Minnesota
Department of Natural Resources

Hardwood Hills Subsection Forest Resource Management Plan (Fiscal Years 2013-2022)

Strategic Direction and Stand Selection
on DNR Managed Lands

March 2012

Department of Natural Resources Planning Document

This document and additional information about the Minnesota DNR Subsection Forest Resource Management Plan (SFRMP) process can be found on the Internet at: http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/index.html

This information is available in an alternative format upon request.

Executive Summary

This subsection forest resource management plan (SFRMP) strategic direction and stand selection document includes management direction, goals and strategies, and a 10-year stand examination list guiding vegetation management on state forestlands administered by the Department of Natural Resources (DNR), Divisions of Forestry and Section of Wildlife. The plan also considered some lands administered by the Divisions of Parks and Trails and Ecological and Water Resources. The subsections landscape unit is approximately 3.5 million acres. State lands comprise approximately 1.6 percent (57,000 acres) of the land ownership in the Subsections, which includes acres in State Parks and Scientific and Natural Areas (SNAs) that are beyond the scope of this management plan. Of the state lands, approximately 46,000 acres (approximately 1.3 percent of the lands in the Subsection) are considered managed timber lands (i.e., lands suitable and available for timber production).

Under the direction of the Minnesota Forest Resource Council (MFRC) Landscape Program, the North Central, East Central and West Central Regional Landscape Committees have completed reports that included desired future conditions for all forest lands in the Landscape Regions. The goals and strategies in this subsection plan for state-administered forest lands are generally consistent with those recommended by these regional landscape committees.

Old forest will be maintained on state lands. Goals for maintaining old forest in forest types typically managed using even-aged management regimes vary in this Subsection, between 10 and 20 percent. In an effort to achieve this, the Subsection Forest Resource Management Team (SFRMP Team) designated extended rotation forest (ERF) in the aspen and oak cover types. Goals were established for the percent of these cover type acres to be managed as Effective Extended Rotation Forest (EERF): The aspen/balm of Gilead cover types have a goal of 10% of the cover type to be managed as EERF; the high site index (55+) oak cover type has a goal of 12% of the cover type to be managed as EERF; and, the bur oak cover type has a goal of 20% of the cover type to be managed as EERF. It should be noted that the aspen and oak cover type age classes are currently out of balance and will take several decades to achieve the goals stated above. Old forest conditions will also be provided in uneven-age managed cover types (e.g., northern hardwoods), ecologically important lowland conifers (EILC), and designated old-growth stands.

Young forest will be maintained on state lands primarily by timber harvest. The 0-30 age classes of aspen and balm-of-Gilead cover types represent young, early succession forest in this plan. Currently, these two cover types comprise 32.5 percent of the timber land acres while the long-term goal is that to have them comprise 30 percent of the acres. Currently, 60 percent of these cover type acres 3,164 acres is in the 0-30 age classes while the long-term goal is 61 percent, or 2,978 acres.

Oak acres will increase and aspen/balm of Gilead acres will decrease over the course of the planning period. Oak, northern hardwoods and aspen/balm of Gilead are currently the predominant forested cover types and that will continue to be the case.

Some stands will be managed to maintain or increase within-stand species and structural diversity. Oak will be increased as a component in the northern hardwoods cover type. Moving northern hardwoods stands toward an uneven-aged structure is a desired outcome of this plan.

The HH SFRMP Team completed an initial patch assessment based on CSA data for the Subsection. Parcel size, natural mixes of upland and lowland, and the need to mix habitat age structure on management units eliminate opportunities to designate patches in the Subsection. Objectives of patch management will be accomplished by generally managing whole stands, trying to group harvest treatments, and not fragmenting existing large old forest areas.

Vegetation management will provide a broad range of habitats that meet the needs of most game and nongame wildlife species (coarse filter approach) while providing specific habitat needs for individual species (fine filter approach) when needed. The goal is to provide healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species. In some cases, strategies will attempt to reduce the negative impacts caused by wildlife species on forest vegetation.

Riparian areas will be managed to provide habitat for fish, wildlife, and native plant species. The MFRC Voluntary Site-Level Forest Management Guidelines will be applied on all state lands, and as a general rule DNR will meet or exceed these guidelines. Management of riparian areas along streams is important from a fisheries perspective to maintain/improve water quality for native and introduced fish species. Forest management strategies to maintain/improve water quality will be implemented.

Minnesota County Biological Survey (MCBS) work is currently completed in all of the counties in the Subsections with the exception of Clearwater County. MCBS sites with statewide biodiversity significance rankings of Outstanding or High were determined to be of importance in this SFRMP. Strategies have been developed to manage forest land in these MCBS sites while maintaining the biodiversity significance factors on which the MCBS sites were ranked. On all state lands, known locations of rare plants and animals and their habitats and rare native plant communities (especially those with a conservation rank of G1, G2, S1 or S2) will be protected, maintained, or enhanced in the Subsection.

The treatment level (i.e., harvest, etc.) recommended for the 10-year plan is approximately 4,475 cords per year, compared to an estimated 3,959 cords per year during the decade preceding this planning period. This treatment level reflects a sustainable harvest level for timber management in the Subsection. The proposed level is a 13 percent increase in the estimated volume. Based on cover type treatment modeling (using a harvest-scheduling model), treatment levels will fluctuate each decade as the plan attempts to achieve the desired age-class distributions in all the cover types. Strategies such as intermediate treatments and harvests in younger age classes will be implemented to increase timber productivity and quality, and to increase the average harvestable volume per acre growing on state lands over time.

Other topics addressed in the plan include: protecting wetlands and seasonal ponds; limiting damage from insects, disease, and non-native invasive species; minimizing forest management impacts on visual quality; mitigating climate change effects on forest lands; planning of new road accesses; protecting cultural resources; and evaluating disturbance events (e.g., fire and wind).

DNR Personnel Involved in Developing the SFRMP

SFRMP Core Team Members

Division of Forestry
Martin Wiley – Area Forestry Supervisor – Park Rapids Forestry Area
Peter Willis - Assistant Area Forest Supervisor - Little Falls Forestry Area
Jeff Edmonds – Regional Timber Program Forester – Northwest Region
Division of Fish and Wildlife
Beau Liddell – Area Wildlife Supervisor – Little Falls Wildlife Area
Erik Thorson – Regional Forest Wildlife Coordinator – Northwest Region
Division of Ecological and Water Resources
Becky Marty – Regional Plant Ecologist – Northwest Region

Field Participants/Consultants*

Fred Bengtson – Area Wildlife Manager – Central Region
Jon Drimel – Program Forester – Bemidji Forestry Area
Shelley Gorham – Area Wildlife Supervisor – Bemidji Wildlife Area
Chris Gronewold – Assistant Regional Plant Ecologist – Northwest Region
Jim Gubbels – Area Forestry Supervisor – Bemidji Forestry Area
Ross Hier – Assistant Area Wildlife Manager – Crookston Wildlife Area
Erica Hoaglund – Regional Nongame Specialist – Central Region
Blane Klemek – Assistant Area Wildlife Manager – Bemidji Wildlife Area
John Korzeniowski – Area Forestry Supervisor – Little Falls Forestry Area
Kevin Kotts – Area Wildlife Supervisor – Glenwood Wildlife Area
Tom Kucera - Assistant Area Wildlife Manager – Detroit Lakes Wildlife Area
Howard Mooney – Program Forester– Park Rapids Forestry Area
Don Schultz – Area Wildlife Supervisor – Fergus Falls Wildlife Area
Nick Snavely - Assistant Area Wildlife Manager – Sauk Rapids Wildlife Area
Hannah Texler – Regional Plant Ecologist – Central Region
Brian Torgusson –Wildlife Technician – Detroit Lakes Wildlife Area
Terry Wolfe – Area Wildlife Supervisor– Crookston Wildlife Area
Doug Hedtke – Assistant Area Wildlife Manager – Fergus Falls Wildlife Area
Jeff Straub – Forestry Technician – Bemidji Wildlife Area

Geographic Information Systems (GIS) Support

Chris Scharenbroich – Wildlife GIS Specialist – Northwest Region

Planning Support

Amy Huseby – Regional Forestry Office Specialist - Northwest Region
Pat Matuseski – Planner, Principal – Northwest Region

Table of Contents

Ch. 3: Plan Direction and Strategies

***Note**: The maps (in color) and this report are available on CD and also the DNR Web site at:*
http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/index.html

Introduction

Planning Area Description

This Subsection Forest Resource Management Plan (SFRMP) process focuses on state forest lands administered by the Department of Natural Resources (DNR), Divisions of Forestry, Fish and Wildlife – Wildlife Section in the Hardwood Hills Subsection's landscape units. The Subsection covers approximately 3.5 million acres in an area from near Mentor in the northwest to near Clearbrook in the northeast, and from near Paynesville in the southwest to near Clearwater in the southeast. (See *Maps Appendix P*) For more detailed land descriptions, refer to chapters 1 through 3 of the Preliminary Issues and Assessment, at:
http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/preliminary.html

Recreation and agriculture are major uses of land in the subsection. Public agencies administer approximately 2.5 percent of the land, with the state portion being approximately 57,000 acres or 1.6 percent. Approximately 18,019 acres of the state land is timber land that will be considered for wood products production and other resource management objectives in this plan. Other cover types on Forestry or Wildlife
Lands, totaling 27,000 acres are non-forested and may be considered to meet other resource management objectives. Other than considerations for old-growth, patches and ecologically important lowland conifers, state lands totaling 14,000 acres in State Parks and Scientific and Natural Areas were not included in this plan.

In addition, the federal government owns approximately 30,000 acres (less than one percent) that are managed by the U.S. Fish and Wildlife Service as part of the Tamarac and Rydell National Wildlife refuges and waterfowl production areas in the Subsection. Becker, Clearwater, Douglas, Mahnomen, Meeker, Morrison, Otter Tail, Polk, Stearns, Todd and Wright counties own and manage 20,000 acres (less than one percent). Tribal lands comprise approximately 20,000 acres (less than one percent).Private owners control approximately 3 million acres (87 percent). There are no industrial forest lands in the Subsection For more details about land ownership, refer to Chapter 2 of the Preliminary Issues and Assessment, at
http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/preliminary.html

Figure 1a: Land Ownership in the Hardwood Hills Subsection

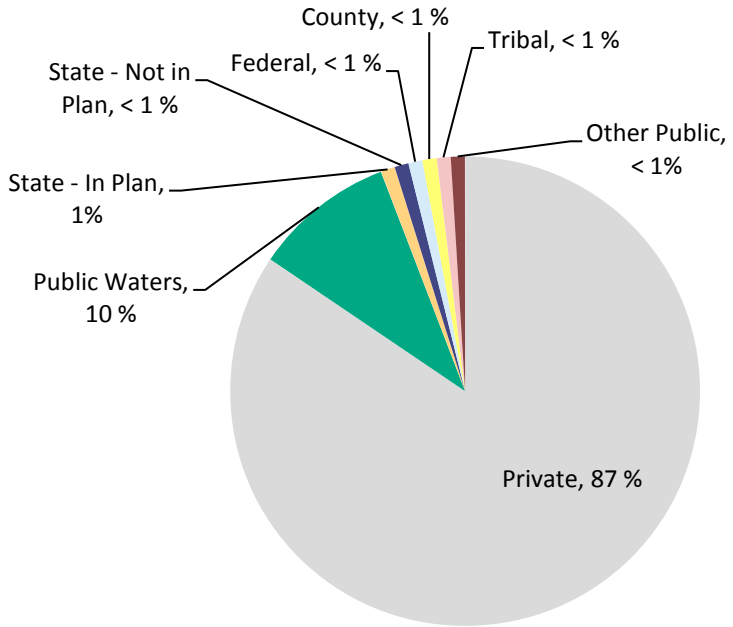


Table 1a: Land Ownership in the Hardwood Hills Subsection (Acres)[1]

Ownership status	Acres (percent)
Private	3,017,571 (87%)
Federal	29,932 (<1%)
Tribal	19,882 (<1%)
Public Waters	335,636 (10%)
State Included in Plan	
~ Forestry	14,911 (<1%)
~ Fish and Wildlife	28,348 (<1%)
State Excluded from Plan	13,953 (<1%)
County	20,195 (<1%)
TOTALS	**3,480,428**

[1] Source: 1976 to 1998 Minnesota DNR GAP Stewardship <Updated 2007>
[2] Includes all lands administered by Divisions of DNR including Forestry, Fish and Wildlife, Parks and Trails, and Ecological and Water Resources. SFRMP only covers Division of Forestry and Section of Wildlife administered lands

Based on the Gap Analysis Program (GAP) classification was completed by the DNR Division of Forestry using satellite imagery of all lands in the subsection, 14 percent of the land area (non-water) is covered by forest. Aspen, northern hardwoods and oak cover types comprise approximately 90 percent of this forest. 65 percent of the subsection land area is cropland or grasslands.

The aspen/balm of Gilead (5,274 acres, 32.5%), northern hardwoods (4,532 acres, 28%), and oak (4,732 acres, 29.2%) cover types comprise the vast majority of the subsection's timberlands under state ownership. Table 1.1b shows the general cover type percentages for all ownerships based on GAP data for forested classes of land and for state lands in this SFRMP based on state land forest inventory data (CSA – Cooperative Stand Assessment).

Table 1b: Generalized Forest Cover Type Composition for state administered lands in the Subsection

Cover Type Group	State lands in SFRMP (CSA acres)[1]
Aspen, birch, and balm-of-Gilead	5,274
Northern hardwoods (maple, basswood)	4,532
Oak (red, bur, etc.)	4,732
Pine (red pine, scotch pine, white pine, and jack pine)	256
White spruce, balsam fir, and upland black spruce	190
Lowland conifers (black spruce, tamarack, and white cedar)	758
Ash/lowland hardwoods	458
Brush/Grass	11,305

[1]Includes all lands administered by Divisions of DNR including Forestry, Fish and Wildlife, Parks and Trails, and Ecological and Water Resources. SFRMP only covers Division of Forestry and Section of Wildlife administered lands

For additional information, see the Hardwood Hills Preliminary Issues and Assessment August 4, 2011 at the following web link: http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/preliminary.html

Scope of Subsection Forest Resource Management Plan

Subsection Forest Resource Management Plan (SFRMP)

ECS Subsections in Minnesota (Hardwood Hills Subsection is highlighted)

A SFRMP is a DNR plan for vegetation management on forest lands administered by the DNR Division of Forestry and Section of Wildlife. Vegetation management includes actions that affect the composition and structure of forest lands, such as timber harvesting, thinning, prescribed burning, biomass harvest and reforestation. The geographic area covered by these plans is defined by Ecological Classification System (ECS) subsections (Appendix A). The SFRMPs will also consider the condition and management of forest lands not owned by the DNR, but will only propose forest management direction and actions for DNR lands. The amount of DNR-administered forest lands within forested subsections varies across the state. Examples of forest resource management planning activities that are beyond the scope of SFRMPs are: OHV trail system planning, comprehensive road access plans, state park land management planning, old-growth forest designation, SNA establishment, wilderness designation, wildlife population goals, cumulative effects analysis at the watershed-level, fire management, and recreation facilities/systems planning.

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.

The SFRMP process is divided into three steps. In Steps 1 and 2, the subsection team prepares information to assess the current forest resource conditions in the subsection and identify forest resource management issues that will be addressed in the subsection plan. In Step 3, the subsection team finalizes the issues and develops general directions and strategies to address these issues. The strategies will help in developing the cover type management recommendations, stand-selection criteria, and stand treatment levels. In this step, stands to be evaluated for treatment during the 10-year plan period are also selected and preliminary prescriptions are assigned. There are two opportunities for public input during the plan's development.

ECS Subsections

The DNR has developed an Ecological Classification System (ECS) as a tool to help identify, describe, and map ecosystems. ECS units are defined by climatic, geologic, hydrologic, topographic, soil, and vegetation data. The DNR ECS divides the state into six levels of ecological units, each level nested

together within the next higher level. Subsections are the third level down in the ECS hierarchy in Minnesota. There are 17 forested subsections in the state, ranging in size from 339,285 to 3,657,011 acres.

Goals for the Planning Effort

While the planning process will produce many tangible "products," such as assessment information, issues, and strategies, the end result of the planning process will be two key products:

Desired Future Composition (DFC) goals

The goals will include long-term (50 years or more) and short-term (10 years) desired changes in the structure and composition of DNR forest lands in the subsection. Composition goals could include the amount of various cover types, age-class distribution of cover types, and their geographic distribution across the subsection. DFC goals for state forest lands will be developed from assessment information, issues, the general direction identified in response to the issues, and strategies to implement the desired management direction.

List of DNR forest stands to be treated over the next 10-year period.

SFRMPs will identify forest stands on DNR Forestry, Fish 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 DFCs. 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. Decisions will be made based upon the management activities (including no action) that will best move the forest landscape toward the DFC goals for state forest lands.

Who Develops SFRMPs?

SFRMP team members include DNR forestry, wildlife, and ecological and water resources staff. A list of SFRMP team members for the subsection is on Page v. These teams have primary responsibility for the work and decision making involved with the subsection plans. Decision-making by the team is through an informed consent process. Managers of adjacent county, federal, tribal, and industrial forest lands may be invited to provide information about the condition of their forest lands and their future management direction. Data relating to all ownerships are used in the planning process. This information will help the DNR make better decisions on the forest lands it administers.

SFRMP and MFRC Regional Landscape Planning

The recommended desired outcomes, goals, and strategies developed for the North Central and West Central Landscape regions by regional landscape committees under the direction of the Minnesota Forest Resources Council (MFRC) Landscape Program were considered in developing this SFRMP. By considering the recommendations from the landscape region plans, the decisions for management of DNR-administered lands incorporate

recommendations from a broader landscape perspective across all ownerships and assists in cooperation across ownerships in this larger landscape area.

SFRMP Process Overview

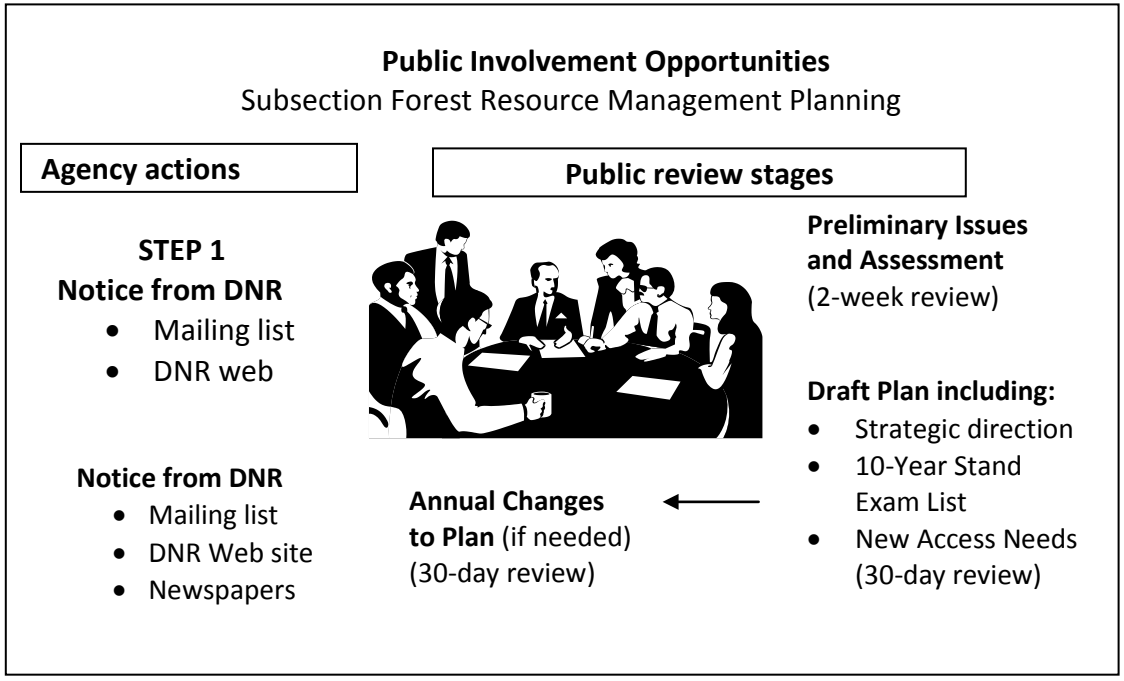
Table 1.1c outlines the steps in the DNR SFRMP process. As of this printing, this SFRMP is in the third step of the process, i.e., the DNR interdisciplinary team has developed general directions and strategies to address the final list of issues, established desired future forest composition goals for DNR lands in the subsection, developed stand-selection criteria, and identified stands to treat over the 10-year planning period. Figure 1.1b shows the opportunities for public involvement during the planning process.

Table 1c: SFRMP Process Overview

Step 1	**Initiating the Planning Process** • DNR forms interdisciplinary team for the subsection(s). • DNR staff assembles base assessment information. • Web page is established for the subsection on the DNR Web site. • DNR develops mailing list of public/stakeholders. • Public is informed that the planning process is beginning in the subsection, the estimated schedule for the planning process, and how and when they can be involved.
Step 2	**Assessment and Issue Identification** • Subsection team adjusts and supplements the base resource assessment information for the subsection. • Team identifies the preliminary issues to be addressed in the plan. • DNR posts assessment information and the preliminary issues on the DNR's web site for public review and input.
Step 3	**Strategies, Desired Future Forest Composition, and Stand Selection Criteria** • DNR finalizes the list of issues to be addressed in the plan based on public input from Step 2. • Subsection team develops general direction statements (GDSs) in response to the final list of issues. • Subsection team and work groups develop strategies and desired future forest composition (DFC) goals consistent with the general direction. • Team develops stand-selection criteria to help identify DNR forest stands for treatment over the 10-year planning period to move toward the goals. • DNR distributes GDSs, DFC goals, strategies, and stand-selection criteria for public review and comment. **Draft List of Stands to be Treated and New Access Needs** • Subsection team finalizes DFC goals, strategies, and stand-selection criteria. • DNR personnel identify state forest land stands to be considered for treatment over the 10-year planning period.

	• DNR personnel identify new access needs associated with the list of stands proposed to be treated. • Draft list of stands to be treated and new access needs is distributed for public review and comment.
Step 4	**Final Plan** • Subsection team summarizes public comments and develops DNR responses. • A summary of comments, responses, and plan revisions are presented to the department for the commissioner's approval. • Commissioner approves final plan. • Final plan is distributed, including summary of public comments and DNR responses.

Figure 1b: Public Involvement Opportunities



Public involvement will, at a minimum, occur through:

- Posting of the initial assessment information (via the DNR's Web site).

- A public comment period to help identify key forest management issues and solicit public opinion of preferred management direction.
- A public comment period to review the draft plan and strategic direction (i.e., general direction, forest management strategies, and DFCs 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.

Contents of Document and Focus of Current Review

This document contains products developed by the SFRMP interdisciplinary team for public review as part of Step 3 in the planning process. Those products include the final list of issues addressed in the plan, GDSs and strategies to address the issues, DFC goals, stand-selection criteria, cover type management recommendations, draft 10-year stand examination list, and a list of new access needs.

In Step 2 of the process, the interdisciplinary subsection team identified a preliminary list of issues to be addressed in the plan. These issues were developed based on the general field knowledge of department staff and forest resource information assembled by the subsection team in the Preliminary Issues and Assessment. The preliminary list of issues and their descriptions were distributed for public review and comment in August 4 2011. This list of issues is presented in Chapter 2 of this draft plan as the final list of issues to be addressed in the plan.

In Step 3, the subsection team developed GDSs and strategies to address the final list of issues. Strategies developed by the work groups are based on existing DNR policies/mandates, technical expertise from within and outside the subsection team, forest resource information from the Preliminary Issues and Assessment and other sources, and public input from Step 2 of the process. Strategies developed to address the various issues were then examined to ensure consistency with each other, to identify and group similar strategies. The strategies presented in this document are the product of this effort to develop a refined list of strategies to address the final list of issues.

The subsection team developed the DFC goals based on current conditions on DNR forest lands in the subsection, and on the output of the harvest-scheduling model. DFC goals are most commonly expressed in terms of desired changes in the age-class structure, the amount of various forest types within the subsection, and the geographic distribution of forest types and age classes across the subsection.

GDSs, strategies, DFC goals, and cover type management recommendations were used to define proposed criteria to select a pool of forest stands for treatment over the 10-year planning period. Stand selection criteria can include: “normal” rotation ages (i.e., ages at which most forest stands will be harvested); extended rotation forest rotation ages (i.e., ages at which stands designated for older forest management will be harvested); potential productivity of the site for timber (i.e., site index); soil types; stand density, or stocking measures (e.g., basal area); tree species composition; brush and ground cover; stand size; stand location; insect and disease occurrence; and other specific criteria needed to address issues. Stand selection criteria presented in this document are those identified by the subsection team as most likely to move DNR forest lands toward the identified DFC goals for these subsections.

The final plan includes summaries of comments received during Step 2 of the process and those received during the public review of the final plan. Where appropriate, specific references are provided as to where and how comments and concerns were incorporated into the final issues, strategies, DFC goals, or stand-selection criteria.

Public Review Period and How to Provide Input

The GDSs, strategies, DFC goals, stand-selection criteria, cover type management recommendations, draft stand examination list, and list of new access needs in this draft plan will be available for a 30-day public review and comment period. This document is available on the DNR web site at: http://www.dnr.state.mn.us/forestry/subsection/HardwoodHills/index.html , or upon request as hard copy or CD. Public comments or requests for a copy of the plan can be submitted via the Web site or submitted to:

Pat Matuseski; DNR Forestry; 2115 Birchmont Beach Road N.E.; Bemidji, Mn., 56601 or pat.matuseski@state.mn.us

Next Step

The SFRMP team will use the comments received during this public review step to finalize the GDSs, strategies, DFC goals, cover type management recommendations, new access needs, and stand examination list. A final plan, including a final stand examination list will be published after public comments are incorporated.

Chapter 2: SFRMP Issues

Page

Introduction

How SFRMP Issues Were Identified

Subsection Forest Resources Management Plan (SFRMP) teams used assessment information[1], Minnesota Department of Natural Resources (DNR) policies and guidelines, local knowledge, existing plans, and public input to identify the final issues relevant to the scope of this plan. The subsection team began with a common set of issues developed from previous SFRMPs. These common SFRMP issues were refined and supplemented based on subsection-specific conditions and considerations and public comments.

Issue Definition

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 divisions of Forestry, Fish and Wildlife, and Parks and Trails. Relevant issues were 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 a SFRMP is whether the issue can be addressed in whole or substantial part by vegetation management decisions on DNR-administered lands.

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, a 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 that with respect to wildlife populations, the plan establishes wildlife habitat goals (e.g., amount of various cover types and age-class distribution) but not goals for wildlife population levels.

Issues

Issue topics A through M were identified as “Preliminary Issues” in the first steps of the SFRMP process

[1] Minn. DNR, August 2011, *Preliminary Issues and Assessment*, Subsection Forest Resource Management Plan.

A. Desired Age-Class Distribution

A1. What are the desired age-class and growth-stage distributions of forest types across the landscape?

Adequate representation of all age classes and growth stages provides a supply of wildlife habitats, timber products, and ecological values over time. A forest with a variety of stand ages and growth stages provides habitat suitable for more species and has greater potential to provide a sustainable yield of timber. A diverse forest is healthier and more resilient to widespread insect and disease outbreaks and the effects of climate change, than a less diverse forest.

There are many likely consequences of managing a non-diverse forest (without adequate representation of all age classes and growth stages); a forest with too few age classes and growth stages risks epidemic insect and disease outbreaks; loss of species with age-specific habitat requirements; long-term loss of forest productivity; and, the 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 particular forest products over time.

A2. What are the appropriate amount, kind, and location of old forest?

Old forest, in the context of this issue, is defined as stands that exceed their normal rotation age. The distribution of old forest represents age classes and growth stages of forest beyond the normal rotation age of each cover type. Old forest provides essential habitat for some animal, plant, and fungi species and provides optimal habitat for other species. Old forest also allows the development of late successional growth stages and communities, and increases overall structural and species diversity on the forest landscape. Old forest can also reduce timber quantity and quality for some types of forest products over time by holding timber longer between harvests. Old forest also produces large trees for sawmill. Therefore, a balance is needed that considers essential habitats, forest diversity, and timber production.

The likely consequences of managing a forest *without* age classes beyond the normal rotation age are the loss of individuals or populations of species with old forest-specific habitat requirements; loss of diversity; reduced recreational and economic opportunities associated with the loss of old forest values such as rare bird watching, fall color viewing, mushroom gathering, and camping; reduced ecological services associated with old forest values such as maintaining water quality, natural disturbance regimes, and biodiversity; and, the loss of potential for some large-diameter forest products (sawtimber, cabin logs, etc).

The likely consequences of managing a forest *with* an overabundance of age classes beyond the normal rotation age are reduction in populations of species that use younger forest habitats; decreased timber production; and, decreased timber quality and quantity due to decay, disease, windthrow, and mortality.

A3. What are the appropriate amount, kind, and location of young, early successional forest?

Young, early successional forest is defined here as the 0-30 age group of aspen and balm-of-Gilead cover types

Young, early successional forest is an issue because it provides important habitat for several plant and animal species that must be represented on the landscape to maintain overall biodiversity. These plant, game, and nongame species are important to those who use state forestlands. Some species depend on dense young forests to provide cover from predation and an ample supply of available foods. In addition, the patch size and spatial distribution of this young forest on the landscape is an important element of habitat quality.

Currently, significant acres of young age classes exist in the aspen, balm of Gilead and cover types. 2,831 acres (17%)

If an appropriate amount of early successional forest does not occur in the landscape, the likely consequences of *not* addressing this issue are reduced populations of important game species, particularly ruffed grouse, deer, moose, and American woodcock; reduced recreational hunting opportunities associated with these game species; reductions in some associated songbird populations; loss of social, economic, and ecological value of these species; and' loss of traditional use of the natural resources associated with these young forests (e.g., berry picking).

B. Desired mix of forest composition, structure, spatial arrangement, growth stages, and Native Plant Communities

B1. What is the appropriate forest composition, structure, representation of growth stages, within-stand diversity, spatial arrangement of vegetative types, and native plant community distributions necessary to maintain sustainability goals for biodiversity, forest health, and productivity across the three subsections? How do we get there?

The subsection has experienced changes that represent a movement away from ecological diversity. Since European settlement, forest composition and structure have been simplified. White pine, white spruce, pin oak, bur oak, black spruce, tamarack, cottonwood/willow and ironwood have declined while ash, aspen, balm of Gilead, basswood, box elder, elm, jack pine, paper birch, red maple, red oak, red pine, yellow birch and balsam fir have increased. For more information please see the preliminary assessment document at the following website:

http://files.dnr.state.mn.us/forestry//subsection/hardwoodhills/sfrmp_hardwoodhills_PreliminaryIssuesAssessment.pdf

Many forest stands today are not as diverse as they were historically. The age structure of the forest has been truncated (cut short) compared to historical conditions. Currently more of the forest is in younger age classes and less in older age classes. Harvesting and other factors have reduced

forest patch size. The forest is becoming increasingly fragmented by construction of roads, trails, and residential development. Ongoing sales of large tracts of land by private corporations will undoubtedly exacerbate forest change. Habitat connectivity has suffered as a result of these changes.

The likely consequences of *not* addressing this issue are: loss of wildlife habitat; loss or reduction of species associated with declining habitats; increase in non-native invasive species; increase in populations of desirable species to the point where they reach undesirable levels; dominance of a few species (i.e., loss of biodiversity); loss of ecologically intact landscapes; loss of ability to produce a diversity of forest products (e.g. sawtimber, aesthetics, nontimber forest products, recreation, and tourism); and, reduced resilience to disturbance and climate change.

B2. How will we ensure restoration of important component tree species that have declined within forest communities in the subsection?

Declines in many species have occurred in the subsection. For example, oak has declined in mesic (moderately moist) hardwood forests and mesic mixed forests. These declines have resulted from historic harvests that were not sustainable, insect infestations, disease, drought, and browsing by wildlife). As a result, the composition, structure, and function of many forest stands no longer resemble that of (historic) native plant communities. This results in a loss of regenerative capacity for these tree species, and also the composition and structure necessary to sustain associated species. Many of these tree species are difficult to regenerate due to browsing (e.g., white-tailed deer), lack of large downed trees (for nurse logs and to create micro-sites for seed germination and plant and wildlife habitat), spruce bark beetles, white pine blister rust, and a lack of seed trees.

The likely consequences of *not* addressing this issue are: loss of native tree species diversity within forest communities; simplified forest stands and landscapes; loss of native plant community composition, structure, and function; loss of associated wildlife to the ecosystem; loss of the social, economic, and ecological values provided by these species and the forest communities that sustain them; and, reduced resilience to disturbance and climate change.

B3. How will we maintain forest communities of particular concern in the subsection?

Certain native plant communities are of particular concern in the subsection because of their global or statewide rarity, limited occurrence in the subsection, known association with rare species or significant changes in composition as compared to historical examples. Examples of these types of forest communities in the subsection are: FDc23a2; FDc34a; FFs59c; FPs63a; MHs39c; UPn13b; UPn13c; UPn13d; Ups14a; Ups14b; and, WFs57a There is a concern for maintaining the composition, structure, and function of high-quality examples of these native plant communities.

The likely consequences of *not* addressing this issue are: loss of examples of high-quality intact native plant communities used as controls to compare and monitor the effects of management on biodiversity; continued forest stand and landscape simplification; loss of habitat for rare species; and, a loss of (reduction in) overall forest biodiversity and sustainability.

B4. How can intensive management of forest communities be adapted to retain some of the characteristics of natural stand-replacement disturbance events?

Intensive management of forest communities often results in forest simplification and fragmentation of native plant communities at the stand and landscape scale. Even in fire-dependent systems, where the natural disturbance events (e.g., wind and fire) were "stand replacing", the resulting forest mosaic included undisturbed islands of vegetation. These areas were *refugia* (areas where plants and animals persisted through a wind or fire event). In addition, natural catastrophic events typically leave a considerable number of standing dead and live trees.

