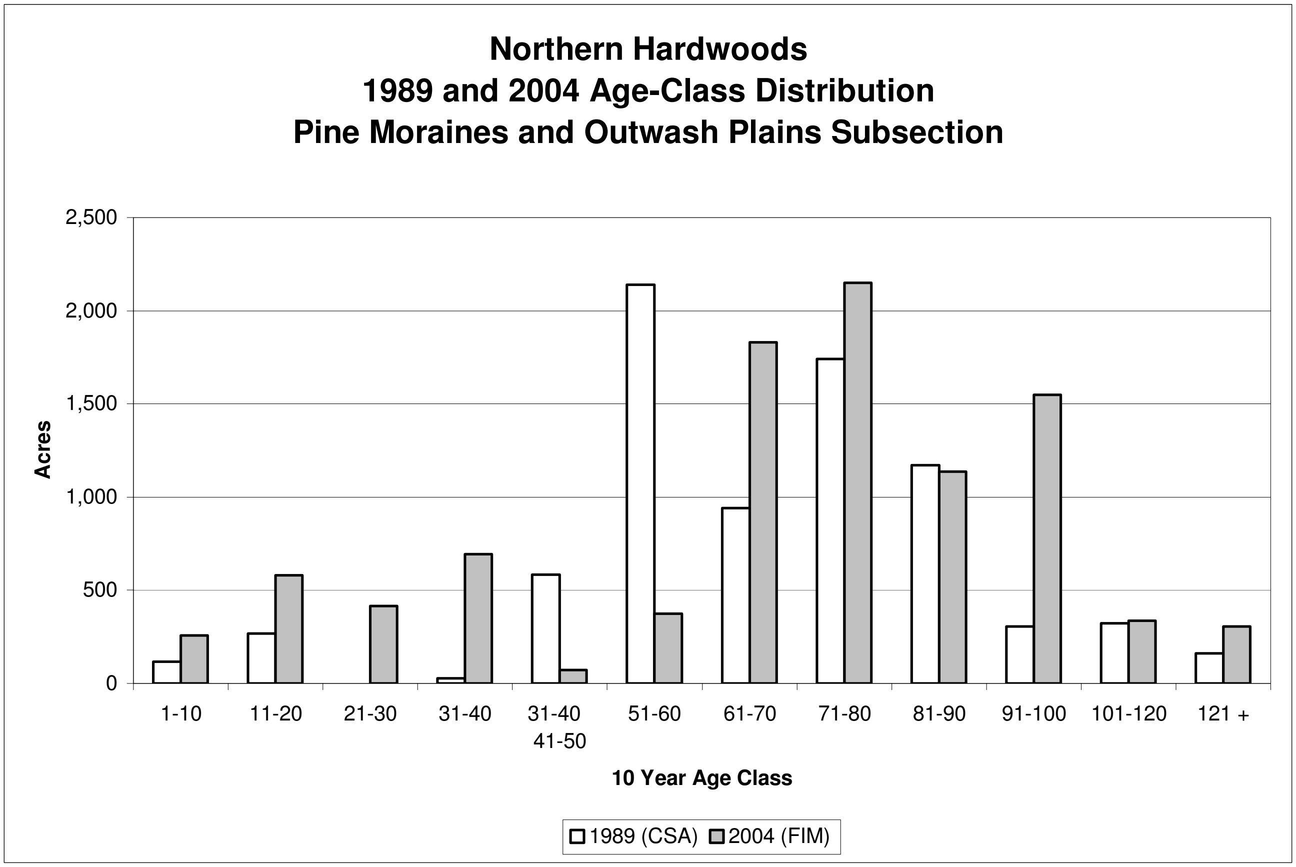


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the northern white cedar cover type occupied 1 percent (2,071 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 1 percent (1,687 acres). This still amounted to 19 percent reduction in type acreage.

Harvesting of white cedar has been virtually suspended on state land for some time. This is due to its significant value as wintering cover for deer and the difficulty experienced in regenerating it due to browsing. This has resulted in a substantial portion of the type in older age classes with a limited number of young stands.

Chart 3.4 pm10



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

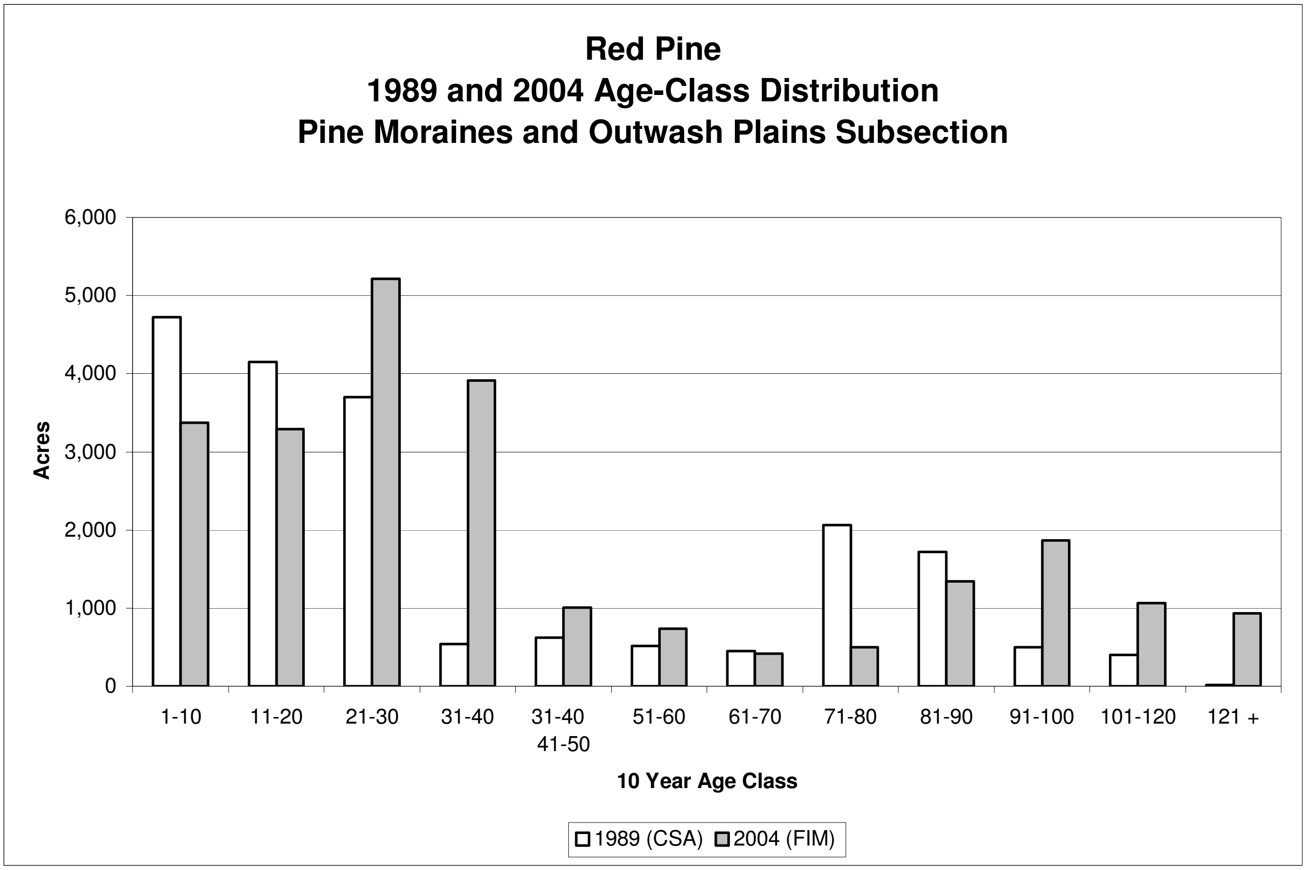
In 1989, the northern hardwoods cover type occupied 4 percent (7,780 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 5 percent (9,701 acres). This represents a 25 percent increase in the acreage of this type.

Many northern hardwood stands originated following the drought and fires of the 1930s. This is evidenced by the concentration of stands in the 71- to 80-year age class. A limited amount of regeneration harvesting has occurred since 1989, as indicated by the limited acreage in the zero-to10-year age class.

A couple of key factors combine to expand the population of northern hardwood stands in older age classes. First, middle- to older-aged northern hardwood stands frequently appear when a primary cover-type species such as aspen, birch, or jack pine is removed or allowed to deteriorate, leaving the hardwood component. Secondly, some partial-cut harvesting occurs in stands with higher-quality trees but does not remove enough to set these stands back into the zero- to 10-year age class. These stands continue to show up as a maturing northern hardwood cover type.

Other primary reasons for changes are likely to include the continued aging of forest stands and updates to the forest inventory.

Chart 3.4 pm11



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

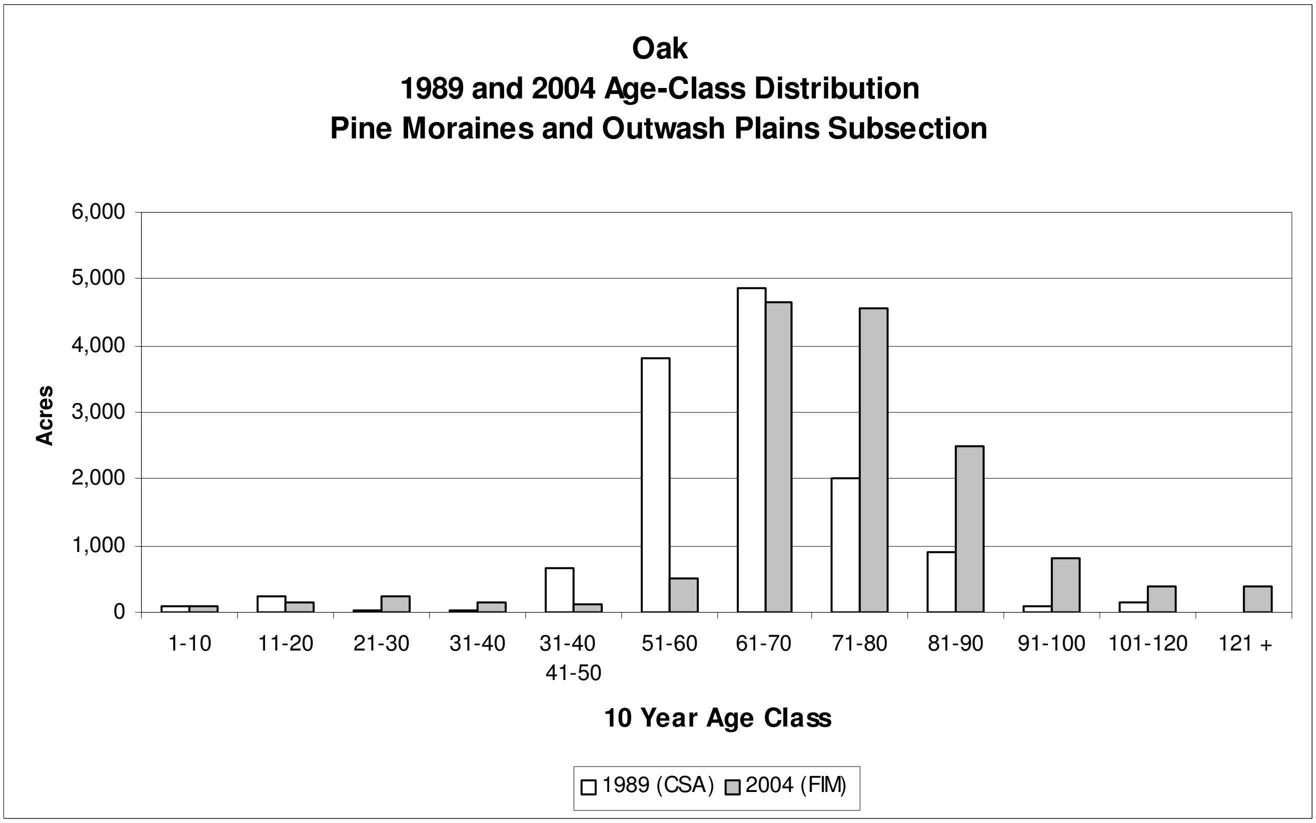
In 1989, the red pine cover type occupied 9 percent (19,381 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 11 percent (23,642 acres). This amounts to a 22 percent increase in the acreage of this type.

The primary reason for the large increase in the zero- to 40-year age classes is a long-standing effort to plant red pine. Some of this has been done on natural red/white pine sites that had become occupied by other cover types (e.g., aspen and hardwoods). In other instances, a choice has been made to replace jack pine on better sites due to red pine's pest resistance, product potential, and lower susceptibility to browsing.

Limited regeneration harvesting has occurred in this cover type in the past 10 years, as indicated by the slight reductions in the older age classes. Much of the harvest in the red pine cover type occurs through periodic thinning of stands, which would not have a significant effect on changes in cover-type age classes. Additionally, red pine stands that are clear-cut are usually restored using red pine, which tends to maintain the acreage.

Other changes are likely due to the continued aging of forest stands and updates to the forest inventory.

Chart 3.4 pm12



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

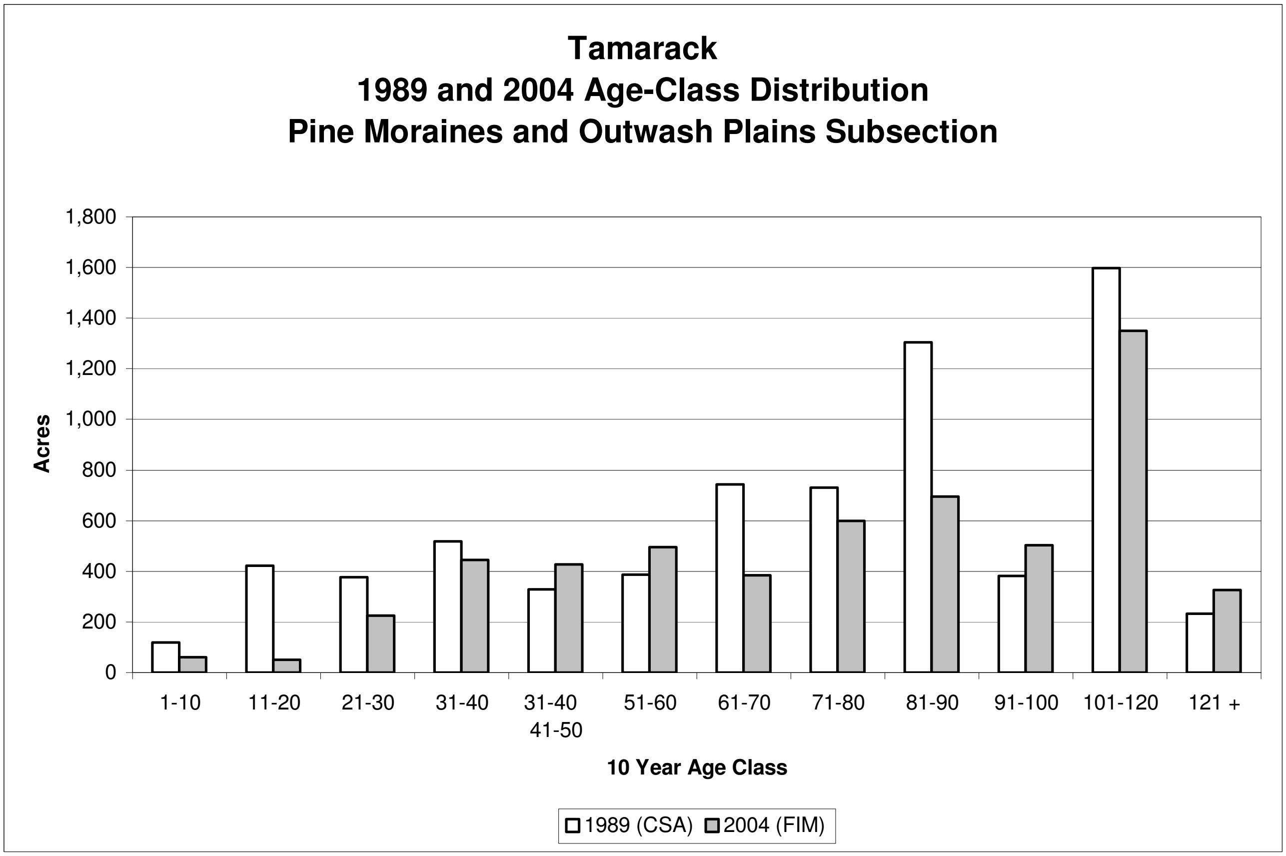
In 1989, the oak cover type occupied 6 percent (12,862 acres) of state-administered timberlands and in 2004 occupied 7 percent (14,553 acres). This amounts to a 13 percent increase in the acreage of this type.

A significant portion of the oak resource grows as a component of cover types such as jack pine and aspen, which became more common following the fires of the early 1900s. It occurs as individual scattered trees or small clumps that were not classified as separate stands during the original forest inventory. During the period from 1989 through 2004, much of the oak included in timber sales was reserved for its wildlife value and to maintain diversity. These retained trees and/or clumps were sometimes reclassified as oak cover type, contributing to an increase in acreage.

In high-site index stands, oak is commonly managed through thinning, which removes volume but does not alter the type designation. This likely has contributed to increased acreage in the older age classes.

One other primary reason for change is the continued aging of the cover type.

Chart 3.4 pm13

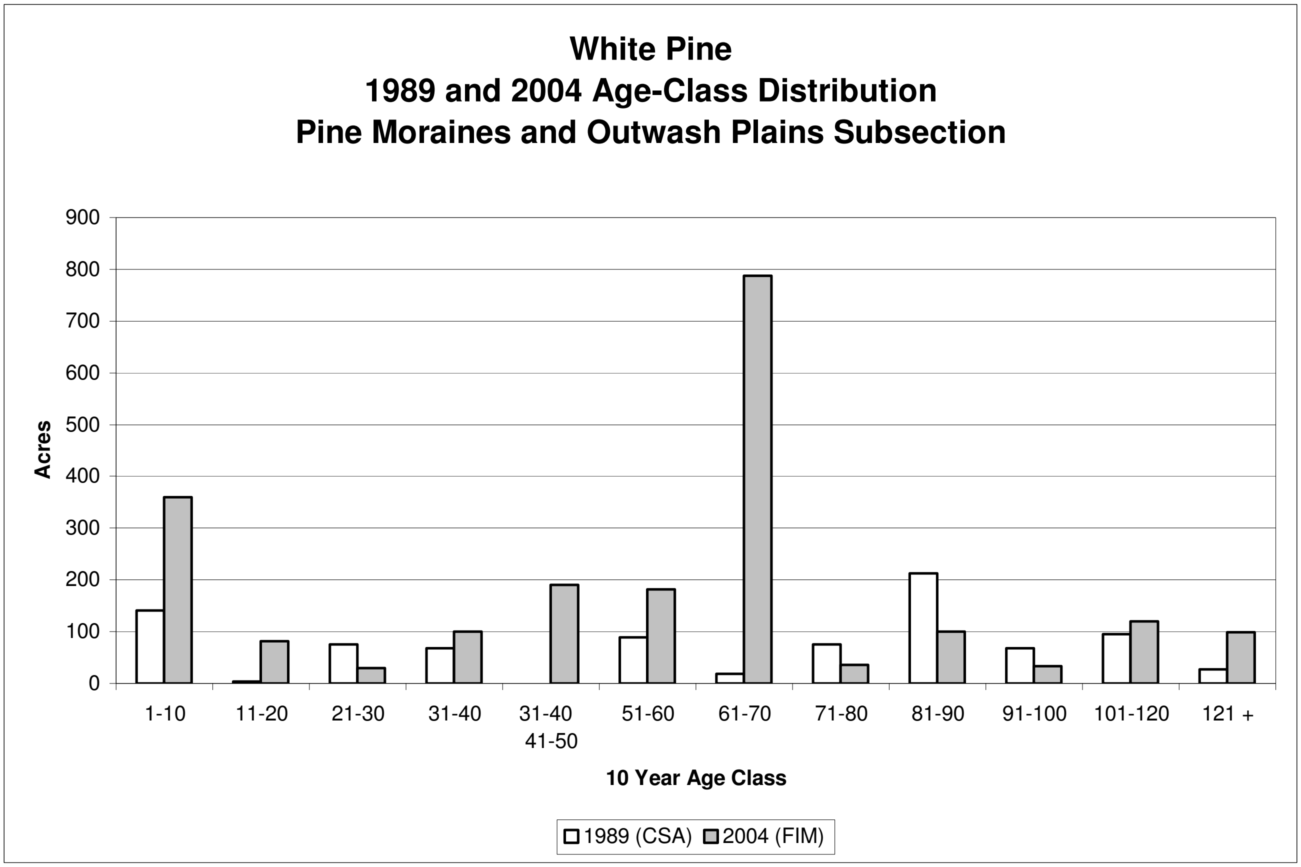


Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the tamarack cover type occupied 3 percent (7,142 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 3 percent (5,565 acres). This amounts to a 22 percent decrease in the acreage of this type.

Tamarack has had markets and been harvested for many years. Although these markets have ebbed and flowed, they have resulted in a somewhat balanced distribution of age classes. This is supported by the fact that many harvested tamarack sites regenerate naturally to tamarack. Since recent markets have been poor, the zero- to 10-year-old age-class is significantly below average.

Chart 3.4 pm14



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

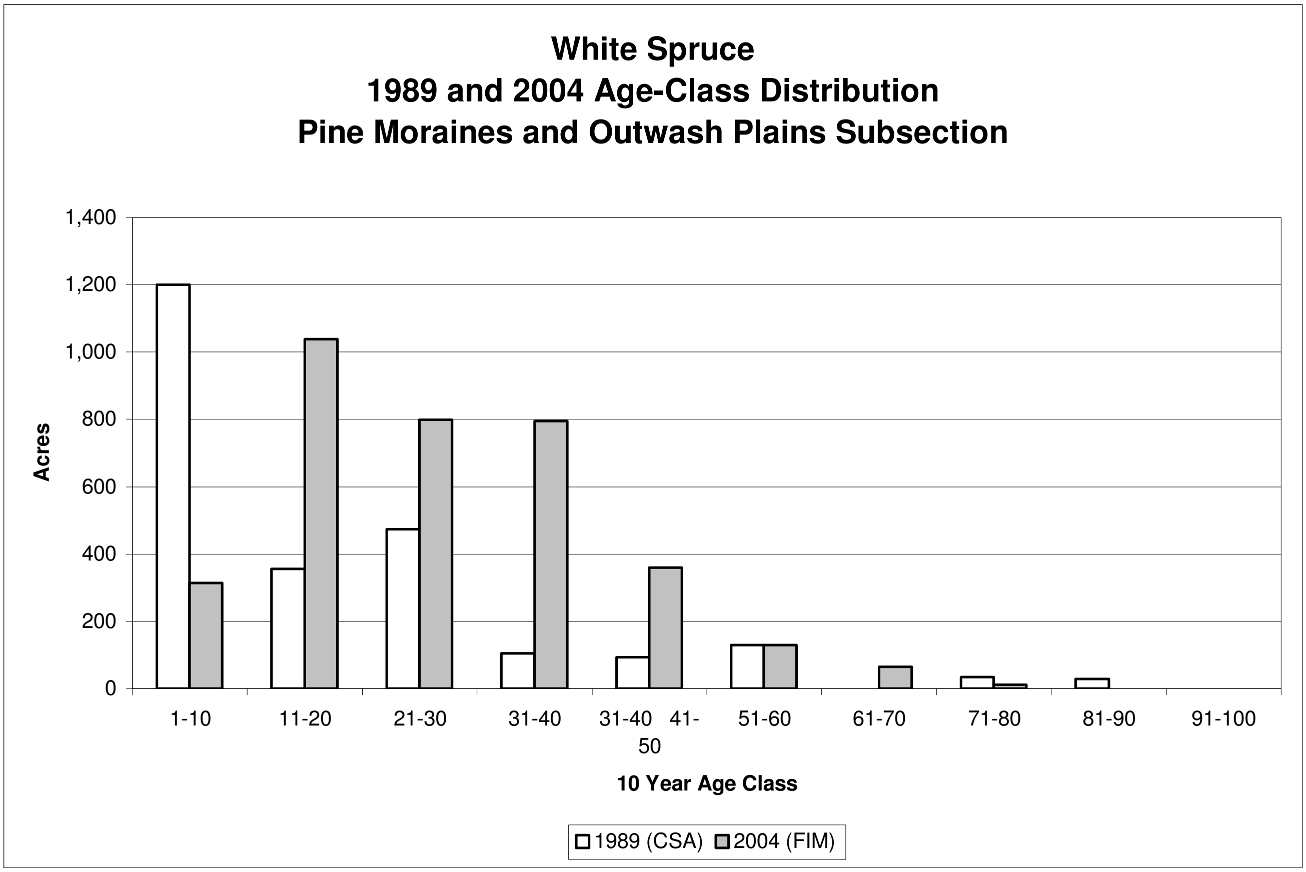
In 1989, the white pine cover type occupied less than 1 percent (942 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 1 percent (2,118 acres). This amounted to a 125 percent increase in the type.

An effort to more fully identify white pine cover-type acres in the forest inventory has increased the total type acreage. Older stands also frequently appear when aspen is the primary cover-type species and is either removed or allowed to deteriorate, leaving the white pine component.

A very limited amount of regeneration harvesting has occurred in the white pine cover type over the past 10 years. Consequently, most of the increase in acreage of young stands has resulted from planting or seeding areas that were previously other cover types, such as balsam fir and paper birch.

One other primary reason for change is the continued aging of the cover type.

Chart 3.4 pm15



Source: 1989 and 2004 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory

In 1989, the white spruce cover type occupied 1 percent (2,421 acres) of state-administered timberlands in the Pine Moraines and Outwash Plains Subsection and in 2004 occupied 2 percent (3,510 acres). This amounts to a 45 percent increase in the acreage of the type.

Very little clear-cut harvesting has occurred in this cover type during the past 10 years as only small amounts of it have reached maturity. The large acreage increase in the zero- to 30-year age classes is due to planting white spruce on sites that were previously other cover types. In recent years, planting spruce has been favored over planting pine in part due to the susceptibility of the pines to animal damage. Other changes are likely due to the continued aging of forest stands and updates to the forest inventory. It should be recognized that white spruce is often an important component of pine and aspen stands.

Part 2

3.5 Stand Origin

The following tables summarize the acres of each cover type that originated naturally and were established by artificial means (i.e., planting or aerial seeding).

Some species regenerate easily by sprouting or natural seed fall (e.g., aspen and tamarack), while others are commonly planted or seeded mechanically (e.g., red pine, jack pine, and black spruce). Stands that are planted or seeded occasionally are only partially successful but fill in through sprouting or natural seed cast from remaining trees. The result is a stand of mixed origin.

In the following tables, stands with no evidence of planting or seed application are classified as "natural." Stands that are partly artificial (i.e., regenerated with planting or seed application) are separated into greater than 40 percent and less than 40 percent categories. The N/A acres are stands that were not identified as being either natural or artificial due to lack of evidence, survey omission, computer entry error, or some other factor.

Table 3.5 cppm

Chippewa Plains/Pine Moraines and Outwash Plains

Cover-Types by Stand Origin

	N/A	Natural	> 40% artificial	< 40% artificial	Total	% Natural
Ash/Lowland Hardwoods	263	16,597	0	6	16,866	100
Aspen	4,050	183,512	744	3,752	192,057	96
Birch	274	10,959	27	117	11,378	96
Balm of Gilead	53	2,695	0	61	2,808	96
Northern Hardwoods	651	20,558	63	203	21,475	96
Oak	1,866	12,773	98	208	14,946	85
Central Hardwoods	0	6	0	0	6	100
White Pine	38	2,210	858	80	3,186	69
Red Pine	446	14,560	23,384	1,228	39,617	37
Jack Pine	383	10,995	5,140	1,296	17,814	62
White Spruce	284	678	5,443	189	6,594	10
Balsam Fir	322	7,924	83	42	8,370	95
Black Spruce Lowland	546	26,490	2,049	129	29,214	91
Tamarack	1,132	43,304	344	131	44,911	96
White Cedar	164	12,542	25	114	12,845	98
Black Spruce Upland	10	19	93	0	122	16
Cutover Area	2,543	1,484	107	35	4,169	36
Total	13,026	367,305	38,457	7,590	426,378	

Table 3.5 cp **Chippewa Plains Cover-Types by Stand Origin**

	N/A	Natural	> 40% artificial	< 40% artificial	Total	% Natural
Ash/Lowland Hardwoods	204	10,542	0	6	10,752	98
Aspen	1,354	62,343	229	786	64,711	96
Birch	30	4,678	0	58	4,765	98
Balm of Gilead	53	2,485	0	12	2,550	97
Northern Hardwoods	546	7,603	24	14	8,186	93
Oak	77	1,030	15	13	1,135	91
Central Hardwoods	0	0	0	0	0	0
White Pine	11	636	151	12	810	79
Red Pine	131	4,080	7,143	441	11,795	35
Jack Pine	224	3,563	1,876	81	5,744	62
White Spruce	89	361	2,423	142	3,015	12
Balsam Fir	256	5,150	60	42	5,508	94
Black Spruce Lowland	456	24,470	2,034	121	27,080	90
Tamarack	876	37,626	219	131	38,851	97
White Cedar	164	10,856	25	114	11,159	97
Black Spruce Upland	10	12	17	0	38	30
Cutover Area	2,303	878	41	26	3,247	27
Total	6,783	176,310	14,254	1,998	199,345	

Table 3.5 pm **Pine Moraines Cover-Types by Stand Origin**

	N/A	Natural	> 40% artificial	< 40% artificial	Total	% Natural[1]
Ash/Lowland Hardwoods	59	6,055	0	0	6,115	100
Aspen	2,696	121,170	515	2,966	127,346	95
Birch	244	6,282	27	60	6,612	95
Balm of Gilead	0	210	0	49	259	81
Northern Hardwoods	106	12,955	39	189	13,288	97
Oak	1,789	11,743	83	195	13,811	85
Central Hardwoods						
White Pine	27	1,574	707	68	2,377	66
Red Pine	315	10,479	16,241	787	27,823	38
Jack Pine	159	7,432	3,264	1,215	12,070	62
White Spruce	195	317	3,020	48	3,579	9
Balsam Fir	66	2,774	22	0	2,863	97
Black Spruce Lowland	90	2,020	16	8	2,134	95
Tamarack	256	5,678	126	0	6,060	94
White Cedar	0	1,687	0	0	1,687	100
Black Spruce Upland	0	7	76	0	83	9
Cutover Area	240	606	66	9	922	66
Total	6,243	190,995	24,202	5,593	227,033	

3.6 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 Chippewa Plains/Pine Moraines and Outwash Plains 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 3.6 cp

Designated old-growth acres in the Chippewa Plains Subsection. From a candidate pool of 670 acres, 452 acres were designated as old growth (i.e., given official protection) and 218 acres were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	110	210
White Cedar	170	329
Lowland Hardwoods	225	156
Northern Hardwoods	375	1,019
Oak	40	31
Red Pine	305	356
White Pine	90	77
White Spruce	25	0
Total	1,340	2,160

Table 3.6 pm

Designated old-growth acres in the Pine Moraines and Outwash Plains Subsection. From a candidate pool of 4,585 acres, 2,267 acres were designated as old growth (i.e., given official protection) and 2,318 were released from candidacy.

Forest Type	Old-Growth 1994 Acreage Goal	Old-Growth Acres Designated
Black Ash	65	127
White Cedar	85	6
Lowland Hardwoods	385	145
Northern Hardwoods	710	878
Oak	125	95
Red Pine	615	653
White Pine	320	363
White Spruce	45	0
Total	2,350	2,267

3.7 An Estimate of Historical Forest Composition Compared to Today's Forest

Relative Tree Species Abundance of Bearing Trees and Forest Inventory and Analysis (FIA) Trees (all units are percentages)

Background

The original land survey in Minnesota was completed in the mid-1800s to early 1900s. Procedure required four witness trees to be established at the corner of each square mile (i.e., "section") and two to be established at the half-mile points on each side. These trees were recorded in the original survey notes as to their species, diameter, direction from the corner, and distance. They are known as bearing trees (BTs) and provide insight into the prevalence and distribution of certain tree species prior to settlement.

Methodology

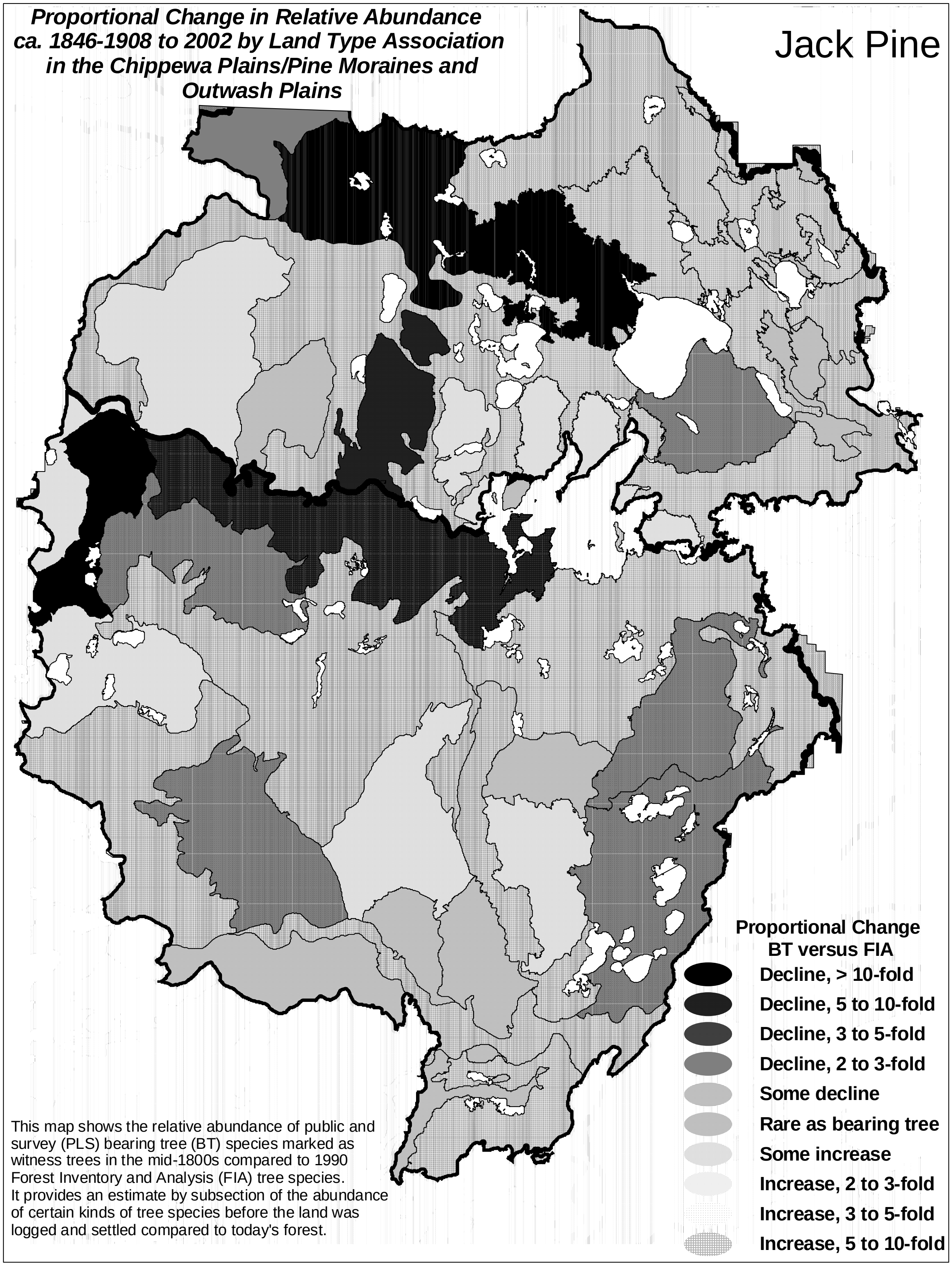
Dr. John Almendinger completed a study for the DNR that compared the relative abundance of the tree species used for bearing trees during the original survey to what was found during forest inventory (i.e., FIA) between 1977 and 2002. FIA data was modified to mimic the establishment of survey corners by recording only one tree in each quadrant of the FIA sampling point, similar to how BT trees were selected in the past. The relative abundance of original BTs is the percent by tree species identified as BTs in the original land survey records for the subsection. The relative abundance of FIA tree species is based on the process that was designed to mimic the selection of BTs by the original surveyors.

Summary of Maps 3.2-3.28 and Relative Abundance Tables

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

Note: For a map of Land-Type Associations (LTAs) in the subsections and a table of LTA names, see Chapter 5, Section 5.2.

Map 3.7 cppm—JP Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Jack Pine



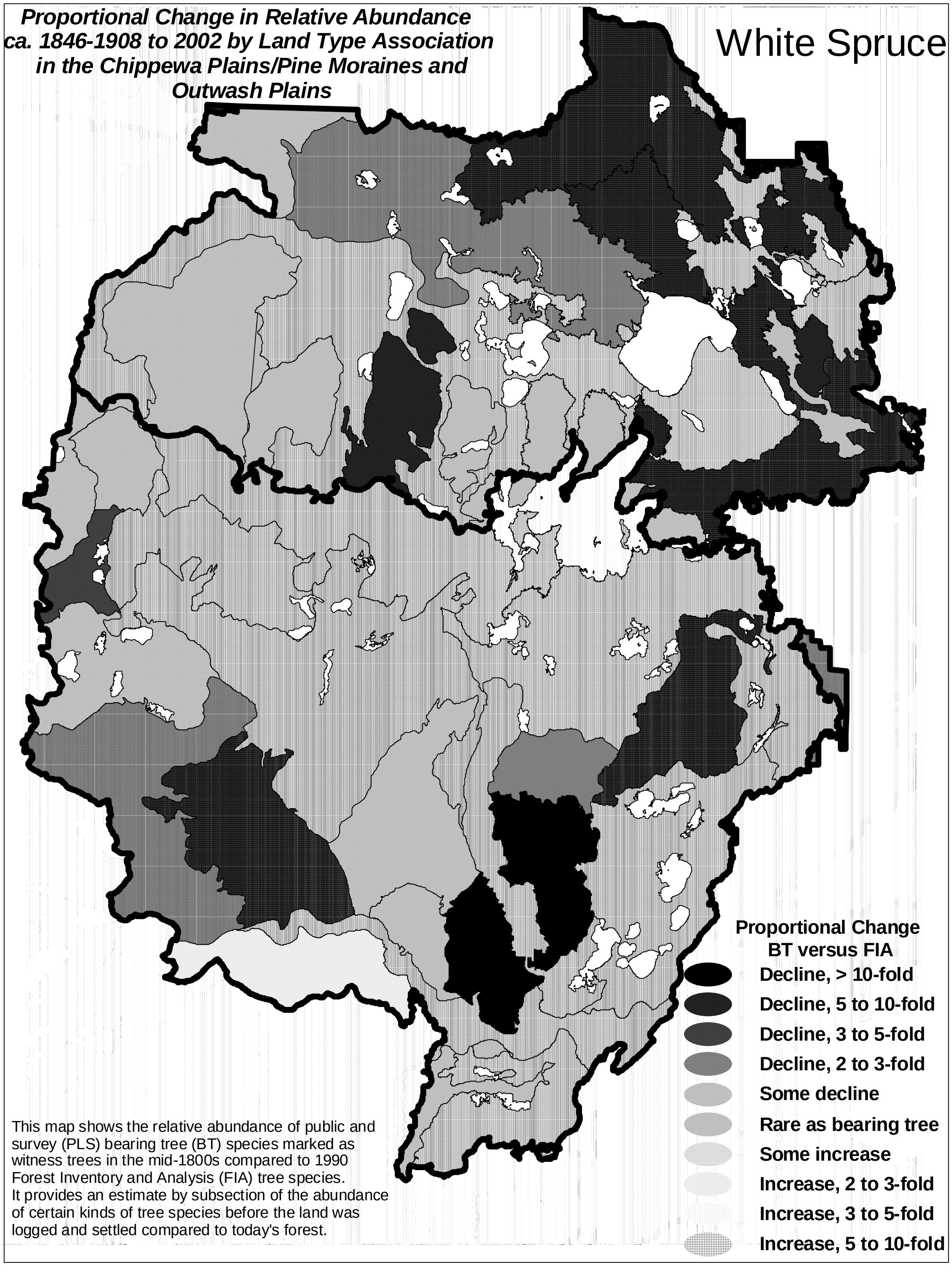
Relative Abundance—Jack Pine

Table 3.7 cppm - JP

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change ($RA_{FIA}-RA_{BT}$)	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	Rare as bearing tree	0.0		
Debs Till Plain	11.5	4.7	-6.8	0.4
Bemidji Sand Plain	32.1	24.0	-8.2	0.7
Blackduck Moraine	4.0	0.2	-3.8	0.0
Alida Till Plain	4.9	6.0	1.1	1.2
Bowstring Till Plain	0.0	0.0	0.0	0.0
Rosey Lake Plain	4.5	3.8	-0.8	0.8
Deer River Peatlands	Rare as bearing tree	0.0		
Nary Till Plain	19.1	3.3	-15.9	0.2
Becida Till Plain	26.1	13.9	-12.1	0.5
Bena Dunes and Peatlands	13.0	4.4	-8.6	0.3
Guthrie Till Plain	2.4	2.7	0.3	1.1
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	2.1	2.5	0.4	1.2
Bass Lake Moraine	4.6	0.4	-4.2	0.0
Itasca Moraine, Steep	22.3	2.9	-19.4	0.1
Two Inlets Moraine	31.4	12.6	-18.7	0.4
Round Lake Sand Plain	11.5	0.3	-11.1	0.0
Park Rapids Sand Plain	57.2	35.0	-22.2	0.6
Itasca Moraine	7.8	6.8	-1.0	0.9
Shell Lake Moraine	5.0	5.2	0.2	1.0
Spring Brook Till Plain	2.9	1.0	-1.9	0.3
Outing Moraine	2.0	1.6	-0.4	0.8
Nimrod Drumlin Plain	23.9	43.4	19.5	1.8
Crow Wing Sand Plain	39.7	17.4	-22.4	0.4
Mildred Sand Plain	10.3	10.2	0.0	1.0
Wadena Drumlin Plain	4.1	1.6	-2.5	0.4
Pine River Drumlin Plain	6.4	11.8	5.4	1.8
Mosquito Creek Drumlin Plain	12.3	9.1	-3.2	0.7
Swan Creek Sand Plain	51.8	46.6	-5.2	0.9
Pillager Sand Plain	30.6	24.9	-5.7	0.8
Verndale Sand Plain	14.2	13.2	-1.0	0.9
St. Croix Moraine	3.5	2.6	-0.8	0.8
Henning Till Plain	Rare as bearing tree	3.8		
Scandia Valley Sand Plain	Rare as bearing tree	4.8		

*Percent of all identifiable bearing tree species recorded as jack pine.

Map 3.7 cppm—WS Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—White Spruce



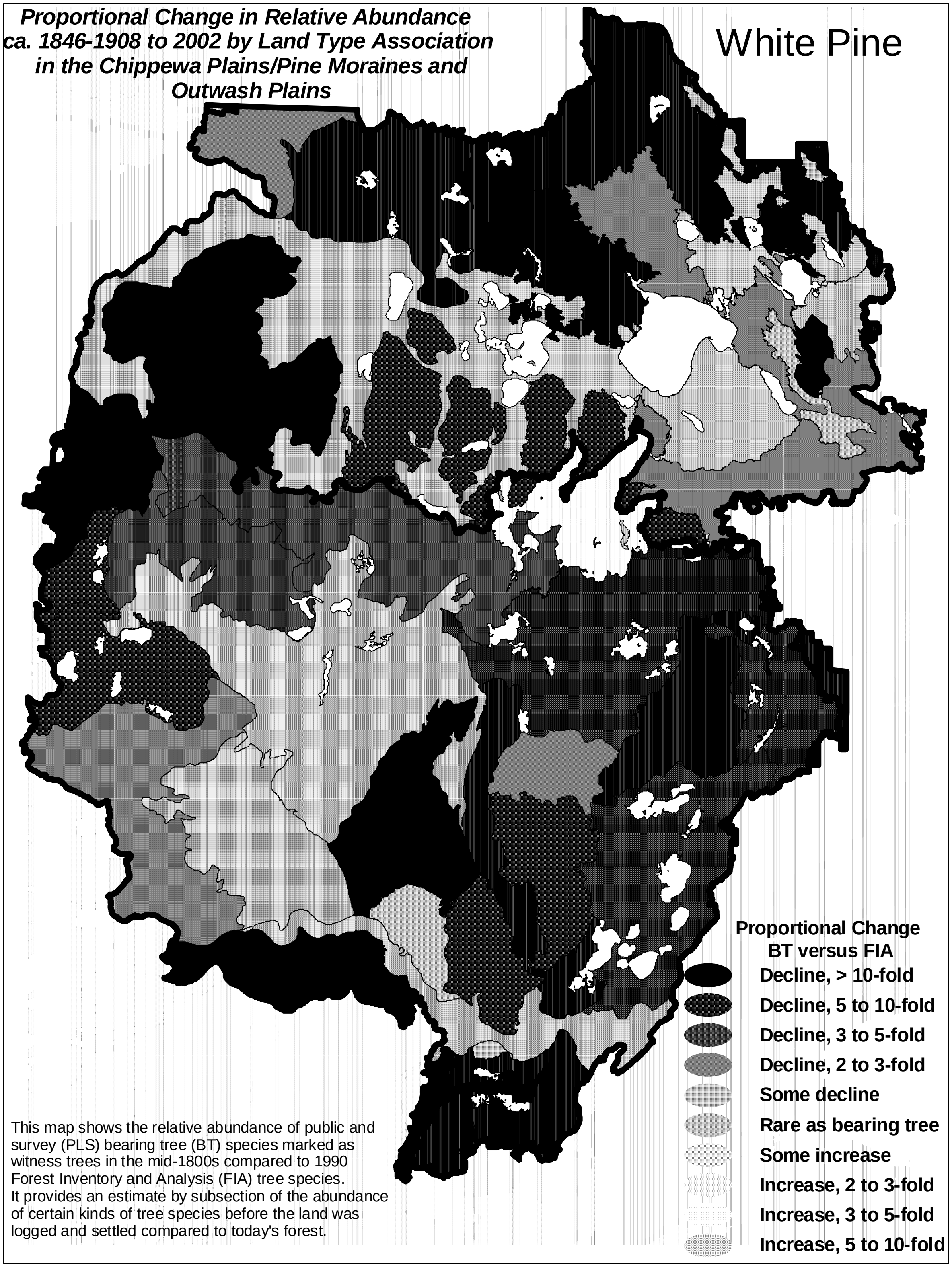
Relative Abundance—White Spruce

Table 3.7 cppm - WS

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Debs Till Plain	Rare as bearing tree	0.7		
Bemidji Sand Plain	Rare as bearing tree	1.1		
Alida Till Plain	2.9	1.7	-1.2	0.6
Bowstring Till Plain	Rare as bearing tree	0.0		
Deer River Peatlands	Rare as bearing tree	0.0		
Rosey Lake Plain	5.9	0.9	-5.0	0.1
Blackduck Moraine	3.1	1.3	-1.8	0.4
Blackduck Till Plain	10.0	1.6	-8.4	0.2
Nary Till Plain	3.5	0.6	-2.9	0.2
Becida Till Plain	2.0	1.5	-0.5	0.7
Bena Dunes and Peatlands	Rare as bearing tree	0.3		
Guthrie Till Plain	Rare as bearing tree	0.7		
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	Rare as bearing tree	1.2		
Bass Lake Moraine	Rare as bearing tree	0.4		
Itasca Moraine, Steep	Rare as bearing tree	0.6		
Two Inlets Moraine	Rare as bearing tree	0.2		
Itasca Moraine	Rare as bearing tree	0.2		
Round Lake Sand Plain	4.1	1.3	-2.8	0.3
Park Rapids Sand Plain	Rare as bearing tree	0.4		
Shell Lake Moraine	2.1	1.6	-0.4	0.8
Spring Brook Till Plain	2.3	0.4	-1.9	0.2
Outing Moraine	Rare as bearing tree	1.1		
Mildred Sand Plain	3.8	1.5	-2.3	0.4
St. Croix Moraine	Rare as bearing tree	0.0		
Nimrod Drumlin Plain	Rare as bearing tree	0.0		
Crow Wing Sand Plain	Rare as bearing tree	0.0		
Wadena Drumlin Plain	2.2	0.4	-1.8	0.2
Pine River Drumlin Plain	3.5	0.0	-3.5	0.0
Mosquito Creek Drumlin Plain	5.5	0.0	-5.5	0.0
Swan Creek Sand Plain	Rare as bearing tree	0.0		
Pillager Sand Plain	Rare as bearing tree	0.0		
Verndale Sand Plain	2.2	4.9	2.7	2.3
Henning Till Plain	Rare as bearing tree	0.0		
Scandia Valley Sand Plain	Rare as bearing tree	0.0		

* Percent of all identifiable bearing tree species recorded as white spruce.

Map 3.7 cppm—WP Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—White Pine



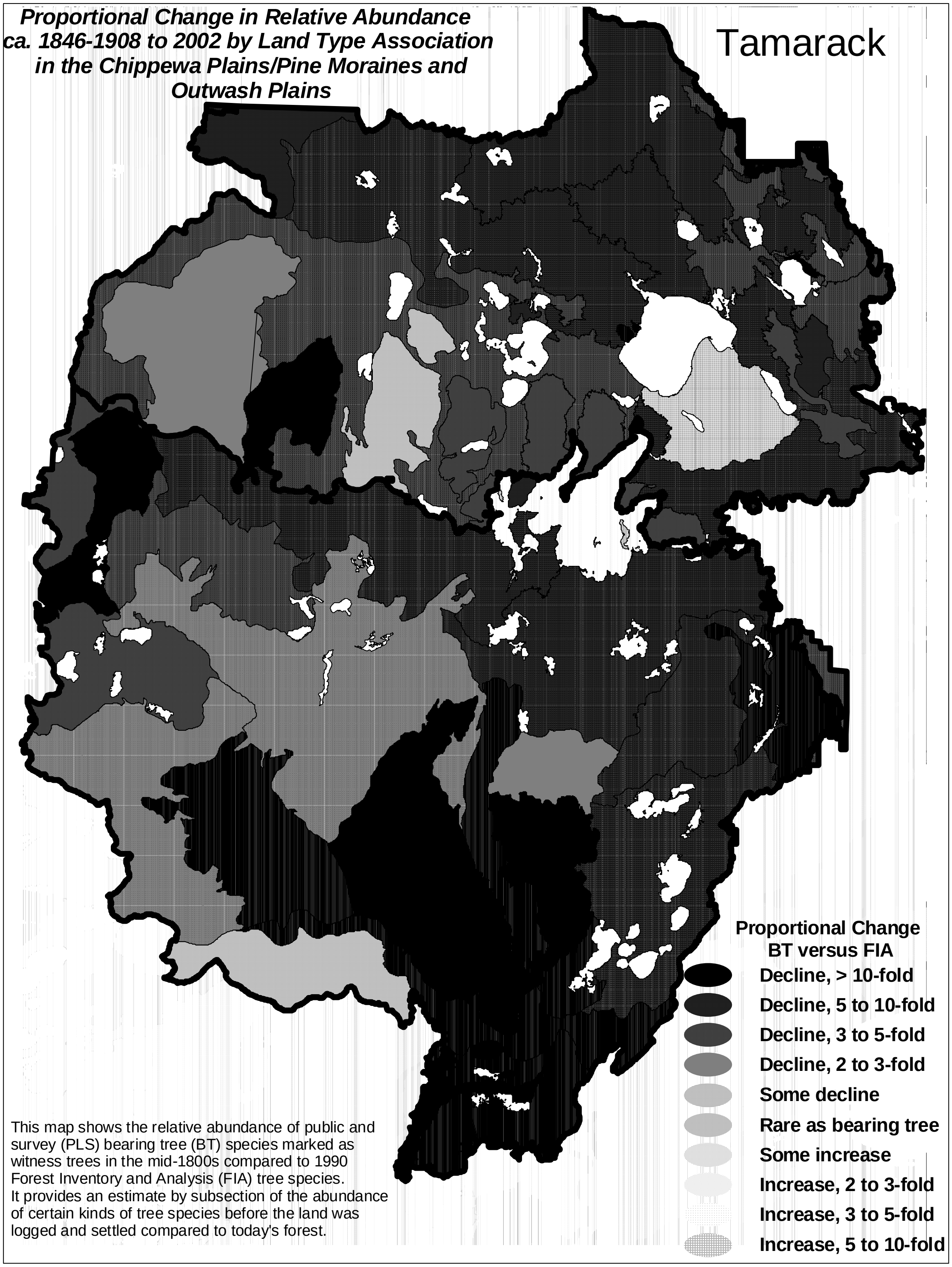
Relative Abundance—White Pine

Table 3.7 cppm - WP

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	5.1	0.0	-5.1	0.0
Debs Till Plain	11.6	4.0	-7.6	0.3
Bemidji Sand Plain	3.4	1.8	-1.5	0.5
Blackduck Moraine	9.6	0.9	-8.7	0.0
Alida Till Plain	19.8	0.8	-18.9	0.0
Bowstring Till Plain	7.1	0.0	-7.1	0.0
Deer River Peatlands	Rare as bearing tree	0.0		
Nary Till Plain	14.1	2.8	-11.3	0.2
Rosey Lake Plain	4.2	1.7	-2.5	0.4
Becida Till Plain	7.6	0.3	-7.3	0.0
Bena Dunes and Peatlands	Rare as bearing tree	3.3		
Guthrie Till Plain	13.9	1.7	-12.2	0.1
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	22.1	0.2	-21.9	0.0
Bass Lake Moraine	19.5	1.2	-18.4	0.0
Itasca Moraine, Steep	10.3	2.1	-8.1	0.2
Two Inlets Moraine	5.2	1.3	-3.9	0.2
Round Lake Sand Plain	7.7	1.0	-6.7	0.1
Park Rapids Sand Plain	Rare as bearing tree	0.3		
Itasca Moraine	13.0	2.3	-10.7	0.2
Shell Lake Moraine	8.4	1.5	-6.8	0.2
Spring Brook Till Plain	14.6	0.6	-14.0	0.0
Outing Moraine	20.1	2.0	-18.0	0.1
St. Croix Moraine	16.0	1.5	-14.6	0.0
Nimrod Drumlin Plain	2.9	0.0	-2.9	0.0
Crow Wing Sand Plain	6.9	1.3	-5.6	0.2
Mildred Sand Plain	7.3	2.9	-4.4	0.4
Wadena Drumlin Plain	3.1	2.2	-0.9	0.7
Pine River Drumlin Plain	10.5	1.6	-8.9	0.2
Mosquito Creek Drumlin Plain	2.1	0.4	-1.8	0.2
Swan Creek Sand Plain	Rare as bearing tree	0.0		
Pillager Sand Plain	Rare as bearing tree	4.7		
Verndale Sand Plain	2.1	0.0	-2.1	0.0
Henning Till Plain	14.0	10.0	-4.0	0.7
Scandia Valley Sand Plain	18.7	0.0	-18.7	0.0

* Percent of all identifiable bearing tree species recorded as white pine.

Map 3.7 cppm—T Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Tamarack



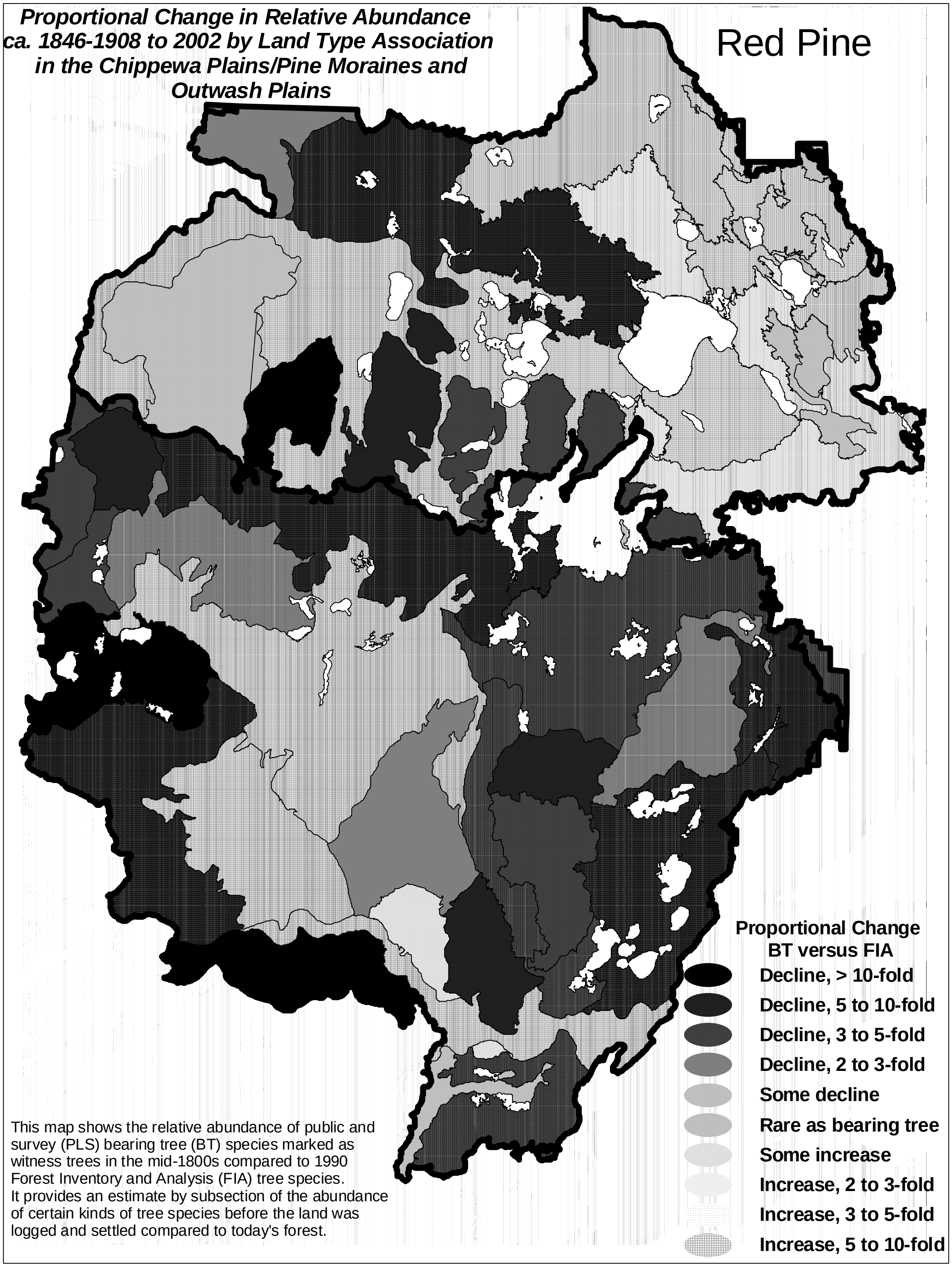
Relative Abundance—Tamarack

Table 3.7 cppm - T

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Debs Till Plain	11.7	1.4	-10.3	0.1
Bemidji Sand Plain	17.1	3.4	-13.7	0.2
Blackduck Moraine	21.1	3.6	-17.5	0.2
Alida Till Plain	14.4	4.9	-9.5	0.3
Bowstring Till Plain	21.4	0.0	-21.4	0.0
Deer River Peatlands	51.8	13.4	-38.4	0.3
Nary Till Plain	3.2	2.4	-0.8	0.7
Rosey Lake Plain	26.8	5.0	-21.9	0.2
Becida Till Plain	6.1	0.3	-5.8	0.0
Bena Dunes and Peatlands	34.8	18.3	-16.5	0.5
Guthrie Till Plain	8.1	1.7	-6.4	0.2
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	8.3	2.7	-5.6	0.3
Bass Lake Moraine	3.9	0.4	-3.5	0.0
Itasca Moraine, Steep	4.1	0.4	-3.7	0.1
Two Inlets Moraine	13.0	3.2	-9.9	0.2
Round Lake Sand Plain	13.5	0.0	-13.5	0.0
Park Rapids Sand Plain	4.5	1.7	-2.8	0.4
Itasca Moraine	9.9	1.7	-8.2	0.2
Shell Lake Moraine	15.8	3.8	-12.1	0.2
Spring Brook Till Plain	12.3	1.7	-10.6	0.1
Outing Moraine	13.4	1.0	-12.5	0.0
St. Croix Moraine	8.6	0.8	-7.8	0.0
Nimrod Drumlin Plain	31.4	0.8	-30.7	0.0
Crow Wing Sand Plain	3.2	0.6	-2.6	0.2
Mildred Sand Plain	17.3	6.0	-11.3	0.3
Wadena Drumlin Plain	21.7	1.2	-20.5	0.0
Pine River Drumlin Plain	18.6	1.1	-17.4	0.0
Mosquito Creek Drumlin Plain	15.4	0.4	-15.1	0.0
Swan Creek Sand Plain	17.8	0.0	-17.8	0.0
Pillager Sand Plain	15.8	0.0	-15.8	0.0
Verndale Sand Plain	14.5	12.3	-2.3	0.8
Henning Till Plain	23.3	0.0	-23.3	0.0
Scandia Valley Sand Plain	15.3	0.0	-15.3	0.0

* Percent of all identifiable bearing tree species recorded as tamarack.