Plantations often include ground-disturbing activities such as rock-raking and herbicide application that can further reduce plant species and structural diversity in the forest community. It may result in disruption of the soil profile, soil compaction, loss of native herbaceous species diversity, reduced structural complexity, and an increase in non-native invasive plants such a smooth brome grass and reed canary grass and aggressive native plants such as bracken fern, Canada blue-joint grass, , and raspberry.

The likely consequences of not addressing this issue are: increasing simplification of forest stand and landscape communities; fragmentation of high-quality native plant communities; loss and fragmentation of habitat for associated wildlife and native plant species; and, loss of forest sustainability.

B5. How can management on state lands, especially large patch management, better reflect natural landscape patterns (the size and configuration of growth stages and types resulting from broad-scale natural disturbances) in the subsection?

Existing landscape patterns do *not* reflect natural disturbance patterns and the composition, structure, and function of native plant community complexes that have developed historically over long periods of time. In particular, large patches and older growth stages are much less frequent in managed forest landscapes than they were historically. This has resulted in problems with: fragmentation and simplification of forest ecosystems at the landscape scale; lowered availability of habitat complexes and associations; and, reduced habitat for native animals and plants.

The likely consequences of *not* addressing this issue are: increasing isolation of wildlife and plant populations; species loss or decline; reduced resilience of forest ecosystems to disturbance events; and, increases of certain populations to undesirable levels resulting in negative impacts to forest communities.

B6. How do we limit forest fragmentation and maintain connectivity among habitats?

In the subsection, harvesting and other factors such as road and trail construction and residential development have reduced forest patch size, composition, structure, and age. These changes have reduced biodiversity and lessened the ability of the forest to produce a range of forest products. Habitat connectivity has suffered. Forest fragmentation results in a loss of resilience to change, habitat and loss or reduction in the population of species associated with those habitats. Loss of connectivity will result in the loss of ecologically intact landscapes.

The likely consequence of *not* addressing this issue is a reduction in forest patch size and less connectivity between habitats.

C. Riparian and Aquatic Areas

C1. How can we address the impacts of forest management on permanent wetlands, wetland inclusions, and seasonal ponds?

Site-level considerations and guidelines that are routinely applied without considering site-specific conditions may not be adequate to protect aquatic resources such as permanent wetlands, wetland inclusions, and seasonal ponds.

Relying strictly on existing guidelines without considering specific conditions associated with a given site, such as soils, topography, hydrology, past management, existing vegetation, and desired vegetation may negatively affect these ecosystems.

The likely consequence of *not* addressing this issue is a loss or degradation of these communities and loss of associated wildlife. There is also concern for impacts to permanent wetlands from management activities in adjacent upland stands, such as skid trails along the wetland-upland boundary.

C2. What vegetative management activities will be allowed to take place within the riparian management zone (RMZ) and how will the appropriate width of the RMZ be determined to minimize the impacts of forest management activities on water quality, fisheries, and wildlife habitat?

Management activities carried out within the RMZ can affect the functions associated with riparian areas. RMZs are areas of special concern along streams, lakes, and open water wetlands and are among the most important and diverse parts of ecosystems. Management activities in the RMZs are intended to retain a relatively continuous cover for the protection and maintenance of aquatic and wildlife habitat, aesthetics, recreation, and forest products.

Historically, northern Minnesota streams maintained cold-water temperatures, but over the last 100 years the vegetation has changed dramatically due not only to past logging practices and subsequent fires, but also to more recent changes in land use such as commercial and residential development near lakes and streams. Stream temperatures have increased, becoming marginal for trout in a number of streams.

The subsection includes many lakes, rivers, wetlands and streams. Failure to protect riparian zone functions may cause negative impacts to the water quality, fisheries, and wildlife habitat in the planning area.

The likely consequences of *not* addressing this issue are a reduction in water quality in streams and rivers in the Subsection and a reduction of associated plants and animals associated with the riparian zones in the Subsection.

C3. How can we address cumulative impacts to aquatic resources of forest management on a watershed/sub-watershed level?

Forest management activities may greatly affect the hydrology within any specific watershed or sub-watershed because the amount and type of vegetative cover greatly influences the rate of hydrologic change. Failure to consider the cumulative impacts to aquatic resources could result in increased run-off and stream bank erosion, more conspicuous run-off events, less stable flows, and reduction or destruction of habitat for aquatic organisms resulting in poor water quality.

Issue is beyond the scope of this plan: This SFRMP will not address this issue for the following reasons: 1) the issue cannot be addressed in whole or a substantial part by vegetation management decisions on DNR-administered lands. State-administered timber lands (see table 3.1 of Preliminary Assessment for the Hardwood Hills Subsection) comprise 16,213 acres or less than one percent of the land ownership in the subsection. To fully evaluate cumulative impacts within watersheds, timber and biomass harvest, forest and agriculture development, and current and proposed forest land-use changes need to be evaluated across all ownerships. 2) A standard definition for young forest and a critical threshold for the amount of young forest and open forest within a watershed need to be established to evaluate cumulative impacts uniformly in watersheds in Minnesota.

Future SFRMPs may include a current assessment of young forest on DNR ownerships in watersheds where DNR forest lands contain a significant portion (e.g., more than 50 percent) of the land ownership. This would be done to identify watersheds of particular concern that could serve as subject areas of a focused study such as the one mentioned above. If a process is developed to monitor cumulative impacts of forest management at the watershed level across all ownerships, the DNR will be a participant/cooperator.

D. Access to State Land

D1. How can we plan for access to the stands identified for management during the 10-year plan period while protecting and minimizing the negative impacts that timber access development or use may have on other forest resources?

Access routes are necessary to effectively manage forest stands identified for management during the 10-year planning period. These access routes will have both positive and negative attributes. They provide access for forest management activities, insect and disease control, fire response, and recreation. However, the development, construction, and maintenance of forest access routes also results in land disturbance, loss of acres from the timberland base, increased spread of non-native invasive species and undesirable native plants and animals, potential conflicts with adjacent private landowners, potential for user-developed trails, degradation of water quality, destruction of fish habitat, forest fragmentation, and increased road densities..

The likely consequence of *not* addressing this issue is the lost opportunity to have a well thought-out forest access plan to minimize the negative attributes.

E. Biological Diversity

E1. How can management of stands within areas of biodiversity significance be adapted to enhance biodiversity and native plant community composition, structure, and function?

Areas with biodiversity significance provide reference areas to improve our understanding of these ecosystems and help us evaluate the effects of vegetation management on biodiversity. These areas present opportunities for large patch management of older forest communities and the restoration of forest communities and ecosystems. These areas have great potential for addressing forest certification, landscape level goals, and biodiversity-related goals of the Minnesota Department of Natural Resources and other landowners.

The likely consequences of *not* addressing this issue are; degradation of existing biodiversity and ecosystem function; loss of opportunities for maintaining or restoring patch relationships that are ecologically based (e.g., based on natural disturbance processes, wildlife habitat connectivity, and wildlife-habitat associations); the loss of landscape level habitat connectivity; and, the inability to maintain forest certification.

E2. How do we plan to retain and restore within-stand structural complexity (e.g., vertical structure, stem size and density, coarse woody debris, and pit and mound micro-topography) on actively managed lands?

Forests are dynamic ecosystems. Management of both public and private lands has altered the rate and direction of natural change. Current practices tend to reduce within-stand structural complexity and diversity of vegetation, both directly and indirectly (through substrate modification). The concern is that structure is impacted directly by management where the objective is usually maintenance of a simplified structure and by silvicultural practices where existing woody debris and finer organics are removed and micro-topographic features are reduced or eliminated.

The likely consequences of *not* addressing this issue are: loss of composition and vertical structure necessary to sustain native plant and animal species; loss of regeneration sites for some species; loss of native tree species diversity within forest communities; simplified forest stands and landscapes; loss of native plant community composition, structure and function; loss of associated wildlife; and, a reduction in overall biodiversity in these stands.

F. Wildlife Habitat

F1. How do we manage vegetation to balance the habitat needs of game and nongame species?

Forest wildlife is important to society. A wide range of factors, from timber harvest to development, has an effect on wildlife species and populations. Interest groups advocating for wildlife are many and varied. Some are interested in the full range of species while others are species specific. Interests include the preservation of biodiversity and management of individual species for hunting opportunities or for wildlife viewing. At times, the goals of these groups may conflict. Both game and non-game wildlife species depend on healthy ecosystems. Legal mandates, the expectations of stakeholders, and the Minnesota DNR internal policies require the ecological integrity of these ecosystems to be maintained and enhanced. Forest change affects forest wildlife. Some species' populations have increased in some subsections and decreased in others. Several species listed by the state as either threatened or of special concern live in these areas.

Loss of important habitat in our forests, brushlands and prairies is a reason for concern for a number of wildlife species. *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* [2] lists 85 Species in Greatest Conservation Need (SGCN) that are known or predicted to occur within the Subsection. Of these, 30 species are federal or state endangered, threatened, or of special concern. A wide range of factors from timber and biomass

[2] Minnesota Department of Natural Resources, 2006.*Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife*, Comprehensive Wildlife Conservation Strategy. Division of Water & Ecological Resources Department of Natural Resources.

harvest practices, to development have an effect on wildlife species and the ecosystems in which they inhabit. Best Management Practices (BMPs) can and should be implemented to minimize impacts that could have a negative effect on habitat.

The likely consequences of *not* addressing this issue are: loss of wildlife habitat; loss or reduction of species associated with declining habitats; economic losses resulting from a decline in recreational activity associated with wildlife viewing and hunting; and, social losses because of a decline in enjoyment associated with wildlife viewing, hunting, and aesthetics.

G. Forest Health

G1. How do we address the impacts of forest insects and disease on forest ecosystems?

Forest insects and disease organisms influence forest ecosystem dynamics. These influences have both positive and negative impacts. What is perceived to be beneficial from one perspective may be viewed as detrimental from another. Insects and diseases can reduce timber production and lumber grade and increase fire hazard. Alternatively, they can promote diversity of tree species, direct forest development and forest structure and generate dead wood, which provides important habitat and soil nutrients.

Native insects and disease organisms are usually well-balanced with their respective host trees. A few trees may die while the insect and disease populations are sustained; basically, they co-exist. Where climate or management has altered the natural disturbance regime (e.g., prolonged drought or fire control), insects and disease organisms can 'take over' the role of fire in a fire-dependent forest. An example would be the increasing impact of jack pine budworm on senescing jack pine stands in the absence of wildfires, which normally would have caused stand re-initiation.

Non-native insect and disease organisms have not co-evolved with our tree species, so they can cause a range of problems once they become established. Effects can range from non-discernable effects to widespread and rapid tree mortality, depending on the organisms involved. For example, Dutch elm disease spread through Minnesota in the 1970's killing elms and altering riparian ecosystems. Emerald ash borer is our newest immigrant. Emerald ash borer, from eastern Asia, is expected to cause 99.99% mortality of black and green ash and cause deforestation of our Wet Forest sites as it spreads into our forests. We anticipate that it will take more than a few decades to accomplish the infestation of the 950 million ash trees that are currently growing in Minnesota.

The likely consequences of *not* addressing this issue are: reduced productivity in certain cover types; and, loss of critical wildlife habitat; loss of ability to grow certain variety of cover types.

G2. How will we respond to non-native invasive species threats/invasions?

Natural resource managers are concerned about non-native invasive species that are introduced and become established on public land. European and Glossy Buckthorn are two non-native invasive species of particular concern for the Hardwood Hills Subsection. Non-native insect and disease organisms have not co-evolved with our tree species, so they can cause a range of problems once they become established. Effects can range from non-discernable effects to widespread and rapid tree mortality, depending on the organisms involved. For example, Dutch elm disease spread through Minnesota in the 1970's killing elms and altering riparian ecosystems. Emerald ash borer is our newest immigrant. Emerald ash borer, from eastern Asia, is expected to cause 99.99% mortality of black and green ash and cause deforestation of our Wet Forest sites as it spreads into our forests. We anticipate that it will take more than a few decades to accomplish the infestation of the 950 million ash trees that are currently growing in Minnesota. Non-native invasive species have the potential to displace native species, carry or cause diseases, or disrupt natural community functions. On the other hand, there are good examples of the control of non-native invasive species. For example, introduced exotic beetles are controlling purple loosestrife populations. Some species managed for timber production (e.g., European larch) are non-native species. Increased use of public lands results in greater risk for the transport of invasive species of all kinds. Failure to address the non-native invasive species issue could result in permanent changes to native communities through invasion or displacement.

The likely consequences of *not* addressing this issue are: reduced productivity in certain cover types; a reduction in the quality of native plant communities; and, an inability to effectively regenerate cover types in affected areas.

G3. How will natural disturbances like fire and blowdown be considered in forest management decisions?

Catastrophic events such as wind and fire may have a negative impact on the amount of forestland "harvested" during the 10-year stand treatment time frame. They may also impact the long-term desired future composition (DFC) goals of the subsection plan. It is difficult to predict when and where a catastrophic event may occur. However, failure to consider what forest management practices might be allowed in disturbed areas could result in a loss of marketable timber available for sale, as well as an increase in fire danger in the vicinity of the catastrophic event.

The likely consequences of *not* addressing this issue are: a loss of timber productivity in affected stands; loss of viable timber source; and, an inability to effectively regenerate a damaged stand.

G4. How do we manage vegetation to reduce negative animal impacts?

Vegetation management directly affects wildlife populations. Undesirable increases in certain wildlife populations can have adverse impacts on plant

communities resulting from the browsing and grazing by wildlife (herbivory), crop depredation, nuisance animal complaints, potential spread of wildlife disease, and possible human health issues (e.g., Lyme disease).

The likely consequences of *not* addressing this issue are: loss of public support for management programs; undesirable competition between species; increased non-native invasive and other undesirable species; an increase in populations to the point they become a nuisance; negative economic impacts; and, negative impacts to native plant communities.

G5. How should forest management respond to global climate change within the planning period?

Canadian and Hadley climate model predictions for the Midwest (MacCracken *et al. 2000*[3]) suggest that the average temperature will have increased two to five degrees Fahrenheit by 2030 and five to twelve degrees Fahrenheit by 2095. In Minnesota uncertainty exists on how or if average annual precipitation will change. Seasonal precipitation patterns are predicted to change, however, with precipitation concentrated in fewer storm events leading to longer more intense droughts (*MNDNR-Section of Wildlife*[4]*, Galatowitsch et al. 2009*[5]).

Scientists believe that predicted climate change will affect the size, frequency, and intensity of disturbances and stresses such as fires, windstorms (blowdown), and droughts. It will affect the survivorship of existing plant and animal species and the distributions of plants and animals. Increases in the reproductive capability and survivorship of exotic species, insect pests, and pathogens will impact forests and wildlife.

Large-scale mortality due to a combination of drought stress, blowdown, fire, and insect damage is likely, and has led to rapid and widespread forest change in the past (*Galatowitsch et al. 2009*). Moisture is the most important limiting factor and fire is the most important disturbance in the forest-prairie transition zone which includes the Hardwood Hills Subsection. Certain tree species, such as black spruce, balsam fir, and birch will respond negatively to increased soil warming, decreased soil moisture, etc.

Because Minnesota is situated on the prairie-forest border, summer precipitation is already marginal for forests on some soils. Many contemporary forests are projected to become savannas, with forests restricted to cooler, wetter refuges, such as silty soils, lowlands, and north slopes. Although many of Minnesota's existing grasslands may persist, a gradual shift in composition to drier species (e.g. mesic prairie to dry prairie; dry oak savannah to prairie) will likely occur in response to higher temperatures and evapotranspiration (*Galatowitsch et al. 2009*). Carbon sequestration by forests and wetlands may be affected.

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[3] MacCracken M., E. Barron, D. Easterling, B. Felzer, and T. Karl. 2000. Scenarios for climate variability and change: the potential consequences of climate variability and change for the United States. U.S. Global Change Research Program, National Science Foundation, Washington, D.C.

[4] Climate Change: Preliminary Assessment for the Section of Wildlife of the Minnesota Department of Natural Resources

[5] Galatowitsch, S., et al. Regional climate change adaptation strategies for biodiversity conservation in a midcontinental region of North America. Biol. Conserv. (2009), doi:10.1016/j.biocon.2009.03.030

The likely consequences of *not* addressing this issue are: acceleration and exacerbation of climate change effects to forest communities; lost opportunity to begin directing management toward mitigating and slowing the effect of climate change on most vulnerable species and native plant communities; species and community losses; and, reduced habitat for use and occupation by native wildlife and plants.

H. Harvest Level

H1. What is the appropriate timber harvest level on state lands with consideration for the sustainability of all forest resources?

One of the primary outcomes of this plan is to develop a timber harvest plan for state forest lands in the subsection for the next 10 years. The harvest level will determine the future age-class distribution of the forest. Some of the cover types in the planning area have a pronounced age-class imbalance and the harvest level will be the primary tool used to correct this imbalance over time.

Establishing an appropriate timber harvest level will require the successful integration of economic, social, and ecological factors. Timber harvest provides forest products for society and jobs for those in forest-related industries. Demand for timber is expected to grow in most parts of the state once the economy picks up. Managing for sustainability requires that we balance timber harvest with other forest benefits. Sustainably managed forests can support a healthy and competitive timber industry, provide the diversity of habitats needed by plant and animal species, maintain water quality, and provide a wide array of recreational opportunities.

The likely consequences of not addressing harvest levels and age-class imbalance are: an unpredictable supply of timber and biomass for industry; reduced diversity of habitat for use and occupation by native plants and animals; and, continued age-class imbalance across the landscape.

H2. How can we ensure adequate and sustainable “nontimber forest products” for the future?

Demand for some of these types of forest products has been light, for others it is increasing. Nontimber forest products (e.g. mushrooms and maple syrup) provide diversification for local economies and are a traditional harvest for some groups. Nontimber forest products are particularly important in areas where employment opportunities in the mainstream economy are limited. They help support local individuals, families, and cottage industries in an expanding worldwide market. For example, the Christmas wreath industry is a multi-million dollar enterprise in Minnesota that relies on thousands of individuals who collect boughs in the forest.

The likely consequences of *not* addressing this issue include: the possible unsustainable harvest of these resources; adverse impacts to wildlife habitat and native plant communities; loss of diverse economies in rural communities; and, inadvertent harvest of rare species.

I. Timber and Biomass Productivity

I1. How can we increase timber productivity on state lands?

Forests on public lands are managed using a variety of strategies that produce timber products as well as wildlife habitats, recreational values and scenic values. Timber products from state lands provide approximately 25 percent of the requirements of the forest products industry, which is the sixth largest in Minnesota and a vital component of the economy. Timber sales are the means by which Minnesota DNR accomplishes most of its vegetation management; a diverse and healthy forest industry is therefore a critical component of our ability to manage forests. Increasing the productivity of state forest lands is a way to maintain or increase harvest levels on the same acreage, improve timber quality overall, reduce waste and foster a healthy forest industry in the state.

Timber productivity on state lands can be improved by: managing for plant communities and associated tree species that are best suited to the site to produce higher timber quantity and quality; increasing the health and resilience of the forest by enhancing the natural diversity of plant species to minimize or prevent losses due to insects and disease; focusing timber management activities on more productive soils and forest types; and, harvesting timber on productive sites at younger ages to minimize decay and volume loss.

A likely consequence of managing state forest lands without regard for increasing timber productivity levels is further decline in timber quality and quantity as older age classes continue to lose merchantable volume through disease and decay in the absence of a harvest. More acres would have to be harvested to produce equal volumes of useable forest products.

I2. How can sustainable biomass production be integrated into vegetation management?

Biomass harvesting has recently become a potential source of sustainable energy. Both grass and woody biomass resources on state owned lands can be viable alternatives to petroleum based fuels. Land managers within the Subsection have been maintaining open land and brushland communities by shearing, mowing, and prescribed burning. Biomass harvesting can be another tool to accomplish this maintenance.

Recently, a Brushland Biomass Harvesting chapter was added to the *MFRC Site-Level Guidelines* due to increased demand for woody biomass and recent biomass power legislation (M.S. § 216B.2424). These guidelines are best management practices for sustainably managing woody biomass harvest and are intended to be a tool for maintaining brushland and open land habitat on public and private lands.

The level of biomass production from lowland and upland brushland sites is directly correlated with the nutrient levels in the soils. The biomass guidelines state that high production sites have the greatest nutrient loss, but also have the greatest nutrient capital and highest rates of nutrient

replenishment—lost nutrients are usually replaced within 10 years. Less productive sites have lower nutrient replenishment rates, but biomass and thus nutrient removal are also lower.

These guidelines should not replace site-specific evaluations of woody biomass management techniques. Ongoing research will continue to quantify and qualify what level of woody biomass harvest is sustainable without adversely impacting these brushland and open land habitats.

The likely consequences of not addressing this issue are: loss of a valuable forest product; reduced productivity in stands where too much biomass is removed; and, increased management costs.

J. Visual Quality

J1. How will forest management activities minimize impacts on visual quality?

Scenic beauty, or visual quality, is a primary reason people choose to spend their recreation and vacation time in or near forested areas. Where forests include or are adjacent to recreational trails, lakes, waterways, or near public roads and highways there is a need to consider the impacts of forest management activities on the visual quality of the site after the forest management activity is completed.

Lack of sensitivity to the visual quality impacts of any management activity may result in a negative experience for the vacationing and recreating public in forested areas of the state and increased regulations for forest management activities.

The likely consequences of *not* addressing this issue are: public disapproval of forest management activities in their area; potential loss of tourism economy; potential loss of recreational activities in affected areas; and, increased public relations efforts.

K. Legal and policy requirements

K1. How will land managers achieve desired results and continue to uphold various state and federal statutes and departmental policies?

Divisions within the DNR must follow legal mandates, while fulfilling both Department and division missions. Vegetation management will take administrative land status and relevant statutes into consideration during the planning process. 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 protection is the primary objective for acquired Wildlife Management Area (WMA) lands. Another related example is the DNR commitment to certified sustainable forests, which requires the department to manage most MCBS sites of outstanding biodiversity significance as well as some areas of high

biodiversity significance as High Conservation Value Forest (HCVF), may require practices that reduce the near term income derived from timber harvest on these lands.

Failure to follow these mandates and legislative intent may be a violation of federal or state law. Failure to follow these may also cause a loss of certification for state lands.

L. Cultural Resources

L1. How will cultural resources be protected during forest management activities on state-administered lands?

Cultural resources are scarce, nonrenewable features that provide physical links to our past. A cultural resource is an archaeological site, cemetery, historic structure, historic area, or traditional use area that is of cultural or scientific value. Cultural resources are remaining evidence of past human activities. To be considered important, a cultural resource generally has to be at least 50 years old. A cultural resource may be the archaeological remains of a 2,000- year-old Indian village, an abandoned logging camp, a portage trail, a cemetery, food gathering sites such as wild rice harvesting and maple sugaring camps, or a pioneer homestead. They often possess spiritual, traditional, scientific, and educational values and should be treated as assets rather than liabilities. In addition to federal and state laws that protect certain types of cultural resources, the *Voluntary Site-Level Forest Management Guidelines* provide information and recommendations to assist private and public land managers in taking responsible actions when cultural resources are encountered.

Failure to follow the recommended management practices to protect cultural resources could result in loss of or damage to the cultural resource.

M. Rare Features

M1. How can we ensure that rare plants and animals, their habitats, and other rare features are protected in the subsection?

Protecting rare features on state lands is a key component of ensuring species, community, and forest-level biodiversity in the subsection. In 1978, the Minnesota Legislature, through the Legislative Committee on Minnesota Resources[6] (LCMR), established requirements for the DNR (Natural Heritage Program) to collect and disseminate data on Minnesota's significant biological resources. Information on the distribution, abundance, and ecology of rare species, their habitats, and other rare features gathered by the DNR provides much of the basis for determining the status of rare features in the state. The DNR acknowledges this leadership role in advocating for the maintenance of habitat for rare features throughout the state, regardless of ownership, and in protecting and providing habitat for rare and threatened species on state lands (Directions 2000).

[6] Now called the Legislative-Citizen Committee on Minnesota Resources (LCCMR)

In 2006, the DNR published *Tomorrow's Habitat for the Wild and Rare: an Action Plan for Minnesota Wildlife* which was established as part of the U.S. Fish and Wildlife Service's State Wildlife Grants program established by Congress in 2001. This plan identifies 292 "Species of Greatest Conservation Need" (SGCN) and their habitats by ecological subsection in Minnesota. A SGCN is defined as: "a wildlife species whose populations are rare, declining, or vulnerable in Minnesota". The Hardwood Hills Subsection is home to 85 SGCN and their habitats. The DNR is committed to protection of the species and habitats outlined in the plan.

Minnesota's List of Endangered, Threatened, and Special Concern Species (ETS List) was created in 1984 and was last revised in 2007, and will likely be revised again in 2012[7]. Created under Minnesota's Endangered and Threatened Species Statute, the ETS List draws attention to species that are at greatest risk of extinction within the state; special regulations are applied to those 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 of the importance of the ETS List in influencing 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 that changes to the ETS List be considered periodically. A set of changes to the ETS List was proposed in 2007, rule making took place during the summer of 2009.

Note that the federal Endangered Species Act of 1973, as amended (16 USC 1531 _1544) 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 pertaining to those species. Examples of species found in the Subsection that are federally listed as endangered, threatened, proposed or candidate, include: Western prairie fringed orchid (threatened); Sprague's pipit (candidate); and, Poweshiek skipperling (candidate).

The likely consequences of *not* addressing this issue are: rare species extirpation at the local and state level; rare species declines leading to status changes, e.g., special concern species changed to a threatened or endangered species; rare species habitat loss or degradation; and, loss of biodiversity at the species (genetic), community, and/or landscape level.

N. Other jurisdictions

N1. How will vegetation management objectives be coordinated across ownership boundaries?

Vegetation management across ownership boundaries must be a multidisciplinary collaboration to ensure that we reach landscape level ecological benefits. Fragmentation of habitat across the landscape as a result of split ownership boundaries may pose a challenge as we attempt to meet future

[7] http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf Effective 7/1/96; Updated 11/13/07; future revisions are planned for 2012

management objectives in the Hardwood Hills Subsection. Through coordination with adjoining landowners we can minimize the reduction of patch sizes and maintain or enhance wildlife corridors between existing habitat patches. This effort will involve communication and organization between local government units, private landowners, federal and state agencies, and local conservation organizations.

A number of conservation plans and agendas currently exist that include goals towards meeting this challenge. *A Strategic Conservation Agenda 2009-2013* outlines goals and management directions for the Minnesota Department of Natural Resources (DNR) as we move forward with integrated management of private and public lands. *Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife* was written in cooperation with a wide range of conservation organizations in Minnesota. The documents' main focus is on Minnesota's animal "species in greatest conservation need" (SGCN) and suggests priority conservation actions for these species within the Subsection. These examples highlight only a few of the available tools that will help guide the effort for coordinated vegetation management across the Subsection.

The likely consequences of not addressing this issue are: continued fragmentation of habitat; loss or reduction of species and their populations as a result of fragmentation; reduced recreational hunting opportunities for the public; reduction in patch sizes across the landscape; reduction in patch sizes across the landscape; potential loss of species diversity as patch size decreases; and, delayed habitat work because of lack of coordination.

O. From Issues to General Direction and Strategies

Table 2.1a provides a linkage between the issues described in Chapter 2 and the associated general direction statements (GDSs) and strategies in Chapter 3.

Table 2.1a: General Direction Statements Generated from SFRMP Issues

Major Issue	Focused Issue	General Direction Statements (GDSs) that address the focused issue
Desired age-class distribution	What are the desired age-class and growth-stage distribution of forest types across the landscape?	GDS-1A: Most stands on state lands will be managed to reflect the composition, structure, and function of native plant communities. GDS-2A: The SFRMP treatment level for each cover type moves toward the desired age class structure of even-aged managed cover types (both normal and extended rotation forest), and improves the age-structure and timber quality of uneven-aged managed cover types. GDS-3C: Forest cover type composition on state lands moves closer to the range of cover type composition that historically occurred within the ecosystems found in the Subsection. GDS-3E: Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to maintain or enhance the biodiversity significance factors on which these MCBS sites were ranked.

Desired age-class distribution (continued)	What are the desired age-class and growth-stage distribution of forest types across the landscape? (continued)	GDS- 3H: Even-aged managed cover types will be managed to move toward a balanced age class structure. GDS-3I: ERF stands in even-aged managed cover types will be managed to achieve a declining age-class structure from the normal rotation age to the maximum rotation age. GDS-3J: State lands will include representation of each of the Native Plant Community growth stages that historically occurred in the Subsection. GDS-3K: Young, early-successional forest is distributed across the landscape over time.
Desired age-class distribution (continued)	What are the appropriate amount, kind, and location of old forest?	1A: (description above) GDS-1B Species, age, and structural diversity within some stands will be maintained or increased. GDS 2A: (description above) GDS-3A: Old forest in the subsection is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity. GDS – 3H (description above)

		GDS – 3I (description above) GDS – 3J (description above) GDS-4A: Adequate habitat and habitat components exist, simultaneously at multiple scales, to provide for nongame species found in the Subsection. GDS-4B: Adequate habitat and habitat elements exist, simultaneously at multiple scales, to provide for game species found in Subsection. GDS-5A: Riparian areas are managed to provide critical[8] habitat for fish, wildlife, and plant species.
	What are the appropriate amount, kind, and location of young, early successional forest?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-3H: (description above) GDS-3J: (description above) GDS-3K: (description above) GDS-4A: (description above) GDS-4B: (description above) GDS-5A: (description above)

[8] *Critical habitat:* habitat or habitat elements that must be present and properly functioning to assure the continued existence of the species in question.

Desired mix of forest composition, structure, spatial arrangement, growth stages and native plant communities	What is the appropriate forest composition, structure, representation of growth stages, within-stand diversity, spatial arrangement of vegetative types, and native plant community distributions necessary to maintain sustainability goals for biodiversity, forest health, and productivity across the Subsection? How do we get there?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-2B: The harvest of nontimber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity. GDS-3A: (description above) GDS-3B: Species of Greatest Conservation Need and Key Habitats are maintained or enhanced in the subsection. GDS-3C: (description above) GDS-3D: Patch management in the Subsection maintains existing large patches and increases the average patch size on state lands over time, with consideration of natural spatial patterns. GDS-3E: Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to maintain or enhance the biodiversity significance factors on which these MCBS sites were ranked. GDS-3F: Rare plants and animals and their habitats are protected, maintained, or enhanced in the Subsection.

Desired mix of forest composition, structure, spatial arrangement, growth stages and native plant communities (continued)	What is the appropriate forest composition, structure, representation of growth stages, within-stand diversity, spatial arrangement of vegetative types, and native plant community distributions necessary to maintain sustainability goals for biodiversity, forest health, and productivity across the Subsection? How do we get there? (continued)	GDS-3G: Rare native plant communities are protected, maintained, or enhanced in the subsection. GDS-3H: (description above) GDS-3I: (description above) GDS-3J: (description above) GDS-3K: (description above) GDS-4A: (description above) GDS-4B: (description above) GDS-5A: (description above) GDS-6: Timber productivity and quality on state timber lands is increased. GDS-7A: Limit damage to forests from insects, disease, and non-native invasive species to acceptable levels where feasible. GDS-7B: Reduce the negative impacts caused by wildlife species on forest vegetation on state forest lands. GDS-8: Forest management on state lands attempts to mitigate global climate change effects on forest lands. Management is based on our current knowledge and will be adjusted based on future research findings. GDS-10: Forest access routes are well planned and there is a high level of collaboration with federal, private, and local units of government

Desired mix of forest composition, structure, spatial arrangement, growth stages and native plant communities (continued)		to share access and minimize new construction.
	How will we ensure restoration of important component tree species that have declined within forest communities in the subsection?	GDS-1A: (description above) GDS-3A: (description above) GDS-3B: (description above) GDS-3C: (description above) GDS-3E: (description above) GDS-3F: (description above) GDS-3G: (description above) GDS-3J: (description above)
	How will we maintain forest communities of particular concern in the subsection?	GDS-1A: (description above) GDS-3A: (description above) GDS-3B: (description above) GDS-3C: (description above) GDS-3E: (description above) GDS-3F: (description above) GDS-3G: (description above) GDS-3J: (description above) GDS-5A: (description above) GDS-5B: Forest management on state lands adequately protects wetlands and seasonal ponds.
	How can intensive management of forest communities be adapted to retain some of the characteristics of natural stand replacement disturbance events?	1C: (description above) 1E: (description above) 12A: Natural disturbance events that occur on state land within the subsection are promptly evaluated to determine the appropriate forest management needed to their impacts.