Map 3.7 cppm—RP Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Red Pine



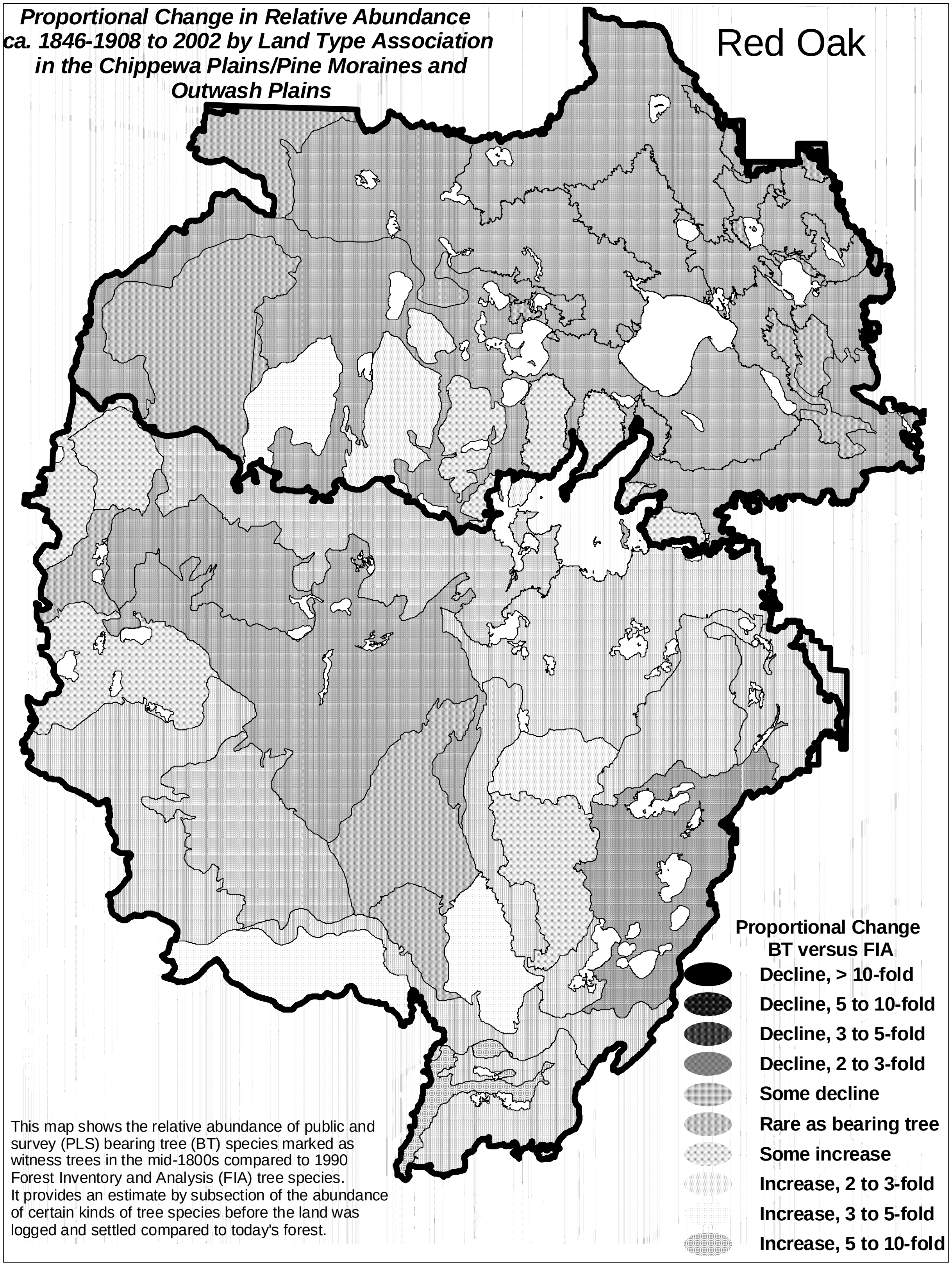
Relative Abundance—Red Pine

Table 3.7 cppm - RP

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	Rare as bearing tree	0.8		
Debs Till Plain	19.8	9.1	-10.7	0.5
Bemidji Sand Plain	16.4	13.4	-2.9	0.8
Blackduck Moraine	8.2	1.3	-6.9	0.2
Alida Till Plain	9.1	4.6	-4.5	0.5
Bowstring Till Plain	0.0	0.0	0.0	
Deer River Peatlands	0.3	0.0	-0.3	0.0
Nary Till Plain	9.0	1.0	-7.9	0.1
Rosey Lake Plain	4.9	7.5	2.7	1.5
Becida Till Plain	15.0	1.5	-13.5	0.0
Bena Dunes and Peatlands	16.0	15.6	-0.4	1.0
Guthrie Till Plain	7.0	2.2	-4.8	0.3
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	5.2	1.3	-3.8	0.3
Bass Lake Moraine	11.2	1.7	-9.5	0.2
Itasca Moraine, Steep	21.2	3.0	-18.1	0.1
Two Inlets Moraine	16.5	7.4	-9.1	0.5
Round Lake Sand Plain	13.8	3.0	-10.8	0.2
Park Rapids Sand Plain	19.2	11.9	-7.3	0.6
Itasca Moraine	18.4	5.1	-13.3	0.3
Shell Lake Moraine	13.4	0.9	-12.5	0.0
Spring Brook Till Plain	8.8	3.2	-5.5	0.4
Outing Moraine	13.8	2.6	-11.2	0.2
St. Croix Moraine	16.2	4.0	-12.2	0.2
Nimrod Drumlin Plain	12.8	6.3	-6.6	0.5
Crow Wing Sand Plain	31.1	5.2	-25.9	0.2
Mildred Sand Plain	10.6	1.7	-8.9	0.2
Wadena Drumlin Plain	4.9	3.0	-1.8	0.6
Pine River Drumlin Plain	9.5	2.7	-6.7	0.3
Mosquito Creek Drumlin Plain	5.7	0.8	-4.9	0.1
Swan Creek Sand Plain	12.9	15.0	2.1	1.2
Pillager Sand Plain	9.7	5.0	-4.7	0.5
Verndale Sand Plain	3.5	0.0	-3.5	0.0
Henning Till Plain	9.3	16.3	6.9	1.7
Scandia Valley Sand Plain	3.9	2.4	-1.5	0.6

* Percent of all identifiable bearing tree species recorded as red pine.

Map 3.7cppm—RO Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Red Oak



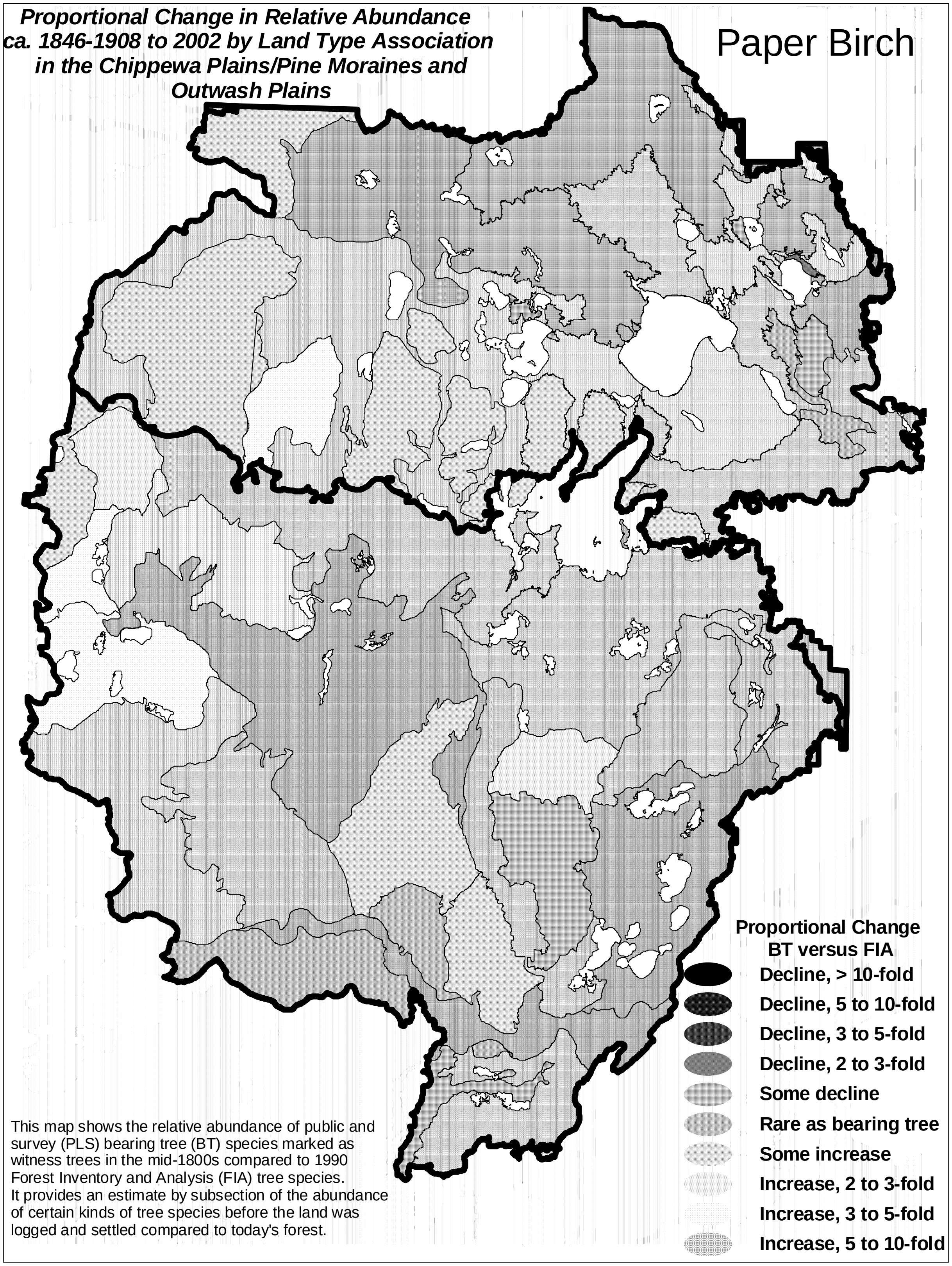
Relative Abundance—Red Oak

Table 3.7 cppm - RO

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	Rare as bearing tree	0.0		
Debs Till Plain	Rare as bearing tree	3.9		
Bemidji Sand Plain	Rare as bearing tree	2.1		
Blackduck Moraine	Rare as bearing tree	1.1		
Alida Till Plain	Rare as bearing tree	1.7		
Bowstring Till Plain	Rare as bearing tree	0.0		
Deer River Peatlands	Rare as bearing tree	0.0		
Nary Till Plain	3.5	7.4	3.9	2.1
Rosey Lake Plain	Rare as bearing tree	0.3		
Becida Till Plain	2.4	7.6	5.2	3.2
Bena Dunes and Peatlands	Rare as bearing tree	0.1		
Guthrie Till Plain	4.8	7.6	2.9	1.6
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	4.4	7.0	2.6	1.6
Bass Lake Moraine	5.5	8.5	2.9	1.5
Itasca Moraine, Steep	3.8	7.4	3.6	2.0
Two Inlets Moraine	Rare as bearing tree	4.8		
Round Lake Sand Plain	Rare as bearing tree	7.6		
Park Rapids Sand Plain	Rare as bearing tree	6.0		
Itasca Moraine	3.8	8.9	5.1	2.3
Shell Lake Moraine	6.2	10.5	4.3	1.7
Spring Brook Till Plain	3.2	6.6	3.4	2.1
Outing Moraine	3.9	11.1	7.2	2.9
St. Croix Moraine	11.0	22.4	11.4	2.0
Nimrod Drumlin Plain	Rare as bearing tree	2.3		
Crow Wing Sand Plain	2.2	21.4	19.2	9.7
Mildred Sand Plain	3.1	6.9	3.8	2.2
Wadena Drumlin Plain	4.0	7.1	3.1	1.8
Pine River Drumlin Plain	3.7	6.3	2.6	1.7
Mosquito Creek Drumlin Plain	3.7	12.9	9.2	3.5
Swan Creek Sand Plain	Rare as bearing tree	2.4		
Pillager Sand Plain	5.0	13.3	8.3	2.7
Verndale Sand Plain	2.9	9.3	6.4	3.2
Henning Till Plain	3.1	23.8	20.6	7.7
Scandia Valley Sand Plain	6.5	45.2	38.7	6.9

*Amount of time that red oak was recorded as a bearing tree shown as a percent of all identifiable species.

Map 3.7 cppm—B Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Paper Birch



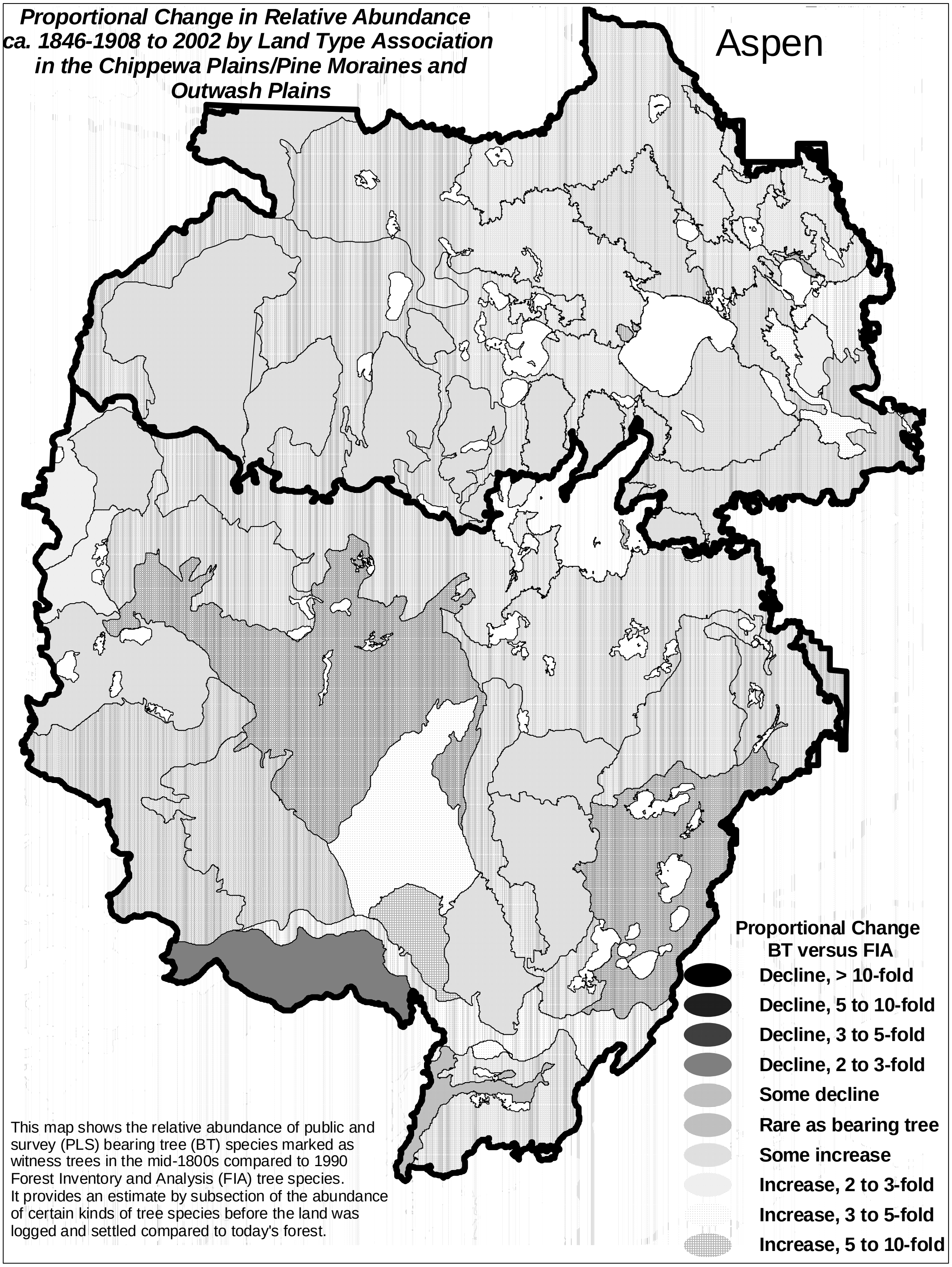
Relative Abundance—Paper Birch

Table 3.7 cppm - B

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	13.4	8.4	-5.0	0.6
Debs Till Plain	5.5	7.9	2.4	1.4
Bemidji Sand Plain	3.6	7.6	3.9	2.1
Blackduck Moraine	11.3	9.8	-1.4	0.9
Alida Till Plain	4.8	6.6	1.8	1.4
Bowstring Till Plain	21.4	7.7	-13.7	0.4
Deer River Peatlands	Rare as bearing tree	2.7		
Nary Till Plain	5.5	10.8	5.3	2.0
Rosey Lake Plain	6.8	7.2	0.4	1.1
Becida Till Plain	4.2	14.2	10.0	3.4
Bena Dunes and Peatlands	4.4	9.5	5.1	2.2
Guthrie Till Plain	6.3	9.1	2.8	1.4
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	2.9	4.9	2.0	1.7
Bass Lake Moraine	4.4	9.8	5.3	2.2
Itasca Moraine, Steep	7.9	15.0	7.1	1.9
Two Inlets Moraine	3.1	9.7	6.6	3.2
Round Lake Sand Plain	4.6	18.2	13.6	4.0
Park Rapids Sand Plain	Rare as bearing tree	5.3		
Itasca Moraine	8.5	15.8	7.3	1.9
Shell Lake Moraine	5.0	15.6	10.6	3.1
Spring Brook Till Plain	14.7	16.9	2.2	1.2
Outing Moraine	13.3	16.8	3.5	1.3
St. Croix Moraine	12.2	16.8	4.6	1.4
Nimrod Drumlin Plain	2.5	4.7	2.2	1.9
Crow Wing Sand Plain	Rare as bearing tree	13.1		
Mildred Sand Plain	3.6	7.9	4.3	2.2
Wadena Drumlin Plain	3.0	3.3	0.4	1.1
Pine River Drumlin Plain	12.9	12.2	-0.6	1.0
Mosquito Creek Drumlin Plain	5.7	7.6	1.9	1.3
Swan Creek Sand Plain	Rare as bearing tree	2.4		
Pillager Sand Plain	Rare as bearing tree	3.0		
Verndale Sand Plain	Rare as bearing tree	1.5		
Henning Till Plain	Rare as bearing tree	2.5		
Scandia Valley Sand Plain	5.2	3.6	-1.6	0.7

* Percent of all identifiable bearing tree species recorded as birch.

Map 3.7 cppm—A Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Aspen



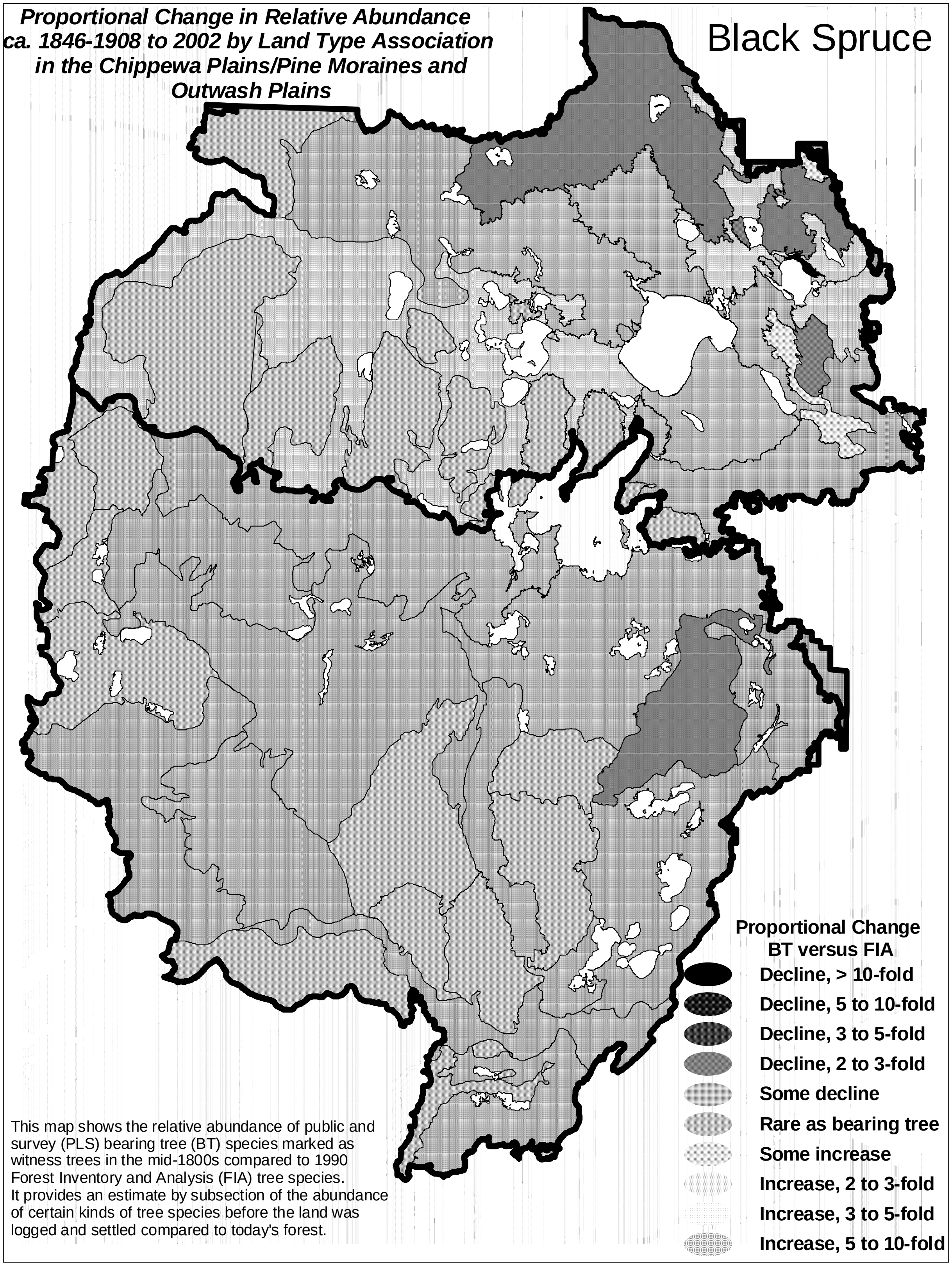
Relative Abundance—Aspen

Table 3.7 cppm - A

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	11.9	33.2	21.3	2.8
Debs Till Plain	21.1	36.5	15.3	1.7
Bemidji Sand Plain	8.5	21.9	13.5	2.6
Blackduck Moraine	12.3	25.3	13.0	2.1
Alida Till Plain	24.1	30.8	6.7	1.3
Bowstring Till Plain	Rare as bearing tree	15.4		
Deer River Peatlands	3.4	15.1	11.7	4.5
Nary Till Plain	18.2	34.0	15.8	1.9
Rosey Lake Plain	11.8	20.9	9.1	1.8
Becida Till Plain	24.5	35.4	11.0	1.4
Bena Dunes and Peatlands	11.0	11.4	0.3	1.0
Guthrie Till Plain	17.5	30.2	12.8	1.7
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	16.6	41.4	24.8	2.5
Bass Lake Moraine	24.5	44.2	19.7	1.8
Itasca Moraine, Steep	21.9	50.1	28.2	2.3
Two Inlets Moraine	16.4	40.6	24.2	2.5
Round Lake Sand Plain	13.5	38.4	24.9	2.8
Park Rapids Sand Plain	4.8	26.5	21.8	5.6
Itasca Moraine	13.6	37.2	23.6	2.7
Shell Lake Moraine	20.2	28.4	8.2	1.4
Spring Brook Till Plain	16.8	41.1	24.3	2.4
Outing Moraine	12.0	29.9	17.9	2.5
St. Croix Moraine	13.1	33.8	20.7	2.6
Nimrod Drumlin Plain	6.8	32.4	25.7	4.8
Crow Wing Sand Plain	4.3	31.1	26.7	7.2
Mildred Sand Plain	23.1	32.9	9.9	1.4
Wadena Drumlin Plain	33.1	36.2	3.1	1.1
Pine River Drumlin Plain	21.1	37.2	16.1	1.8
Mosquito Creek Drumlin Plain	30.8	37.9	7.1	1.2
Swan Creek Sand Plain	3.3	18.9	15.6	5.7
Pillager Sand Plain	8.7	28.8	20.1	3.3
Verndale Sand Plain	19.0	7.8	-11.2	0.4
Henning Till Plain	9.3	31.3	21.9	3.4
Scandia Valley Sand Plain	22.8	22.6	-0.2	1.0

* Percent of all identifiable bearing tree species recorded as aspen.

Map 3.7 cppm—BS Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Black Spruce



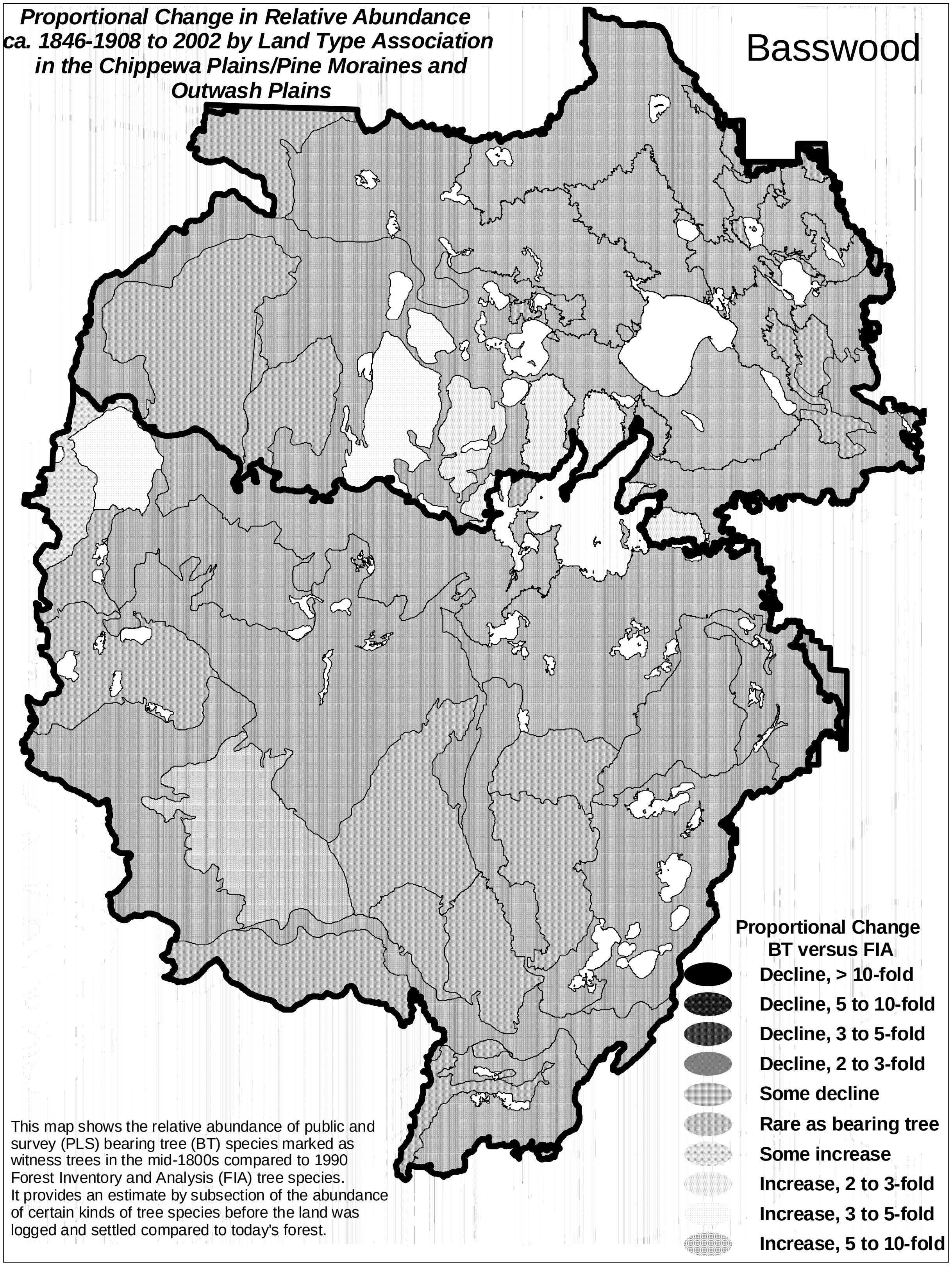
Relative Abundance—Black Spruce

Table 3.7 cppm - BS

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	5.7	2.6	-3.1	0.5
Debs Till Plain	Rare as bearing tree	.05		
Bemidji Sand Plain	Some increase	2.6	0.4	1.2
Blackduck Moraine	Rare as bearing tree	4.5		
Alida Till Plain	Rare as bearing tree	1.9		
Bowstring Till Plain	7.1	0.0	-7.1	0.0
Deer River Peatlands	16.9	23.1	6.2	1.4
Nary Till Plain	Rare as bearing tree	0.3		
Rosey Lake Plain	Some decline	5.3	-2.1	0.7
Becida Till Plain	Rare as bearing tree	0.6		
Bena Dunes and Peatlands	Rare as bearing tree	4.0		
Guthrie Till Plain	Rare as bearing tree	0.9		
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	Rare as bearing tree	0.7		
Bass Lake Moraine	Rare as bearing tree	0.0		
Itasca Moraine, Steep	Rare as bearing tree	1.1		
Two Inlets Moraine	Rare as bearing tree	1.8		
Round Lake Sand Plain	Rare as bearing tree	0.0		
Park Rapids Sand Plain	Rare as bearing tree	0.4		
Itasca Moraine	Rare as bearing tree	0.8		
Shell Lake Moraine	Rare as bearing tree	0.5		
Spring Brook Till Plain	2.1	0.9	-1.1	0.5
Outing Moraine	3.3	2.3	-1.0	0.7
St. Croix Moraine	Rare as bearing tree	0.0		
Nimrod Drumlin Plain	Rare as bearing tree	0.0		
Crow Wing Sand Plain	Rare as bearing tree	0.0		
Mildred Sand Plain	Rare as bearing tree	3.4		
Wadena Drumlin Plain	Rare as bearing tree	0.7		
Pine River Drumlin Plain	Rare as bearing tree	0.0		
Mosquito Creek Drumlin Plain	Rare as bearing tree	0.0		
Swan Creek Sand Plain	Rare as bearing tree	0.0		
Pillager Sand Plain	Rare as bearing tree	0.0		
Verndale Sand Plain	Rare as bearing tree	0.5		
Henning Till Plain	Rare as bearing tree	0.0		
Scandia Valley Sand Plain	Rare as bearing tree	0.0		

*Percent of all identifiable bearing tree species recorded as black spruce.

Map 3.7 cppm—BAS Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Basswood



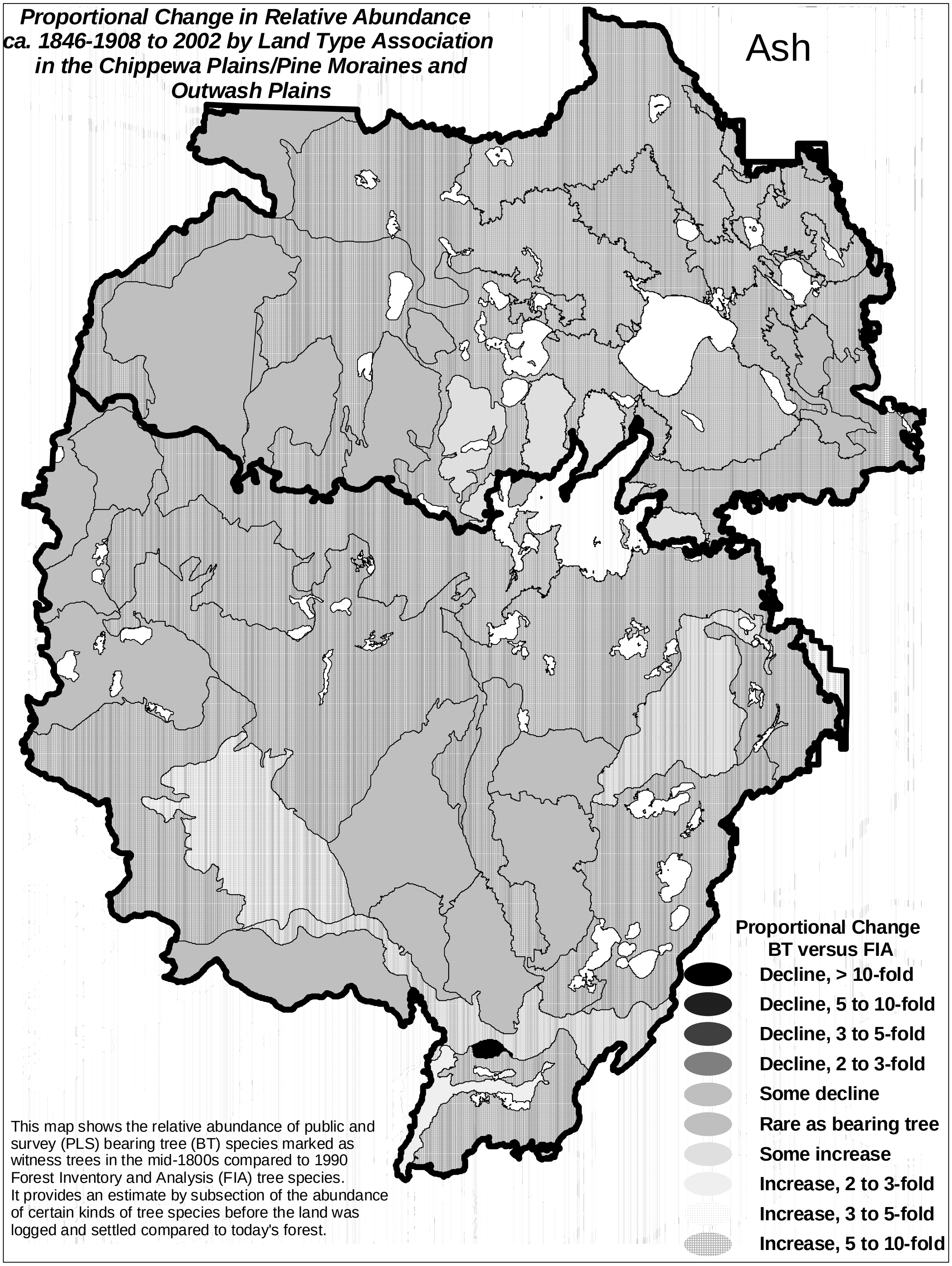
Relative Abundance—Basswood

Table 3.7 cppm - BAS

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}-RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	Rare as bearing tree	3.4		
Debs Till Plain	Rare as bearing tree	4.3		
Bemidji Sand Plain	Rare as bearing tree	0.9		
Blackduck Moraine	Rare as bearing tree	9.8		
Alida Till Plain	Rare as bearing tree	7.4		
Bowstring Till Plain	Rare as bearing tree	30.8		
Deer River Peatlands	Rare as bearing tree	0.0		
Nary Till Plain	2.2	6.8	4.7	3.2
Rosey Lake Plain	Rare as bearing tree	2.4		
Becida Till Plain	Rare as bearing tree	1.8		
Bena Dunes and Peatlands	Rare as bearing tree	0.3		
Guthrie Till Plain	2.8	7.4	4.6	2.7
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	3.2	6.2	3.0	1.9
Bass Lake Moraine	2.3	11.1	8.8	4.8
Itasca Moraine, Steep	0.4	1.7	1.2	3.9
Two Inlets Moraine	Rare as bearing tree	1.2		
Round Lake Sand Plain	Rare as bearing tree	6.0		
Park Rapids Sand Plain	Rare as bearing tree	0.1		
Itasca Moraine	Rare as bearing tree	4.0		
Shell Lake Moraine	Rare as bearing tree	5.3		
Spring Brook Till Plain	Rare as bearing tree	1.4		
Outing Moraine	Rare as bearing tree	1.7		
St. Croix Moraine	Rare as bearing tree	1.8		
Nimrod Drumlin Plain	Rare as bearing tree	0.0		
Crow Wing Sand Plain	Rare as bearing tree	0.8		
Mildred Sand Plain	Rare as bearing tree	2.1		
Wadena Drumlin Plain	2.5	3.5	0.9	1.4
Pine River Drumlin Plain	Rare as bearing tree	3.2		
Mosquito Creek Drumlin Plain	Rare as bearing tree	0.4		
Swan Creek Sand Plain	Rare as bearing tree	0.0		
Pillager Sand Plain	Rare as bearing tree	0.6		
Verndale Sand Plain	Rare as bearing tree	2.5		
Henning Till Plain	Rare as bearing tree	0.0		
Scandia Valley Sand Plain	Rare as bearing tree	0.0		

* Percent of all identifiable bearing tree species recorded as basswood.

Map 3.7 cppm—ASH Change in Relative Tree Species Abundance of Bearing Trees (BTs) and Forest Inventory and Analysis (FIA) Trees—Ash



Relative Abundance—Ash

Table 3.7 cppm - ASH

LTA Name	Relative Abundance* Bearing Trees (1846-1908)	Relative Abundance FIA (1977-2002)	Absolute Change (RA_{FIA}- RA_{BT})	Proportional Change (RA_{FIA}/RA_{BT})
Chippewa Plains				
Blackduck Till Plain	Rare as bearing tree	6.5		
Debs Till Plain	Rare as bearing tree	2.7		
Bemidji Sand Plain	Rare as bearing tree	2.1		
Blackduck Moraine	Rare as bearing tree	5.9		
Alida Till Plain	Rare as bearing tree	2.7		
Bowstring Till Plain	Rare as bearing tree	0.0		
Deer River Peatlands	Rare as bearing tree	11.7		
Nary Till Plain	Rare as bearing tree	3.3		
Rosey Lake Plain	2.0	11.3	9.3	5.6
Becida Till Plain	Rare as bearing tree	1.5		
Bena Dunes and Peatlands	Rare as bearing tree	3.2		
Guthrie Till Plain	2.4	3.2	0.8	1.3
Pine Moraines and Outwash Plains				
Naytahwaush Moraine	Rare as bearing tree	2.9		
Bass Lake Moraine	Rare as bearing tree	0.7		
Itasca Moraine, Steep	Rare as bearing tree	1.8		
Two Inlets Moraine	Rare as bearing tree	2.3		
Round Lake Sand Plain	Rare as bearing tree	1.7		
Park Rapids Sand Plain	Rare as bearing tree	1.7		
Itasca Moraine	Rare as bearing tree	0.9		
Shell Lake Moraine	Rare as bearing tree	4.7		
Spring Brook Till Plain	2.2	3.7	1.5	1.7
Outing Moraine	Rare as bearing tree	4.5		
St. Croix Moraine	Rare as bearing tree	1.3		
Nimrod Drumlin Plain	Rare as bearing tree	1.6		
Crow Wing Sand Plain	Rare as bearing tree	1.5		
Mildred Sand Plain	Rare as bearing tree	4.8		
Wadena Drumlin Plain	2.4	6.1	3.7	2.6
Pine River Drumlin Plain	Rare as bearing tree	4.3		
Mosquito Creek Drumlin Plain	Rare as bearing tree	3.0		
Swan Creek Sand Plain	Rare as bearing tree	2.4		
Pillager Sand Plain	2.9	3.0	0.1	1.0
Verndale Sand Plain	Rare as bearing tree	8.8		
Henning Till Plain	2.3	0.0	-2.3	0.0
Scandia Valley Sand Plain	2.6	6.0	3.4	2.3

* Percent of all identifiable bearing tree species recorded as ash.

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C H A P T E R 4

Timber Harvest

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

4.1 ... Acres of Timber Sold on DNR Lands in the Subsections
Charts 4.1cppm
Table 4.1cppm

4.2 ... Percent of Timber Sale Acres by Subsection
Chart 4.2 cppm

4.3 … Volume of Timber Sold From DNR Lands in the Subsections
Chart *4.3 cppm*

4.4 … Total Value of Timber Sold From DNR Lands Per Fiscal Year (FY) in the Subsections
Chart 4.4 cppm through 4.4 pm

4.5 … Average Stumpage Price Paid Per Cord for Timber From DNR Lands in the Subsections
Chart 4.5 cppm through 4.5 pm

4.6 … Average Size of Timber Sales Sold on DNR Lands in the Subsections
Chart 4.6 cppm through 4.6 pm

4.7 … Average Cords Per Acre for Timber Sold From DNR Lands in the Subsections
Chart 4.7 cppm through 4.7 pm

4.8 … Average Volume Sold Per Fiscal Year by Species From DNR Lands in the Subsections
Chart 4.8 cppm through 4.8 pm

4.9 … Decorative Trees Sold on Timber Sales on DNR Lands in the Subsections

4.10 … Mean Annual Increment (MAI) Graphs by Cover Type

Chart 4.10 cppm-A through 4.10 pm-A
Chart 4.10 cppm-BF through 4.10 pm-BF
Chart 4.10 cppm-Bi through 4.10 pm-Bi
Chart 4.10 cppm-BS
Chart 4.10 cp-BS 40+
Chart 4.10 cp-BS 29-39
Chart 4.10 cppm-JP through 4.10 pm-JP
Chart 4.10 cppm-RP through 4.10 pm-RP
Chart 4.10 cppm-O through 4.10 pm-O
Chart 4.10 cppm-T through 4.10 pm-T
Chart 4.10 cppm-WS through 4.10 pm-WS
Chart 4.10 pm-BS

How graphics are labeled:

All charts and tables apply to activities on DNR Division of Forestry and Division of Fish and Wildlife lands (hereafter "*DNR lands"*) in the Chippewa Plains/Pine Moraines and Outwash Plains Subsection.

Graphics (i.e., Tables and Charts) referring to both subsections combined (Chippewa Plains/Pine Moraines and Outwash Plains) are indicated by a "cppm" after the chart designation (e.g., *Chart 4.5 cppm*).

Graphics referring to the Chippewa Plains Subsection *only* are indicated by a "cp" after each chart designation (e.g., *Chart 4.8 pm*).

Graphics referring to the Pine Moraines and Outwash Plains Subsection *only* are indicated by "pm" after each chart designation (e.g., *Chart 4.10 pm*).

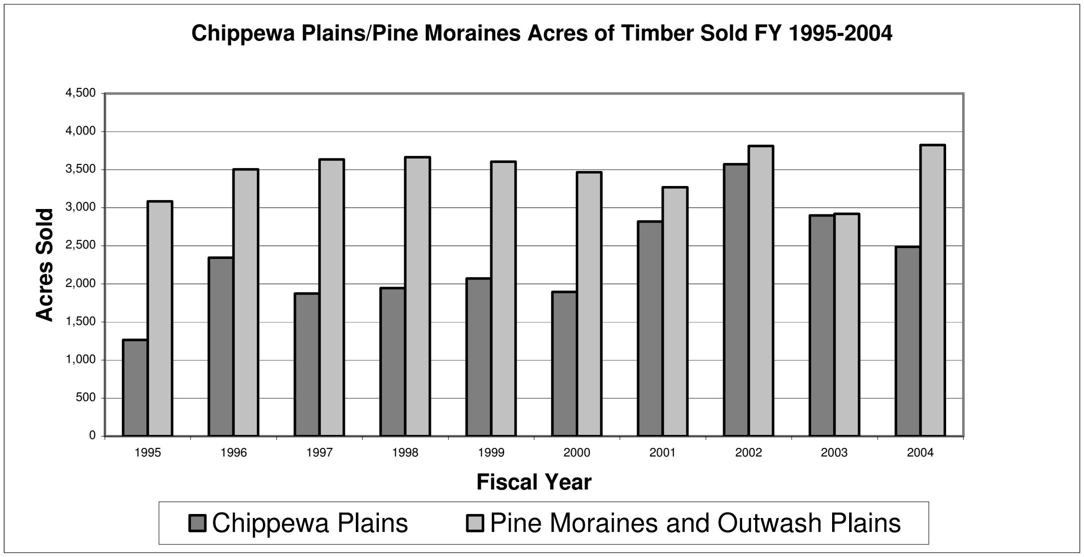
Notes relating to this chapter:

Printed documents will be available for review at Area DNR offices within the planning area, public libraries, and on compact disk by request.

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 cppm



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

An average of 5,795 acres per year was sold from DNR lands in the Chippewa Plains/Pine Moraines and Outwash Plains subsections during 1995 – 2004.

Table 4. 1 cppm

**Chippewa Plains/Pine Moraines
Acres of Timber Sold FY 1995-2004**

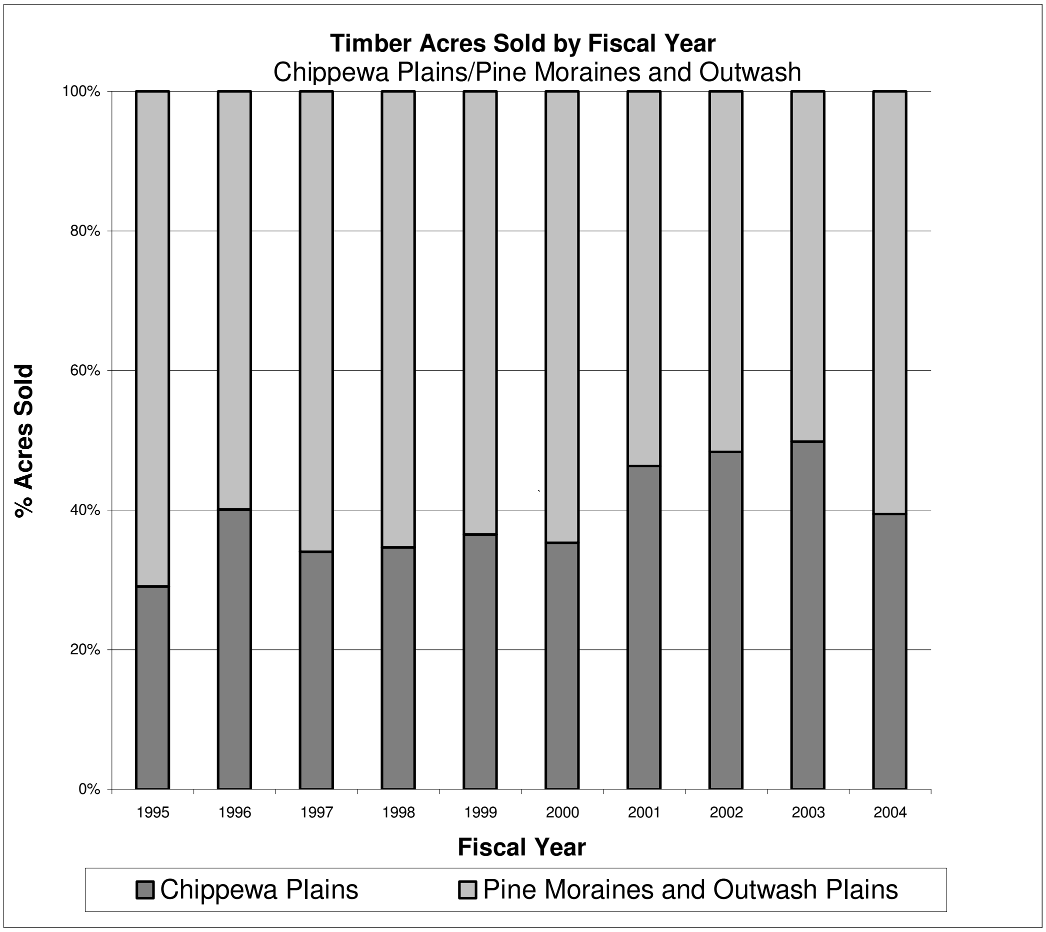
Year	Chippewa Plains	Pine Moraines	Total
1995	1,263	3,083	4,346
1996	2,346	3,503	5,849
1997	1,873	3,634	5,507
1998	1,945	3,664	5,609
1999	2,072	3,606	5,677
2000	1,895	3,468	5,363
2001	2,818	3,269	6,086
2002	3,570	3,812	7,382
2003	2,900	2,922	5,822
2004	2,487	3,823	6,310
Total	23,169	34,784	57,952

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

4.2 Percent of Timber Sale Acres by Subsection

One reason for differences in the yearly harvest level is the variation in timber markets and the resulting amount sold each fiscal year.

Chart 4.2 cppm

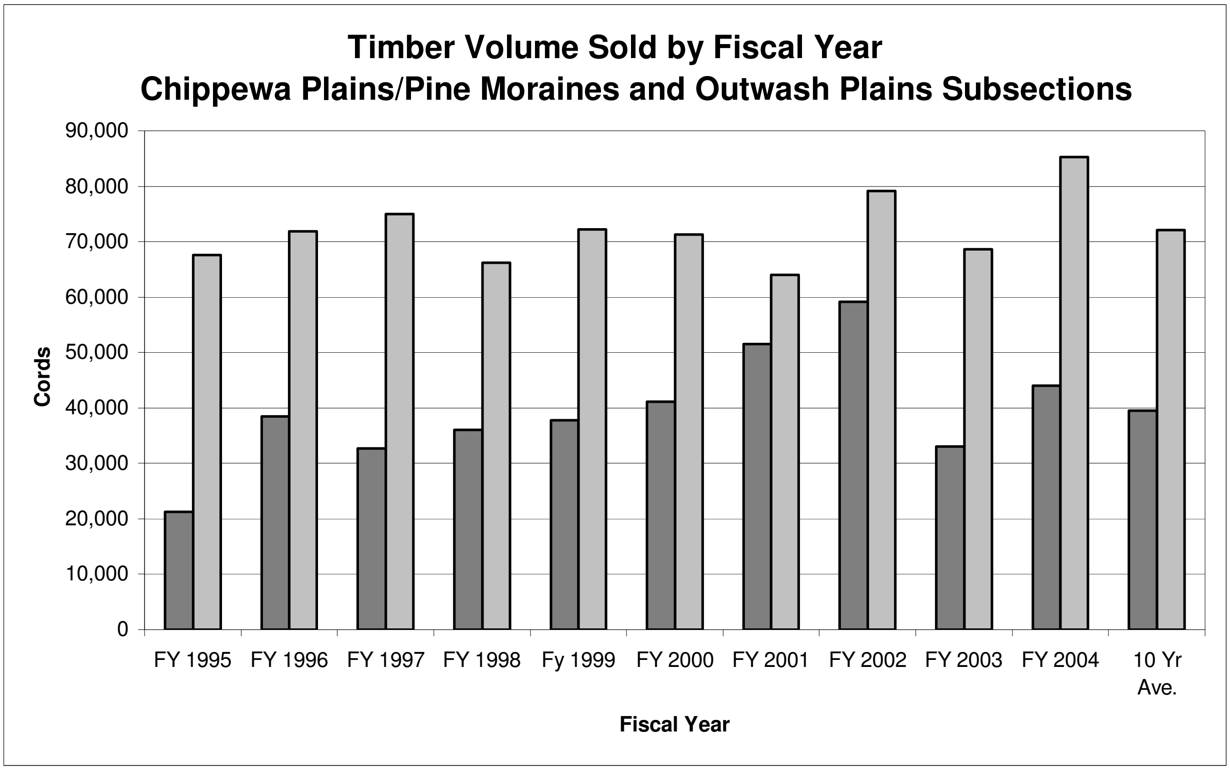


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

4.3 Volume of Timber Sold From DNR Lands in the Subsections

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

Chart 4.3 cppm



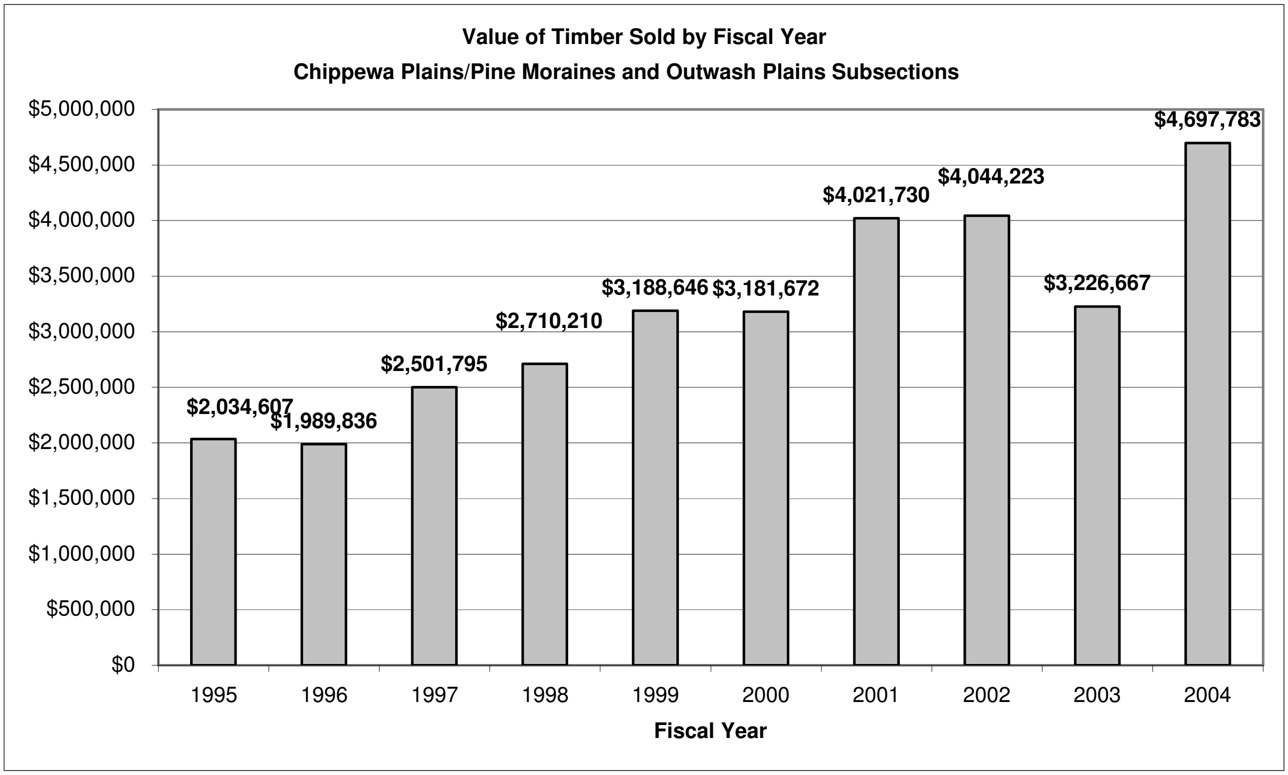
Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

An average of 111,642 cords per year were sold from DNR lands during fiscal years 1995 – 2004 in the Chippewa Plains/Pine Moraines and Outwash Plains subsections combined.

4.4 Total Value of Timber Sold From DNR Lands Per Fiscal Year in the Subsections

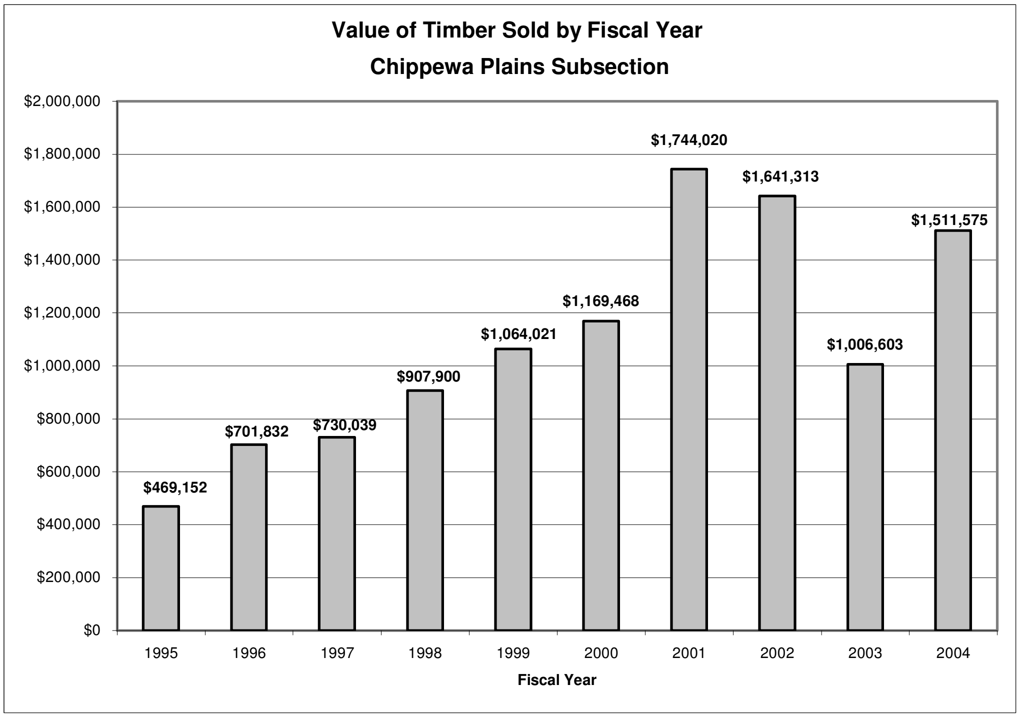
The following charts show the ***value*** of timber sold from DNR lands in the subsections during the past 10 fiscal years.

Chart 4.4 cppm



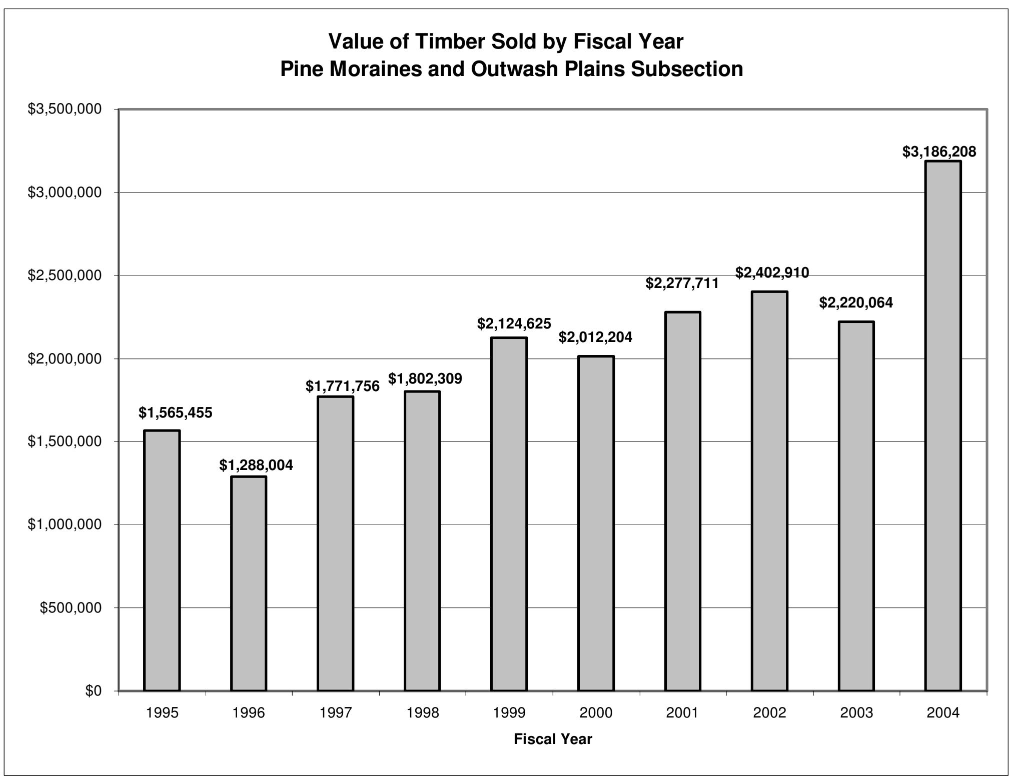
Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul.

Chart 4.4 cp



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

Chart 4.4 pm

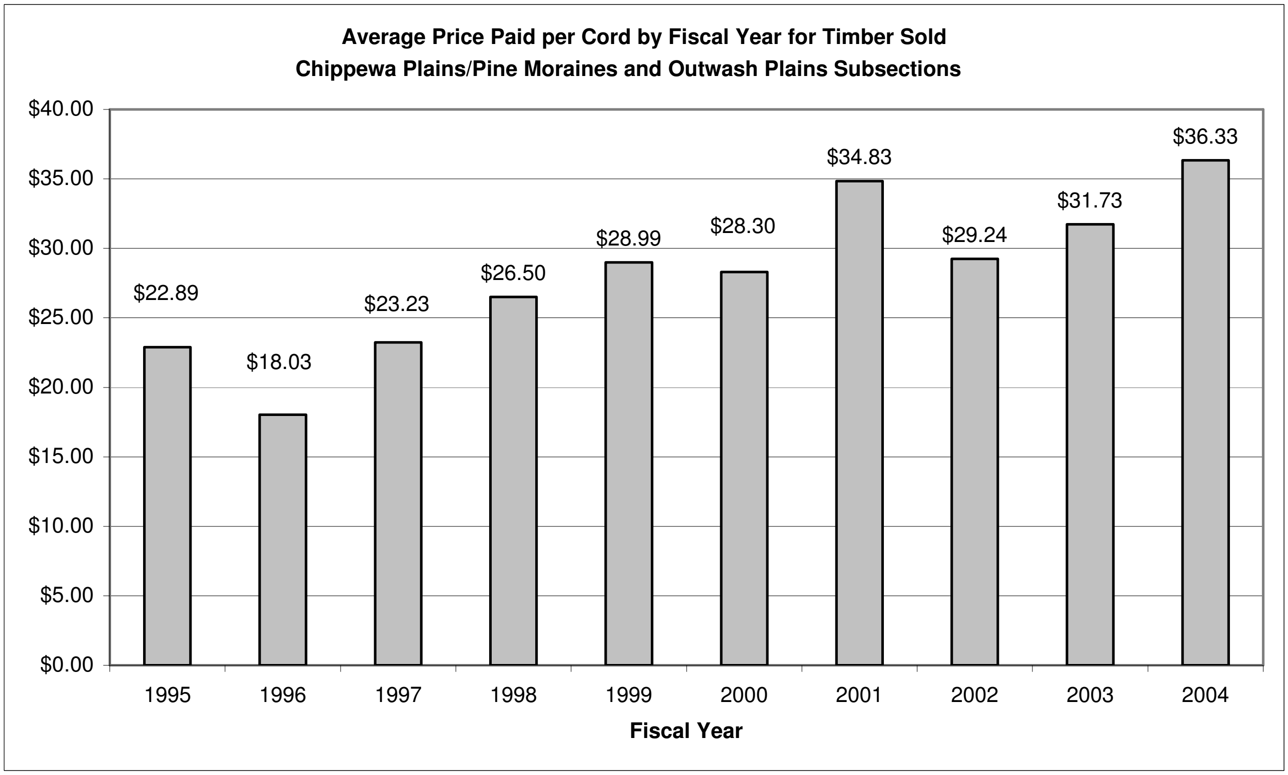


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

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

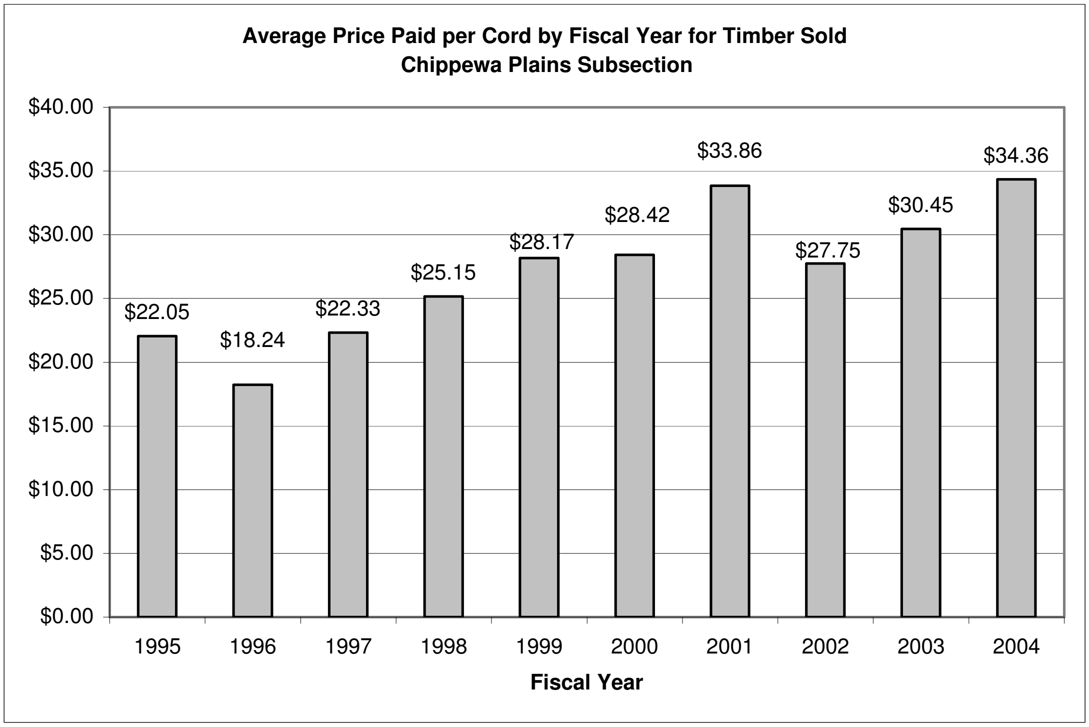
The following charts show how the stumpage value of timber sold from DNR lands in the subsections has changed from 1995 to 2004.