Desired mix of forest composition, structure, spatial arrangement, growth stages and native plant communities (continued)	How can management on state lands, especially large patch management, better reflect natural landscape patterns (the size and configuration of growth stages and types resulting from broad-scale natural disturbances) in the subsection?	GDS-2A: (description above) GDS-3H: (description above) GDS-3K: (description above) GDS-4A: (description above) GDS-4B: (description above)
	How do we limit forest fragmentation and maintain connectivity between habitats?	GDS-2A: (description above) GDS-3C: (description above) GDS-3D: (description above) GDS-3D: (description above)
Riparian and aquatic areas	How can we address the impacts of forest management on permanent wetlands, wetland inclusions, and seasonal ponds?	5A: (description above) 5B: (description above)
	What vegetative management activities will be allowed to take place within the riparian management zone (RMZ) and how will the appropriate width of the RMZ be determined to minimize the impacts of forest management activities on water quality, fisheries, and wildlife habitat?	1A: (description above) 5A: (description above) 5B: (description above)

	How can we address cumulative impacts to aquatic resources of forest management on a watershed/sub-watershed level?	***Cumulative impacts are beyond the scope of this SFRMP.***
Access to state land	How can we plan for access to the stands identified for management during the 10-year plan period while protecting and minimizing the negative impacts that timber access development or use may have on other forest resources?	GDS-10: (description above)
Biological diversity	How can management of stands within areas of biodiversity significance be adapted to enhance biodiversity and native plant community composition, structure, and function?	GDS-1A: (description above) GDS-1B: (description above) GDS-3A: (description above) GDS-3B: (description above) GDS-3C: (description above) GDS-3E: (description above) GDS-3F: (description above) GDS-3G: (description above) GDS-3J: (description above)
	How do we plan to retain and restore within-stand structural complexity (e.g., vertical structure, stem size and density, coarse woody debris, and pit and mound micro-topography) on actively managed lands?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-3A: (description above) GDS-3C: (description above) GDS-3H: (description above) GDS-3I: (description above) GDS-3J: (description above) GDS-4A: (description above) GDS-4B: (description above)

Wildlife habitat	How do we manage vegetation to balance the habitat needs of game and nongame species?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-2B: (description above) GDS-3A: (description above) GDS-3B: (description above) GDS-3F: (description above) GDS-3K: (description above) GDS-4A: (description above) GDS-4B: (description above) GDS-5A: (description above) GDS-7B: (description above)
Forest health	How do we address the impacts of forest insects and disease on forest ecosystems? How will we respond to non-native invasive species threats/invasions? How will natural disturbances like fire and blowdown be considered in forest management decisions? How do we manage vegetation to reduce negative animal impacts? How should forest management respond to global climate change within the planning period?	GDS-7A: (description above) GDS-7A: (description above) GDS-12: (description above) GDS-7B: (description above) GDS-8: (description above)

Harvest level	What is the appropriate timber harvest level on state lands with consideration for the sustainability of all forest resources? How can we ensure adequate and sustainable "nontimber forest products" for the future?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-2B: (description above) GDS-3A: (description above) GDS-3C: (description above) GDS-3D: (description above) GDS-3H: (description above) GDS-3I: (description above) GDS-3J: (description above) GDS-3K: (description above) GDS-4A: (description above) GDS-4B: (description above) GDS-8: (description above) GDS-10: (description above) GDS-2B: (description above)
Timber & biomass productivity	How can we increase timber productivity on state lands? & How can sustainable biomass production be integrated into vegetation management?	GDS-1A: (description above) GDS-1B: (description above) GDS-2A: (description above) GDS-3H: (description above) GDS-3I: (description above) GDS-3J: (description above) GDS-5B: (description above) GDS-6: (description above) GDS-10: (description above)
Visual quality	How will forest management activities minimize impacts on visual quality?	GDS-9: Minimize forest management impacts on visual quality in sensitive areas. GDS-10: (description above)

Legal & policy requirements	How will land managers achieve desired results and continue to uphold various state and federal statutes and departmental policies?	GDS-9: (description above) GDS-10: (description above)
Cultural resources	How will cultural resources be protected during forest management activities on state-administered lands?	GDS-11: Cultural Resources will be protected on state-administered lands.
Rare features	How can we ensure that rare plants and animals, their habitats, and other rare features are protected in the subsection?	GDS-1A: (description above) GDS-1B: (description above) GDS-2B: (description above) GDS-3B: (description above) GDS-3E: (description above) GDS-3F: (description above) GDS-3G: (description above) GDS-3J: (description above) GDS-4A: (description above) GDS-4B: (description above) GDS-5A: (description above) GDS-5B: (description above)
Other Jurisdictions	How will vegetation management objectives be coordinated across ownership boundaries?	To the extent possible, the DNR will attempt to coordinate management activities with other land owners in the Subsection. The SFRMP Team has reviewed the MFRC Landscape Management Plans for the North-Central, East-Central and West Central Landscapes. This plan considers the objectives of those planning efforts.

Chapter 3: General Direction Statements and Strategies

Introduction

In response to the final list of issues identified in Chapter 2, the subsection team developed general direction statements (GDSs) to address the issues, strategies to achieve the general directions, and desired future forest composition (DFC) goals. General direction statements take into account the direction provided in State statutes and rules, Department policies, guidelines, and direction (e.g., *A Strategic Conservation Agenda 2009-2013)*, and management that will sustain the forest resources on state-administered forest lands in the Subsection. GDSs provide general direction such as: increase, decrease, maintain, or protect a certain condition, output, or quality. Strategies were developed for each of the GDSs to achieve the general direction.

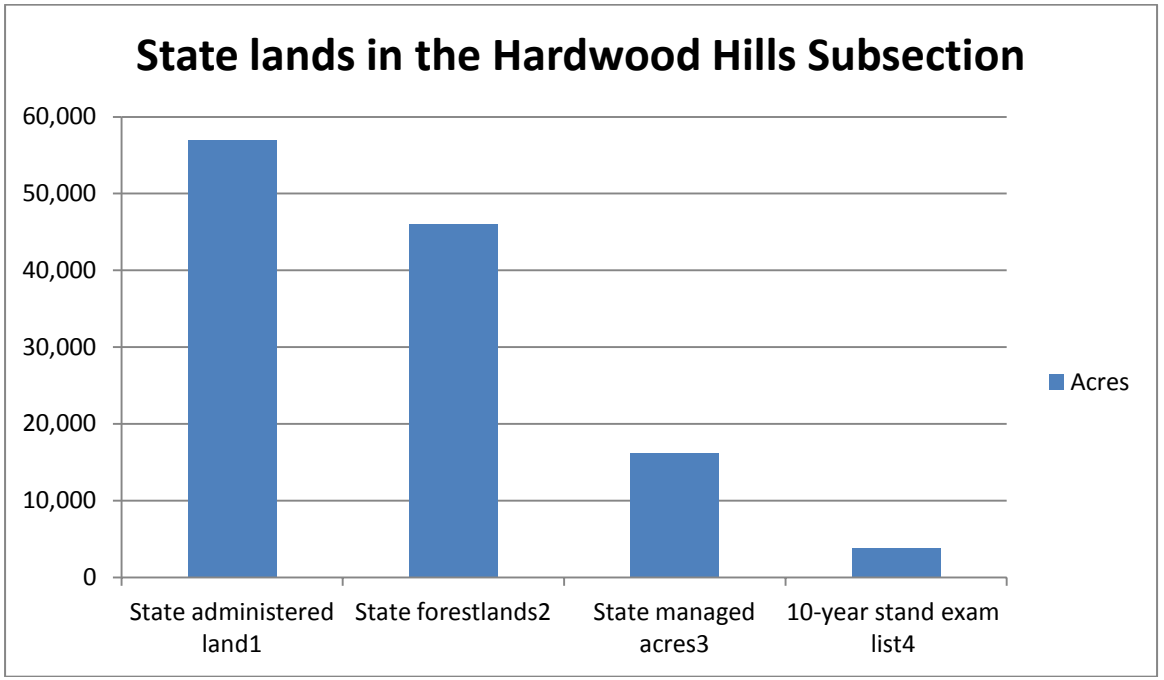
In situations where there is currently an ability to measure and quantify progress, DFC goals were identified. DFC goals are long-term (10 and 50+ years) goals for the desired condition of DNR forest lands in the Subsection. Examples of DFC goals are: cover type acres, age class distribution, amount of young and old forest, and cover type treatment levels (e.g., harvest levels). DFC goals, general direction strategies (Chapter 3), and cover type management guidance documents were used to develop stand selection criteria used to identify a pool of stands from which to select stands to be treated during this 10-year plan. Treatment levels by cover type were also established. Selection and treatment of stands from this pool is expected to move state-administered forests in the Subsection toward the DFC goals. The GDSs, strategies, and DFC goals presented in this chapter guided the selection of stands and the application of treatments to stands.

For most even-aged managed cover types, recommendations assume that balancing the distribution of the 10-year age classes is a long-term goal, even though it may take more than one rotation to achieve for most cover types. In some cover types (e.g. red pine, jack pine, birch and balsam fir), this will be very difficult to achieve, due to limited occurrence in the Subsection, species characteristics and changing disturbance regimes.

Under the direction of the Minnesota Forest Resource Council (MFRC) Landscape Program, the Regional Landscape committees completed reports and plans for six forest landscapes in the state that included desired future conditions and strategies for consideration across all ownerships. These plans recommend desired outcomes, long-term goals, and strategies for forest lands and specific ecosystem types. The goals and strategies in this subsection plan for state-administered forest lands are generally consistent with those recommended by the regional landscape committees.

The figure below shows the acres of state land included in this plan:

Figure 3a State administered lands, forestlands, managed acres and 10-year stand exam list acres in the Hardwood Hills Subsection



1 State administered lands include all Divisions of Forestry, Fish and Wildlife, Trails and Waterways, and state park administered lands in the Subsection.
2 Forestland consists of all lands included in the DNR forest stand inventory (i.e., Cooperative Stand Assessment, or CSA), including cover types from aspen to stagnant conifers, lowland brush, and other wetlands. In this plan,
3 *managed* acres are those Division of Forestry and Section of Wildlife forestland acres available for timber management purposes (i.e., excludes forest lands reserved as old growth, SNAs; inoperable stands, brush and grass). These managed acres are approximately 35 percent of total DNR forest lands the Subsection.
4 10-year stand exam list is a total of the acres that are proposed to be site-visited and managed in the first decade of the planning period.

In this chapter, the GDSs and associated strategies are grouped under 12 forest resource management topic areas or categories. Some categories have several GDSs to address the associated issues while others have only one.

Note: Due to updates to the forest inventory and other data sources during the planning process, there may be slight differences in acreages shown between various tables and figures in this planning document. These differences will not have a significant effect on the recommendations in this plan.

3.1 Within-Stand Composition and Structure

Major cover types in the Subsection background information

The purpose of the following sections is to provide data and management information by cover type. For forest cover types, these management recommendations will also provide direction to field staff for on-the-ground management activities for stands in the various cover types.

Tables in Chapter 3 of this plan show the treatment level (acres), recommended conversion acreages, old forest percent, effective Extended Rotation Forest (ERF) percentage, and average treatment ages. Some information from the general direction statements (GDS) and strategies is incorporated into this section, but staff should be familiar with the full contents of the GDSs and strategies found in Chapter 3.

Information provided by cover type includes:

- Current Condition;
- Future Direction;
- Cover Type Conversion Management (as applicable);
- Stand Treatment Summary; and,
- Special concerns or limiting factors for each cover type.

Acreage figures in this chapter include state forest lands administered by the Divisions of Forestry and Fish and Wildlife (Section of Wildlife) that are available for forest management activities. State lands in state parks, designated old growth stands, and Scientific and Natural Areas (SNAs) are not included as managed acres in this plan.

Several cover types in the HH Subsection have very limited acres (i.e. <1000 acres /cover type) or are not covered in detail by the scope of this plan (e.g. brushland and openland cover types). These cover types were not included in the stand selection modeling. Therefore, cover type management recommendations for these cover types are necessarily brief, general, and are described below in the following section.

Aspen/Balm of Gilead

Current Conditions

Cover Type Acres
The aspen and balm of Gilead (A/BG) cover types are combined for the SFRMP because these two species are commonly associated with each other and are managed under the same management prescriptions. Mature aspen stands are typically comprised of a mixture of species, with aspen being the major component as measured by volume. In 2011 the aspen/balm of Gilead cover type comprised 5,274 acres or 32.5% of state forest lands in the Subsection.

Age class Distribution:
The current A/BG age class distribution does not reflect the desired balanced age class structure for even-aged managed cover types. (See Appendix C for the current, 10-year and 50-year age class charts for aspen/balm of Gilead)

Stand Composition:
A mixture of species comprises the typical mature aspen stand, with aspen being the major component as measured by volume. In this subsection, typical secondary species in the aspen cover type are: paper birch, red maple, sugar maple, basswood, red oak and bur oak.. Understory species in this planning area are more likely to be seedlings and saplings of the same species listed above, along with beaked hazel, American hazel, dogwood and prickly ash.

Native Plant Communities:
Typical NPCs where the aspen cover type is found include: FDs36 Southern Dry-Mesic Oak-Aspen Forest, and MHn44 Northern Wet-Mesic Boreal Hardwood Conifer Forest.

Conversion Goals:
The decision whether or not to convert a stand to another cover type may be suggested through the planning process, but will be determined when the stand is field visited. The outcome of a NPC-ECS field evaluation will determine the appropriate species conversions. The aspen/balm of Gilead cover type is targeted for a reduction of 196 acres (3.7%) in the first 10-years and 310 acres (5.9%) over the 50-year planning period.

Future Direction (a goal for the next 50 years)

Cover Type Acres:
A goal of the Hardwood Hills SFRMP is to have 5,078 acres of A/BG at the end of the first decade. After 50 years of plan implementation, the goal is to have approximately 4,964 acres of A/BG cover type, or 310 acres (5.9%) less than is currently on the landscape.

Age class Distribution:
After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes. A goal is to have 10 percent of the cover type acres over NRA.

Stand Composition:
There is no plan to change the stand composition of aspen/balm of Gilead stands in the future in the Subsection, however stand specific changes may occur based on NPC information and local management goals.

Special Concerns or Limiting Factors:
The non-native invasive species of buckthorn is of particular concern for the Subsection. Buckthorn is easily spread in disturbed environments and difficult to control once established on a site. Buckthorn can displace native plants and reduce the potential for a stand to regenerate to its original cover type. When present in a stand efforts should be made to control this species, if feasible.

Ash/Lowland Hardwoods

Current Conditions

Cover Type Acres:
These cover types are combined into one management category for this SFRMP because these two cover types are commonly associated with each other and are managed under the same management prescriptions. In 2011 the ash/lowland hardwood cover type comprised 457 acres or 2.8% of state forest lands in the Subsection.

Age class Distribution:
There are limited markets for the low- to medium-quality material found in many of these stands. Stands are generally small, with 60% being less than 10 acres in size. 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. Thus, the vast majority of the ash/lowland hardwoods stands in the Subsection are over 60 years of age. These cover types are managed using uneven-aged treatments thus a balanced age class is not a goal.

Stand Composition for Ash/Lowland Hardwoods:
Windthrow is a dominant natural disturbance in Ash/LH stands, resulting in large downed logs, hummocks, and hollows that promote tree seedling establishment and create diverse sites for wet and mesic forest herbs.

Although combined because of similar management and soil conditions, there is a substantial difference in stand structure between ash and lowland hardwoods cover types. Ash cover types are typically dominated by black ash and are typically situated on wet to very wet sites. Stand composition ranges from pure ash to predominantly ash mixed with balm of Gilead, elm and red maple. Black ash understory is commonly young black ash mixed with alder, dogwood and grasses. Lowland hardwood cover types are more frequently found along streams or river bottoms. Black ash is often a lesser component of the species mix. Balm of Gilead, green ash, elm, cottonwood, aspen, paper birch, red maple and box elder make up the majority mix. Bur oak, basswood, and red oak are often lightly mixed in as stand components. The understory contains young trees of these species as well as alder, dogwood, sumac and prickly ash.

Native Plant Communities:
Typical NPCs where the ash/lowland hardwood cover type is found include: WFn55 Northern Wet Ash Swamp, and FFn57 Northern Terrace Forest.

Conversion Goals:
The long term goal will be to reduce the existing acres of ash/lowland hardwoods by 19 acres (4.1%) over the 50-year planning period. However, by following ash management guidelines to minimize Emerald Ash Borer, management will strive to reduce ash to less than 20% of the tree cover in lowland hardwoods stands in the Subsection, and establish other understory species in the black ash types to preserve site hydrology. Follow Department guidance on management of A/LH in the face of the Emerald Ash Borer invasion.[1]

Future Direction (a goal for the next 50 years)

Cover Type Acres:
The Hardwood Hills SFRMP has no planned reduction in the acres of ash/lowland hardwoods at the end of the first decade and a reduction of 19 acres (4.1%) at the end of the 50-year planning period.

Age class Distribution:
These cover types are managed using uneven-aged treatments thus a balanced age class is not a goal.

Stand Composition:
Emerald ash borer is a major threat to ash stands located throughout the State. Due to the emerald ash borer threat, the DNR has established a goal to reduce the presence of ash in lowland hardwood stands to less than 20% and increase other understory species on black ash sites to preserve site hydrology over time in the event of an emerald ash borer outbreak in the Subsection.

[1] http://files.dnr.state.mn.us/forestry/ecssilviculture/policies/guidelinesManagingAshMinnesotaForestryLands-100723.pdf

Special Concerns or Limiting Factors:
Emerald ash borer was discovered in the state in 2009. It is yet to be determined what effect this non-native invasive species will have on the ash/lowland hardwood cover type in the Subsection or across the State. It is assumed that the pest will greatly reduce the presence of the ash/lowland hardwoods cover type across the State.

Northern Hardwoods

Current Conditions

Cover Type Acres:
In 2011 the northern hardwoods cover type comprised 4,529 acres or 28% of the state forest lands in the Subsection.

Age class Distribution:
Typical management schemes for this cover type involve selective harvesting, rarely removing enough trees to set the stand age back to the youngest age classes. This means that these stands continue to show up in the maturing age groups with very few acres appearing in the younger age classes.

Stand Composition:
Natural, mature NH stands are mixed stands. Species in the northern hardwood cover type are: sugar maple, red maple, red oak, bur oak, white oak, American elm, basswood, green ash, quaking aspen, bigtooth aspen, paper birch, and ironwood, and to a lesser extent yellow birch, black ash, white pine, white cedar, and white spruce. Understory species include seedlings and advanced regeneration of the previously listed species as well as choke cherry, pin cherry, juneberry, leatherwood, hazel, alder, and prickly ash.

Native Plant Communities:
Typical NPCs where the northern hardwoods cover type is found include: MHc37 Central Mesic Hardwood Forest (western), and MHs38 Southern Mesic Oak-Basswood Forest.

Conversion Goals:
The conversion goals for the northern hardwoods cover type are a net reduction of 22 acres (<1%) in the first 10 years of the plan and a net reduction of 144 acres (3.2%) over the 50-year planning period for the Subsection. Much of this reduction is likely to result in an increase in the oak cover type based on NPC site evaluations.

Future Direction (a goal for the next 50 years)

Cover Type Acres:
A goal of the Hardwood Hills SFRMP is to have 4,507 acres of northern hardwoods at the end of the first decade. After 50 years of plan implementation, the goal is to have approximately 4,385 acres of northern hardwoods cover type, or 3.2% less than is currently on the landscape.

Age class Distribution:
The age class distribution for the northern hardwoods cover type is not expected to change over time due to management in the Subsection.

Stand Composition:
A goal of the SFRMP is to increase the presence of oak within some northern hardwood stands in the Subsection over time through selective harvest and promotion of oak regeneration within northern hardwood stands.

Special Concerns or Limiting Factors:
The non-native invasive species of buckthorn is of particular concern for the Subsection. Buckthorn is easily spread in disturbed environments and difficult to control once established on a site. Buckthorn can displace native plants and reduce the potential for a stand to regenerate. When present in a stand efforts should be made to control this species, if feasible.

Oak

Current Conditions

Cover Type Acres:
The oak cover type includes high site index northern red oak (SI equal to or greater than 55), low site index northern red oak (SI<55) and bur oak, and other oak (white, pin) stands. Additional oak species are also present in some stands (e.g. white oak) but are rarely occur as a large portion of the stand. In 2011 the combined oak cover types comprised 4,732 acres or 29.2% of the state forest lands in the Subsection. In 2011 the high site index red oak cover type comprised 1,832 acres, the low site index red oak cover type comprised 1,451 acres, and the bur oak cover type comprised 1,222 acres of the overall oak cover type in the Subsection.

Age class Distribution:
The combined oak cover type currently shows an age class imbalance with the vast majority of stands aged at 60 – 100 years of age.

Stand Composition:

Red Oak High Site Index (55+)

The secondary species in a high site index red oak stand can be very diverse. Aspen, sugar maple, basswood and other oaks such as bur and white are the most common. Stands in the subsection also include birch, big tooth aspen, green ash, black ash, elm, boxelder, balm of Gilead, cherry, and jack pine. The understory is not quite as diverse with the main species being aspen and sugar maple. Other species included birch, big tooth aspen, basswood, cherry, red maple, green ash, black ash, elm and even some white pine. Hazel is the most common understory shrub with a good mix of dogwood, prickly ash and other upland shrub species mixed in.

Red Oak Low Site Index (under 55)

These stands are not as diverse as the high site index stands. Many of the same species are found the main ones are aspen, red maple, sugar maple and basswood. Other species include ash, elm, birch, big tooth aspen other oak species and green ash. The understory is also less diverse and includes ash, elm, aspen, birch, red maple, sugar maple, basswood and green ash. Hazel is again the most common understory shrub with a good mix of dogwood, prickly ash and other upland shrub species mixed in.

Bur oak

These stands include some species that are found on lower ground but not to a large extend. Aspen is the most common second species. To a lesser degree the following species are also found in these stands: black ash, elm, silver maple, birch, balm of Gilead, sugar maple, basswood, cherry, green ash and boxelder. The understory is a similar mix and includes black ash, elm, aspen, birch, sugar maple, basswood, cherry, green ash and boxelder. Hazel is again the most common understory shrub with a good mix of dogwood, prickly ash and other upland shrub species mixed in.

Native Plant Communities:

Typical NPCs where the oak cover type is found include: FDs37 Southern Dry-Mesic Oak (Maple) Woodland; and Mhc36 Central Mesic Hardwood Forest (Eastern).

Conversion Goals:

The decision whether convert a stand to another cover type will be determined when the stand is field visited. The outcome of a NPC- ECS field evaluation will determine the appropriate species conversions. A goal of the planning process is to increase the presence of oak within northern hardwood stands, eventually transitioning some stands to the oak cover types listed above. The 10-year goals for net increases in the cover type subsets are: red oak 55+SI +122 acres; red oak <55 SI +70 acres; and, bur oak +12 acres.

Future Direction (a goal for the next 50 years)

Cover Type Acres:
A goal of the Hardwood Hills SFRMP is to have an additional 204 acres of combined oak at the end of the first decade (bur oak: +12 acres, red oak 55+SI: +122 acres, red oak <55SI: +70 acres). After 50 years of plan implementation, the goal is to have approximately 475 additional acres of oak cover type (bur oak: -10 acres, red oak 55+SI: +277 acres, red oak <55SI: +208 acres), or 10.5% (combined) (bur oak: -1%, red oak 55+SI: +15.1%, red oak <55SI: +14.3%) more than is currently on the landscape.

Age class Distribution:
After this plan is implemented, the age class distribution is expected to more closely approach the desired balance among age classes. A goal is to have 220 acres (12%) of the red oak 55+ SI cover type and 244 acres (20%) of the bur oak cover type acres over NRA. There is no plan to manage ERF stands in the low (<55) SI red oak cover type.

Stand Composition:
Stand composition for the combined oak cover type is not expected to change much. Effort will be taken with-in specific stands to promote regeneration of the stand to the oak cover type post any management activities.

Special Concerns or Limiting Factors:
The non-native invasive species of buckthorn is of particular concern for the Subsection. Buckthorn is easily spread in disturbed environments and difficult to control once established on a site. Buckthorn can displace native plants and reduce the potential for a stand to regenerate. When present in a stand efforts should be made to control this species, if feasible. Fire was a major factor in creating and maintaining oak stands historically, and re-introducing fire to these stands will be challenging in some locations due to surrounding land use patterns.

Tamarack

Current Conditions

Cover Type Acres:
In 2011, at 4.6 percent (739 acres), the tamarack cover type is widely distributed across state administered forest lands in the Subsection; 75% of the stands are less than 15 acres in size.

Age class Distribution:
The current acreage representing the tamarack cover type in the Subsection is insufficient to achieve a balanced age class over time. A majority of the tamarack cover type in 2011 was between the ages of 50-100 years.

Stand Composition:
Stands making up the tamarack cover type are typically dominated by tamarack or tamarack/black spruce mixes. Stands often have a light to heavy component of black ash and include scattered paper birch, aspen, elm and occasionally white cedar, balsam fir or a bur or red oak. Understories are likely to contain tamarack and black spruce seedlings and lowland brush species including Alder, Dogwood, Willow, Labrador Tea, and Leather Leaf mixed with sedge grasses.

Native Plant Communities
Typical NPCs where the tamarack cover type is found include: FPs63 Southern Rich Conifer Swamp; and FPn82 Northern Rich Tamarack Swamp (Western Basin).

Conversion Goals:
There are no planned conversion goals for increasing the presence of tamarack in the Subsection. However if opportunities arise in appropriate native plant communities, increases will be considered.

Future Direction (a goal for the next 50 years)

Cover Type Acres:
A goal of the Hardwood Hills SFRMP is to maintain the current acreage of tamarack found in the Subsection. No deliberate gains or losses in the tamarack cover type acres currently found in the Subsection are planned, however, minor changes may occur due to inventory updates as stands are site visited over the course of the plan.

Age class Distribution:
The current acreage for tamarack stands located in the Subsection is insufficient to achieve a balanced age class over time. Stands will be site-visited and harvested based on their stand age.

Stand Composition:
There are no plans to change the with-in stand composition of tamarack stands located in the Subsection.

Special Concerns or Limiting Factors:
Larch beetle presence in the Subsection is on the rise. Larch beetles can invade tamarack stands and cause mortality and associated flooding of the stand post mortem, making it difficult to regenerate the stand in the flooded areas.

Brushland (upland and lowland brush)

Current condition

Cover type acres: In 2011 the current upland or lowland brush cover type comprised 5,912 acres of the state-managed acres in the Subsection.

Age class distribution: Unlike commercial forest types, information on the age of upland and lowland brush cover type stands is not collected through Cooperative Stand Assessment (CSA) or monitored consistently. Generally, stand age for these brush types would be considered the time since the last major natural disturbance or management activity (shearing, mowing, prescribed burning, or herbicide treatment). Managed brushlands are generally 0-20 years old and a portion of unmanaged brushlands may be older than 30 years.

One potential surrogate for stand age is the shrub density information collected through CSA. The 1990 Draft of the Long Range Plan for Brushland Habitats (MNDNR Division of Fish and Wildlife) thought brush density was indicative of stand openness and consequently, the successional stage. Stands in advanced stages of succession should be dominated by high or medium density brush; high density would also indicate decadence. In this Subsection, brush density codes were available for 4,152 acres of the brush acreage. (2,328 acres) 56 percent of this acreage had moderate brush density and (1,609 acres) 39% was listed as heavy density.

Stand composition: Species composition and density of upland and lowland brush cover types can be highly variable and is dependent on NPC, natural disturbances, management history, presence of non-native invasive species, drainage, etc. In this Subsection, most of the acreage is lowland brush (5,695 acres), which is generally dominated by willow and alder species. Upland brush stands tend to be more variable in shrub composition.

Native plant communities: Information about Hardwood Hills NPCs in which upland and lowland brush stands are typically found is located in the *NPC Field Guide*. Consult this reference when determining sites appropriate for upland and lowland brush emphasis.

Future direction

Cover type acres: Brushland acres will generally be maintained as this plan is implemented. The 50-year planned goal for grass and brush cover types is to increase these types by less than one percent or 81 acres. These planned increases are for prairie and oak savannah habits.

Age class distribution: Managed upland and lowland brush stands are generally burned, mowed, grazed, or could support a biomass harvest on a 5 to 20-year rotation to promote vigorous growth and maintain open landscapes. A significant portion of the upland and lowland brush acres in this Subsection will have an older age structure due to access problems, low shrub densities, and/or wildlife habitat goals. Future timing of management activities may be adjusted on a site specific basis if new ecological information suggests a longer or shorter interval would be more appropriate.

Stand composition: The future stand composition goal in brushlands is to maintain the range of species in the appropriate amounts that would normally be present in the associated NPC.

Stand management

Management direction: Currently, brushlands are primarily managed for wildlife habitat through treatments such as shearing followed by a prescribed fire a year later. Biomass harvest may play an important role in management of these sites in the near future. Existing management treatments and new biomass harvest techniques should be evaluated to prevent loss of species richness, loss of soil function and other negative impacts to these sites.

Final harvest methods: For any planned biomass harvest in brushlands, follow the biomass harvesting guidelines contained in the MFRC voluntary site-level forest management guidelines. These biomass guidelines contain guidance on reserve areas, type of structural habitat components to retain, and operational considerations when shearing or harvesting brush. A recent brushland resource assessment in Minnesota estimated an average high density brush site contains 8.3 dry tons/acre while a medium density site contains 5.3 dry tons/acre.

Stand selection criteria

Preferred stand selection criteria:
For initial biomass harvest sites, consider offering larger sites with good access and high to medium density brush that are closer to biomass markets.

Openland (upland and lowland grass)

Current condition

Cover type acres: In 2011 the current upland or lowland grass cover type comprised 5,393 acres of the state-managed acres in the Subsection.

Age class distribution: Age classes for upland and lowland grass cover types are not collected and monitored as timber cover types are. Stand age for grasses generally refers to the timing between burning, mowing, or grazing and is currently tracked differently by each land manager. Age class can also refer to the time since planting for restored or enhanced stands.

Stand composition: Species composition for upland and lowland grass stands can be highly variable and is dependent upon: Presence or absence of non-native species; Whether or not it is a virgin (untilled) native grassland; Years since restoration or enhancement; Hydrology; Soils; etc. Virgin native prairie stands, for example, can have more than 200 different grass and forb species; whereas a wet prairie invaded by reed canarygrass may have fewer

than 20. Tree and shrub species have become much more common on upland and lowland grasslands in this Subsection since human settlement due primarily to encroachment from reduced fire prevalence and interval.

Native plant communities: Information about Hardwood Hills NPCs in which upland and lowland grass stands are typically found is located in the *NPC Field Guide*. Consult this reference when determining sites appropriate for upland and lowland grass emphasis.

Future direction

Cover type acres: Grassland acres will increase slightly as some stands are converted to prairie or oak savannah. —. The 50-year planned goal for grass and brush cover types is to increase these types by less than one percent or 81 acres.

Age class distribution: Managed upland and lowland grass stands are generally burned, mowed, or grazed on a 3 to 5-year rotation to promote vigorous growth and stimulate seed production. Future timing of management activities may be adjusted on a site specific basis if new ecological information suggests a longer or shorter interval would be more appropriate. Other practices, such as mowing, haying, and spot herbicide treatments may be used periodically to manage stands.

Stand composition: The future stand composition goal in grasslands is to maintain the range of species in the appropriate amounts that would normally be present in the associated NPC as described by the Department's ECS system.

Stand management

Management direction: Grasslands are primarily managed for wildlife habitat and for their intrinsic value. Prescribed fire rotation intervals and timing should be evaluated on a site by site basis to prevent loss of species richness. Managers often harvest seed from native and restored/enhanced grasslands to generate revenue or to restore/enhance other grassland sites. A closely monitored grazing program should also be considered as a management tool when feasible. Restorations and enhancement projects should strive to plant at least a 25 species grass/forb mixture. Each site should be evaluated to assess proper management practices to help maximize diversity.

Timing of harvest: Recent research evaluating the use of grasslands for biofuel production may lead to increased consumptive demand on these cover types. Additional information is needed to determine the long-term implications of fire timing/intervals and seed and biomass removal from grasslands.

Management methods: Grasslands can be managed through grazing, haying, seed collection, chemical and mechanical treatment and prescribed burning. Where using prescribed fire, managers should continue to follow a 2 to 5-year rotation until site specific information indicates a more suitable interval. Seed harvest is often conducted the fall following a spring fire. Intense, short-duration, rotational grazing by bison is preferred, but difficult to

accomplish. Managers primarily use cattle on a rotational grazing system, resting the grasslands from 1-3 years. Where these methods are ineffective at reducing invading woody vegetation, a combination of mechanical or chemical treatments may be needed to control such vegetation from dominating a stand. Biomass harvest prescriptions are currently being investigated to determine impacts to long-term maintenance of grasslands.

Table 3.1a: Non-modeled Cover Types

Cover Types	Paper Birch	Black Spruce (Upland and Lowland)	White Pine	Red Pine	Jack Pine	White Spruce	Balsam Fir
Type Acres	13 acres	21 acres	39 acres	154 acres	52 acres	131 acres	57 acres
0-20 years	0 acres	2 acres	31 acres	7 acres	0 acres	5 acres	0 acres
21-50 years	4 acres	8acres	0acres	140 acres	26 acres	126 acres	0 acres
51+ years	9 acres	11 acres	8acres	7acres	26 acres	0 acres	57 acres
Stand Composition or Origin	natural	natural	plantations	plantations	natural and artificial regeneration	plantations	natural
50 year DFC	13 acres	21 acres	39 acres	154 acres	40 acres	131 acres	57 acres
Future Age Class Dist.	maintain or improve	maintain or improve	NA	NA	maintain or improve	NA	maintain or improve
Future Stand Composition	NA	NA	increase diversity (oak)	convert type (oak)	NA	increase diversity (oak/aspen)	NA
Mgmt. Direction	Even-aged	Uneven-aged	Thin	Thin->Final	Even-aged	Thin	Even-aged
Final Harvest Method	Clearcut w/ reserves	Shelterwood	Clearcut	Clearcut	Clearcut w/reserves	Clearcut w/reserve	Clearcut w/reserves
Regeneration Methods	natural seeding and sprouting	natural seeding and sprouting	natural seeding	NA	natural or artificial	natural seeding	natural seeding
Preferred Selection Criteria	select if above normal	select if above 80	select all	select all	select if above normal	select all	select if above normal

GDS-1A: Most stands on state lands will be managed to reflect the composition, structure, and function of native plant communities.

A *native plant community* (NPC) is a group of native plants that interact with each other and the surrounding environment in ways not greatly altered by humans or by introduced plant or animal species. These groups of native plants form recognizable NPC communities (e.g. Southern Dry-Mesic Oak-Aspen Forest, Northern wet Ash Swamp, FDc37 Southern Dry-Mesic Oak (Maple) Woodland, etc.) that tend to repeat across the landscape and over time. The goal is to retain NPC characteristics in most managed stands.

This GDS differs from GDS-1B in that it emphasizes managing for the suite of species, growth stages, and disturbance regimes appropriate to the NPC class or type identified using the NPC Field Guide. Whereas GDS-1B emphasizes species, age, and structural diversity in and of itself without direct connection to the native plant community. In managed stands, defining tree species diversity and relative abundance, age class distribution, and structural diversity within a native plant community paradigm lends support to the development and/or maintenance of NPC composition, structure, and function through time. Forest management that incorporates native plant community form and function is more likely to accommodate a greater proportion of Minnesota's native biodiversity than forest management focused on a single or select group of species.

GDS-1A Strategies

a. Continue to use the *Field Guide to the Native Plant Communities in Minnesota: the Eastern Broadleaf Forest Province* and associated ECS Silvicultural Interpretations to classify stands to NPC and inform silvicultural prescriptions.

b. Follow strategies in GDS-2C relating to retaining components of various growth stages in stands.

Table 3.1b: Native Forested Plant Communities (NPC) Found in this subsection

The following forested NPCs are found in this subsection: (for a complete listing of the community types found in the Subsection, see the Hardwood Hills Preliminary Assessment (August 2011) pages 5.5-5.7.

Community Name	Community Code
Northern Poor Conifer Swamp	APn81
Poor Tamarack - Black Spruce Swamp	APn81b
Poor Tamarack - Black Spruce Swamp: Tamarack Subtype	APn81b2
Central Dry Pine Woodland	FDc23
Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype	FDc23a2

Central Rich Dry Pine Woodland	FDc24
Red Pine - White Pine Forest	FDc34a
Oak - Aspen Forest	FDc34b
Bur Oak - Aspen Forest	FDs36a
Southern Dry-Mesic Oak (Maple) Woodland	FDs37
Oak - (Red Maple) Woodland	FDs37a
Pin Oak - Bur Oak Woodland	FDs37b
Northwestern Wet-Mesic Aspen Woodland	FDw44
Black Ash - Silver Maple Terrace Forest	FFn57a
Silver Maple - Green Ash - Cottonwood Terrace Forest	FFs59a
Elm - Ash - Basswood Terrace Forest	FFs59c
Silver Maple - (Virginia Creeper) Floodplain Forest	FFs68a
Alder - (Maple - Loosestrife) Swamp	FPn73a
Northern Rich Tamarack Swamp (Western Basin)	FPn82
Rich Tamarack - (Alder) Swamp	FPn82a
Extremely Rich Tamarack Swamp	FPn82b
Tamarack Swamp (Southern)	FPs63a
Central Dry-Mesic Oak-Aspen Forest	MHc26
Oak - Aspen - Red Maple Forest	MHc26a
Central Mesic Hardwood Forest (Eastern)	MHc36
Red Oak - Basswood Forest (Noncalcareous Till)	MHc36a
Red Oak - Basswood Forest (Calcareous Till)	MHc36b
Central Mesic Hardwood Forest (Western)	MHc37
Aspen - (Sugar Maple - Basswood) Forest	MHc37a
Sugar Maple - Basswood - (Aspen) Forest	MHc37b
Basswood - Black Ash Forest	MHc47a
Northern Mesic Hardwood Forest	MHn35

Aspen - Birch - Basswood Forest	MHn35a
Red Oak - Sugar Maple - Basswood - (Bluebead Lily) Forest	MHn35b
Northern Wet-Mesic Boreal Hardwood-Conifer Forest	MHn44
Aspen - Birch - Fir Forest	MHn44d
Northern Wet-Mesic Hardwood Forest	MHn46
Aspen - Ash Forest	MHn46a
Red Oak - White Oak - (Sugar Maple) Forest	MHs37b
Basswood - Bur Oak - (Green Ash) Forest	MHs38b
Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	MHs38c
Southern Mesic Maple-Basswood Forest	MHs39
Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	MHs39b
Sugar Maple Forest (Big Woods)	MHs39c
Elm - Basswood - Black Ash - (Hackberry) Forest	MHs49a
Dry Barrens Oak Savanna (Northern)	UPn13b
Dry Sand - Gravel Oak Savanna (Northern)	UPn13c
Dry Hill Oak Savanna (Northern)	UPn13d
Dry Barrens Oak Savanna (Southern)	UPs14a
Dry Sand - Gravel Oak Savanna (Southern)	UPs14b
Lowland White Cedar Forest (Northern)	WFn53b
Northern Wet Ash Swamp	WFn55
Black Ash - Yellow Birch - Red Maple - Basswood Swamp (East-central)	WFn55b
Northern Very Wet Ash Swamp	WFn64
Black Ash - Conifer Swamp (Northeastern)	WFn64a
Black Ash - Alder Swamp (Northern)	WFn64c
Northern Wet Alder Swamp	WFn74
Lowland Aspen Forest	WFs55a
Black Ash - (Red Maple) Seepage Swamp	WFs57a

To learn more about wooded NPCs typically found in the Subsection, refer to Appendix B, and the *Field Guide to Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* Sustainable treatment levels must continue to be analyzed and described by cover type.

GDS-1B Species, age, and structural diversity within some stands will be maintained or increased.

Although future age class distributions are modeled to the best of our ability, there will be variation from decade to decade in the acreages of these cover types, due to variation in the current age class distributions of most cover types.

Diverse forest stands are more resilient to perturbations than less diverse forest stands. A forest stand with a mix of tree species and ages provides habitat for a wider variety of associated species while providing a diversity of forest products. The net economic, social, and ecological values and functions of most forest stands are related to the composition of trees, shrubs, ground flora, and structural characteristics. Structural characteristics include the sizes (diameter and height), abundance, and distribution of overstory trees; understory vegetation; and the arrangement (scattered or clumped) of vegetation in the stand. Structural characteristics also include the presence or absence of snags and coarse woody debris and how these features are distributed through space. Retaining large-diameter structures provides micro-sites for seed germination, cavities for nesting and den sites, and important escape and nesting cover within stands.

GDS-1B Strategies

a. Use selective harvesting to encourage diversity of species, ages, and stand structures.

Refer to stand treatment prescription definitions: http://www.dnr.state.mn.us/forestry/harvesting/prescription_defs.html

b. Implement the *Site-Level Guidelines* designed to maintain a diversity of tree species within a stand.

The MFRC guidelines provide direction on retaining leave trees and snags, conifer retention and regeneration, and timber stand improvement (TSI) activities, among others http://www.frc.state.mn.us/documents/council/site-level/MFRC_FMG&Biomass_2007-12-17.pdf

c. Use the NPC Field Guide,[2] tree suitability tables, site index, soils data, and ECS Silvicultural Interpretations to aid in determining the species composition and structure appropriate for the site.

[2] Minn. DNR, 2003, *Field Guide to Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province*. Ecological Land Classification Program, Minnesota County Biological Survey, Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources St. Paul, MN 55155.

See silvicultural guidance documents at: http://www.dnr.state.mn.us/forestry/ecs_silv/index.html

d. Retain tree species, stand structure, and ground layer diversity within stands when prescribing timber stand improvement and thinning activities.

- Rather than managing for one tree species when thinning or performing TSI, manage for the variety of species found in the stand.
- Based on current stand composition and other considerations (e.g., insect and disease concerns or wildlife habitat), take advantage of opportunities to diversify stands when prescribing thinning. Thinning intensities in stands may vary depending on current stand condition, such as trees per acre, tree size, and species composition, or the future desired within-stand composition.

e. Reserve seed trees in harvest areas and site preparation areas, where possible.

Resistance to windthrow, insect and disease risks, and the quality, number, and distribution of seed trees must all be considered when selecting seed trees.

- Timber harvesting techniques and site preparation methods that expose mineral soil may be used on some sites to facilitate natural seeding.
- Select seed trees that have the potential to survive to produce seeds.

f. Use the least intensive site preparation methods possible to ensure success.

Site preparation can create conditions favorable to non-native invasive species and alter structural and compositional diversity in the ground layer. Striving to minimize site preparation intensity will minimize these threats.

g. Use harvest systems or methods that protect advance regeneration. Retain conditions that favor regeneration and understory initiation.

When it is desirable to protect the existing seedlings and saplings in a stand, timber sale regulations will specify outcomes to protect these regenerating trees. In some cases, portions of the stand will be delineated to protect regeneration by restricting harvest activity in those areas. To enhance seedling recruitment of some species, a partial canopy may be retained to meet needed moisture and light requirements of the seedlings.

h. Identify some stands where succession is allowed to occur to encourage development of within-stand diversity. Movement to the next successional stage may be achieved with or without harvest.

Use field evaluation of stands to determine if a stand should be allowed to succeed to the understory species. This strategy will meet some of the forest composition change goals. Consult *NPC Field Guide* and ECS Silvicultural Interpretations for help in reaching these decisions.

i. Increase and/or maintain by reserving from harvest, target species such as red oak and bur oak as components within northern hardwood types. Silvicultural practices that may add or increase the presence of these target species will include prescribed burning, selective harvest, and artificial or natural seeding.

The targeted increases in the red and bur oak composition are important for wildlife habitat goals and to increase desired species in some cover types in the Subsection. The *NPC Field Guide*, tree suitability tables, site index, soils data, and ECS Silvicultural Interpretations, and observations that the species is now naturally occurring and doing well on the site, can aid in determining the appropriate species for the site.

j. Manage planted and seeded stands to represent the array of native plant diversity.

Planted and seeded stands will be managed to meet aesthetic and biodiversity goals. This may be accomplished by:

- Accepting lower stocking levels of planted species in younger plantations if other desirable species are present.
- Planting or seeding mixed species appropriate to the site.
- Using intermediate harvests to enhance age, species, and structural diversity.
- Use the least intensive site preparation necessary to successfully regenerate the site, while favoring retention of the existing ground-layer plant species.

Some plant communities can naturally exhibit low species diversity. Low species diversity can be natural and has occurred historically in peatlands and in association with large-scale disturbances, particularly fire.

k. Use ERF in some even-aged managed stands to encourage greater structural diversity. (GDS-1A)

l. Encourage fruit and mast-producing species.

Follow the MFRC *Site-Level Guidelines* for retaining and enhancing hard and soft mast (fruit) production.

3.2 Harvest Levels

GDS-2A: The SFRMP treatment level for each cover type moves toward the desired age class structure of even-aged managed cover types (both normal and extended rotation forest), and improves the age-structure and timber quality of uneven-aged managed cover types.

SFRMP treatment levels reflect the number of acres that will be divided into annual stand examination lists and field visited over the 10-year period. After field visits, treatments may include timber harvest, inventory alteration (i.e., correcting or updating forest inventory data), forest development without harvest, or deferring treatment (treat in a future planning period).
Treatment levels were developed for this plan by considering the other General Direction Statements (GDSs), and specifically the following factors:

- Age class imbalances for even-aged cover types;
- Desired future composition goals for increases/decreases in various cover types; and,
- Silvicultural emphasis on regenerating certain cover types.

Table 3.2a: Rotation Ages for Even-aged Managed Forest Cover Types in the Hardwood Hills Subsection
Abbreviations: SI = site index; MA = merchantable age; NRA = normal rotation age; MRA = maximum rotation age

Cover Type	Site Index	Merchantable Age	Normal Rotation Age	Maximum Rotation Age
Red oak High SI	55+	35	80	120
Red oak Low SI	<55	35	80	NA
Bur oak	NA	35	80	170
Aspen/balm of Gilead	NA	30	45	70
Balsam fir	NA	30	45	60
Birch	NA	30	50	60
Black spruce	NA	30	65	95
Jack pine	NA	30	40	65
Red pine High SI		25	100	170
Red pine Low SI		35	80	150
White spruce (planted)	NA	30	50	60
Tamarack	NA	30	70	105

Notes:

1. Due to the limited presence of several even-aged cover types in the Subsection, only the high and low SI red oak, bur oak and aspen/balm of Gilead cover types will try to achieve a balanced age class via the planning process.

Table 3.2b: Managed Cover type Treatment Pool Summary for the Hardwood Hills Subsection (*summarizes total acres of even-aged and uneven-aged managed cover types on the 10-year stand exam list which have been selected for site visit and/or treatment during the first decade of the planning implementation period.)*

Cover Type	Total Managed Acres [1]	Total Treatment Acres[2]
Aspen/ balm of Gilead	5,274	1,137
Northern hardwoods	4,532	1,427
Oak (high SI, low SI and bur)	4,732 (includes other oak)	893
Red pine	154	130
Jack pine	52	15
White spruce	131	120
Balsam fir	57	28
Tamarack	739	7
Off-site/other oak	489 (not from assessment)	30
Totals	16,160	3,787

1 Total managed acres data source: HH SFRMP Preliminary Assessment (August 2011)
2 Total Treatment Acres data source: hardwoodhills_volumeestimates_12082011.xls

GDS-2A Strategies

Following are descriptions and/or examples of how the above factors were considered.

Even-aged Cover Types

a. Age class Imbalances

The high and low site index red oak, bur oak and aspen/balm of Gilead cover types are the only even-aged cover types in the Subsection that have adequate acreages to achieve a balance age class over time. The figures presented below show the desired future condition (DFC) goal for balancing the aspen/balm of Gilead cover type in the Hardwood Hills Subsection.
(see Figures 3.2a and 3.2b).

Figure 3.2a: Current Age Class Distribution of the Aspen/Balm of Gilead Cover Types in the Hardwood Hills Subsection (2011)

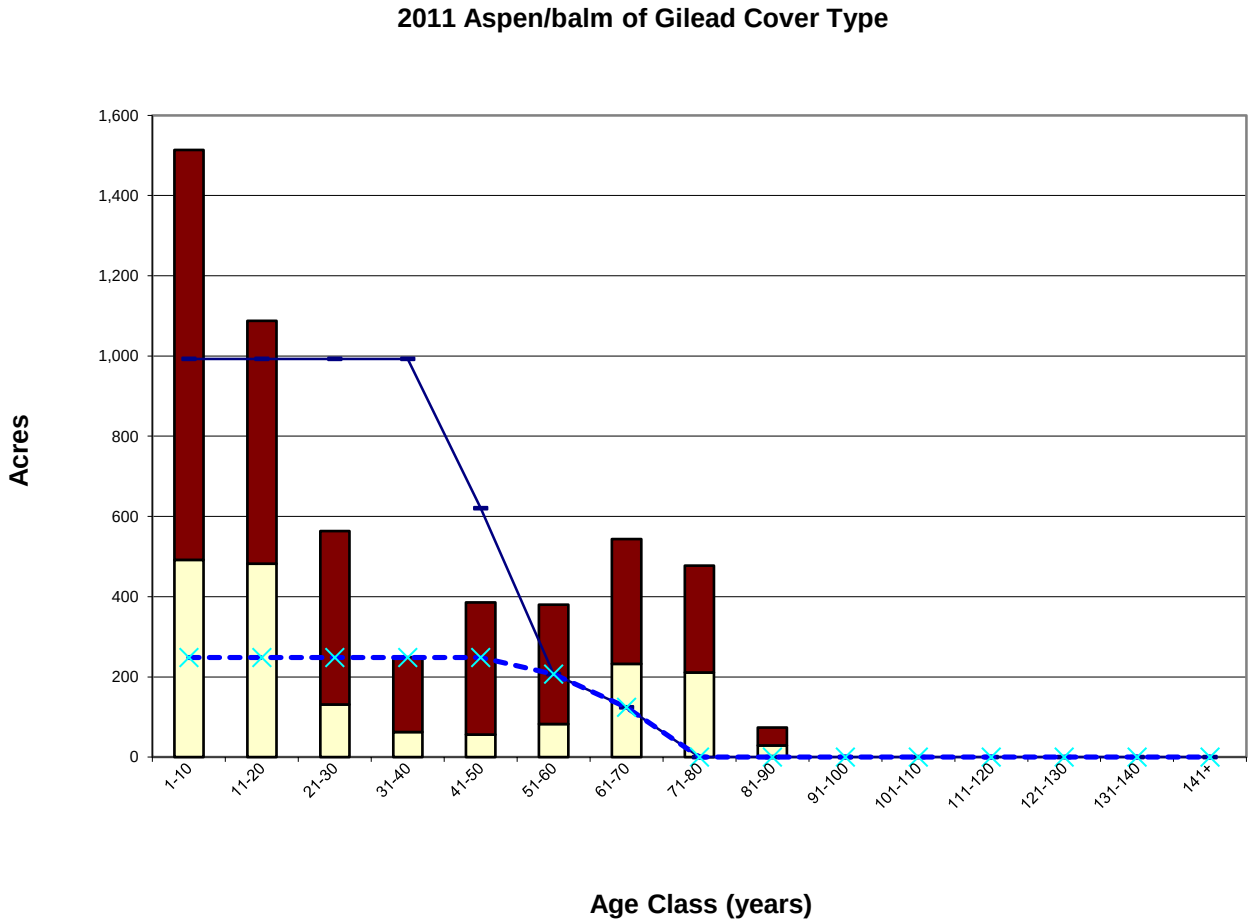
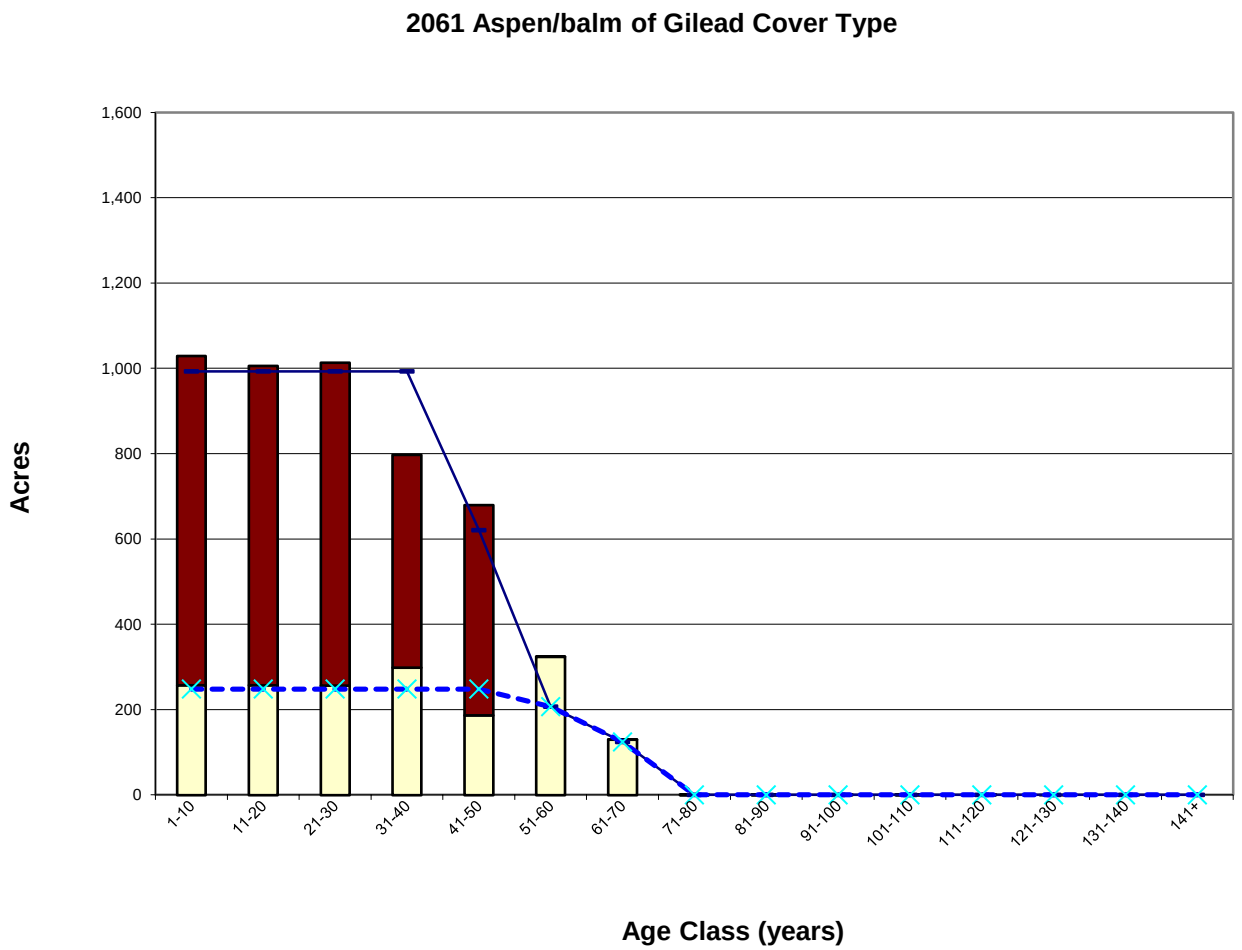


Figure 3.2b: Estimated Aspen/Balm of Gilead Cover Type Age Class Distribution in Hardwood Hills Subsection (2061)



Treating Stands Older than Normal Rotation Age

There is currently a surplus of acres beyond the normal and ERF rotation ages established by this plan, in most even-aged managed cover types. Several different treatment scenarios were considered for each cover type, to determine the desired declining age class distribution beyond the normal rotation age. Treatment levels were developed to address many of these beyond rotation acres in the next 10 years. This will effectively bring the average treatment age closer to the appropriate rotation ages for the even-aged cover types. For the red and bur oak cover types, the older age acreages are so large that treating them all in the next decade would exacerbate the current age class imbalance. For these cover types, a substantial number of over-normal rotation age stands will be carried through succeeding 10-year periods over the next 50 years to facilitate balancing the age classes.
See Tables 3.2c , 3.2d, and 3.2e following.

Table 3.2c: Acres Over Normal Rotation Age by Cover type for the Hardwood Hills Subsection[1]

Cover Type	Rotation Class	Acres over normal rotation age
Red Oak High SI (55+)	Normal	315
	Maximum (ERF)[2]	76
Red Oak Low SI (<55)	Normal	890
	Maximum (ERF)	135
Bur Oak	Normal	640
	Maximum (ERF)	262
Aspen/balm of Gilead	Normal	1,085
	Maximum (ERF)	583

1This table does not include acres that are currently under timber sales contracts.
2 The oldest age that even-aged stands can be managed and still expect to be able to regenerate to the original cover type.
Acres over normal rotation age data sources: Red oak 55_11302011_HH_SFRMP.xlsx; Redoak-55_12052011_HH_SFRMP.xlsx; Burroak_11302011_HH_SFRMP.xlsx; A-BG_10312011_HH_SFRMP.xlsx

Table 3.2d: Rotation Age and Modeled Average Stand Treatment Age for Even-aged Managed Cover Types in the Hardwood Hills Subsection

Cover Type	Rotation Class	Rotation Age	Average Treatment Age per decade of planning period				
			1	2	3	4	5
Red oak (high SI: 55+)	Normal	80	86	95	103	112	124
	Maximum (ERF)[1]	120	88	90	115	107	NA
Red oak (low SI: <55)	Normal	80	109	108	110	120	116
	Maximum (ERF)	NA	NA	NA	120	NA	NA
Bur oak	Normal	80	93	106	118	128	137
	Maximum (ERF)	170	106	116	124	134	124
Aspen/balm of Gilead	Normal	45	71	57	48	47	48
	Maximum (ERF)	70	80	77	47	50	63

1 The oldest age that even-aged stands can be managed and still expect to be able to regenerate to the original cover type.
Average Treatment age data sources: Red oak 55_11302011_HH_SFRMP.xlsx; Redoak-55_12052011_HH_SFRMP.xlsx; Burroak_11302011_HH_SFRMP.xlsx; A-BG_10312011_HH_SFRMP.xlsx

a. Maintaining Old Forest

In all the major even-aged cover types in the Subsection (e.g. aspen/balm of Gilead and oak) there is currently an overabundance of old forest due to age class imbalances. For the aspen/balm of Gilead cover type the age class imbalance will be almost be corrected by the 5th decade of the planning period (i.e. 50-years). All subsets of the oak cover type (i.e. high SI, low SI and bur) the age class imbalance will not be corrected by the 5th decade of the planning period and will extend further into the future.

Table 3.2e: Percent Old Forest per Decade for Even-aged Systems by Cover Type in the Hardwood Hills Subsection.

Cover Type	Percentage of cover type considered old forest per decade of planning period				
	1	2	3	4	5
Red oak High SI (55+)	21.3%	64.2%	58.3%	48.0%	40.4%
Red oak Low SI (<55)	70.7%	55.3%	43.0%	35.7%	30.2%
Bur oak	73.8%	65.8%	67.7%	65.4%	54.7%
Aspen/balm of Gilead	31.6%	18.8%	11.0%	11.7%	16.7%

Percent old forest data sources: Red oak 55_11302011_HH_SFRMP.xlsx; Redoak-55_12052011_HH_SFRMP.xlsx; Burroak_11302011_HH_SFRMP.xlsx; A-BG_10312011_HH_SFRMP.xlsx

b. Maintaining young forest

In the aspen/balm of Gilead cover type group, higher levels of young forest will occur in the initial decades due to the accelerated treatment of the acres prior to the implementation of this plan.

c. Planned Increases/Decreases in Cover type Acres

The long-term (50-year) desired future condition calls for decreases in the aspen/balm of Gilead cover type group, some net decreases in Northern Hardwoods, and generally net increases in the Oak cover type subgroups. These conversion plans are based primarily on the summation of site specific goals identified by forestry and wildlife staff. These cover type changes are not planned to occur proportionately throughout the 50-year period, because of considerations related to management opportunities and balancing the age class distribution.

Currently unplanned changes may occur over time in cover types such as upland grass, lowland brush, or agriculture. Any deliberate changes will be based new site specific goals developed using NPC information and interdisciplinary review. Wildlife managers have and will continue to evaluate the need and appropriateness of the agricultural areas on WMAs. These areas are generally managed as food and cover plantings through Cooperative Farming Agreements (CFAs).

Table 3.2f: Cover Type Conversion Goals for the First Decade and 50-year planning period

Cover Type	Current Cover Type Acres (2011)	Cover Type Conversion Acres (1st decade of planning period) 2011-2021	Cover Type Conversion Acres (50-year DFC) 2011-2061	Final Cover Type Acres (2061)
Red oak High SI (55+)	1,832	+122	+277	2,109
Red oak Low SI (<55)	1,451	+70	+208	1,659
Bur oak	1,222	+12	-10	1,213
Aspen/balm of Gilead	5,274	-196	-310	4,964
Ash/lowland hardwoods	457	0	-19	438
Jack pine	52	0	-12	40
Northern hardwoods	4,529	-22	-144	4,386
Offsite/other oak	489	0	-44	445
Scotch pine	11	0	-11	0
Upland grass/brush	8,615	+31	+81	8,697
Agriculture	1,679	-18	-18	1,661

Conversions were identified by wildlife and forestry staff based on specific site goals for wildlife, and accessibility and marketability of the stands.

d. Supply of Timber

A harvest-scheduling model was used to achieve a sustainable treatment level, taking into consideration any planned increases or decreases in each cover type over the next 50 years. While 10-year treatment levels will vary above or below the sustainable level until the age classes are balanced, adjustments were made in some decades to reduce these variations. The long-term goal is to narrow the peaks and valleys in harvest levels to provide a relatively stable supply of timber from state lands. Tables 3.9g-I summarize treatment levels in acres by decade in the Hardwood Hills Subsection.

Uneven-aged Management and Thinning

All uneven-aged and some even-aged managed cover types will be assigned prescriptions that use selective harvest treatments (see Tables 3.2h-i). The uneven-aged managed cover types include ash/lowland hardwood and northern hardwoods. The even-aged managed cover types where thinning is likely to occur include red and bur oak, white spruce, red pine and white pine. All stands that meet the stand selection criteria will be field-visited and evaluated for possible treatment. Some stands in the uneven-aged managed cover types, may initially be treated with even-aged methods to improve long term stand age-structure and timber quality. Additional stand acres outside of the 10 year stand selection pool, may be selectively harvested or thinned if field evaluation shows that the stand meets prescription criteria for the cover type and will not change stand age structure. These additional stands will be available for review during the annual harvest plan or annual plan addition review process.

Comparison of past harvest levels to harvest levels assigned in the plan

Table 3.2g: Treatment Levels for the major Even-aged Managed Cover Types (or subgroups) by Decade for the Hardwood Hills Subsection

Cover type	Treatment Level (acres) for Even-aged Managed Cover Types by Decade 2011-2060				
	1 (2011-2020)	2 (2021-2030)	3 (2031-2040)	4 (2041-2050)	5 (2051-2060)
Red oak High SI (55+)	300	300	300	300	300
Red oak Low SI (<55)	300	300	245	180	180
Bur oak	157	157	157	157	157
Aspen/balm of Gilead	1,043	888	1,013	1,029	1,029

Table 3.2h: Treatment Levels for Uneven-aged Managed Cover Types for the Hardwood Hills Subsection

Cover Type	1st Decade of the plan (2011-2020)
	Treatment Acres
Northern Hardwoods	847

Table 3.2i: Thinning Treatment Levels for Even-aged Cover Types for the Hardwood Hills Subsection

Cover Type	1st Decade of the plan (2011-2020)
	Treatment Acres
Northern hardwoods	62
Red pine	130
Oak	48
White spruce	120

Biomass Harvesting

Although there is no target or DFC for biomass harvest at this time, the Hardwood Hills SFRMP Team estimates that 13,400 cords or 31,000 tons of biomass would be available as tops and limbs from roundwood harvests proposed in this plan. This is an emerging market in response to demand for alternative energy production. Minnesota DNR policy is changing in response to this changing market.

- Biomass as tops and limbs will be available for purchase on most timber sale sites where roundwood is harvested. Sites not available for biomass harvest are defined in the MFRC Biomass Harvesting Guidelines[3].

[3] http://www.frc.state.mn.us/documents/council/site-level/MFRC_forest_BHG_2001-12-01.pdf

- In addition as markets change over time, some non-commercial forest sites may be available for biomass harvest consistent with plan goals and biomass harvesting guidelines. Section of Wildlife staff may identify some areas with potential for biomass harvest from brushlands. (See brushland cover type description above in this plan for further information)

Stands Reserved or Deferred for Further Evaluation

In the HH Subsection, a total of 73 stands (totaling 2,931 acres) have been reserved or deferred during the 10-year planning period. These stands included designated OG, pending OG, Ecologically Important Lowland Conifers (EILC), and pending Representative Sample Areas (RSA). Following evaluation, the non-designated stands of these types will become available for active management. Evaluation procedures for the pending OG, EILC and RSA stands are being developed in a separate process from this plan. Because these deferred acres are included in the cover-type treatment level calculations, the proposed treatment levels recommended in this plan are not affected by the deferrals.

Table 3.2j: Summary of Reserved or Deferred Stands acres for the Hardwood Hills Subsection by Cover Type

Cover Type	Acres reserved or deferred from treatment during the planning period
Ash	24
Aspen	68
Black spruce (lowland)	11
Lowland hardwoods	232
Northern hardwoods	1,831
Oak	435
Tamarack	330
Total acres reserved or deferred	2,931

Table 3.2k: Summary of Reserved or Deferred Stands acres by Reason for Deferment for the Hardwood Hills Subsection

Reason for reserve/deferment	Acres reserved/deferred
Old growth[1]	2,509
EILC	297
Pending RSA[2]	81
EILC and Pending RSA[3]	44
Total reserved/deferred acres in the Subsection	**2,931**

1. Includes both designated and pending old growth stands. Pending old growth stands are under review to determine if they should be designated as old growth in the future.
2. RSA boundaries are not yet finalized. An estimated 120 acres are under consideration for RSA designation.
3. 44 acres of stands are currently dually designated as EILC and RSA.

Acres Comparison between the Past Plan and the Recommended SFRMP Treatment Levels

The proportion of each of the forestry area's cover type acres in the Subsection was used to calculate the estimated portion of past area plans treatment acres by cover type in the Subsection. These estimates were used for comparing the past cover type acres treatment levels to those recommended in this SFRMP. Table 3.2i (above) provides a comparison of treatment level by cover type between the past plan and those recommended in this SFRMP.

Volume Comparison between the Past Plan and the Recommended SFRMP Treatment Levels

Minnesota DNR develops annual planned treatment levels on a cover type acreage basis rather than a volume basis. These SFRMP Estimates (2011-2020) provided in Tables 3.2l and 3.2m for harvest volume are produced by the harvest-scheduling model, based on treatment acres, yield equations, treatment method, and cords per acre based on forest inventory data and preliminary prescriptions. It is a rough estimate because not all treatment acres are suitable, or result in timber sales; the treatment method (prescription) may change after the field examination of the stand; and the forest inventory volume data (cords per acre) is typically not as accurate as the more intensive appraisals that are completed for timber sales. The previous decade volume given for comparison 2001-2010is based on actual average volume sold per year. (see table 3.2l below)

Table 3.2l: Estimate of Volume[1] (cords) to be Offered for Sale in First Plan Decade by Cover Type

Cover Type	Previous Decade harvest levels (2001-2010)	Expected Volume (Cords) for 1st decade of the planning period 2011-2020
Aspen	**27,000[1]**	**20,032**
Balm of Gilead		**1,034**
Northern Hardwoods	**4,500**	**8,778**
Oak	**4,300**	**12,637**
Red pine	**1,500**	**771**
Jack pine	**2,500**	**303**
White spruce	**0**	**474**
Balsam fir	**559**	**469**
Tamarack	**0**	**9**
Off-site oak	**0**	**242**
Total Cords Offered	**39,959**	**44,748**

[1] The aspen and balm of Gilead past harvest volumes were not differentiated. Previous harvest levels listed for the aspen cover type are aspen and balm of Gilead combined acres.

Data source: hardwoodhills_volumeestimates_12082011.xls

Table 3.2m: Estimate of Volume[1] (cords) to be Offered for Sale in First Plan Decade by Treatment Group

Treatment Group	Cords
Even-aged management	**21,730**
Shelterwood	**12,294**
Uneven-aged management	**7,309**
Thinning	**1,897**
On-site visit	**1,519**

Data source: hardwoodhills_volumeestimates_bytreatment.xls

GDS-2B: The harvest of nontimber forest products is managed to provide a sustainable supply for humans while providing for wildlife habitat and biodiversity.

Nontimber forest products, also known as special forest products, can be categorized into five general areas: decorative materials, foods, herbs, medicinal materials, and specialty items. Nontimber forest products include, but are not limited to: mushrooms and maple syrup.