Chart 4.5 cppm



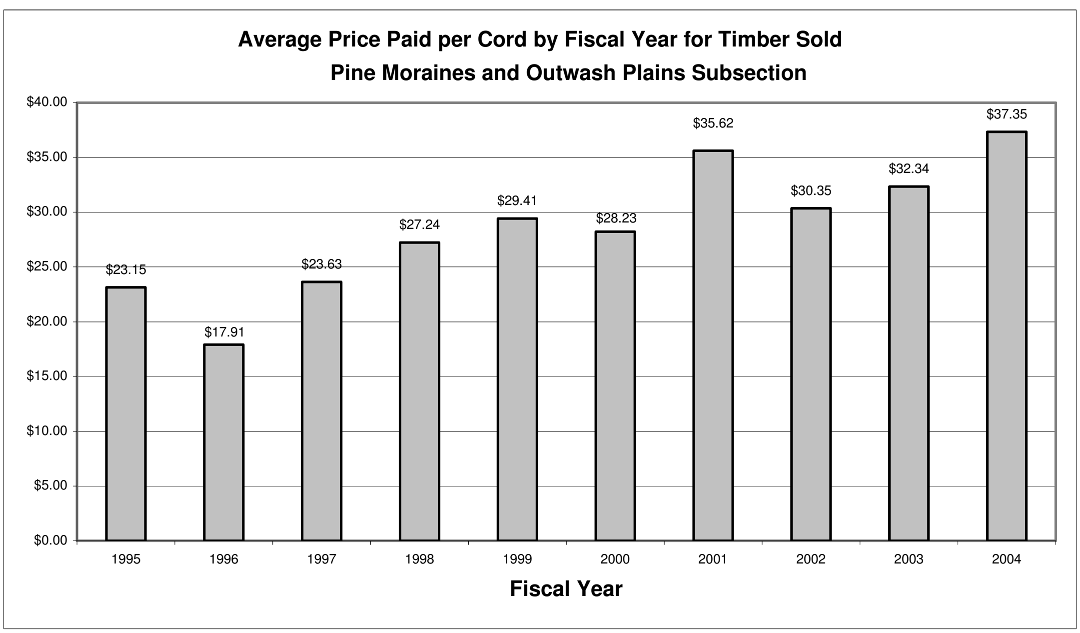
Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

Chart 4.5 cp



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

Chart 4.5 pm

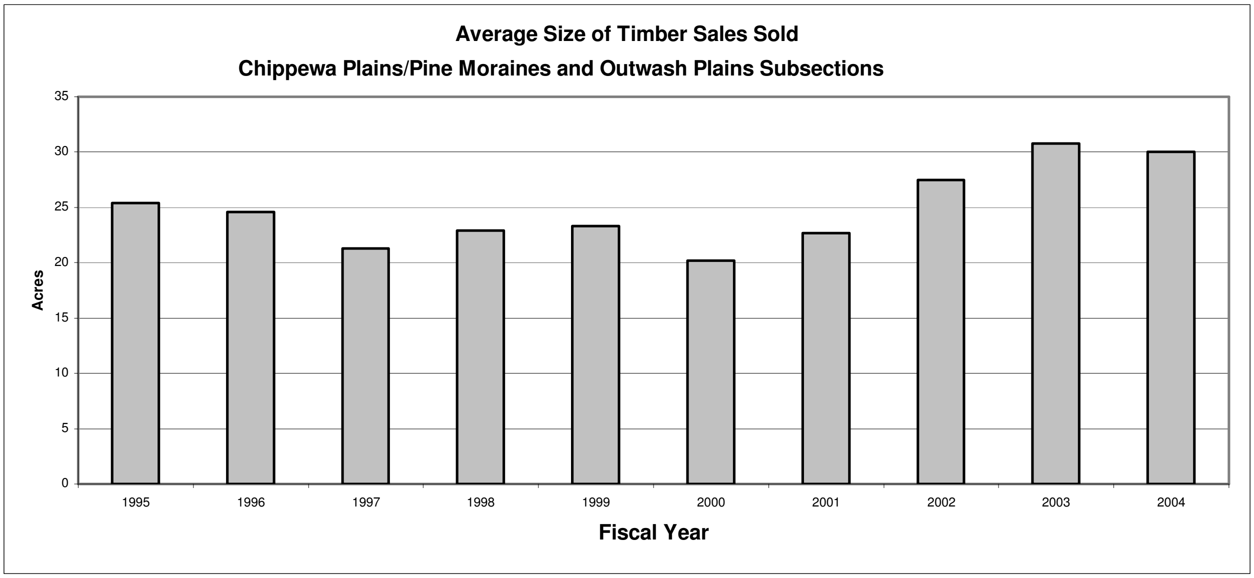


Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

4.6 Average Size of Timber Sales Sold on DNR Lands in the Subsections

Timber sales may include all the acres in a stand, a portion of a stand, or more than one stand. They may also include several units on more than one site. The following graphs provide a look at the relative size of timber sales (in total acres) on DNR lands in the subsections over a 10-year period.

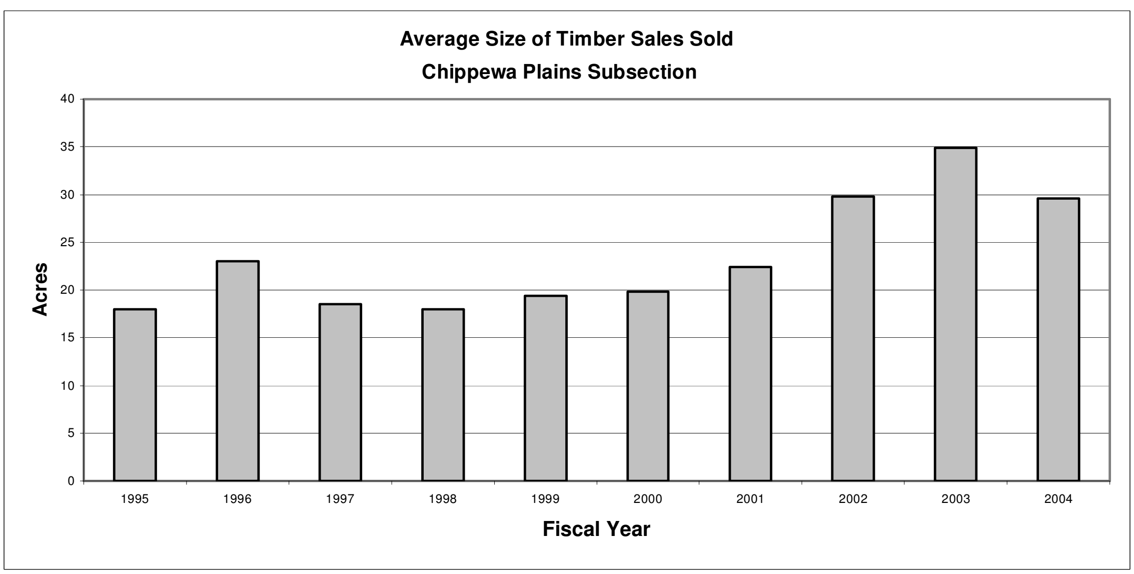
Chart 4.6 cppm



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

In the Chippewa Plains/Pine Moraines and Outwash Plains subsections, the average size of timber sales on DNR lands has increased from approximately 25.4 acres to 30 acres between 1995 and 2004.

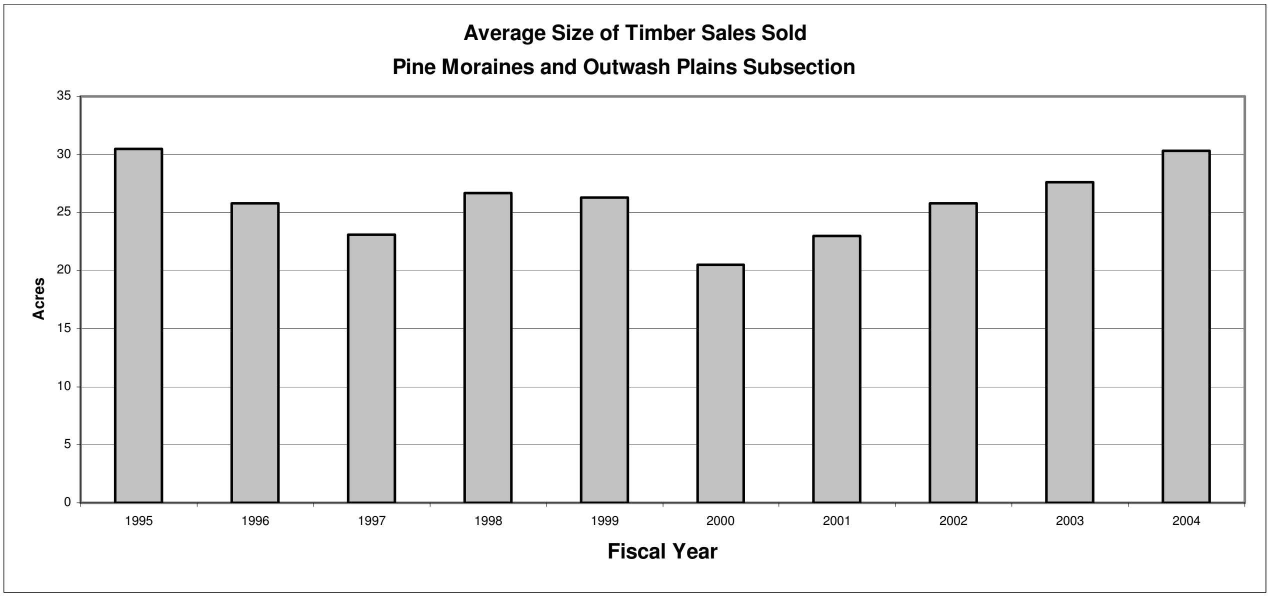
Chart 4.6 cp



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

In the Chippewa Plains Subsection, the average size of timber sales on DNR lands has increased from approximately 18 acres to 29.6 acres between 1995 and 2004.

Chart 4.6 pm



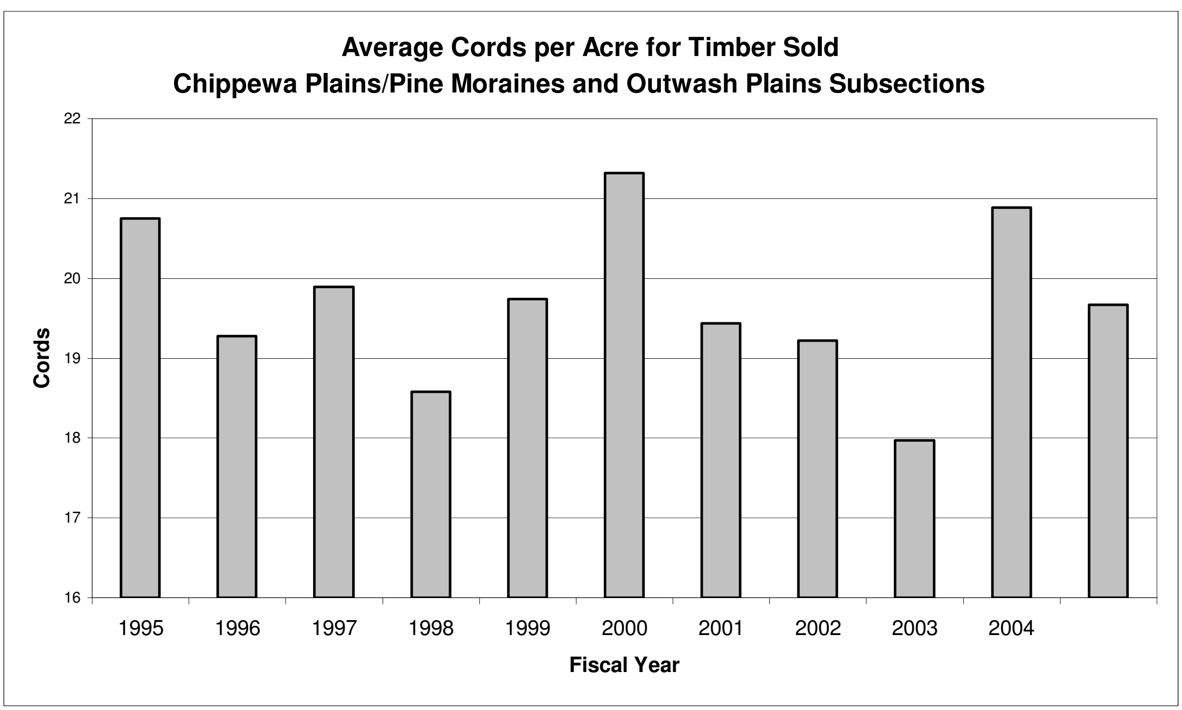
Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

In the Pine Moraines and Outwash Plains Subsection, the average size of timber sales on DNR lands began at 30.5 acres in 1995, decreased to 20.5 acres in 2000 and returned to 30.3 acres in 2004.

4.7 Average Cords Per Acre for Timber Sold From DNR Lands in the Subsections

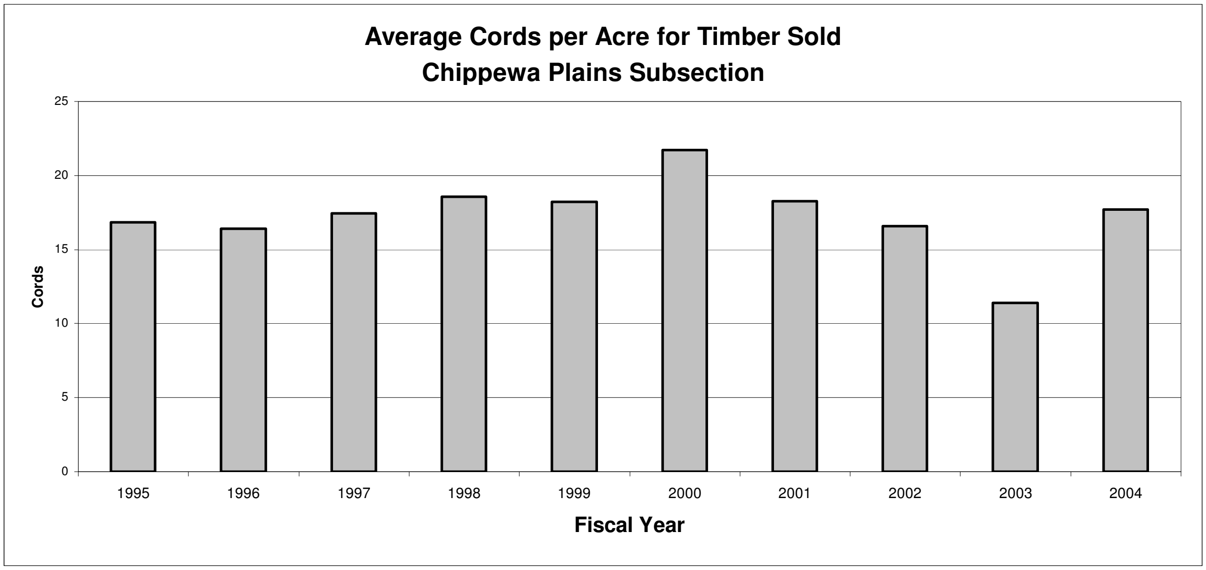
During the period of 1995 to 2004, the two subsections averaged 20 cords per acre of appraised timber on the timber sale acres sold.

Chart 4.7 cppm



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

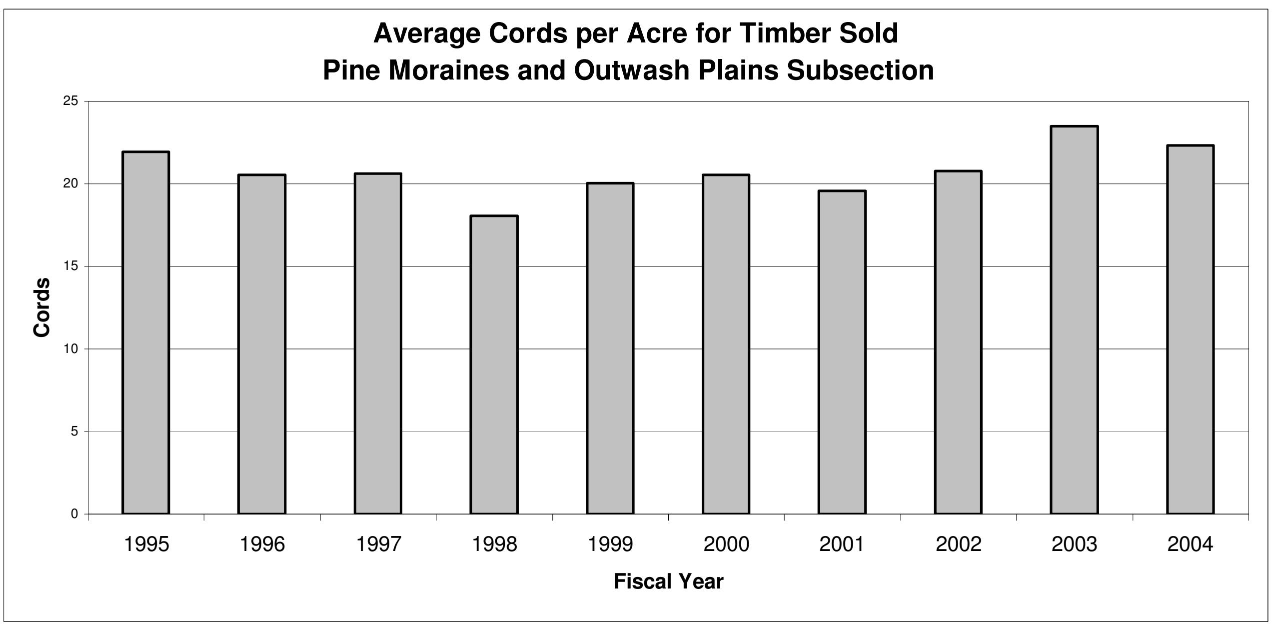
Chart 4.7 cp



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

During the period of 1995 to 2004, timber sales on DNR forestlands in the Chippewa Plains Subsection averaged 17 cords per acre.

Chart 4.7 pm



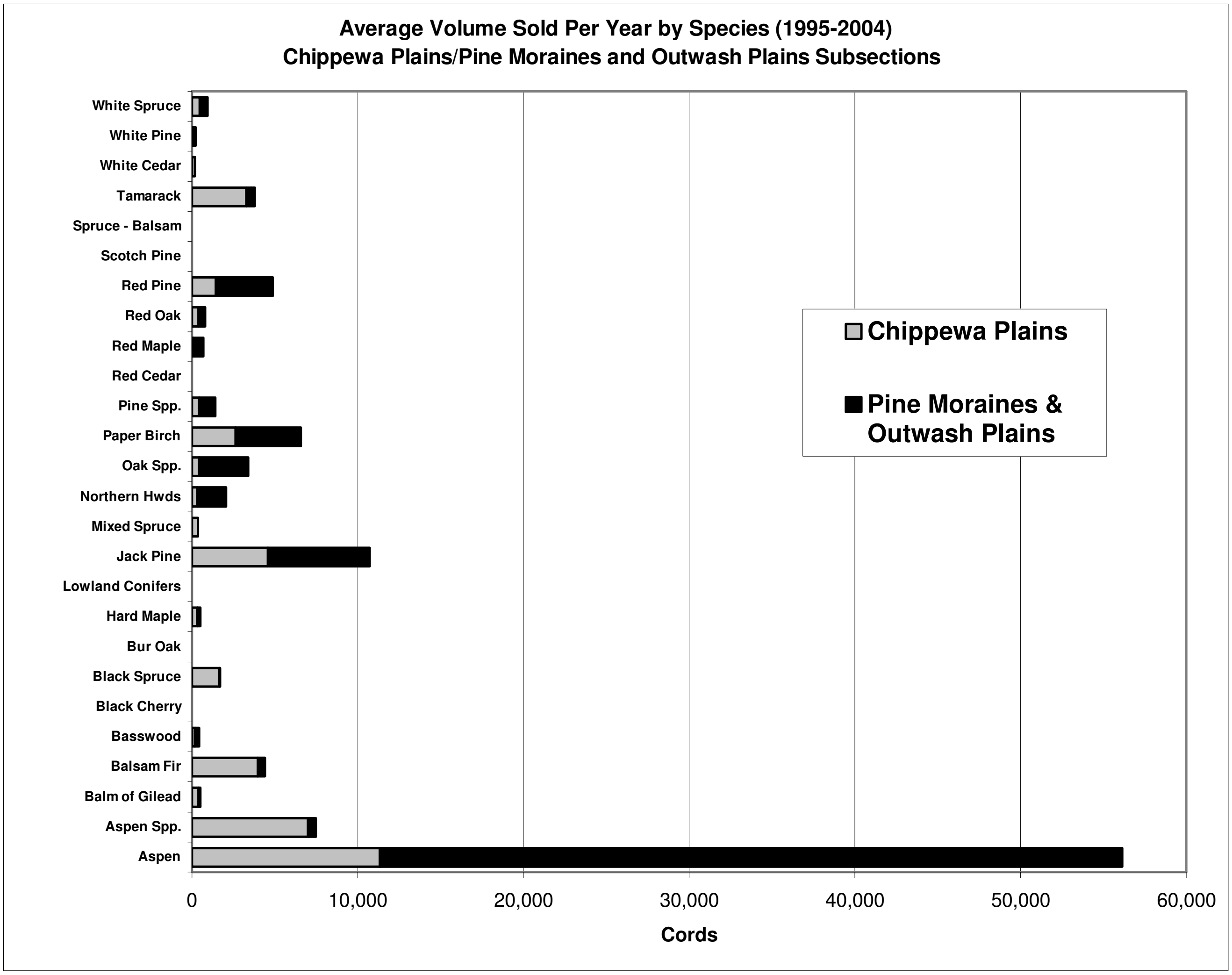
Source: Timber Sales Historical Records database, Minnesota DNR, St. Paul

During the period of 1995 to 2004, timber sales on DNR forestlands in the Pine Moraines and Outwash Plains Subsection averaged 21 cords per acre.

4.8 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 graphs show volumes sold by species.

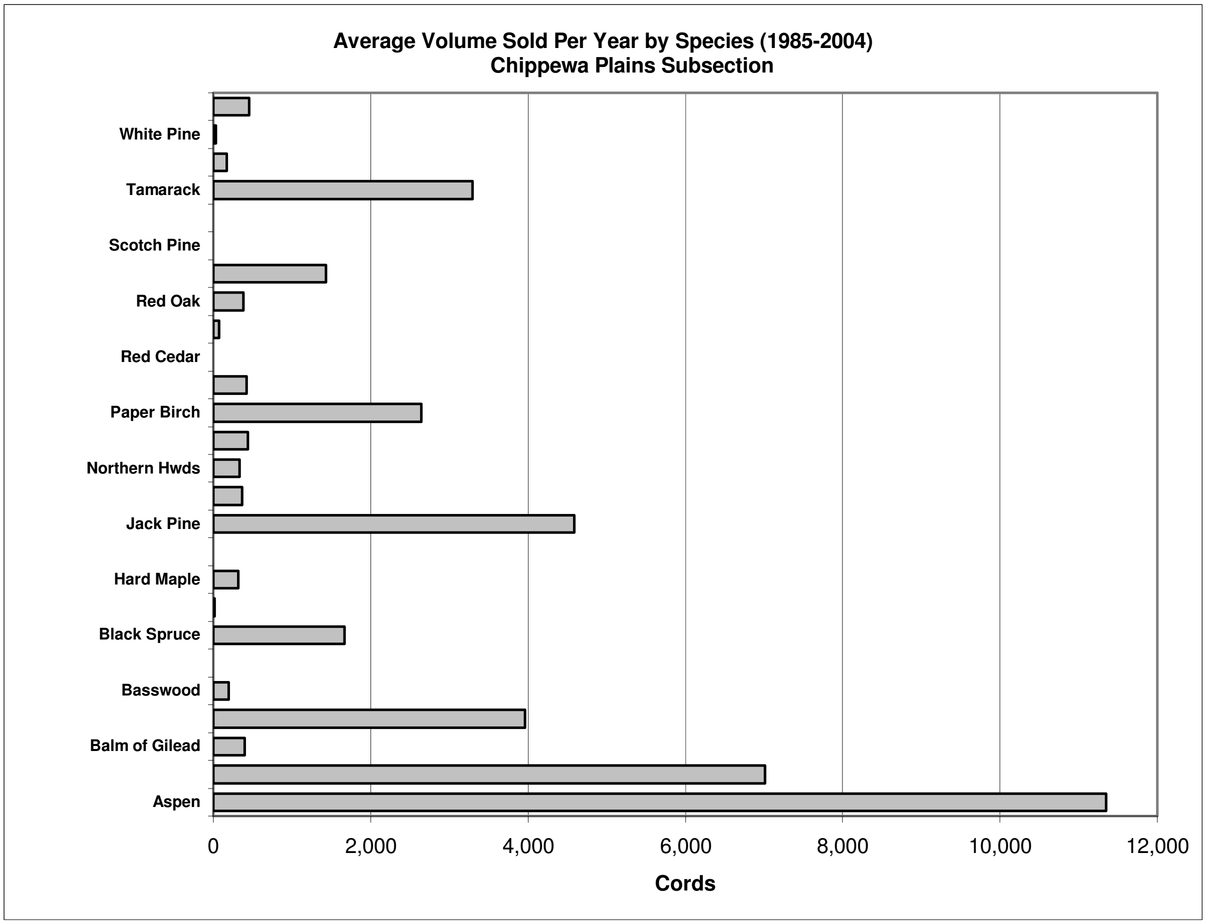
Chart 4.8 cppm



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

During the period of 1995 to 2004, an average of 111,642 cords were sold per year from DNR forestlands in the two subsections combined. The aspen volume includes volumes sold as aspen species, which includes both aspen and balm of Gilead.

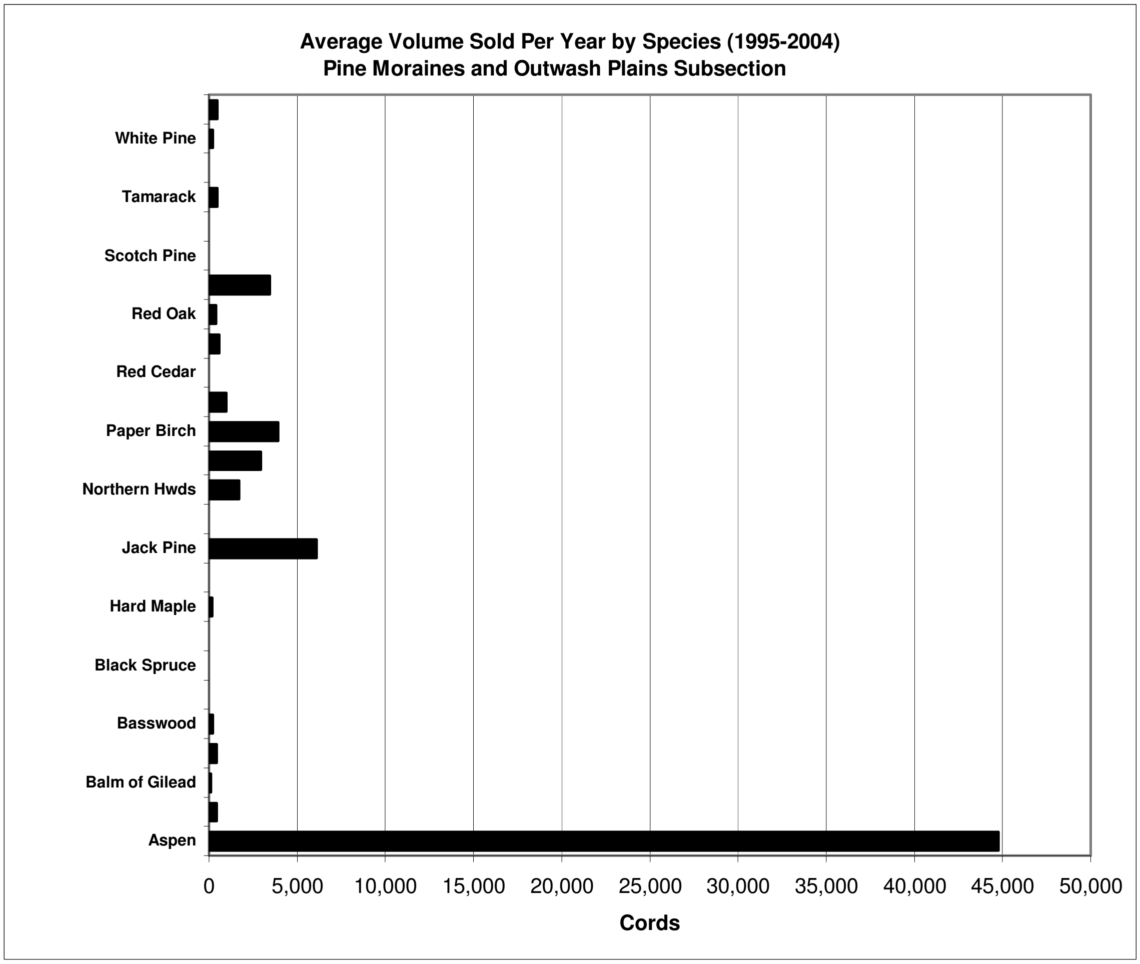
Chart 4.8 cp



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

During the period of 1995 to 2004, an average of 39,518 cords per year were sold from DNR forestlands in the Chippewa Plains Subsection.

Chart 4.8 pm



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

During the period from 1995 to 2004, an average of 72,124 cords per year were sold from DNR forestlands in the Pine Moraines and Outwash Plains Subsection.

4.9 Decorative Trees Sold on Timber Sales on DNR Lands in the Subsections

Decorative tree harvesting (i.e., spruce tops, birch tops, etc.) in the Chippewa Plains/Pine Moraine and Outwash Plains subsections during the period of 1990 to 2004 was limited to the Deer River Forestry Area and occurred primarily in 2001 and 2002. Three timber sales were sold with a total of 171,000 spruce tops.

Statewide, the sale of black spruce tops has increased greatly since 1997. Black spruce decorative tree products are harvested from the *stagnant* spruce cover type where the trees grow very slowly. (A stagnant cover type is defined as growing less than 23 feet after 50 years of growth, or a site index less than 23.)

4.10 Mean Annual Increment (MAI) Graphs by Cover Type

Introduction

SFRMP teams use mean annual increment (MAI)[1] estimates as a tool when considering management of forest cover types managed under even-aged systems.

The following MAI graphs are based on Forest Inventory and Analysis (FIA) data from all forestland ownerships in the two subsections or Forest Inventory Module (FIM) data from DNR Forestry- and Wildlife-administered lands in these subsections. In cases where enough FIA plot data was available for statistical accuracy, it was used to develop the graphs. In cases where there were too few FIA plots to make the data statistically accurate, a graph based on FIM data is provided. FIA cords per acre volume data are often lower than FIM data because volume deductions for rot and other defects affecting use of the timber products are measured more precisely on the FIA survey plots.

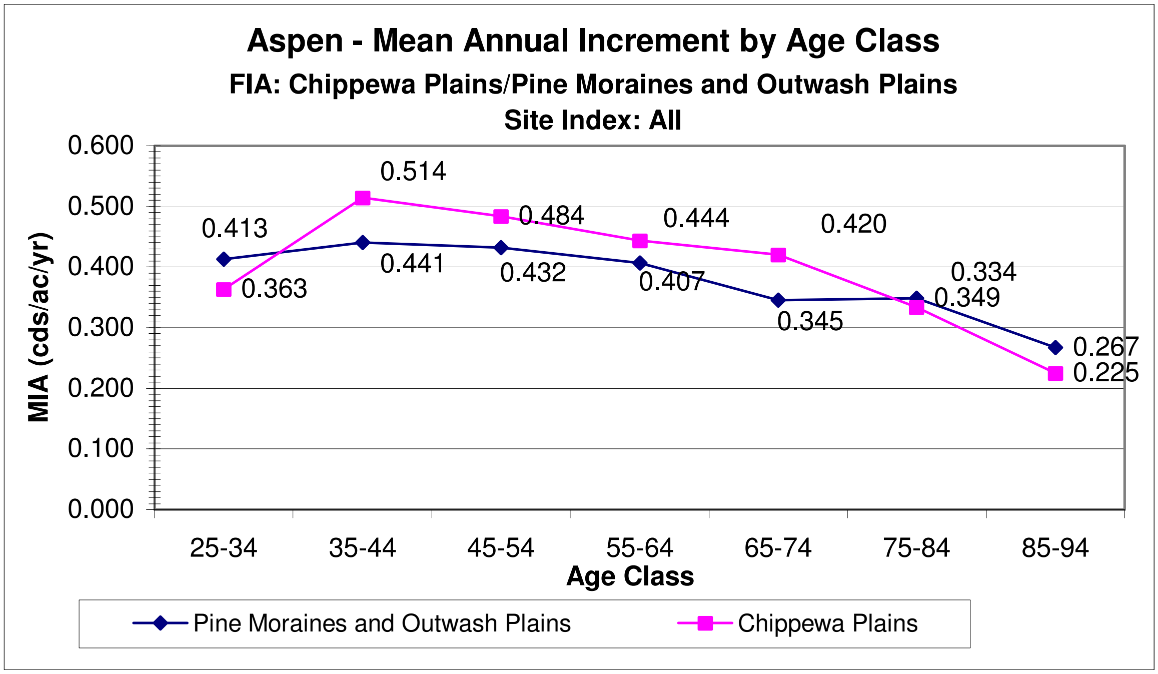
Following the MAI graphs for each cover type, graphs are provided showing acreage and volume relationships for 10-year age intervals of stand age. These graphs are based on FIM data. In each case, the bars show the acres required to produce 1,000 cords based on the average cords per acre of the cover type at specified harvest ages. The line graphs show the acres of the cover type required to produce 1,000 cords of timber annually on a continuous or sustainable basis at specified harvest ages. For example, the line graph for aspen indicates that it requires more acres to produce 1,000 cords of timber on an annual basis as the harvest age increases.

Aspen

The following MAI chart shows the average yearly volume (in cords per acre) accumulated by aspen stands of various ages in the two subsections based on FIA data.

[1] **Mean annual increment (MAI)** based on timber volume is the average amount of volume accumulated each year over the lifetime of a stand. This figure is determined by dividing the total accumulated volume (e.g., cords/acre) by the age of the stand. It is normally considered for stands managed on an even-aged basis. It is difficult to determine MAI for uneven-aged stands since they include a variety of ages. The MAI provides the best estimate of the maximum production rate that can be sustained by a given combination of tree species and site quality, provided stands are replaced close to the age of maximum MAI. The peak of MAI is a key value used when determining how much can be harvested annually from a forest that is managed to produce a sustained yield and how long the stands should be held to maximize production.

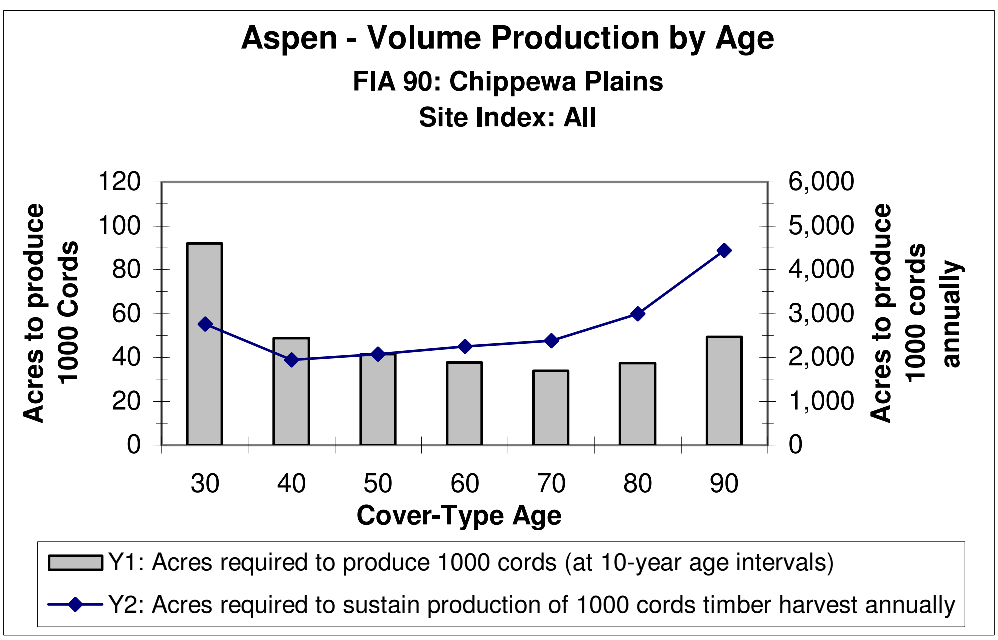
Chart 4.10 cppm-A



Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Example: To calculate the total cords per acre produced by 35- to 44-year-old aspen stands in the Chippewa Plains, the tree age (40) must be multiplied by the MAI (0.514) for that age class. The 35 to 44 year old age class assumes the average age is 40. In this case, the result is 20.56 total cords/acre.

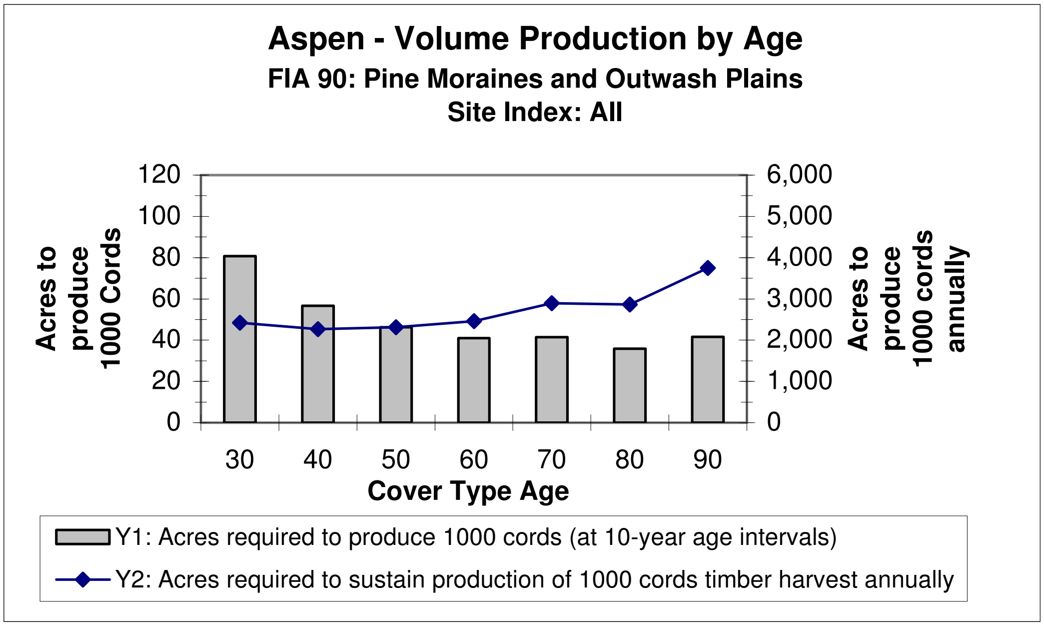
Chart 4.10 cp-A



Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of aspen in the Chippewa Plains is 34 acres at a harvest age of 70. The minimum number of acres needed to produce 1,000 cords ***annually*** is 1,946 at a harvest age of 40.

Chart 4.10 pm-A



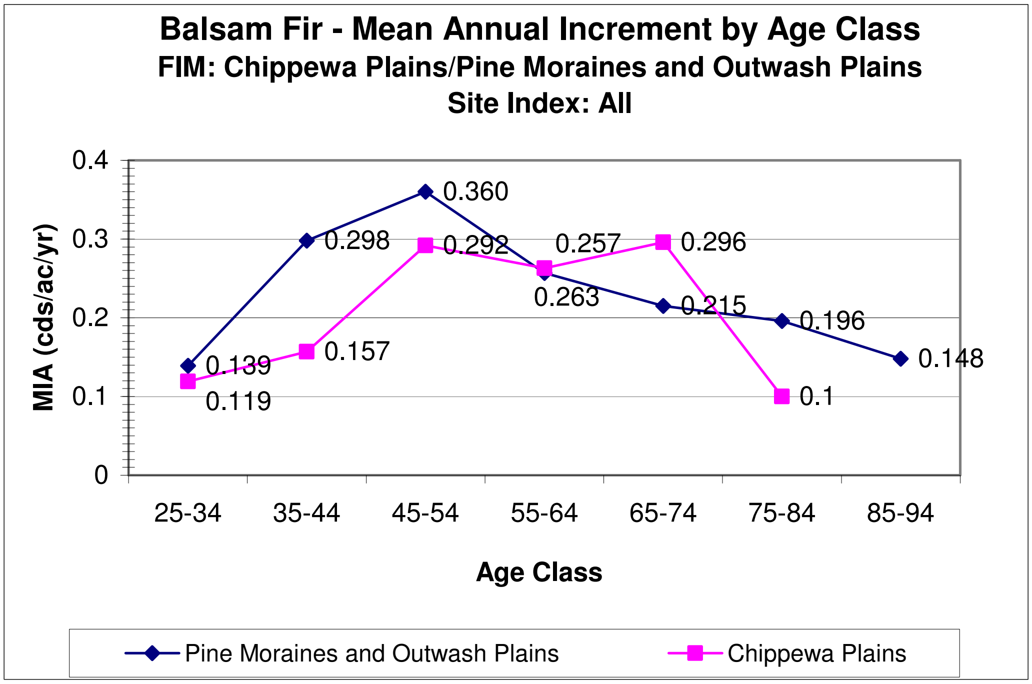
Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of aspen in the Pine Moraines and Outwash Plains Subsection is 36 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2,268 at a harvest age of 40.

Balsam Fir

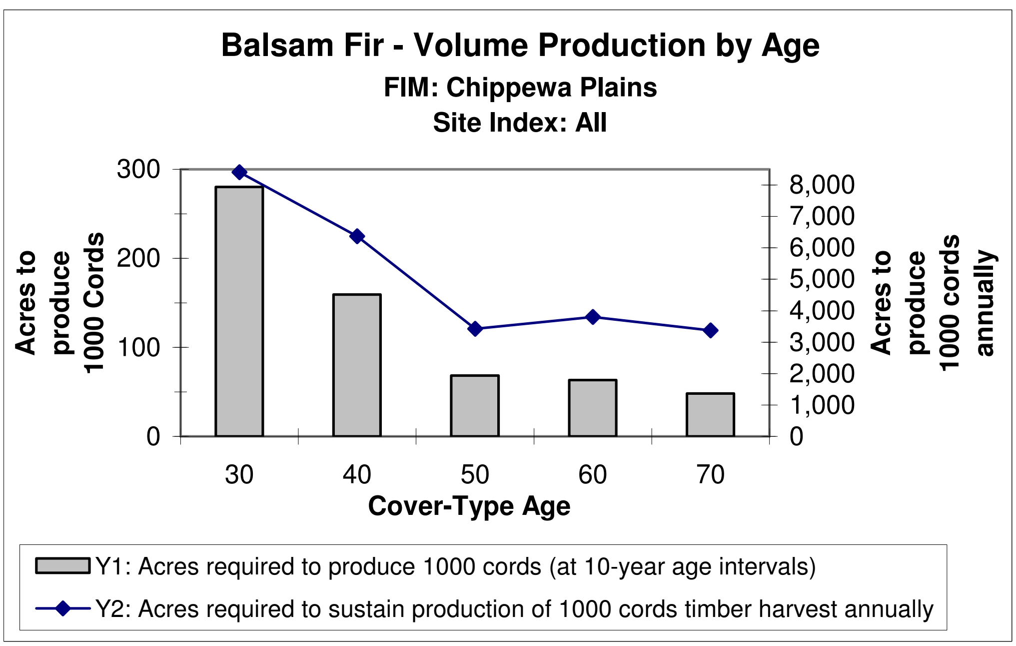
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by balsam fir stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-BF



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

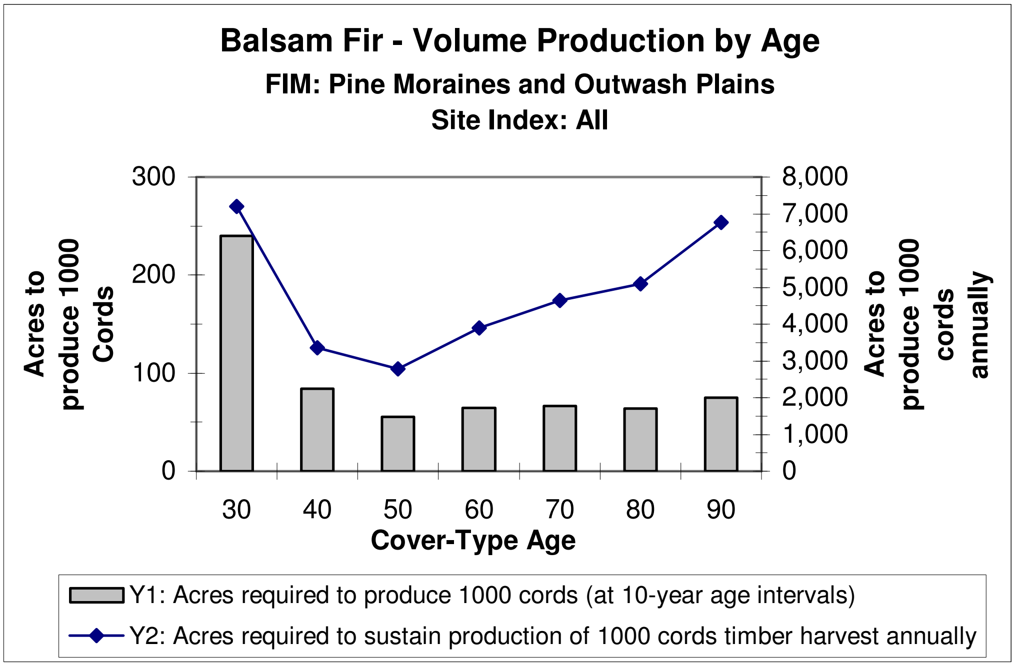
Chart 4.10 cp-BF



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the previous graph, the minimum number of acres that will yield 1,000 cords of balsam fir in the Chippewa Plains is 48 acres at a harvest age of 70. The minimum number of acres needed to produce 1,000 cords ***annually*** is 3,425 at a harvest age of 50.

Chart 4.10 pm-BF



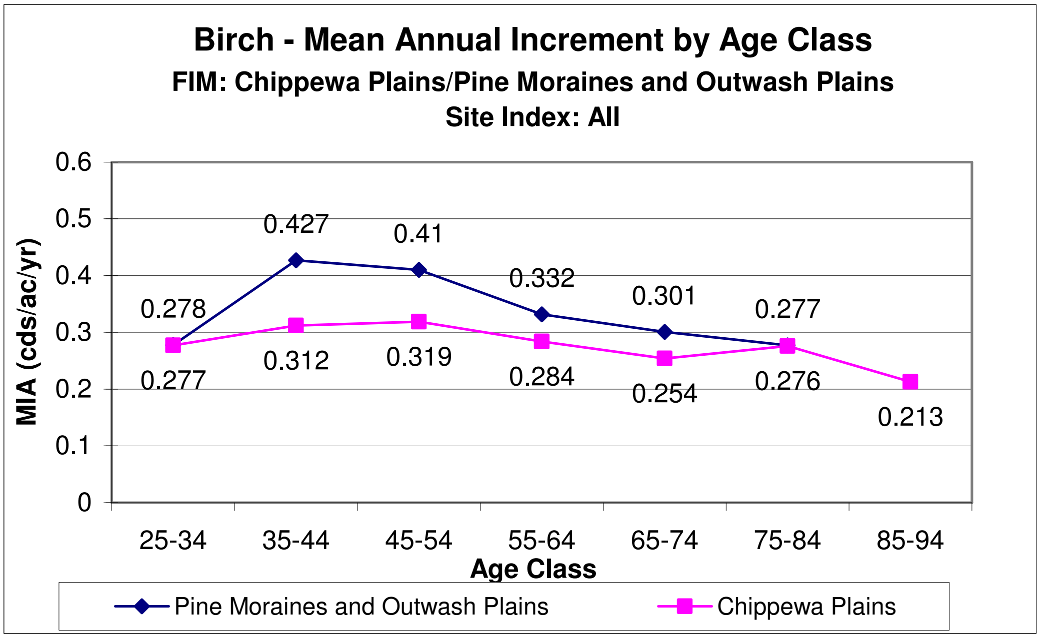
Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of balsam fir in the Pine Moraines and Outwash Plains Subsection is 56 acres at a harvest age of 50. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2,778 at a harvest age of 50.

Birch

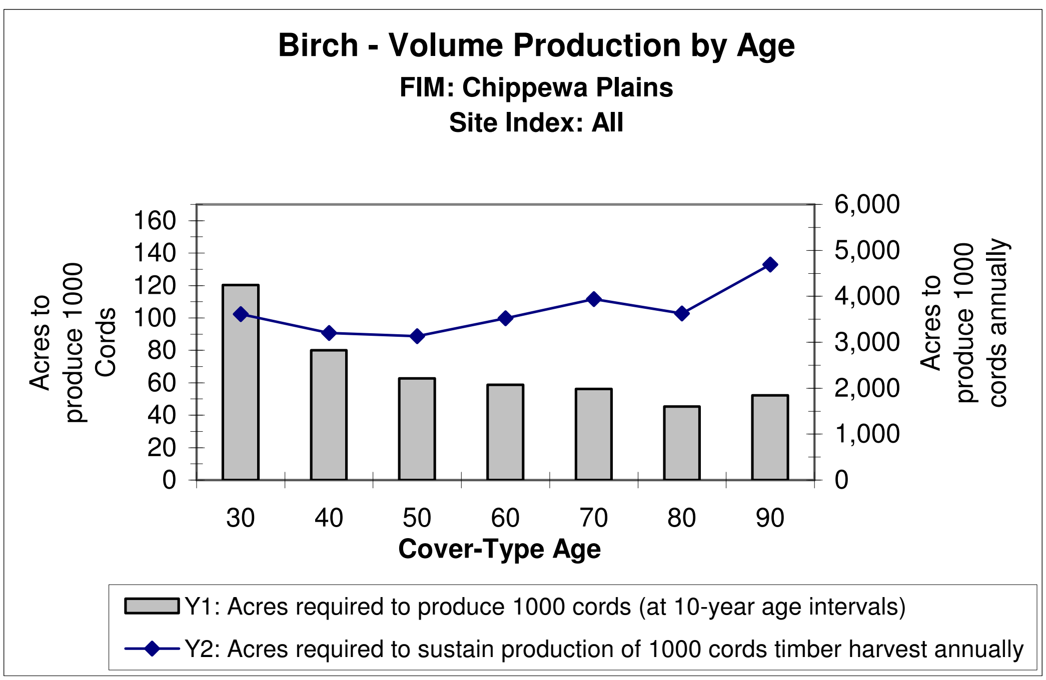
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by birch stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-Bi



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

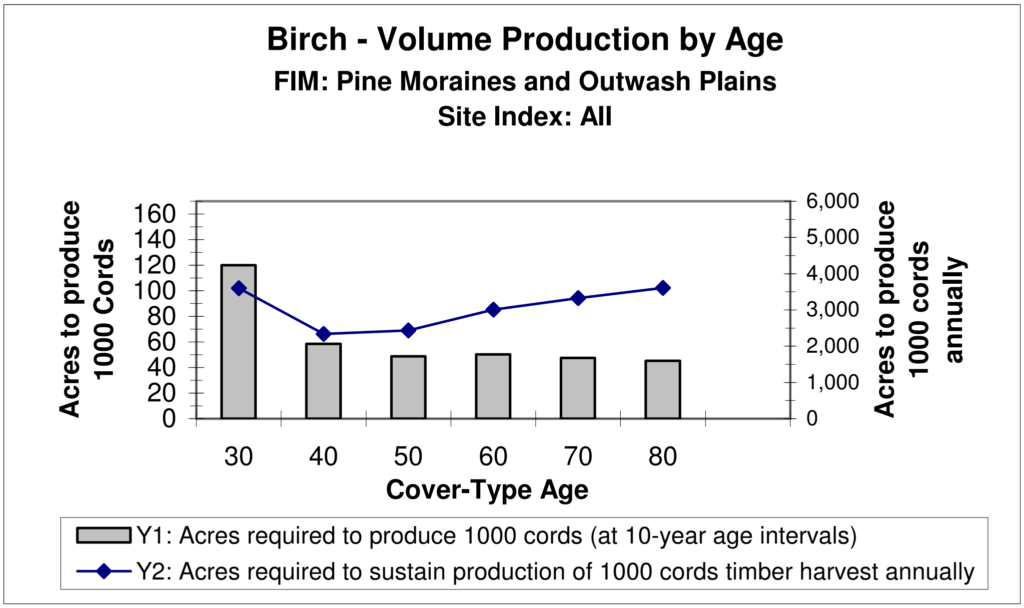
Chart 4.10 cp-Bi



Source Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of birch in the Chippewa Plains is 45 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 3,135 at a harvest age of 50.

Chart 4.10 pm-Bi



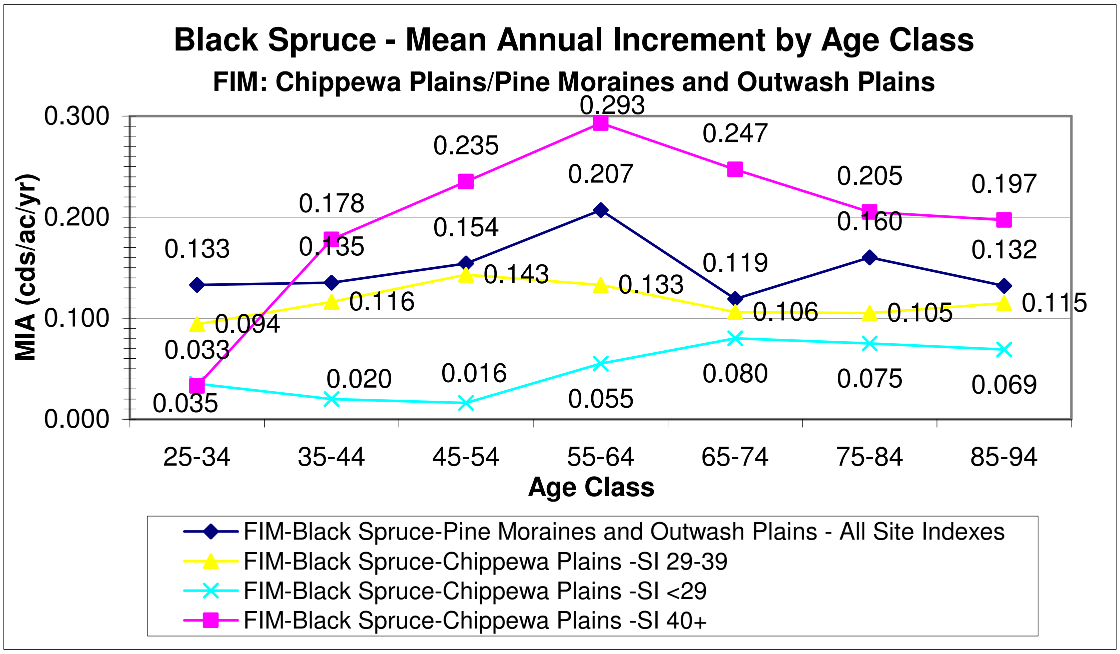
Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of birch in the Pine Moraines and Outwash Plains is 47 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2,342 at a harvest age of 40.

Black Spruce

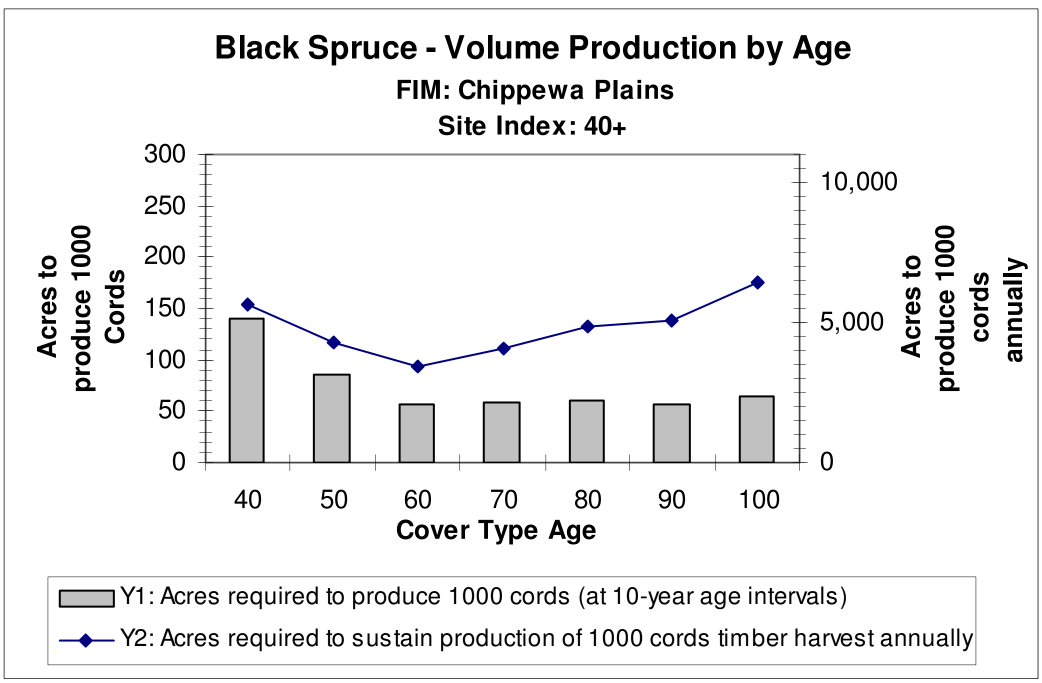
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by black spruce stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-BS



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

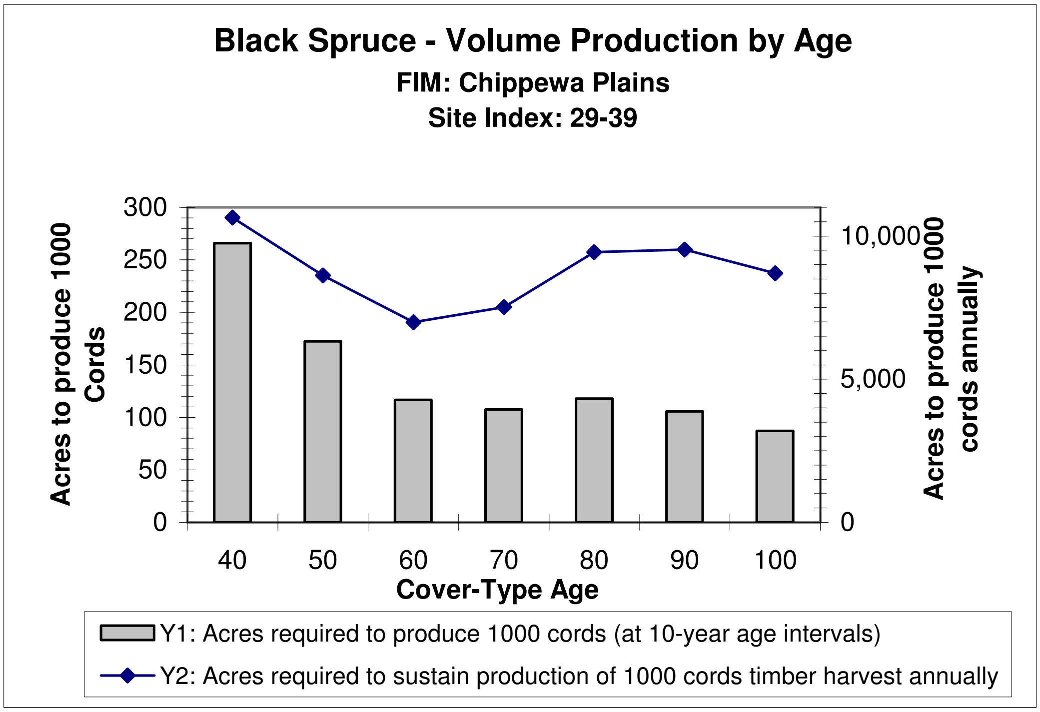
Chart 4.10 cp-BS 40+



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the previous graph, the minimum number of acres that will yield 1,000 cords of black spruce in the Chippewa Plains is 56 acres at a harvest age of 90. The minimum number of acres needed to produce 1,000 cords ***annually*** is 3,413 at a harvest age of 60.

Chart 4.10-BS 29-39



Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data

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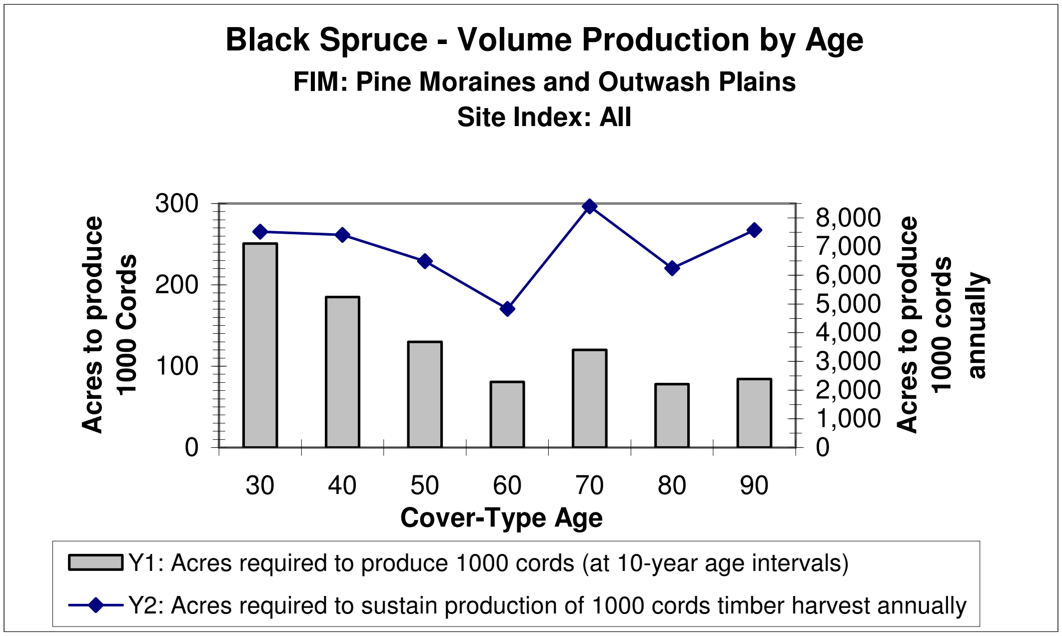
Based on the above graph, the minimum number of acres that will yield 1,000 cords of black spruce in the Chippewa Plains is 87 acres at a harvest age of 100. The minimum number of acres needed to produce 1,000 cords ***annually*** is 6,993 at a harvest age of 60.

Chart 4.10 pm-BS



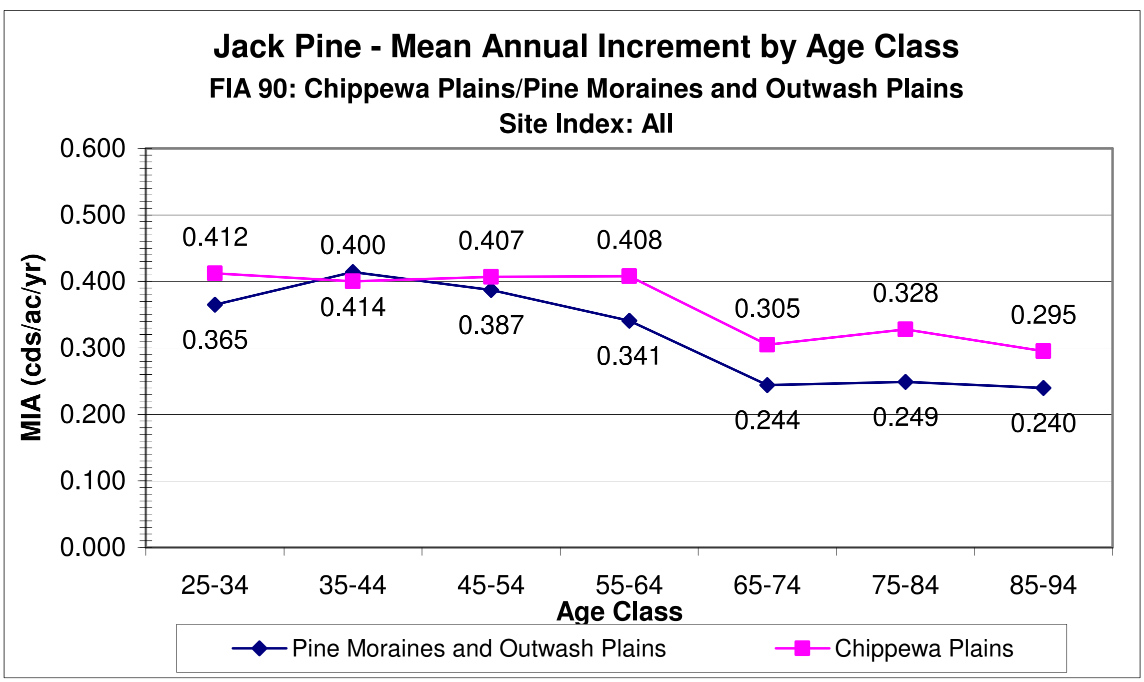
Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of black spruce in the Pine Moraines and Outwash Plains is 78 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 4,831 at a harvest age of 60.