The social importance, ecological role, and function of special forest products resources are only beginning to be understood. Improving our species-specific knowledge, as well as broadening forest inventories and developing appraisal methods for most types of nontimber forest products, will make determining sustainable harvest levels possible in the future. Currently, special product permits or informal timber sales are issued for some nontimber forest products (e.g. maple syrup sugarbush) to ensure that harvest operations do not damage the site's potential for future production. Harvest of nontimber forest products may be restricted on some state-administered forest lands such as WMAs, aquatic management areas (AMAs), and SNAs.

The following strategies will be used to protect the long-term availability of these forest resources.

GDS-2B Strategies

a. **Consider known traditional gathering areas when managing other forest resources.** For example, consider forest management effects on known areas such as those traditionally used for gathering maple syrup (sugarbush areas) or gathering wild rice (ricing camps) when planning forest management activities.

b. **Supervise and enforce special product permit regulations to ensure that the site's capacity for future production is not jeopardized.** Consider managing or using some forest stands for nontimber forest products, such as maple syrup (sugarbush).

c. **Consider the known locations of important wildlife habitats, rare native plant communities or species, and the possible impacts of nontimber forest products harvest practices before issuing special product permits.**

d. **Forest managers should proceed judiciously when issuing special products permits for species where limited knowledge and understanding constrains our ability to know if we are managing these groups of species sustainably.**

3.3 Biological Diversity, Forest Composition, and Spatial Distribution

GDS-3A: Old forest in the subsection is distributed across the landscape to account for timber products, wildlife habitat, and ecological diversity.

Consideration of old forest during planning was done to:

- Ensure an adequate representation of older stands and old forest components within even-aged cover types.
- Address visual quality concerns and recreation desires.
- Help maintain the integrity of forested riparian areas.
- Complement or connect old growth stands and other old patches.
- Provide habitat for wildlife species associated with old forest.
- Provide for older growth stages of NPC types.
- Provide large-diameter timber products.
- Help contribute to carbon sequestration on state forest lands.

A forest stand of any particular even-aged managed forest cover type is considered old forest whenever its age exceeds the normal rotation age agreed on by the landscape rotation age work group for that cover type. Determining the amount of old forest to be sustained in the Subsection required balancing many factors: timber productivity, economic impacts, historical forest conditions, habitat requirements, forest health, old forest protected on other ownerships, and timber quality. The goal is to provide a representation of older forest stands and old forest components that is sustainable over time, balanced with the need to provide a stable timber supply, increased timber productivity, and early successional forest habitat. Information about Minnesota's old growth forest policy can be found at http://www.dnr.state.mn.us/forests_types/oldgrowth/index.html

The type and acreage, of old growth forests in the subsection can be found in the Hardwood Hills Subsection's *Preliminary Issues and Assessment*, Chapter 3: http://files.dnr.state.mn.us/forestry//subsection/hardwoodhills/sfrmp_hardwoodhills_PreliminaryIssuesAssessment.pdf
Providing for adequate and sustainable amounts of old forest across the landscape over time requires:

- Maintaining and updating DNR's current network of Old growth Forest stands
- Designating forest that is held to an older forest condition (i.e., extended rotation forest).
- Specifying situations under which forest managers will create or maintain old forest components within treated stands, based on site factors found there (e.g., some patch management; management within some High Conservation Value Forest and Minnesota County Biological Survey (MCBS) sites of High and Outstanding biodiversity significance).

Uneven-aged managed stands and other state lands (e.g., State Parks and SNAs) also contribute to old forest conditions.

GDS-3A Strategies

a. Determine the desired level of effective extended rotation forest for even-aged managed cover types.

The acreage and age of DNR timber lands to be managed as Extended Rotation Forest (ERF) was provided to the SFRMP team by an interdisciplinary statewide ERF workgroup. Forests managed as ERF are key to achieving DFCs for the subsection. "Old forest" is the portion of ERF acreage that is over the normal rotation age (NRA) for the cover type at a given time, plus designated old growth in the subsection. Because forest stands designated as ERF can (and should) be in any age class, there are cases where large numbers of acres must be designated ERF to achieve the identified old forest goal, due to the current cover type age class distribution. Cover types typically managed under even-aged management scenarios are the focus of ERF designation – such a management designation is unnecessary for cover types managed under uneven-aged management scenarios.

Designated ERF stands are selected for harvest when they are between normal rotation age and maximum rotation age leaving enough acres in each affected age class to help achieve the desired tapering distribution in older age classes.

Figure 3.3.a: Extended Rotation Forest Example

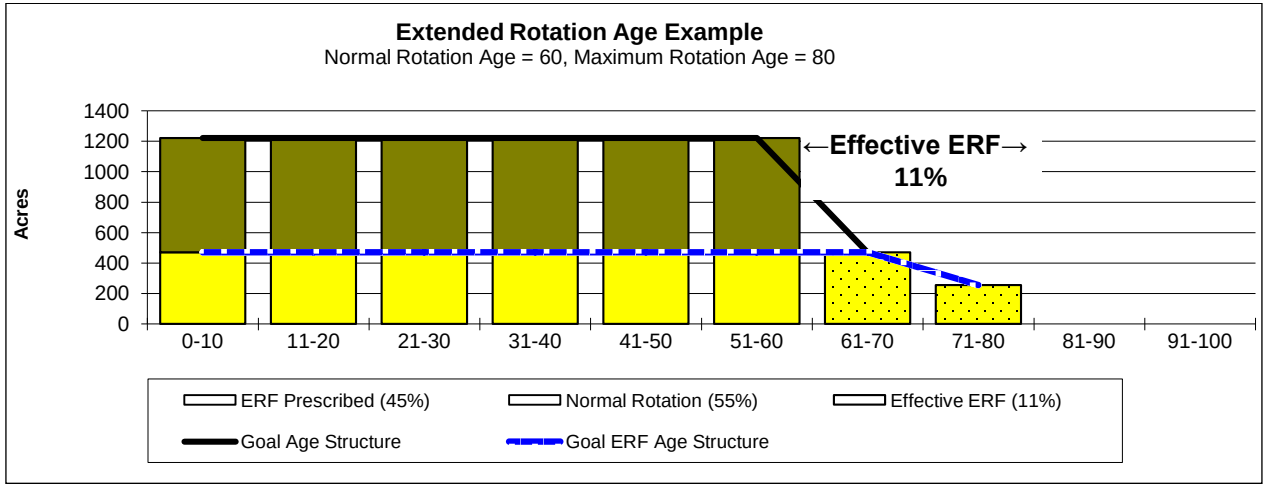


Table 3.3a: Current Old Forest acres for Even-aged Managed Cover Types

Cover type	2011 Acres[1]	2011 Ac >NRA[2]	2011 % >NRA	Goal % >NRA[3]
Aspen/balm of Gilead	5,274	1,668	31.6%	10%
Red oak High SI (55+)	1,832	391	21.3%	12%
Red oak Low SI (<55)	1,451	1,025	70.7%	0%
Bur oak	1,222	902	73.8%	20%

[1]Managed Acres: Forestry and Wildlife lands considered available for timber harvest.
[2] Acres of managed forest older than the normal rotation age (NRA) established for the cover type.
[3] Old Forest percentage goal: Percent goal of cover type timber land acreage to be managed beyond the normal rotation age
.

b. Prescribe ERF stands and schedule harvest in even-aged managed cover types so that when a balanced age class distribution is achieved, the desired amount of effective ERF will be provided.

Due primarily to existing imbalances in age classes in some cover types, there will be fluctuations in the amount of effective ERF until a balanced age class distribution is reached. After this, fluctuations may occur periodically because of major disturbances such as wind or fire. These estimates are based on modeling of proposed stand treatments over the next five decades.

ERF stands were selected using the following criteria provided by the Hardwood Hills SFRMP Team:

- Total prescribed ERF targets by type pre-selected
- Cover type pre-selected
- Old Forest Management Complex pre-selected
- Natural Heritage Locations pre-selected
- Ruffed Grouse Mgmt Areas ERF negative
- Riparian area stands pre-selected
- Natural Heritage Elements buffers ERF positive
- Priority Open Landscapes ERF negative

c. Allow some stands to naturally succeed to long-lived cover types with, or without the use of harvest.

Field evaluation of these potential stands will use the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province*[4] *(Native Plant Community (NPC) Field Guide)* and associated Silvicultural Interpretations.

d. Manage designated old growth stands and old forest management complexes according to DNR policy.

Complete and follow long-term management plans for designated old growth stands and the surrounding acres in the old forest management complexes (OFMCs) that are to be managed for old forest characteristics. Use the *DNR Old growth Forests Guideline, Amendments 5 and 6* as a guide. High-quality native plant communities (NPCs) and other stands that meet old growth criteria can be nominated for designation as old growth following the *DNR Old growth Forests Guideline and Amendment 2*.

e. Manage ecologically important lowland conifers according to department direction.

Ecologically important lowland conifers (EILC) include stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands that are representative examples of high quality lowland conifer NPCs found in the Subsection. Appendix H, Ecologically Important Lowland Conifers (EILC): Acreage Goals and Rationale, describes the method the team used to designate EILC for the Subsection. Table 3.3b summarizes the acres designated by cover type. The designated EILC stands will be reserved from treatment during this 10-year planning period or until such time as designation or release decisions are made by the department. *(DNR Memorandum, July 3, 2000, Old growth Forest Guideline and Protection of Important Lowland Conifer Sites)*

Note: Lowland conifers are not a significant cover type in the subsection. 19 stands have been selected, for a total of 341 acres, representing 45% of the lowland conifer cover type.

[4]Minn. DNR, 2005, *Field Guide to Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province*. Ecological Land Classification Program, Minnesota County Biological Survey, Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources St. Paul, MN 55155.

Table 3.3b: Acres Designated as EILC in the Hardwood Hills Subsection[5]

Cover type	Total # of stands	Total acres	#EILC stands	EILC acres	Percent of total cover type acres designated as EILC
Black spruce (lowland)	3	19.0	2	11.3	59.5%
Tamarack	50	738.9	17	329.7	44.6%
Totals	53	757.9	19	341.0	45.0%

f. Meet or exceed the MFRC *Voluntary Site-Level Forest Management Guidelines (Site-Level Guidelines)* to retain components of old forest in even-aged managed cover types.

Examples of retention of old forest components include retaining leave trees, legacy patches, snags, and coarse woody debris.

g. Use silvicultural treatments that retain old forest components in some stands.

(See GDS-1A, 1B, 3A, 3C, 3H, 3I, 4A, 4B, 5A and DNR Forest Management Direction Documents #6)
Examples of silvicultural treatments that can retain old forest components include:

- Selective harvest (i.e., group selection and single tree selection)
- Intermediate harvest (i.e., thinning)
- Shelterwood harvest with reserves
- Seed tree harvest with reserves
- Variable retention harvest
- Variable density thinning

h. Consider the status of old forest within the Subsection when making decisions to add and offer unplanned wood for harvest.

[6] DNR Divisions of Forestry, Fish and Wildlife, and Ecological Resources: *Interdisciplinary Forest Management Coordination Framework*. St. Paul, Minnesota. December 2007.

GDS-3B: Species of Greatest Conservation Need and Key Habitats are maintained or enhanced in the subsection.

Minnesota DNR participates in the State Wildlife Grants Program (SWG), created by the US Congress in 2001. Congress mandated that to participate in the SWG Program, states, in partnership with other conservation agencies and organizations must develop a Comprehensive Wildlife Conservation Strategy (CWCS) to identify and manage Species of Greatest Conservation Need (SGCN) and associated Key Habitats.

SGCN are defined as native animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Minnesota's SGCN list includes 292 native animal species, 85 of which reside in the Hardwood Hills Subsection (see App E for this list). Key habitats are defined as those habitats most important to the greatest number of SGCN in the subsection. Minnesota's CWCS identifies Key Habitats in terms of the DNR's three-volume Field Guide to native Plant Communities. For the Key Habitats found in this subsection, see App L.

By alerting resource managers and the public to SGCN and Key Habitats, activities will be reviewed and prioritized to complement Minnesota's CWCS.

GDS-3B Strategies

a. Provide current SGCN and Key Habitat data to DNR staff upon request.

DNR staff from all divisions will have access to the most up-to-date SGCN and Key Habitat locations by coordinating with the Division of Ecological and Water Resources.

b. Incorporate new SGCN and Key Habitat locations and data as they are collected in the Subsection.

SGCN and Key Habitat data are collected by MCBS and various other programs. As these new data are compiled they will be made available to DNR staff and applied to management decisions per the *Interdisciplinary Forest Management Coordination Framework*[7].

Species of Greatest Conservation Need (SGCN) and Key Habitats are identified as part of Minnesota's Comprehensive Wildlife Conservation Strategy (CWCS). SGCN are defined as animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Key Habitats are defined as those habitats most important to the greatest number of SGCN in a subsection. Minnesota DNR participates in the State Wildlife Grants Program (SWG), created by the US Congress in 2001. Congress mandated that to participate in the SWG Program, states, in partnership with other conservation agencies and organizations, must develop a Comprehensive Wildlife Conservation Strategy

[7] Manolis, J. December 2003. *Project Summary: Results from the Minnesota Spatial Analysis and Modeling Project*. Minnesota Forest Resources Council and Minnesota DNR.

(CWCS) to identify and manage their SGCN. Management activities will be carried out in a manner that complements Minnesota's CWCS. (See website for more information: http://www.dnr.state.mn.us/cwcs/index.html)

c. Provide current SGCN and Key Habitat data to DNR staff upon request.

DNR staff from all divisions will have access to the most up-to-date SGCN and Key Habitat locations by coordinating with the Division of Ecological and Water Resources.

d. Incorporate new SGCN and Key Habitat locations and data as they are collected in the Subsection.

SGCN and Key Habitat data are collected by MCBS and various other programs. As these new data are compiled they will be made available to DNR staff and applied to management decisions per the *Interdisciplinary Forest Management Coordination Framework.*

e. Select some ERF, OFMC, and EILC stands based on their association with SGCNs and Key Habitats.

SGCNs and Key Habitats were considered during the selection of stands in ERF, OFMCs, EILC areas, and the designated patches.

f. Stand-level management accounts for SGCN and Key Habitats.

Use the *Coordination Framework* to maintain or enhance SGCNs and Key Habitats.
Ecological and Water Resources will deliver SGCN and Key Habitat management considerations to forest managers for use in making forest management decisions for stands selected for treatment, access routes, and other management or development activities per processes outlined in the *Coordination Framework*.

SGCN and Key Habitat datasets are made available to area staff by Ecological and Water Resources upon request.

GDS-3C: Forest cover type composition on state lands moves closer to the range of cover type composition that historically occurred within the ecosystems found in the Subsection.

The proposed cover type change goals reflect the SFRMP team's attempt to increase the acreage of cover types that have declined historically, while maintaining or enhancing important wildlife habitats and plant communities, and providing a sustainable level of forest products. The ecological, economic, and social considerations used in developing the cover type change goals for the Subsection include:

- Historical forest composition
- Historical disturbance regimes /Range of natural variation

- Wildlife habitat
- Forest insects and diseases
- Forest productivity (e.g., match the species to the site using NPC Field Guide)
- Increase availability of certain forest products (e.g., sawtimber)
- Recreational values

GDS-3C Strategies

a. Increase the acres of oak cover type using the following actions:

Use the NPC Field Guide as a tool to guide the on-site evaluation of stands for conversion from one cover type to another or managing for mixed forest conditions (species composition and stand structure).

Options available include:

- Convert some stands through mechanical site preparation, prescribed burning, planting, or seeding.
- Selectively harvest some stands to facilitate movement toward the desired cover type and within-stand composition.

Conversions can be immediate or can take place over the span of a rotation period through thinning, partial cuts, and intermediate treatments.

b. Increase mixed-forest condition in some stands in all cover types.

Implementation of this strategy may range from application of the Site-Level Guidelines (e.g. legacy patches) in harvest operations, to other management such as mechanical site preparation, prescribed burn, etc.

The strategy to achieve this goal is to favor species found in native plant communities appropriate to the site, at appropriate growth stages especially tree species that have declined significantly from historical levels in the Subsection such as bur oak and sugar maple.

c. Forest composition goals and objectives are consistent with the MFRC Landscape plans.

Department personnel have been involved in the MFRC Regional Landscape planning efforts for Minnesota for a number of years. Although the planning processes differ in scope and scale, they share a number of goals and are committed to maintaining close relationships.

Some inherent differences are:

- DNR manages state-administered forest lands by cover type, with goals by 10-year age classes, whereas MFRC Landscape Plan recommendations are based on ecosystem types and growth stages. There is no direct comparison between age class distributions for cover

types and range of natural variation growth stages for ecosystem types. However, the landscape and subsection plans share many goals including keeping forested and open landscapes where they occurred historically and restoring the size of forested and prairie landscapes.

- MFRC Landscape plans include all ownerships, therefore they do not identify specific acreage goals for recommended changes. When requested, Minnesota DNR will provide MFRC staff with information regarding state land management, to assist them in monitoring accomplishments in the MFRC regional landscapes. Chapter 7 (Appendices) of this plan includes the SFRMP implementation monitoring plan for state lands in the Subsection.

GDS-3D: Patch management in the Subsection maintains existing large patches and increases the average patch size on state lands over time, with consideration of natural spatial patterns.

The HH SFRMP Team completed an initial patch assessment based on CSA data for the Subsection. Parcel size, natural mixes of upland and lowland, and the need to mix habitat age structure on management units eliminate opportunities to designate patches in the Subsection. Objectives of patch management will be accomplished by generally managing whole stands, trying to group harvest treatments, and not fragmenting existing large old forest areas.

GDS-3E: Managers of state lands in MCBS sites of statewide biodiversity significance implement measures to maintain or enhance the biodiversity significance factors on which these MCBS sites were ranked.

Minnesota County Biological Survey sites range from 10s to 1,000s of acres in size and contain intact native plant communities, populations and/or concentrations of rare species, critical animal habitat, and/or functional landscapes. The MCBS “site” provides a geographic framework for evaluating and communicating statewide and regional biodiversity significance. The boundaries of MCBS sites are influenced by land-use history and/or notable differences in landforms, native plant communities, rare species occurrences, and/or Ecosystem Classification System (ECS) units (e.g., subsections). These sites span all ownerships.

Sites of biodiversity significance serve as ecological reference areas that help us (1) improve our understanding of ecosystem form and function; (2) improve our understanding of Minnesota’s native biodiversity; and (3) evaluate the effects of management on biodiversity, rare species, native plant communities, and ecosystem form and function.

In order to provide a relative measure of how Sites of Biodiversity compare to each other, MCBS sites are ranked according to the four levels described below. Important factors influencing MCBS site ranks include:

- Rare species occurrences, concentration and conditions;
- Native plant community quality, rarity, co-occurrence and size; and
- Landscape context and presence/absence of landscape-level functions.

Biodiversity significance ranks are typically assigned by MCBS at the conclusion of the survey in a county to provide a relative measure of how sites of biodiversity compare to each other. MCBS sites are ranked according to the four levels described below.

O - OUTSTANDING. MCBS sites 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.

H - HIGH. MCBS sites containing very good quality occurrences of the rarest species, high quality examples of the rarest native plant communities, and/or important functional landscapes.

M - MODERATE. MCBS sites containing significant occurrences of rare species and/or moderately disturbed native plant communities, and landscapes that have a strong potential for recovery.

B – BELOW. MCBS sites below the minimum biodiversity threshold (BMT) for statewide significance.
These sites lack significant populations of rare species and/or natural features that meet MCBS minimum standards for size and condition. They 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.

Minnesota County Biological Survey biodiversity significance guidelines are applied statewide, but not all criteria may be applicable to all regions i.e., portions of the state are highly fragmented and completely lack significant components of functional landscapes whereas other portions of the state contain large, intact landscapes but lack rare species and/or rare native plant communities – yet both areas may share the same biodiversity significance rank based on the statewide significance of the features they each contain. Biodiversity significance rankings for some sites may need to be updated as survey work proceeds across the state to reflect new information and our growing understanding of Minnesota's native biodiversity.

MCBS work has been completed in all counties located in the Hardwood Hills Subsection, except Clearwater County.

Table 3.3c provides a summary of biodiversity significance and survey priority rankings for MCBS sites that include state lands.

Table 3.3c: Summary of Biodiversity-Significance Rankings for MCBS Sites[1] (2012)

Subsection	Rank	Number of MCBS Sites	Total MCBS Site Acres[2]	State Forestland[3] Acres	Timberland[4] Acres	10-year stand exam list acres
Hardwood Hills Subsection	O	2	19,006	4,147	2,347	577
	H	19	55,058	7,239	3,897	968
	M	72	205,526	14,526	6,453	1,690
	B	34	47,516	2,489	877	229
	Total	127	327,106	28,400	13,574	3,463

[1]Subsection summary includes MCBS inventory which has been completed in Becker, Clay, Douglas, Grant, Kandiyohi, Mahnomen, Meeker, Morrison, Norman, Otter Tail, Polk, Stearns, Todd and Wright counties

[2]Acres are based on the intersection of shapefiles from MCBS sites, and SFRMP adjusted subsection boundaries.

[3]*Forestland* acres include all cover types on lands administered by the Division of Forestry and the Section of Wildlife.

[4]*Timberland* acres include only the cover types that produce merchantable timber on lands administered by the Division of Forestry and the Section of Wildlife. It does not include stagnant cover types (e.g., stagnant spruce), lowland brush, etc. or lands reserved from harvest such as old growth.

In 2009, the DNR began implementing the High Conservation Value Forest policy as part of the state's Forest Certification program. This policy states that on certified state forestry and wildlife managed lands, a selected set of outstanding and high biodiversity significance sites will be managed as High Conservation Value Forests (HCVFs). These sites will be managed to maintain or enhance identified high conservation values. The DNR is currently in the process of reviewing proposed sites. Final HCVF sites are expected to be designated in 2012. See Appendix I for more information on HCVF.

Forest management activities such as timber harvesting, site preparation, access route construction and maintenance, and tree planting will occur on Forestry and Wildlife administered lands within MCBS sites and HCVFs following the guidance and directions contained in this plan. Forest management activities carried out in those MCBS sites determined to be of greatest concern or importance for SFRMP will emphasize the following strategies to help minimize loss of the factors on which the MCBS sites were ranked.

GDS-3E Strategies

a. Determine which MCBS sites are of greatest concern or importance for SFRMP over the 10-year planning period.

MCBS sites of greatest concern or importance for SFRMP have been determined to be those MCBS sites with state lands that have a biodiversity significance rank of Outstanding or High, or are in survey priority areas with a rank of High. These MCBS sites represent the best occurrences of existing biodiversity significance, so they provide the greatest opportunity to sustain or minimize the loss to native biodiversity.

The subset of MCBS sites that have been selected as proposed HCVF sites will require special attention in our management planning and implementation to assure we maintain and/or enhance the high conservation values of the sites.

b. Consider the broader context and significance of the MCBS site as a whole when assigning management objectives and designing silvicultural prescriptions.

Management decisions should be made considering the broader context and factors that contribute to the significance of the MCBS site as a whole. Silvicultural prescriptions incorporate connections between stand-level actions and their effect on a site's biodiversity significance. Final management objectives will be carried out consistent with the *Coordination Framework* and the guidance recommendations for high conservation value forests (HCVF).

c. Determine location and composition of stand conversions based on NPCs. (GDS-1A)

Resource managers will determine the NPC for stands planned for site preparation, tree planting, forest development and other management activities using the *Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province*. Additional information to help determine the NPC class of a stand will become available as MCBS completes NPC mapping for MCBS sites of outstanding and high statewide biodiversity significance, and as various other efforts continue to expand the collection and application of NPC data in Minnesota.

The NPC Field Guide and associated ECS Silvicultural Interpretations[8], and information in will help resource managers determine appropriate management direction for the identified NPC.

Whenever possible and practical, manage stand conversions with less intensive site preparation or plantations with less intensive timber stand improvement (TSI).

d. Allow some stands to succeed to the next native plant community growth stage, with or without harvest.

Most likely candidates for succession would be stands that contain adequate regeneration stocking levels and structural characteristics for the site to convert to a later growth stage. Other candidates would include stands whose location, condition, or rare species occurrences are critical factors to a site's biodiversity significance.

e. Emulate the within-stand composition, structure, and function of NPC growth stages when managing stands in MCBS sites.

[8] http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Determine which species to harvest and retain and their spatial and temporal arrangement based on NPC tree succession and disturbance ecology. DNR Forestry's ECS Silvicultural Interpretations will be used to make the link between stand-level considerations and NPC ecology.

Examples include: Coarse woody debris and snags – species, size class distribution, spatial distribution, availability through time; Leave trees and legacy patch selection and design are influenced by how the NPC would have been disturbed under natural conditions; Include super-canopy trees as leave trees and in legacy patches; Diameter classes in uneven-aged managed stands reflect the range and abundance expected for the NPC; Retain or create a legacy of species and structural features that are found in older growth stages, so that maintenance or movement of the stand towards other growth stages is an option. Natural disturbances rarely destroy all biological and physical features of the NPC, so older growth stage species and structures often persist in young stands regenerating from catastrophic disturbances; Use silvicultural techniques during forest management activities to recruit desired species through natural regeneration – leave trees that are likely to produce seeds, leave trees that help create/maintain microclimate conditions favorable to seedling establishment and growth; Use gap management with varying gap sizes to encourage recruitment of desired species (e.g., yellow birch, white cedar, and white spruce) in northern hardwood stands; Use silvicultural techniques that take advantage of opportunities to increase recruitment of desired species from adjacent stands of the same and adjacent native plant communities; and, Manage stands based on NPC boundaries recognizing that a change in cover type may or may not relate to a change in NPC.

f. Apply variable density management strategies during harvest or reforestation.

Variable density techniques may be prescribed during the planning of timber sales and/or forest development activities. Using this approach, harvest (clear-cut or thinning) and planting (or seeding) would be accomplished in a pattern (clumped or dispersed) that more closely replicates patterns created after natural disturbance. For example, retain legacy patches versus scattered reserves in clear-cuts to retain islands of residual vegetation that include tree species present at older growth stages.

g. Apply variable retention harvest techniques during harvest.

The main objectives of variable retention are to retain the natural range of stand structure and forest functions. With retention systems, forest areas to be retained are determined before deciding which areas will be cut. The following are techniques to be considered: Standing trees are left in a dispersed or aggregate form to meet objectives such as retaining NPC form and function, old growth structure, habitat protection, and visual qualities; Retain structural features (e.g., snags, large woody debris, and live trees of varying sizes and canopy levels) as habitat for a host of forest organisms; See legacy patches recommendations in *MRFC Voluntary Site-level Forest Management Guidelines, Wildlife Habitat Section, pages 43-47;* During harvest, retain tree species and diameters present at older growth stages, in clumps or dispersed, to more closely replicate pattern after natural disturbance; And, Include retention of large, downed logs. For example: Leave legacy patches throughout the stand; islands of residual vegetation that include tree species present at older growth stages.

h. Designate some stands as ERF to provide old forest conditions.

ERF designated stands will help maintain old forest conditions within MCBS sites and will retain older growth stages on the landscape for longer periods of time than stands managed as normal rotation forests. When ERF stands are harvested within MCBS Sites make efforts to retain the older forest components that are present in the stand or retain features that allow older forest components to continue developing.

i. Increase the use of prescribed fire as a silvicultural technique in managing fire-dependent NPCs.

j. Locate roads to minimize fragmentation of a MCBS site. (GDS-3D and 10)

Roads contribute to a decrease in interior forest conditions and an increase in terrestrial non-native invasive species abundance. All efforts should be taken to minimize new road construction and enlarging existing roads/trails in MCBS sites.

k. Emulate natural disturbance conditions in patch management. (GDS-3C and 3D)

Patches include both even-aged and uneven-aged patches. Managing for and maintaining patches on the landscape will minimize habitat fragmentation as well as provide valuable wildlife habitat for some species. Consider retaining more than the recommended number of leave trees in larger harvest sites (greater than 100 acres) because this would better mimic natural disturbances, such as fire and windstorm. *(MFRC Site-level Forest Management Guidelines, Timber Harvesting, Page 39.)*

l. Apply special management recommendations for known rare features, Species of Greatest Conservation Concern, and Key Habitats. (GDS-3F and 3G)

Rare features include rare plants, rare animals, and rare communities. Additional rare feature locations are likely to be discovered in the Subsection. Management activities will be carried out in a manner that protects, maintains, or enhances rare features according to DNR policy, state statute, and forest certification requirements

m. Defer management of some stands that have been identified as having high conservation value for further assessment (e.g., EILC, G1G2 native plant communities, nominated natural areas, and rare or representative ecosystems).

Designated EILC stands will be reserved from treatment during this 10-year planning period or until old growth guidelines or other EILC guidelines are in place. See Appendix H for more detailed information on EILC acre goals and rationale.

Other reasons that may lead to a recommendation to defer a stand from treatment include nominated old growth, rare native plant communities, rare species habitat, or significant negative impacts to a site's biodiversity significance.
Designated G1G2 (globally rare) native plant communities will be reserved from treatment during this 10-year planning period.

n. Consider timber productivity, trust responsibilities, and other forest management priorities when managing stands in these MCBS sites. (GDS-6)

Land status and timber productivity will be considered while implementing the other strategies on stands identified for management. Areas will follow DNR policy regarding replacing stands that are deferred from treatment. Consistent with the *Coordination Framework*, other divisions will have an opportunity to review proposed preliminary MCBS sites.

o. Forestry, Wildlife, and Ecological and Water Resources personnel will communicate with other landowners, as opportunities arise, to inform them of the significance of these MCBS sites and management options that could be implemented to address the biodiversity objectives of these MCBS sites.

For example: DNR resource management staffs will seek to implement stand-level management activities that achieve landscape-level biodiversity goals and objectives across ownerships. (See the MFRC's West Central Minnesota landscape plan for more information); When assisting private landowners with woodland stewardship plans, provide information on the biodiversity significance of these MCBS sites, including any HCVFs; And, DNR personnel will communicate and deliver information about priority MCBS sites of biodiversity significance to other landowners within these MCBS sites when opportunities arise.

The intent of this strategy is to provide information on the MCBS sites and cooperate in forest land management across ownerships in the landscape when possible and agreed upon by the landowners affected. It is not meant to imply or mandate how other landowners should manage their lands.

GDS-3F: Rare plants and animals and their habitats are protected, maintained, or enhanced in the Subsection.

Minnesota's List of Endangered, Threatened, and Special Concern Species (ETS List) was created in 1984 and was revised in 1996. Created under Minnesota's Endangered and Threatened Species Statute, the ETS List draws attention to species that are at greatest risk of extinction within the state with special regulations applied to those species listed as endangered or threatened. By alerting resource managers and the public to species in jeopardy, activities can be reviewed and prioritized to protect them. Because of the importance of the ETS List in influencing 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 the ETS List to be periodically revised. The latest ETS list revision is currently in-progress with rule-making estimated to be completed within the early years of this plan.

Up-to-date information about rare plants and animals in the state is available through the Rare Species Guide on the DNR website, at: http://www.dnr.state.mn.us/rsg/index.html.

The DNR takes a leadership role in protecting and providing habitat for rare plants and animals in Minnesota by managing the listing of rare species in the state. Protecting rare plants and animals and their habitat is a key component of ensuring the continuance/long-term viability of Minnesota's species, community, and landscape- level biodiversity. Implementation of the strategies below will assist the DNR's ability to protect rare species and their habitats in the Subsection.

GDS-3F Strategies

a. Provide the current rare features database (Natural Heritage Information System) to DNR staff through the DNR Quick Layers in ArcGIS and encourage public land managers to obtain a license providing them access to the most up-to-date information.

DNR staffs from all divisions will have access to the most up-to-date rare features locations.

b. Incorporate new and updated rare features inventory information as the MCBS is completed in the Subsection.

c. Consider current rare plant and animal species, and rare habitats in management activities in the Subsection.

d. Select some ERF, OFMC, and EILC stands based on their association with rare features.

When extended rotation forests (ERF), old forest management complexes (OFMCs), and ecologically important lowland conifers (EILC) stands were selected in the Subsection, locations of rare species populations and conditions for rare species and their habitats were considered.

e. During the development of the 10-year stand examination list and annual stand examination lists, land managers check the rare features database and flag for follow-up consultation those stands proposed for treatment that includes a rare feature.

If rare feature locations occur in stands proposed for treatment, land managers confer with the appropriate Wildlife or Ecological and Water Resources staff to determine if adjustments to proposed treatments are needed to protect the rare plant or animal or its habitat.

f. Harvest prescriptions, access plans, and other management proposals identify and implement measures that protect rare features.

Prescriptions for stands selected for treatment, access routes, and other management or development activities include mitigation measures that protect the rare feature(s) within the stand. Mitigation includes measures that reduce the likelihood of the introduction or spread of non-native

invasive species (and the impacts of the control measures for non-native invasive species, e.g., effects on rare species and/or habitat from use of herbicides to eradicate non-native invasive species).

GDS-3G: Rare native plant communities are protected, maintained, or enhanced in the subsection.

Minnesota's NPCs have been evaluated and assigned an S-Rank based on the Heritage Conservation Status Rank (S-Rank) by the State's natural heritage program. The resulting S-Rank is a value assigned to a NPC type (or subtype) that best characterizes the relative rarity or endangerment of the NPC statewide (Tables 3.3d-e). Through NatureServe[9], some of these plant communities have been evaluated across their entire range in the world and have a global rank (G-Rank). This global ranking is an assessment of the condition of the ecological community across its entire range.

Table 3.3d: Statewide Heritage Conservation Ranks (S-Ranks) for Native Plant Communities found in the Hardwood Hills Subsection

NPC Type S-Rank	Definition
S1	Critically imperiled
S2	Imperiled
S3	Rare or uncommon
S4	Widespread, abundant, and apparently secure, but with cause for long-term concern
S5	Demonstrably widespread, abundant, and secure

Table 3.3e: Global Heritage Conservation Ranks (G-Ranks) for Native Plant Communities found in the Hardwood Hills Subsection

G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperiled**—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

[9] NatureServe - In cooperation with the Network of Natural Heritage Programs and Conservation Data Centers. 2002. Element Occurrence Data Standard. Arlington, VA.