Jack Pine

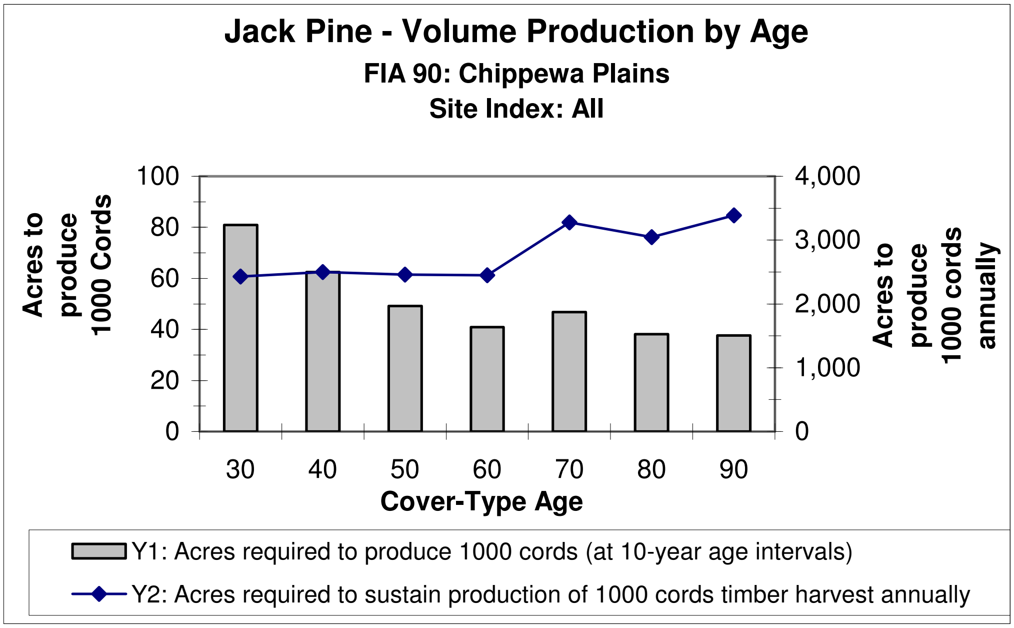
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by jack pine stands of various ages in the two subsections based on FIA data.

Chart 4.10 cppm-JP



Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

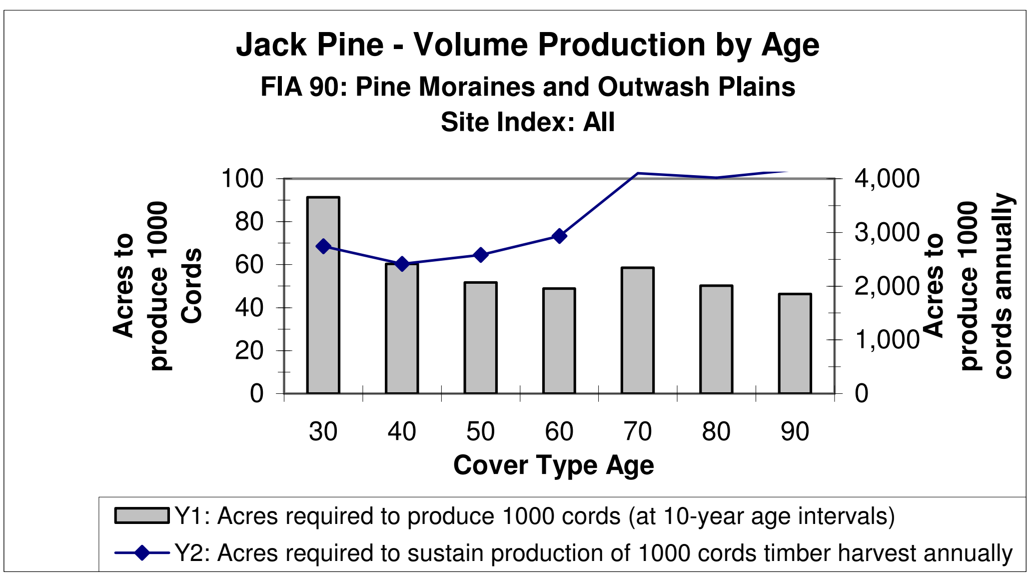
Chart 4.10 cp-JP



Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of jack pine in the Chippewa Plains is 38 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2451at a harvest age of 60.

Chart 4.10 pm-JP

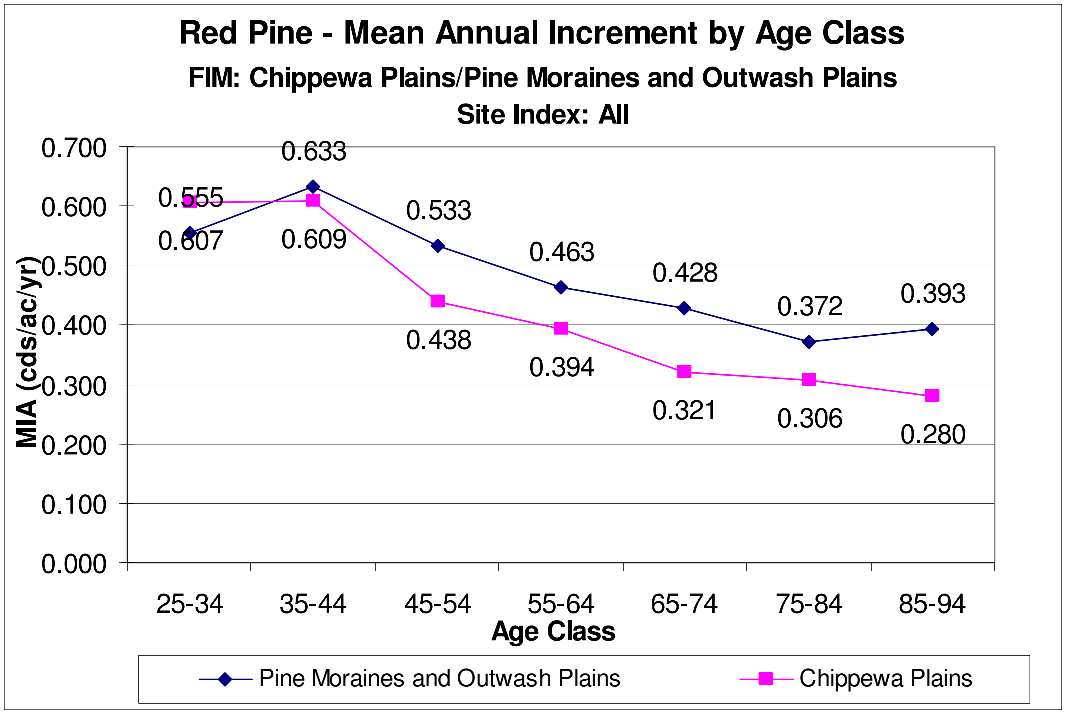


Source: Minnesota DNR, St. Paul based on USDA Forest Service 1990 Forest Inventory and Analysis (FIA) data.

Based on the previous graph, the minimum number of acres that will yield 1,000 cords of jack pine in the Pine Moraines and Outwash Plains is 46 acres at a harvest age of 90. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2,415 at a harvest age of 40.

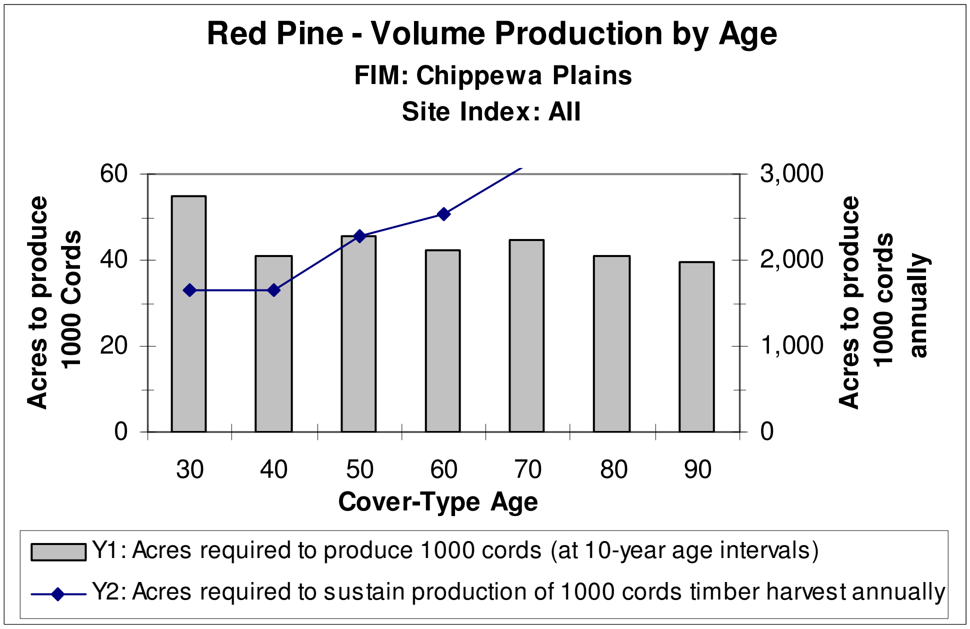
Red Pine
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by red pine stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-RP



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

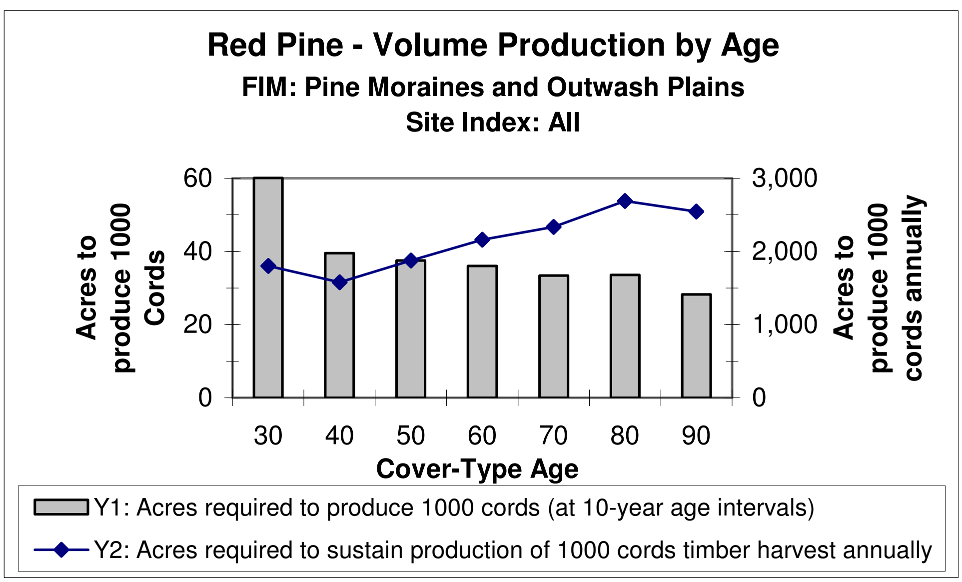
Chart 4.10 cp-RP



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of red pine in the Chippewa Plains is 42 acres at a harvest age of 60. On the other hand, the minimum number of acres needed to produce 1,000 cords ***annually*** is 1,642 at a harvest age of 40. Since most red pine stands are managed with intermediate harvests, this measure may not be as significant as for other cover types.

Chart 4.10 pm-RP



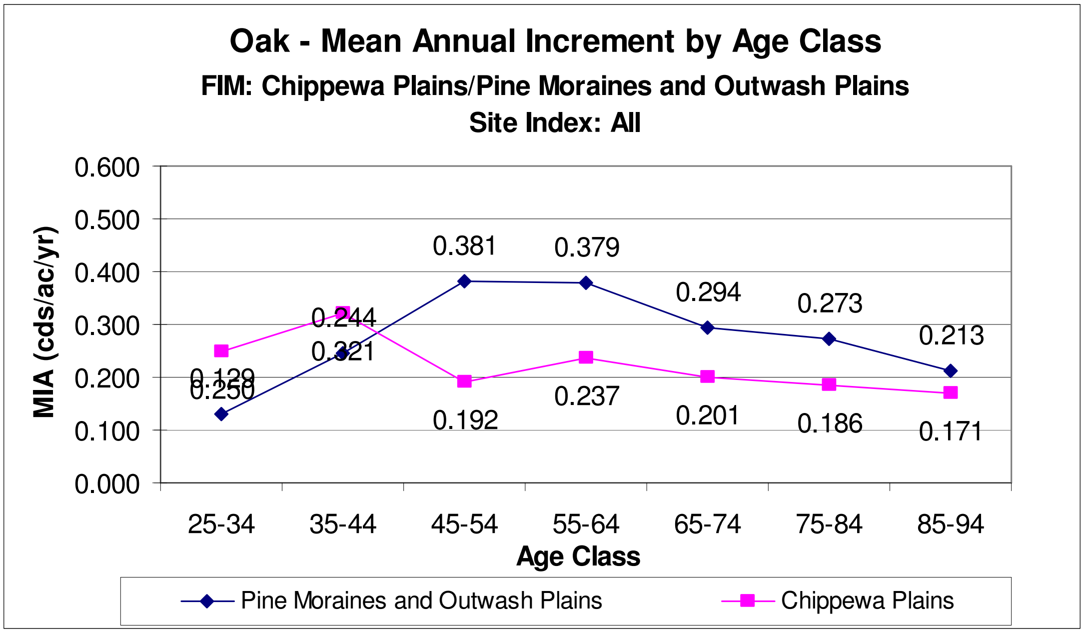
Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of red pine in the Pine Moraines and Outwash Plains is 28 acres at a harvest age of 90. On the other hand, the minimum number of acres needed to produce 1,000 cords ***annually*** is 1,580 at a harvest age of 40. Since most red pine stands are managed with intermediate harvests, this measure may not be as significant as for other cover types.

Oak

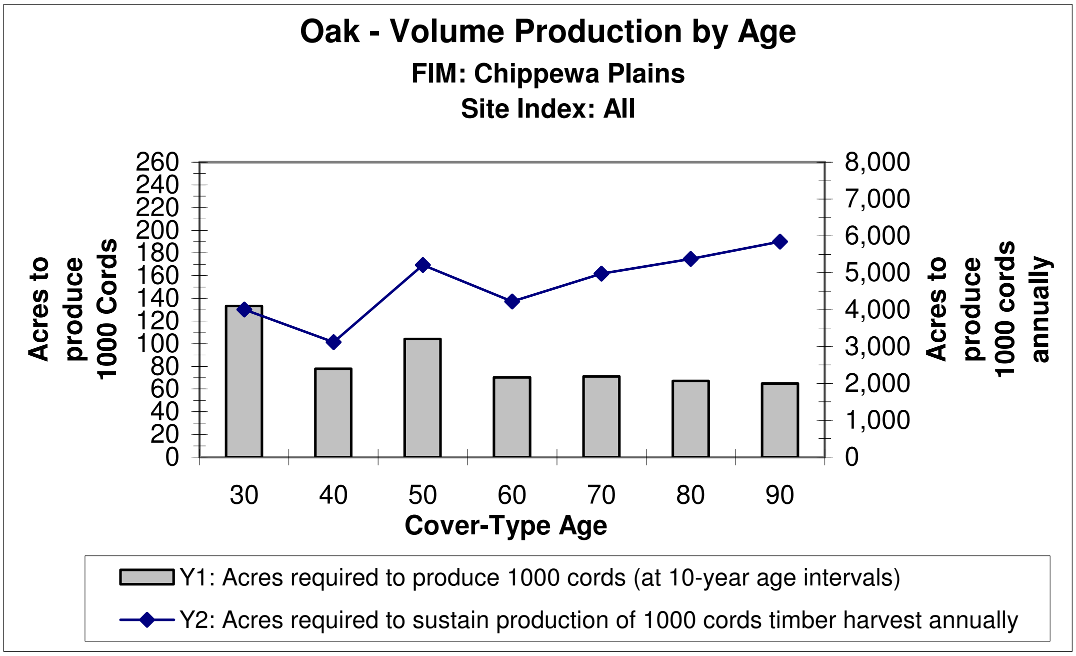
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by oak stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-O



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

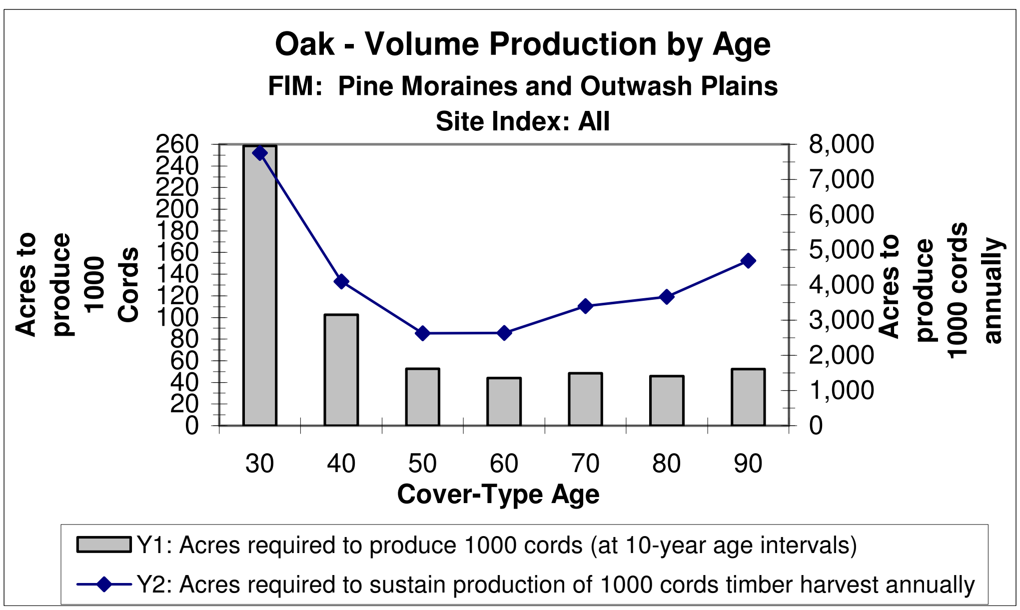
Chart 4.10 cp-O



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of oak in the Chippewa Plains is 65 acres at a harvest age of 90. The minimum number of acres needed to produce 1,000 cords ***annually*** is 3,115 at a harvest age of 40. Since most oak stands on better quality sites are managed with intermediate thinning, this measure will not be applicable to all stands.

Chart 4.10 pm-O



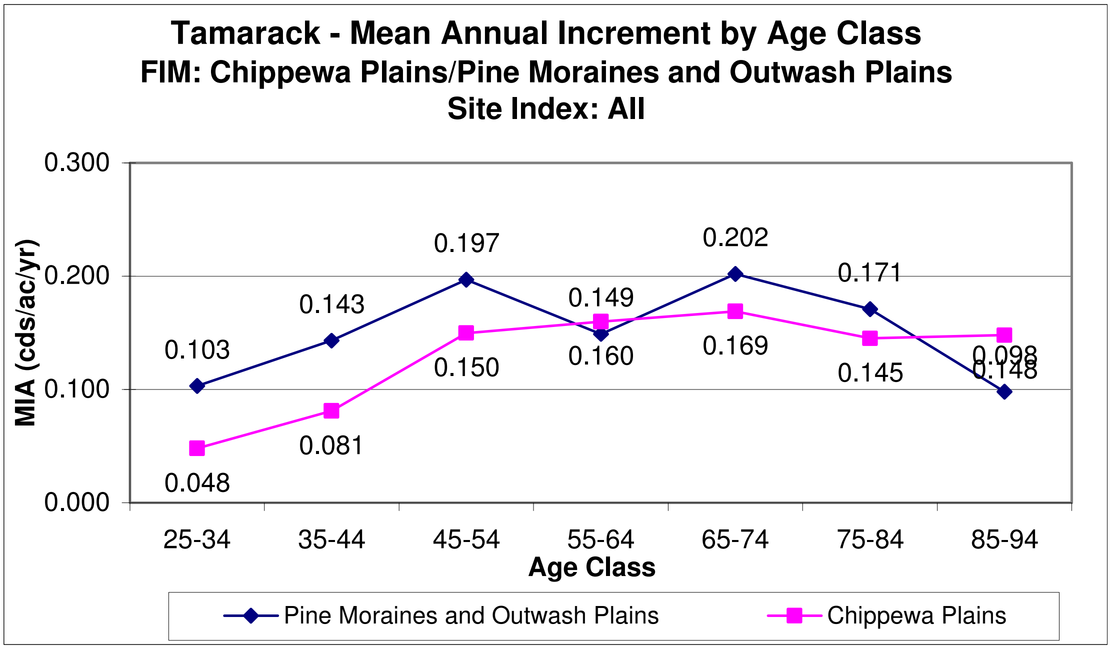
Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the previous graph, the minimum number of acres that will yield 1,000 cords of oak in the Pine Moraines and Outwash Plains is 44 acres at a harvest age of 60. The minimum number of acres needed to produce 1,000 cords ***annually*** is 2,625 at a harvest age of 50. Since most oak stands on better quality sites are managed with intermediate thinning, this measure will not be applicable to all stands.

Tamarack

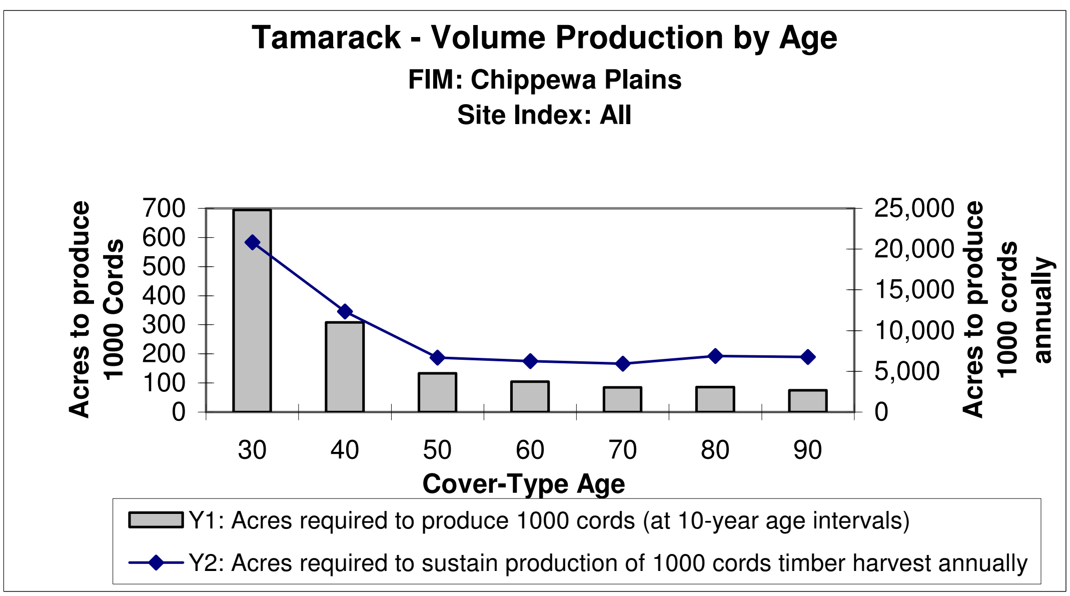
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by tamarack stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-T



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

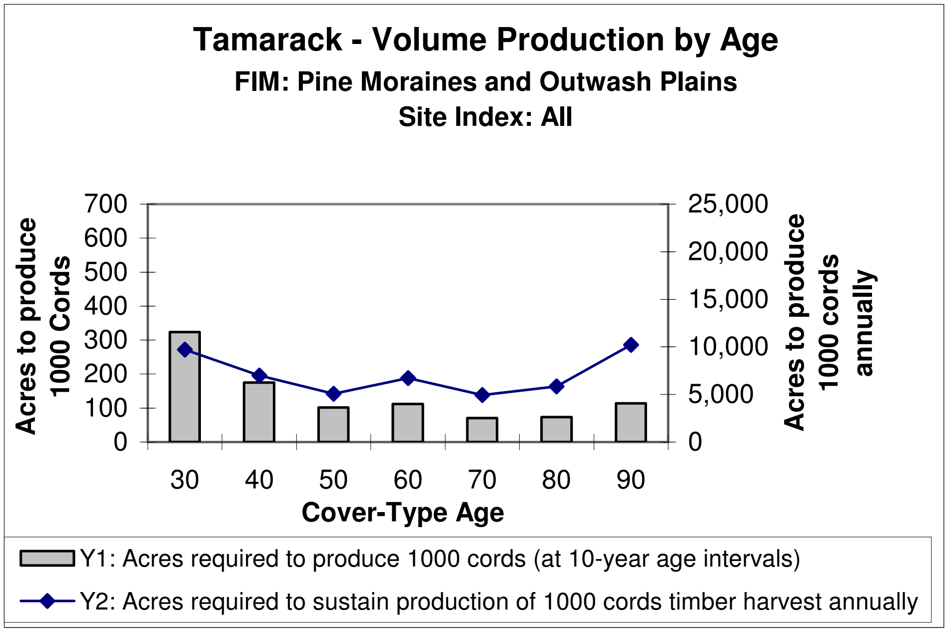
Chart 4.10cp-T



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of tamarack in the Chippewa Plains is 85 acres at a harvest age of 70. The minimum number of acres needed to produce 1,000 cords ***annually*** is 5,917 at a harvest age of 70.

Chart 4.10pm-T



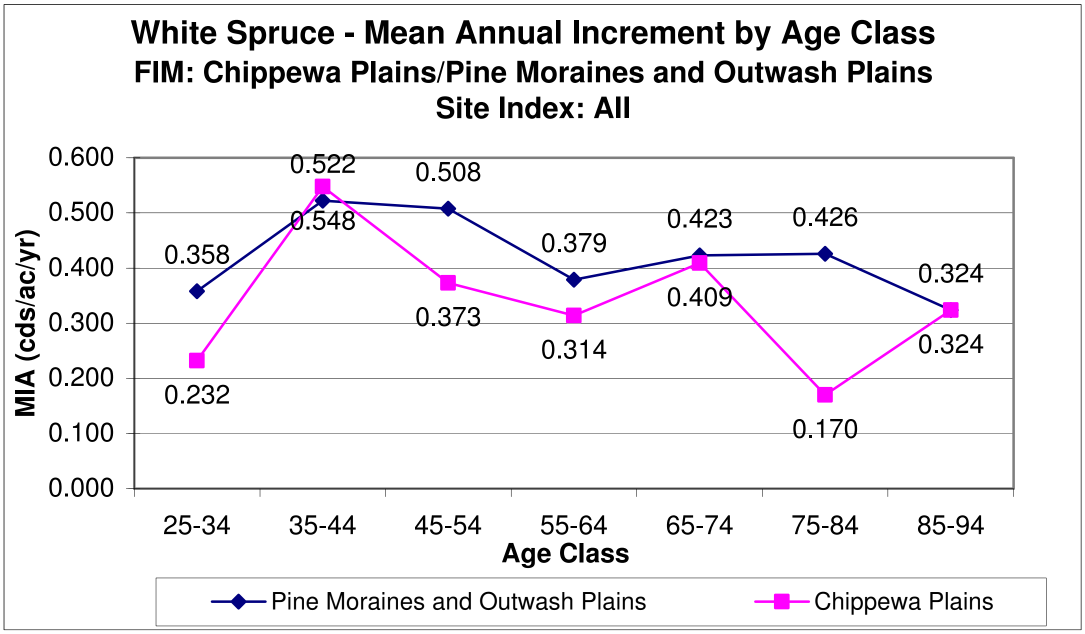
Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of tamarack in the Pine Moraines and Outwash Plains is 71 acres at a harvest age of 70. The minimum number of acres needed to produce 1,000 cords ***annually*** is 4,950 at a harvest age of 70.

White Spruce

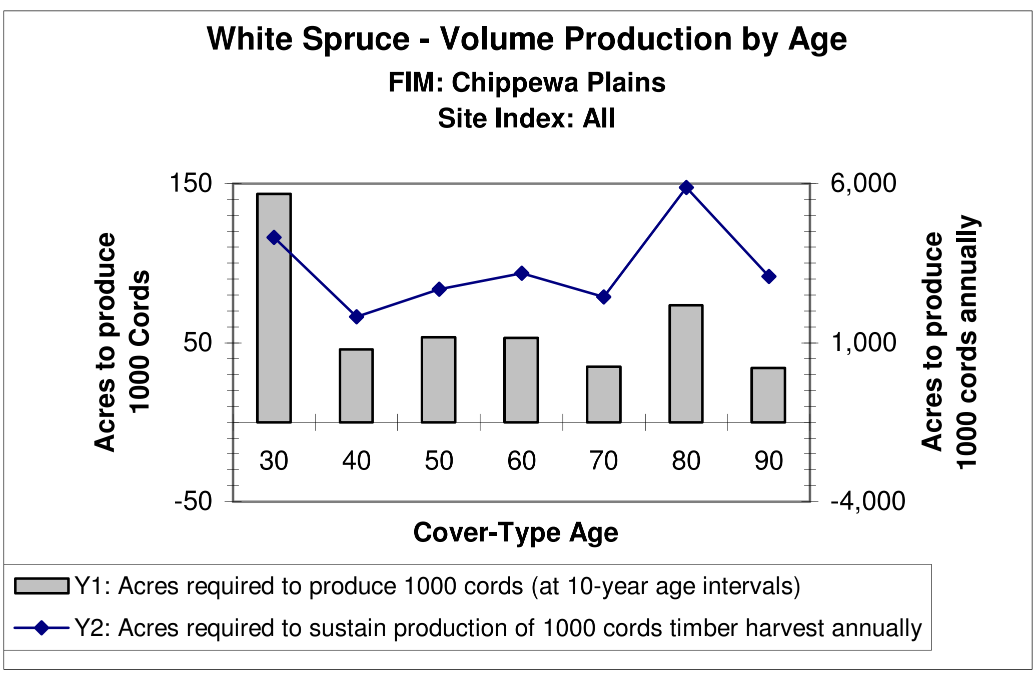
The following MAI chart shows the average yearly volume (in cords per acre) accumulated by white spruce stands of various ages in the two subsections based on FIM data.

Chart 4.10 cppm-WS



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

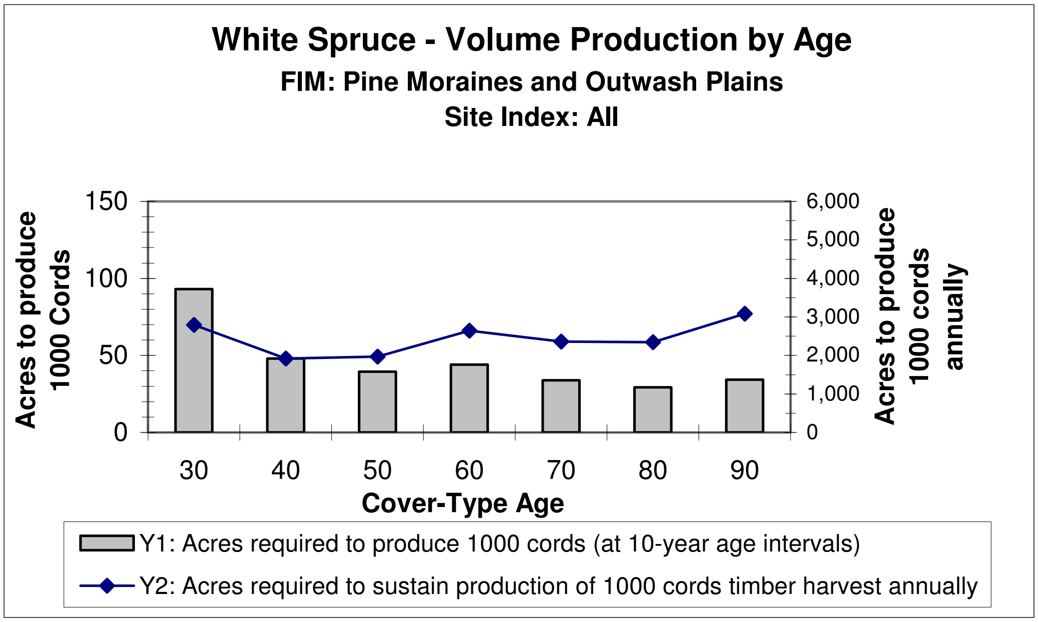
Chart 4.10 cp-WS



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the previous graph, the minimum number of acres that will yield 1,000 cords of white spruce in the Chippewa Plains is 35 acres at a harvest age of 70. The minimum number of acres needed to produce 1,000 cords ***annually*** is 1,825 at a harvest age of 40.

Chart 4.10 pm-WS



Source: Minnesota DNR, St. Paul based on 2005 Minnesota DNR Cooperative Stand Assessment (CSA) forest inventory.

Based on the above graph, the minimum number of acres that will yield 1,000 cords of white spruce in the Pine Moraines and Outwash Plains is 29 acres at a harvest age of 80. The minimum number of acres needed to produce 1,000 cords ***annually*** is 1,916 at a harvest age of 40.

4.11 Wood Products Industry Timber Demand

Introduction

The pulp, paper, and oriented strand board (OSB) industry in Minnesota has either been established or rebuilt since 1975, most activity taking place since 1982. Capital investments of the major industries that use wood from these two subsections have exceeded **$3.1 billion** since 1975.

The **major** industries that purchase wood or stumpage in the Chippewa Plains/Pine Moraines and Outwash Plains subsections include:

Ainsworth Lumber, Bemidji……………..……………………… Oriented Strand Board
NorBord Minnesota, Solway…………….………………………… Oriented Strand Board
Potlatch Lumber Mill, Bemidji..…………………………………… Lumber
Boise Cascade Corporation, International Falls ……………………Paper
International Paper, Sartell ………………….……………………. Paper
UPM Kymmene, Grand Rapids …………………………………… Paper
Trus Joist, Deerwood ……………………………………………… Laminated Strand Lumber

The industries that purchase **minor** amounts of wood or stumpage from the Chippewa Plains/Pine Moraines and Outwash Plains subsections include:

Ainsworth Lumber, Cook and Grand Rapids ………………………Oriented Strand Board
Rajala Lumber, Grand Rapids …………………………………….. Lumber, Veneer
Georgia-Pacific Corporation, Duluth and Superior ……………….. Hardboard
Sappi Corporation, Cloquet ……………………………………… Paper
Stora Enso, Duluth …………………………………………………Paper
International Bildrite, International Falls ………………………… Sheathing

All major modernizations and new establishments required an extensive review process before permits were granted for their expansion or development. Included in the review process is the condition that timber supply is available to meet the demands of the mill expansion.

Current Demand

The current demand for timber stumpage from the Chippewa Plains/Pine Moraines and Outwash Plains subsections, by species, is as follows:

High Demand
Aspen/balm of Gilead ……………….…….. Sawbolts and pulpwood
Red and jack pine …………………….…. Sawtimber and sawbolts
Black and white spruce ……………….…… Pulpwood
Balsam fir……………………………..….Pulpwood
Medium Demand
Balsam fir …………………………………..Sawbolts
Paper birch ………………………………… Sawbolts and pulpwood
Red and jack pine …………………………..Pulpwood
White spruce ……………………...…….. Sawtimber and sawbolts
Tamarack ………………………………….. Pulpwood
White pine …………………………...……..Sawtimber
Limited Demand
Black Ash …………………………………..Sawtimber and sawbolts
White Cedar ……………………………….. Sawbolts

Table 4.11sw-a

Current and Projected Wood Harvest From Timberland

- Minnesota Statewide -

Species	2002	Projected 2005*
Aspen/Balm of Gilead	2,205.7	2,110.0
Birch	245.6	265.6
Ash	29.9	71.0
Oak	140.6	145.0
Basswood	47.4	64.0
Maple	104.5	147.4
Cottonwood	8.1	10.0
Other Hardwoods	18.6	30.0
Pine	429.6	479.6
Spruce	227.6	225.0
Balsam Fir	177.1	189.0
Tamarack	30.0	80.0
Cedar	5.7	6.0
Other Softwoods	4.9	5.0
Total	**3,675.3**	**3,827.6**

Source: 2002 Harvest data compiled by the North Central Forest Experiment Station (NCFES) and DNR

*Projected 2005 based on announced expansions and industry interviews. Adjustments mainly due to:

- SAPPI pulp mill in Cloquet species mix change.
- A portion of Boise Cascade proposed increase.
- Species changes at Ainsworth Lumber OSB mills; installation of new dryer line at Bemidji mill.
- Shutting down two paper machines at UPM Blandin.

Table 4.11sw-b

Estimate of Increases/Decreases 2002 to 2005: Statewide Harvest
(In Thousand Cords)

	Aspen/ Balm	Pine	Spruce	Balsam Fir	Tamarack	Ash	Birch	Maple	Basswood
OSB/ Engineered Mills	(-45)	35	7	4	46	20	(-20)	13	13
Pulp & Paper Mills	(-45)	5	(-20)	6	10	20	40	30	4
Sawmills/ Specialty	(-5)	10	10	0	2	0	0	0	0
Export	0	0	0	0	(-8)	0	0	0	0
Totals	**(-95)**	**50**	**(-3)**	**10**	**50**	**40**	**20**	**43**	**17**

Source: Minnesota DNR, St. Paul

NOTES

2002 harvest figures are used as a basis for determining estimated harvest in 2005.

Projected 2005 based on announced expansions and industry interviews. Adjustments mainly due to:

- SAPPI pulp mill in Cloquet species mix change.
- A portion of Boise Cascade proposed increase.
- Species changes at Ainsworth Lumber OSB mills; installation of new dryer line at Bemidji mill.
- Shutting down two paper machines at UPM-Blandin.

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CHAPTER 5

Ecological Information

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

5.1 … Summary Descriptions of Each of the Two Subsections
Map 5.1 cp – 5.1 pm
Table 5.1 cppm

5.2 … Land-Type Associations (LTA)

5.3 … Native Plant Communities of Each Subsection

5.4 … Minnesota's List of Endangered, Threatened, and Special Concern Species
Table 5.4 cppm-Animals *Table 5.4 cppm-"NONs"-Animals*
Table 5.4 cppm-Plants *Table 5.4 cppm-"NONs"-Plants*

5.5 … Minnesota County Biological Survey (MCBS)
Table 5.5 cppm

How graphics are labeled:

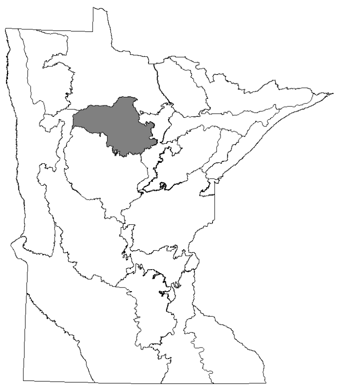
Graphics (i.e., Tables and Maps) referring to both subsections combined (Chippewa Plains/Pine Moraines and Outwash Plains) are indicated by a "cppm" after the graphic designation (e.g., *Table 5.1 cppm).*

Notes relating to this chapter:
Maps are included within this chapter. Also, all maps may be viewed as separate PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Printed documents will be available for review at Area DNR offices within the planning area, public libraries, and on compact disk by request.

5.1 Summary Descriptions of Each of the Two Subsections

Chippewa Plains Subsection



The southern boundary is Leech Lake and the moraines south of the lake. The northern boundary is the southern shore of Glacial Lake Agassiz. On the east side, the boundary of this subsection is a series of end moraines (Rainy Lobe in origin, but later covered by the St. Louis Sublobe). The Alexandria Moraine Complex frames the west side.

Level to gently rolling lake plains and till plains characterize this subsection. Three large, well-used lakes are found here. These include Leech Lake, Lake Winnibigoshish, and Cass Lake. Conifers dominated the sandier portions of the subsection before settlement. Aspen-birch, sugar maple, basswood, red oak, and bur oak were common components on more productive sites. Present day land use is recreation and forestry.

Landform

The primary landforms are ground moraines, a lake plain, stagnation moraines, and an outwash plain. All these are associated with the Des Moines Lobe or the Wadena Lobe (middle to late Wisconsin glaciation period). The ground moraines are characterized by gently rolling topography and have calcareous, loamy parent material. The lake plain (Glacial Lake Aitkin) is level to gently rolling and has variable parent material ranging from fine sands to clays. The stagnation moraines have gently rolling to hilly topography and have calcareous, loamy parent materials. The outwash plain has level to gently rolling topography and has fine to medium-sandy parent material.

Bedrock geology

Thick glacial drift covers bedrock over most of the subsection. Drift thicknesses range from 200 to more than 600 feet. The underlying bedrock consists of a diversity of Precambrian rock, including Early Precambrian (Late Archean) and Middle Precambrian (Early Proterozoic) gneiss, undifferentiated granite, and meta-morphosed mafic to intermediate volcanic and sedimentary rocks (Morey, 1976; Morey et al., 1981).

Soils

Soils range from sandy to clayey, depending on parent material. Most fall in the Alfisol, Entisol, or Histosol orders. On moraines, most soils are loamy, well to moderately well-drained, and are classified as Boralfs. Soils on the outwash plain are dominantly sandy and excessively well drained. They are classified as Psamments (young, undeveloped sandy soils).

Climate

Total annual precipitation ranges from 23 inches in the northwest to 27 inches in the east, with about 40 percent occurring during the growing season. Only 12 percent to16 percent 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 major river running through this subsection is the Mississippi River. The headwaters are just to the south in the Pine Moraines and Outwash Plains Subsection. Two large bodies of water are present—they are Lake Winnibigoshish (a reservoir) and Cass Lake. The drainage network throughout the subsection is poorly developed due to the age and characteristics of the landforms.

Pre-settlement vegetation

Pre-settlement vegetation was a mixture of deciduous and conifer trees. White pine and red pine were present on the moraines. Jack pine was the dominant cover type on outwash plains and sandy lake plains. Hardwoods (red oak, sugar maple, and basswood) grew in sheltered areas of the moraines, generally close to large lakes. Forested lowlands were occupied by black spruce, tamarack, white cedar, and black ash. Sedge meadow communities dominated non-forested wetlands.

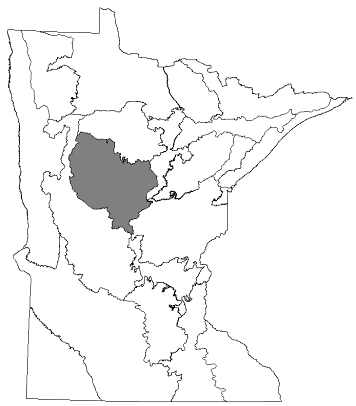
Present vegetation and land use

Much of this subsection is presently forested and forestry is one of the most important land uses. Aspen is the most common tree species. It is found in both pure stands and mixed stands with birch, maple, oak, white spruce, jack pine, and red pine. Tourism and recreation are the other important land use. There are many lakes present and most are developed with summer homes. Agriculture is important locally, particularly in the western part.

Natural disturbance

Fire was an important disturbance within the white pine-red pine forests. However, it is not clear whether the fires were from the Bemidji Outwash Plain immediately to the south or from lightning fires originating within the pine stands themselves.

Pine Moraines and Outwash Plains Subsection



The Itasca Moraine forms most of the northern boundary. To the west, the east side of the Alexandria Moraine is the dividing line. Rainy Lobe ground moraine and end moraines form the eastern line.

This subsection is a mix of end moraines, outwash plains, till plains, and drumlin fields. White and red pine dominated the majority of forest communities on end moraines and till plains. Jack pine barrens and jack pine woods were found on well-drained sites on outwash plains. Black spruce, tamarack, white cedar, and black ash were prominent tree species in poorly to very poorly drained soils. Lakes are very common on the end moraines and some of the outwash plains. Current land uses include tourism, forestry, and some agriculture.

Landform

This subsection consists primarily of large outwash plains, narrow outwash channels, and end moraines (Hobbs and Goebel, 1982). The moraines are relatively large and were formed from portions of several glacial lobes. Most of the glacial drift was sandy, but there is loamy drift to the north.

Bedrock geology

Thick glacial drift covers bedrock over most of the subsection. Thicknesses range from 200 to more than 600 feet. The greatest depths are in the southwestern portion (0lsen and Mossler, 1982). A diversity of Precambrian rock underlies the glacial drift (Morey, 1976; Morey et al., 1981). There are also iron formations at the southeastern edge of the subsection, along with argillite, siltstone, quartzite, and graywacke. Cretaceous marine shale, sandstone, and variegated shale are localized in the southwest. (Albert, 1993).

Soils

The morainic soils are predominantly coarse to moderately coarse in texture (sands and sandy loams). There are exceptions to this on the Itasca Moraine and the Fosston Till Plain, where calcareous loamy soils are present. (Dept. of Soil Science, Univ. of Minnesota, 1969, 1980). On outwash plains, excessively drained sands are prevalent, but they are interspersed with numerous wetlands. More than 10 percent of the soils are organic. The soils are classified as Psamments and Aquents on outwash plains (Anderson and Origal, 1984). Boralfs are most common on moraines.

Climate

Total annual precipitation ranges from 23 inches in the northwest to 27 inches in the east, with about 40 percent occurring during the growing season. Only 12 percent to16 percent of the annual precipitation falls during winter months (based on Midwest Climate Center, 1992). Growing season length varies from 111 to 131 days.

Hydrology

Kettle lakes are common on pitted outwash plains and within stagnation moraines. There are hundreds of lakes within the subsection that have a surface area greater than 160 acres. The headwaters of the Mississippi River (Itasca Lake in Itasca State Park) are in this subsection. Other large rivers flowing through the outwash plains of the subsection include the Pine and Crow Wing rivers.

Pre-settlement vegetation

Jack pine, in a mix with northern pin oak, was the most common species on excessively drained portions of broad outwash plains. Aspen-birch and pine forests (mixture of red and white pine) dominated large areas of the other landforms. Red pine-white pine forests occupied the rolling to irregularly sloped end moraines. Mixed hardwood and pine forests, dominated by a diverse mix of northern hardwoods and white pine, were found in the most fire-protected areas at the northern and eastern edges of the subsection. Irregular topography, broad wetlands, and relatively large lakes provided fire protection. Some of the hardwood-pine forests mapped by Marschner may have been dominated by red oak and basswood, without sugar maple (Albert, 1993).

Present vegetation and land use

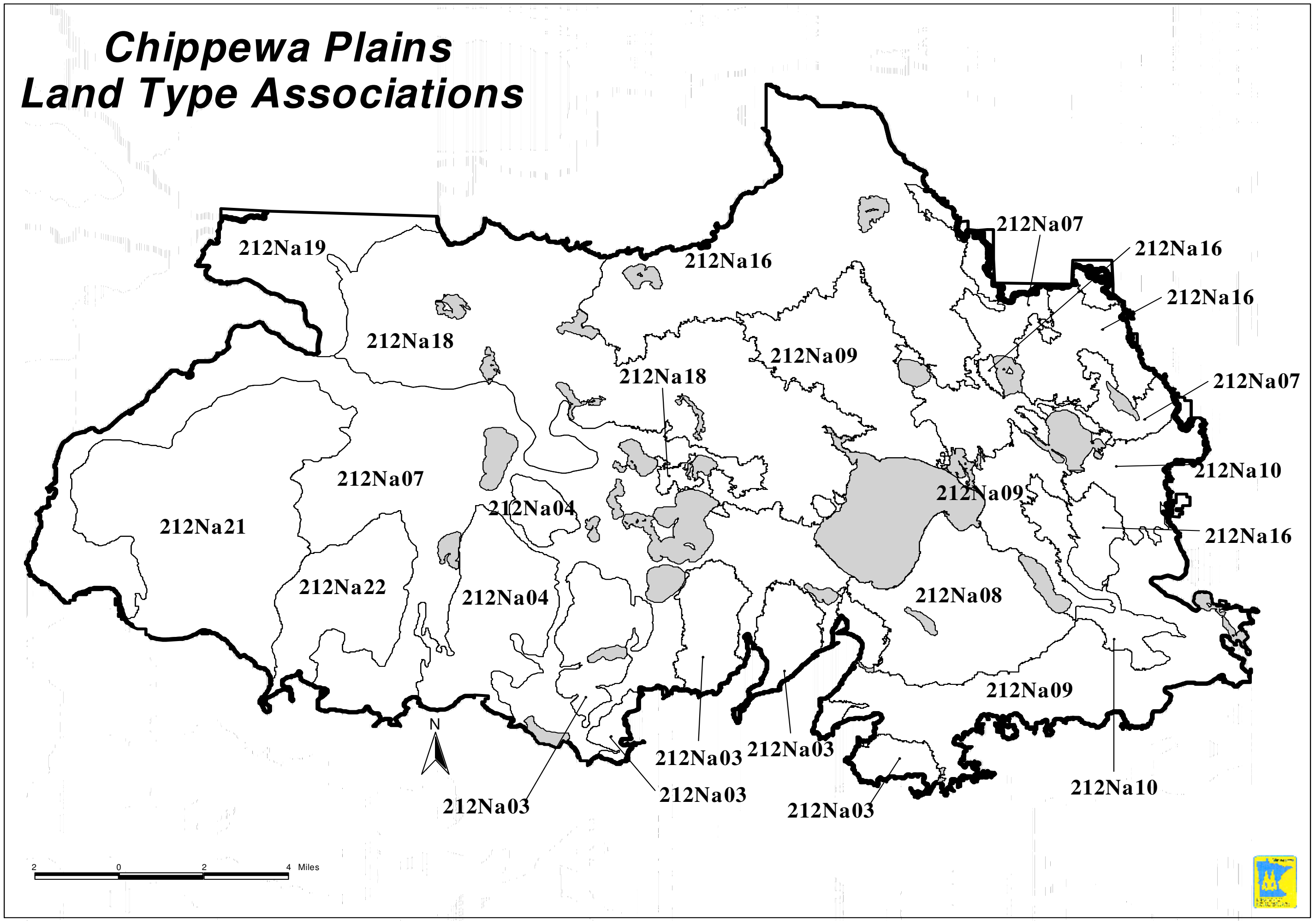
Forest management and tourism are the most important land uses. Agriculture is common in the west, where center pivot irrigation of corn and potatoes is common. Tourism is common where there are concentrations of lakes. Summertime swells the population of these areas significantly. Brainerd, a community of 14,000, absorbs more than 10 times that number within a 30-mile radius during summer weekends.

Natural disturbance

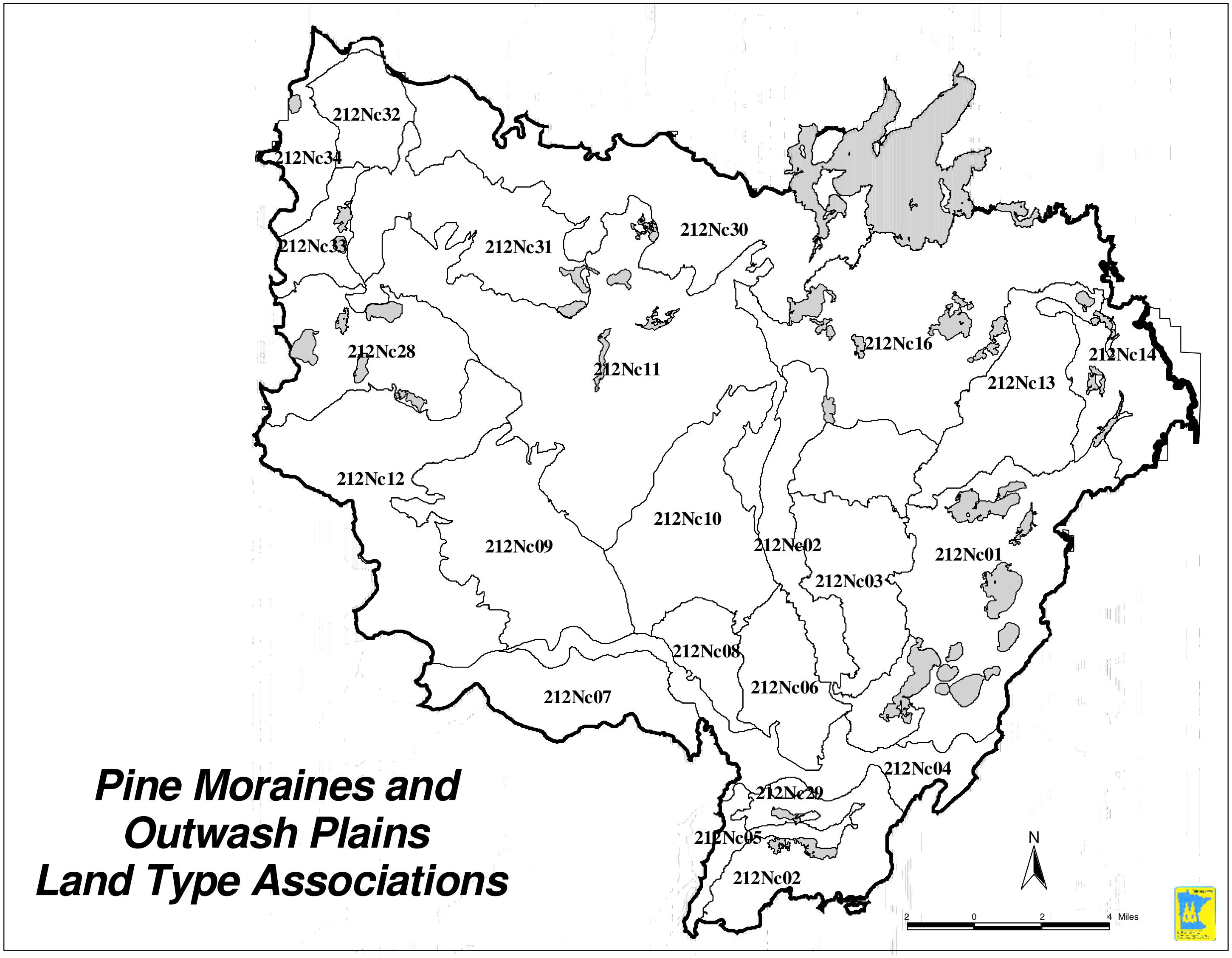
Fire occurred on a 10- to 40-year rotation within much of the subsection, accounting for the dominance by upland conifers and trembling aspen-birch forests (Frissel, 1973).

5.2 Land-Type Associations (LTA)

Map 5.2 cp



Map 5.2 pm



All maps may be viewed as separate PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.html.

Table5.1 cppm ***Chippewa*** **Plains/Pine Moraines and Outwash Plains Land-Type Associations**

Subsection	LTA Name	ECS LTA Code
Chippewa Plains	Blackduck Till Plain	212Na16
Chippewa Plains	Debs Till Plain	212Na19
Chippewa Plains	Blackduck Moraine	212Na18
Chippewa Plains	Bemidji Sand Plain	212Na07
Chippewa Plains	Alida Till Plain	212Na21
Chippewa Plains	Bowstring Till Plain	212Na11
Chippewa Plains	Rosey Lake Plain	212Na09
Chippewa Plains	Deer River Peatlands	212Na10
Chippewa Plains	Nary Till Plain	212Na04
Chippewa Plains	Becida Till Plain	212Na22
Chippewa Plains	Bena Dunes and Peatlands	212Na08
Chippewa Plains	Guthrie Till Plain	212Na03
Pine Moraines & Outwash Plains	Naytahwaush Moraine	212Nc34
Pine Moraines & Outwash Plains	Bass Lake Moraine	212Nc32
Pine Moraines & Outwash Plains	Itasca Moraine Steep	212Nc30
Pine Moraines & Outwash Plains	Two Inlets Moraine	212Nc31
Pine Moraines & Outwash Plains	Round Lake Sand Plain	212Nc33
Pine Moraines & Outwash Plains	Park Rapids Sand Plain	212Nc11
Pine Moraines & Outwash Plains	Itasca Moraine	212Nc16
Pine Moraines & Outwash Plains	Shell Lake Moraine	212Nc28
Pine Moraines & Outwash Plains	Spring Brook Till Plain	212Nc13
Pine Moraines & Outwash Plains	Outing Moraine	212Nc14
Pine Moraines & Outwash Plains	St. Croix Moraine	212Nc02
Pine Moraines & Outwash Plains	Nimrod Drumlin Plain	212Nc10
Pine Moraines & Outwash Plains	Crow Wing Sand Plain	212Nc01
Pine Moraines & Outwash Plains	Mildred Sand Plain	212Nc12
Pine Moraines & Outwash Plains	Wadena Drumlin Plain	212Nc09
Pine Moraines & Outwash Plains	Pine River Drumlin Plain	212Nc03
Pine Moraines & Outwash Plains	Mosquito Creek Drumlin Plain	212Nc06
Pine Moraines & Outwash Plains	Swan Creek Sand Plain	212Nc08
Pine Moraines & Outwash Plains	Pillager Sand Plain	212Nc04
Pine Moraines & Outwash Plains	Verndale Sand Plain	212Nc07
Pine Moraines & Outwash Plains	Henning Till Plain	212Nc29
Pine Moraines & Outwash Plains	Scandia Valley Sand Plain	212Nc05

Land-Type Association (LTA) Descriptions—Chippewa Plains Subsection

Province 212—Laurentian Mixed Forest

Subsection 212Na—Chippewa Plains

Na02 Lake Winnibigoshish—61,074 acres

Lake polygon.

Na03 Guthrie Till Plain—120,556 acres **Guthrie Till Plain—120,556 acres**

Level to rolling till plains formed by the Koochiching Lobe Glacier. The LTA consists of several islands of till separated by narrow sand plains from a different LTA. Uplands occupy 81 percent, wetlands occupy 16 percent, and lakes occupy 3 percent of the LTA (MN DNR, 1998). The majority (85 percent) of the soils have loam and clay loam textures (NRCS, 1994). Minor amounts of sand over loam are present on the edges next to sand plains.

The upland pre-settlement vegetation was mesic northern hardwoods, mixed white pine-red pine, dry-mesic pine-hardwoods, and wet-mesic hardwood-conifer (white pine) (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was commonly conifer bog and swamp (Marschner, 1974).

Na04 Nary Till Plain—88,092 acres

Level to rolling till plains formed by the Koochiching Lobe Glacier. Uplands occupy 92 percent, wetlands occupy 7 percent, and lakes occupy 1 percent of the LTA (MN DNR, 1998).

The majority of the upland pre-settlement vegetation was wet-mesic hardwood-conifer (white pine), mixed white pine-red pine and dry-mesic pine-hardwoods (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was commonly conifer bog and swamp (Marschner, 1974).

Na07 Bemidji Sand Plain—535,790 acres

A nearly level to gently rolling outwash plain formed by meltwater from the Des Moines Lobe Glacier. Uplands occupy 62 percent, wetlands occupy 23 percent, and lakes occupy 15 percent of the LTA (MN DNR, 1998). There are 0.5 miles of streams per square mile. The majority of upland soils are dry sand. Calcium carbonate has been leached out of the upper six feet or more. Minor amounts of sandy loam or loam soils also occur (NRCS, 1994).

The majority of the upland pre-settlement vegetation was dry pine (jack pine) and dry-mesic pine-hardwood forests (Shadis, 1999). Lowland pre-settlement vegetation was commonly conifer bog and swamp (Marschner, 1974). Historic fire regimes for the dominant upland types were: a) 30- to 75-year forest replacement and b) 150- to 350-year forest replacement with five- to 50-year forest maintenance, respectively (Shadis, 1999).

Na08 Bena Dunes and Peatlands—93,003 acres

A nearly level outwash plain formed by melt waters from the Des Moines Lobe Glacier that was extensively reshaped by wind action. Uplands occupy 47 percent, wetlands occupy 51 percent, and lakes occupy 2 percent of the LTA (MN DNR, 1998). Extensive swamps and bogs occur, especially in the southern portions of the LTA. Soil parent material is predominantly fine sand. Calcium carbonate has been leached out of the upper six feet or more.

The dominant upland pre-settlement vegetation was dry (jack and red) pine forest and dry-mesic (red and white) pine/hardwood. The majority of lowland pre-settlement vegetation was conifer swamp. Historic fire regimes for the dominant upland types were 150- to 350-year forest replacement with five- to 50-year forest maintenance for both communities.

Na09 Rosey Lake Plain—283,851 acres

A nearly level glacial lake basin (Aitkin) formed by melt waters of the Des Moines Lobe Glacier. Uplands occupy 51 percent, wetlands occupy 41 percent, and lakes occupy 8 percent of the LTA (MN DNR, 1998). There are 0.5 miles of streams per square mile. Mineral soils with silt and clay textures occupy 36 percent and fine sand textures occupy 25 percent of the LTA.

The pre-settlement vegetation was wet-mesic hardwood-conifer (pine) with minor amounts of dry pine and mesic northern hardwoods in the northern two polygons and wet-mesic hardwood-conifer (spruce-fir) in the southern polygon (Marschner, 1974). Lowland pre-settlement vegetation was wet sedge meadows and conifer bog and swamp (Marschner, 1974). Historic fire regimes for the dominant upland types were a) 150- to 350-year forest replacement, b) 150- to 350-year forest replacement with five- to 50-year forest maintenance, c) 250- to 1,000-year forest replacement, and d) 70- to 150-year forest replacement.

Na10 Deer River Peatlands—62,261 acres

A level glacial lake basin that was formed by melt waters from the Des Moines Lobe Glacier. Uplands occupy 20 percent, wetlands occupy 77 percent, and lakes occupy 3 percent of the LTA (MN DNR, 1998). The mineral soils have fine sand (25 percent), clay (16 percent), and silt (6 percent) textures.

The upland pre-settlement vegetation was wet-mesic hardwood-conifer (spruce-fir) with minor amounts of dry pine (Marschner, 1974). Lowland pre-settlement vegetation was wet sedge meadows and conifer bog and swamp (Marschner, 1974). Historic fire regimes for the dominant upland type were 70- to150-year forest replacement.

Na11 Bowstring Till Plain—1,856 acres

A nearly level to rolling landscape formed in till and sand-capped till. Uplands occupy 90 percent, wetlands occupy 10 percent, and lakes occupy less than 1 percent of the LTA (MN DNR, 1998). Soil parent materials have loam and clay loam textures in the northwestern half and along the lake. The southeast half has 20 to 40 inches of sand over the loamy till (Itasca County Soil Survey).

The majority of the upland pre-settlement vegetation was wet-mesic hardwood-conifer (pine) and mesic northern hardwoods (Shadis, 1999 and Marschner, 1974). The dominant lowland pre-settlement vegetation was wet meadows or conifer bog and swamp (Marschner, 1974). Historic fire regimes for the dominant upland types were a) 150- to 350-year forest replacement and b) 250- to 1,000-year forest replacement, respectively.

The majority of the upland pre-settlement vegetation was aspen-birch (trending to conifers) and Big Woods—Hardwoods (Marschner, 1974). The dominant lowland pre-settlement vegetation was wet meadows or conifer bog and swamp (Marschner, 1974).

Na16 Blackduck Till Plain—290,516 acres

A nearly level to rolling till plain formed by the Koochiching Lobe Glacier. Uplands occupy 66 percent, wetlands occupy 30 percent, and lakes occupy 4 percent of the LTA (MN DNR, 1998). Small wet depressions that are dry in the summer are common. Intermittent streams are commonly present in areas where the loamy till is near or at the surface. There are 0.5 miles of streams per square mile. The majority of upland soils have loam to clay loam textures. A cap of sandy material is commonly found on the surface.

The dominant upland pre-settlement vegetation was wet-mesic hardwood-conifer (spruce-fir) (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974). Historic fire regime for the dominant upland type was 70- to 150-year forest replacement (Shadis, 1999).

Na18 Blackduck Moraine—304,436 acres

A rolling to steep end moraine formed by the Koochiching Lobe Glacier. Uplands occupy 63 percent, wetlands occupy 28 percent, and lakes occupy 9 percent of the LTA (MN DNR, 1998). Soil parent material is loam to clay loam till.

The dominant upland pre-settlement vegetation was dry-mesic (red and white) pine forest, wet-mesic hardwood-conifer (spruce-fir) forest, and wet-mesic hardwood/conifer (white pine) forest, (Shadis, 1999 and Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974). Historic fire regimes for the dominant upland types were a) 150- to 350-year forest replacement with five- to 50-year forest maintenance, b) 70- to 150-year forest replacement, and c) 250- to 1,000-year forest replacement, respectively (Shadis, 1999).