G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.

Appendix L provides a list of all rare NPC Types and Subtypes and associated Conservation Status Ranks for Minnesota[2] that are known to occur in this subsection. Rare NPCs are defined as NPCs with a conservation status rank of S1 or S2 as well as those S3 NPCs that are identified in this plan as being rare in the subsection. *Note: As new information on the status of NPCs becomes available, S-ranks and G-ranks will be revisited and refined as justified.* A complete list of the Statewide S-Ranks for NPC types in Minnesota is available from the DNR Natural Heritage and Nongame Research Program.[10]

Most of the rare NPC types or subtypes have been assigned a relative rank for the quality of the NPC. Generally, NPCs are ranked for quality based on factors associated with size, condition, and landscape context. Specifications for condition ranking of NPCs are currently being revised by the MN DNR Division of Ecological and Water Resources to complement the MN DNR's three-volume *Field Guide to the Native Plant Communities of Minnesota* (version 2.0). The relative quality of the NPC is assigned on a continuum from "A" through "D", with an "A" rank indicating an excellent quality NPC, and a "D" rank indicating a poor quality NPC. The DNR is committed through forest certification to maintaining or enhancing all G1 and G2 NPCs with quality ranks greater than "C". The protection of many MCBS-mapped rare native plant communities will be addressed by considering how to maintain or enhance high conservation values (including native plant communities) in HCVF and RSA sites once they are designated.

Because MCBS is a primary source for NPC data and MCBS prioritizes survey efforts within MCBS sites, most documented locations of rare NPCs are within MCBS sites. However, there may also be locations of rare NPCs documented in areas outside MCBS sites. This will become more common as NPC data collection is being completed by other DNR divisions and by a growing number of cooperators.

GDS-3G Strategies

a. Manage known locations of critically imperiled (S1) or imperiled (S2) NPCs and those NPCs that are rare statewide or with limited occurrences in this subsection to maintain their ecological integrity.

Where rare NPCs occur, vegetation management within and adjacent to these NPCs will protect, maintain, or enhance the ecological integrity of the NPCs. Additionally, Forest Certification has required the DNR to protect and appropriately manage some of the best examples of rare native plant communities on state wildlife and forestry lands through two designations: G1G2 and Representative Sample Areas (RSAs). RSAs are in the process of

[10] Minn. DNR 2008. Conservation Status Ranks for Minnesota Native Plant Communities (October 2008). Minnesota Department of Natural Resources – Division of Ecological Resources. St. Paul, MN 55155.

being selected and will be designated early in the implementation of this plan. State and globally rare wooded NPCs found in the Hardwood Hills Subsection are listed below.

Table 3.3f: Critically Imperiled or Imperiled NPCs in the Hardwood Hills Subsection

Community Name	Community Code	State Rank	Global Rank
Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype	FDc23a2	S1S2	G2
Red Pine - White Pine Forest	FDc34a	S2	
Elm - Ash - Basswood Terrace Forest	FFs59c	S2	
Tamarack Swamp (Southern)	FPs63a	S2S3	G2G3
Sugar Maple Forest (Big Woods)	MHs39c	S2	
Dry Barrens Oak Savanna (Northern)	UPn13b	S1S2	G2
Dry Sand - Gravel Oak Savanna (Northern)	UPn13c	S1	G1G2
Dry Hill Oak Savanna (Northern)	UPn13d	S1	G1G2
Dry Barrens Oak Savanna (Southern)	UPs14a	S1S2	
Dry Sand - Gravel Oak Savanna (Southern)	UPs14b	S1S2	
Black Ash - (Red Maple) Seepage Swamp	WFs57a	S1S2	

Some locations with rare NPCs are best managed by avoidance, while other sites can either be maintained or enhanced by using the appropriate harvesting or other forest management activities (e.g. application of ECS silvicultural interpretations). Resource managers should work closely with state-wide, tribal, and federal cooperators and adjacent land owners on all management activities that will affect these communities.

DNR personnel have been trained in the use of the *Field Guide to the Native Plant Communities of Minnesota: Eastern Broadleaf Forest Province* for identification of NPCs. Additional ECS products, such as silvicultural interpretations for management of NPCs, have been developed for use by field staff for implementing ECS-based management on state lands.

b. Ecological and Water Resources staff identified stands that are high quality examples of rare native plant communities.

Subsequent coordination (joint site visits) between divisions of Forestry, Fish and Wildlife, and Ecological and Water Resources staff will determine if adjustments to proposed treatments are needed to protect, maintain, or enhance the ecological integrity of the rare NPCs.

For a discussion of key habitats and species in greatest conservation need, go to GDSs 3G-F.

GDS- 3H: Even-aged managed cover types will be managed to move toward a balanced age class structure.

A balanced age class structure has relatively equal acres in each 10-year age class out to the normal rotation age. A goal is to provide for an even flow of timber harvest volumes and adequate wildlife habitat in the Subsection over time. A steady supply of these resources over time is important to wildlife, recreation, the forest products industry, and the local economies that depend on them. Many cover types managed under even-aged regimes (see above) do not currently display a balanced age class distribution.

The following strategy will be implemented to move even-aged managed cover types toward a balanced age class distribution.

GDS-3H Strategies

a. Target the selection of stand treatment acres to the appropriate age classes.

Forest planning attempts to balance age classes by selecting stands from specific age classes based on criteria developed during the planning process, including normal rotation age, maximum rotation age, and ERF percentage. While it may not be possible to attain a balanced age class structure within 50 years for most even-aged cover types, it can be accomplished more quickly by adjusting short-term harvest levels.

GDS-3I: ERF stands in even-aged managed cover types will be managed to achieve a declining age class structure from the normal rotation age to the maximum rotation age.

DNR guidance to SFRMP teams requires the development of a declining age class structure from normal rotation age to the determined maximum rotation age for most even-aged managed cover types. ERF stands, when held beyond the normal rotation age begin to provide old forest habitat, recreational opportunities in older forests, and opportunities for large-diameter timber product management as they age.

The following strategies will be used to achieve the desired declining age class structure in even-aged managed cover types:

GDS-3I Strategies

a. Prescribe ERF stands within even-aged managed cover types so that each age class will be represented to produce a sustainable amount of old forest over time.

The SFRMP Team identified a list of ERF stands based on criteria provided to the team by St. Paul staff. The identified stands were reviewed by field staff prior to making the final selections for ERF. Old forest conditions in even-aged managed cover types will be achieved by designating some stands in each of these cover types for ERF management. In addition to evenly distributing the designation of ERF stands among age classes, spatial considerations (e.g. openlands) will be used to develop and maintain desired old forest conditions throughout the Subsection.

b. Target ERF treatment acres to the appropriate age classes to move toward the declining age class structure after normal rotation age.

Harvest scheduling provided for the achievement of old forest conditions by harvesting appropriate acreages from each age class of ERF over normal rotation age. The remaining un-harvested acres will contribute to old forest conditions until they reach the maximum rotation age.

GDS-3J: State lands will include representation of each of the Native Plant Community growth stages that historically occurred in the Subsection.

Growth stages incorporate both horizontal and vertical developmental stages (stand structure changes over time) and successional stages (species composition changes over time) that occur after a disturbance. (e.g. In the Central Mesic hardwood Forest (Western) NPC, MHc37, there are three growth stages. The first, 0-55 years, is a young forest recovering from disturbance such as fire, dominated by quaking aspen mixed with paper birch, American elm, basswood, red oak and sugar maple. The second, 55-135 years, consists of mature forests of sugar maple mixed with many other species including old quaking aspen, paper birch, American elm, basswood, some bur oak and minor amounts of white spruce. And the third, >135 years, is old forest similar in composition to mature forests but with less sugar maple.) In the past, growth stages developed over time following natural disturbances such as wind and fire. Now, growth stages can be emulated through forest management activities such as timber harvest, prescribed burns, and forest development activities.

These growth stages are important to the wildlife species that inhabit these plant communities. Wildlife habitat and the species occurrence can vary with growth stage, for example, White-tailed deer may use the early growth stage of MHn44 for feeding but use the old forest and mature growth stage for winter thermal cover. Northern goshawks will not use the early growth stage of MHn44 but will use the old forest and mature growth stage for nesting and hunting. Songbird populations will change in MHn44 as the community matures, and will become more diverse as the structure becomes more complex with time".

This SFRMP does not establish acreage goals for growth stages by ecosystem type or native plant community. The strategies in this SFRMP will provide representation of all NPC growth stages. Young and intermediate growth stages are typically adequately represented on the landscape. Older growth stages are more of a concern; management strategies can provide some components of older growth stages in much younger stands by leaving coarse woody debris, snags, super canopy trees, and legacy patches. Stands can also be managed to maintain the existing growth stage or assist in moving the stand to the next older growth stage. The Strategies identified below, the *Field Guide to Native Plant Communities*, and the Silvicultural Interpretations can provide options to field staff for accomplishing these goals.

GDS-3J Strategies

a. Determine growth stage stands selected for treatment in the Subsection.
Stands in this SFRMP will be classified to NPC consistent with DNR policy. Field staff are encouraged to identify and use growth-stage information in developing stand management prescriptions.

b. Strive to emulate the within-stand composition, structure, and function of NPC growth stages when managing stands.
Field staff should focus on characteristics of older growth stages due to their relative rarity.

c. Consider the contribution of inoperable stands and reserved areas (e.g., old growth, SNAs, state parks) in providing representations of growth stages when developing prescriptions.

d. Manage designated representative ecosystems (RSAs) and High Conservation Value Forests (HCVF) consistent with forthcoming DNR direction to achieve distributions of native plant communities

e. Apply ECS Silvicultural Interpretations when proposing stand management prescriptions

GDS-3K: Young, early-successional forest is distributed across the landscape over time.

The 0-30 age class of aspen/ balm of Gilead, cover type represents young, early successional forest in the context of this GDS. The desired long-term goal for balancing age class distribution in even-aged managed cover types and the acreage goals for young early successional forest cover types will determine the amount of young forest to be sustained over time in this SFRMP. Currently the 0-30 age class aspen/balm of Gilead cover type comprises 60% of the total aspen/balm of Gilead acres in the Subsection. For a summary of the young forest acres over the course of the planning (See tables 3.3F below)

Table 3.3f: Hardwood Hills Subsection Acres of Young Forest in Early-Successional Cover Types by Decade

Young Forest – Acres of Cover Type Under 30 Years Old Hardwood Hills Subsection												
Cover type	**Current**	**%**	**1st Decade**	**%**	**2nd Decade**	**%**	**3rd Decade**	**%**	**4th Decade**	**%**	**5th Decade**	**%**
Aspen/BG	3,164	60%	3,448	68%	3,158	63%	2,657	53%	2,816	57%	3,048	61%

Regulated harvest of aspen/balm of Gilead cover types will ensure that young, early-successional forest will be adequately represented over time. Stands retained in these cover types will be managed to move towards a more balanced age class structure than currently exists, which will provide a more consistent amount of young forest over time. Most of the harvest in these cover types will occur through clearcut methods. Harvest prescriptions will attempt to mimic the intense wildfires and wind events that occurred naturally to initiate fully stocked, early successional forest. Maintenance of existing large patches and creation of additional large patches in the future will be accomplished by grouping of harvest activities and using a variety of harvest sizes.

For aspen/ balm of Gilead, and oak, the emphasis will be on maintaining an adequate amount of young age classes on the landscape through a regulated harvest level.

Young, early successional tree species will also be present in other cover types. Many cover type conversions will occur in early successional stands that are already in decline due to old age, insect or disease problems, or other damage agents.

GDS-3K Strategies

a. **Move aspen, balm of Gilead, red oak (high and low SI) and bur oak cover types toward a balanced age class structure.** (GDS-2A)

3.4 Wildlife Habitat

GDS-4A: Adequate habitat and habitat components exist, simultaneously at multiple scales, to provide for nongame species found in the Subsection.

Nongame[11] *species* are an important indicator of the biological health of the forest and are important to society for their inherent values. Legal statutes, public expectations and desires of interest groups, and Department of Natural Resources (DNR) internal policies require the consideration of nongame species in the management of state-administered lands. The DNR strategic plan *Directions 2000* (Minnesota DNR 2000) and the DNR's Conservation Agenda 2010-2013 calls for an objective of "healthy self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species, especially those species listed as threatened or endangered."

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

There are numerous nongame species [12] and game species known or predicted to occur within the Subsection. Each species has different habitat requirements, some of which conflict. Individual consideration of management needs for each species is therefore impossible to accomplish with a single approach across the planning area[13]. To ensure that the Subsection is managed to maintain and enhance the habitat of game species, a number of management techniques will be considered using both a coarse filter approach and a fine filter approach (discussed below).
Providing a variety of patch sizes that better reflect the patterns created by natural disturbance factors and efforts to reduce the effects of habitat fragmentation (GDS-1D) will help provide habitat for nongame species with different patch size requirements.

Several management techniques will be considered to ensure that the Subsection is managed to maintain and enhance the habitat of nongame species. The three primary approaches are:

A *coarse filter* approach (Hunter, 1990[14]) emphasizes management of forests from a local to landscape scale to: maintain the integrity of ecosystem processes, maintain components of the range of historic habitats and age classes, and retain/enhance structural attributes within habitats. In using a coarse filter approach, it assumes that a broad range of habitats encompassing the needs of most species will be met, and their populations will remain viable on the landscape. Habitat analysis and management emphasis in this plan were primarily done at this level.

A *fine filter* approach considers the specific habitat needs of selected individual species that may not be met by the broader coarse filter approach. Providing habitat at this level will be guided primarily by department policies and guidelines that provide recommendations for habitat management at this finer level for a number of species, such as state or federal listed species.

A *meso filter* focuses on conservation of critical ecosystem elements such as structures (logs, snags, pools, springs, streams, and hedgerows) and processes (fire, flooding) that would be missed by a coarse or fine filter. An example of how these three scales work would be that a meso filter would focus on coarse woody debris (CWD), the processes that created the CWD, and the features it provides to associated biodiversity; a coarse filter would focus on the ecosystem in which the CWD exists, while a fine filter would focus on a species that may use the CWD.[15]

GDS-4A Strategies

a. Provide old forest distributed across the landscape.

Old forest includes stands that are beyond the normal rotation age established for the cover type. There are numerous nongame species within the Subsection that are associated with old forest and old forest conditions such as large-diameter trees and/or uneven-aged successional stages. Examples

[12] Minnesota DNR. 2007. *Hardwood Hills Subsection Preliminary Issues and Assessment (August 2011)*.
[13] Minnesota Department of Natural Resources, 2006. *Tomorrow's Habitat for the Wild and Rare:*
An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.
[14] Hunter, M.L. 1990. *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biodiversity*. Prentice-Hall Inc., Englewood Cliffs, N.J.
[15] Hunter, Malcolm L. Jr. A Mesofilter Conservation Strategy to Complement Fine and Coarse Filters. Cons. Bio. Vol.19, No. 4. August 2005.

of species are hairy woodpecker, southern flying squirrel and the eastern screech owl. Designation and maintenance of areas to be managed for old forest conditions across the landscape over time will ensure available habitat for many of these species. Extended rotation forests (ERF), ecologically important lowland conifers (EILC) and designated old growth forest are examples.

b. **Provide young forest distributed across the landscape.**

Young forest in this plan refers to stands that are 0-30 years old. There are numerous nongame species within the Subsection that are associated with young forest or young forest condition such as seedling and/or sapling successional stages. Examples of species are chestnut-sided warbler, red-tailed hawk and the golden –winged warbler. Areas managed for young forest conditions will provide young forest habitat across the Subsection.

c. Provide a variety of patch sizes across the landscape that better reflect patterns produced by natural disturbances, and attempt to maintain existing large old forest stands.

d. **Manage to retain the integrity of riparian areas and provide protection for seasonal and permanent wetlands.**

Many nongame species are associated with forested wetlands or the riparian forest interface. These areas also serve as movement corridors for additional species. Consideration for the health and integrity of riparian areas (GDS-5A) and protection or mitigation of other wetlands (GDS-5B) will serve to provide such needs.

e. Provide for the needs of species that depend on perches, cavity trees, bark foraging sites, and downed-woody debris.

A number of species rely on tree perches, existing tree cavities or available trees that can be excavated to provide a cavity, insect foraging sites on dead or dying trees, or downed trees or slash for roosting, nesting, or cover. Historically, natural disturbances provided these habitat needs. Today, the frequency and size of these processes have declined.

f. **Provide for the needs of species associated with important native plant communities in this subsection.**

A number of nongame species found within the Subsection have some association or dependence on specific native plant communities.[16] (see Appendix G: Wildlife Habitat Relationships & Species List). Some conifer species (white spruce, tamarack and white pine) have declined significantly from historic levels in the subsection.[17]

The following techniques will be used to meet coniferous habitat needs:

[16] Green, J.C. 1995. *Birds and Forests: A Management and Conservation Guide*. Minnesota Department of Natural Resources.
[17] Minnesota DNR. 2011. *Hardwood Hills Subsection SFRMP Preliminary Issues and Assessment*, Table 3.4.

- Increase the presence of some conifers as a component of other cover types (GDS-3A).
- Follow the conifer retention guidelines found in the *Site-Level Guidelines*

g. Provide for creation and maintenance of within-stand diversity.

Managing for a mix of tree species and ages along with a diversity of structural characteristics (e.g., tree diameter, tree height, and scattered or clumped distribution) in some stands will provide conditions for species that require within-stand diversity (GDSs 1A, 1B, 2A, 3J, 4A, and 4B).

h. Manage to favor native plant communities and retain elements of biodiversity significance.

Habitat for nongame species associated with highly diverse native plant communities will be provided by the following strategies:

- Identify and manage high-quality and/or rare native plant communities so they are maintained or enhanced (GDS-3G).
- Use the NPC Field Guide and associated Silvicultural Interpretations to manage some stands to reflect the composition, structure, age class distribution, successional stage, and function of native plant communities (GDS-1A).
- Maintain or increase biodiversity, where ecologically appropriate, within areas of statewide biodiversity significance (GDS-3E).

i. Consider Natural Heritage Program data and other rare species information during development of both the 10-year and annual stand examination lists.

Rare species data in Natural Heritage Information System is considered during the 10-year and annual stand examination selection process. Before groundwork begins, field staff will check the database for known locations of rare nongame species in stands planned for treatment and, if present, will seek advice from appropriate staff or refer to established guidelines or considerations on avoiding negative impacts to these species.

j. Provide a range of habitats for short-distance and long-distance (neotropical) migratory birds.

According to breeding bird monitoring work in northern Minnesota (e.g., NRRI Technical Report: NRRI/TR-2005/04[18]; USFWS Breeding Bird Survey; Audubon Christmas Bird Counts; DNR's and *Tomorrow's Habitat for the Wild and Rare*), there have been significant declines in populations for some neo-tropical birds. Widespread declines have been reported for ground nesting birds and species found mainly in mature forest habitats. Birds with preferences for aspen-oak, hardwood, oak savanna and brush prairie are some of the most imperiled. Strategies have been developed throughout this SFRMP that address the need to maintain or enhance habitat for both short-distance and long-distance (neotropical) migratory birds, especially those with declining trends in this subsection. Using a coarse filter approach, ERF, providing a range of age classes from young to old, enhancing within-stand

[18] Lind, J., Danz, N., Hanowski, J, and Niemi, G. *Breeding Bird Monitoring in Great Lakes National Forests 1991-2004; 2004 Annual Update Report*. NRRI/TR-2005/04. Natural Resources Research Institute, Duluth, MN. 27p. PDF document at: www.nrri.umn.edu/mnbirds/

diversity, and a variety of other management strategies, provides a range of habitats for a variety of species, including neotropical songbirds. For example, maintaining or restoring savanna habitat by managing for an open understory may benefit some species (e.g., golden-winged warbler, red-headed woodpecker), contiguous stands of hardwood forest will benefit other species (e.g., scarlet tanager), while brush prairie management will support yet a different set of species (e.g. loggerhead shrike).

GDS-4B: Adequate habitat and habitat elements exist, simultaneously at multiple scales, to provide for game species found in Subsection.

Game[19] species are an important indicator of the biological health of the forest and are important to society for their recreational, economic, and inherent values. Legal statutes, public expectations, the desires of interest groups, and DNR internal policies require the consideration of game species in the management of state-administered forest lands. The DNR strategic plan, *Directions 2000,* states that an "objective is healthy, self-sustaining populations of all native and desirable introduced plant, fish, and wildlife species," and for "populations of fish, wildlife and plant species to sustain recreational opportunities." [20]

The abundance of public forest land in the subsection draws many hunters and trappers to the area each fall. Turkey and white-tailed deer hunting has a long tradition in the Subsection and is important to local economies.

The SFRMP team utilized available information and review by field staff to identify and approve the Priority Open Landscape Areas within the following LTAs: Vawler Moraine; Randall Sand Plain; Long Prairie Sand Plain; Clarissa Drumlin Plain; Luxemburg Sand Plain; Rose Sand Plain; Perham Sand Plain; Detroit Lakes Sand Plain; Underwood Moraine; Roscoe Moraine; McIntosh Moraine; Erskine Till Plain; and, Cormorant Sand Plain.

Ecologically, there have been both historic and more recent changes to Subsection that have affected game species and their habitat:

- Changes in the abundance of tree species, age structure of the forest, and structural and species diversity;
- Loss of larger patches and connections between such patches;
- Increased habitat fragmentation from roads, trails, and development; and
- Alteration of natural fire disturbance events.

Both natural events and forest vegetation management through stand treatments, have the potential to positively or negatively affect game species.

GDS-4B Strategies

[19] In this plan, *game* species include those terrestrial species that are hunted and trapped.
[20] Minnesota DNR. 2000. *Directions 2000: The Strategic Plan.* St. Paul, MN.

a. Provide young forest distributed across the landscape.

Young forest in this SFRMP refers to stands that are 0-30 years old. There are numerous game species within Subsection that are associated with young forest or young forest conditions such as seedling and/or sapling successional stages. Some examples of these species are white-tailed deer, black bear, ruffed grouse and woodcock.

Areas managed for young forest conditions (GDS-1A and 3K) will provide a distribution of young forest habitat across the Subsection.

b. **Provide old forest distributed across the landscape.**

Old forest includes stands that are beyond the normal rotation age established for the cover type. There are numerous game species within the Subsection that are associated with old forest and old forest conditions, such as large-diameter trees and uneven-aged successional stages. Some examples of these species are fisher, wood duck, wild turkey and white-tailed deer.

Designation and maintenance of areas to be managed for old forest conditions across the landscape over time (GDSs 1A, 1B, and 3A) are intended to provide available habitat for many of these species. Designated old growth forest and ERF stands are examples of strategies that provide old forest values across the landscape.

c. Provide a balanced age class structure in cover types managed with even-aged silvicultural systems.

A balanced age class structure leads to relatively equal acreages in each age class out to the normal rotation age. To provide an even flow of early successional forest habitat, it is necessary to avoid large fluctuations in harvest levels within the aspen, balm of Gilead, birch, jack pine, and balsam fir cover types. By beginning now, to address current age class imbalances to move toward a future balanced age class structure (GDS-1A, 1B, 2A, 3A, 3C, 3H, 3I, 3K, 4A, 6, 8, 10 and 12 and aspen, balm of Gilead, red oak and bur oak cover type recommendations), future sustainability of game species habitat will be enhanced.

d. Increase the productivity and maintain the health of even-aged managed cover type stands.

There are numerous game species that rely on dense young seedling and/or sapling stage successional stages within even-aged managed cover types for food or cover. Some examples of these species are ruffed grouse and woodcock. Managing to improve stocking levels in these stages and maintain health and vigor (GDSs 1A, 1B, 2A, 2B, 3H, 3Iand 6) will help to ensure that density of young trees will be suitable for game species. Managing prescribed

ERF aspen, balm of Gilead, birch, and balsam fir stands with a declining age class structure from the normal to maximum rotation ages (GDS-3I) will ensure that stands are harvested before they become too old to be regenerated back to the same cover type.

e. **Provide for the needs of species associated with conifer stands and mixed conifer/ hardwood stands.**

Some game species found within the Subsection have some association or dependence on coniferous trees for food and/or cover needs, whether within conifer-dominated stands or in various mixes of conifer/hardwood stands. Some conifer species have declined significantly from historic levels in the Subsection.

The following techniques will be used to increase conifers: Increase acres of long-lived conifer cover types through active management, allow some stands to naturally succeed to conifer types, or increase mixed forest conditions in some stands (GDS-1B); Increase the presence of some conifers as a component of other cover types; and, Follow the conifer retention guidelines found in the *Site-Level Guidelines.*

f. Provide for creation and maintenance of within-stand diversity.

Managing for a mix of tree species, ages, and structural characteristics (such as tree diameter and height, and scattered or clumped distribution) in some stands will provide conditions for species that require such diversity (see GDS-1A, 1B, 2A, 3H, 3I, 3J, 3K,and 8).

Apply the *Site-Level Guidelines* for leave trees, snags, coarse woody debris, riparian management zones, conifer and mast species retention and regeneration, and road maintenance or closure.

g. Continue to manage Special Management Areas (SMAs) for the benefit of game species.

Most management benefiting game species in the Subsection will occur as a result of decisions designed to meet multiple objectives, the application of which will move across the landscape over time (coarse filter). In some cases, areas have been and will continue to be selected with the intent of maintaining these areas over time to provide specific game species benefits (fine filter). See Appendix M for a list of SMAs and primary vegetation management directions for those areas.

Following are examples of areas selected for specific game species management Harvest stands near rotation ages and in 10-30 acre blocks; Maintain upland shrub communities; Create or maintain wildlife openings for woodcock and hunter use; Manage large (`500-1,000 acre) units to promote turkey hunting opportunities; Maintain mast producing oaks and hold some stands on a longer rotation basis to achieve older, open understory preferred by turkeys; Maximize diversity of age classes in the upland deciduous cover types to promote ruffed grouse management .

h. Manage Priority Open Landscape Areas (OLAs) for the benefit of wildlife species (e.g. prairie chicken)

In addition to Special Management Areas, Priority Open Landscape Areas (OLAs) have also been identified with the intent to manage for specific species on a broader scale. Wildlife habitat in OLAs will be improved and managed by: Utilizing available information and review by field staff to identify and approve open landscape projects within designated OLAs in the planning area; Apply criteria that discourages placement of ERF in OLAs; Apply criteria that allow selection of younger-aged hardwood stands for even-aged management during stand selection; Coordinate across divisions on management prescriptions for selected stands within OLAs in a manner that enhances open landscape habitat conditions (e.g., create larger blocks of even-aged cover types managed with a clearcut prescription, minimize snag and leave tree presence in the interior of harvest blocks, discourage conifer planting);and, Coordinate across divisions on management projects designed to enhance open landscape conditions in OLAs (e.g., prescribed burns, shearing, or mowing of brush).

3.5 Riparian and Aquatic Areas

GDS-5A: Riparian areas are managed to provide critical[21] habitat for fish, wildlife, and plant species.

Riparian areas encompass the transition zone between the terrestrial and aquatic habitats that occurs along lakes, streams, and open-water wetlands. A r*iparian management zone* (RMZ) is that portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. Riparian areas are among the richest habitats in the Subsection. The management of riparian areas can influence water quality, water temperature, erosion rates, and deposition of woody debris in lakes and streams and the overall diversity of wildlife and plant species found in the watershed. Riparian areas provide corridors and connecting links of habitat for plant and wildlife species. Well-managed riparian areas are critical to protect, maintain, or enhance aquatic and wildlife habitats, aesthetics, recreation, water quality, and forest products.
The emphasis for riparian areas along all trout streams in the Subsection will be to manage for longer-lived, uneven-aged, mixed species stands to better maintain cold-water temperatures in these streams. For other riparian areas, the emphasis will be to manage for appropriate species for the site, which may include a range of age classes and forest types within and adjacent to these riparian areas.

GDS-5A Strategies

a. Meet or exceed the *MFRC Site-Level Guidelines* relating to riparian areas.

DNR forestry personnel check the application of riparian guidelines as a part of timber sales supervision and inspections. Also, MFRC site-level monitoring will periodically sample sites in Subsection as part of the monitoring program at the statewide level. The objective of this statewide monitoring program is to evaluate the implementation of the *Voluntary Site-Level Forest Management Guidelines* through field visits to randomly

[21] *Critical habitat:* habitat or habitat elements that must be present and properly functioning to assure the continued existence of the species in question.

selected, recently harvested sites distributed across the various forest land ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.) in the state.

b. Manage to maintain or increase old forest in riparian areas.

ERF was identified in riparian areas prior to stand selection. Old forests provide the best source of woody debris in aquatic systems and habitat for a wide variety of wildlife species. Longer rotation age reduces the frequency of future harvest activities and may provide opportunities for a wider variety of forest products. Old forest management complexes and EILC stands in riparian areas will be managed to maintain or increase old forest conditions.

c. Using the NPC Field Guide and associated ECS Silvicultural Interpretations, manage for a species appropriate for the site.

The emphasis for riparian areas in the subsection will typically be lowland hardwood stands. The trees in this type typically live longer than aspen allowing for longer tree cover along the water's edge. Since the type is usually managed on an all aged basis this also helps maintain the cover. This assumes that NPC and soils are compatible with this type. In areas with better drainage other types will be considered but management should lead to later stages of the NPC unless other management considerations dictate a different management scheme.

d. Follow recommendations in Tomorrow's Habitat for the Wild and Rare.

This document identifies Species in Greatest Conservation Need and associated Key Habitats.

GDS-5B: Forest management on state lands adequately protects wetlands and seasonal ponds.

Wetland areas include lowland forested areas (such as black ash, black spruce, tamarack, and white cedar cover types), lowland brush and lowland grass cover types, and seasonal ponds. These areas are protected using different site-level forest management guidelines than those required for riparian areas adjacent to lakes, streams, and rivers or permanent open water ponds.

GDS-5B Strategies

a. **Meet or Exceed MFRC *Site-Level Guidelines*.**

Some examples of recommendations from the guidelines are:

- Maintain filter strips.
- Avoid disturbances such as ruts, soil compaction, excessive disturbance to litter layer, and addition of fill.

- Use timber sale planning and administration to ensure that skidding and other equipment operations in upland stands take place outside of small non-open water wetlands and seasonal ponds. Meet with permittee/operator on site before the start of the permit activities to review details of the wetlands and protection measures within the sale area, and periodically visit the site during the harvest operation.
- Leave-tree guidelines recommend selecting leave trees in clumps, islands, or strips centered around or that coincide with small non-open water wetlands and seasonal ponds.

DNR forestry personnel will check the application of wetlands and seasonal pond guidelines as a part of their timber sales supervision and inspections.

b. Consider landforms (e.g., end moraines) that have seasonal ponds and small open-water wetlands, and address those features in site-specific prescriptions that are developed during the stand examination field visit.

End moraines have a high concentration of seasonal ponds that are easily missed if field evaluations occur outside of spring and early summer seasons. Identification of landforms important for vernal pools, or seasonal wetlands, will help in their identification year-round.

For a discussion of key habitats and species in greatest conservation need, go to GDS-3B.

3.6 Timber and Biomass Productivity

GDS-6: Timber productivity and quality on state timber lands is increased.

Increasing the timber productivity of state forest lands is a way to continue to provide the current (or greater) harvest volume and improve timber quality, while managing some lands with less emphasis on timber productivity. Increases in timber productivity can be achieved during this 10-year plan by accelerating the rate at which the DNR addresses: the age class imbalance over current levels; increasing intermediate stand treatments; converting to site-appropriate species; and, continuing to protect soil productivity by applying the site-level guidelines.

GDS-6 Strategies

a. **Move toward harvesting non-ERF stands in even-aged managed cover types at their normal rotation age** (see GDS-1A and 2A).

b. **Examine all stands over maximum rotation age on stand exam lists in even-aged managed cover types.**

c. Thin or selectively harvest in some red pine, northern hardwood and oak stands.

These treatments may be prescribed for both normal rotation stands and ERF stands. This SFRMP has developed a pool of stands that will be evaluated for thinning or selective harvest). Approximately one-third of the northern hardwoods stands in the subsection have been selected for site visit and/or treatment in the first decade of the plan. Several of these stands may have a thinning prescription assigned.

d. Include silvicultural treatments such as site preparation, inter-planting, release from competition (e.g., herbicide application or hand release), and timely thinning in plantation management, to increase productivity.

The use of pesticides (herbicides, insecticides, etc.) will be minimized. When they must be used to control competing vegetation or forest insects and diseases on state lands, the following operational standards will be followed:

- DNR Operational Order No. 59 - Pesticides and Pest Control
- Division of Forestry - Pesticide Use Guidelines
- Pesticide Labels
- Material Safety and Data Sheets for each pesticide and adjuvant being used or recommended
- *MFRC Site-Level Guidelines* relating to pesticide use
- No products on the FSC list of Highly Hazardous Pesticides are used

e. Apply and supervise the implementation of the MFRC *Site-Level Guidelines* on treatment sites.

f. **Continue to implement, supervise, and enforce current DNR timber sale regulations to protect and minimize damages to sites or residual trees from treatment activities**.

For example, avoid damage to residual trees during harvest or thinning operations.

g. Manage some ERF stands for large diameter, high-quality sawtimber products by retaining adequate stocking and basal area.

h. Respond to insect and disease problems, as appropriate.

3.7 Forest Pests, Pathogens and Non-native Invasive Species

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

Forest insects and disease organisms influence forest ecosystem dynamics. At acceptable levels, they promote diversity of tree species and generate important elements of forest structure that are important as habitat and in nutrient cycling, such as snags and coarse (large) woody debris. However, epidemic populations of insect pests can cause high levels of tree mortality, and can have significant ecological and economic consequences. Native and introduced diseases can cause significant species-specific losses in volume and mortality. Forest management will not attempt to eliminate native insects and diseases or their processes from the landscape, but rather to limit their impact on individual sites to a level that allows goals for timber production, water quality, aesthetics, recreation, wildlife, and biodiversity to be realized.