Na19 Debs Till Plain—99,805 acres

A nearly level till plain formed by the Koochiching Lobe Glacier. Uplands occupy 80 percent, wetlands occupy 13 percent, and lakes occupy 7 percent of the LTA (MN DNR, 1998). The majority of the soil parent material has loam to clay loam textures. About a quarter of the soil parent material has sandy textures. Hay till with small areas of deep sands or sands over till.

The majority of the upland pre-settlement vegetation was mixed white pine and red pine, aspen-birch (trending to hardwoods), aspen-birch (trending to conifers), Big Woods—hardwoods, and jack pine barrens and openings (Marschner, 1974). The dominant lowland pre-settlement vegetation was wet meadows or conifer bog and swamp (Marschner, 1974).

Na21 Alida Till Plain—196,598 acres

A complex of rolling till plains and moraines separated by outwash channels all formed by the Koochiching Lobe Glacier. Uplands occupy 83 percent, wetlands occupy 15 percent, and lakes occupy 2 percent of the LTA (MN DNR, 1998). The most mineral soils in the till plains and moraines have loam to clay loam textures. Sandy loam or sand textures are also present primarily in the outwash channels.

The majority of the upland pre-settlement vegetation was aspen-birch (trending to conifers), mixed white pine and red pine, Big Woods—hardwoods, and jack pine barrens and openings (Marschner, 1974). The dominant lowland pre-settlement vegetation was wet meadows or conifer bog and swamp (Marschner, 1974).

Na22 Becida Till Plain—64,653 acres

A complex of Koochiching and Wadena Lobe glacier till plains separated by Koochiching Lobe glacier outwash channels. Topography is level (outwash channels) to rolling (till plains). Uplands occupy 87 percent, wetlands occupy 8 percent, and lakes occupy 5 percent of the LTA (MN DNR, 1998). The majority of the mineral soils have loam to clay loam textures. Small areas with sandy loam or sand textures are also present.

The majority of the upland pre-settlement vegetation was jack pine barrens and openings, mixed white pine and red pine, aspen-birch (trending to conifers), and Big Woods—hardwoods (Marschner, 1974). The dominant lowland pre-settlement vegetation was wet meadows or conifer bog and swamp (Marschner, 1974).

Land-Type Association (LTA) Descriptions—Pine Moraines and Outwash Plains Subsection

Subsection 212Nc—Pine Moraines and Outwash Plains

Nc01 Crow Wing Sand Plain—219,911 acres

A gently rolling pitted outwash plain with islands of till, all formed by the Rainy Lobe Glacier. Uplands occupy 64 percent, wetlands occupy 10 percent, and lakes occupy 26 percent of the LTA (MN DNR, 1998). Soil parent material is sandy loam or sand. Soils were formed under forest vegetation.

The dominant upland pre-settlement vegetation was dry pine-oak woodlands, dry-mesic (jack, red, and white) pine-hardwood forest, and dry-mesic (white and red) pine forest (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was commonly conifer bog and swamp (Marschner, 1974).

Nc02 St. Croix Moraine—209,266 acres

A steep end moraine formed by the Rainy Lobe Glacier. Uplands occupy 76 percent, wetlands occupy 11 percent, and lakes occupy 13 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) and sandy till. Soils formed under forest vegetation.

The dominant upland pre-settlement vegetation was dry-mesic (white and red) pine, dry-mesic (white) pine/hardwood, wet-mesic hardwood-conifer, (Marschner, 1974). Lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974).

Nc03 Pine River Drumlin Plain—91,555 acres

A rolling till plain with long cigar-shaped hills (drumlin features) formed by the Rainy Lobe Glacier. Uplands occupy 78 percent, wetlands occupy 21 percent, and lakes occupy 1 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) till. Hardpans and stones are common. Soils formed under forest vegetation.

Nc04 Pillager Sand Plain—

A nearly level to rolling outwash plain intermixed with peatlands (west side) formed by the Superior Lobe Glacier. Uplands occupy 78 percent, wetlands occupy 19 percent, and lakes occupy 3 percent of the LTA (MN DNR, 1998). Soil parent material is sand and gravel. Soils were formed under forest and occasionally prairie vegetation. The dominant upland pre-settlement vegetation was dry (jack) pine, dry-mesic (white) pine/hardwood, and mesic oak (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was wet prairie and conifer bog and swamp (Marschner, 1974).

Nc05 Scandia Valley Sand Plain—29,453 acres

A nearly level to rolling outwash plain with small areas of till and lake sediments all formed by the Des Moines Lobe Glacier. Uplands occupy 74 percent, wetlands occupy 24 percent, and lakes occupy 2 percent of the LTA (MN DNR, 1998). Soil parent material is predominantly sand. Soils formed under a combination of forest and prairie vegetation. The dominant upland pre-settlement vegetation was dry-mesic (white and red) pine, dry-mesic (white) pine/hardwood, mesic oak, wet-mesic hardwood-conifer, (Shadis, 1999 and Marschner, 1974). Lowland pre-settlement vegetation was conifer bog and swamp and wet prairie (Marschner, 1974).

Nc06 Mosquito Creek Drumlin Plain—68,845 acres

A rolling drumlin field formed by the Wadena Lobe Glacier. The till is mantled with a blanket of sand. Peatlands are common. Uplands occupy 80 percent, wetlands occupy 19 percent, and lakes occupy 1 percent of the LTA (MN DNR, 1998).

Nc07 Verndale Sand Plain—102,378 acres

A nearly level to rolling outwash plain formed by the Des Moines Lobe Glacier. Uplands occupy 81 percent, wetlands occupy 18 percent, and lakes occupy less than 1 percent of the LTA (MN DNR, 1998). Soil parent material is sand and gravel; extensive areas have a surface mantle of loamy material. The majority of soils have developed under prairie vegetation.

Nc08 Swan Creek Sand Plain—39,924 acres

A landscape dominated by level Rainy and Wadena Lobe outwash plains. Soil parent material is sand. The sand has been reworked by wind; dune features are common. Uplands occupy 64 percent, wetlands occupy 35 percent, and lakes occupy 1 percent of the LTA (MN DNR, 1998).

Nc09 Wadena Drumlin Plain—162,505 acres

A rolling drumlin field formed by the Wadena Lobe Glacier. Uplands occupy 79 percent, wetlands occupy 21 percent, and lakes occupy less than 1 percent of the LTA (MN DNR, 1998). Soil parent material is sandy loam till with a hardpan. Soils formed under forest vegetation.

Nc10 Nimrod Drumlin Plain—140,699 acres

A landscape dominated by level Rainy and Wadena Lobe outwash plains. Long narrow ridges (drumlins) of till material are very common. Uplands occupy 64 percent, wetlands occupy 36 percent, and lakes occupy less than 1 percent of the LTA (MN DNR, 1998).

The majority of the mineral soils has sand over sandy loam textures and sandy loam over sand or gravel textures. They formed under forest vegetation. Hardpans are common in the subsoil. Uplands in the western third of the LTA have sandy soils with features formed under prairie and forest vegetation. Long narrow peatlands are very common. The majority of the upland pre-settlement vegetation was dry pine with minor amounts of lowland (boreal) hardwood-conifer (Shadis, 1999 and Marschner, 1974). The lowland pre-settlement vegetation was conifer bog and swamp (26 percent) and wet prairie (25 percent) (Marschner, 1974).

Nc11 Park Rapids Sand Plain—377,024 acres

A landscape dominated by level to rolling outwash plains formed by the Wadena Lobe Glacier. Channels formed by post-glacial melt water are common. Uplands occupy 82 percent, wetlands occupy 11 percent, and lakes occupy 7 percent of the LTA (MN DNR, 1998). The majority of the mineral soils have sandy loam (52 percent) or sand (40 percent) textures. Fifty-five percent of the upland soils formed under a combination of prairie and forest vegetation while 43 percent formed under forest vegetation. The majority of the upland pre-settlement vegetation was dry pine forest (53 percent) and lowland (boreal) hardwood-conifer (22 percent) (Shadis, 1999 and Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974).

Nc12 Mildred Sand Plain—260,754 acres

A landscape dominated by rolling to steep terrain and sandy soils. The landforms were deposited by melt-water flowing from the Rainy and Wadena Lobe glaciers. Uplands occupy 79 percent, wetlands occupy 19 percent, and lakes occupy 2 percent of the LTA (MN DNR, 1998). Soils in the east unit were formed under forest vegetation from sandy loam, sand, and gravel parent material. Soils in the west unit have formed under both forest/woodland vegetation (northern half) and prairie vegetation (southern half). The soil parent material in the west unit is a mixture of sandy loam over clay loam and loam with a minor amount of sandy loam in the northeast corner. Peatlands are common in both units. The dominant pre-settlement communities were dry-mesic pine-hardwood in the west unit and dry pine (jack and red pine) in the east unit (Shadis, 1999). The historic disturbance regimes were low- to moderate-intensity forest maintenance fires occurring every five to 50 years in the east unit and high-intensity forest replacement fires every 70 to 350 years in the west unit (Shadis, 1999).

Nc13 Spring Brook Till Plain—243,432 acres

A landscape dominated by a rolling till plains with small areas of hilly-pitted outwash, eskers, and melt water channels. The Rainy Lobe Glacier formed all landforms. Uplands occupy 68 percent, wetlands occupy 21 percent, and lakes occupy 11 percent of the LTA (MN DNR, 1998). The majority (63 percent) of the LTA has mineral soils with sandy loam texture. Twenty-four percent of the LTA has mineral soils with loam or clay-loam textures, while 11 percent are sandy. All upland soils formed under forest vegetation (NRCS, 1994). Lakes occupy 6 percent of the area. The majority of the upland pre-settlement vegetation was mixed white pine-red pine (36 percent) and lowland (boreal) hardwood-conifer (13 percent) (Shadis, 1999 and Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974).

Nc14 Outing Moraine—84,845 acres

A landscape dominated by rolling till plains and steep end moraines dissected by outwash channels. The Rainy Lobe Glacier formed all features. Uplands occupy 71 percent, wetlands occupy 23 percent, and lakes occupy 6 percent of the LTA (MN DNR, 1998). Soil parent material is sandy-loam till, with many stones, in the till plains and moraines and sandy in the outwash channels. Soils were formed under forest vegetation.

The dominant upland pre-settlement vegetation was dry-mesic (white and red) pine/hardwood forest, wet-mesic hardwood-conifer (white pine) forest, and mesic northern hardwood forest (Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974). Historic fire regimes for the upland types were: a) 150- to 350-year forest replacement with five- to 50-year forest maintenance, b) 150- to 350-year forest replacement, and c) 250- to 1,000-year stand replacement, respectively.

Nc15 Leech Lake—104,269 acres

Lake polygon.

Nc16 Itasca Moraine—274,822 acres

A landscape characterized by steep, irregularly shaped slopes with many closed depressions. This end moraine formed by the Wadena Lobe Glacier. Uplands occupy 66 percent, wetlands occupy 16 percent, and lakes occupy 18 percent of the LTA (MN DNR, 1998). Stream density is 0.2 miles per square mile (total of 66 miles). Soil parent material is a complex of sandy to loamy and clay loam till with a high content of granitic stones. Soils have formed under forest vegetation. Pre-settlement vegetation was primarily dry-mesic (white) –pine-hardwoods with smaller amounts of dry pine (jack and red pine) in the southwest quarter and lowland –hardwood-conifer (spruce-fir) in the northeast quarter. The historic disturbance regimes were primarily high-intensity forest replacement fires every 70 to 350 years, with low- to moderate-intensity forest maintenance fires occurring every five to 50 years in southwest quarter and low- to moderate-intensity forest maintenance fires occurring every 25 to100 years in the northeast quarter.

Nc28 Shell Lake Moraine—

A landscape dominated by hummocky end moraines formed by the Wadena and Des Moines lobes. Soil parent material is coarse loamy (sandy loam) till. Hardpans and stones are common. Soils have formed under forest vegetation. Lakes are common.

Nc29 Henning Till Plain—3,736 acres

A landscape dominated by rolling till plains formed by the Wadena Lobe Glacier. Small areas of Des Moines Lobe outwash plains occur. Narrow outwash channels are very common. Uplands occupy 68 percent, wetlands occupy 31 percent, and lakes occupy 1 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) till with hardpans and sandy outwash. Soils have formed under forest vegetation in the till plains and a combination of forest and prairie vegetation in the outwash.

Nc30 Itasca Moraine, Steep—239,051 acres

An end moraine characterized by steep rugged terrain. Uplands occupy 84 percent, wetlands occupy 10 percent, and lakes occupy 6 percent of the LTA (MN DNR, 1998). The soils are a complex of sandy, loamy, and sand over loamy textures. The majority is well-drained. The majority of the upland pre-settlement vegetation was dry-mesic pine-oak and dry-mesic pine with minor amounts of dry pine (Shadis, 1999 and Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974).

Native forest communities that have historically persisted on this LTA include: dry jack pine-red pine forest on areas that tend to be sandy and/or have historically had severe (crown) fires at 50- to 80-year intervals.

Dry-mesic pine (white)/oak forest on areas with loamy subsoils present within the rooting zone. Historically low-intensity ground fires occurred every five to 40 years.

Dry-mesic pine (white and red) on areas with loamy subsoils present within the rooting zone. Historically, low-intensity ground fires occurred every 10 to 40 years and severe (crown) fires occurred every 100 to 200 years.

Nc31 Two Inlets Moraine—131,745 acres

A rolling to hummocky landscape dominated by a complex of outwash plains and end moraines formed by the Wadena Lobe Glacier. Ice-walled lake features are common in the east half of township 142 to 37 and the west half of township 142 to 36. Uplands occupy 73 percent, wetlands occupy 18 percent, and lakes occupy 9 percent of the LTA (MN DNR, 1998). Soil parent material is loamy till with stones and hardpans on the moraines. Sandy soils are dominant on outwash plains and inclusions in the moraines. Ice-wall lake features have sandy or loamy soils on the hillsides and silts and/or clays on the flat tops. All soils formed under forest vegetation. The majority of the upland pre-settlement vegetation was dry pine (41 percent) and dry-mesic pine (21 percent) (Shadis, 1999 and Marschner, 1974). The majority of lowland pre-settlement vegetation was conifer bog and swamp (Marschner, 1974).

Nc32 Bass Lake Moraine—50,005 acres

A rolling to hummocky landscape dominated by end moraines and pitted outwash plains formed by the Red River Lobe Glacier. A few outwash channels are present. Uplands occupy 85 percent, wetlands occupy 9 percent, and lakes occupy 6 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) till with hardpans and sandy outwash. Soils formed under forest vegetation.

Nc33 Round Lake Sand Plain—37,409 acres

A rolling to steep landscape dominated by pitted outwash plains formed by the Red River Lobe Glacier. Uplands occupy 59 percent, wetlands occupy 18 percent, and lakes occupy 23 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) till. Stones and hardpans are common. Soils have formed under forest vegetation. Lakes are abundant.

Nc34 Naytahwaush Moraine—51,154 acres

A landscape dominated by a rolling end moraine that is dissected by outwash channels. The Red River Lobe Glacier formed all features. Uplands occupy 81 percent, wetlands occupy 11 percent, and lakes occupy 8 percent of the LTA (MN DNR, 1998). Soil parent material is coarse loamy (sandy loam) outwash and till. Stones and hardpans are common. Soils have formed under forest vegetation.

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5.3 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 Services' 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 ECLP'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 both subsections (Chippewa Plains and Pine Moraines and Outwash Plains) 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 provide another tool to use in making forest management decisions on state lands.

Results of the Classification Revision Project

1. ELCP will have a plant community classification integrated with its statewide land classification system. ELCP will use the community classification to develop ecosystem management tools for field managers that enable rapid identification of the vegetation potential of sites and identification of options for sustainable forest management.

2. MCBS and NHNRP will have a statewide classification that is more useful than the current classification for biodiversity surveys, research, and conservation work in Minnesota.

3. All three programs will be better able to communicate to land managers the role of major ecological processes in plant communities and landscapes.

Classification of Wooded Plant Communities

The delineation of wooded plant communities in the new classification is based on statistical analyses of vegetation plot data, or relevés, which are housed in the DNR's Natural Heritage Information System Relevés 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 tree species.

The following classification of the woody plant communities first lists the native plant communities found in the Northern and Central Floristic regions, then lists their associated codes and gives a brief description of the native plant communities found in the Chippewa Plains/Pine Moraines and Outwash Plains subsections. 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.

Native Plant Community Types and Codes-Northern and Central Floristic Regions

FIRE-DEPENDENT FOREST/WOODLAND SYSTEM

FDn12 NORTHERN DRY-SAND PINE WOODLAND
FDn12a Dry Sand Jack Pine Woodland
FDn12b Dry Sand Red Pine Woodland

FDn33 NORTHERN DRY-MESIC MIXED WOODLAND
FDn33a Red Pine-White Pine Woodland
FDn33a1 Balsam Fir Subtype
FDn33a2 Mountain Maple Subtype

FDc12 CENTRAL POOR DRY PINE WOODLAND
FDc12a Jack Pine-(Bearberry) Woodland

FDc23 CENTRAL DRY PINE WOODLAND
FDc23a Jack Pine-(Yarrow) Woodland
FDc23a1 Ericaceous Shrub Subtype
FDc23a2 Bur Oak-Aspen Subtype

FDc24 CENTRAL RICH DRY PINE WOODLAND
FDc24a Jack Pine-(Bush Honeysuckle) Woodland
FDc24a1 Bracken Subtype
FDc24a2 Bur Oak- Carrion-Flower Subtype

FDc34 CENTRAL DRY MESIC PINE-HARDWOOD FOREST

FDc34a	Red Pine-White Pine Forest
FDc34b	Oak-Aspen Forest

MESIC HARDWOOD FOREST SYSTEM

MHn35 NORTHERN MESIC HARDWOOD FOREST

MHn35a	Aspen-Birch-Basswood Forest

MHn44 NORTHERN WET-MESIC BOREAL HARDWOOD-CONIFER FOREST

MHn44a	Aspen-Birch-Red Maple Forest
MHn44c	Aspen-Fir Forest

MHn46 NORTHERN WET-MESIC HARDWOOD FOREST

MHn46a	Aspen-Ash Forest
MHn46b	Black Ash-Basswood Forest

MHn47 NORTHERN RICH MESIC HARDWOOD FOREST

MHn47a	Sugar Maple-Basswood-(Bluehead Lily) Forest
MHn47b	Sugar Maple-Basswood-(Horsetail) Forest

MHn26 CENTRAL DRY-MESIC OAK-ASPEN FOREST

MHc26a	Oak-Aspen-Red Maple Forest
MHc26b	Red Oak-Sugar Maple-Basswood (Large-Flowered Trillium) Forest

MHn36 CENTRAL MESIC HARDWOOD FOREST (EASTERN)

MHc36a	Red Oak-Basswood Forest (Noncalcareous Till)
MHc36b	Red Oak-Basswood Forest (Calcareous Till)

MHc37 CENTRAL MESIC HARDWOOD FOREST (WESTERN)

MHc37a	Aspen-(Sugar Maple-Basswood) Forest
MHc37b	Sugar Maple-Basswood-(Aspen) Forest

FLOODPLAIN FOREST SYSTEM

FFn57 NORTHERN TERRACE FOREST

FFn57a	Black Ash-Silver Maple Terrace Forest

FFn67 NORTHERN FLOODPLAIN FOREST

FFn67a	Silver Maple-(Sensitive Fern) Floodplain Forest

WET FOREST SYSTEM
WFn53 NORTHERN WET CEDAR FOREST

WFn53b	Lowland White Cedar Forest (Northern)

WFn55 NORTHERN WET ASH SWAMP

WFn55a Black Ash-Aspen-Balsam Poplar Swamp (Northeastern)
WFn55c Black Ash-Mountain Maple Swamp (Northern)

WFn64 NORTHERN VERY WEST ASH SWAMP
WFn64a Black Ash-Conifer Swamp (Northeastern)
WFn64c Black Ash-Alder Swamp (Northern)

FORESTED RICH PEATLAND SYSTEM

FPn63 NORTHERN CEDAR SWAMP
FPn63b White Cedar Swamp (North central)

FPn73 NORTHERN ALDER SWAMP
FPn73a Alder Swamp

ACID PEATLAND SYSTEM

APn80 NORTHERN SPRUCE BOG
APn80a Black Spruce Bog
APn80a1 Treed Subtype
Apn80b2 Semi-Treed Subtype

APn81 NORTHERN POOR CONIFER SWAMP
APn81a Poor Black Spruce Swamp
APn81b Poor Tamarack-Black Spruce Swamp
APn81b1 Black Spruce Subtype
APn81b2 Tamarack Subtype

Native Plant Community Descriptions

Native plant community classes are in capital letters; native plant community type and subtype names are underlined

FIRE-DEPENDENT FOREST SYSTEM

NORTHERN DRY-SAND PINE WOODLAND (FDN12)
Dry jack pine or red pine woodlands on level to gently undulating, sandy outwash or lake plains. Crown and surface fires were common historically.

FDn12a Jack Pine Woodland (Sand)
Woodlands on sandy beach ridges and outwash deposits. Canopy is strongly dominated by jack pine, with 50 percent to 100 percent cover.
FDn12b Red Pine Woodland (Sand)
Woodlands on sandy sites. Canopy is dominated by red pine, or by a mix of red pine and jack pine, with occasional white pine or paper birch. Balsam fir is common in the understory but not usually abundant. Beaked hazelnut and juneberries are common in the shrub layer.

NORTHERN DRY-MESIC MIXED WOODLAND (FDN33)
Dry-mesic conifer, conifer-hardwood, or hardwood woodlands dominated by red pine, white pine, jack pine, black spruce, quaking aspen, or paper birch. Most common on sandy soils but also present on shallow, loamy soils over bedrock. Crown and surface fires were common historically.

FDn33a Red Pine-White Pine Woodland
Canopy is typically dominated by red pine or white pine, or occasionally by jack pine. FDn33a is divided into two subtypes:
FDn33a1 Balsam Fir Subtype
Canopy is most often dominated by red pine and less commonly by white pine or jack pine. Balsam fir and red maple are common in the understory.
FDn33a2 Mountain Maple Subtype
Canopy is typically dominated by red pine or white pine, often with paper birch and red maple in the subcanopy. The presence of mountain maple (Acer spicatum), round-lobed hepatica (Anemone Americana), and large-flowered bellwort (Uvularia grandiflora) help to distinguish FDn33a2 from FDn22a1.

CENTRAL POOR DRY PINE WOODLAND (FDc12)
Dry jack pine woodlands on level, sand lacustrine and outwash deposits in north-central Minnesota. Crown fire and surface fires were common historically.
FDc12a Jack Pine-(Bearberry) Woodland
FDc12a is the only community type recognized in this class.

CENTRAL DRY PINE WOODLAND (FDc23)
Dry-mesic pine woodlands on sandy, level to gently undulating outwash deposits. Crown fires and surface fires were common historically.
FDc23a Jack Pine-(Yarrow) Woodland
FDc23a is the only recognized community type in this class. It is divided into two subtypes:
FDc23a1 Ericaceous Shrub Subtype

Canopy is strongly dominated by jack pine with occasional red pine and paper birch. Northern red oak is common in the tall-shrub layer. Broad-leaved evergreen species such as wintergreen, pipsissewa, and bearberry present in understory.

FDc23a2 Bur Oak-Aspen Subtype

Canopy is strongly dominated by jack pine with occasional quaking aspen, northern red oak, and bur oak. Bur oak is common in the subcanopy and shrub layer.

CENTRAL RICH DRY PINE WOODLAND (FDc24)

Dry-mesic pine woodlands on sandy, level to gently undulating outwash deposits or occasionally on sandy inclusions in rolling to hummocky stagnation moraines and till plains. Crown fires and mild surface fires were common historically.

FDc24aJack Pine-(Bush Honeysuckle) Woodland

FDc24a is the only recognized community type in this class. It is divided into two subtypes.

FDc24a1 Bracken Subtype

Canopy is dominated by jack pine with occasional paper birch, red pine, or quaking aspen. Subcanopy is sparse. Ground layer has abundant bracken.

FDc24a2 Bur Oak-Carrion-Flower Subtype

Canopy is dominated by jack pine with occasional bur oak and less commonly with northern red oak, red pine, or quaking aspen. Bur oak is common in the subcanopy.

CENTRAL DRY-MESIC PINE-HARDWOOD FOREST (FDc34)

Dry-mesic pine, hardwood, or pine-hardwood forests on hummocky glacial moraines, often adjacent to outwash plains. Crown fires were common historically.

FDc34a Red Pine-White Pine Forest

Canopy is dominated by red pine or white pine, or a mixture of the two, with occasional paper birch, red maple, quaking aspen, jack pine, northern red oak, or bur oak.

FDc34b Oak-Aspen Forest

Canopy is dominated by a combination of northern red oak, quaking aspen, paper birch, red maple, bur oak, big-toothed aspen, or basswood.

MESIC HARDWOOD FOREST SYSTEM

NORTHERN MESIC HARDWOOD FOREST (MHn35)

Mesic to dry-mesic hardwood forests typically dominated by sugar maple, American basswood, paper birch, and/or red oak. Most stands are dominated by sugar maple, but this class includes all red oak stands along with most aspen-birch stands at the drier end of the moisture spectrum in the mesic hardwood forest system. Typically found on stagnation moraines and till plains but also occurs bedrock hills in northeastern Minnesota. Mostly on well-drained to moderately well-drained loamy soils. Fires are rare but may be somewhat more common on sites dominated by red oak.

MHn35a Red oak-Red Maple Forest

Canopy is composed of variable mixtures of paper birch, sugar maple, basswood, quaking aspen, and red maple with bur oak and white pine sometimes important. Sugar maple is often abundant in the subcanopy.

NORTHERN WET-MESIC BOREAL HARDWOOD-CONIFER FOREST (MHn44)

Wet-mesic or mesic hardwood and hardwood-conifer forests, most commonly on level, clayey sites with high local water tables on glacial lake deposits, stagnation moraines, and till plains

MHn44a Aspen-Birch-Re Maple Forest
Wet-mesic to mesic forests dominated by quaking aspen, paper birch, or red maple, often with balsam fir and bur oak.
MHn44c Aspen-Fir Forest
Wet-mesic forests, typically with quaking aspen, paper birch, balsam fir, or black ash as canopy dominants, and occasionally with spruce and balsam poplar as dominants.

NORTHERN WET-MESIC HARDWOOD FOREST(MHn35)
Wet-mesic lowland hardwood forests on level sites with clayey subsoils or high local water tables.
MHn46a Aspen-Ash Forest
Canopy is dominated most commonly by quaking aspen, basswood, black ash, bur oak, or red maple, with smaller amounts of paper birch.
MHn36b black Ash-Basswood Forest
Rich forests, typically dominated by black ash, usually basswood and occasionally with sugar maple, cedar, or green ash.

NORTHERN RICH MESIC HARDWOOD FOREST (MHn47)
Mesic hardwood forests on well drained to somewhat poorly drained, rich loamy soils on glacial drift and till in areas of undulating to hummocky topography.
MHn47a Sugar Maple-Basswood-(Bluebead Lily) Forest
Canopy is dominated by sugar maple with lesser amounts of basswood. Understory species include bluebead lily, along with pale bellwort (Uvularia sessilifolia) and swamp red currant (Ribes triste.)
MHn47b Sugar Maple-Basswood-(Horsetail) Forest
Canopy is dominated by sugar maple and basswood. Understory plants include several species of Equisetum including meadow horsetail (Equisetum pratense), dwarf scouring rush (E. scirpoides), tall scouring rush (E. hyemale), and smooth scouring rush (E. laevigatum.)

MHc26 CENTRAL DRY-MESIC OAK-ASPEN FOREST
Dry mesic hardwood or, rarely, hardwood-conifer forests, usually with northern red oak as a canopy dominant. Present on well-drained loamy or sandy soils, primarily on stagnation moraines and less frequently on till plains or glacial terraces.
MHc26a Oak-Aspen-Red Maple Forest
Canopy is typically dominated by northern red oak, paper birch, quaking aspen, or red maple. Ironwood and sugar maple are the most common subcanopy trees.
MHc26b Red Oak-Sugar Maple-Basswood-(Large-flowered Trillium) Forest
Canopy is dominated by northern red oak, often with basswood and less frequently with sugar maple as co-dominates. Paper birch, red maple, and big-toothed aspen may also be present in the canopy. Sugar maple, ironwood, basswood, or red maple can be abundant in the subcanopy. Large-flowered trillium, zigzag goldenrod, and common enchanter's nightshade may be found in the understory.

MHc36 CENTRAL MESIC HARWOOD FOREST (EASTERN)
Mesic hardwood forests dominated by basswood, northern red oak, and sugar maple. Present on loamy or sandy loam soils on hummocky stagnation moraines and rolling till plains.
MHc36a Red Oak-Basswood Forest (Non-calcareous Till)

Mesic hardwood (or rarely hardwood-conifer) forests most common on sites with soils derived from non-calcareous glacial till. Canopy is dominated by basswood and northern red oak, often with sugar maple.

MHc37 CENTRAL MESIC HARDWOOD FOREST (WESTERN)
Mesic hardwood forests dominated by sugar maple and basswood. Present on well-drained loamy soils on rolling to hummocky stagnation moraines.

<u>MHc37a Aspen-(Sugar Maple-Basswood) Forest</u>
Mesic hardwood forests dominated by quaking aspen or paper birch, with sugar maple and basswood present in the understory (and occasionally in the canopy.) MHc37a is an early successional version of MHc37b.

<u>MHc37b Sugar Maple-Basswood-(Aspen) Forest</u>
Mesic hardwood forests dominated by sugar maple and basswood.

FLOODPLAIN FOREST SYSTEM

NORTHERN TERRACE FOREST (FFn57)
Wet-mesic deciduous forests on silty or sandy alluvium on level, occasionally flooded sites along medium and large rivers in the northern half of Minnesota.

<u>FFn57 Black Ash-Silver Maple Terrace Forest</u>
FFn57a is the only community type recognized in this class at present.

NORTHERN FLOODPLAIN FOREST (FFn67)
Deciduous riparian forests on sandy or silty alluvium on low, level, annually flooded sites along medium and large rivers in central and northern Minnesota. Community is characterized by pools and evidence of recent flooding, such as windrowed debris, ice scars on trees, and freshly deposited silt and sand.

<u>FFn67a Silver Maple-(Sensitive Fern) Floodplain Forest</u>
FFn67a is the only community type recognized in this class at present.

WET FOREST SYSTEM

NORTHERN WET CEDAR FOREST (WFn53)
Wet conifer or conifer-hardwood forests on muck or peat soils. Typically present in settings where saturated soils are present throughout most of the growing season, such as depressions; low-level terrain along lakes, rivers, or wetlands; and gently sloping upland drains.

<u>WFn53b Lowland White Cedar Forest</u>
Canopy is dominated by white cedar, sometimes with abundant black ash. Balsam fir and paper birch are occasionally present in the canopy. White cedar, balsam fir, and black ash are sometimes abundant in the subcanopy but most often the community is relatively open below the canopy.

NORTHERN WET ASH SWAMP (WFn55)
Wet hardwood forests on mucky mineral soils in shallow basins and groundwater seepage areas or on low, level terrain near rivers, lakes, or wetlands. Typically with standing water in the spring but draining by late summer.

<u>WFn55a Black Ash-Aspen-Balsam Poplar Swamp (Northeastern)</u>

Wet-mesic to wet forest. Typically with black ash and other hardwood species as canopy dominants, occasionally with minor amounts of white spruce or white cedar. Most (if not all) forest in WFn55 is dominated by balsam poplar.

WFn55c Black Ash-Mountain Maple Swamp

Wet forests. Canopy is dominated by black ash with small amounts of American elm and paper birch and occasionally with abundant white cedar.

NORTHERN VERY WET ASH SWAMP (WFn64)

Wet hardwood or hardwood-conifer forests on peaty soils in small closed depressions or around the edges of large peatlands. Typically with standing water present throughout spring and summer.

WFn64a Black Ash-Conifer Swamp (Northeastern)

Wet to very wet forests dominated by black ash. Conifers, especially balsam fir and white cedar, are often present in the understory and may be present in the canopy. Shrub layer is well developed, with mountain maple and speckled alder abundant.

WFn64c Black Ash-Alder Swamp (Northern)

Very wet forests with canopy composed almost entirely of black ash. Often the community is open below the canopy, although speckled alder is sometimes abundant in the shrub layer. Ground layer is very wet and relatively level, usually lacking the pattern of hummocks and hollows characteristic of many forested swamps. Broad-leaved grasses and sedges are abundant and often dominate the ground layer.

FOREST RICH PEATLAND SYSTEM

NORTHERN CEDAR SWAMP (FPn63)

White cedar-dominated swamps on wet peat soils. Often present in areas influenced by mineral-rich subsurface flow or groundwater seepage along the margins of uplands and peatlands.

FPn63b White Cedar Swamp (North central)

White cedar- or, occasionally, black spruce-dominated swamps on wet peat in small basins, typically associated with stream channels or adjacent to lakes. Tufted loosestrife (Lysimachia thyrsiflora), common marsh marigold (Caltha palustris), long-leaved chicken weed (Stellaria longifolia), and sweet-scented bedstraw may be found in the understory.

NORTHERN RICH TAMARACK SWAMP (WESTERN BASIN) (FPn82)

Tamarack-dominated swamps on moderately deep-to-deep peat in basins on glacial till or deposits, or occasionally along the margins of large peatlands on glacial lake plains or on floating mats along lake or river shores.

FPn82a Rich Tamarack-(Alder) Swamp

Tamarack-dominated swamps, often with black spruce. Speckled alder, bog birch, and bog willow are common in the tall-shrub layer.

FPn82b Extremely Rich Tamarack Swamp

Tamarack-dominated swamps, often with white cedar and deciduous trees such as black ash and red maple. Bog birch, red-osier dogwood, and speckled alder are common in the tall-shrub layer.

ACID PEATLAND SYSTEM

NORTHERN SPRUCE BOG (APn80)

Black spruce-dominated peatlands on deep peat. Canopy is often sparse, with stunted trees. Understory is dominated by ericaceous shrubs and fine-leaved graminoids on high Sphagnum hummocks.

APn80a Black Spruce Bog

Only one plant community type is recognized in this class. It is divided into two subtypes along a continuum from well-developed to sparse tree canopies.

APn80a1 Treed Subtype

Canopy is variable but typically has greater than 50 percent black spruce. Tree cover is sufficient to provide conditions for a relatively high number and cover of shade-tolerant species, including lingonberry (vaccinium vitis-idaea), Indian pipe (Monotropa uniflora), velvet-leaved blueberry, (V. mytrilloides), and lowbush blueberry (V. angustifolium.)

APn80a2 Semi-Treed Subtype

Canopy is relatively open because of water tables high enough to limit tree development. Canopy trees are stunted and patchy, with less than 50 percent cover.

NORTHERN POOR CONIFER SWAMP (APn81)

Conifer-dominated peatlands with sparse canopy of stunted trees. Understory is depauperate and dominated by ericaceous shrubs, fine-leave gramminoids, and low hummocks of sphagnum moss. Minertrophic plant species are present.

APn81a Poor Black Spruce Swamp

Canopy has greater than 50 percent cover, typically dominated by black spruce, occasionally with tamarack (which rarely may be co dominant.) Paper birch is also occasionally present in the canopy. Tall shrubs are usually absent or infrequent.

APn81b Poor Tamarack-Black Spruce Swamp

Canopy has 25 percent to 50 percent cover dominated by black spruce with occasional tamarack or by tamarack with black spruce. APn81 develops in slightly wetter areas than APn81a.

APn81b1 Black Spruce Subtype

Canopy is dominated by black spruce, occasionally with some tamarack.

APn81b2 Tamarack Subtype

Canopy is dominated by tamarack, typically with black spruce, and is slightly more open than the canopy of APn81b1.

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

Rare Features Information

Assessment products have been prepared by staff of the Natural Heritage and Nongame Research Program (NHNRP) and Minnesota County Biological Survey (MCBS), 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 (see http://www.fws.gov/midwest/endangered/lists/minnesot-spp.html) occur in the Chippewa Plains/Pine Moraines and Outwash Plains subsections: gray wolf, bald eagle, and Canada lynx.

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 systematic rare features survey work done since the 1970s by the MCBS and the Natural Heritage Program, 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 Chippewa Plains/Pine Moraines and Outwash Plains 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.

Rare Features Codes

[1] **Occurrence**

CP or PM—Documented occurrence in the subsection

(If a species is documented from only one subsection but suitable habitat is present in the other subsection, a species may occur in both. In addition, other species will very likely be added to this list as the MCBS continues its work in these two subsections.)

[2] **Minnesota Status**

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** (adapted from native plant community systems in *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province*; the aquatic systems listed here, as well as the U and O codes, were created for this SFRMP process and are not a part of the field guide).

A – Aquatic
AL – Aquatic (lake)
AR – Aquatic (river)
FD – Fire dependent habitats
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 (deciduous woodland or scrub on a permanently wet, organic soil.)
U – Wide-ranging and/or associated with a wide variety of habitats
O – Openings (natural and anthropogenic)

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Table 5.4 cppm – Animals

MINNESOTA LISTED SPECIES – Animals
Chippewa Plains/Pine Moraines and Outwash Plains

		Occurrence			
Scientific Name	**Common Name**	**CP**	**PM**	**MN Status**	**NPC System**
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	CP	PM	SPC	AP,WM,0P
Asio flammeus	Short-eared Owl	CP		SPC	MR,OP,AP,WM
Buteo lineatus	Red-shouldered Hawk	CP	PM	SPC	MH,FF,MR
Canis lupus	Gray Wolf				U
Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	CP		SPC	A
Chilostigma itascae	Headwater Chilostigman Caddisfly	CP		END	A
Cicindela patruela patruela	A Tiger Beetle		PM	SPC	FD
Coturnicops noveboracensis	Yellow Rail	CP	PM	SPC	MR;WM
Cygnus buccinator	Trumpeter Swan	CP	PM	THR	A
Dendroica cerulea	Cerulean Warbler		PM	SPC	MH
Emydoidea blandingii	Blanding's Turtle		PM	THR	AR;FD
Etheostoma microperca	Least Darter	CP	PM	SPC	AR,AL
Falco peregrinus	Peregrine Falcon	CP		THR	LK
Haliaeetus leucocephalus	Bald Eagle	CP	PM	SPC	U
Hesperia leonardus leonardus	Leonard's Skipper		PM	SPC	FD
Lasmigona compressa	Creek Heelsplitter	CP	PM	SPC	AR
Lasmigona costata	Fluted-shell	CP		SPC	AR
Ligumia recta	Black Sandshell	CP	PM	SPC	AR
Microtus ochrogaster	Prairie Vole		PM	SPC	FD
Notropis anogenus	Pugnose Shiner	CP	PM	SPC	AR,AL
Oxyethira ecornuta	A Caddisfly	CP	PM	SPC	A
Oxyethira itascae	A Caddisfly	CP		SPC	A
Pelecanus erythrorhynchos	American White Pelican		PM	SPC	A
Phalaropus tricolor	Wilson's Phalarope	CP	PM	THR	A,WM,FD, MR
Polycentropus milaca	A Caddisfly		PM	SPC	A

Setodes guttatus	A Caddisfly	CP		SPC	A
Spilogale putorius	Eastern Spotted Skunk	CP		THR	U
Sterna forsteri	Forster's Tern	CP		SPC	AL,MR
Sterna hirundo	Common Tern		PM	THR	AL,LK
Tympanuchus cupido	Greater Prairie-chicken		PM	SPC	FD
Wilsonia citrina	Hooded Warbler	CP	PM	SPC	MH,FF,WF

Table 5.4 cppm – Plants

MINNESOTA LISTED SPECIES – PLANTS Chippewa Plains/Pine Moraines and Outwash Plains					
		Occurrence			
Scientific Name	**Common Name**	**CP**	**PM**	**MN Status**	**NPC System**
Botrychium lanceolatum	Triangle Moonwort	CP	PM	THR	MH;WF
Botrychium minganense	Mingan Moonwort	CP	PM	SPC	O;MH
Botrychium mormo	Goblin Fern	CP	PM	SPC	MH
Botrychium oneidense	Blunt-lobed Grapefern	CP	PM	END	MH
Botrychium pallidum	Pale Moonwort	CP	PM	END	O;MH
Botrychium rugulosum	St. Lawrence Grapefern	CP	PM	THR	FD;O
Botrychium simplex	Least Moonwort	CP	PM	SPC	U
Cirsium hillii	Hill's Thistle		PM	SPC	FD
Cladium mariscoides	Twig-rush	CP	PM	SPC	OP
Cypripedium arietinum	Ram's-head Lady's-slipper	CP	PM	THR	FP;FD
Dalea candida var. oligophylla	White Prairie-clover		PM	SPC	FD
Dryopteris goldiana	Goldie's Fern	CP	PM	SPC	MH
Eleocharis flavescens var. olivacea	Olivaceous Spike-rush	CP	PM	THR	LK,OP, MR
Eleocharis quinqueflora	Few-flowered Spike-rush	CP	PM	SPC	O
Eleocharis rostellata	Beaked Spike-rush	CP		THR	OP
Hudsonia tomentosa	Beach-heather		PM	SPC	LK
Juglans cinerea	Butternut		PM	SPC	MH
Malaxis monophyllos var. brachypoda	White Adder's-mouth	CP	PM	SPC	WF; FP
Malaxis paludosa	Bog Adder's-mouth	CP	PM	END	FP
Najas gracillima	Thread-like Naiad	CP	PM	SPC	AL
Orobanche uniflora	One-flowered Broomrape	CP		SPC	U
Panax quinquefolius	American Ginseng		PM	SPC	MH
Platanthera clavellata	Club-spur Orchid	CP		SPC	AP;OP;O
Poa paludigena	Bog Bluegrass		PM	THR	WF
Poa wolfii	Wolf's Bluegrass	CP		SPC	LK;FF
Potamogeton bicupulatus	Snailseed Pondweed		PM	END	AL
Potamogeton vaginatus	Sheathed Pondweed	CP		SPC	AL;AR
Potamogeton vaseyi	Vasey's Pondweed		PM	SPC	AL
Ranunculus lapponicus	Lapland Buttercup	CP		SPC	FP
Rhynchospora capillacea	Hair-like Beak-rush	CP		THR	OP

Trichophorum clintonii	Clinton's Bulrush		PM	SPC	FD
Silene drummondii	Drummond's Campion		PM	SPC	FD
Sparganium glomeratum	Clustered Bur-reed	CP	PM	SPC	WF;RV;LK;WM;MR
Torreyochloa pallida	Torrey's Manna-grass	CP		SPC	MR;WM;RV;LK,MH
Utricularia purpurea	Purple-flowered Bladderwort		PM	SPC	AL
Waldsteinia fragarioides	Barren Strawberry	CP	PM	SPC	FD

Additional Species Data

In addition to information on listed species, the Chippewa Plains/Pine Moraines and Outwash Plains 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 or the species is presumed to be extirpated from the state.

This definition describes current practice.

Table 5.4 cppm – “NONs” Animals

MINNESOTA “NONs” – Animals **Chippewa Plains/Pine Moraines and Outwash Plains**					
		Occurrence			
Scientific Name	**Common Name**	**CP**	**PM**	**MN Status**	**NPC System**
Accipiter gentilis	Northern Goshawk	CP	PM	NON	FD; MH
Bartramia longicauda	Upland Sandpiper		PM	NON	O
Botaurus lentiginosus	American Bittern	CP	PM	NON	MR; WMC
Colonial waterbird nesting site	Colonial Waterbird Nesting	CP	PM		A,MR,WF,FF,FD,LK
Dendroica caerulescens	Black-throated Blue Warbler		PM	NON	MH
Euphyes bimacula	Two-spotted Skipper		PM	NON	MR,OP,RV,AP,WM
Grus canadensis	Sandhill Crane	CP	PM	NON	MR;WM
Heterodon platirhinos	Eastern Hognose Snake		PM	NON	U
Mussel sampling site	Mussel Sampling Site	CP	PM		A
Strix nebulosa	Great Gray Owl	CP		NON	FP;AP

Table 5.4 cppm – "NONs"-Plants

MINNESOTA "NONs" – PLANTS Chippewa Plains/Pine Moraines and Outwash Plains					
		Occurrence			
Scientific Name	**Common Name**	**CP**	**PM**	**MN Status**	**NPC System**
Arethusa bulbosa	Dragon's-mouth	CP	PM	NON	OP;FP
Astragalus neglectus	Cooper's Milk-vetch	CP	PM	NON	LK, FD, O
Bidens discoidea	Bur-marigold		PM	NON	MR; RV
Botrychium matricariifolium	Matricary Grapefern	CP	PM	NON	O;MH;FF;WF
Cardamine pratensis var. palustris	Cuckoo Flower	CP		NON	OP, FP, WF
Carex capillaris var. major	Hair-like Sedge	CP		NON	AP,WF,OP,FP,LK,WM
Ceratophyllum echinatum	Spiny Hornwort	CP	PM	NON	A
Eleocharis robbinsii	Robbin's Spike-rush		PM	NON	AL
Lycopus virginicus	Virginia Water Horehound		PM	NON	WF,WM,0P,MR
Myriophyllum tenellum	Leafless Water Milfoil	CP	PM	NON	LK
Polygonum arifolium	Halberd-leaved Tearthumb		PM	NON	MR,WM,WF
Ranunculus gmelini	Small Yellow Water Crowfoot	CP		NON	A
Utricularia gibba	Humped Bladderwort	CP	PM	NON	OP;LK;AL

Listed Species Status Sheets

The Natural Heritage and Nongame Research Program is in the process of preparing and publishing species fact sheets that will include habitat information. Their effort will not be completed for this round of subsection planning. Consequently, the Chippewa Plains/Pine Moraines and Outwash Plains (cppm) assessment's rare features information tables include only broad information on species associations with native plant community systems.

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 the state for which a change in status was proposed during the last list revision in 1996. The *Species Status Sheets* provide some information on the species and describe the rationale for the proposed change in Minnesota Status in 1996.

Natural Heritage and Nongame Research Program Species Fact Sheets

The goal of the current species fact sheet project is to update and publish information on Minnesota's rare species. The database fields that will be used to describe habitats have not yet been finalized, but the database will consolidate and draw from existing databases wherever possible (such as the Natural Heritage Information System, Heritage Data Management System, Minnesota Taxonomy Database-MnTAXA, etc.). Species information will be presented using an interactive database approach that allows visitors to the Web site to search on selected fields from a relatively simple database and create customized reports. Users will also be able to perform alphabetical searches to obtain the information they need and generate standard printouts of rare species accounts.

The Heritage Program is aware of, and sensitive to the broader desire to use existing classification schemes, database fields, etc., and will be designing a rare species accounts database on that premise, hoping to complement and not complicate greater coordination efforts throughout the DNR and beyond.

The anticipated project schedule is over the next 18 to 24 months, during which time the content will likely be published in phases: about 200 accounts of endangered and threatened species will be published first, followed by approximately 240 accounts of species of special concern.

Information Resources

The Minnesota (DNR) Natural Heritage Information System rare features database was the source for species occurrence information. Janet Boe (NW Regional DNR Plant Ecologist) and Katie Haws (NW Regional DNR Nongame Specialist) assessed the native plant community (NPC) system association(s) for these species.

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-overview/index.htm).

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5.5 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 in both the Chippewa Plains and Pine Moraines and Outwash Plains subsections (http://www.dnr.state.mn.us/ecological_services/mcbs/index.html). See *Table 5.5 cppm* for the status of the MCBS survey of counties in these two subsections and the location of data for those counties in which the survey has been completed. 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.

Procedures—sites and native plant community surveys

1. Review of 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.

The ecologist then:

- Refines the boundaries of the sites and native plant communities on topographic maps or digital files and the final boundaries and associated data reside in the NHIS that includes a GIS. The GIS is used to produce many different kinds of maps, including individual county maps of existing native plant communities.
- Prepares a site evaluation 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 field biologists also conduct surveys for rare plants (http://www.dnr.state.mn.us/ecological_services/mcbs/procedures_plants.html) and rare animals (http://www.dnr.state.mn.us/ecological_services/mcbs/procedures_animals.html). Data gathered during these surveys inform decisions about the biodiversity importance of MCBS sites in the survey area.

Status of MCBS in the Chippewa Plains/Pine Moraines and Outwash Plains Subsections

Table 5.5 cppm

County	Field Data Collection Scheduled	Notes On Sites And Npcs	NPC On Data Deli Scheduled	Sites On Data Deli Scheduled
Becker	Will complete county in 2005 (Pine Moraine portion is focus of 2005 surveys)	PM: Sites digital and prioritized for survey	June 2006	June 2006
Beltrami	No		No	No
Cass	Completed	Sites are digital, need revisions	Winter 2005	Winter 2005
Clearwater	Will begin in 2005 (Pine Moraine portion only)	PM: Sites digital and prioritized for survey	PM: December 2005	PM: December 2005
Crow Wing	Completed	Sites are digital, need revisions	December 2005	December 2005
Hubbard	Will begin in 2005 (Pine Moraine portion only)	PM: Sites digital and prioritized for survey	PM: December 2006	PM: December 2006
Itasca	Incomplete; no fieldwork planned for 2005	LSAs and some preliminary sites digitized, prioritized for survey	No	No
Koochiching	No		No	No
Mahnomen	Completed		On Data Deli	On Data Deli with Branks
Morrison	Completed		On Data Deli	On Data Deli with Branks
Otter Tail	Completed	Sites with Branks and NPC digital, need checking	December 2005	December 2005
Todd	Completed	Sites digital, no Branks	December 2005	December 2005
Wadena	Will begin very limited fieldwork in 2005	Sites digital, prioritized for survey	December 2006	December 2006

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PM= Pine Moraines and Outwash Plains Subsection
NPC=Native plant community polygons (native plant community classification version 2.0)
Sites=Minnesota County Biological Survey sites (see definition in glossary)
Branks=sites have been ranked for Biodiversity Significance.
Data Deli=Department of Natural Resources Data Deli (http://deli.dnr.state.mn.us/)
LSA=Landscape Study Areas (see definition in glossary)

C H A P T E R 6

Stand Damage and Mortality

Chippewa Plains/Pine Moraines and Outwash Plains Subsections

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6.2 … Role of Insects and Diseases

6.3 … Damage and Mortality Tables
Table 6.3a Summary of Acres Affected and Acres of Mortality by Cover Type
Table 6.3b List of Agents Known to Cause Mortality and Quality Reductions by Cover-Type

6.4 … Insects and Diseases Common to Each Cover Type
All
Aspen
Map 6.4a Forest Tent Caterpillar Defoliation—2002
Oak
Map 6.4b Risk Assessment For Mortality Caused by Gypsy Moth
Birch
Tamarack
Jack pine
Map.6.4c Historic Occurrences of Jack Pine Budworm—1954 to 2004
White pine
Map 6.4d White Pine Blister Rust Hazard Zones—1972
Red pine
Balsam fir
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 *both subsections combined* *(Chippewa Plains/Pine Moraines and Outwash Plains) are indicated by a "cppm" after the chart designation (e.g.,* Table 6.3 cppm*).*

Graphics referring to the *Chippewa Plains Subsection* only *are indicated by a "cp" after each chart designation (e.g.,* Chart 3.2 cp*).*

Graphics referring to the *Pine Moraines and Outwash Plains Subsection* only *are indicated by a "pm" after each chart designation (e.g.,* Map 3.2 pm*).*

Notes relating to this chapter:
Color maps may be viewed as PDF files on the Chippewa Plains/Pine Moraines and Outwash Plains Subsection Forest Resource Management Plan (SFRMP) Web site at: www.dnr.state.mn.us/forestry/subsection/chippewaplains/index.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. These maps can be easily recognized by "squared off" areas along the eastern boundary.

Printed documents will be available for review at Area DNR offices within the planning area, public libraries, and on compact disk by request.

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 Chippewa Plains/Pine Moraines and Outwash Plains 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 by some 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. They have to be lived and dealt with. This will also happen with gypsy moth after it becomes established in Minnesota.

6.3 Damage and Mortality Tables

The damage and mortality table summarizes acres affected and acres of mortality from the Cooperative Stand Assessment (CSA) inventory on state lands in these subsections.

Table 6.3a

Acres[1] Affected and Acres of Mortality[2] by Cover Type									
	Chippewa Plains			Pine Moraines			Combined Subsections		
Cover Type	Percent Affected	Percent Mortality	Acres	Percent Affected	Percent Mortality	Acres	Percent Affected	Percent Mortality	Acres
Aspen	34.8	24.4	65208	54.0	37.6	127345	47.5	33.1	192553
Oak	41.4	11.4	1134	63.6	29.5	13811	61.9	28.1	14945
Birch	61.9	46.1	4860	86.6	85.0	6612	76.2	68.5	11472
Tamarack	45.8	32.3	38879	53.9	44.5	6059	46.9	33.9	44938
Jack pine	62.2	45.0	5744	67.8	64.2	12056	66.0	58.0	17800
White pine	38.2	31.6	809	34.3	21.3	2376	35.3	23.9	3185
Red pine	19.1	7.8	11808	17.4	9.2	27822	17.9	8.8	39630
Balsam fir	38.0	28.4	5521	67.2	42.4	2862	48.0	33.2	8383
White spr.	10.7	7.9	3014	12.6	5.9	3579	11.7	6.8	6593
Blk spruce	36.3	26.6	27138	41.5	37.8	2217	36.7	27.4	29355

1 Each stand is assessed for the presence or absence of damage. These numbers reflect the sums of all acres in a cover type that are damaged or have died. In reality, the number of damaged and dead trees per acre is usually very low.
2 Percent affected and percent mortality are not additive. A stand cannot have mortality unless it also is affected.

Table 6.3b
This table summarizes the insect and disease agents that are known to cause mortality or quality reductions in these subsections.

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
		Forest tent caterpillar
		Poplar borer
Oak	Gypsy moth	
	Two-lined chestnut borer	
	Oak wilt	
Birch	Birch decline	
Tamarack	Larch beetle	
Jack pine	Jack pine budworm	Red rot
	Ips bark beetles	
White pine	White pine blister rust	
Red pine	*Ips* bark beetles	*Diplodia* shoot blight and canker
		Sirococcus shoot blight
Balsam fir	Spruce budworm	
White spruce	Spruce budworm	
Black spruce	Eastern dwarf mistletoe	

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 outbreaks 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 decay-causing fungi. Stem decay—Many species
  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 decay. Many tree species have the ability to confine decay 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. 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 reduce merchantable volume.

- **Root disease—***Armillaria* spp. and others
  All tree species are susceptible to root disease caused by *Armillaria spp.* 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. *Armillaria* spp. is 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

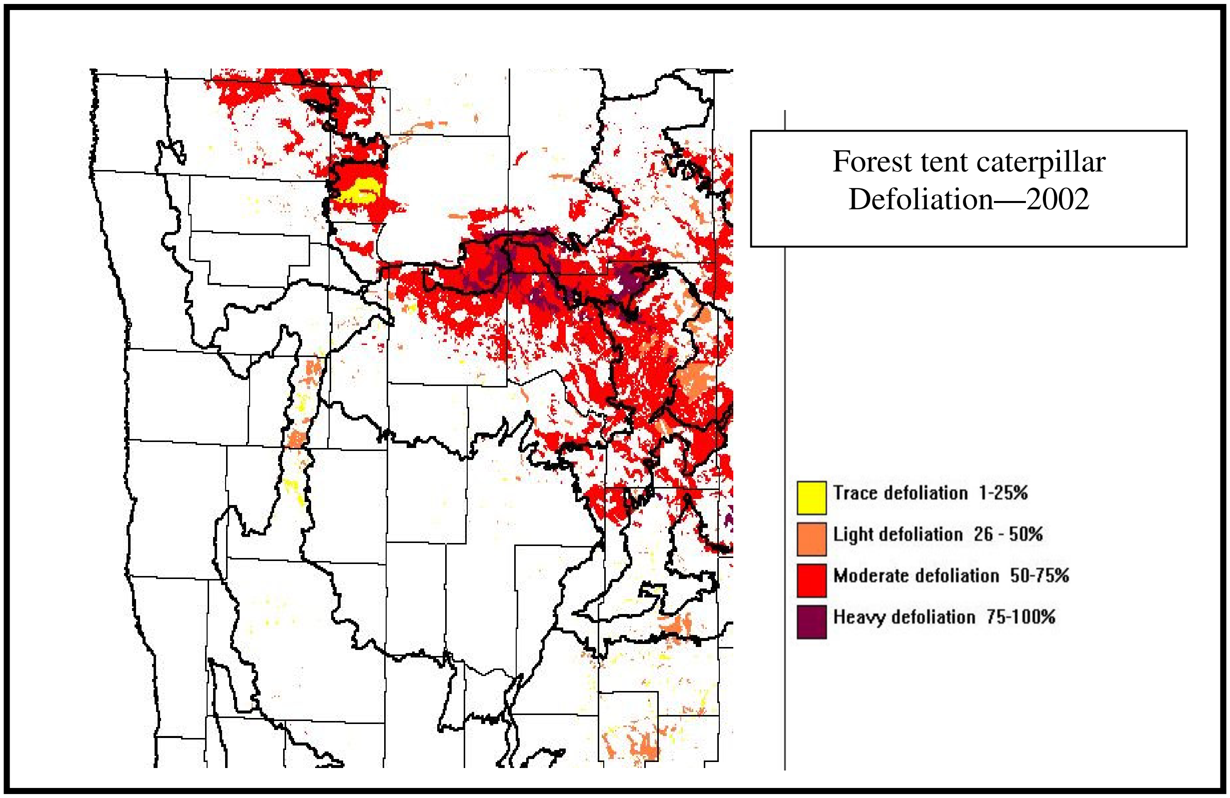
- **Hypoxylon canker—***Entoleuca mammata (=Hypoxylon mammatum)*
  A common disease of aspen, Hypoxylon canker causes mortality and is the most destructive pathogen of young aspen in the Lake States. It is estimated that Hypoxylon canker infects 12 percent and kills 1 percent to 2 percent of the aspen 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. 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 often 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 previous outbreak peaked in Minnesota in 1990 when defoliation occurred across approximately four million acres. 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 6.4a.

- **Poplar borer—***Saperda calcarata*
  Poplar borer occurs wherever aspen grow. 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.

Map 6.4a



Management Implications

As aspen stands are set aside to meet extended-rotation and old-growth targets, or 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. Sequential, partial harvesting 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.

Management practices, such as creating irregular stand shapes, using intermediate cuts to capture mortality, partially harvesting stands at the end of the rotation, or leaving scattered patches of standing live aspen in the stand at the end of the rotation, increase the incidence and severity of poplar borer and Hypoxylon canker. 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 is recommended to convert those clones to other species or other clones more resistant to Hypoxylon canker (Schipper and Anderson, 1976). Both bigtooth aspen and balm of Gilead are more resistant to Hypoxylon canker. If these species exist in proximity to aspen clones with a high infection rate from Hypoxylon, consider favoring these species when regenerating the stands.

Defoliator occurrence and impacts are difficult to predict and to influence by management practices. If forest tent caterpillar continues to cause widespread defoliation every 10 or 12 years, delay the harvest in intensively managed aspen stands on good sites to accommodate reductions in growth rate every decade during the rotation. If forest tent caterpillar 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.

OAK

Damage Agents

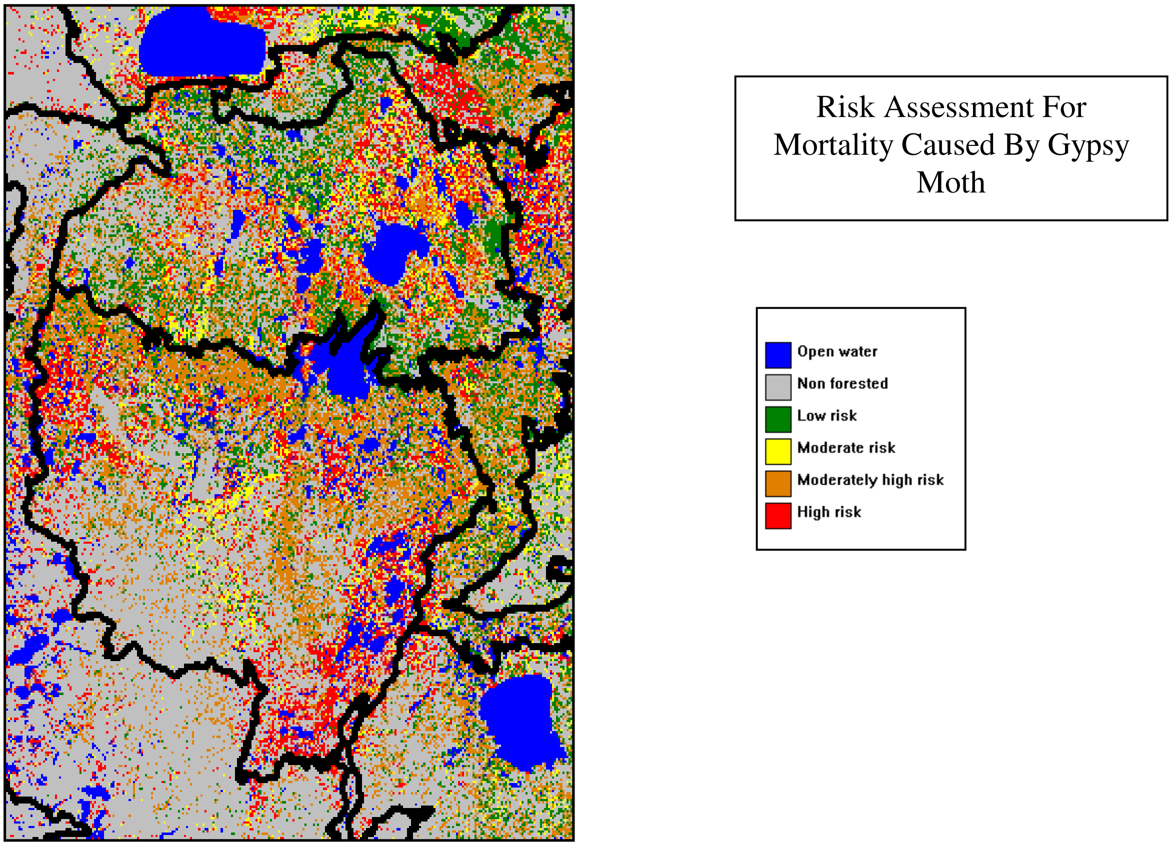
- ❑ **Two-lined chestnut borer—***Agrilus bilineatus*
  This insect is an opportunistic insect that attacks weakened oak trees. It is a native beetle known to attack all oak species found in Minnesota, red oak being its preferred host. When trees and stands are healthy, two-lined chestnut borer (TLCB) 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.

- ❑ **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 into 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. Pressure may also increase from Ontario, Canada. 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 6.4b) was developed in 2003.

Map 6.4b



Risk Potential Map Developed in 2003

- **Oak wilt** —*Ceratocystis fagacearum*
  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 fungus to fresh wounds or (2) the spread of spores in grafted roots of a diseased tree. In the first case, a beetle carrying spores to a fresh wound only travels 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 oak wilt from invading an oak wood lot or a wooded home site. 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). Secondly, do not move infected trees with the bark still attached (logs or firewood) into the wood lot or home site.

Management Implications

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 TLCBs becomes evident, management options are postponement of any activity in the stand, salvage, and sanitation. Thinning during an outbreak should be strictly avoided because it wounds trees and creates droughty conditions for the crop trees.

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. Root graft spread of oak wilt can be controlled by using a vibratory plow to sever roots around the perimeter of an oak wilt infection center. Overland spread can be controlled by cutting and treating all the wilting and recently dead red oaks inside the plow line perimeter so spores are not produced to spread the disease further.

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, maples, ash, and hackberries, which will slowly make the stands less vulnerable to GM and FTC defoliation.

FTC outbreaks affect trees in this subsection averaging two to three years of defoliation each 10 to 12 years. The beginnings of FTC outbreaks usually coincide with droughty weather. When GM outbreaks coincide or are closely timed to FTC outbreaks, there is a high risk of oak, basswood, and birch mortality due to prolonged defoliation. Due to the recurring FTC outbreaks, especially along lakeshores, treating either or both FTC and GM caterpillars with biopesticides would prevent mortality.

The “fall defoliator complex” is a group of insects that causes locally important oak, birch, basswood, and aspen defoliation. Outbreaks occur for one to three years but the interval between outbreaks is highly variable, sometimes up to 20 years. These are rare and unusual insects in Minnesota and should be protected. As with FTC, stands with both GM and fall defoliators will be vulnerable to mortality. If GM and fall defoliators are coincident, spray GM in order to preserve the natural biodiversity represented by the rare and native fall defoliator insects.

Gypsy moth: Chippewa Plains Subsection

According to GM analysis, 39 percent of the forested area is high risk, 27 percent is moderate, and 34 percent is low (see map 6.4b). Mortality due to concurrent droughts and GM outbreaks is likeliest on the Bagley outwash plain, Bemidji sand plain, and Aitkin Lacustrine plain. Oaks, basswoods, and birches on ridge tops and steep slopes on moraines are also likely to suffer from the effects of drought and defoliation. Low-quality oaks and aspen growing with jack pines on nutrient-poor and dry sites will suffer the most mortality.

Gypsy moth: Pine Moraines Subsection

According to GM analysis, 67 percent of the forest is at high risk for GM damage, 14 percent is at moderate risk, and 19 percent is at low risk (see map 6.4b). This subsection has a very high potential for damage due to GM defoliation because of the composition of the forest, underlying droughty soils, and continuity of forest cover. The lowest risk of impact occurs on the Wadena Drumlin Field and Henning Till Plain where agricultural land use is more prevalent and woodlands become more scattered. Once infested, there will be a rapid spread rate between stands. Spraying biopesticides to prevent establishment may be effective in these stands, but will not be very useful in preventing damage once gypsy moths are established.

Aspen-birch stands occupy 53 percent of the forested acres, oaks 11 percent. FTC populations infest the aspen/basswood/oak cover types that surround lakes in this subsection when there are no other FTC outbreaks in the state. This makes the likelihood of defoliation impact even greater when GM and FTC outbreaks are concurrent or separated by only a year or two. There is a high risk of mortality due to the duration and severity of defoliation when both defoliators are present.

BIRCH

Damage Agents

- **Birch decline—**unknown etiology and causal agents
  Birch decline is a complex disease caused by a combination of factors including stress from drought, high temperatures, 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. 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 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. 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. Adults stay in the tree until the following spring. Flooding, droughts, defoliation by larch casebearers, and old age have been associated with larch beetle attacks.

  Larch beetle also appears to be able to develop widespread outbreaks and kill healthy trees as well. Populations can build up in tamarack logging slash and then attack and kill live trees left for seed production as well as live trees in surrounding stands. Presently, populations and attacks are on the increase, and in some stands 30 percent to 90 percent tree mortality has been observed.

Management Implications

Apparent healthy trees can be successfully attacked when there are high populations of larch beetles. Harvesting can also create stress conditions on residual trees left for seed production or biodiversity objectives by affecting water table levels and by increasing temperatures. Most harvesting plans are salvage operations due to larch beetle mortality.

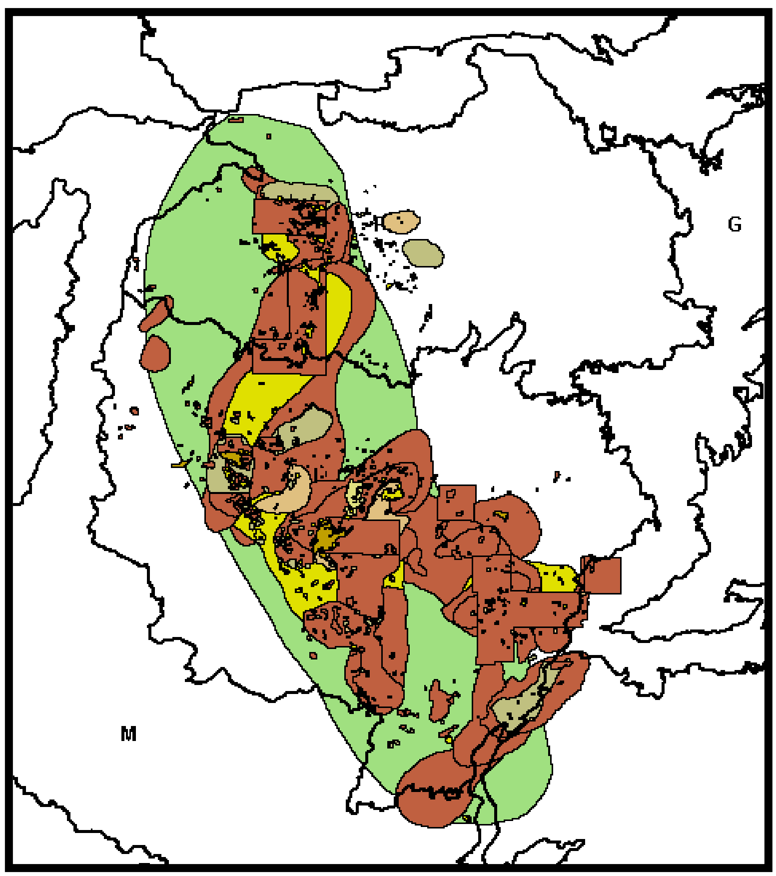
JACK PINE

Damage Agents

- **Jack pine budworm—***Choristoneura pinus pinus*
  Jack pine budworm (JPBW) larvae eat the needles of jack pine causing defoliation, which leads to top kill and mortality. In the Lake States, JPBW outbreaks tend to occur at roughly six- to 12-year intervals and persist for two to four years and then decline. In Minnesota, there have been five major budworm outbreaks since 1969 (Albers, et. al., 1995). 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. There is often an “edge-effect” with JPBW. Populations tend to be heavier and more damage occurs on the edges of the stand. The most recent outbreak ended in 2005.

Map 6.4c

Historic Occurrences Of Jack Pine Budworm- , 1954 To 2004



- **Bark beetle** (pine engraver beetle) - *Ips pini*
  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; however, in the Agassiz Lowlands, two generations are more likely to occur. 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 treetops and progress downward. Stress from 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 against bark beetle attacks and it becomes easy for the beetles to kill the trees.

- **Stem decay (red rot)** - *Phellinus pini*
  This organism is the most destructive decay organism in the United States. It 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. 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; decay usually is not found unless the trees are tapped. Boring trees is not part of the procedures for CSA inventory. 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. Mushrooms that would predict red rot are not prominent and are easily missed during inventory and cruising. Often red rot is not discovered until harvesting takes place. For more details see both discussions of stem decay for the aspen and tamarack cover types.

Management Implications

Jack pine budworm (JPBW) is a perennial problem in these subsections (see map 6.4c). Stands 50 years of age and greater are high-risk stands and will be most vulnerable to the JPBW (Jones and Campbell, 1986). In these older stands when defoliation occurs, the trees do not have the reserves to pitch out and defend themselves against bark beetle attacks. Bark beetle outbreaks often occur during and after an outbreak of JPBW leading to catastrophic stand mortality.

Management strategies that call for holding jack pine beyond 50 years of age will lead to conditions where stands begin to break up because of budworm and bark beetle outbreaks, and jack pine sites will be lost. Also, as the stands age, the incidence of red rot caused by *Phellinus pini* will also increase, and older stands may exist as “jack pine stands,” but the amount of red rot in the older stands may make the stands unmerchantable.

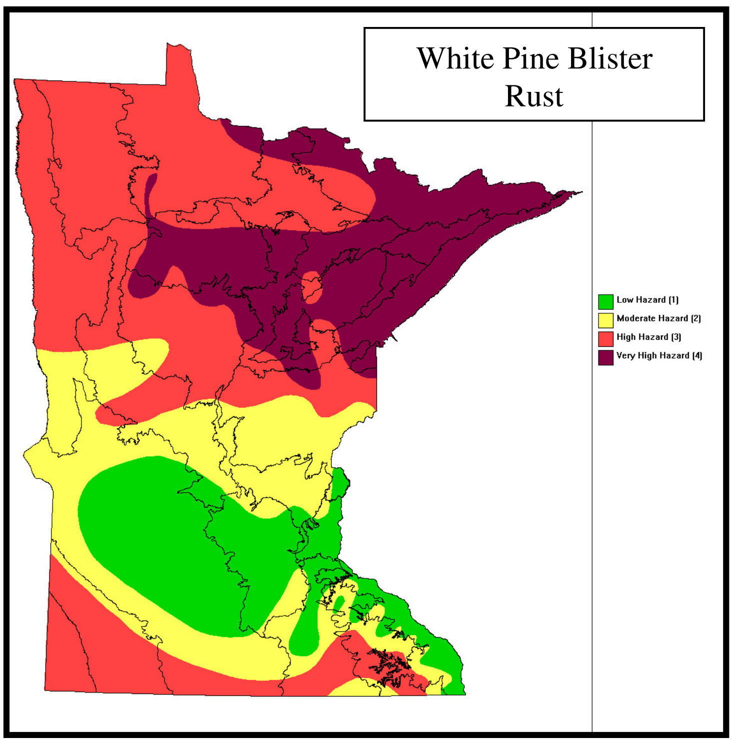
Leaving stands older than 50 years will also produce “reservoirs” for JPBW. These older stands may sustain populations longer than populations would exist under the more normal cyclic buildup and crash dynamics the budworm usually exhibits. This may lead to areas where outbreaks tend to be more continuous and budworm populations never crash. It has also been observed that when budworm populations build up on older trees surrounding unharvested areas, larvae "rain" down on the younger pines. Significant mortality can occur to these young pines while the older surrounding trees survive with little apparent long-term damage. Management strategies that lead to smaller stands or scattered jack pine patches with a higher proportion of edge may also experience more budworm damage from the edge effect.

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. 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. 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. Injury to *Ribes* species is not significant.

Map 6.4d



Management Implications

As more white pine is planted, the incidence of white pine blister rust will increase. Van Arsdel developed a hazard zone map for Minnesota (see map 6.4d) based on the likelihood of infection (Anderson, 1973). The Chippewa Plains Subsection occurs in the Very High Risk Zone for white pine blister rust damage. Here, damage will usually occur to more than 50 percent of the established white pines and it will be very difficult to establish new plantings and natural regeneration. The Pine Moraine

Subsection occurs in the High Risk Zone. The “probability” of a stand experiencing high levels of blister rust mortality is great in this zone. Choosing planting sites based on microclimatic factors is critical” (Jones, 1989). Establishing white pine as an understory tree will help mitigate the impacts from blister rust.

RED PINE

Damage Agents

- **Diplodia tip blight and canker -** *Sphaeropsis sapinea*
  Diplodia damage can be locally high on sites where large infected red pine and jack pine are left on or next to sites being regenerated to red pine or jack pine. It causes a tip blight as well as a canker that can girdle branches and stems and kill trees. It spreads most during wet weather where it can infect through wounds, but this fungus does not require a wound for infection. A strain of this fungus can cause latent infections, which become activated when the host trees 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.

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 existing stands of pine. As management strategies lead to more partial harvesting and development of all-aged stands, understory pines will be susceptible to both shoot blights. In some locations, the presence of one or both of these diseases will preclude natural red pine regeneration. 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.

BALSAM FIR

Damage Agents

- **Spruce budworm -** *Choristoneura fumiferana*
  Spruce budworm 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 46 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. Presently there is a general budworm population decline statewide. However, the pattern of the past 46 years indicates that outbreaks with high levels of defoliation and mortality can be expected to continue as balsam fir stands mature.

Management Implications

Spruce budworm is a sporadic invader of balsam fir and white spruce in these subsections; however, management strategies that increase the component of balsam fir will only lead to more frequent and more severe 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 occurrence of spruce budworm in white spruce plantations may be related to the plantations being overcrowded and not managed. Again, 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.

Management Implications

The 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.

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. Once a stand is infected, it remains infected until all the mistletoe-infected trees are killed by fire, harvesting, or shearing. 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 60 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.

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. If dwarf mistletoe is not aggressively eradicated from black spruce stands when harvesting and regenerating the stands, the total acreage of this cover type will decline.

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.

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CHAPTER 7

Wildlife Species Status & Trends

Chippewa Plains/Pine Moraines and Outwash Plains

Chapter 7 provides information on the occurance, legal status and the population trends of some hunted wildlife species in these two subsections that are surveyed annually by the DNR. Trend information on forest songbirds from an ongoing long term monitoring program in the Chippewa Plains is also included.

A new DNR initiative *Minnesota's Comprehensive Wildlife Conservation Strategy* provides additional information and summaries about wildlife species and habitats in greatest need of conservation. Information is presented on their distribution and abundance including low and declining populations and wildlife-related issues.

7.1……Terrestrial Vertebrate Species List, Status and Trends.

7.2…… Matrix of forest vertebrates by habitat type.

7.3…….. Fall deer densities.

7.4…….. Cavity nesting duck Trends for Drift & Lake Plains Section.

7.5…….. Prairie Chicken Survey History.

7.6………Ruffed Grouse Survey History.

7.7………Forest Songbird Trends for Chippewa Plains/Pine Moraines and Outwash Plains.

7.8………Comprehensive Wildlife Conservation Strategy.

7.1 Terrestrial, Vertebrate Species List
Pine Moraines and Outwash Plains, and Chippewa Plains ECS Subsections

[a] **Species Common Name:** Are standardized nomenclature for GAP protocol uses through NatureServe and its related searchable plant, animal and ecological communities database called NatureServe Explorer (2002) located at www.natureserveexplorer.org.

[b] **Resident Status: R**=Regular resident as Breeding, Nesting, or Migratory (acceptable record exists in at least eight of the past 10 years); **PR=**Permanent Resident (exists year-round).

[c] **State 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.

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

[e] **ECS Subsection Resident Status: B**=Minnesota breeding record exists for the species; **P**=Presence known or predicted, as year around resident; **M=**Spring or fall migrant, non-breeder; **SV**= Summer visitor, non-breeder; **WV**=Winter visitor, non-breeder; **A**=Absent; **(L)**=Limited distribution within ECS Subsection.

Terrestrial Vertebrate Species List
January 2005

Common Name[a]	Scientific Name	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	ECS Subsection[e]: Pine Moraines & Outwash Plains	ECS Subsection[e]: Chippewa Plains
BIRDS						
Common Loon	*Gavia immer*	R	PB	P	B	B
Pied-billed Grebe	*Podilymbus podiceps*	R	PB	P	B	B
Red-necked Grebe	*Podiceps grisegena*	R	PB	P	B	B
American White Pelican	*Pelecanus erythrorhynchos*	R	PB, SC	P	B	M/SV
Double-crested Cormorant	*Phalacrocorax auritus*	R	UB	P	B	B
American Bittern	*Botaurus lentiginosus*	R	PB	P	B	B
Least Bittern	*Ixobrychus exilis*	R	PB	P	B	B
Great Blue Heron	*Ardea herodias*	R	PB	P	B	B
Green Heron	*Butorides virescens*	R	PB	P	B	B
Trumpeter Swan	*Cygnus buccinator*	R	PB, MW, T	P	B	B
Canada Goose	*Branta canadensis*	R	PB, MW	P	B	B
Wood Duck	*Aix sponsa*	R	PB, MW	P	B	B
Green-winged Teal	*Anas crecca*	R	PB, MW	P	M	B
American Black Duck	*Anas rubripes*	R	PB, MW	P	M	B
Mallard	*Anas platyrhynchos*	R	PB, MW	P	B	B
Blue-winged Teal	*Anas discors*	R	PB, MW	P	B	B
American Wigeon	*Anas americana*	R	PB, MW	P	M	B
Ring-necked Duck	*Aythya collaris*	R	PB, MW	P	B	B
Common Goldeneye	*Bucephala clangula*	R	PB, MW	P	B	B
Hooded Merganser	*Lophodytes cucullatus*	R	PB, MW	P	B	B
Common Merganser	*Mergus merganser*	R	PB, MW	P	B	B
Turkey Vulture	*Cathartes aura*	R	PB	P	B	B

Terrestrial Vertebrate Species List January 2005						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
Osprey	*Pandion haliaetus*	R	PB	P	B	B
Bald Eagle	*Haliaeetus leucocephalus*	R	PB, SC	P/T	B	B
Northern Harrier	*Circus cyaneus*	R	PB	P	B	B
Sharp-shinned Hawk	*Accipiter striatus*	R	PB	P	B	B
Cooper's Hawk	*Accipiter cooperii*	R	PB	P	B	B
Northern Goshawk	*Accipiter gentilis*	R	PB	P	B	B
Red-shouldered Hawk	*Buteo lineatus*	R	PB, SC	P	B	B
Broad-winged Hawk	*Buteo platypterus*	R	PB	P	B	B
Red-tailed Hawk	*Buteo jamaicensis*	R	PB	P	B	B
American Kestrel	*Falco sparverius*	R	PB	P	B	B
Merlin	*Falco columbarius*	R	PB	P	B	B
Spruce Grouse	*Falcipennis canadensis*	PR	PB, SG		A	P
Ruffed Grouse	*Bonasa umbellus*	PR	PB, SG		P	P
Greater Prairie Chicken	*Tympanuchus cupido*	PR	PB, SG, SC		P	A
Sharp-tailed Grouse	*Tympanuchus phasianellus*	PR	PB, SG		P	P
Wild Turkey	*Meleagris gallopavo*	PR	PB, SG		P	A
Yellow Rail	*Coturnicops noveboracensis*	R	PB, SC	P	B	B
Virginia Rail	*Rallus limicola*	R	PB, SG	P	B	B
Sora	*Porzana carolina*	R	PB, SG	P	B	B
American Coot	*Fulica americana*	R	PB, SG	P	B	B
Sandhill Crane	*Grus canadensis*	R	PB	P	B	B
Killdeer	*Charadrius vociferus*	R	PB	P	B	B
Spotted Sandpiper	*Actitis macularia*	R	PB	P	B	B
Upland Sandpiper	*Bartramia longicauda*	R	PB	P	B	B
Wilson's Snipe	*Capella delicate*	R	PB, SG	P	B	B
American Woodcock	*Scolopax minor*	R	PB, SG	P	B	B
Wilson's Phalarope	*Phalaropus tricolor*	R	PB, T	P	B	B
Ring-billed Gull	*Larus delawarensis*	R	PB	P	B	B
Herring Gull	*Larus argentatus*	R	PB	P	B	B
Common Tern	*Sterna hirundo*	R	PB, T	P	B	M
Forster's Tern	*Sterna forsteri*	R	PB, SC	P	M	B
Black Tern	*Chlidonias niger*	R	PB	P	B	B
Rock Dove	*Columba livia*	R	PB	P	P	P
Mourning Dove	*Zenaida macroura*	R	PB	P	B	B
Black-billed Cuckoo	*Coccyzus erythropthalmus*	R	PB	P	B	B
Yellow-billed Cuckoo	*Coccyzus americanus*	R	PB	P	B	M
Great Horned Owl	*Bubo virginianus*	PR	UB	P	P	P

Terrestrial Vertebrate Species List January 2005						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
Barred Owl	*Strix varia*	PR	PB	P	P	P
Great Gray Owl	*Strix nebulosa*	PR	PB	P	P	P
Long-eared Owl	*Asio otus*	PR	PB	P	B	B
Short-eared Owl	*Asio flammeus*	R	PB, SC	P	B	B
Common Nighthawk	*Chordeiles minor*	R	PB	P	B	B
Whip-poor-will	*Caprimulgus vociferus*	R	PB	P	B	B
Chimney Swift	*Chaetura pelagica*	R	PB	P	B	B
Ruby-throated Hummingbird	*Archilochus colubris*	R	PB	P	B	B
Belted Kingfisher	*Ceryle alcyon*	R	PB	P	B	B
Red-headed Woodpecker	*Melanerpes erythrocephalus*	R	PB	P	B	B
Red-bellied Woodpecker	*Melanerpes carolinus*	PR	PB	P	P	WV
Yellow-bellied Sapsucker	*Sphyrapicus varius*	R	PB	P	B	B
Downy Woodpecker	*Picoides pubescens*	PR	PB	P	P	P
Hairy Woodpecker	*Picoides villosus*	PR	PB	P	P	P
Black-backed Woodpecker	*Picoides arcticus*	PR	PB	P	WV	P
Northern Flicker	*Colaptes auratus*	R	PB	P	B	B
Pileated Woodpecker	*Dryocopus pileatus*	PR	PB	P	P	P
Olive-sided Flycatcher	*Contopus cooperi*	R	PB	P	B	B
Eastern Wood-Pewee	*Contopus virens*	R	PB	P	B	B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	R	PB	P	B	B
Alder Flycatcher	*Empidonax alnorum*	R	PB	P	B	B
Least Flycatcher	*Empidonax minimus*	R	PB	P	B	B
Eastern Phoebe	*Sayornis phoebe*	R	PB	P	B	B
Great Crested Flycatcher	*Myiarchus crinitus*	R	PB	P	B	B
Western Kingbird	*Tyrannus verticalis*	R	PB	P	B	A
Eastern Kingbird	*Tyrannus tyrannus*	R	PB	P	B	B
Horned Lark	*Eremophila alpestris*	R	PB	P	B	B
Purple Martin	*Progne subis*	R	PB	P	B	B
Tree Swallow	*Tachycineta bicolor*	R	PB	P	B	B
Northern Rough-winged	*Stelgidopteryx serripennis*	R	PB	P	B	B
Bank Swallow	*Riparia riparia*	R	PB	P	B	B
Cliff Swallow	*Petrochelidon pyrrhonota*	R	PB	P	B	B
Barn Swallow	*Hirundo rustica*	R	PB	P	B	B
Gray Jay	*Perisoreus canadensis*	PR	PB	P	P	P
Blue Jay	*Cyanocitta cristata*	PR	PB	P	P	P
Black-billed Magpie	*Pica pica*	PR	UB	P	A	P
American Crow	*Corvus brachyrhynchos*	PR	PB	P	P	P
Common Raven	*Corvus corax*	PR	PB	P	P	P

Terrestrial Vertebrate Species List January 2005						
					ECS Subsection[e]	
Common Name[a]	Scientific Name	Resident Status[b]	State Legal Status[c]	Federal Legal Status[d]	Pine Moraines & Outwash Plains	Chippewa Plains
Black-capped Chickadee	*Poecile atricapillus*	PR	PB	P	P	P
Boreal Chickadee	*Poecile hudsonicus*	PR	PB	P	A	P
Red-breasted Nuthatch	*Sitta canadensis*	PR	PB	P	P	P
White-breasted Nuthatch	*Sitta carolinensis*	PR	PB	P	P	P
Brown Creeper	*Certhia americana*	R	PB	P	B	B
House Wren	*Troglodytes aedon*	R	PB	P	B	B
Sedge Wren	*Cistothorus platensis*	R	PB	P	B	B
Marsh Wren	*Cistothorus palustris*	R	PB	P	B	B
Golden-crowned Kinglet	*Regulus satrapa*	R	PB	P	B	B
Ruby-crowned Kinglet	*Regulus calendula*	R	PB	P	M	B
Blue-gray Gnatcatcher	*Polioptila caerulea*	R	PB	P	B	A
Eastern Bluebird	*Sialia sialis*	R	PB	P	B	B
Veery	*Catharus fuscescens*	R	PB	P	B	B
Swainson's Thrush	*Catharus ustulatus*	R	PB	P	M	B
Hermit Thrush	*Catharus guttatus*	R	PB	P	B	B
Wood Thrush	*Hylocichla mustelina*	R	PB	P	B	B
American Robin	*Turdus migratorius*	R	PB	P	B	B
Gray Catbird	*Dumetella carolinensis*	R	PB	P	B	B
Brown Thrasher	*Toxostoma rufum*	R	PB	P	B	B
European Starling	*Sturnus vulgaris*	PR	UB	P	P	P
Cedar Waxwing	*Bombycilla cedrorum*	R	PB	P	B	B
Blue-headed Vireo	*Vireo solitarius*	R	PB	P	B	B
Yellow-throated Vireo	*Vireo flavifrons*	R	PB	P	B	B
Warbling Vireo	*Vireo gilvus*	R	PB	P	B	B
Red-eyed Vireo	*Vireo olivaceus*	R	PB	P	B	B
Golden-winged Warbler	*Vermivora chrysoptera*	R	PB	P	B	B
Tennessee Warbler	*Vermivora peregrina*	R	PB	P	M	B
Nashville Warbler	*Vermivora ruficapilla*	R	PB	P	B	B
Northern Parula	*Parula americana*	R	PB	P	B	B
Yellow Warbler	*Dendroica petechia*	R	PB	P	B	B
Chestnut-sided Warbler	*Dendroica pensylvanica*	R	PB	P	B	B
Magnolia Warbler	*Dendroica magnolia*	R	PB	P	B	B
Cape May Warbler	*Dendroica tigrina*	R	PB	P	M	B
Yellow-rumped Warbler	*Dendroica coronata*	R	PB	P	B	B
Black-throated Green Warbler	*Dendroica virens*	R	PB	P	B	B
Blackburnian Warbler	*Dendroica fusca*	R	PB	P	B	B
Pine Warbler	*Dendroica pinus*	R	PB	P	B	B
Palm Warbler	*Dendroica palmarum*	R	PB	P	B	B

Terrestrial Vertebrate Species List *January 2005*						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
Cerulean Warbler	*Dendroica cerulea*	R	PB, SC	P	B	A
Black-and-white Warbler	*Mniotilta varia*	R	PB	P	B	B
American Redstart	*Setophaga ruticilla*	R	PB	P	B	B
Ovenbird	*Seiurus aurocapillus*	R	PB	P	B	B
Northern Waterthrush	*Seiurus noveboracensis*	R	PB	P	B	B
Connecticut Warbler	*Oporornis agilis*	R	PB	P	B	B
Mourning Warbler	*Oporornis philadelphia*	R	PB	P	B	B
Common Yellowthroat	*Geothlypis trichas*	R	PB	P	B	B
Canada Warbler	*Wilsonia canadensis*	R	PB	P	B	B
Scarlet Tanager	*Piranga olivacea*	R	PB	P	B	B
Northern Cardinal	*Cardinalis cardinalis*	PR	PB	P	P	WV
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	R	PB	P	B	B
Indigo Bunting	*Passerina cyanea*	R	PB	P	B	B
Eastern Towhee	*Pipilo erythrophthalmus*	R	PB	P	B	B
Chipping Sparrow	*Spizella passerina*	R	PB	P	B	B
Clay-colored Sparrow	*Spizella pallida*	R	PB	P	B	B
Field Sparrow	*Spizella pusilla*	R	PB	P	B	A
Vesper Sparrow	*Pooecetes gramineus*	R	PB	P	B	B
Lark Sparrow	*Chondestes grammacus*	R	PB	P	B	A
Savannah Sparrow	*Passerculus sandwichensis*	R	PB	P	B	B
Grasshopper Sparrow	*Ammodramus savannarum*	R	PB	P	B	M
Le Conte's Sparrow	*Ammodramus leconteii*	R	PB	P	B	B
Nelson's Sharp-tailed sparrow	*Ammodramus nelsoni*	R	PB, SC	P	B	B
Song Sparrow	*Melospiza melodia*	R	PB	P	B	B
Swamp Sparrow	*Melospiza georgiana*	R	PB	P	B	B
White-throated Sparrow	*Zonotrichia albicollis*	R	PB	P	B	B
Dark-eyed Junco	*Junco hyemalis*	R	PB	P	M	B
Bobolink	*Dolichonyx oryzivorus*	R	PB	P	B	B
Red-winged Blackbird	*Agelaius phoeniceus*	R	UB	P	B	B
Eastern Meadowlark	*Sturnella magna*	R	PB	P	B	B
Western Meadowlark	*Sturnella neglecta*	R	PB	P	B	B
Yellow-headed Blackbird	*Xanthocephalus*	R	UB	P	B	B
Brewer's Blackbird	*Euphagus cyanocephalus*	R	UB	P	B	B
Common Grackle	*Quiscalus quiscula*	R	UB	P	B	B
Brown-headed Cowbird	*Molothrus ater*	R	PB	P	B	B
Baltimore Oriole	*Icterus galbula*	R	PB	P	B	B
Purple Finch	*Carpodacus purpureus*	R	PB	P	B	B
House Finch	*Carpodacus mexicanus*	PR	PB	P	P	P
Pine Siskin	*Carduelis pinus*	R	PB	P	P	P

Terrestrial Vertebrate Species List *January 2005*						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
American Goldfinch	*Carduelis tristis*	R	PB	P	B	B
Evening Grosbeak	*Coccothraustes vespertinus*	R	PB	P	P	P
House Sparrow	Passer domesticus	PR	UB	P	P	P
MAMMALS						
Cinereus Shrew	*Sorex cinereus*	PR			P	P
Water Shrew	*Sorex palustris*	PR			P	P
Arctic Shrew	*Sorex arcticus*	PR			P	P
Pygmy Shrew	*Sorex hoyi*	PR			P	P
Northern Short-tailed Shrew	*Blarina brevicauda*	PR			P	P
Star-nosed Mole	*Condylura cristata*	PR			P	P
Little Brown Bat	*Myotis lucifugus*	PR			B	B
Northern Myotis	*Myotis septentrionalis*	PR	SC		B	B
Silver-haired Bat	*Lasionycteris noctivagans*	R			B	B
Big Brown Bat	*Eptesicus fuscus*	PR			B	B
Eastern Red Bat	*Lasiurus borealis*	R			B	B
Hoary Bat	*Lasiurus cinereus*	R			B	B
Snowshoe Hare	*Lepus americanus*	PR	PWA, SG		P	P
Eastern Cottontail	*Sylvilagus floridanus*	PR	PWA, SG		P	P
White-tailed Jackrabbit	*Lepus townsendii*	PR	PWA, SG		P	A
Least Chipmunk	*Tamias minimus*	PR			P	P
Eastern Chipmunk	*Tamias striatus*	PR			P	P
Woodchuck	*Marmota monax*	PR			P	P
Thirteen-lined Ground Squirrel	*Spermophilus*	PR			P	P
Franklin's Ground Squirrel	*Spermophilus franklinii*	PR			P	P
Eastern Gray Squirrel	*Sciurus carolinensis*	PR	PWA, SG		P	P
Eastern Fox Squirrel	*Sciurus niger*	PR	PWA, SG		P	P
Red Squirrel	*Tamiasciurus hudsonicus*	PR			P	P
Southern Flying Squirrel	*Glaucomys volans*	PR			P	A
Northern Flying Squirrel	*Glaucomys sabrinus*	PR			P	P
Plains Pocket Gopher	*Geomys bursarius*	PR	UWA		P	P
American Beaver	Castor canadensis	PR	PWA.		P	P
Woodland Deer Mouse	*Peromyscus maniculatus*	PR			P	P
Prairie Deer Mouse	*Peromyscus maniculatus*	PR			P	P
White-footed Mouse	*Peromyscus leucopus*	PR			P	P
Southern Red-backed Vole	*Clethrionomys gapperi*	PR			P	P
Meadow Vole	*Microtus pennsylvanicus*	PR			P	P
Prairie Vole	*Microtus ochrogaster*	PR	SC		P	A
Muskrat	*Ondatra zibethicus*	PR	PWA,SG, F		P	P

Terrestrial Vertebrate Species List January 2005						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
Southern Bog Lemming	*Synaptomys cooperi*	PR			P	P
Meadow Jumping Mouse	*Zapus hudsonius*	PR			P	P
Woodland Jumping Mouse	*Napaeozapus insignis*	PR			P	P
North American Porcupine	*Erethizon dorsatum*	PR	UWA		P	P
Coyote	*Canis latrans*	PR	UWA		P	P
Gray Wolf	*Canis lupus*	PR	SC	T, P	P	P
Red Fox	*Vulpes vulpes*	PR	PWA, SG, F		P	P
Gray Fox	*Urocyon cinereoargenteus*	PR	PWA, SG, F		P	P
American Black Bear	*Ursus americanus*	PR	PWA, BG	P	P	P
Northern Raccoon	*Procyon lotor*	PR	PWA, SG, F		P	P
American Marten	Martes americana	PR	PWA, SG, F		P	P
Fisher	*Martes pennanti*	PR	PWA, SG, F		P	P
Ermine	*Mustela erminea*	PR	UWA		P	P
Long-tailed Weasel	*Mustela frenata*	PR	UWA		P	A
American Mink	*Mustela vison*	PR	PWA, SG, F		P	P
American Badger	*Taxidea taxus*	PR	PWA, SG, F		P	P
Striped Skunk	*Mephitis mephitis*	PR	UWA		P	P
Northern River Otter	*Lontra canadensis*	PR	PWA, SG, F		P	P
Bobcat	*Lynx rufus*	PR	PWA, SG, F	P	P	P
White-tailed Deer	*Odocoileus virginianus*	PR	PWA, BG		P	P
AMPHIBIANS AND REPTILES						
Blue-spotted Salamander	**Ambystoma laterale**	PR			P	P
Tiger Salamander	*Ambystoma tigrinum*	PR			P	P
Four-toed Salamander	*Hemidactylium scutatum*	PR	SC		P	A
Redback Salamander	*Plethodon cinereus*	PR			P	P
Eastern Newt	*Notophthalmus viridescens*	PR			P	P
American Toad	*Bufo americanus*	PR	PWA		P	P
Cope's Gray Treefrog	*Hyla chrysoscelis*	PR	PWA		P	A

Terrestrial Vertebrate Species List January 2005						
					ECS Subsection[e]	
Common Name[a]	**Scientific Name**	**Resident Status[b]**	**State Legal Status[c]**	**Federal Legal Status[d]**	**Pine Moraines & Outwash Plains**	**Chippewa Plains**
Gray Treefrog	*Hyla versicolor*	PR	PWA		P	P
Western Chorus Frog	*Pseudacris triseriata*	PR	PWA		P	P
Spring Peeper	*Pseudacris crucifer*	PR	PWA		P	P
Green Frog	*Rana clamitans*	PR	PWA		P	P
Northern Leopard Frog	*Rana pipiens*	PR	PWA		P	P
Mink Frog	*Rana septentrionalis*	PR	PWA		P	P
Wood Frog	*Rana sylvatica*	PR	PWA		P	P
Snapping Turtle	*Chelydra serpentina*	PR	PWA, SC		P	P
Painted Turtle	*Chrysemys picta*	PR	PWA		P	P
Blanding's Turtle	*Emydoidea blandingii*	PR	PWA, T		P	A
Prairie Skink	*Eumeces septentrionalis*	PR			P	P
Eastern Hognose Snake	*Heterodon platyrhinos*	PR			P	A
Redbelly Snake	*Storeria occipitomaculata*	PR			P	P
Plains Garter Snake	*Thamnophis radix*	PR			P	A
Common Garter Snake	*Thamnophis sirtalis*	PR			P	P
Smooth Green Snake	*Liochlorophis vernalis*	PR			P	P

[A] **MNWRAP Disclaimer**: This species list is a representation of the current occurrence of these species based upon Minnesota Ecological Classification System Subsections. The species may not occur everywhere within the Subsection. Animal distributions are dynamic and occurrence revisions may be made as new information becomes available.

7.2 Wildlife Habtiat Relationships- Habitat Master Table

This page contains a standard table header format, column/row format, content description and selected species examples for the following tables: Amphibians and Reptiles, Birds and Mammals.

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

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-Forested types>>>	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Forest land cover types>>> Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
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

The above table and its content serve to note habitat relationships (i.e. land cover types, habitat features and forest size class) of wildlife known or predicted to occur in the Chippewa Plains and/or Pine Moraines and Outwash Plains ECS subsections. Details to this information is as follows:

SPECIES GROUP:	Notes a common species group to search by.
Species common name:	Species common name as standardized through NatureServe located at <www.natureserveexplorer.org>.
Habitat feature:	C = Cavity, D = Dead/down material, M = Mast, R = Riparian, S = Snag, V = Vernal pool
Habitat relationships:	Y = species utilizes noted land cover type for at least part of its habitat needs.
Forest age class/successional stage:	Y = species utilizes noted age class/successional stage for at least part of its habitat needs.

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 suggested revisions.

7.2 Wildife Habitat Relationships- Amphibiasn and Reptiles

Amphibian habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Non-Forest land cover types>>> Forest land cover types>>>

				Urban/ Dev.			Ag./Gra ss			Shrub			Aquatic				Upland Coniferous Fores									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 sh	Lowland evergreen sh	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Catta	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 Spruc	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Ce	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous m	Black Ash	Silver Maple	Cottonwood	Lowland deciduous m	Low. deciduous/coniferous m		Seedling	Sapling	Pole timber	Saw timber	Uneven
AMPHIBIANS																																																
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	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
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																																
Blanding's Turtle								Y	Y				Y	Y	Y	Y																																

7.2 Wildlife Habitat Relationships- Bird Habitats

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

Non-Forested types>>> Forest land cover types>>>

			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest size class				
SPECIES GROUP Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous s	Lowland evergreen s	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Catt	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer	Up. coniferous/deciduous mi	Lowland Black Spruc	Stagnant black spruc	Tamarack	Stagnant tamarack	Low. N. White Ceda	Stagnant N. White C	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous m	Black Ash	Silver Maple	Cottonwood	Lowland deciduous m	Low. deciduous/coniferous m	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
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																																														
Wood Duck	CMRS									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

7.2 Wildlife Habitat Relationships- Bird Habitats

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

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP / Species Common Name	Habitat feature		Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
		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
Blue-winged Teal	R					Y	Y	Y	Y	Y		Y	Y	Y	Y																															
Northern Pintail	R					Y	Y	Y				Y	Y	Y	Y																															
Green-winged Teal	R						Y	Y	Y	Y		Y	Y	Y	Y																															
Ring-necked Duck										Y		Y	Y	Y	Y																															
Common Goldeneye	CRS											Y	Y		Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Hooded Merganser	CRS									Y		Y	Y	Y	Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Common Merganser	CRS											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
Cooper's Hawk							Y		Y							Y	Y	Y														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
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

7.2 Wildlife Habitat Relationships- Bird Habitats

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

Non-Forested types>>> Forest land cover types>>>

			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
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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																																
Greater Prairie Chicken						Y	Y	Y																																						
Wild Turkey	M					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																															
Common Moorhen	R									Y		Y	Y		Y																															
American Coot	R											Y	Y	Y	Y																															
CRANES																																														
Sandhill Crane						Y	Y	Y		Y	Y		Y	Y	Y																															
PLOVERS																																														
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																															

7.2 Wildlife Habitat Relationships- Bird Habitats

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

Non-Forested types>>> | Forest land cover types>>>

SPECIES GROUP			Urban/ Dev.			Ag./Gra ss			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shru	Lowland evergreen shru	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 Ceda	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
JAEGERS, GULLS AND TERNS																																														
Ring-billed Gull	R	Y		Y		Y	Y					Y		Y	Y																															
Herring Gull	R	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																																				
Yellow-billed Cuckoo									Y	Y																						Y	Y	Y	Y	Y		Y				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
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
Short-eared Owl						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	
HIMMINGBIRDS																																														
Ruby-throated Hummingbird	R			Y			Y		Y																							Y			Y		Y	Y	Y		Y				Y	Y

7.2 Wildlife Habitat Relationships- Bird Habitats

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

Non-Forested types>>> Forest land cover types>>>

				Urban/			Ag./Gra			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous							Upland					Lowland						Forest size				
SPECIES GROUP Species Common Name	Habitat feature		Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shru	Lowland evergreen shru	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	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		Seedling	Sapling	Pole timber	Saw timber	Uneven
KINGFISHERS																																																
Belted Kingfisher	B		Y										Y	Y		Y																																
WOODPECKERS																																																
Red-headed Woodpecker	CMS																																	Y	Y	Y	Y									Y	Y	
Red-bellied Woodpecker	CMS																																			Y		Y	Y		Y						Y	Y
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
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																																																
Western Kingbird					Y		Y	Y	Y	Y	Y						Y	Y	Y						Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
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																																					
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	
SHRIKES																																																
Northern Shrike								Y		Y																							Y	Y	Y	Y	Y							Y	Y			
Loggerhead Shrike							Y	Y	Y	Y																							Y	Y	Y	Y	Y											

7.2 Wildlife Habitat Relationships- Bird Habitats

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

		Non-Forested types>>>														Forest land cover types>>>																														
			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
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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
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	
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	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

7.2 Wildlife Habitat Relationships- Bird Habitats

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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
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			
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
Blue-gray Gnatcatcher																																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
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			

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Non-Forested types>>> | Forest land cover types>>>

			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest 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
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		
Cape May Warbler																			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y											Y	Y	Y	Y	
Yellow-rumped Warbler																Y	Y		Y	Y	Y		Y		Y	Y	Y	Y			Y										Y			Y	Y	Y
Black-throated Green																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	
Cerulean Warbler																																			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	
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			
Canada Warbler	D								Y		Y							Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y			Y	Y								Y	Y	

7.2 Wildlife Habitat Relationships- Bird Habitats

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

SPECIES GROUP / Species Common Name	Habitat feature	Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shru	Lowland evergreen shru	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 Ceda	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-Forested types>>>	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Forest land cover types>>> Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
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			
Field Sparrow							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					
Lark Sparrow				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													
Grasshopper Sparrow				Y		Y	Y	Y	Y					Y																																
Le Conte's Sparrow						Y	Y	Y		Y	Y			Y	Y																															
Nelson's Sharp-tailed							Y	Y		Y				Y	Y													Y		Y	Y															
Song Sparrow									Y	Y				Y		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																																														
Northern Cardinal	M			Y					Y	Y													Y									Y	Y	Y	Y	Y	Y	Y		Y		Y	Y			
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			

7.2 Wildlife Habitat Relationships- Bird Habitats

			Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type>>																																													
			Non-Forested types>>>														Forest land cover types>>>																															
				Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Fores									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest size class				
SPECIES GROUP Species Common Name	Habitat feature		Barren	High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shru	Lowland evergreen shru	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 Ceda	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
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																																
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																																											
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	

7.2 Wildlife Habitat Relationships- Mammal Habitats.

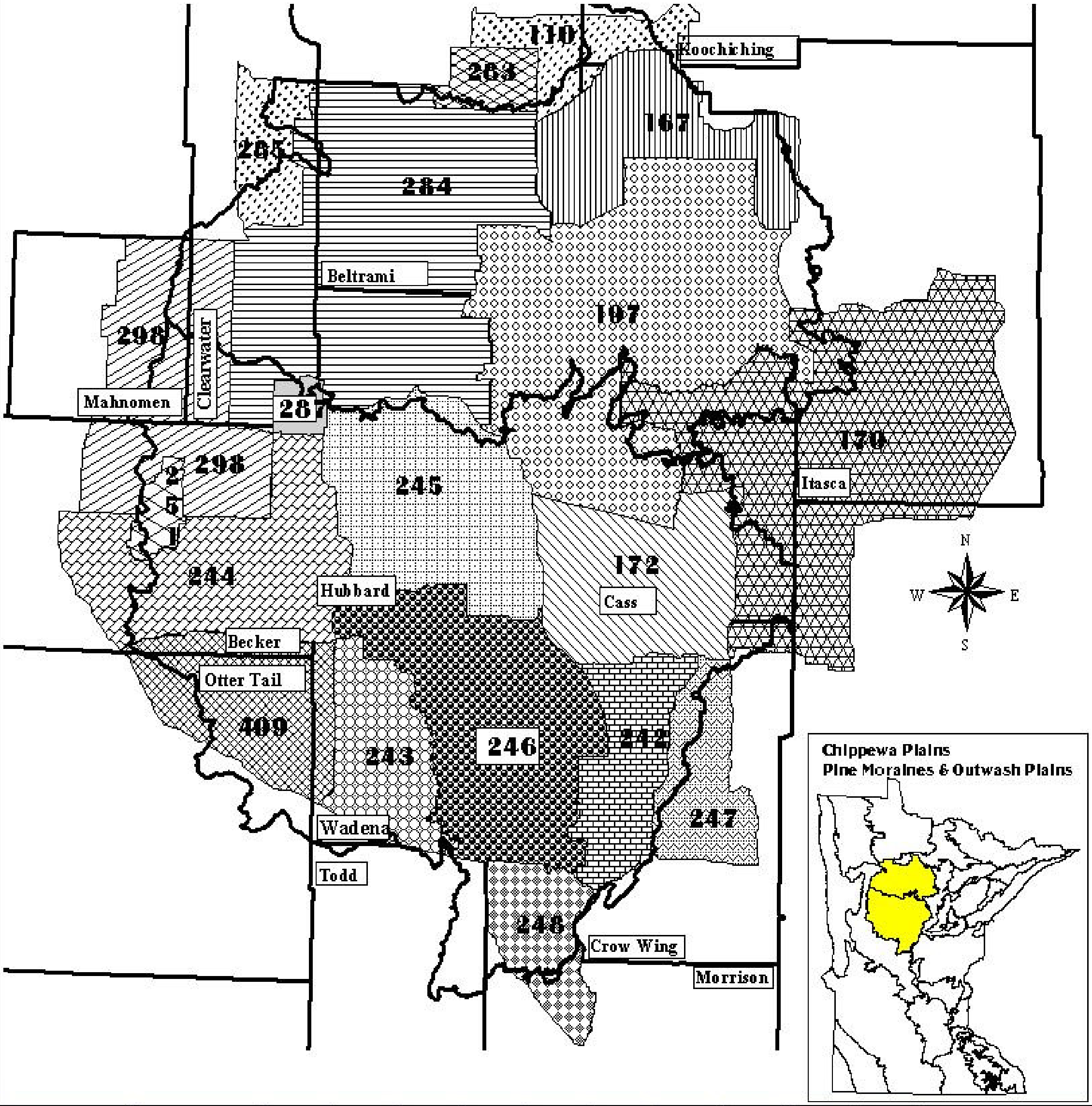
Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Non-Forest land cover types>>> | Forest land cover types>>>

SPECIES GROUP / Species common name	habitat Feature	Barren	Urban/Dev.: High intensity urban	Urban/Dev.: Low intensity urban	Urban/Dev.: Transportation	Ag./Grass: Cropland	Ag./Grass: Grassland	Ag./Grass: Prairie	Shrub: Upland shrub	Shrub: Lowland deciduous sh	Shrub: Lowland evergreen sh	Aquatic: Water	Aquatic: Floating aquatic	Aquatic: Sedge Meadow	Aquatic: Broadleaf sedge/Catta	Upland Coniferous Forest: Jack Pine	Upland Coniferous Forest: Red Pine	Upland Coniferous Forest: White Pine mix	Upland Coniferous Forest: Balsam Fir mix	Upland Coniferous Forest: White Spruce	Upland Coniferous Forest: Upland Black Spruce	Upland Coniferous Forest: Up. N. White Cedar	Upland Coniferous Forest: Upland Conifer	Up. coniferous/deciduous mix	Lowland Coniferous Forest: Lowland Black Spruce	Lowland Coniferous Forest: Stagnant black spruce	Lowland Coniferous Forest: Tamarack	Lowland Coniferous Forest: Stagnant tamarack	Lowland Coniferous Forest: Low. N. White Cedar	Lowland Coniferous Forest: Stagnant N. White Ce	Lowland Coniferous Forest: Stagnant conifer	Upland Deciduous Forest: Aspen/White Birch	Upland Deciduous Forest: Bur/White Oak	Upland Deciduous Forest: Red Oak	Upland Deciduous Forest: Maple/Basswood	Upland Deciduous Forest: Upland deciduous m	Lowland Deciduous Forest: Black Ash	Lowland Deciduous Forest: Silver Maple	Lowland Deciduous Forest: Cottonwood	Lowland Deciduous Forest: Lowland deciduous m	Low. deciduous/coniferous m	Forest size class: Seedling	Forest size class: Sapling	Forest size class: Pole timber	Forest size class: Saw timber	Forest size class: Uneven
INSECTIVORES																																														
Northern Short-tailed	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
Arctic Shrew	R									Y	Y			Y	Y										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	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			Y	Y	Y	Y	Y	Y	Y
Water Shrew	DR									Y	Y	Y		Y	Y										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	Y			Y	Y	Y
BATS																																														
Big Brown Bat	CRS			Y			Y	Y				Y				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				Y	Y
Eastern Red Bat	CR		Y	Y			Y		Y	Y		Y			Y					Y	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	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	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				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	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	Y	Y	Y	Y	Y
Gray Fox	CDM					Y	Y	Y	Y	Y																							Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
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	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	Y	Y
Northern River Otter												Y	Y	Y	Y																															
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	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	Y	Y
Long-tailed Weasel	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	Y
American Mink	DR									Y		Y	Y	Y	Y																															

7.2 Wildlife Habitat Relationships -Mammal Habitat																									
			Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type																						
			Non-Forest land cover types>>>														Forest land cover types>>>								
				Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								
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
American Badger							Y	Y	Y	Y															
Striped Skunk	DM				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
Black Bear	CDMR									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
RODENTS																									
Northern Flying Squirrel	CDMS																Y	Y	Y	Y	Y	Y	Y	Y	Y
Southern Flying Squirrel	CDMS																								
Woodchuck					Y		Y	Y		Y	Y														
Eastern Gray Squirrel	CDM				Y		Y																		Y
Eastern Fox Squirrel	CDM				Y			Y																	
Franklin's Ground Squirrel					Y			Y	Y	Y															
Thirteen-lined Ground					Y		Y	Y	Y	Y															
Least Chipmunk	DM								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
Red Squirrel	CDMS																Y	Y	Y	Y	Y	Y	Y	Y	Y
American Beaver	R									Y	Y		Y												
Plains Pocket Gopher							Y	Y	Y	Y															
Woodland Jumping Mouse	DM																			Y	Y	Y		Y	
Meadow Jumping Mouse								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y		Y	
Woodland Deer Mouse								Y		Y							Y	Y	Y	Y	Y	Y	Y	Y	
Prairie Deer Mouse																									
White-footed Mouse	CDMS									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
Meadow Vole								Y		Y					Y	Y	Y	Y	Y						

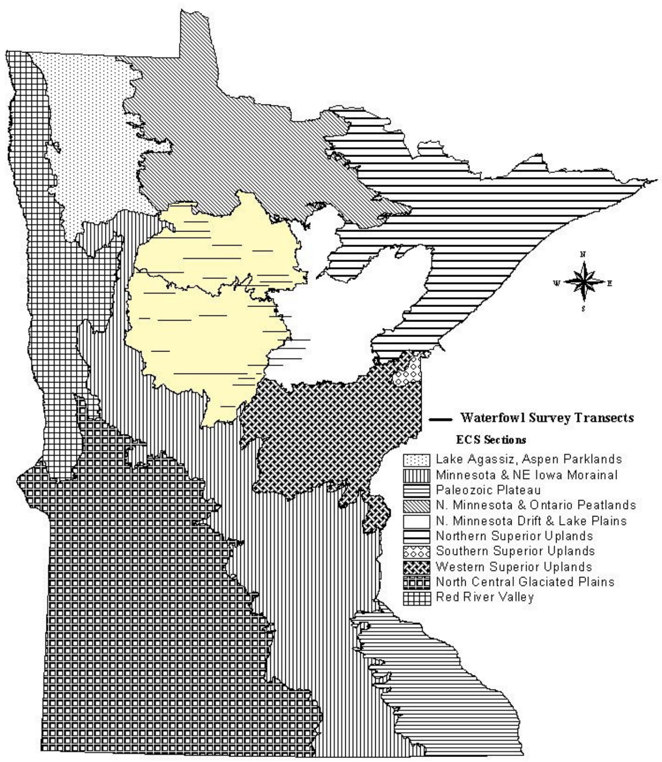
	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest size class				
SPECIES GROUP Species common name	Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White 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
American Badger									Y														
Striped Skunk								Y	Y	Y	Y	Y							Y	Y	Y	Y	Y
Northern Raccoon								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Black Bear	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
RODENTS																							
Northern Flying Squirrel											Y						Y					Y	Y
Southern Flying Squirrel									Y	Y	Y	Y	Y	Y							Y	Y	Y
Woodchuck									Y	Y									Y				
Eastern Gray Squirrel									Y	Y	Y	Y	Y									Y	
Eastern Fox Squirrel									Y	Y	Y	Y		Y								Y	Y
Franklin's Ground Squirrel																					Y	Y	
Thirteen-lined Ground																							
Least Chipmunk					Y			Y				Y							Y	Y	Y	Y	Y
Eastern Chipmunk								Y	Y	Y	Y	Y			Y				Y	Y	Y	Y	Y
Red Squirrel	Y	Y	Y	Y	Y	Y	Y										Y				Y	Y	Y
American Beaver								Y				Y							Y	Y	Y	Y	Y
Plains Pocket Gopher								Y	Y	Y	Y	Y							Y	Y			
Woodland Jumping Mouse											Y	Y	Y			Y				Y	Y	Y	Y
Meadow Jumping Mouse																			Y				
Woodland Deer Mouse								Y	Y	Y	Y	Y	Y	Y		Y			Y	Y	Y	Y	
Prairie Deer Mouse																							
White-footed Mouse								Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y
Southern Red-backed Vole	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Meadow Vole								Y	Y	Y	Y	Y											



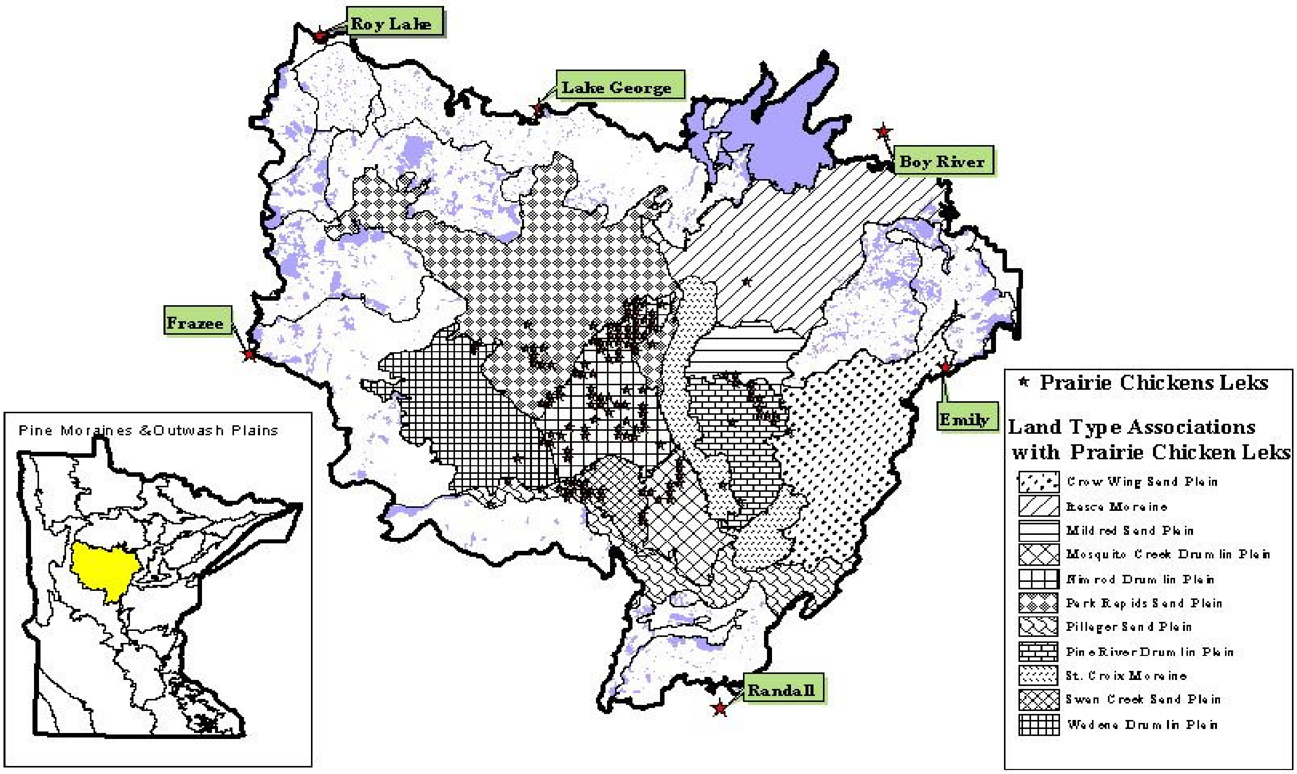
Permit Area	Area__mi 2	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	'04 - '05 Change
110	300	23	20	25	30	31	32	34	36	35	32	- 8%
167	440	24	19	24	24	26	26	27	25	23	21	- 9%
168	724	15	14	17	21	22	21	23	23	23	20	- 12%
170	1315	18	17	21	25	29	28	31	33	32	30	- 6%
172	451	26	26	34	43	49	48	51	52	45	40	- 13%
184	1260	21	18	22	27	31	33	37	39	37	35	- 7%
197	960	14	12	14	16	18	18	21	22	23	23	1%
242	209	30	28	32	35	38	36	37	36	31	27	- 14%
243	314	37	33	39	45	51	50	53	55	51	49	- 5%
244	586	32	28	34	39	46	49	54	56	55	52	- 5%
245	583	26	24	31	38	43	44	47	49	43	39	- 9%
246	758	29	26	30	34	37	35	36	37	35	33	- 6%
247	229	30	28	32	35	38	36	37	36	31	27	- 14%
248	213	25	22	26	28	31	28	31	32	30	27	- 9%
251	56	25	22	25	28	31	34	37	37	37	37	0%
298	620	19	16	18	20	22	22	25	28	27	25	- 5%
409	611	45	41	41	44	49	47	47	48	47	45	- 4%

7.3 Fall Deer Densities Chippewa Plains/Pine Moraiens and Outwash Plains

7.4 Cavity Nesting Duck Trends in the Drift & Lake



7.5 Pine Moraines & Outwash Plains Prairie Chicken Survey Data, 1977-2004



7.5 Number of Prairie Chicken Leks by Year for the Pine Moraines and Outwash Plains Subsection 1977-2004[a]

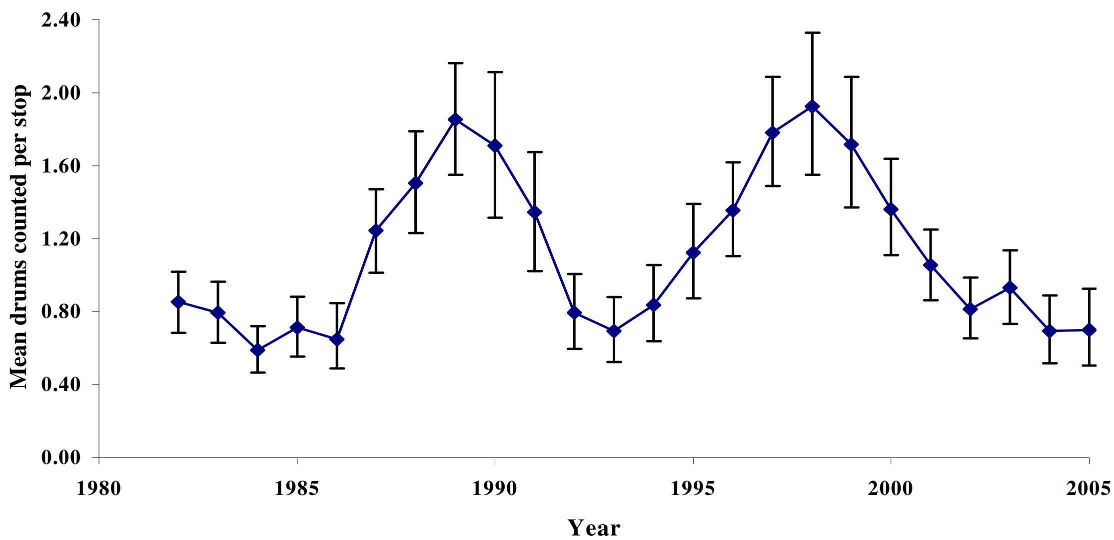
Year	Crow Wing Sand Plain (212Nc01)	St. Croix Moraine (212Nc02)	Pine River Drumlin Plain (212Nc03)	Pillager Sand Plain (212Nc04)	Mosquito Creek Drumlin Plain (212Nc06)	Swan Creek Sand Plain (212Nc08)	Wadena Drumlin Plain (212Nc09)	Nimrod Drumlin Plain (212Nc10)	Park Rapids Sand Plain (212Nc11)	Mildred Sand Plain (212Nc12)	Itasca Moraine (212Nc16)	Total
1977					1							1
1978					1	4		5	1			11
1979				1	1			9	6		1	18
1980				2	1			14				17
1981			4		6	1		18	5			34
1982			4	1	4			19	2			30
1983			2	1	4	2		12	1	1		23
1984			2		4	1		9	1	1		18
1985	1		3	1	4	1		23	7	1		41
1986			2	1	3	2		20	3	1		32
1987			3		3	2		28	4	1		41
1988		1	3			2	1	22	3	1		33
1989			2	1	1			20	2	1		27
1990			1		1	2		23	3			30
1991			3		1	1		26	6	1		38
1992			3			1		14		2		20
1993			1			1		15	1	1		19
1994			1					10	1			12
1995			1					8	1			10
1996			2					9				11
1997								5				5
1998								4				4
1999								4				4
2000								6				6
2001								2				2
2003								2				2
2004												
2005								2				2
Total	1	1	37	8	35	20	1	329	47	11	1	491[b]

a. No consistency between years in survey effort or area searched. b. Represents 203 different locations.
Source: Unpublished survey data, Mn Dept. Nat. Resources, St.Paul, Mn

7.6 Ruffed Grouse Survey History

Mean number of drums counted per stop for survey routes at least partially within the CP-PMOP Subsections.

		Limits of 95% Conf. Interval		N		Error bars	
Year	Mean	Lower	Upper	routes		Minus	Plus
1982	0.85	0.68	1.02	26		0.17	0.17
1983	0.79	0.63	0.96	33		0.17	0.17
1984	0.59	0.47	0.72	33		0.12	0.13
1985	0.71	0.55	0.88	34		0.16	0.17
1986	0.65	0.49	0.85	31		0.16	0.20
1987	1.24	1.01	1.47	35		0.23	0.23
1988	1.51	1.23	1.79	33		0.28	0.28
1989	1.85	1.55	2.16	34		0.30	0.31
1990	1.71	1.32	2.11	35		0.39	0.41
1991	1.34	1.02	1.67	30		0.32	0.33
1992	0.79	0.60	1.01	34		0.20	0.21
1993	0.69	0.52	0.88	35		0.17	0.19
1994	0.84	0.64	1.05	33		0.20	0.22
1995	1.12	0.87	1.39	36		0.25	0.27
1996	1.36	1.11	1.62	38		0.25	0.26
1997	1.78	1.49	2.09	35		0.29	0.31
1998	1.92	1.55	2.33	39		0.37	0.41
1999	1.72	1.37	2.09	36		0.35	0.37
2000	1.36	1.11	1.64	40		0.25	0.28
2001	1.05	0.86	1.25	37		0.19	0.20
2002	0.81	0.66	0.99	36		0.16	0.17
2003	0.93	0.73	1.14	37		0.20	0.21
2004	0.69	0.52	0.89	36		0.18	0.19
2005	0.70	0.51	0.93	38		0.19	0.23



Unpublished data Minn. Dept. Nat. Res. Annual Ruffed Grouse drumming count survey.
This survey is designed as an index of ruffed grouse densities so index values are drum counts not grouse densities

7.7 Forest Songbird Trends for the CP-PMOP.

The information presented here is taken with the permission of the authors from the report titled NRRI Technical Report: NRRI/TR-2005/04. 2004 Annual Update Report: Breeding Bird Monitoring in Great Lakes National Forests: 1991-2004. Lind, J., Danz, N., Hanowski, J. and Niemi, G.H., Natural Resources Research Institute 5013 Miller Trunk Highway Duluth, MN 55811.
The original full report is available on the Internet at: http://www.nrri.umn.edu/mnbirds/reports.htm.

When possible, without compromising the original report and data, we have summarized the results from the Chippewa NF and provided the associated detailed information in the Appendix. Some portions of the report dealing with all three national forests are included to provide important clarity and understanding of the information.

INTRODUCTION

In response to the need for regional population data, a long-term forest breeding bird-monitoring program was established in 1991 on the Chippewa and Superior national forests (NF), and in 1992 on the Chequamegon NF and St. Croix region of east-central Minnesota.

Minnesota's Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (GEIS) completed in 1994 added further interest in assessing forest songbird population trends. The completed GEIS is available at http://www.frc.state.mn.us/.