Natural resource managers are concerned about the introduction and establishment of non-native invasive insect, disease, and plant species on public land. Invasion of forest ecosystems by non-native invasive species can cause significant economic losses and expenditures for control because they destroy or displace native plants and animals, degrade native species habitat, reduce productivity, pollute native gene pools, and disrupt forest ecosystem processes (e.g., hydrological patterns, soil chemistry, moisture-holding capability, susceptibility to erosion, and fire regimes). Examples of non-native invasive species with known adverse effects on Minnesota forest resources include: white pine blister rust, gypsy moth, and European buckthorn. There is potential for significant adverse impacts from other species present in the subsection, such as: Buckthorn; tansy; spotted knapweed; purple loosestrife; leafy spurge; and wild parsnip. Management will seek to minimize impacts from these species, limit the introduction of new non-native invasive species, and minimize the impact of control measures on vulnerable native species.

Local introductions and spread of harmful non-native invasive plant species can happen through several activities. Forest management activities and recreation have significant potential as an avenue for unintentional introductions of non-native invasive plant species, especially in less developed portions of the Subsection. Global warming effects and a variety of insect and disease concerns (e.g. oak wilt (*Ceratocystis fagacearum*), two-lined chestnut borer (*Agrilus bileneatus*), gypsy moth (*Lymantria dispar*), and armillaria root rot (*Armillaria spp*.) may impact oak management on some sites.

Establishing and promoting practices that minimize these introductions will slow the spread of non-native invasive species and harmful native species and reduce the associated losses.

GDS-7A Strategies

a. Identify and monitor insect, disease, and non-native invasive species populations as part of the Forest Health Monitoring Program and document their occurrence on state-managed lands.

Early identification and risk assessment of new non-native invasive species introductions improve potential to develop and implement appropriate responses. Monitoring known insect and disease pests, conditions conducive to outbreaks, and populations of non-native invasive plant species can provide useful information for predicting potential outbreaks and documenting and predicting range expansion. Involve private landowners and local units of government in gathering and disseminating information. This information helps determine when and where preventive measures to limit impacts or control action are needed.

Mutually established protocols for data collection and information sharing among federal (U.S. Environmental Protection Agency, U.S. Department of Agriculture) and state agencies improve capacity to respond to the spread of established non-native invasive species into new areas, new species introductions, and outbreaks of established pests and diseases.

b. Follow Minnesota DNR Operational Order 113 (Invasive Species) and appropriate division guidelines to minimize the spread of non-native invasive species during forest management activities.

c. Adhere to the Minnesota DNR 2010 Invasive Species Program Directive on Forestry Lands

For additional information of invasive species guidance see the following links:

http://files.dnr.state.mn.us/assistance/backyard/treecare/forest_health/invasiveGuidelines.pdf

http://www.dnr.state.mn.us/treecare/forest_health/invasive.html

d. Manage existing forest insect and disease problems, as appropriate.

e. Use the least intensive site preparation methods possible to ensure success.

Site preparation can create conditions favorable to non-native invasive species and alter structural diversity in the ground layer. Striving to minimize site preparation intensity will minimize these threats.

Information gathered and provided by the agencies mentioned above is used as a basis for decisions regarding where and when insect and disease problems require action involving vegetation management.

Prepare collaboratively developed intervention plans *before* pest outbreaks (e.g., the strategic plan for the cooperative management of gypsy moth in Minnesota involving Minnesota DNR, Minnesota Department of Agriculture, USDA-APHIS, and USDA-FS). These plans detail appropriate integrated pest management strategies, circumstances under which strategies can be appropriately and effectively used, responsibilities, and cost-sharing arrangements. Containment and eradication measures will seek to minimize impacts from these species, while minimizing the impact of control measures on vulnerable native species.

If pesticides are needed to control forest insects and diseases on state forest lands, the following operational standards will be used:

- DNR Operational Order No. 59 - Pesticides and Pest Control
- Divisions of Forestry and Fish and Wildlife - Pesticide Use Guidelines
- Pesticide Labels
- *MFRC Site-Level Guidelines* relating to pesticide use.
- Refer to Material Safety and Data Sheets for each pesticide and adjuvant being used or recommended.
- No products on the FSC list of Highly Hazardous Pesticides are used

f. Manage stands to reduce the potential impact of insects and diseases.

- Develop management plans and stand treatment prescriptions using the DNR Forest Development Manual and other recognized insect and disease management sources, while considering ecological processes and functions and impacts to native species and habitats.
- Provide information and training via logger education programs to equipment operators and tree fellers regarding techniques that minimize damage to retained trees (e.g., leave trees or crop trees).
- Emphasize the use of fire in management for prevention of insect and disease outbreaks (e.g., regeneration, residual stem, and slash management in black spruce stands to reduce the spread of eastern dwarf mistletoe disease).

g. In ERF stands, a higher level of impact from native insect and disease infestations may be accepted as long as it does not jeopardize the ability to regenerate the stand to the desired forest cover type or the management goals of the surrounding stands.

This will enhance old forest conditions within the Subsection. Retaining the potential to regenerate the stand will be the primary objective, except in stands where a conversion is planned to another type not at risk from a damaging agent.

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

Wildlife species such as deer, hare, porcupine, beaver, and other rodents impact forests and plant regeneration through browsing, stem damage, and girdling. Solutions require an understanding of the dynamics of herbivory, seasonal wildlife movements, population structure, population control tools and their effectiveness, and proven repellents or exclusion methods. Keys to success include coordination between department staff, adequate funding, and sharing information regarding successful exclusion or abatement methods. The management strategies below attempt to minimize adverse impacts.

GDS-7B Strategies

a. Improve knowledge about the complexity of factors that affect solutions to preventing or reducing damage caused by wildlife. Do this through training and/or field level coordination on sites where problems exist.

- Conduct training sessions addressing the factors that affect damage, potential solutions, and prevention based on research and experience.
- Coordinate field visits at problem sites with area wildlife staff and the appropriate land manager.
- Collect information from damaged sites for database entry and analysis of wildlife damage.
- Use the expertise of the DNR – Section of Wildlife's Depredation Program and research units when regeneration plans call for use of repellents or exclusion techniques.

b. Consider the potential for wildlife impacts to planted or natural regenerating trees before damage occurs. Coordinate on preventative strategies before planting or timber sales begin.

- Work with area wildlife staff to identify sites where significant damage may occur before forest management activities occur. Where necessary, incorporate plans for post-sale damage mitigation into forest regeneration and development plans.
- In riparian areas, favor tree species less palatable to beavers.

c. Focus forest regeneration efforts in areas less likely to be negatively impacted by wildlife species.

- Avoid unprotected plantings of susceptible species (i.e., those known to be a preferred food source such as white cedar and white pine) near known seasonal deer concentration areas.
- Avoid planting susceptible species in locations surrounded by habitat attractive to ungulates without some plan for protection from browsing.
- In mixed species plantations, scatter susceptible species among those that are less susceptible.
- In larger mixed species plantations, plant susceptible species in the middle of the site.

d. On sites where damage from wildlife species is anticipated, use mitigation techniques to reduce damage when planting susceptible tree species.

- Favor planting on sites where edge (irregular boundaries) is minimized.
- Plant larger sites.
- Plant susceptible species away from the edge of the site.
- Use protective measures such as fenced enclosures, bud capping, repellents, tree shelters, etc.
- To more efficiently implement protection control measures, clump plantings and/or locate them to be easily accessible.

e. When deciding what to plant, consider species or stock sources that are less palatable to wildlife.

- Consider the potential for seedling damage and/or growth reduction from wildlife damage in selection of susceptible species planting stock.

3.8 Climate Change

GDS-8: Forest management on state lands attempts to mitigate global climate change effects on forest lands. Management is based on our current knowledge and will be adjusted based on future research findings.

Minnesota DNR recognizes that climate change, also known as global warming, is occurring at a rate that exceeds historical levels, and that the rate is likely to continue to increase. A growing body of evidence concludes that climate change is real and will have serious implications for people and the natural world upon which we depend. The DNR completed a report on climate change and renewable energy in August of 2011 to provide guidance to DNR staff on management strategies in Minnesota that take into consideration the estimated impacts of climate change for the state. For more information on the planned response to climate change for DNR staff a link to the document *Climate Change and Renewable Energy: Management Foundations (August 2011)* can be found at the following website: http://files.dnr.state.mn.us/aboutdnr/reports/conservationagenda/crest-ccref.pdf

In an important step forward for Minnesota's environment, the Minnesota Climate Change Advisory Group in 2007 developed a comprehensive plan for reducing the state's greenhouse gas emissions. The DNR supports the Minnesota Climate Change Advisory Group's 2007 climate change initiatives with the following programs:

- **Minnesota Forests for the Future (Forest Land Easements)** Forest easements are a cost-effective tool for retaining forest lands in private ownership and maintaining important recreational opportunities, wood products production, fish and wildlife habitat, and climate change mitigation by capturing and storing carbon dioxide from the atmosphere. State funding will provide for easement acquisition or acquisition of interests in lands by fee title, gift, or donation. These efforts will prevent development and conversion of forest land, provide forest values in perpetuity, and allow landowners to continue to manage forests sustainably for timber and other products while retaining land in private

ownership.

Several climate models (e.g., atmospheric-ocean general circulation models[22]) in use around the world predict global climate change. The Intergovernmental Panel on Climate Change refers to climate change as any change in climate over time, whether due to natural variability or as a result of human activity. The models agree that average temperatures are increasing and predict more variable changes in precipitation. This global warming will affect forests and wildlife in Minnesota.[23,24]

Scientists believe the predicted climate change will affect the size, frequency, and intensity of disturbances such as fires, windstorms, and insect outbreaks. It will affect the survivorship of existing plant and animal species and the distributions of plants and animals. Even at modest levels, independent studies are finding mounting evidence that the current climate change influences plant and animal ranges and behavior.[25] Some plant and animal species may not be able to adapt to the rate of change. Increases in the reproductive capability and survivorship of non-native invasive species, insect pests, and pathogens will impact forests and wildlife. Certain tree species, such as black spruce, balsam fir, birch, and jack pine will respond negatively to increased soil warming and decreased soil moisture in. Carbon sequestration by forests and wetlands may be affected because of accelerated decomposition rates.

Most tree species in Minnesota reach the limit of their geographic range somewhere within the boundaries of the forested portion of the state. Predictions have been made on the potential future distributions of trees.[26] There is a need to facilitate species adaptation to change in response to possible rapid climatic changes.

Although there are uncertainties about the effects of climate change on forest vegetation at the subsection scale, the following strategies will be used to help monitor and mitigate the predicted effects of climate change on vulnerable species and native plant communities.

GDS-8 Strategies

a. Maintain or increase species diversity across the Subsection.

[22] IPCC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). [Houghton, J.T., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 881pp.
[23] Weflen, K., *The Crossroads of Climate Change*. Minnesota Conservation Volunteer, January-February 2001, Minnesota Department of Natural Resources, St. Paul, MN.
[24] Pastor, John, personal communication at March 13, 2003 North Shore SFRMP meeting. Natural Resources Research Institute, University of Minnesota-Duluth.
[25] Root, T. et al., *Fingerprints of Global Warming on Wild Animals and Plants*, Stanford University, Nature- January 2, 2003; and Parmesan, Camille, A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems, University of Texas.
[26] Iverson, L, et al. 1999. *An Atlas of Current and Potential Future Distributions of Common Trees of the Eastern United States.* Gen. Tech. Rep. NE-265. Radnor, PA. USDA Forest Service. Northeastern Research Station. 245 p.

The forest composition and within-stand diversity goals of this SFRMP will provide a more diverse forest across the subsection. By maintaining a variety of species at the stand and landscape levels across the subsection, the forest will be more resilient, more genetically diverse, and will utilize a broader range of site conditions (i.e., niches). This variety promotes forest survival as well as to serve as a reproductive source for forest plant and animal migration in the face of accelerated climate change. Maintaining species diversity at multiple scales will minimize the risk of widespread, stand-replacing insect and disease outbreaks that could result from accelerated climatic change.

b. Maintain or increase structural diversity across the subsection.

Structural characteristics include the size (diameter and height), abundance and distribution of overstory trees, understory vegetation, and their arrangement (scattered or clumped) within the stand. Structural characteristics also include the presence or absence of snags and coarse woody debris and the way these features are distributed in space. Appropriate structural types, amounts, and arrangements vary by native plant community and growth stage. By maintaining or increasing structural diversity across the subsection, the forest will provide habitat to a greater number of species than a forest with uniform structural diversity. For example, large-diameter structures, both standing and lying on the ground, provide micro-sites for seed germination, cavities for nesting and den sites, and important escape and nesting cover within stands. This variety will assist the forest to survive as well as serve as a reproductive source for forest plant and animal migration in the face of accelerated climate change.

c. Maintain connectivity that permits the migration of plants and animals as climate changes the landscape.

Maintaining NPC spatial patterns where patches of vegetation are connected will allow the flow of plants, animals, and processes (e.g., seed dispersal) between suitable habitats. The ability of species to move to a new more hospitable site is a critical survival tactic. The following techniques have been used during the planning phase to address this strategy: ERF stands were grouped on the landscape and placed around old growth stands and along riparian corridors; Group selected stands to maintain and/or create larger areas of older forest and minimize fragmentation.

The following are some methods for addressing this strategy during plan implementation:

- Where available, MCBS sites of biodiversity significance are used as a means to identify, quantify, compare, and monitor NPC spatial patterns as they relate to Hardwood Hills SFRMP direction.
- Classification of stands to NPC and application of *ECS Silvicultural Interpretations* provide a means to maintain NPC spatial patterns on managed lands.
- Plan harvests to minimize road construction and landings.
- Stand management incorporates actions that minimize the potential for non-native invasive species establishment.
- Consider current and potential corridors, such as those identified in the Minnesota Prairie Conservation Plan 2010, when planning management activities. The Minnesota Prairie Conservation Plan is available at the following link: http://www.dnr.state.mn.us/prairierestoration/index.html

d. Evaluate site conditions with respect to climate change when selecting tree species for regeneration.

Use the NPC Field Guide, associated silvicultural references, existing tree distributions, and modeled future tree distributions when selecting the species most appropriate for the site.

e. Use the concept of carbon sequestration to remove carbon dioxide (the most significant anthropogenic greenhouse gas) from the atmosphere.

Climate models (e.g., *Hadley Centre for Climate Prediction and Research-UK, carbon cycle models*) predict that, as future atmospheric carbon dioxide concentrations increase, global temperatures will increase. Forests have the ability to remove carbon dioxide through photosynthesis and to store the carbon as woody material. Carbon is stored in all parts of the forest including living plants, dead plants, fallen leaves, and soil. The storage of carbon is called *carbon sequestration*. Carbon also remains stored in wood that is harvested and processed into wood products.[27] The carbon remains stored in wood until it is gradually released through slow decay or is released rapidly when it is burned.

Forest management activities, such as ensuring existing stands are adequately stocked and ensuring regeneration is adequate after harvest, sequester carbon. Basically, any activity that provides healthy and productive forests will increase carbon sequestration. In this plan, stands in a wide range of age classes will be evaluated for treatment. Increasing the stocking and growth rate of timber will help in sequestering carbon. Stands will be field examined to determine if there is sufficient advance regeneration. If the site lacks adequate regeneration, silvicultural techniques will be used that result in a more fully stocked stand. Stands that contain a variety of tree species are more likely to fully occupy a site, increasing the overall wood volume grown on the site. Increasing the woody biomass over what is currently on these under-stocked sites will help sequester carbon. The following are some examples of forest management strategies in this SFRMP that will help in carbon sequestration: Examine stands for treatment from a wide range of age classes; Balance the age class distribution in even-aged managed cover types; Emphasize longer-lived species; Designate forest stands to be managed as extended rotation forest (ERF); Reserve and maintain old growth forests; Increase timber productivity in managed stands; Retain leave trees, legacy patches, snags, and coarse woody debris on harvested sites; Minimize roads and landings; Minimize slash burning; Utilize biomass for alternative energy supplies; Manage for quality timber with lower defect levels that will be available for a wider range of uses and require less processing.

f. Maintain or increase conifers adjacent to coldwater streams to moderate the microclimate that provides a cooling effect in warm weather and retains a snowpack longer, slowing discharge in the spring.

Meet or exceed the MFRC *Site-Level Guidelines* for riparian corridors. See riparian area guidelines (GDS-5A).

[27] Heath, L. 2000. *Carbon Sequestration: Yet Another Benefit of Forests*. Forest Legacy Program. USDA Forest Service, Durham, NH.

g. Apply the MFRC *Site-Level Guidelines* for tree species at the edge of their range (*Rationale for Guidelines Section, Wildlife Habitat, pages 26-35*).

3.9 Visual Quality

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

Scenic beauty is a primary reason people choose to spend their recreation and vacation time in or near forested areas. Where forests are near recreational trails, lakes, waterways, public roads, and highways, consider impacts of forest management activities to the visual quality of the site during and after management activities.

GDS-9 Strategies

Apply the *Site-Level Guidelines* on visual quality on all vegetative management activities.

The MFRC guidelines contain many recommended forest management techniques that will minimize the impacts of vegetative management activities on visual quality. *Directions 2000* (*Objective 3.3*)[28] states that the "DNR will apply the appropriate guidelines so that visual quality is not adversely impacted during forest management activities." Several examples of the recommended techniques included in the guidelines are listed below: Minimize visibility of harvest areas by limiting the apparent size of the harvest area; Avoid management operations during periods of peak recreational use whenever possible; Locate roads and trails to minimize visibility from nearby vantage points, such as scenic overlooks, streams, and lakes; Encourage long-lived species and other visually important species (e.g., paper birch) along high visual quality identified roadways. This will minimize the frequency of management activities. It will also provide larger-crowned, larger-diameter trees that improve forest aesthetics; Reduce visual penetration with appropriate curves in the road alignment.

DNR forestry staff checks the application of visual quality guidelines as a part of timber sales supervision and inspections. Roads have been classified based on visual quality ratings. Classifications can be viewed on the DNR Web site at:
http://www.dnr.state.mn.us/forestry/visual_sensitivity/index.html

[28] Minnesota Department of Natural Resources, *Directions 2000: The Strategic Plan*, Objective 3.3, p22.

3.10 Access to State Land

GDS-10: Forest access routes are well planned and there is a high level of collaboration with federal, private, and local units of government to share access and minimize new construction.

Access routes (provided by a network of federal, state, county, and private forest access roads) are needed to effectively manage forest stands identified for treatment during this 10-year plan. The overall density of roads in specific geographic areas can be minimized through cooperation with other landowners in the Subsection. The access routes that are selected must be developed in a way that protects or minimizes the negative effects on other forest resources.

GDS-10 Strategies

a. Continue to seek cooperation with other forest landowners to retain existing access to state land and to coordinate new road access development and maintenance across mixed ownerships. Cooperative road planning that involves all affected landowners will be done whenever possible to maximize the efficiency of the transportation system. Use the DNR GIS-based road and trail inventory. The goal is to serve as many acres of forest land with as few miles of road as possible.

b. Follow Minnesota statutes and guidelines and DNR policies for state forest roads.

Follow the *Site-Level Guidelines* for road design, construction, maintenance, reconstruction, and closure. Follow the guidelines and policies relating to roads and trails in the *DNR Forestry Road Manual* and the *Forestry-Wildlife Habitat Management Guidelines (page 50)*. Use the *DNR Site-Level Design and Development Guidelines for Recreational Trails* for guidance on post-sale treatment.

c. Apply the department direction regarding access roads across EILC and other areas that have been reserved (or deferred) from treatment during the 10-year plan.

Evaluate on a case-by-case basis (DNR Forestry administrative area review by Forestry, Fisheries and Wildlife, and Ecological Services staff) as access is needed in these areas, applying the following principles (in order):

1) Avoid access routes across EILC areas, if possible. For example: Use other reasonable access routes that don't involve EILC stands if they are available; And,

2) If the only reasonable access to stands to be treated is across EILC areas, then strive to minimize impacts. For example: Use seasonal/temporary access versus a permanent road. (Since EILC are in lowland areas, this road access would typically be seasonal winter roads; Use narrow corridors; Use routes causing the least disturbance; Use only during frozen ground conditions that support the equipment using it.)

d. Follow strategies identified under other General Direction Statements that apply to roads throughout the planning, development, and disposition of forest roads.

- GDS-3E, Strategy j: Locate roads to minimize fragmentation of a MCBS site.

e. Complete a timber access plan.

After the 10-year stand exam list was compiled, GIS staff completed a timber access plan. The purpose of the timber access plan is to identify any new road and any temporary access needed to access stands identified in SFRMP for field visit and/or treatment. The new access plan will help in assessing road access/fragmentation/density concerns. It will also provide post-sale treatment intentions on the estimated new access/temporary access locations. Existing roads or previously used corridors of disturbance will be followed whenever feasible. The timber access plan will identify where USDA Forest Service road permits are required. For new roads and temporary access, the road classification (whether it is winter or summer access), miles of new road, and proposed post-sale treatment will be documented. Of the 210 stands on the 10-year Stand Exam List, 21 stands were identified as requiring new access (totaling 10.2 miles). All new access routes were designated as winter season, temporary access.

The proposed post-sale treatment information on new roads and trails can be used for planning the maintenance, closure (e.g., gate, sign, slash, or berm), abandonment, or reclamation (e.g., with natural or planted vegetation) of the access route. Limiting unplanned secondary usage should also be considered in post-sale road planning. The timber sale appraiser will refine the proposed road access and post-sale treatment plan as part of the design of the timber sale. Final adjustments may be made at the pre-sale meeting between the timber sale administrator and the permittee.

Most temporary roads will not be maintained after harvest is completed. These access routes should be used again for future forest management activities instead of disturbing new areas.

3.11 Cultural Resources

GDS-11: Cultural Resources will be protected on state-administered lands.

A cultural resource is an archaeological site, cemetery, historic structure, historic area, or traditional use area that is of cultural or scientific value. Cultural resources are remaining evidence of past human activities. To be considered important, a cultural resource generally has to be at least 50 years old. A cultural resource may be the archaeological remains of a 2,000 year-old Indian village, an abandoned logging camp, a portage trail, a cemetery, food gathering sites such as ricing camps and sugarbushes, or a pioneer homestead. They often possess spiritual, traditional, scientific, and educational values. In addition to federal and state laws that protect certain types of cultural resources, the *Voluntary Site-Level Forest Management Guidelines* provide information and recommendations to assist private and public land managers in taking responsible actions when cultural resources are encountered.

GDS-11 Strategies

a. Annual Stand Exam lists are reviewed by DNR archeologists; recommendations for mitigation are implemented as part of sale design.

3.12 Natural Disturbance Events

GDS-12: Natural disturbance events that occur on state land within the Subsection are promptly evaluated to determine the appropriate forest management needed to their impacts.

By promptly evaluating known disturbance events (e.g., fire, wind, or insects and disease), land managers will be able to quickly recommend what, if any, forest management activities are necessary to mitigate the impacts of the event. Depending on the scale of the event and potential positive or negative impacts, management recommendations will range from no action to salvage harvesting and/or prescribed burning. Where quick action is needed to salvage harvest timber from damaged stands, the annual plan addition process for public review will be used.

GDS-12 Strategies

a. The subsection planning team will evaluate large-scale (100's to 1000's of acres) disturbance events to determine appropriate action.
If large-scale disturbance events occur during the 10-year plan, the core team will assess the extent and significance of the event on the structure and condition of forest lands in the Subsection. The team will propose forest management actions to be implemented within the area impacted by the event and determine whether adjustments to the short-term harvest levels are needed.

When large-scale disturbance events involve multiple ownerships, the DNR will cooperate in assessment and implementation of management actions with other agencies and landowners, when possible. To better inform the public of planned large-scale salvage harvest, a press release will be completed that includes information on the disturbance and the planned management actions.

b. Local land managers will evaluate and determine appropriate actions for small-scale (10s of acres) disturbance events.

After small-scale disturbances, local forest and wildlife managers will do a timely evaluation of the disturbance area and take the appropriate action needed to address the situation.

Appendix A - Ecological Classification System (ECS)

Definition

The Ecological Classification System (ECS) is part of a nationwide mapping initiative developed to improve our ability to manage all natural resources on a sustainable basis.

The ECS 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, topographic, soil, and vegetation data.

In Minnesota, the classification and mapping is divided into six levels of detail (see Figure 6.1 for a map of Ecological Provinces, Sections, and Subsections of Minnesota. These levels are:

Province: Largest units representing the major climate zones in North America, each covering several states. Minnesota has four provinces: eastern broadleaf forest, Laurentian mixed forest, prairie parkland and tallgrass aspen parklands.

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., Lake Agassiz, Aspen Parklands).

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., Aspen Parklands).

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., Bronson Lake Plain).

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., Mesic Aspen-Oak Woodland).

Purpose of an Ecological Classification System

- Define the units of Minnesota's landscape using a consistent methodology.
- Provide a common means for communication among a variety of resource managers and with the public.
- Provide a framework to organize natural resource information.
- Improve predictions about how vegetation will change over time in response to various influences.

- Improve our understanding of the interrelationships between plant communities, wildlife habitat, timber production, and water quality.

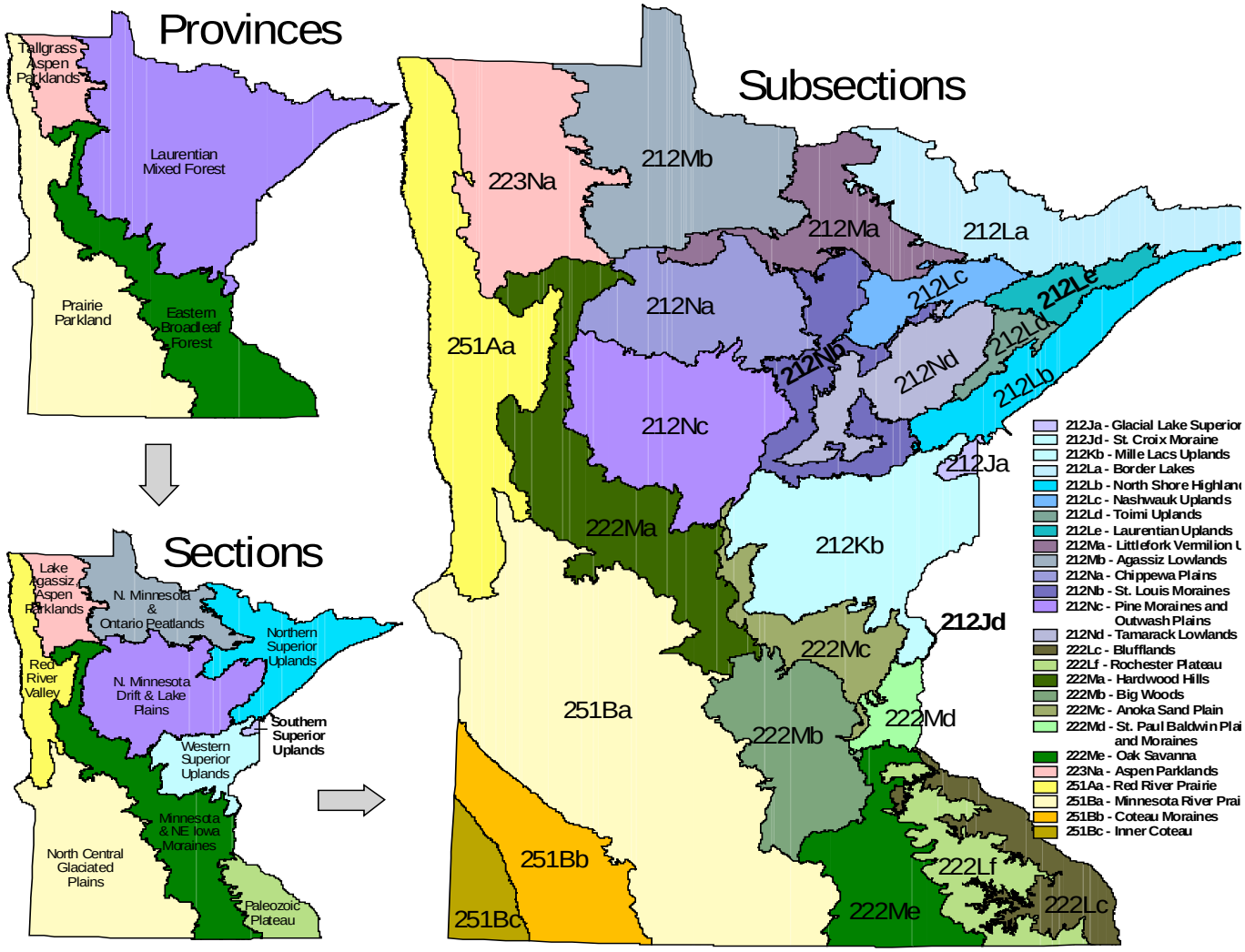
End Products

- 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.

For more information on ECS visit: http://www.dnr.state.mn.us/ecs/index.html

ECS Provinces, Sections and Subsections in Minnesota

Ecological Provinces, Sections, and Subsections of Minnesota, 199



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Appendix B – Wooded Native Plant Communities in the Hardwood Hills Subsection

These plant communities are ranked per an assessment of their vulnerability. The ranks are based upon input from Minnesota DNR ecologists using eleven rank criteria: number of occurrences, number of occurrences with good viability or integrity, number of protected occurrences, range extent, area of occupancy, long-term trends, short-term trends, threats (severity, scope, and immediacy), number of protected and managed occurrences, intrinsic vulnerability, and environmental specificity. Thus the rank draws attention to the communities that are at greatest risk. By alerting resource managers and the public to communities in jeopardy, activities can be reviewed and prioritized to help preserve the diversity and abundance of Minnesota's natural heritage.

Table B1: Wooded Native Plant Community Systems, Classes, Types and Subtypes Documented in the Hardwood Hills Subsection with their Associated Rarity Rank.