The better-known U.S. Geological Survey's Breeding Bird Survey (BBS) provides important information on trends at the state, regional, and continental scale, however, limited coverage in some areas make it difficult to use BBS data to characterize population trends at smaller geographic scales (Peterjohn et al. 1995). Currently there are six six active BBS survey routes in the Chippewa Plains and three in the Pine Moraines and Outwash Plains. Data for these routes and other routes in Minnesota can be examined at http://www.pwrc.usgs.gov/bbs/.

Although trend data from this survey presented here is from only the Chippewa NF portion of the Chippewa Plains, it provides the best opportunity to assess trends and understanding of forest songbirds for the CP-PMOP SFRMP Process. This original report focuses on relative abundance trends of individual species, and assemblages of species, over the 13- to 14-year time frame of the monitoring.

The relatively heavily forested landscapes of northern Minnesota and Wisconsin are considered to be population "sources" for many forest bird species and may be supplementing population "sinks" in the agricultural landscapes of the lower Midwest (Robinson et al. 1995, Temple and Flaspohler 1998), highlighting the importance of monitoring trends in forest bird populations in the upper Midwest.

The national forests of the western Great Lakes have among the richest diversity of breeding bird species in North America (Green 1995, Rich et al. 2004).

For complete details, refer to the full technical report (NRRI Technical Report: NRRI/TR-2005/04. 2004 Annual Update Report: Breeding Bird Monitoring in Great Lakes National Forests: 1991-2004. Lind, J., Danz, N., Hanowski, J. and Niemi, G.H., Natural Resources Research Institute 5013 Miller Trunk Highway Duluth, MN 55811).

Summary:

1. A total of 132, 134, and 164 stands (1,246 survey points) were surveyed for breeding birds in the Chequamegon, Chippewa, and Superior National Forests (NF), respectively in 2004. Annual surveys have been conducted since 1991 in the Chippewa and Superior NF, and since 1992 in the Chequamegon NF.
2. Annual surveys have been conducted since 1991 in the Chippewa NF.
3. Trends in relative abundance were calculated for 54 bird species in the Chippewa NF.
4. A total of 154 species/national forest trends were calculated (not including pooled trends), 59 (38%) of which were significant ($P \leq 0.05$). Seventeen species increased significantly ($P \leq 0.05$) in at least one national forest and 24 species decreased. Eight species had significant increasing pooled trends and 14 had decreasing trends.
5. Of the 54 species tested in the Chippewa NF, 10 species (18%) increased significantly and 11(20 percent) decreased. Thirty-three species (61percent) showed no significant trend.
6. The short-distance migrant guild showed highly significant declines but the long-distance migrants and permanent residents increased in the Chippewa NF.
7. The ground-nesting guild declined on all national forests, while shrub/sub-canopy nesters increased on all national forests.
8. The lowland coniferous, deciduous and early-successional forest bird guilds showed widespread declines, but the mixed forest bird guild increased on the Chippewa NF.
9. Evidence from recent regional studies have demonstrated greater nest predation rates on ground nests near forest/clear-cut edges, as well as a significant increase in the creation of forest edges in recent years. Increasing amounts of forest edge and nest predation may be having negative effects on declining ground-nesters such as the winter wren, veery, hermit thrush, ovenbird, and white-throated sparrow.
10. Of the 1274 survey sites on the three national forests, 14.2 percent have been at least partially harvested since the beginning of monitoring, which is about 1 percent a year (Table 7). This harvest rate is comparable to the 4.8 percent change from mature forest to early-successional types on federally managed forest lands in northeastern Minnesota between 1990 and 1995 (i.e., ~1 percent annual change). Thus, it appears that management activities on our sample sites are representative of the national forests as a whole, and that the trends we are documenting are probably occurring across the regional landscape.
11. Many of the declining trends that we have detected have been consistent across the years and are not likely due to annual variation. One of the main goals of this monitoring program is to identify potential declines of forest bird species. This is especially true for species of conservation concern such as the eastern wood-pewee, winter wren, hermit thrush, ovenbird, and white-throated sparrow. The declines observed over the past years for common species such as the ovenbird and white-throated sparrow are a continuing concern and special management consideration should be given to these species.

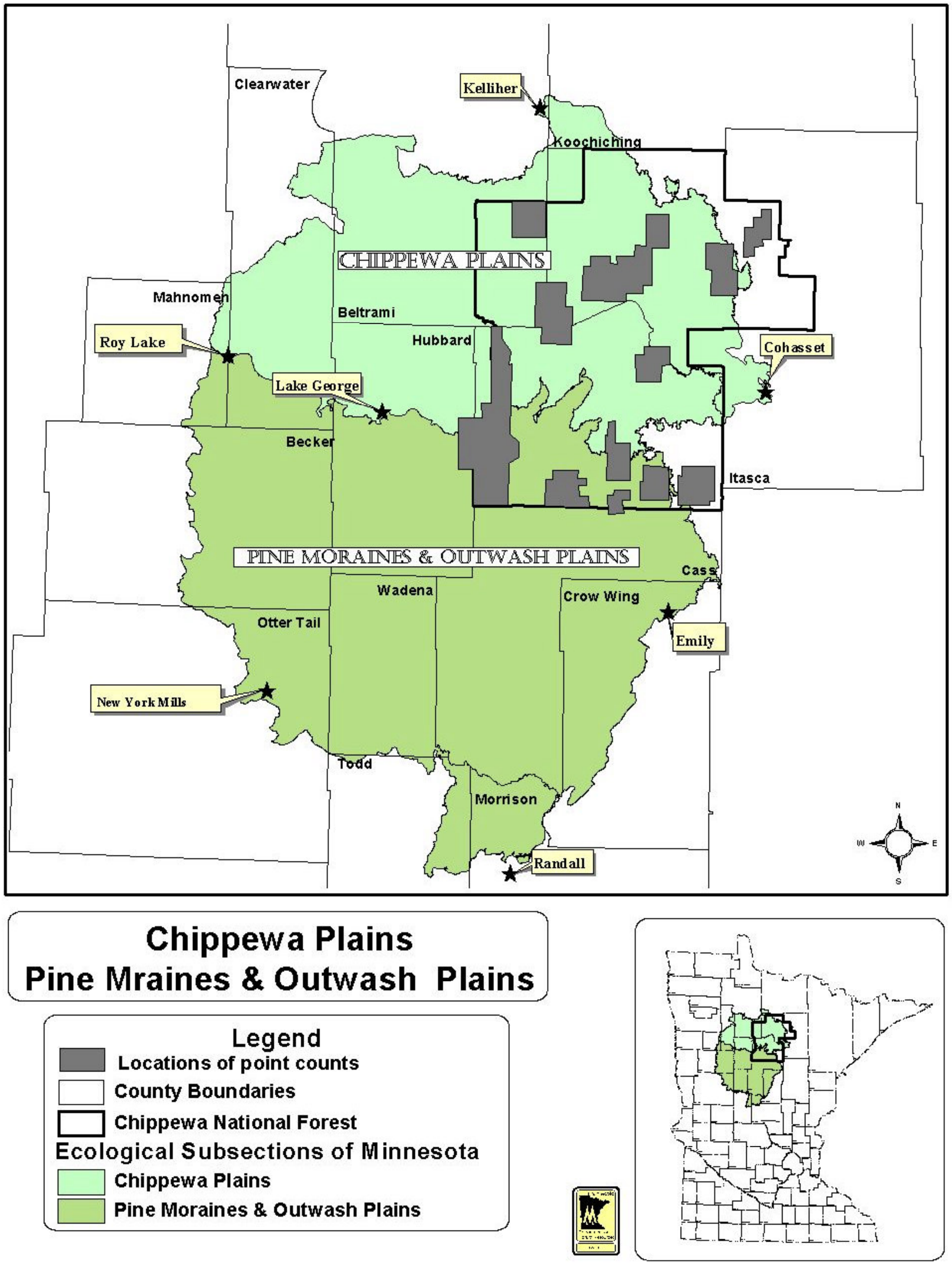


Figure 1. Representation of forest breeding bird point count locations in the Chippewa NF. (1991-2004). From Lind et al 2004.

DESIGN AND METHODS

Sample Design

We distributed sampling locations across the forest mosaic in a stratified random manner. Stands were ≥ 16 ha (40 acres) and were identified from the individual national forest inventories. For each national forest, a number of stands were selected from each stratum so that the final proportion of stands of each stand type was equal to the proportion of forested land area of each stand type (Hanowski and Niemi 1995). Our sample of stands is therefore representative of the forest cover in each national forest.

S*ampling*

Point count sampling used in our program follow national and regional standards (Ralph et al. 1993, 1995, Howe et al. 1997). Ten-minute point counts were conducted at each point between June and early July (Reynolds et al. 1980). Point counts are appropriate for determining the relative abundance of most singing passerine species, but are inadequate for waterfowl, grouse, woodpeckers, and most raptors. In addition, because our surveys are conducted during the summer months, we may underestimate the relative abundance of early-nesting species (e.g., permanent residents that begin breeding in April, such as woodpeckers and chickadees).

RESULTS AND DISCUSSION

In 2004, 134 stands were sampled in the Chippewa NF. Fifty-four species were tested for trends (Table 1). See Appendix A for graphs of individual species trajectories and Appendix B for test statistics and sample sizes used in the trend analyses.

Chippewa National Forest

Of the 54 species tested in the Chippewa NF, 10 species (19 percent) increased significantly and 18 (20 percent) decreased (Figure 3). The cedar waxwing has the highest annual rate of increase (14 percent), but its population trajectory (Appendix A) shows an increase since the mid-1990’s with an increase in the variance about the mean. This is probably due to encountering flocks of this gregarious species during some point counts and none in others. The black-capped chickadee, chestnut-sided warbler, and American redstart are well-represented species on the forest, with 4-6 percent annual increases. The red-eyed vireo has one of the lowest rates of increase among the significantly increasing species, but because of its wide distribution, the increase is probably occurring over a large portion of the forest. It has also had a dramatic increase since 1998 (Appendix A). The American robin has a new increasing trend this year, and the blue-headed vireo, palm warbler, and indigo bunting are no longer increasing significantly (Table 4).

The greatest rate of annual decrease in the Chippewa NF is that of the Connecticut Warbler (14 percent). Although it is sampled on only 14 stands, it has declined consistently since 1991 and the stands it is monitored on are spread across most of the forest. Well-represented species that are showing annual rates of decline of 5 percent or more include the great crested flycatcher, winter wren, ovenbird, song sparrow, white-throated sparrow, and brown-headed cowbird. The Nashville warbler is declining at 2 percent per year, but its trend may be especially important given its widespread distribution on the Chippewa NF. No species have new decreasing trends, and seven formerly decreasing species are no longer showing a significant decline (Table 4).

Six species are moving toward their historic population levels (RNV) on the Chippewa NF. Four species are below their RNV but have increasing trends (black-and-white warbler, American robin, cedar waxwing and black-capped chickadee), and two species are above their RNV but declining (song sparrow and brown-headed cowbird; (Table 6). Conversely, eight species are moving away from their historic population levels. The gray catbird is above its RNV and has an increasing trend, and six species are below their RNV and decreasing (especially white-throated sparrow, Nashville warbler, winter wren and hermit thrush). Of the 11 species within their RNV, five are increasing and two are decreasing.

Overview of Population Trends

A total of 154 species/national forest trends were calculated (not including pooled trends), 59 (38%) of which were significant ($P \leq 0.05$). Seventeen species increased in at least one national forest, including five (red-eyed vireo, black-capped chickadee, cedar waxwing, blackburnian warbler, and American Redstart) that increased in multiple national forests (Tables 2 and 3). Twenty-four species decreased in at least one national forest, including seven (Eastern wood-pewee, winter wren, veery, hermit thrush, black-throated green warbler, ovenbird, and white-throated sparrow) that decreased in multiple national forests.

Twenty-three (15 percent) of the 151species/national forest trends calculated in 2003 (Lind et al. 2003), changed in 2004 (Table 4). Negative trends (n = 15) were more likely to change from 2003 than positive trends (n = 8). Trends at the $0.01 > P > 0.05$ significance level (20 trends) were more likely to change than those at the $P \leq 0.01$ level (three trends).

Many of the species that have been monitored exhibit large annual fluctuations in abundance, a phenomenon which has been documented on several other long-term studies (Virkkala 1991, Blake et al. 1994, Weslowski and Tomialojc 1997, Holmes and Sherry 2001). Long-term monitoring studies are important for differentiating between these short-term fluctuations and actual long-term trends. In previous years' results, we often saw species with contradictory trends in different study areas (e.g., five species in 2000 results; Lind et al. 2001a). After 14 years of sampling, nearly all of our significant trends are consistent across the national forests, suggesting that many of these are more than short-term population fluctuations.

Management Activities on Study Areas

Since the beginning of monitoring in 1991, 63 (16 percent) of the 393 survey sites on the Chippewa NF have been at least partially harvested, which is about 1 percent a year (Table 7). A small number of the monitoring points have also had a prescribed burn treatment since the start of monitoring, but this is usually done after harvesting is completed. This harvest rate is comparable to the 4.8 percent change from mature forest to early-successional types on federally managed forest lands in northeastern Minnesota between 1990 and 1995 (i.e., ~1percent annual change; Wolter and White 2002). Thus, it appears that management activities on our sample sites are representative of the national forests as a whole, and that the trends we are documenting are probably occurring across the regional landscape.

Guild Analyses

Short-distance migrants (species that winter mainly north of Mexico) showed highly significant declines ($P \leq 0.01$) (Table 5). The most abundant short-distance migrants in our analyses include white-throated sparrow, American robin, hermit thrush, and yellow-rumped warbler.
Long-distance migrants (species that winter mainly south of the U.S./Mexico border) increased in the Chippewa NF. Abundant long-distance migrants included ovenbird, red-eyed vireo, Nashville warbler, and chestnut-sided warbler. Chippewa NF permanent residents increased. black-capped chickadee, blue jay, and red-breasted and white-breasted nuthatches are the most abundant permanent residents.

Ground nesting birds showed highly significant declines in all study areas, while shrub/sub-canopy nesters increased in all study areas (Table 5). Abundant ground-nesters include Ovenbird, Nashville warbler, veery, and white-throated sparrow. The most common shrub and subcanopy-nesting species include red-eyed vireo, chestnut-sided warbler, and American redstart. Canopy and cavity nesters showed stable trends, except for a decrease in canopy nesters in the Chequamegon NF and an increase in cavity nesters in the Superior NF.

The lowland coniferous, deciduous and early-successional forest bird guilds showed widespread declines on our study areas. The mixed forest bird guild increased on the Chippewa NF.

Conclusions

Most of the seven species with widespread increasing trends are either forest habitat generalists (red-eyed vireo, black-capped chickadee and blue jay) or early successional species (cedar waxwing, Chestnut-sided Warbler and American Redstart). Many of these increasing species are currently at or above their estimated RNV values. Recent increases in the amount of edge and early-successional habitat on the regional landscape (Wolter and White 2002) may be benefiting these species. The black-capped chickadee is a year-round resident that may also be responding to increased food availability from bird feeding activities, especially considering their increasing numbers on Minnesota Christmas Bird Counts in the past decade (National Audubon Society 2004). The blackburnian warbler is a mature coniferous/mixed forest species that has also shown widespread increases. Population fluctuations in this species are often attributed to changes in spruce budworm (*Choristonuera fumiferana*) abundance. There was an outbreak in early 1990's with a decline since 1998 (Blackford 2001), that seems to correspond to the blackburnian warbler's trajectory (Appendix A). However, this is difficult to corroborate with other spruce budworm specialists (e.g., Tennessee, bay-breasted and cape May warblers) which are on the southern fringe of their ranges in our study areas.

Species with widespread declines on our study sites are mainly found in mature forest habitats, with the possible exception of veery and white-throated sparrow. While white-throated sparrow abundance is often higher in clearcuts than in mature forests, reproductive rates have been shown to be up to three times greater in older forests (75-100 years) than in younger forests. The Eastern wood-pewee, winter wren, veery, and white-throated sparrow have each shown significant declines on our surveys as well as USGS Breeding Bird Survey routes over much of their range (Sauer 2004). Increases in edge and early-successional habitats may be having negative effects on these species, although there are examples of increases in mature forest species on individual national forests (e.g., white-breasted nuthatch black-throated blue warbler, northern waterthrush).

The declines in ground nesters and increases in shrub nesters in our study seem to occur irrespective of migration strategy and habitat. It is possible that declines in ground-nesting populations are being influenced by recent changes in the landscapes of the upper Midwest. Although the landscape surrounding the three national forests is primarily forested, average forest stand sizes and ages have changed in recent years. Wolter and White (2002) demonstrated a substantial decrease in patch size and interior forest area and a significant increase in edge density in early successional forest types in northeastern Minnesota between 1990 and 1995. Studies have shown that nesting success is reduced in landscapes with reduced patch sizes and high amounts of edge habitat, probably due to an increase in generalist nest predators (Robinson et al. 1995, Donovan et al. 1997). In the forested landscapes of the upper Midwest, recent studies have found higher predation rates on ground nests near forest/clearcut edges than in interior areas (Fenske-Crawford and Niemi 1997, Manolis et al. 2000, Flaspohler et al. 2001). Data from the Minnesota DNR winter track survey (Berg 2001) between 1991 and 2000 indicate a peak in track indices in 1995 for potential ground nest predators such as fisher (*Martes pennati*) and pine marten (*Martes martes*), which loosely follows the declines between 1994 and 1996 in many of the species we monitor. Nonetheless, the effects of nest predation on population trends in this study are unknown.

Many of the declining trends that we have detected have been consistent across the years and are not likely due to annual variation. Many of the declining trends that we have detected have been consistent across the years and are not likely due to annual variation. One of the main goals of this monitoring program is to identify potential declines of forest bird species. This is especially true for species of conservation concern such as the eastern wood-pewee, winter wren, hermit thrush, ovenbird, and white-throated sparrow. The declines observed over the past years for common species such as the ovenbird and white-throated sparrow are a continuing concern and special management consideration should be given to these species. Several species are currently well below their estimated RNV values and they may not remain common if their declining trends continue.

Many of the declining species breed in mature forests, and many are ground-nesters. Some of these population declines may be linked to recent reductions in forest patch size and stand age on the landscape, especially in light of regional studies showing high nest predation on ground-nests near forest edges. Although the factors responsible for population declines are not definitively known, the prominence of declining ground-nesting species suggests that it would be prudent to curb further reductions in average forest patch sizes and age on the landscape. Several of these declining species have high PIF conservation values (e.g., veery, mourning warbler, eastern wood-pewee), and the extensive forests of northern Minnesota and Wisconsin represent excellent opportunities to provide “source” populations for many species.

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Table 1. Trends for three national forests and combined trend (1991 – 2004). Based on linear regression. I = significantly increasing, D = significantly decreasing. * $P \leq$ 0.05, ** $P \leq 0.01$. See Appendix A for species graphs and Appendix B for test statistics and sample sizes.

Species	Chippewa NF	Species	Chippewa NF
Yellow-bellied Sapsucker	ns	Tennessee Warbler	
Downy Woodpecker	ns	Nashville Warbler	D**
Hairy Woodpecker	ns	Northern Parula	ns
Northern Flicker		Yellow Warbler	D**
Olive-sided flycatcher	ns	Chestnut-sided Warbler	I**
Eastern Wood-Pewee	D**	Magnolia Warbler	ns
Yellow-bellied	ns	Black-throated Blue	
Alder Flycatcher	ns	Yellow-rumped Warbler	ns
Least Flycatcher	I*	Black-throated Green	ns
Great Crested Flycatcher	D*	Blackburnian Warbler	ns
Eastern Kingbird		Pine Warbler	ns
Yellow-throated Vireo	ns	Palm Warbler	
Blue-headed Vireo	ns	Black-and-white Warbler	I*
Red-eyed Vireo	I**	American Redstart	I**
Gray Jay	ns	Ovenbird	D**
Blue Jay	ns	Northern Waterthrush	ns
Black- capped Chickadee	I**	Connecticut Warbler	
Red-breasted Nuthatch	ns	Mourning Warbler	ns
White-breasted Nuthatch	I**	Common Yellowthroat	ns
Brown Creeper	ns	Canada Warbler	ns
House Wren		Scarlet Tanager	ns
Winter Wren	D**	Eastern Towhee	
Golden-crowned Kinglet	ns	Chipping Sparrow	ns
Ruby-crowned Kinglet		Clay-colored Sparrow	
Veery	ns	Vesper Sparrow	
Swainson’s Thrush		Song Sparrow	D**
Hermit Thrush	D**	Swamp Sparrow	ns
Wood Thrush		White-throated Sparrow	D**
American Robin	I*	Rose-breasted Grosbeak	ns
Gray Catbird	I**	Indigo Bunting	ns
Brown Thrasher		Red-winged Blackbird	ns
Cedar Waxwing	I**	Brewer's Blackbird	
Golden-winged Warbler	ns	Brown-headed Cowbird	D*
Purple Finch			
American Goldfinch			
Evening Grosbeak			

Table 2. Chippewa NF species trends (P ≤ 0.05) by study area (1991-2004). Based on linear regression. ** P ≤ 0.01. Species graphs can be found in Appendix A.

Increasing Species	Decreasing Species
Least Flycatcher	**Eastern Wood-pewee
**Red-eyed Vireo	Great Crested Flycatcher
** Black-capped Chickadee	**Winter Wren
** White-breasted Nuthatch	**Hermit Thrush
American Robin	**Nashville Warbler
**Gray Catbird	**Yellow Warbler
**Cedar Waxwing	**Ovenbird
**Chestnut-sided Warbler	**Connecticut Warbler
Black-and-white Warbler	**Song Sparrow
**American Redstart	**White-throated Sparrow
Brown-headed Cowbird	

Table 3. Summary of species with increasing or decreasing trends. ** *P* ≤ 0.01. 1991-2004. Individual species graphs can be found in Appendix A.

Increased in one national forest	Increased in two national forests	Increased in three national forests	Pooled national forests
Least Flycatcher	Black-capped Chickadee	Red-eyed Vireo	Yellow-bellied Flycatcher
White-breasted Nuthatch	Cedar Waxwing	American Redstart	Red-eyed Vireo
American Robin	Blackburnian Warbler		Blue Jay
Gray Catbird			Black-capped Chickadee
Northern Parula			Northern Parula
Yellow Warbler			Chestnut-sided Warbler
Chestnut-sided Warbler			Blackburnian Warbler
Magnolia Warbler			American Redstart
Black-throated Blue Warbler			
Black-and-white Warbler			
Northern Waterthrush			
Swamp Sparrow			
Decreased in one national forest	**Decreased in two national forests**	**Decreased in three national forests**	**Pooled national forests**
Great Crested Flycatcher	Veery	Eastern Wood-Pewee	Eastern Wood-Pewee
Brown Creeper	Hermit Thrush	Winter Wren	Brown Creeper

Table 7.7-3 cont.

Decreased in one national forest	Decreased in two national forests	Decreased in three national forests	Pooled national forests
Golden-crowned Kinglet	Black-throated Green Warbler	Ovenbird	Winter Wren
Ruby-crowned Kinglet		White-throated Sparrow	Veery
Tennessee Warbler			Hermit Thrush
Nashville Warbler			Nashville Warbler
Yellow Warbler			Black-throated Green Warbler
Yellow-rumped Warbler			Ovenbird
Northern Waterthrush			Mourning Warbler
Connecticut Warbler			Common Yellowthroat
Common Yellowthroat			Scarlet Tanager
Scarlet Tanager			Song Sparrow
Song Sparrow			White-throated Sparrow
Rose-breasted Grosbeak			Rose-breasted Grosbeak
Red-winged Blackbird			
Brown-headed Cowbird			
Evening Grosbeak			

Table 4. Summary of changes in trends between 2003 and 2004 analyses.

Species with new significant trends (P≤ 0.05) in 2004.	
Increasing	**Decreasing**
American Robin	None
Species no longer showing significant trends (P > 0.05) in 2004.	
Was increasing in 2003	**Was decreasing in 2003**
Blue-headed Vireo	Yellow-bellied Sapsucker
Palm Warbler	Brow Creeper
Indigo Bunting	Veery
	Blackburnian Warbler
	Common Yellowthroat
	Scarlet Tanager

Table 5. Test sizes and sample sizes for guild trend analyses (1991-2004). All species combined within each guild category and analyzed as a group regardless of weather a species meets criteria for individual species analysis. Change= percent annual change. N= number of stands analyzed. See Appendix A. for trend graphs.

Guild Category		Chippewa NF			
		Change	P	R^2	N
Migration	Short distance	- 1.849	0.000	0.779	126
	Long distance	0.248	0.260	0.030	126
	Permanent resident	2.189	0.008	0.680	124
Nesting	Ground	- 3.017	0.000	0.850	126
	Shrub/Sub-canopy	3.295	0.000	0.853	126
	Canopy	- 0.608	0.220	0.235	126
	Cavity	0.856	0.244	0.227	125
Vegetation Preference	Coniferous forest	0.706	0.196	0.371	107
	Lowland coniferous	- 2.339	0.000	0.891	96
	Deciduous forest	- 0.271	0.412	0.018	126
	Early-succession	2.285	0.004	0.658	117
	Mixed forest	-0.824	0.188	0.296	122

Table 6. Comparison of species trends (1991-2004 and % of the range of natural variability (RNV) for 2003 populations on the Chippewa National Forest (from Hanowski and Danz 2003). 100% of RNV indicates that a species was considered to be within its historic range of natural variability. I = significantly increasing, D = significantly decreasing. * $P \leq 0.05$, $P \leq 0.01$.**

Species	Chippewa NF trend	% of RNV	Species	Chippewa NF trend	% of RNV
Yellow-bellied Sapsucker	ns	100	Golden-winged Warbler	ns	112
Downy Woodpecker	ns	122	Tennessee Warbler		
Hairy Woodpecker	ns	71	Nashville Warbler	D**	52
Olive-sided flycatcher	ns	53	Northern Parula	ns	44
Eastern Wood-Pewee	D**	100	Chestnut-sided Warbler	I**	100
Yellow-bellied Flycatcher	ns	100	Magnolia Warbler	ns	38
Least Flycatcher	I*	100	Black-throated Blue Warbler		

Table 6. continued.

Species	Chippewa NF trend	% of RNV	Species	Chippewa NF trend	% of RNV
Least Flycatcher	I*	100	Black-throated Blue Warbler		
Great Crested Flycatcher	D*	100	Yellow-rumped Warbler	ns	46
Yellow-throated Vireo	ns	110	Black-throated Green Warbler	ns	76
Blue-headed Vireo	ns	39	Blackburnian Warbler	ns	70
Red-eyed Vireo	I**	100	Pine Warbler	ns	56
Gray Jay	ns	69	Palm Warbler	ns	28
Blue Jay	ns	72	Black-and-white Warbler	I*	59
Black-capped Chickadee	I**	95	American Redstart	I**	100
Red-breasted Nuthatch	ns	56	Ovenbird	D**	88
White-breasted Nuthatch	I**	100	Northern Waterthrush	ns	
Brown Creeper	ns	91	Connecticut Warbler	D**	97
Winter Wren	D**	60	Mourning Warbler	ns	100
Golden-crowned Kinglet	ns	80	Canada Warbler	ns	47
Ruby-crowned Kinglet			Scarlet Tanager	ns	105
Veery	ns	100	Chipping Sparrow	ns	88
Swainson's Thrush			Song Sparrow	D**	110
Hermit Thrush	D**	70	White-throated Sparrow	D**	42

Table 7. Number of Harvested Points in the Chippewa NF study area since the beginning of monitoring.

Study Area	Total # of sites	# clearcut	# partially or selectively cut*	% harvested
Chippewa NF	393	21	42	16.2%

*** Sites in the partially cut category can include anywhere form 10-90% of the 100 m radius count circle harvested.**

Figure 2. Total number of individuals detected annually in the Chippewa NF (1991-2004), based on raw data before applying analysis criteria.

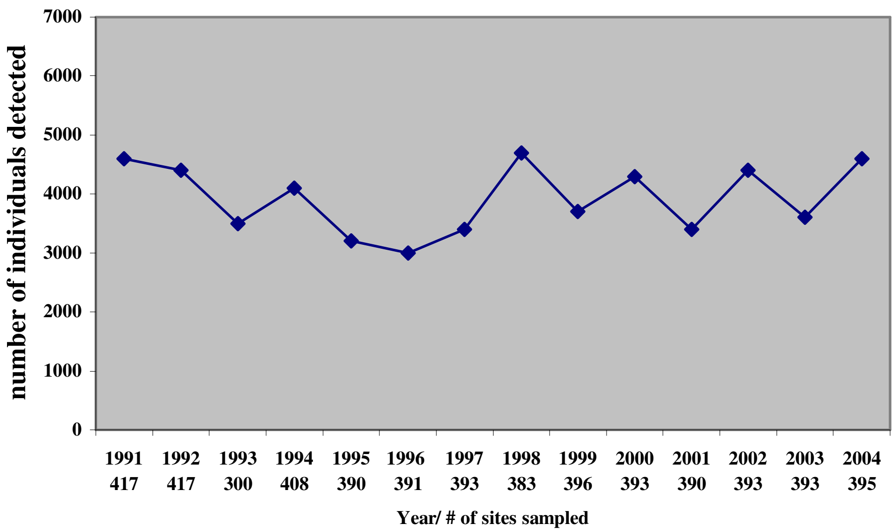
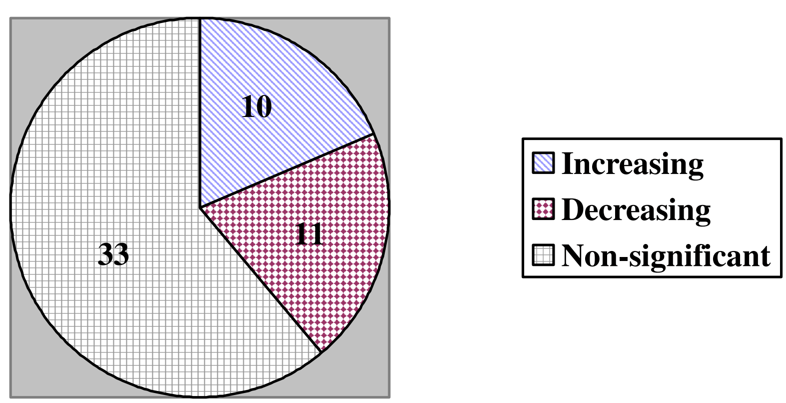


Figure 3. Summary of significant trends (P 0.05) for the Chippewa NF (1991-2004) See Table 1 for list of trends by species.



Glossary:

1. Guilds are groups of species that are likely to interact competitively because of their use of similar resources in similar ways (Root 1967).
2. Guild membership, in their scheme, is based on three characteristics: (1) the principal vegetation stratum where a species feeds, i.e., canopy, c (a complex interconnected layer of tree tops 25–35 m above the forest floor); understory or subcanopy, u (a relatively open, multilayer stratum ≧3–20 m); shrub layer, s (from just above the ground to a height of 3 m); ground, g; (2) the kind of food, i.e., small insects (si), large insects and small vertebrates (li), fruit and seeds (fr), nectar (ni), grass seeds (se), or omnivorous (so), etc.; and (3) the principal foraging mode and substratum of the species, i.e., gleaning live foliage or fruits (f), probing dead foliage (d), ground foraging (g), sallying or "air" foraging (a), scouring branches or trunks or "creeping" (b), twig hopping (t), and ant following (r). Karr et al. (1990).

7.8 Minnesota’s Comprehensive Wildlife Conservation Strategy (MNCWCS)

Tomorrow’s Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife is a strategic plan focused on managing populations of species in greatest conservation need in the state. These are defined by this plan as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability.

There are 292 species in Minnesota that meet these criteria, including those species legally defined as endangered or threatened by the state and federal government as well as many other species whose populations are in decline.

Chapter 5 of *Tomorrow’s Habitat for the Wild and Rare* is the heart of the strategic plan. In this chapter are profiles for each of the 25 subsections in Minnesota’s Ecological Classification System. These profiles include an overview of the subsection, a list of the subsection’s species in greatest conservation need, an analysis of the factors influencing the vulnerability or decline of species in the subsection, a description of key habitats for these vulnerable species, and a list of remedial goals and strategies.

Profiles for the two subsections covered by this plan- ***Chippewa Plains and Pine Moraines and Outwash Plains***- are included below.

Please see *Tomorrow’s Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife*, Comprehensive Wildlife Conservation Strategy (Minnesota Department of Natural Resources. 2006. Division of Ecological Services) http://www.dnr.state.mn.us/cwcs/strategy.html for the list and analyses of Minnesota’s species in greatest conservation need as well as state-wide goals and habitat descriptions.

Chippewa Plains

SUBSECTION OVERVIEW

The Chippewa Plains Subsection borders the Agassiz Lowlands and Littlefork Vermilion Uplands subsections to the north and includes Lake Winnibigoshish, Cass Lake, and hundreds of other smaller lakes of various sizes. The Mississippi River flows through a large part of this subsection and has its headwaters at Lake Itasca. Wetlands exist throughout the area. Before being settled by people of European descent, this area was heavily timbered with a diverse mixture of deciduous and coniferous trees.

This subsection includes the Chippewa National Forest, and much of the subsection is forested, most commonly by aspen. Recreation, tourism, and forestry are the predominant land uses. Most of the shorelines are developed with summer homes, and marginal shorelines once determined unsuitable for residential development are now being developed.

Quick facts

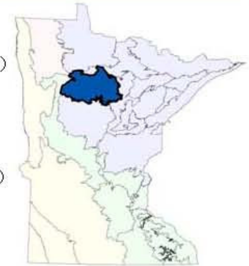
Acres: 2,202,497 (4.1% of state)

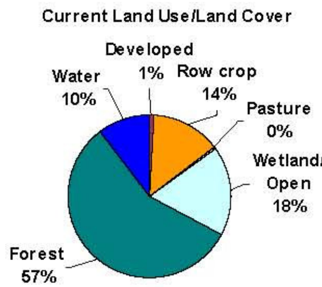
Ownership

Public	Private	Tribal
44.9%	52.1%	3.0%

Population density (people/sq. mi.)

Current	Change (2000-2010)
32.7	+2.8





SPECIES IN GREATEST CONSERVATION NEED

83 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Chippewa Plains. These SGCN include 21 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 6 mammal SGCN are known or predicted to occur in the Chippewa Plains, approximately 27% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	NA
Birds	60	61.9	Northern goshawk
Fishes	4	8.5	Pugnose shiner
Insects	8	14.3	Vertree's ceraclean caddisfly
Mammals	6	27.3	Gray wolf
Mollusks	2	5.1	Black sandshell
Reptiles	2	11.8	NA
Spiders	0	0	NA

HIGHLIGHTS

- The exceptional mix of forests and lakes in this subsection provides prime habitats for numerous featured species such as great gray owls, yellow rails, common loons, black-backed woodpeckers, red-shouldered hawks, red-necked grebes, ospreys, bald eagles, northern goshawks, gray wolves, and smooth green snakes.
- Areas important for SGCN include the Chippewa NF; Hole in the Bog, Pennington Bog, Lake Bemidji, Iron Springs Bog, and Lost 40 SNAs; Blackduck, Buena Vista, Mississippi Headwaters, Paul Bunyan, Welsh Lake, Bowstring, and Big Fork SFs; Lake Bemidji and Schoolcraft SPs; and Mud-Goose and Carmen Borgerding WMAs.

SPECIES SPOTLIGHT

Northern goshawk *(Accipiter gentilis)*

Distribution Primarily inhabits northern hardwood forests and mixed hardwood-coniferous forests of northern and northeastern MN. Distribution is broad but spotty.

Abundance Uncommon. Statewide surveys over the past few years document typically fewer than 30 nests per year.

Legal Status Federally protected migratory bird.

Comments Concerns have been raised about the rangewide status of this bird and of the need to include its habitat needs in forest management prescriptions.

Photo by Carol Henderson

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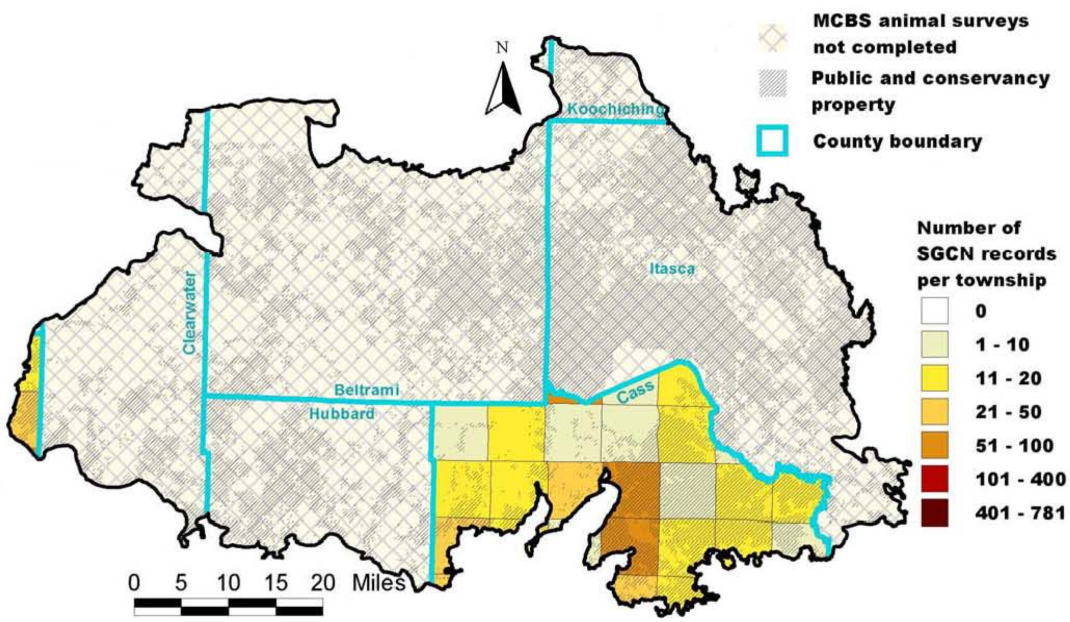
SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	84
Habitat Degradation in MN	89
Habitat Loss/Degradation Outside of MN	42
Invasive Species and Competition	23
Pollution	29
Social Tolerance/Persecution/Exploitation	22
Disease	2
Food Source Limitations	2
Other	8

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Chippewa Plains

KEY HABITATS - For Species in Greatest Conservation Need

The CWCS identified key habitats for SGCN within the subsection using a combination of five analyses, labeled A-E below. The table depicts the five analyses, and under which analyses the key habitats qualified. To qualify as a key habitat for the subsection, the habitat had to meet the criteria used in at least one of the five analyses, as specified in the descriptions to the right of the table. The graphs below depict results from four (A-D) of the five analyses used in determining key habitats. Those habitats that meet the criteria are highlighted in **RED** in the graph for that analysis. Those habitats that do not meet the criteria are shaded in **GOLD**. Analysis E is not represented by a graph; the results of this analysis are presented as a list of key rivers/streams in Appendix I. For a more detailed explanation of the five analyses used, see Chapter 7, Methods and Analyses.

	ANALYSIS				
KEY HABITATS	A	B	C	D	E
Forest-Upland Coniferous	X	X			
Shrub/Woodland-Upland (Jack pine woodland)			X		
Wetland-Nonforest	X	X			
River-Headwater to Large					X

Description of Analyses

A: Terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and are modeled to have the most SGCN using them based on a z-test with p<0.01.

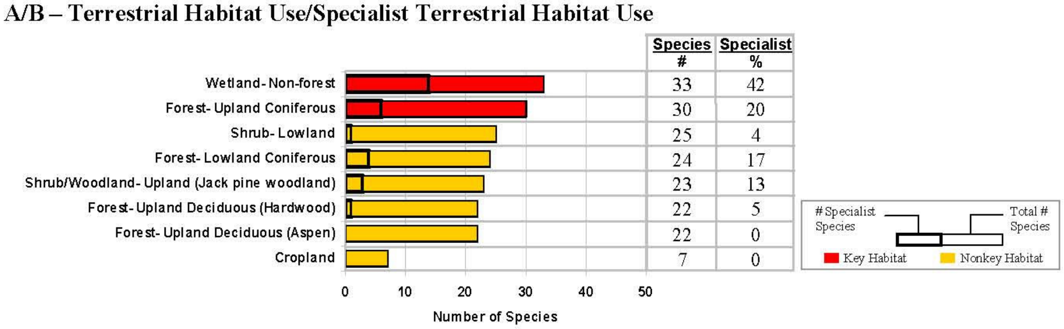
B: Specialist terrestrial habitat use analysis - terrestrial habitats that represent more than 5% of 1890s or 1990s landcover and have more than 15 species, 20% of which use 2 or fewer habitats (specialist species).

C: Terrestrial habitat change analysis - terrestrial habitats that represent more than 5% of the 1890s landcover and have declined by more than 50% in the 1990s landcover. For wetlands this change was based on an analysis done by Anderson & Craig in *Growing Energy Crops on Minnesota's Wetlands: The Land Use Perspective* (1984).

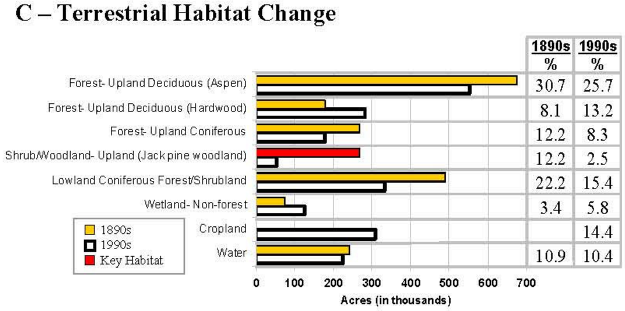
D: Aquatic habitat use analysis - lake or stream habitats that have the most SGCN use based on a z-test with p<0.01 of all subsections.

E: The Nature Conservancy/SGCN occurrence analysis - stream reaches identified in the Areas of Aquatic Biodiversity Significance in the four TNC Ecoregional Assessments and reaches with high SGCN occurrences (see Appendix I for list of stream reaches).

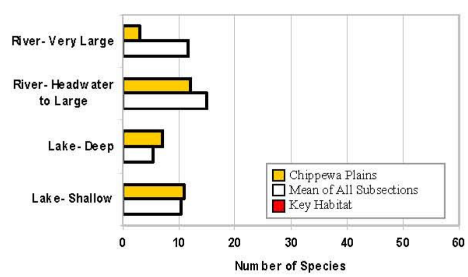
A/B – Terrestrial Habitat Use/Specialist Terrestrial Habitat Use



C – Terrestrial Habitat Change



D – Aquatic Habitat Use



E – The Nature Conservancy/SGCN Occurrence

To reference the key rivers and streams for the subsection, see Appendix I.

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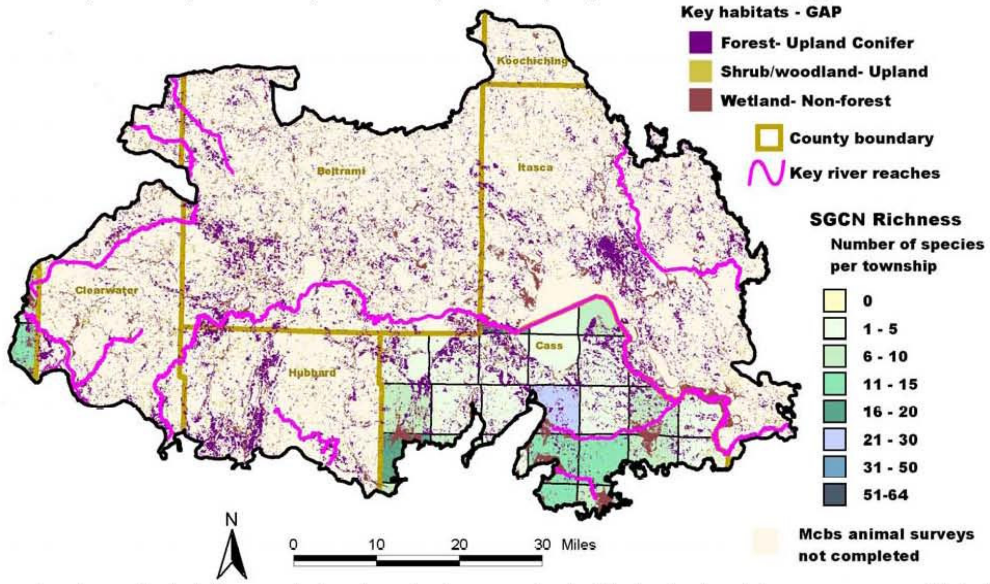
DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP

This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).



Sources: Information used for key habitats was first based on native plant community classifications (NPC), and where NPC were not available, the MN GAP landcover. Shallow lakes are from the MN DNR shallow lake program; deep lakes are those with at least one SGCN occurrence. Grasslands are identified from the HAPET GBCA model where available, and otherwise, from the regionally significant environmental areas, or HAPET landcover map.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fishes	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	30.7	25.8	1	17			4				22
Forest-Lowland Coniferous	22.2	15.4		20		1	3				24
Cropland	N/A	14.4		5			2				7
Forest-Upland Deciduous (Hardwood)	8.1	13.2	1	16			5				22
Forest-Upland Coniferous	12.2	8.3	1	21		2	5		1		30
Lake-Deep	N/A	7.2		2	3	1			1		7
Wetland-Nonforest	3.4	5.8		29			3		1		33
Forest- Lowland Deciduous	0.3	3.2		13			3				16
Lake- Shallow	N/A	3.2		9					1		10
Shrub/Woodland-Upland (Jack pine woodland)	12.2	2.5		14		2	6		1		23
Developed	N/A	0.7		4			3				7
Grassland	N/A	0.3		15			5		1		21
Shoreline-dunes-cliff/talus	N/A	N/A		10			1				11
Shrub-Lowland	N/A	N/A		20		1	4				25
River-Headwater to Large	N/A	N/A		2	4	3		2	1		12
River-Very Large	N/A	N/A				1		1	1		3

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain and Enhance the Key Habitats

1. **Upland coniferous forest habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance to interested individuals and organizations
2. **Jack pine woodland habitats**, actions include:
   a. Incorporate SGCN habitat concerns in forest management planning
   b. Provide technical assistance to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
   a. Enforce the Wetlands Conservation Act
   b. Manage habitats adjacent to wetlands to enhance SGCN values
   c. Provide technical assistance to interested individuals and organizations
4. **Stream habitats**, actions include:
   a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
   b. Maintain and enhance riparian areas along priority stream reaches
   c. Provide technical assistance to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
   a. Continue MCBS rare animal surveys
   b. Survey SGCN populations related to key habitats
   c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
   a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
   a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
   a. Identify best management practices for maintaining and enhancing key habitats
   b. Identify important patterns and distributions of key habitats to better support SGCN populations
   c. Identify important functional components within key habitats to support specific SGCN
   d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
   a. Identify people's attitudes and values regarding SGCN
   b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
   a. Continue existing population monitoring activities
   b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
   a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
   a. Develop partner-specific performance measures within the subsection
   b. Develop project-specific performance measures for SWG-funded projects
   c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people

Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

Pine Moraines and Outwash Plains

SUBSECTION OVERVIEW

The Pine Moraines and Outwash Plains Subsection, named for its mix of end moraines and outwash and till plains, is a resource-rich, heavily forested area. The subsection contains sections of the Mississippi River, along with hundreds of lakes, including Leech, Itasca, Ten Mile, Upper and Lower Whitefish, and Gull. Kettle lakes and wetlands are common on the outwash plains. Before this area was settled by people of European descent, forests of jack pine mixed with northern pin oak were most common on outwash plains, and aspen-birch and pine forests were the most common on end moraines.

Forest management and tourism are the predominant land uses in this subsection today. The bait industry is also well represented here. The area around the city of Brainerd, located on the southeastern edge of this subsection, swells in population dramatically each summer. The number of year-round residents is increasing as they convert small lake cabins into larger, year-round houses. Near-shore habitat is being lost at a rapid pace, which negatively affects fish and wildlife. Motorized recreation is popular in many of the state forests in this area. Agriculture is common in the western part of this subsection.

Quick facts

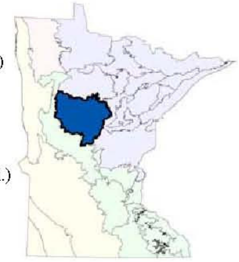
Acres: 3,025,749 (5.6% of state)

Ownership

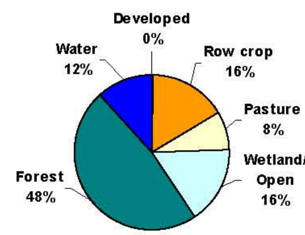
Public	Private	Tribal
29.6%	69.1%	1.3%

Population density (people/sq. mi.)

Current	Change (2000-2010)
25.6	+4.2



Current Land Use/Land Cover



SPECIES IN GREATEST CONSERVATION NEED

89 Species in Greatest Conservation Need (SGCN) are known or predicted to occur within the Pine Moraines and Outwash Plains. These SGCN include 29 species that are federal or state endangered, threatened, or of special concern. The table, SGCN by Taxonomic Group, displays by taxonomic group the number of SGCN that occur in the subsection, as well as the percentage of the total SGCN set represented by each taxon. For example, 5 mammal SGCN are known or predicted to occur in the Pine Moraines and Outwash Plains, approximately 23% of all mammal SGCN in the state.

SGCN BY TAXONOMIC GROUP

Taxa	# of SGCN	Percentage of SGCN Set by Taxon	Examples of SGCN
Amphibians	1	16.7	NA
Birds	61	62.9	Bald eagle
Fishes	4	8.5	Least darter
Insects	12	21.4	Caddisfly (*C. itascae*)
Mammals	5	22.7	Prairie vole
Mollusks	2	5.1	Creek heelsplitter
Reptiles	4	23.5	Eastern hognose snake
Spiders	0	0	NA

HIGHLIGHTS

- This is an important transition zone interspersed with valuable lakes and wetlands.
- Featured wildlife includes bald eagles, gray wolves, sharp-tailed grouse, sandhill cranes, upland sandpipers, common terns, yellow rails, red-necked grebes, trumpeter swans, common loons, least darters, and eastern hognose snakes.
- This is one of the most important areas in the state for red-shouldered hawks.
- Areas important for SGCN include Camp Ripley Military Reservation; Chippewa NF; Deep Portage Conservation Reserve; Smoky Hills, Two Inlets, Badoura, Huntersville, Foot Hills, Pillsbury, and Crow Wing SFs; Greenwater Lake SNA; Itasca SP; and several WMAs.

SPECIES SPOTLIGHT

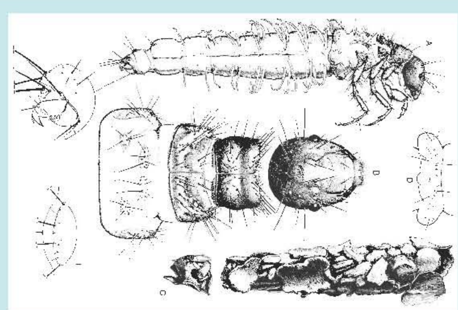
Headwater chilostigman caddisfly *(Chilostigma itascae)*

Distribution Known only from Nicollet Creek in Itasca State Park, Clearwater County. This is the only occurrence of this genus in North America, with other representatives found in Finland and Scandinavia.

Abundance Extremely rare.

Legal Status State list-Endangered.

Comments This is one of the few endemic species known to MN. Adults emerge onto the snow in midwinter along Nicollet Creek.



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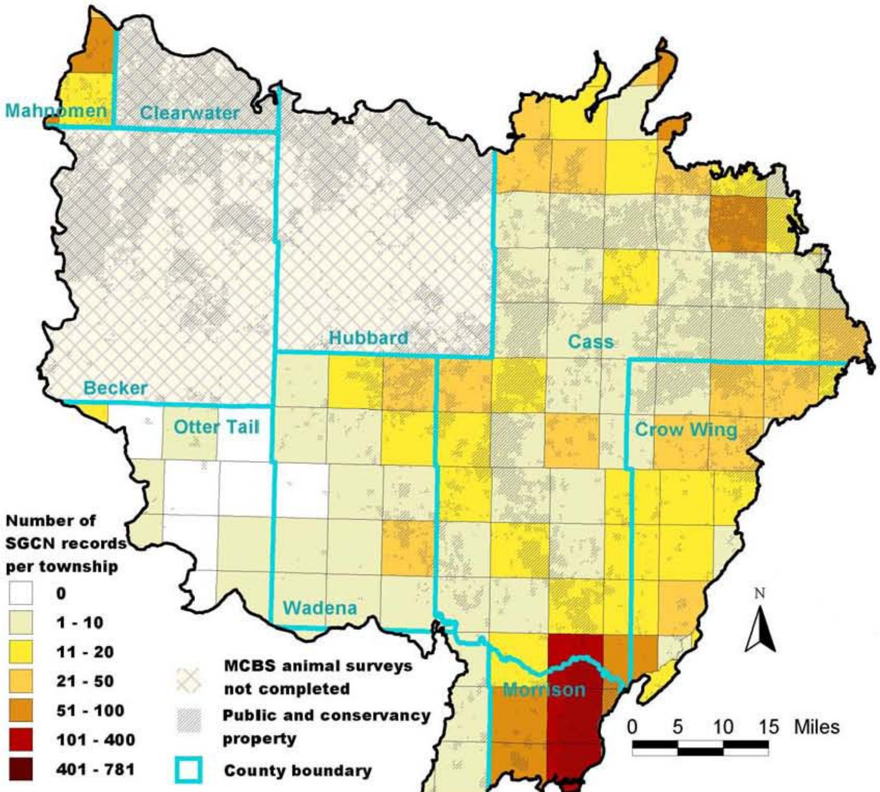
SGCN ELEMENT OCCURRENCES BY TOWNSHIP

This map depicts the number of validated records of species in greatest conservation need since 1990 per township and public land/conservancy land. It suggests relationships between known SGCN occurrences and conservation management lands. It also displays areas that have not been surveyed for rare animals by MCBS.



Sources: MN DNR Natural Heritage database, MN DNR County Biological Survey (MCBS), MN DNR Statewide Mussel Survey, MN DNR Fisheries Fish database. Areas with no MCBS animal surveys have had mussel and fish surveys, as well as reports of other species occurrences recorded in the MN DNR Natural Heritage database.

SPECIES PROBLEM ANALYSIS

The species problem analysis provides information on the factors influencing the vulnerability or decline of SGCN that are known or predicted to occur in the subsection. The table lists the nine problems, or factors, used in the analysis, and the percentage of SGCN in the subsection for which each factor influences species vulnerability or decline. The results of the species problem analysis indicate that habitat loss and degradation in the subsection are the most significant challenges facing SGCN populations.

NOTE: The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead may indicate that there is not sufficient information available to determine the level of influence the factor has on SGCN in the subsection.

Problem	Percentage of SGCN in the Subsection for Which This Is a Problem
Habitat Loss in MN	83
Habitat Degradation in MN	88
Habitat Loss/Degradation Outside of MN	39
Invasive Species and Competition	26
Pollution	30
Social Tolerance/Persecution/Exploitation	20
Disease	3
Food Source Limitations	2
Other	10

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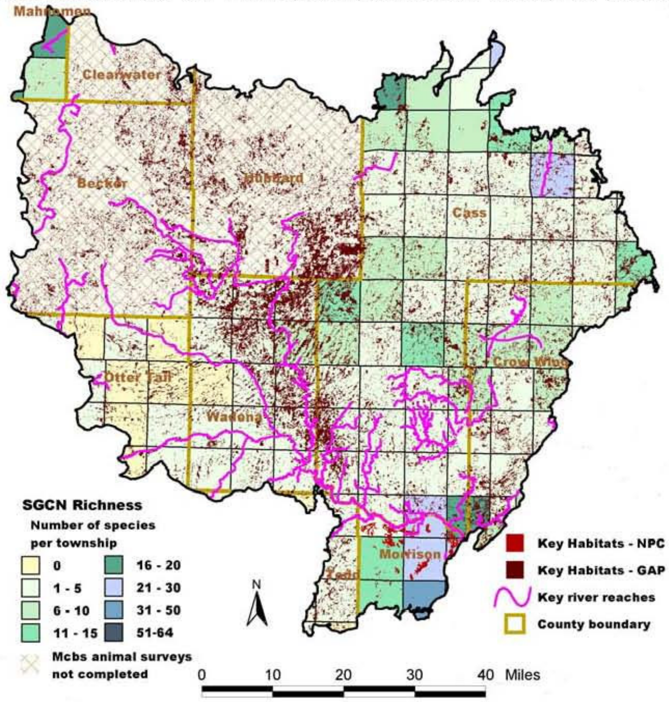
DISTRIBUTION OF KEY HABITATS AND SPECIES RICHNESS BY TOWNSHIP



This map depicts key habitats and the number of species of SGCN per township based on the sources listed below. It suggests there is often a relationship between key habitats and species richness (i.e., the variety of species of SGCN in a township).

Sources: Information used for key habitats was first based on native plant community classifications (NPC), and where NPC were not available, the MN GAP landcover. Shallow lakes are from the MN DNR shallow lake program; deep lakes are those with at least one SGCN occurrence. Grasslands are identified from the HAPET GBCA model where available, and otherwise, from the regionally significant environmental areas, or HAPET landcover map.

SUBSECTION HABITAT PERCENTAGES AND HABITAT USE BY SGCN TAXA

This table presents information on the percentages for each habitat in the subsection (showing changes in coverage between the mid- to late 1800s and the 1990s), as well as habitat use by SGCN taxonomic group. Habitats are listed in ranked order for percent coverage within the subsection in the 1990s. Key habitats for the subsection (as identified on previous page) are listed in **BOLD**. SGCN habitat use is broken down by taxonomic group, with a total number of species for all taxonomic groups listed at the far right of the table.

			SGCN BY TAXONOMIC GROUP								
HABITAT	Percentage of Subsection (1890s)	Percentage of Subsection (1990s)	Amphibians	Birds	Fishes	Insects	Mammals	Mollusks	Reptiles	Spiders	Total Number of Species
Forest-Upland Deciduous (Aspen)	26.4	30.7	1	16			2				19
Cropland	N/A	16.0		6			3				9
Lake-Deep	N/A	9.4		2	3	1			1		7
Grassland	N/A	8.0		17			5		3		25
Wetland-Nonforest	4.2	7.5		30		1	2		2		35
Forest-Upland Deciduous (Hardwood)	5.9	7.5	1	17		1	3		1		23
Forest-Upland Coniferous (Red-white pine)	18.0	6.7	1	17		3	3		2		26
Forest-Lowland Coniferous	10.8	5.9		15		1	1				17
Shrub/Woodland-Upland (Jack pine woodland)	20.8	4.9		13		4	5		2		24
Lake-Shallow	N/A	1.8		8					2		10
Forest-Lowland Deciduous	1.2	1.2		13			1		1		15
Developed	N/A	0.4		4		1	2				7
Prairie	0.2	0.0		15		1	5		3		24
Shoreline-dunes-cliff/talus	N/A	N/A		12			1		1		14
Shrub-Lowland	N/A	N/A		20		1	3		1		25
River-Headwater to Large	N/A	N/A		2	4	4		2	2		14
River-Very Large	N/A	N/A				1		1	2		4

N/A: Insufficient data available to determine percent coverage within subsection. We have no data to indicate the existence of cropland, grassland, or developed land prior to settlement by people of European descent, although these land uses likely did occur at very low levels.
NOTE: 0.0 indicates less than 0.05 percent coverage.

Pine Moraines and Outwash Plains

Ten-Year Goals, Management Challenges, Strategies, and Priority Conservation Actions

Goal I: Stabilize and increase SGCN populations

Management Challenge 1 – There has been significant loss and degradation of SGCN habitat
Strategy I A – Identify key SGCN habitats and focus management efforts on them

Priority Conservation Actions to Maintain and Enhance the Key Habitats

1. **Upland coniferous red-white pine forest habitats**, actions include:
    a. Incorporate SGCN habitat concerns in forest management planning
    b. Provide technical assistance to interested individuals and organizations
2. **Jack pine woodland habitats**, actions include:
    a. Incorporate SGCN habitat concerns in forest management planning
    b. Provide technical assistance to interested individuals and organizations
3. **Nonforested wetlands**, actions include:
    a. Enforce the Wetlands Conservation Act
    b. Manage habitats adjacent to wetlands to enhance SGCN values
    c. Provide technical assistance to interested individuals and organizations
4. **Stream habitats**, actions include:
    a. Maintain good water quality, hydrology, geomorphology, and connectivity in priority stream reaches
    b. Maintain and enhance riparian areas along priority stream reaches
    c. Provide technical assistance to interested individuals and organizations

Management Challenge 2 – Some SGCN populations require specific management actions
Strategy I B – Manage federal and state listed species effectively

Priority Conservation Actions for Specific SGCN

1. Implement existing federal recovery plans
2. Develop and implement additional recovery plans
3. Provide technical assistance to managers, officials, and interested individuals related to listed species
4. Enforce federal and state endangered species laws, as well as other wildlife laws and regulations

Strategy I C – Manage emerging issues affecting specific SGCN populations

Priority Conservation Actions for Specific SGCN

1. Work with partners to effectively address emerging issues affecting SGCN populations
2. Enforce federal and state wildlife laws and regulations

Goal II: Improve knowledge about SGCN

Management Challenge 1 – More information about SGCN and SGCN management is needed
Strategy II A – Survey SGCN populations and habitats

Priority Conservation Actions for Surveys

1. Survey SGCN populations within the subsection, actions include:
    a. Continue MCBS rare animal surveys
    b. Survey SGCN populations related to key habitats
    c. Survey wildlife taxa underrepresented by MCBS animal surveys
2. Survey SGCN habitats within the subsection, actions include:
    a. Assess the amount and quality of key habitats and map their locations

Strategy II B – Research populations, habitats, and human attitudes/activities

Priority Conservation Actions for Research

1. Research important aspects of species populations within the subsection, actions include:
    a. Better understand the life history and habitat requirements of important SGCN
2. Research important aspects of SGCN habitats within the subsection, actions include:
    a. Identify best management practices for maintaining and enhancing key habitats
    b. Identify important patterns and distributions of key habitats to better support SGCN populations
    c. Identify important functional components within key habitats to support specific SGCN
    d. Explore important, emerging SGCN habitat management issues

Priority Conservation Actions for Research (continued)

3. Research important aspects of people's understanding of SGCN within the subsection, actions include:
    a. Identify people's attitudes and values regarding SGCN
    b. Identify places and ways people can enjoy and appreciate SGCN

Strategy II C – Monitor long-term changes in SGCN populations and habitats

Priority Conservation Actions for Monitoring

1. Monitor long-term trends in SGCN populations, actions include:
    a. Continue existing population monitoring activities
    b. Develop additional monitoring activities for specific SGCN populations
2. Monitor long-term trends in SGCN habitats, actions include:
    a. Develop long-term monitoring activities for important SGCN habitats

Strategy II D – Create performance measures and maintain information systems

Priority Conservation Actions for Performance Measures and Information Systems

1. Create and use performance measures, actions include:
    a. Develop partner-specific performance measures within the subsection
    b. Develop project-specific performance measures for SWG-funded projects
    c. Actively incorporate monitoring and performance measure information to enhance adaptive management
2. Maintain and update information management systems

Goal III: Enhance people's appreciation and enjoyment of SGCN

Management Challenge 1 – Need for greater appreciation of SGCN by people
Strategy III A – Develop outreach and recreation actions

Priority Conservation Actions for Outreach and Recreation

1. Create new information and communicate with people to enhance their appreciation of SGCN
2. Create opportunities for people to appropriately enjoy SGCN-based recreation

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A P P E N D I C E S

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B. Background on DNR Forest Inventory and Data Currency A.12

C. Ecological Classification System A.14

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E. Glossary A.18

F. Acronyms A.40

A P P E N D I X A

Minnesota Department of Natural Resources

Directions 2000

Forest Resources

Contents

I. Introduction
II. Forest ecosystem goals and objectives (4)
III. Forest ecosystem management strategies (16)
IV. Goals for measuring progress (3)

The complete document, Directions 2000: The Strategic Plan*, September 2000, Minnesota Department of Natural Resources can be found at the Web site:* *http://www.dnr.state.mn.us/about/directions2000.pdf*

I. Introduction

Directions 1997 identified four forest management priorities:

- Protecting riparian areas
- Ensuring forest soils productivity
- Maintaining wildlife diversity
- Managing for healthy and resilient forest ecosystems across landscape scales.

Working with partners, the Department of Natural Resources (DNR) has made considerable progress developing new approaches to address these priorities. The Sustainable Forest Resources Management Act established sustainable forest ecosystems as a priority goal for Minnesota. The act was based on recommendations of the Generic Environmental Impact Statement (GEIS) on Timber Harvesting and Forest Management in Minnesota. The GEIS studied the potential impacts from current and increased levels of timber harvesting and recommended strategies for the sustainable management of the state's forest resources.

The DNR has become increasingly concerned about problems posed by land-use conversion throughout rural areas of the state. Land-use conversion is the process of converting forest or other natural areas into housing and related uses (commercial development, parking lots, roads, etc.). At the same time, many larger blocks of land are subdivided into smaller blocks. Increased fragmentation of the landscape is a critical threat to the state's natural resource base. Land conversion and fragmentation decrease the area in forest cover, destroy fish and wildlife habitat, degrade water quality, and reduce the large blocks of ownership best suited to managing land holistically. When land-use conversion occurs within large blocks of publicly owned land, concern increases because the character and ability to manage the surrounding land are changed dramatically. Over the long-term, continuing these patterns poses large concerns for the health of forest resources and viability of industry dependent on healthy forest ecosystems. These concerns form the basis for the DNR's approach to developing "smart growth" and "conservation connections" strategies. They also are the basis for DNR's investment in sustainable forest initiatives.

II. Forest Ecosystem Goals and Objectives

Building on the GEIS, the Minnesota Forest Resources Council (MFRC) identified three priority forest management goals. DNR developed a fourth goal to address mineral development in forest ecosystems.

Goal 1. Minnesota's forest land base will be enlarged and protected. No net loss of forest land will occur and some previously forested areas will be returned to forest cover. The forest land base will be protected from decreases and fragmentation by land-use changes.

> **Objective 1.1**. **Landowners will have viable options for restoring former farmland to forest and other open land conditions**. As use of some lands changes from the production of agricultural commodities to other uses, opportunities arise to direct new uses to serve natural resource purposes, including forestry.
>
> **Objective 1.2**. **Loss and fragmentation of private forest lands will be minimized.** Subdivision of forest lands or conversion of those lands to nonforest uses diminishes the capacity of forests to provide healthy public benefits and results in a net loss of forest acreage. The objective is to maintain the productive capacity of forests by minimizing the loss and fragmentation of private forest lands.

Goal 2. Forest ecosystems will be healthy, resilient, and functioning. Forests will be composed of appropriate mixes of vegetative types and age classes that maintain wildlife and biological diversity.

> **Objective 2.1. Forests will be managed for structural and plant species diversity.** A forest with a variety of tree species, native plant communities, and ages provides habitat suitable for more species and has greater potential to provide a sustainable yield of timber. A diverse forest generally is healthier and more resilient than a less diverse forest. Landscape metrics provide useful tools for measuring vegetative spatial patterns across landscapes. The objective is to establish and manage towards landscape goals that provide a diversity of age classes, habitats, patch sizes, and spatial configuration using the natural range of variation as a guide.
>
> **Objective 2.2. Forest practices will ensure healthy forest soils and water resources.** The objective is to ensure that forestry practices minimize damage to soils and maintain healthy aquatic ecosystems.
>
> **Objective 2.3**. **Forests will support self-sustaining fish and wildlife populations.** Self-sustaining fish and wildlife population's—game and nongame—are important to the recreating public and as components of healthy ecosystems. The objective is healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species, especially those species listed as threatened and endangered.
>
> **Objective 2.4. Natural corridors will connect forest habitat areas.** Where forests are fragmented by other land uses such as agriculture or urban areas, corridors of forest, often along streams or trails, may connect larger forest habitat areas serving both wildlife and recreation uses. In a primarily forested landscape, where younger forest fragments older

forest blocks, corridors composed primarily of older or uneven-aged forests and careful planning of timber harvest patterns can provide continuous forest cover. The objective is to identify and maintain natural areas representative of the variety of the forested landscape and connect those areas by natural corridors.

Objective 2.5. Exotic species will have a minimal impact on forests and other native plant and animal species. Minnesota's forests are susceptible to significant impacts from exotic species. Examples of exotics that adversely affect Minnesota forest resources include white pine blister rust, gypsy moth, and buckthorn. Management will seek to minimize impacts from these species while also minimizing the impact of control measures on vulnerable native species.

Objective 2.6. Damage from native insects, diseases, and wildlife will be managed at acceptable levels. Native insects, diseases, and wildlife have both positive and negative impacts on forests. On one hand, they are a major source of mortality and reduce resistance of forests to other stresses. On the other hand, they promote diversity of tree species and forest structure and generate dead wood, which provides important habitat and soil nutrients. Widespread pest outbreaks cause high levels of tree mortality and can have significant ecological and economic consequences. The objective is to reduce vulnerability of forests to the effects of significant outbreaks and to manage impacts of native pests, including wildlife, at levels consistent with forest ecosystem sustainability.

Objective 2.7. **The acreage of healthy brush land landscapes will increase**. Large, open brush lands are some of the state's most productive wildlife habitat and are essential to survival of several wildlife species, some of which are declining in Minnesota (e.g. sharp-tailed grouse, yellow rail, savanna sparrow, short-eared owl). Brush land acreage has declined due to conversion to agriculture and fire suppression.

Goal 3. Forest-based economic and recreational opportunities will be numerous and wide-ranging. The contribution of forests to the state's economic and social well-being will be acknowledged. Economic opportunities for Minnesota's forest-based industries, including tourism and wood-based businesses, will be large, sustainable, and diverse.

Objective 3.1. Commercial timber supply will be abundant and sustainable. DNR will manage state lands and work with other forest landowners to help provide a predictable and sustainable amount of quality wood to meet the raw material needs of a growing population consistent with the sustainability of forest ecosystems. Predictable and sustainable harvests of quality wood from forests will support a strong state economy by helping maintain a viable forest products industry in the state.

Objective 3.2. Use of nontimber forest products will expand. Nontimber products, such as balsam boughs and birch bark, help diversify local economies. DNR will expand use of nontimber forest products consistent with sustainability of forest ecosystems.

Objective 3.3. Forest management will minimize impacts on visual quality. The visual quality of forest landscapes is especially important in areas of significant public use, such as roadsides, shorelands, and park areas. MFRC has incorporated "Visual Sensitivity Categories," developed by the Timber Tourism Visual Quality Committee, into site-level forest management guidelines. DNR will apply the appropriate guidelines so that visual quality is not adversely impacted during forest management activities.

Objective 3.4. Forests will support diverse recreation opportunities. Forests provide opportunities for many outdoor recreation activities, which in turn provide economic benefits to local communities. The objective is to meet the demand for forest-related outdoor recreation where and when these activities are consistent with the sustainability of forest ecosystems. See the "Recreation Systems" section for a more comprehensive development of recreation goals.

Objective 3.5. Private forest landowners will be able to manage their forests to provide public benefits. Public lands cannot provide all benefits demanded from forests. Private lands will play a key role. The objective is for private landowners to have sufficient access to the technical assistance and other services they need to satisfy their own management goals, while also maintaining healthy forest ecosystems, providing timber and serving recreation needs.

Objective 3.6. Cultural resources will be protected. Cultural resources are scarce, nonrenewable features that provide physical links to our past. MFRC voluntary site-level guidelines protect cultural resources during forest activities. The objective is to increase the awareness and use of the guidelines by forest landowners, loggers, and resource managers.

Objective 3.7. Trust fund revenues from mining and forest management will continue. Trust fund and other DNR-administered state land management will be proactive in the identification of surplus parcels for an annual sale and will initiate land exchanges with private landowners within established natural resource management areas to consolidate state ownership. The DNR also will identify and remove some trust fund lands from nonrevenue-producing natural resource management units on an annual basis.

Goal 4. Mineral resources use will be economically viable and environmentally sound. Extraction of subsurface resources on all lands will continue to be a significant component of the state's economy. DNR will manage mineral development to protect public health and safety, reduce environmental impacts, and restore land for post-mining uses.

Objective 4.1. Opportunities for mineral exploration will continue. Minnesota has excellent potential for nonferrous and industrial mineral deposits. These deposits are found throughout the state, though predominantly in the forested areas. Mineral exploration requires availability of land in areas of high mineral potential, preferably within regions with compatible land uses. The objective is to provide improved data on the quality and quantity of mineral deposits, including a consideration of the ecological impacts of minerals extraction.

Objective 4.2. The diversity of the minerals industry will continue to expand. Areas for mineral development include peat, clay, stone, nonferrous minerals, and stockpiled material from existing or previous mining. Value-added processing of taconite or iron ore will further add stability and diversity to the minerals industry. The objective is to develop uses, marketing, and transportation strategies in cooperation with industry and other partners in order to expand the diversity of the mineral industry.

Objective 4.3. Mining and exploration will have minimal environmental impacts. The objective has three components: 1) restoring expired mine lands to productive uses, including for recreation and fish and wildlife habitat, 2) minimizing the impact of new mining operations on areas with high biodiversity or where extractive operations will fragment significant native habitats, and 3) addressing the multiple concerns relating to how mining operations affect surface and subsurface water resource quality and flows.

III. Forest Ecosystem Management Strategies

The DNR will employ the following management strategies to achieve forest land resource goals and objectives.

Strategy 1. Develop landscape-scale management plans to guide timber harvest and biodiversity protection. The DNR is developing ecosystem subsection plans for forest management. Plans will develop interdisciplinary approaches to meeting multiple forest objectives on state forestry and wildlife lands. Harvest, reforestation, and protection strategies will guide management in reaching a variety of objectives such as timber production, diversity of age classes, patch-size distribution, native plant communities (forest land, wetland, and open brush land communities) and connectivity (to provide habitat corridors and wildlife habitat). The DNR's "Old-Growth and Extended Rotation Forest Guidelines" will focus on maintaining older forests. The DNR will coordinate landscape plans and priorities with other owners when possible, including MFRC's landscape planning effort. (This strategy applies to *forest ecosystem goals and objectives* 1.1 through 3.7.)

Strategy 2. Apply MFRC Site-Level Forest Management Guidelines. DNR will apply the MFRC guidelines on DNR-administered land and encourage widespread adoption and use of the guidelines on other public and private lands to protect wildlife habitat, historic and cultural resources, riparian areas, soils productivity, water quality, and visual quality of forest lands across the state. The DNR will assist with education and training for guideline implementation and coordinate efforts to monitor the application of these guidelines in forest management practices. The DNR will encourage land managers to use the guidelines whenever appropriate (e.g., road construction, forest harvest, pesticide use, reforestation, thinning, fire management, and recreation management). In some cases, land managers may choose to apply land treatments that are more restrictive than the guidelines; in other areas, less restrictive standards may be appropriate. Specifics of local conditions and management objectives will determine appropriate application of guidelines. (This strategy applies to *forest ecosystem goals and objectives* 1.1 through 3.7.)

Strategy 3. Manage insect pests and forest diseases. Exotic insects such as the gypsy moth and native insects (such as the spruce budworm) and diseases (such as white pine blister rust and oak wilt) are major threats to forest resources. The DNR will monitor exotic and native forest insects and diseases and seek to minimize damage on public and private lands. The DNR will seek to minimize impacts of control efforts on nontarget organisms. The DNR will coordinate management efforts with the Minnesota Department of Agriculture and the U. S. Forest Service. (This strategy applies to *forest ecosystem goals and objectives* 2.1, 2.2, 2.3, 2.5 through 3.5, and 3.7.)

Strategy 4. Expand focus on corridor management and planning. Corridors provide opportunities to connect habitat, provide outdoor recreation, and protect scenic vistas. The DNR, through the "conservation connections" initiative, will work closely with private landowners, other land management agencies, and local communities to identify corridor opportunities and to implement corridor management concepts. (This strategy applies to *forest ecosystem goals and objectives* 1.1 through 2.4, 2.7, and 3.3 through 3.5.)

Strategy 5. Provide habitat for rare and threatened species. Restoring populations of rare and threatened species requires information on the location and prevalence of suitable habitats and development of guidelines and plans to ensure that habitats are restored or maintained, such as the DNR's old-growth forest guidelines. The DNR will take a leadership role in advocating for maintaining habitat for rare and threatened species in all forests regardless of ownership. (This strategy applies to *forest ecosystem goals and objectives* 1.1 through 2.7, and 3.5.)

Strategy 6. Enhance opportunities to use state forests for outdoor recreation. The DNR will continue to seek a balance between intensive recreation uses like off-highway vehicles (OHVs) and activities that require nature and solitude in forests. The DNR will maintain forest campgrounds and will complete its recreation trail system planning for OHVs. Additional focus on recreation opportunities in forest ecosystems appears in the Recreation Systems section. (This strategy applies to *forest ecosystem goals and objectives* 1.1 through 2.7 and 3.3 through 3.7)

Strategy 7. Incorporate wildlife population targets in all forest management efforts. The DNR will consider fish and wildlife population targets in forest ecosystem management as part of an integrated strategy to maintain healthy forest ecosystems. Fish and wildlife population goals will continue to be an important consideration in planning timber harvests, old-growth management, reforestation, and forest recreation. (This strategy applies to *forest ecosystem goals and objectives* 2.1 through 3.7)

Strategy 8. Provide appropriate access roads to forest lands. Access to forest lands is provided by an intermingled network of federal, state, county, and private forest access roads. Cooperation with other forest landowners will be critical in maintaining existing access to DNR forest lands and to coordinate future road access needs and road management direction. DNR balances a variety of considerations (e.g., biodiversity, wildlife management, fire suppression, timber harvest, and recreation) in developing access roads. The DNR will continue providing access to forest lands consistent with management plans, MFRC site-level guidelines, and forest ecosystem sustainability. (This strategy applies to *forest ecosystem goals and objectives* 1.1, and 2.1 through 3.7)

Strategy 9. Manage fire to protect public safety and foster healthy, diverse forest and brush land ecosystems. Wildfire prevention and suppression will continue to be guided by statutory directives to protect public safety, property, and natural resources. Prescribed (i.e., ignited and controlled) fire will be used to mimic natural processes, alter forest or brush land composition, encourage regeneration of certain species, eliminate exotic species, and reduce risk/potential of wildfire (i.e., fuels reduction). The DNR will increasingly use prescribed burning to manage wildlife habitats, plant communities, brush lands, and timberlands. Fuels management (including prescribed fire, constructing fire breaks, and salvage harvesting) will be a growing need to help reduce the risk of dangerous wildfires in forested areas damaged by natural events (e.g., blowdowns, insects, and diseases) and where residential and commercial development has expanded into forested areas. (This strategy applies to *forest ecosystem goals and objectives* 1.2 through 3.7)

Strategy 10. Accelerate management of brush land landscapes. Active management is required to maintain productive brush lands wildlife habitat. The DNR will complete efforts to assess the extent and quality of large, open brush land landscapes. DNR will use the landscape planning process to identify priority brush land areas and will develop management plans across all ownerships for these areas. Management plans will specify appropriate use of controlled fire, mechanical disturbance, and herbicide treatments to maintain the health of the priority brush lands using the range of natural variation as a guide. (This strategy applies to *forest ecosystem goals and objectives* 2.1, 2.2, 2.3, and 2.7)

Strategy 11. Increase focus on timber quality and productivity. Demand for more and higher-quality timber will continue as society's need for forest products continues to grow and Minnesota's forest industry seeks to remain competitive in a worldwide market. Focusing attention on timber productivity and quality will help increase the quality and quantity of wood available for harvest in Minnesota and will enhance the protection of nontimber values in forested landscapes. For example, increasing the wood fiber productivity of a certain portion of the forest will help reduce the intensity of harvest pressures on other forest land. DNR will increase efforts in programs and initiatives that focus on increasing the amount and quality of timber produced from appropriate forest lands. (This strategy applies to *forest ecosystem goals and objectives* 1.1, 1.2, 2.1, 2.5, 2.6, 3.1, 3.2, 3.5, and 3.7)

Strategy 12. Continue acquisition of critical land parcels. The DNR will continue to acquire parcels of land that are adjacent to or within blocks of existing DNR land. This strategy is especially important in areas of growing recreation or residential/commercial pressures. (This strategy applies to *forest ecosystem goals and objectives* 1.2, 2.4, 3.1, 3.2, 3.4, and 3.7 through 4.2)

Strategy 13. Cooperate broadly with stakeholders and other agencies. Cooperative approaches to managing forest resources have expanded, especially with MFRC activities. DNR will continue to involve other agencies, stakeholders, and the public in forest management decisions. The forest subsection planning process provides opportunities to involve the public to provide input in developing management goals. (This strategy applies to all *forest ecosystem goals and objectives*.)

Strategy 14. Cooperate with other landowners in sale and exchange of DNR-administered land. The DNR will be proactive in identifying surplus parcels for sale and will initiate land exchanges with public and private landowners within established natural resource management areas to consolidate state ownership. The DNR will identify and remove trust fund lands from nonrevenue-producing natural resource management units on an annual basis. (This strategy applies to all *forest ecosystem goals and objectives*.)

Strategy 15. Cooperate with other agencies, local government, and stakeholders to help establish viable rural economies. The DNR will work with other state agencies, especially the Minnesota Department of Agriculture and the Minnesota Department of Trade and Economic Development, and with other stakeholders to strengthen the rural economy by minimizing the impact of land fragmentation and development on forest lands. (This strategy applies to all *forest ecosystem goals and objectives*.)

Strategy 16. Increase investments in information technology. Information technology includes data collection, research, ecosystem monitoring, inventory efforts, and acquisition of technology. The expansion of information management technology allows a better understanding of the relationships between management techniques and resource conditions.

Forest inventories and related data-gathering efforts provide information needed by all landowners to manage land in a sustainable manner. DNR will maintain and provide access to a wide range of databases (e.g., Forest Inventory and Analysis, Cooperative Stand Assessment, Ecological Classification System (ECS), Forest Health Monitoring, County Biological Survey, Natural Heritage, mineral potential, etc.) and coordinate access to other databases that provide information on forest composition, wildlife habitat, rare species, cultural resources, etc. The DNR will develop compatible forest information across all ownerships, focusing on spatial features of landscapes (habitat patch size, shape, connectivity) not addressed in previous inventories and assessments.

Data assessment and applications, such as those made possible by the native plant community classification effort and the interagency effort to develop a range of natural variation for forest age classes, provide important opportunities to better use databases. Monitoring of impacts from roads, timber harvests, and recreation use provide information needed to develop timber management plans and forest-use policies. The DNR will intensify data collection, database development, information sharing, data assessment, and monitoring efforts so as to provide forest managers with the information tools needed to manage forest ecosystems in a sustainable manner. The DNR will improve the state land records system so that geographic information system (GIS) technology can be better used to analyze land ownership records. (This strategy applies to all *forest ecosystem goals and objectives*.)

Strategy 17. Provide technical assistance and financial incentives to landowners. The DNR will use private landowner assistance and easement programs (e.g., private forest stewardship plans, Conservation Reserve Program, and Forest Legacy Program) to help landowners manage their lands to meet personal and broader forest ecosystem objectives for timber production, maintaining forest ownership parcel size, recreation, wildlife habitat, and other forest resources. The DNR will provide technical assistance to builders and developers to assist them in developing land in ways that are compatible with the limitations and opportunities provided by natural settings. The DNR will coordinate stewardship programs with other entities, such as soil and water conservation districts.

The DNR will provide technical assistance for mineral processing projects and for reclamation of mineral extractive sites. Long-term management planning will provide communities with information and advice for mineral resources development and associated land-use practices. The DNR will assist private landowners in developing mineral product marketing efforts. (This strategy applies to all *forest ecosystem goals and objectives*.)

Strategy 18. Continue forest restoration and improvement. The DNR will encourage restoration of nonforest land to forest cover where appropriate. The DNR will assist private landowners in considering options for using land once in nonforest cover for timber and other beneficial uses. The DNR will restore the presence of some forest types such as big woods and white pine, which are less common than they once were. Other restoration strategies (buckthorn removal and prescribed fire) will restore and maintain the ecological health of forest habitats. (This strategy applies to all *forest ecosystem goals and objectives*.)

IV. Goals for Measuring Progress

Measuring progress toward forest management goals and objectives requires regular collection of forest resources information, including information on how those resources benefit society. To demonstrate forest resource accountability, the DNR also must document how strategies have been implemented. Information (and specific indicators, where appropriate) will allow the DNR to measure: 1) the ecological status of forests, 2) the economic status of forest-based industries, and 3) progress in implementing management strategies.

Goal 1: Minnesota's forest land base will be enlarged and protected. Maintaining the state's forest land base is fundamental to achieving all of the DNR's goals, including those associated with forests. To ensure that forest land is protected for the long term, the DNR needs information on the extent of forest land, ownership, and productive capacity. Examples of performance measures are:

- Acres of forest land categorized by ownership type (public, private industrial, private nonindustrial) and productivity class (timber producing, nontimber producing)
- Average size of nonindustrial private forest land ownership

Goal 2: Forest ecosystems will be healthy, resilient, and functioning. Forest ecosystem health and resilience ensures that forests can respond to disturbances and the demands society place on them. Measures of forest composition and ecosystem functions are useful in documenting forest health.

Examples of performance measures that focus on the distribution of forest plant communities, species, and ages are:

- Acres of old-growth forest by type, or
- Acres of forest by community or forest type and age class.

Examples of performance measures that focus on forest health are:

- Number of species of plants and animals with significantly reduced geographic ranges or population sizes (compared to historic conditions)
- Tree growth rates.

Goal 3: Forest-based economic and recreational opportunities will be numerous and wide-

ranging. Performance measures for this goal focus on uses of forests and the benefits of those uses for Minnesotans. Examples of performance measures are:

- Quantity of timber available
- Quantity of timber harvested
- Implementation of visual-quality guidelines
- Number of state forest campground user nights.

A P P E N D I X   B

Background on DNR Forest Inventory and Data Currency

The Minnesota Department of Natural Resources (DNR) uses a forest stand mapping and information system to classify the approximately 5 million acres (7,800 sq. mi.) owned and administered by the state. The system is designed to be a course classification of forest stands adequate to guide management decisions. It is commonly referred to as the "forest inventory."

The forest inventory system maps the boundaries and tabulates the contents of all forest stands five acres and larger on state-owned land. A forest stand is a group of trees uniform enough in composition to be managed as a unit. Boundaries are drawn by interpretation of aerial photographs. All other stand data are collected in the field on plots within each stand and boundaries may be adjusted at the time of the field visit.

The general descriptive term for the content of a stand is "cover-type." Although cover-types commonly bear the name of the primary tree species, they are usually an association of multiple tree species along with shrubbery and herbaceous plants.

When it originated in 1952, the forest inventory was called the Cooperative Stand Assessment (CSA) and was based on pencil-drawn maps with a computer punch-card database. Over the years, the system matured into a geographic information system (GIS) database accessible to DNR forest managers online. Forest inventory is now managed using a computer program called the Forest Inventory Module (FIM). Consequently, the inventory is now referred to as "FIM" rather than "CSA."

FIM data are not compatible with the previous CSA layers. FIM data follows an internal DNR Division of Forestry classification and attribute-coding scheme not used by CSA. Also, comparisons between past inventory data (CSA) and current conditions (FIM) encounter some difficulty due to CSA stands being limited by section lines. This limitation does not exist with FIM data and stand boundaries can extend all the way to a township line if the stand characteristics warrant it.

The accuracy of forest inventory is limited by the method used to establish stand boundaries. Features are digitized on screen over standard electronic topographical maps [24k Digital Raster Graphic (DRG) images] and electronic aerial photography [USGS Digital Orthophoto Quads (DOQs)] and inherit the horizontal positional accuracy of these products.

FIM allows foresters to update data as changes to stands occur due to the passage of time, natural events, or management activities. However, many stands do not receive field visits or re-measurement for 20 years or more if they are established but not approaching maturity. These stands have their age brought up-to-date by computer calculation, but other attributes such as volume, disease, and understory composition are not updated until a field visit. Attempts to model these attributes forward have met with some success, but they have not become standard practice.

A synopsis of the currency of field inventory is shown in the attached table. It is important to keep in mind that only selected stands are scheduled for a visit depending on a number of factors. These include the years since inventory, known natural factors that may have impacted the stand, potential merchantability, potential for treatment, etc.

All these factors must be taken into consideration when looking at inventory data, using it in analysis, and making management decisions.

Years Since Inventory	Number of Stands	Total Acres
1	6	142
2	1,034	17,939
3	599	10,969
4	601	9,354
5	898	13,319
6	749	12,750
7	1,125	16,921
8	1,363	40,383
9	376	6,384
10	734	11,330
11	795	15,286
12	1,001	16,919
13	806	14,167
14	2,017	33,576
15	1,674	31,313
16	1,977	41,628
17	571	8,867
18	1,149	16,231
19	688	10,948
20	235	5,476
21	1,873	34,443
22	355	8,315
23	582	12,623
24	1,433	25,914
25	559	11,570
26	48	899
27	5	287
28	8	114

Forested covertypes only (Forest inventory covertype codes 1-74, 82)

Average age of inventory = 15years old
Weighted average age of inventory = 14 years old

APPENDIX C

Ecological Classification System (ECS)

Contents

I. Definition
II. Purpose
III. End Products

I. Definition

The ECS is part of a nationwide mapping initiative developed to improve our ability to manage all natural resources on a sustainable basis.

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

In Minnesota, the classification and mapping is divided into six levels of detail. These levels are:

Province: Largest units representing the major climate zones in North America, each covering several states. Minnesota has three provinces: eastern broadleaf forest, northern boreal forest and prairie.

Section: Divisions within provinces that often cross state lines. Sections are defined by the origin of glacial deposits, regional elevation, distribution of plants, and regional climate. Minnesota has 10 sections (e.g., Red River Valley).

Subsection: County-sized areas within sections that are defined by glacial land-forming processes, bedrock formations, local climate, topographic relief, and the distribution of plants. Minnesota has 24 subsections (e.g., Mille Lacs Uplands).

Land-type association: Landscapes within subsections, characterized by glacial formations, bedrock types, topographic roughness, lake and stream patterns, depth to ground water table, and soil material (e.g., Alexandria Moraine).

Land type: The individual elements of land type associations, defined by recurring patterns of uplands and wetlands, soil types, plant communities, and fire history(e.g., fire-dependent xeric pine-hardwood association).

Community: Unique combinations of plants and soils within land types, defined by characteristic trees, shrubs and forbs, elevation, and soil moisture (e.g., sugar maple-basswood forest).

II. Purpose of an Ecological Classification System

- Defines the units of Minnesota's landscape using a consistent methodology.
- Provides a common means for communication among a variety of resource managers and with the public.
- Provides a framework to organize natural resource information.
- Improves predictions about how vegetation will change over time in response to various influences.
- Improves our understanding of the interrelationships between plant communities, wildlife habitat, timber production, and water quality.

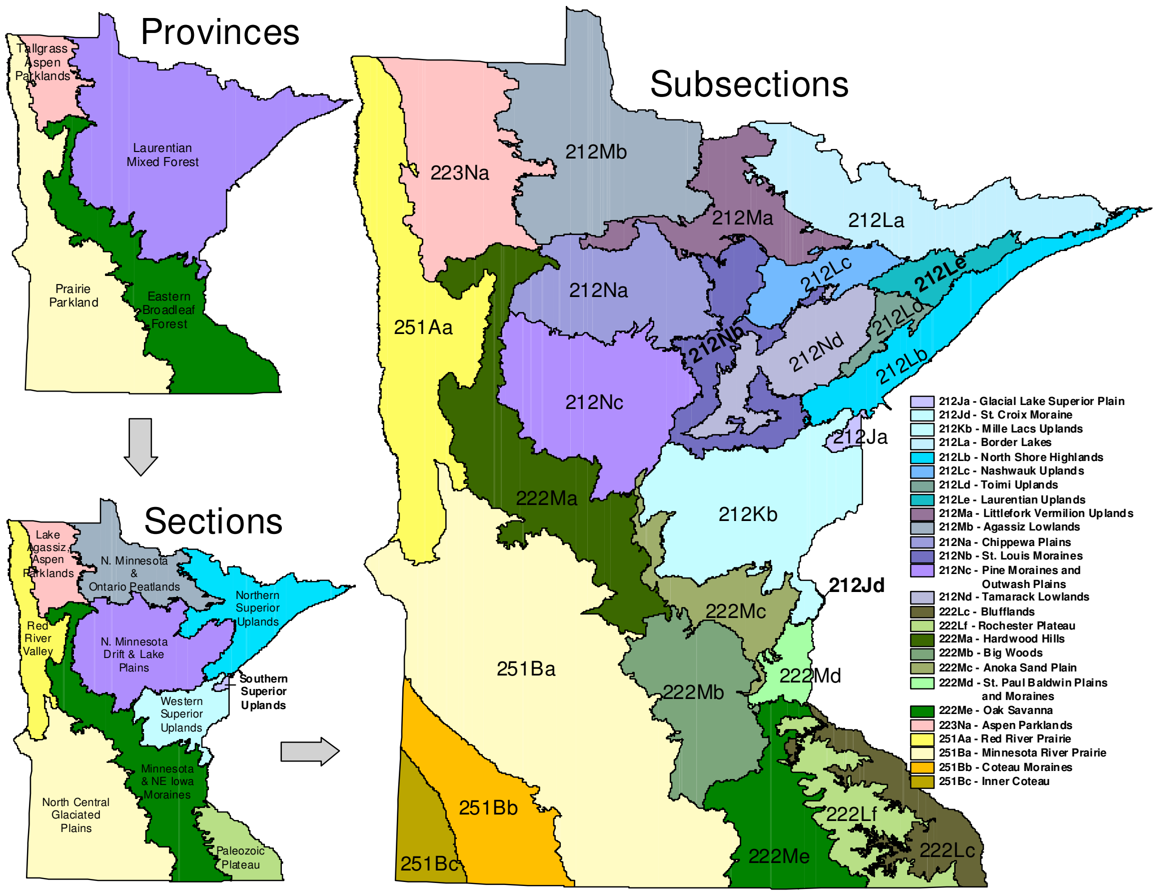
III. End Products

- Maps and descriptions of ecological units for provinces through land types.
- Field keys and descriptions to determine which communities are present on a parcel of land.
- Applications for management for provinces through communities.
- Mapping of province, section, subsection, and land-type association boundaries is complete throughout Minnesota (See map on next page).

Figure A
Ecological Provinces, Sections, and Subsections of Minnesota, 1999

APPENDIX C

Ecological Provinces, Sections, and Subsections of Minnesota, 1999



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Minnesota
DEPARTMENT OF NATURAL RESOURCES

Ecological Land Classification Program

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A P P E N D I X   D

School Trust Fund Lands

The granting of the school trust fund lands to the state of Minnesota was part of the federal act making Minnesota a state in 1858. According to Minnesota Statute §127A.31, the goal of the permanent school fund is as follows:

> *The legislature intends that it is the goal of the permanent school fund to secure the maximum long-term economic return from the school trust lands consistent with the fiduciary responsibilities imposed by the trust relationship established in the Minnesota Constitution, with sound natural resource conservation and management principles, and with other specific policy provided in state law.*

Sound natural resource conservation and management principles have been interpreted as managing trust land to preserve unique characteristics or values (e.g., wildlife habitat), or to serve the public benefit by providing recreational opportunities. According to the Forest Resource Management Act of 1995, it is state policy to pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals. So, in addition to maximizing the long-term economic return, the goal allows the Minnesota Department of Natural Resources (DNR) to manage school trust land by providing wildlife habitat, recreational opportunities, protection of unique characteristics (e.g., old-growth forest), and other environmental and social goals. The DNR acknowledges that it should seek a method of compensating the school trust fund for foregone revenues if trust land is used for purposes either restricting or prohibiting revenue generation.

Proceeds from timber sales on trust land (i.e., after subtraction of forest management costs charged by the DNR) are added to the Permanent School Fund (PSF) principal. The Minnesota Constitution requires that the principal of the fund not be spent. As of 2001, the market value of the principal within the PSF was about $549 million from dollars generated through land sales, timber sales, land leases, and mineral taxes and royalties since the fund's origination in the 1850s. At the end of each fiscal year, the commissioner of Education distributes the income earned from investment of the PSF principal to school districts as part of the state's general education aid payments. This income is distributed based on the average daily enrollment during the preceding year. This money is distributed to schools statewide; it does not go just to schools where the trust fund land is located. The amount of money paid out of the PSF is a small percentage of the total amount of state and local government education funding. In Fiscal Year (FY) 2001, $24 million was distributed to schools from the trust fund, which comprised less than 1 percent (0.7 percent) of all state revenues to K-12 schools ($3.36 billion in FY2001). The PSF monies are used to offset school aid payments from the general fund education appropriation. The per student payment to school districts is neither increased nor decreased by the trust fund monies, they reduce the amount appropriated from the general fund. **Schools located within the subsections do not receive additional school funding because of increased timber sales income from trust lands in the subsection.**

A P P E N D I X E

Glossary

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

Area forest resource management plan (AFRMP): Successor to timber management planning (TMP), recognizing that TMP discussions and decisions affected or included a lot more than the decision to harvest. This should not be confused with the comprehensive FRMPs developed for a number of areas in the mid-to late-1980s.

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

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

Age-class distribution: The proportionate amount of various age classes of a forest or forest cover-type within a defined geographic area (e.g., ecological classification system subsection).

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

Animal aggregations: A concentration of animals (of rare or common species or a mixture of rare and common) that occurs during part or all the species life cycle, such that when these animals are in these aggregations, they are highly vulnerable to disturbance. Examples are colonial water bird nesting sites, bat hibernacula, and mussel beds.

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

Annual work plan: The annual work responsibilities at the area (i.e., Division of Forestry administrative boundary) documented for the fiscal year.

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

Assessment: A compilation of information about the trends and conditions related to natural and socio-economic resources and factors. The initial round of Subsection Forest Resource Management Plans (SFRMP) will focus primarily on trends and conditions of forest resources.

Standard core assessment information sources and products have been defined.

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

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

Biodiversity Significance: The relative value, in terms of size, condition and quality, of native biological diversity for a given area of land or water. *(Adapted from: Guidelines for MCBS Statewide Biodiversity Significance Rank):* The Minnesota County Biological Survey uses a statewide ranking system to evaluate and communicate the biodiversity significance of surveyed areas (MCBS Sites) to natural resource professional, state and local government officials, and the public. MCBS Sites are ranked according to several factors, including the quality and types of *Element Occurrences*, the size and quality of native plant communities, and the size and condition of the landscape within the Site. Areas are ranked as *Outstanding, High, Moderate, or Below the Minimum Threshold* for statewide biodiversity significance. (*Draft definition 3/24/2004*)

> ***Outstanding Sites:*** Those containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes present in the state.
> ***High Sites:*** Those containing the "best of the rest", such as sites with very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes.
> ***Moderate Sites:*** Those containing significant occurrences of rare species, and/or moderately disturbed native plant communities and landscapes that have a strong potential for recovery.
> ***Sites Below the Minimum Threshold:*** Those lacking significant populations of rare species and/or natural features that meet MCBS minimum standards for size and condition. These include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movements, buffers surrounding higher quality natural areas, and open space areas.

Board foot: A unit of measuring wood volumes equaling 144 cubic inches. A board foot is commonly used to measure and express the amount of wood in a tree, sawlog, veneer log, or individual piece of lumber. For example, a 16-inch diameter at breast height (DBH) standing tree that is 80 feet tall, contains approximately 250 board feet of wood and a tree with a 30-inch DBH and 80 feet tall contains about 1000 board feet or one metric board foot (MBF). A piece of lumber one cubic foot (1 foot x 1 foot x 1 inch) contains one board foot of lumber.

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

Carr: Deciduous woodland or scrub on a permanently wet, organic soil. A carr develops from a bog, fen or swamp.

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

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

Coarse filter: Management of lands from a local to landscape scale that addresses the needs of all or most species, communities, environments, and ecological processes. In using a coarse filter approach (Hunter, 1990), it assumes that a broad range of habitats encompassing the needs of most species needs will be met, and their populations will remain viable on the landscape.

Cohort: a group of trees developing after a single disturbance, commonly consisting of trees of similar age.

Collaboration: A group in which members identify with the group and seriously consider the group's overall charge. Group members assume collective responsibility for outcomes, are interdependent, and have a joint ownership of decisions.

Common forest inventory: Also, known as CCSA (Common Cooperative Stand Assessment). Forest inventory stand data compiled by the Minnesota Interagency Information Cooperative from public agencies including the Minnesota DNR, Superior and Chippewa National Forests, and county land departments (2001). The common format contains the common attributes found in the state, federal, and counties forest inventories.

Competition: The struggle between trees to obtain sunlight, nutrients, water and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

Comprehensive DNR subsection plans: Address Minnesota Department of Natural Resources (DNR) programs and activities within the subsection. Involves programs and activities of multiple DNR divisions, not just the Division of Forestry.

Comprehensive Division of Forestry SFRMPs: Address other aspects of forest resource management on DNR Forestry lands (e.g., recreation, land acquisition/sales, fire management, private forest management).

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

Conversion: A change through forest management from one tree species to another within a forest stand or site.

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

Cord: A pile of wood 4 feet high, 4 feet wide, and 8 feet long, measuring 128 cubic feet, including bark and air space. Actual volume of solid wood may vary from 60 to 100 cubic feet, depending on size of individual pieces and how tight the wood is stacked. In the lake states, pulpwood cords are usually four feet x four feet x 100 feet and contain 133 cubic feet. Pulpwood volume of standing trees is estimated in cords. For example, a 10-inch DBH tree, which is 70 feet tall, is about 0.20 cords; or five trees of this size would equal one cord of wood.

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

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

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

Critical habitat: habitat or habitat elements that must be present and properly functioning to assure the continued existence of the species in question.

Crop tree: any tree selected or retained to be a component of a future commercial harvest.

Cruise: (v) A survey of forestland to locate timber and estimate its quantity by species, products, size, quality, or other characteristics. (n) An estimate derived from such a survey.

Cubic foot: A wood volume measurement containing 1,728 cubic inches, such as a piece of wood measuring one foot on a side. A cubic foot of wood contains approximately six to 10 usable board feet of wood. A cord of wood equals 128 cubic feet.

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

Desired future forest composition (DFFC) goals: Broad vision of landscape vegetation conditions in the long-term future. For the purposes of the initial round of subsection planning, DFFC goals will focus on future desired forest composition looking ahead 50 years. DFFC goals may include aspects like 1) the amount of various forest cover types within the subsection, 2) age-class distribution of forest cover types, 3) the geographic distribution of these across the subsection, and the related level of management for even-aged forest, 4) extended rotation forest, etc.

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

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

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

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

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

Ecological evaluation: A concise report containing descriptions of the significant natural features of a site, such as the flora, fauna, rare features, geology, soils, and any other factors that provide interpretation of the site's history, present state, and biodiversity significance. Management and protection recommendations are often included in these reports. Evaluations are produced by the MCBS at the completion of work in a given county or ECS subsection, and are generally reserved for those sites with the highest biodiversity significance in a geographic region, regardless of ownership.

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

Ecologically important lowland conifers (EILC): includes stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands, that are examples of high quality native plant communities (NPC) that are representative of lowland conifer NPC's found in the subsections. The designated EILC stands will be reserved from treatment during this 10-year planning period. Future management/designation of these stands is yet to be determined.

Ecosystem based management: The collaborative process of sustaining the integrity of ecosystems through partnerships and interdisciplinary teamwork. Ecosystem based management seeks to sustain ecological health while meeting social and economic needs.

Element Occurrence (EO): An area of land and/or water where a rare feature (plant, animal, natural community, geologic feature, animal aggregation) is, or was present. An Element Occurrence Rank provides a succinct assessment of estimated viability or probability of persistence (based on condition, size, and landscape context) of occurrences of a given Element. An Element Occurrence Record is the locational and supporting data associated with a particular Element Occurrence. Element Occurrence Records for the State of Minnesota are managed as part of the rare features database by the Natural Heritage and Nongame Research Program. (Draft definition 3/24/2004, Adapted from Biotics EO Standards: Chapter 2)

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

Even-aged: A forest stand composed of trees of primarily the same age or age class. A stand is considered even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years).

Evenflow: Providing a relatively consistent amount of timber (or other products) in successive management periods.

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

Extended rotation forests (ERF): Forest stands for which the harvest age is extended beyond the normal or economic harvest age. ERF provides larger trees, old forest wildlife habitat, and other nontimber values. Additional details regarding management of ERF on DNR-administered lands is contained in the DNR Extended Rotation Forest Guidelines (1994). **Prescribed ERF** is the cover type acreage designated for management as ERF. Stands designated as ERF will be held beyond the recommended normal rotation (harvest) age out to the established ERF rotation age(s). A stand of any age can be prescribed as ERF. **Effective ERF** is defined as the portion of the prescribed ERF acreage that is actually over the normal rotation age for the cover type at any one time.

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

Fine filter: Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem. For example, individual nests, colonies, and habitats are emphasized. A *fine filter* approach (Hunter, 1990) considers the specific habitat needs of selected individual species that may not be met by the broader coarse filter approach.

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

Forest Inventory Module (FIM): The FIM provides a database and application through which field foresters can maintain an integrated and centralized inventory of the forests on publicly owned lands managed by the Division of Forestry and other divisions. In the field, foresters collect raw plot and tree data. Those data are summarized in stand level data that are linked to a spatial representation of stand boundaries. Part of the DNR's **FOR**estry **I**nformation **S**ys**T**em (FORIST).

Forest land: Consists of all lands included in the forest inventory from aspen and pine cover types to stagnant conifers, muskeg, lowland brush, and lakes.

Forest management: the practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest. Note: forest management includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, and other forest resource values. *From: The Dictionary of Forestry. 1998.* The Society of American Foresters. J.A. Helms, ed.

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

> ***System roads*** - These roads are the major roads in the forest that provide forest management access, recreational access and may be connected to the state, county, or township public road systems. These roads are used at least on a weekly basis and often used on a daily basis. The roads should be graveled and maintained to allow travel by highway vehicles, and road bonding money can be used to fund construction and reconstruction of these types of roads. The level and frequency of maintenance will be at the discretion of the Area Forester and as budgets allow.
>
> ***Minimum maintenance roads*** - These roads are used for forest management access on an intermittent, as-need basis. Recreational users may use them, but the roads are not promoted or maintained for recreation. The roads will be open to all motorized vehicles but not maintained to the level where low clearance licensed highway vehicles can travel routinely on them. The roads will be graded and graveled as needed for forest management purposes. Major damage such as culvert washouts or other conditions that

may pose a safety hazard to the public will be repaired as reported and budgets allow.

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

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

FORIST: The **FOR**estry **I**nformation **S**ys**T**em (FORIST) is a collection of integrated spatial applications and datasets supporting day-to-day operations across the Division of Forestry. The first two parts of the system are in operation: Forest Inventory Module (FIM) and Silviculture and Roads Module (SRM). A Timber Sales Module is scheduled to be operational in 2006.

Fragmentation: Breaking up of large and contiguous ecosystems into patches separated from each other by different ecosystem types. Breaking up a contiguous or homogeneous natural habitat through conversion to different vegetation types, age classes, or uses. *Forest fragmentation* occurs in landscapes with distinct contrasts between land uses, such as between woodlots and farms. *Habitat fragmentation* occurs where a contiguous or homogeneous forest area of a similar cover type and age is broken up into smaller dissimilar units. For example, a conifer-dominated forest (or portion of it) is fragmented by clearcutting if it is converted to another type, such as an aspen-dominated forest.

Fully-stocked stand: A forest stand in which all growing space is effectively occupied but having ample space for development of the crop trees.

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

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

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

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

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

Habitat: An area in which a specific plant or animal normally lives, grows and reproduces; the area that provides a plant or animal with adequate food, water, shelter and living space.

Herbivory: Plant communities resulting from the browsing and grazing of wildlife. A plant-animal interaction whereby an organism eats some or all of a plant and the plant responds immediately (stress, decline, or death) or over time (evolutionary adaptation). Herbivory occurs both above and below ground. As defined for the issues concerned with herbivory in the plan; the influence by dominant herbivores on forest composition, structure, forest dynamics and spatial patterns. Dominant herbivores include beaver, deer, moose, hares, rabbits, small mammals, and forest tent caterpillars.

High risk low volume (HRLV): HRLV stands are identified based on one or more of the following: 1) stands coded as high risk in FIM forest inventory, 2) significant insect or disease damage to the main species in the stand, 3) stands over normal rotation age at time of survey with total stand volume eight cords per acre (low volume), or 4) very old stand, e.g., aspen over than 80 years old.

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

Intensive management: Intensity of management refers to the degree of disturbance associated with silvicultural treatments. In this plan, references to it range from less intensive to more intensive management. Examples of more intensive management are: 1) Site preparation techniques such as rock-raking that disrupts the soil profile and leaves coarse woody debris in piles; 2) broadcast herbicide use that eliminates or dramatically reduces herbaceous plant and shrub diversity; 3) Conversions of mixed forest stands through clear-cutting and/or site preparation that result in the establishment of a more simplified monotypic stand such as mostly pure aspen regeneration or high-density pine plantations. Examples where more intensive management may be needed are: to regenerate a site successfully to a desired species, control of insect or disease problems, and wildlife habitat management (e.g., maintenance of wildlife openings).

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

Issue: 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 DNR divisions of Forestry and Fish and Wildlife. Relevant issues will likely be defined by current, anticipated, or desired resource conditions and trends, threats to resources, and vegetation management opportunities. The key factor in determining the importance of issues for SFRMP is whether vegetation management issues can address the issue in whole or substantial part on DNR-administered lands.

Landform: Any physical, recognizable form or feature of the earth's surface, having a characteristic shape, and produced by natural causes. Examples of major landforms are plains, plateaus, and mountains. Examples of minor landforms are hills, valleys, slopes, eskers, and dunes. Together, landforms make up the surface configuration of the earth. The "landform" concept involves both empirical description of a terrain (land-surface form) class and interpretation of genetic factors ("natural causes"). (An Ecological Land Classification Framework for the United States, 1984, p. 40).

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

Landscape region: A geographic region that is defined by similar landforms, soils, climatic factors, and potential native vegetation. The landscape region used for this planning effort is the subsection level of the ECS.

Landscape study area (LSA): A large geographic area identified by the MCBS as a core area for the MCBS survey process in northern Minnesota. The LSA is intended to represent some of the landscapes within an ecological subsection (a unit in Minnesota's ECS. A LSA 1) generally captures the range of environmental gradients and ecological conditions found in large landscapes, 2) generally encompasses the range of native plant community complexes that exhibit repeatable patterns at the landform or ecological land-type association (LTA) scale, 3) exhibits the potential for intact landscape level processes to occur, 4) contains representative native plant communities functioning under relatively undisturbed conditions, and 5) often contains habitat for rare species. An LSA area is typically thousands of acres and contains two to several MCBS sites. A LSA may encompass portions of one or more ecological LTAs and lie in more than one county. LSAs are identified prior to MCBS field surveys and boundaries are modified during the survey process. At the completion of the MCBS surveys, a LSA becomes a macrosite, two or more sites, or a combination of macrosites and sites. In some cases a LSA is eliminated from further survey consideration during the MCBS survey process.

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

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

Macrosite: A large area, generally thousands of acres, containing two or more sites that have some geographical and ecological connection relevant to conservation planning. MCBS sites within a macrosite are generally close to one another but are not necessarily contiguous. Thus, macrosites may contain some disturbed areas. In northern Minnesota, MCBS macrosites correspond to the final (post field-evaluation) boundaries of LSAs. (Areas less than 2,000 acres formerly labeled "preserve designs " are also macrosites).

Managed acres: Timberland acres that are available for timber management purposes.

Management pool: In this plan, the acres available for timber management purposes.

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

Marketable timber: Merchantable timber that is accessible now.

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

Maximum rotation age: In this plan, the maximum age at which a forest cover type will retain its biological ability to regenerate to the same cover type and remain commercially viable as a marketable timber sale.

Mean annual increment (MAI): Average annual growth of a stand up to a particular age. It is calculated by dividing yield at that age by the age itself (e.g., the mean annual increment for a stand at age 50 with 25 cords per acre total volume: 25 ÷ 50 years = 0.5 cords per year).

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

Mesic: Moderately moist.

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

Minnesota forest resources plan (MFRP): Statewide DNR strategic forest resources plan. Includes statewide vision, mission, preferred future, goals, strategies and objectives. For each of the division's programs, it includes goals, statewide direction, and major strategies and objectives.

Minnesota TAXA: Minnesota Taxonomy Database maintained by the DNR Division of Ecological Services.

Minnesota Wildlife Resource Assessment Project (MNWRAP): A wildlife species database and related information system that provides the overall data management, framework, analysis functions, and long-term support for statewide, landscape, and site level wildlife resource assessment efforts. It will cover the total spectrum of wildlife diversity and habitat associations in Minnesota.

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

Mixed forest conditions: In this plan, refers to vegetative composition and structure that is moving toward the mix and relative proportion (e.g., dominated by, common, occasional, or scattered) of species found in the native plant community for that site. Tree species mix and proportion depends not only on the targeted growth stage (based on the rotation age for the desired cover type) but also species found in older growth stages.

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

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

Multiple use: Using and managing a forested area to provide more than one benefit simultaneously. Common uses may include wildlife, timber, recreation, and water.

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

Natural Area: An area of land, with significant native biodiversity, where a primary goal is to protect, enhance or restore ecological processes and Native Plant Community composition and structure. An MCBS *Site* of Outstanding or High biodiversity significance is often recommended for nomination as a natural area. For these Sites, an MCBS *Ecological Evaluation* is written to characterize the ecological significance of the Site as a whole and to serve as a guide for conservation action by the various landowners. Sites (or portions of Sites) that are recommended as natural areas may be identified by the landowner or land management agency for conservation activities such as designation as a (city, county, state, private) park, non-motorized recreation area, scientific and natural area, reserve, special vegetation management (e.g. natural disturbance based forest management for maintenance of mature growth stage), etc. (*Draft definition 3/24/2004*)

Natural Area Registry (NAR) Agreement: a memorandum of understanding between the Ecological Services Division and another governmental unit. The other governmental unit can be Division of Forestry, Wildlife, or Parks, depending on who the land administrator is for the parcel in question. It can also be city, county, tribal, or federal government. The NAR generally identifies the site, explains its significance, sets a proposed management direction, and states that before any management contrary to that direction occurs, the parties will get together and talk about it first. It is not a binding agreement. Examples of NAR's: an old growth yellow birch stand in Crosby-Manitou State Park; the South Fowl Lake cliff community on Division of Forestry land in Cook County; and a ram's-head orchid site on Hubbard County land.

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

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

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

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

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

Nontimber forest products: Foods, herbs, medicinals, decoratives and specialty items also known as special forest products. Special forest products might include berries, mushrooms, boughs, bark, Christmas trees, lycopodium, rose hips and blossoms, diamond willow, birch tops, highbush cranberries, burls, conks, Laborador tea, seedlings, cones, nuts, aromatic oils, extractives.

Normal rotation age: For even-aged managed cover types, the rotation age set by the SFRMP Team for non-ERF timberland acres. It is based on the culmination of mean annual increment (CMAI), other available data related to forest productivity that also considers wood quality, and local knowledge.

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

Guidelines (1994).

Old forest: A forest stand of any particular forest cover type is considered old forest whenever its age exceeds the normal rotation age established by the landscape team for that cover type. In this plan, it does not include designated old growth, state park lands, etc.

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

Old forest management complex: Represents an area of land, made up of several to many stands that are managed for old-growth, special management zone (SMZ), and extended rotation forest (ERF) in the vicinity of designated old growth stands.

Operational planning: What specifically will happen. The specific actions (i.e., projects, programs, etc.) that will be taken to move towards the desired future established by the various sources of strategic direction. Examples include stand examination lists, road projects, recreational trail/facilities projects, staffing, annual work plan targets, etc. Operational planning is also referred to as tactical planning.

Overmature: A tree or even-aged stand that has reached an age where it is declining in vigor and health and reaching the end of its natural life span resulting in a reduced commercial value because of size, age, decay, and other factors.

Overstocked: The situation in which trees are so closely spaced that they are competing for resources, resulting in less than full-growth potential for individual trees.

Overstory: The canopy in a stand of trees.

Partial cut: A cutting or harvest of trees where only some of the trees in a stand are removed.

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

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

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

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

Pulpwood: Wood cut or prepared primarily for manufacture into wood pulp or chips, for subsequent manufacture into paper, fiber board, or chip board. Generally, trees 5- to-12 inches diameters at breast height are used.

Pure forest or stand is defined as composed principally of one species, conventionally at least 80 percent based on numbers, basal areas, or volumes.

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

Rare Features Database is maintained by the Natural Heritage and Nongame Research Program and is comprised of locational records of the following features:

- **Rare plants.** Rare plants tracked are all species that are listed as Federally endangered, threatened or as candidates for Federal listing; all species that are State listed as endangered, threatened or special concern. Several rare species are also tracked which currently have no legal status but need further monitoring to determine their status.
- **Rare animals.** All animal species that are listed as Federally endangered or threatened (except the gray wolf) are tracked, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened or special concern.
- **Natural communities**. Natural communities are functional units of landscape that are characterized and defined by their most prominent habitat features - a combination of vegetation, hydrology, landform, soil, and natural disturbance cycles. Although natural communities have no legal protection in Minnesota, the Natural Heritage and Nongame Research Program and the Minnesota County Biological Survey have evaluated and ranked community types according to their relative rarity and endangerment throughout their range. Locations of high quality examples are tracked in the Rare Features Database.
- **Geologic features**. Noteworthy examples of geologic features throughout Minnesota are tracked if they are unique or rare, extraordinarily well preserved, widely documented, highly representative of a certain period of geologic history, or very useful in regional geologic correlation.
- **Animal aggregations**. Certain types of animal aggregations, such as nesting colonies of waterbirds (herons, egrets, grebes, gulls and terns), bat hibernacula, prairie chicken booming grounds, and winter bald eagle roosts are tracked regardless of the legal status of the species that comprise them. The tendency to

aggregate makes these species vulnerable because a single catastrophic event could result in the loss of many individuals.

Rare species: A plant or animal species designated as **endangered, threatened,** or of **special concern** by the state of Minnesota (this includes all species designated as endangered or threatened at the federal level), or an uncommon species that does not (yet) have an official designation, but whose distribution and abundance need to be better understood.

Refuge/refugia: Area(s) where plants and animals can persist through a wind and/or fire event.

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

Regional landscapes: MFRC established eight regional landscapes covering Minnesota based on ecological, socio-economic, and administrative factors. These landscapes were established to undertake landscape-based planning and coordination across all forest ownerships. The subsections included in this plan are in the Northeast Landscape Region.

Release: Freeing a tree, or group of trees, from competition that is overtopping or closely surrounding them.

Relevés: Vegetation survey plot data.

Research natural areas (RNAs): Areas within national forests that the U.S. Forest Service has designated to be permanently protected and maintained in natural condition (e.g., unique ecosystems or ecological features, rare or sensitive species of plants and animals and their habitat, and high-quality examples of widespread ecosystems).

Reserved forestland: Forestland withdrawn from timber utilization through statute, administrative regulation, or designation.

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

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

Rotation age: The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors.

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

Sanitation cut: A cutting made to remove trees killed or injured by fire, insects, disease, or other injurious agents (and sometimes trees susceptible to such injuries) for the purpose of preventing the spread of insects or disease.

Sapling: A tree that is 1 inch to 5 inches in diameter at breast height.

Sawlog: A log large enough to produce lumber or other products that can be sawed. Its size and quality vary with the utilization practices of the region.

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

Scarify: To break up the forest floor and topsoil preparatory to natural regeneration or direct seeding.

Scientific and natural areas (SNAs): Areas established by the DNR, Division of Ecological Services to preserve natural features and rare resources of exceptional scientific and educational value.

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

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

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

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

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

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

Silviculture and Roads Module (SRM): The SRM provides a database and application through which field foresters can record planned and actual forest development prescriptions (e.g., site preparation, tree planting projects, timber harvest, road maintenance, etc.) and follow-up surveys. SRM supports the geographic description of the extent of a development project separate from

FIM stand boundaries. A variety of maps and other reports can be generated by the development system. SRM will also produce maps and reports that roll up forestry area data to the regional or statewide level. Part of the DNR's **FOR**estry **I**nformation **S**ys**T**em (FORIST).

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

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

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

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

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

Snag: A standing dead tree.

Soil productivity: The capacity of soils, in its normal environment, to support plant growth.

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

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

Stand: A contiguous group of trees similar in age, species composition, and structure, and growing on a site of similar quality, to be a distinguishable forest unit. A forest is comprised of many stands. A ***pure stand*** is composed of essentially a single species, such as a red pine plantation. A ***mixed stand*** is composed of a mixture of species, such as a northern hardwood stand consisting of maple, birch, basswood, and oak. An ***even-aged stand*** is one in which all of the trees present are essentially the same age, usually within 10 years of age for aspen and jack pine stands. An ***uneven-aged stand*** is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

Stand age: The average age of the main species within a stand.

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

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

Stand-selection criteria: Criteria used to help identify stands to be treated as determined by the subsection team. Criteria will likely be based on include rotation ages, site index, basal area, cover-type composition, understory composition, location, etc. Factors considered in developing stand-selection criteria will include: 1) desired forest composition goals, 2) timber growth and harvesting, 3) old-growth forests, 4) extended and normal rotation forests, 5) riparian areas, 6) wildlife habitat, 7) age and cover-type distributions, 8) regeneration, 9) thinning and 10) prescribed burning needs.

State forest road: Any permanent road constructed, maintained, or administered by the DNR for the purposes of accessing or traversing state forest lands.

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

Strategic planning: A process to plan for desired future states. Includes aspects of a plan or planning process that provide statements and guides for future direction. The geographic, programmatic, and policy focus can range from very broad and general to more specific in providing tiers/levels of direction. Strategic planning is usually long term (i.e., at least five years, often longer). It usually includes an assessment of current trends and conditions (e.g., social, natural resource, etc.), opportunities, and threats; identification of key issues; and the resulting development of goals (e.g., desired future conditions), strategies, and objectives. Vision and mission statements may also be included.

Stumpage: The value of a tree as it stands in the forest uncut. Uncut trees standing in the forest.

Stumpage price: The value that a timber appraiser assigns to standing trees or the price a logger or other purchaser is willing to pay for timber as it is in the forest.

Subsection: A subsection is one level within the ECS. From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province → Section → Subsection→ Land Type Association → Land Type→Land Type Phase. Subsections areas are generally one to four million acres in Minnesota, with the average being 2.25 million acres. Seventeen subsections are scheduled for the SFRMP process.

Subsection forest resource management plan (SFRMP): A DNR plan for vegetation management on forest lands administered by DNR Divisions of Forestry and Fish and Wildlife that uses ECS subsections as the basic unit of delineation. Initial focus will be to identify forest stands and road access needs for the duration of the 10-year plan. There is potential to be more comprehensive in the future.

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

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

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

Sustainability: Protecting and restoring the natural environment while enhancing economic opportunity and community well-being. Sustainability addresses three related elements: the environment, the economy, and the community. The goal is to maintain all three elements in a healthy state indefinitely. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

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

Tactical planning: See operational planning.

Temporary access: A temporary access route for short-term use that will not be needed for foreseeable future forest management activities. It is usually a short, temporary, dead-end access route.

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

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

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

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

Timber management plan: The same thing as vegetation management if used with the SFRMP process.

Timber management planning (TMP): Successor to the TMP information system (TMPIS). Recognizes the entire timber management planning process as being more than just the computerized system. Incorporates GIS technology and an interactive process with other resource managers.

Timber management planning information system (TMPIS): Circa mid-1980s. Original computerized system for developing 10-year stand treatment prescriptions by area.

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

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

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

Two-aged stand: a stand with trees of two distinct age class separated in age by more than 20 percent of the rotation age.

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

Understocked: A stand of trees so widely spaced that even with full growth potential realized, crown closure will not occur.

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

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

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

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

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

Vegetation growth stage: The vegetative condition of an ecosystem resulting from natural succession and natural disturbance, expressed as vegetative composition, structure and years since disturbance. The vegetation growth stage describes both the successional changes (i.e., the change in the presence of different tree species over time) and developmental changes (i.e., the change in stand structure overtime due to the regeneration, growth, and mortality of trees). Vegetation growth stages express themselves along the successional pathways for a particular ecosystem depending on the type and level of natural disturbance that has occurred. Forest tree and other vegetation composition, habitat features, and wildlife species use change with the various growth stages.

Vegetation management plan: In the process of developing the 10-year stand examination list, many decisions and considerations go beyond identifying what timber will be cut (i.e., broader than timber management). This includes designation of old growth, extended rotation forests, riparian areas, desired future forest composition, visually sensitive travel corridors, etc., all of which are intended to address wildlife habitat, biodiversity, and aesthetic and other concerns. Prescriptions assigned to stands reflect decisions based on these multiple considerations and are broader than decisions relative to final harvest (e.g., ERF designation, uneven-aged management, thinning, regeneration, underplanting, prescribed burning, etc.).

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

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

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

Wildlife management area (WMA): Areas established by the DNR, Division of Fish and Wildlife, to manage, preserve and restore natural communities, perpetuate wildlife populations, and provide recreational and educational opportunities.

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

APPENDIX F

Acronyms

AFRMP	Area Forest Resource Management Plan
BT	Bearing Tree
CMAI	Culmination of Mean Annual Increment
CMT	Commissioner's Management Team
CP	Chippewa Plains
CPPM	Chippewa Plains/Pine Moraines and Outwash Plains
CSA	Cooperative Stand Assessment
CWCS	Comprehensive Wildlife Conservation Strategy
DBH	Diameter at Breast Height
DFC	Desired Future Condition
DFFC	Desired Future Forest Composition
DMT	Division Management Team
DNR	Department of Natural Resources
DOQ	Digital Orthophoto Quadrangle
DRG	Digital Raster Graphics
ECS	Ecological Classification System
EILC	Ecologically Important Lowland Conifers
ELCP	Ecological Land Classification Program
ERF	Extended Rotation Forestry
ETS	Endangered, Threatened, or Special Concern
FIA	Forest Inventory and Analysis
FIM	Forest Inventory Module
FORIST	Forest Information System
FRIT	Forest Resource Issues Team
FTC	Forest Tent Caterpillar
FY	Fiscal Year
GAP	Gap Analysis Program
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GM	Gypsy Moth
HRLV	High Risk/Low Volume
HWDs	Hardwoods
LSA	Landscape Study Area
LSL	Laminated Strand Lumber
LTA	Land Type Association
MACLC	Minnesota Association of County Land Commissioners
MAI	Mean Annual Increment
MBF	Thousand Board Feet
MCBS	Minnesota County Biological Survey
MFRC	Minnesota Forest Resources Council
MFRP	Minnesota Forest Resources Plan

MnTAXA	Minnesota Taxonomy Database
MnWRAP	Minnesota Wildlife Resource Assessment Project
NAPP	National Aerial Photography Program
NAR	Natural Area Registry Agreement
NCFES	North Central Forest Experiment Station
NHIS	Natural Heritage Information System
NHNRP	Natural Heritage & Nongame Research Program
NPC	Native Plant Community
NRCS	Natural Resource Conservation Service
OFMC	Old Forest Management Complex
OHV	Off-Highway Vehicles
OSB	Oriented Strand Board
PM	Pine Moraines and Outwash Plains
RMT	Regional Management Team
RMZ	Riparian Management Zone
RNAs	Research Natural Areas
RNV	Range of Natural Variability
SFRMP	Subsection Forest Resource Management Plan
SGCN	Species in Greatest Conservation Need
SI	Site Index
SMC	Special Management Complex
SMZ	Special Management Area
SNA	Scientific and Natural Area
SNN	Shipstead-Newton-Nolan Act
SONAR	Statement of Need and Reasonableness
SPP	Species
SRM	Silviculture and Roads Module
TMP	Timber Management Plan
TMPIS	Timber Management Plan Information System
TNC	The Nature Conservancy
WMA	Wildlife Management Area