Wooded Native Plant Communities found in the Hardwood Hills					
Native Plant Community System	**Floristic Region**	**Community Code**	**Community Name**	**State Rank**	**Global Rank**
Acid Peatland System	Northern	APn81	Northern Poor Conifer Swamp		
Acid Peatland System	Northern	APn81b	Poor Tamarack - Black Spruce Swamp	S4	
Acid Peatland System	Northern	APn81b2	Poor Tamarack - Black Spruce Swamp: Tamarack Subtype	S4	
Acid Peatland System	Northern	APn91	Northern Poor Fen		
Acid Peatland System	Northern	APn91a	Low Shrub Poor Fen	S5	
Acid Peatland System	Northern	APn91b	Graminoid Poor Fen (Basin)	S3	
Fire-Dependant Forest/Woodland System	Central	FDc23	Central Dry Pine Woodland		G2
Fire-Dependant Forest/Woodland System	Central	FDc23a2	Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype	S1S2	G2
Fire-Dependant Forest/Woodland System	Central	FDc24	Central Rich Dry Pine Woodland		
Fire-Dependant Forest/Woodland System	Central	FDc34a	Red Pine - White Pine Forest	S2	

Fire-Dependant Forest/Woodland System	Central	FDc34b	Oak - Aspen Forest	S3	
Fire-Dependant Forest/Woodland System	Southern	FDs36a	Bur Oak - Aspen Forest	S3S4	
Fire-Dependant Forest/Woodland System	Southern	FDs37	Southern Dry-Mesic Oak (Maple) Woodland		
Fire-Dependant Forest/Woodland System	Southern	FDs37a	Oak - (Red Maple) Woodland	S4	
Fire-Dependant Forest/Woodland System	Southern	FDs37b	Pin Oak - Bur Oak Woodland	S3	
Fire-Dependant Forest/Woodland System	Western	FDw44	Northwestern Wet-Mesic Aspen Woodland		
Floodplain Forest System	Northern	FFn57a	Black Ash - Silver Maple Terrace Forest	S3	
Floodplain Forest System	Southern	FFs59a	Silver Maple - Green Ash - Cottonwood Terrace Forest	S3	
Floodplain Forest System	Southern	FFs59c	Elm - Ash - Basswood Terrace Forest	S2	
Floodplain Forest System	Southern	FFs68a	Silver Maple - (Virginia Creeper) Floodplain Forest	S3	
Forested Rich Peatland System	Northern	FPn73a	Alder - (Maple - Loosestrife) Swamp	S5	
Forested Rich Peatland System	Northern	FPn82	Northern Rich Tamarack Swamp (Western Basin)		
Forested Rich Peatland System	Northern	FPn82a	Rich Tamarack - (Alder) Swamp	S5	
Forested Rich Peatland System	Northern	FPn82b	Extremely Rich Tamarack Swamp	S4	
Forested Rich Peatland System	Southern	FPs63a	Tamarack Swamp (Southern)	S2S3	G2G3
Mesic Hardwood Forest System	Central	MHc26	Central Dry-Mesic Oak-Aspen Forest		
Mesic Hardwood Forest System	Central	MHc26a	Oak - Aspen - Red Maple Forest	S4	
Mesic Hardwood Forest System	Central	MHc36	Central Mesic Hardwood Forest (Eastern)		
Mesic Hardwood Forest System	Central	MHc36a	Red Oak - Basswood Forest (Noncalcareous Till)	S4	
Mesic Hardwood Forest System	Central	MHc36b	Red Oak - Basswood Forest (Calcareous Till)	S4	
Mesic Hardwood Forest System	Central	MHc37	Central Mesic Hardwood Forest (Western)		
Mesic Hardwood Forest System	Central	MHc37a	Aspen - (Sugar Maple - Basswood) Forest	S4	

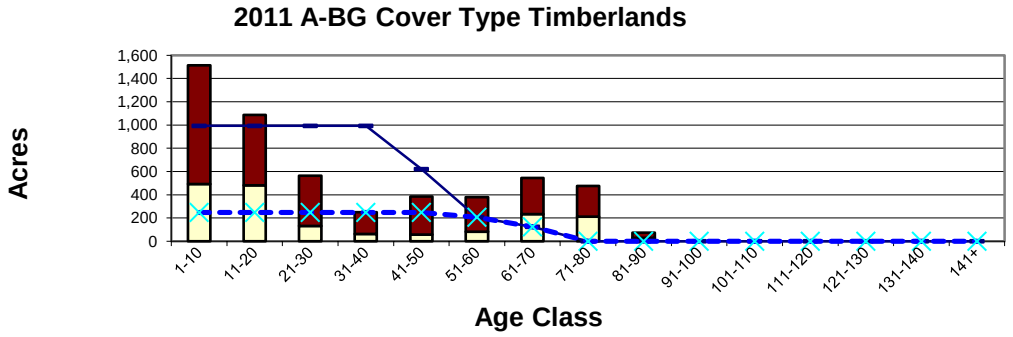
Mesic Hardwood Forest System	Central	MHc37b	Sugar Maple - Basswood - (Aspen) Forest	S4	
Mesic Hardwood Forest System	Central	MHc47a	Basswood - Black Ash Forest	S3	
Mesic Hardwood Forest System	Northern	MHn35	Northern Mesic Hardwood Forest		
Mesic Hardwood Forest System	Northern	MHn35a	Aspen - Birch - Basswood Forest	S4	
Mesic Hardwood Forest System	Northern	MHn35b	Red Oak - Sugar Maple - Basswood - (Bluebead Lily) Forest	S4	
Mesic Hardwood Forest System	Northern	MHn44	Northern Wet-Mesic Boreal Hardwood-Conifer Forest		
Mesic Hardwood Forest System	Northern	MHn44d	Aspen - Birch - Fir Forest	S3	
Mesic Hardwood Forest System	Northern	MHn46	Northern Wet-Mesic Hardwood Forest		
Mesic Hardwood Forest System	Northern	MHn46a	Aspen - Ash Forest	S4	
Mesic Hardwood Forest System	Southern	MHs37b	Red Oak - White Oak - (Sugar Maple) Forest	S4	
Mesic Hardwood Forest System	Southern	MHs38b	Basswood - Bur Oak - (Green Ash) Forest	S3	
Mesic Hardwood Forest System	Southern	MHs38c	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest	S3	
Mesic Hardwood Forest System	Southern	MHs39	Southern Mesic Maple-Basswood Forest		
Mesic Hardwood Forest System	Southern	MHs39b	Sugar Maple - Basswood - Red Oak - (Blue Beech) Forest	S3	
Mesic Hardwood Forest System	Southern	MHs39c	Sugar Maple Forest (Big Woods)	S2	
Mesic Hardwood Forest System	Southern	MHs49a	Elm - Basswood - Black Ash - (Hackberry) Forest	S3	
Upland Prairie System	Northern	UPn13b	Dry Barrens Oak Savanna (Northern)	S1S2	G2
Upland Prairie System	Northern	UPn13c	Dry Sand - Gravel Oak Savanna (Northern)	S1	G1G2
Upland Prairie System	Northern	UPn13d	Dry Hill Oak Savanna (Northern)	S1	G1G2
Upland Prairie System	Southern	UPs14a	Dry Barrens Oak Savanna (Southern)	S1S2	
Upland Prairie System	Southern	UPs14b	Dry Sand - Gravel Oak Savanna (Southern)	S1S2	G1G2
Wet Forest System	Northern	WFn53b	Lowland White Cedar Forest (Northern)	S3	
Wet Forest System	Northern	WFn55	Northern Wet Ash Swamp		
Wet Forest System	Northern	WFn55b	Black Ash - Yellow Birch - Red Maple - Basswood Swamp (Eastcentral)	S3	
Wet Forest System	Northern	WFn64	Northern Very Wet Ash Swamp		
Wet Forest System	Northern	WFn64a	Black Ash - Conifer Swamp (Northeastern)	S4	

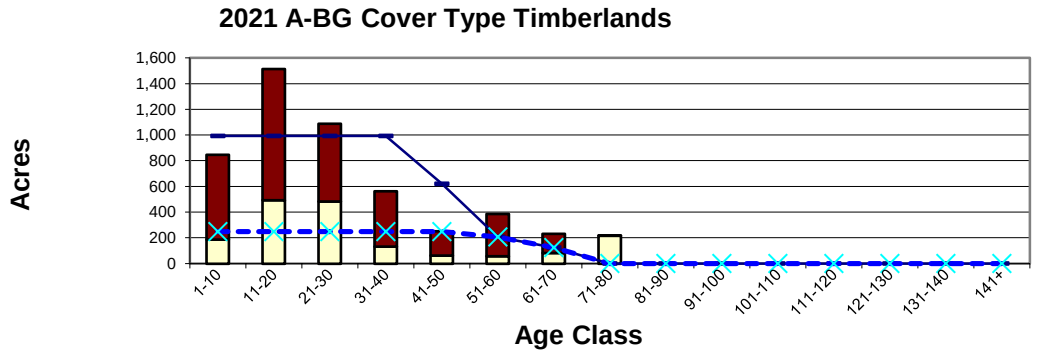
Wet Forest System	Northern	WFn64c	Black Ash - Alder Swamp (Northern)	S4	
Wet Forest System	Northern	WFn74	Northern Wet Alder Swamp		
Wet Forest System	Southern	WFs55a	Lowland Aspen Forest	S4	
Wet Forest System	Southern	WFs57a	Black Ash - (Red Maple) Seepage Swamp	S1S2	

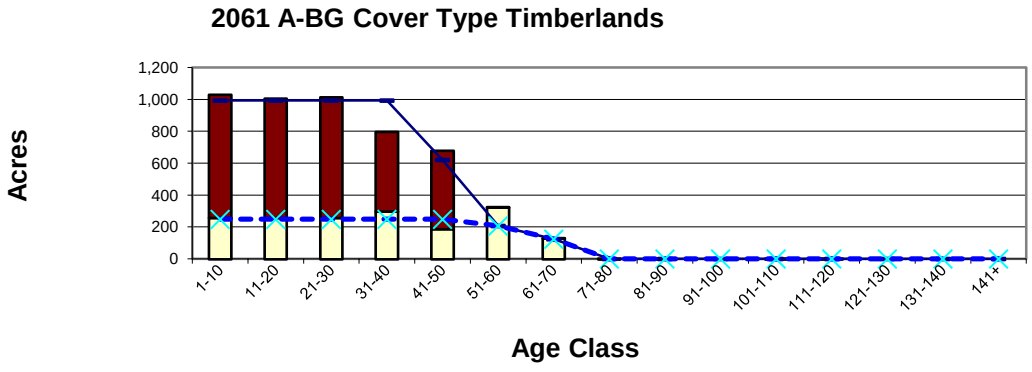
Appendix C – Major Even-age Cover Types Age Class Charts

The major even age cover types in the HH Subsection include: aspen/balm of Gilead; high and low site index (SI) red oak and the bur oak cover types. Age class charts for the current age class, the first decade of the planning period and the 50-year age class charts are provided below for these cover types.

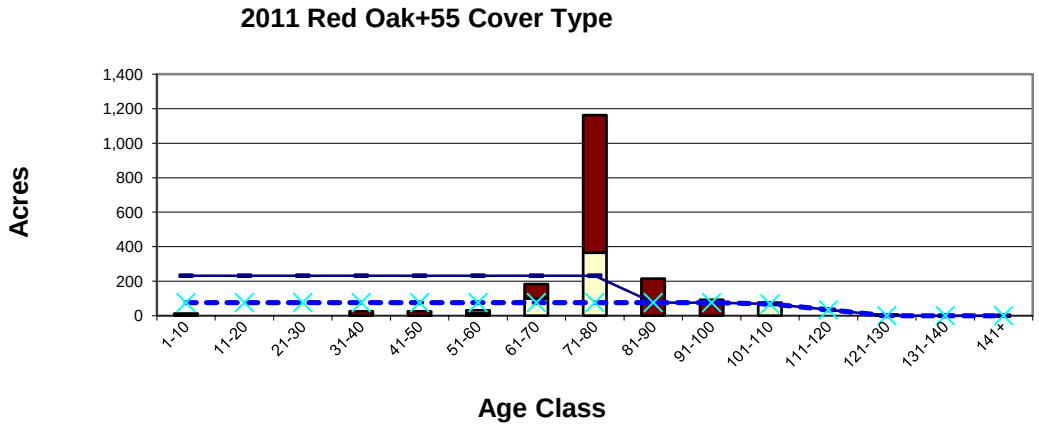
Aspen/balm of Gilead

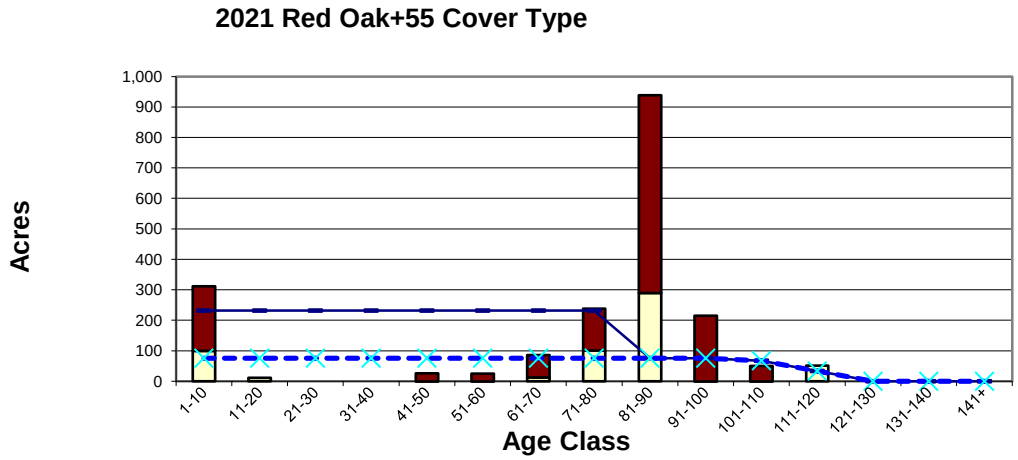


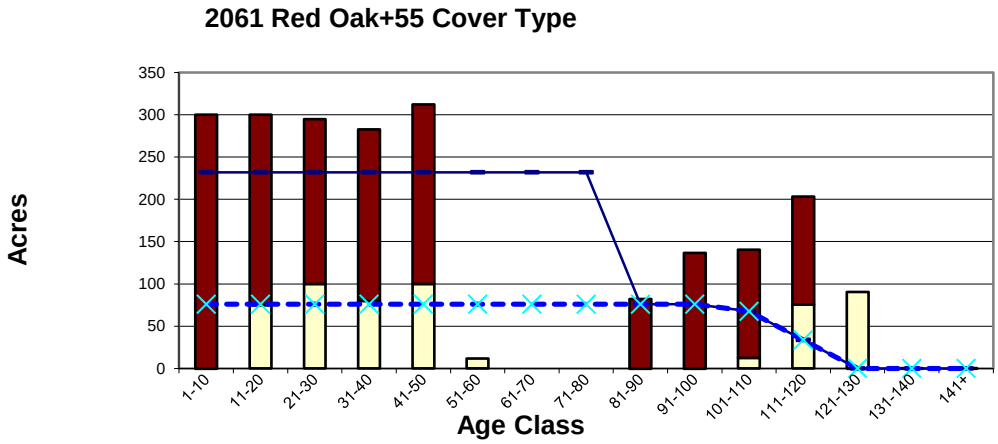




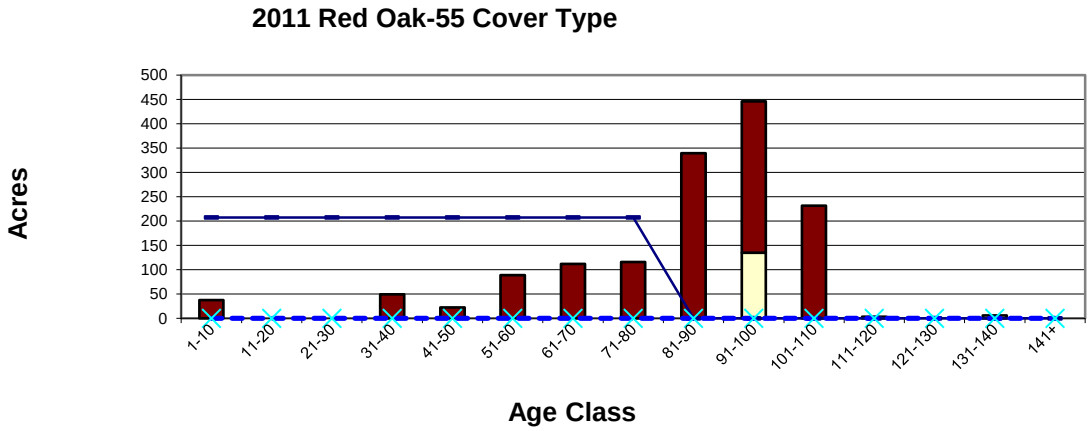
Red oak (High SI =55+)

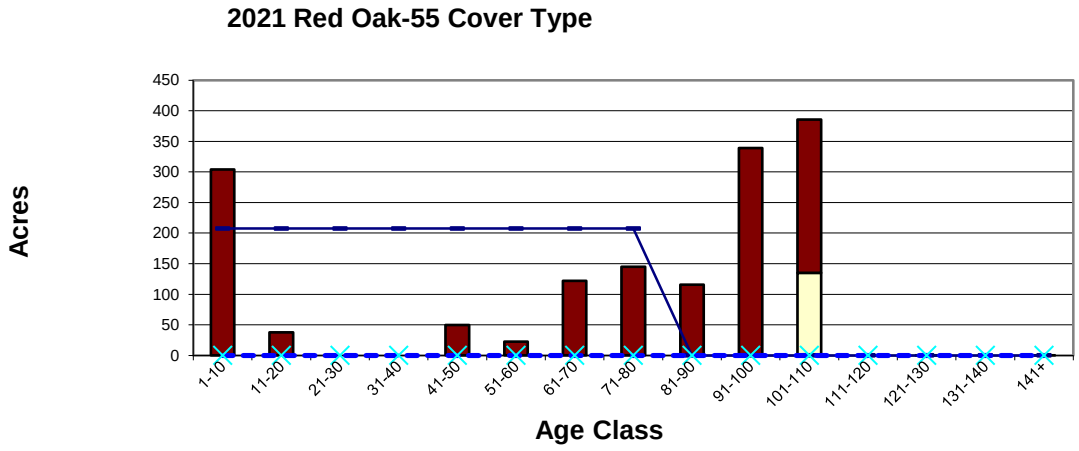


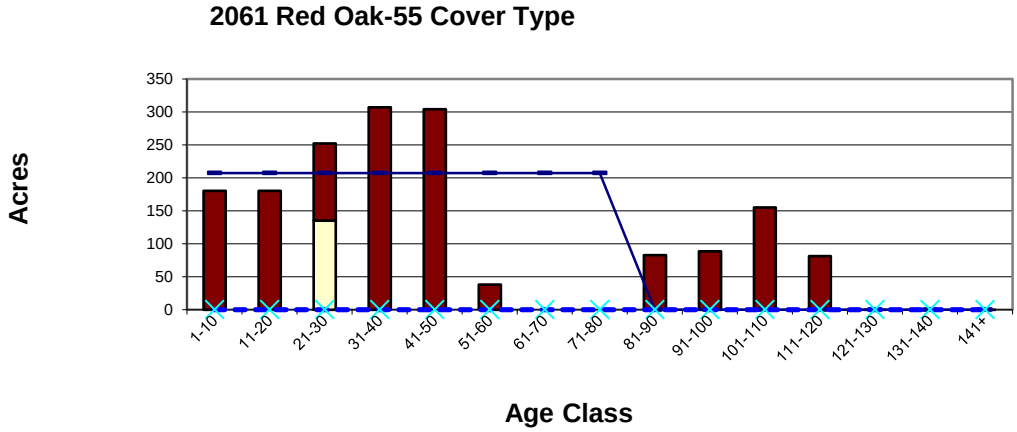




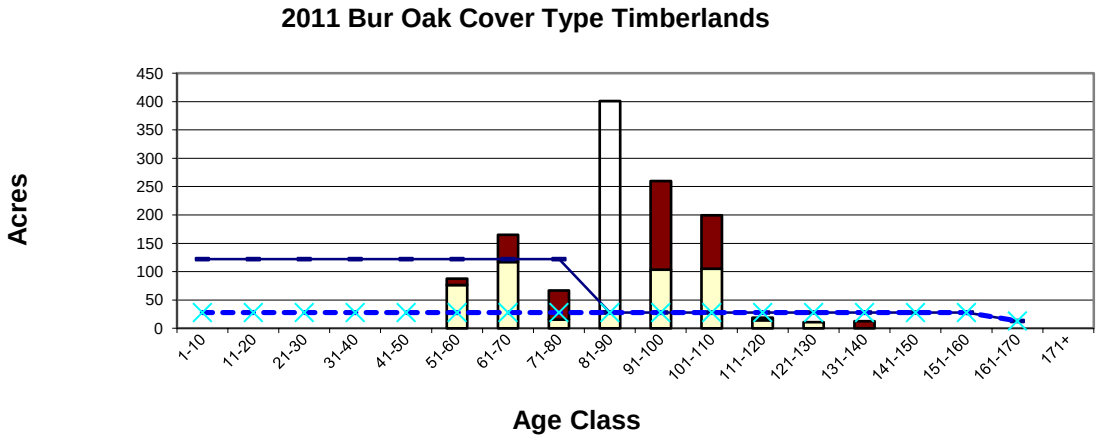
Red oak (Low SI <55)

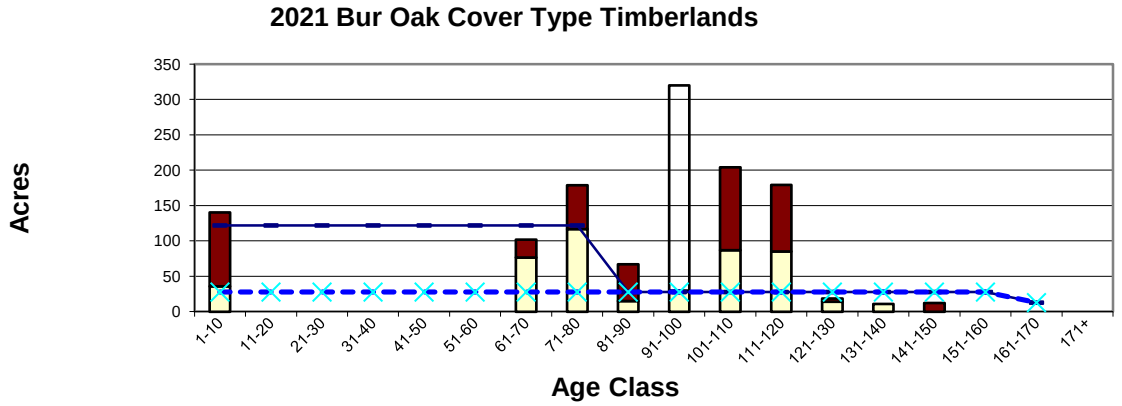


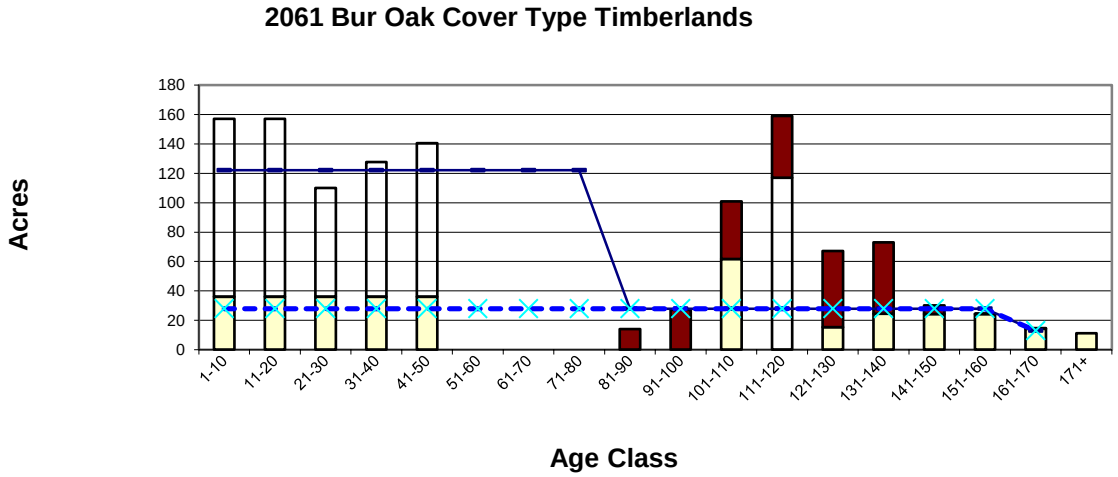




Bur oak


2011 Bur Oak Cover Type Timberlands
Acres
450
400
350
300
250
200
150
100
50
0
1-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
101-110
111-120
121-130
131-140
141-150
151-160
161-170
171+
Age Class


2021 Bur Oak Cover Type Timberlands
Acres
350
300
250
200
150
100
50
0
1-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
101-110
111-120
121-130
131-140
141-150
151-160
161-170
171+
Age Class


2061 Bur Oak Cover Type Timberlands
Acres
180
160
140
120
100
80
60
40
20
0
1-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
101-110
111-120
121-130
131-140
141-150
151-160
161-170
171+
Age Class

Appendix D - Ten-Year Stand Examination List

This Appendix identifies the list of stands by location, cover type, treatment acres, and preliminary prescription selected as a result of the Hardwood Hills SFRMP stand selection process.

Stand Examinations (Field Visits)
Over the 10-year planning period it is anticipated that every stand on the 10-Year Stand Examination List will be field visited to determine the actual management to be implemented. A total of 208 stands are identified on the 10-Year Stand Exam List. As stands were selected and placed on the 10-Year Stand Exam List, preliminary prescriptions were assigned. Final management objectives and final prescriptions will be determined as each stand is field visited.

At the time of field visit a standard *Silvicultural Prescription Worksheet* will be prepared. As the *Worksheet* is prepared the range of decisions about each stand's management include:

1. Appraise the stand for a timber sale.
2. Defer treatment of the stand to a future year.
3. Update the stand's forest inventory data to reflect current conditions without prescribing a management action at this time.
4. Manage for the understory without harvesting at this time.
5. Prescribe silviculture treatment (e.g., site preparation and tree planting).
6. Prescribe timber stand improvement (tsi) to enhance stand vigor, diversity, and/or productivity.

Maps of 10-Year Stand Exam List
Maps identifying the locations of stands on the 10-Year Stand Exam List can be viewed at:

http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/index.html

In addition, a link has been created to view and comment on the stands that are planned for management during the first ten years of the planning period. To view and comment on the selected stands please see:

http://www.dnr.state.mn.us/maps/forestview/index.html

Maps identifying all lands administered by DNR by generalized cover type are provided in Appendix M as are maps of designated old-growth forest, Ecologically Important Lowland Conifers (EILC), and Extended Rotation Forests (ERF).

Note: The maps have been reduced in size for inclusion in this document. It is recommended that these maps be viewed at a larger scale and in color. The colored maps and this report can be viewed at

http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/index.html

and are also available in CD format by request.

Stand Evaluations
As the stand field visit examinations are completed, all information from the Aspen Parklands Plan (i.e., desired future forest composition, strategies, cover type management recommendations, and all department policy, guidelines and directives, and Forest Inventory Module (FIM) data) will be considered in evaluating the stands and making final prescriptions. The field process will include completion of the *Silvicultural Prescription Worksheet*. For many stands, the SFRMP FIM database includes: preliminary management objectives; comments concerning stand management; identification of special management areas; and, requests for a joint visit among DNR Divisions (See *Appendix K - SFRMP Additional Field Names and Codes).*

During the development of the Aspen Parklands SFRMP 10-Year Stand Exam List, some stands were identified for joint site visits by personnel from the Divisions of Fish and Wildlife or Ecological and Water Resources. Joint site visits provide an opportunity to achieve consensus concerning stand management that considers the characteristics unique to individual stands and issues of concern in the field based on the goals and objectives for the stand and the surrounding landscape as recommended in the plan. Stands identified for joint site visits are indicated as such on Annual Stand Exam Lists and appraiser stand reports. Results of joint site visits are documented and filed in the timber sale permit file.

Public Review of Stand Examination Lists
The entire 10-Year Stand Exam List is available for public review at:

http://www.dnr.state.mn.us/forestry/subsection/hardwoodhills/index.html

Stands will be available for additional public review as they are included in Annual Stand Exam Lists prepared by each Forestry Area (i.e., by stand examination year). If stands not on the 10-year list are added to the Annual Stand Exam list, they will receive public review as an Annual Plan Addition. For details on these public review processes, see:

http://www.dnr.state.mn.us/forestry/harvesting/plans.html

Treatment Acres Summary
Table 3.2b in chapter 3 of this plan summarizes treatment acres by cover type.

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Becker	Detroit Lakes Area	138	40	16	20	37.0			SFRMP On-site Visit	2014	Northern Hardwoods	83
Becker	Detroit Lakes Area	138	41	36	38	136.9			Shelterwood	2015	Oak	76
Becker	Detroit Lakes Area	138	41	36	41	40.0			Commercial Thinning	2013	Oak	84
Becker	Detroit Lakes Area	138	41	36	44	9.1			SFRMP On-site Visit	2016	Aspen	74
Becker	Detroit Lakes Area	139	39	6	4	193.4			SFRMP On-site Visit	2015	Northern Hardwoods	77
Becker	Detroit Lakes Area	139	39	6	7	6.2			Clearcut- w/ Reserves	2017	Aspen	74
Becker	Detroit Lakes Area	139	39	6	17	14.9			Clearcut- w/ Reserves	2017	Aspen	57
Becker	Detroit Lakes Area	139	39	6	25	54.8			SFRMP On-site Visit	2018	Northern Hardwoods	72
Becker	Detroit Lakes Area	139	39	6	36	8.8			Clearcut- w/ Reserves	2016	Aspen	78
Becker	Detroit Lakes Area	139	39	6	37	15.0			SFRMP On-site Visit	2020	Northern Hardwoods	71
Becker	Detroit Lakes Area	139	39	6	38	27.1			Clearcut- w/ Reserves	2016	Aspen	69
Becker	Detroit Lakes Area	139	39	7	50	14.5			Clearcut- w/ Reserves	2013	Aspen	74
Becker	Detroit Lakes Area	139	39	7	96	14.6			Clearcut- w/ Reserves	2013	Aspen	73
Becker	Detroit Lakes Area	139	39	8	100	3.4			Clearcut- w/ Reserves	2015	Aspen	77
Becker	Detroit Lakes Area	139	39	8	101	14.7			Clearcut- w/ Reserves	2018	Aspen	64
Becker	Detroit Lakes Area	139	39	17	111	24.2			Clearcut- w/ Reserves	2015	Aspen	74
Becker	Detroit Lakes Area	139	39	17	126	3.3			Clearcut- w/ Reserves	2018	Aspen	64
Becker	Detroit Lakes Area	139	39	17	211	9.3			SFRMP On-site Visit	2013	Balsam Fir	64
Becker	Detroit Lakes Area	139	39	18	110	127.8			SFRMP On-site Visit	2016	Northern Hardwoods	80
Becker	Detroit Lakes Area	139	39	18	129	3.3			Clearcut- w/ Reserves	2019	Aspen	78
Becker	Detroit Lakes Area	139	39	18	143	7.1			Clearcut- w/ Reserves	2019	Aspen	71
Becker	Detroit Lakes Area	139	40	1	12	12.2			Clearcut- w/ Reserves	2013	Aspen	62
Becker	Detroit Lakes Area	139	40	12	40	11.1			Clearcut- w/ Reserves	2015	Aspen	64
Becker	Detroit Lakes Area	139	40	15	45	30.6			SFRMP On-site Visit	2013	Northern Hardwoods	132
Becker	Detroit Lakes Area	139	40	15	60	20.0			Shelterwood	2016	Oak	88
Becker	Detroit Lakes Area	139	40	15	100	3.9			Clearcut- w/ Reserves	2016	Aspen	66

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Becker	Detroit Lakes Area	141	39	30	83	30.1		Y	Re-Inventory	2011	Aspen	77
Becker	Detroit Lakes Area	141	40	23	35	2.5			Clearcut- w/ Reserves	2013	Aspen	61
Becker	Detroit Lakes Area	141	40	23	36	36.2			Clearcut- w/ Reserves	2013	Aspen	61
Becker	Detroit Lakes Area	141	40	23	45	15.2			SFRMP On-site Visit	2017	Northern Hardwoods	75
Becker	Detroit Lakes Area	141	40	26	56	34.9			SFRMP On-site Visit	2017	Northern Hardwoods	75
Becker	Detroit Lakes Area	141	40	26	57	10.3			Clearcut- w/ Reserves	2016	Aspen	62
Becker	Detroit Lakes Area	142	39	17	74	7.1			Clearcut- w/ Reserves	2013	Jack Pine	52
Becker	Detroit Lakes Area	142	39	19	81	5.6			Re-Inventory	2014	Aspen	76
Becker	Detroit Lakes Area	142	41	25	70	12.0			Re-Inventory	2022	Aspen	77
Clearwater	Bemidji Area	148	37	23	28	13.1	Y		Uneven-Aged Harvest	2019	Northern Hardwoods	49
Clearwater	Bemidji Area	148	37	23	49	12.0			Clearcut- w/ Reserves	2019	Aspen	56
Clearwater	Bemidji Area	148	37	23	165	1.3			Manage for Understory	0	Aspen	65
Clearwater	Bemidji Area	148	37	24	29	23.7	Y		Uneven-Aged Harvest	2019	Northern Hardwoods	82
Clearwater	Bemidji Area	148	38	4	22	3.4			Manage for Understory	0	Aspen	61
Clearwater	Bemidji Area	148	38	4	73	1.9			Manage for Understory	0	Aspen	61
Clearwater	Bemidji Area	148	38	4	83	1.5			Manage for Understory	0	Aspen	61
Clearwater	Bemidji Area	148	38	19	61	6.8	Y		Uneven-Aged Harvest	2015	Northern Hardwoods	64
Clearwater	Bemidji Area	148	38	19	84	2.4			Uneven-Aged Harvest	2015	Northern Hardwoods	61
Douglas	Detroit Lakes Area	128	38	9	17	7.4			Manage for Understory	2014	Aspen	73
Douglas	Detroit Lakes Area	130	36	9	19	17.9	Y		Clearcut- w/ Reserves	2014	Aspen	76
Douglas	Detroit Lakes Area	130	36	16	33	20.0	Y		Shelterwood	2014	Oak	106
Mahnomen	Bemidji Area	143	39	6	3	11.9			Clearcut- w/ Reserves	2013	Aspen	65
Mahnomen	Bemidji Area	143	39	6	4	9.8			Clearcut- w/ Reserves	2013	Balsam Fir	54
Mahnomen	Bemidji Area	143	39	6	15	8.8			Clearcut- w/ Reserves	2013	Balsam Fir	72
Mahnomen	Bemidji Area	143	39	7	65	5.0			Manage for Understory	0	Aspen	69
Mahnomen	Bemidji Area	143	40	1	10	62.0		Y	Commercial Thinning	2013	Northern Hardwoods	35

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Mahnomen	Bemidji Area	143	40	1	11	17.8			Uneven-Aged Harvest	2013	Northern Hardwoods	78
Mahnomen	Bemidji Area	143	40	1	12	27.4			Commercial Thinning	2013	Norway Pine	42
Mahnomen	Bemidji Area	143	40	1	13	7.4		Y	Clearcut- w/ Reserves	2013	Jack Pine	60
Mahnomen	Bemidji Area	143	40	1	17	14.4	Y		Clearcut- w/ Reserves	2013	Aspen	80
Mahnomen	Bemidji Area	143	40	1	30	25.0	Y		Clearcut- w/ Reserves	2018	Aspen	70
Mahnomen	Bemidji Area	143	40	1	43	37.1			Uneven-Aged Harvest	2018	Northern Hardwoods	31
Mahnomen	Bemidji Area	143	40	1	44	48.6			Uneven-Aged Harvest	2018	Northern Hardwoods	22
Mahnomen	Bemidji Area	143	40	1	46	4.3		Y	Commercial Thinning	2018	Norway Pine	40
Mahnomen	Bemidji Area	143	40	1	50	9.4			Commercial Thinning	2018	White Spruce	27
Mahnomen	Bemidji Area	143	40	2	52	4.4	Y		Manage for Understory	0	Aspen	85
Mahnomen	Bemidji Area	143	40	11	62	10.0	Y		Clearcut- w/ Reserves	2018	Aspen	5
Mahnomen	Bemidji Area	143	40	11	75	11.3	Y		Commercial Thinning	2018	White Spruce	32
Mahnomen	Bemidji Area	143	40	11	79	10.0	Y		Clearcut- w/ Reserves	2018	Aspen	92
Mahnomen	Bemidji Area	143	40	11	115	7.1	Y		Commercial Thinning	2018	White Spruce	32
Mahnomen	Bemidji Area	143	40	12	70	16.1			Uneven-Aged Harvest	2018	Northern Hardwoods	31
Mahnomen	Bemidji Area	143	40	12	71	33.4		Y	Commercial Thinning	2018	Norway Pine	36
Mahnomen	Bemidji Area	143	40	12	78	25.3			Commercial Thinning	2018	Norway Pine	23
Mahnomen	Bemidji Area	143	40	12	98	49.8			SFRMP On-site Visit	2021	Oak	74
Mahnomen	Bemidji Area	143	40	12	101	41.8			Commercial Thinning	2021	White Spruce	32
Mahnomen	Bemidji Area	143	40	12	125	19.4			Commercial Thinning	2021	Norway Pine	44
Mahnomen	Bemidji Area	143	40	12	129	15.8			Commercial Thinning	2021	White Spruce	38
Mahnomen	Bemidji Area	143	40	12	136	5.9			Commercial Thinning	2021	White Spruce	31
Mahnomen	Bemidji Area	143	40	12	139	2.9			Commercial Thinning	2021	Norway Pine	25
Mahnomen	Bemidji Area	143	40	13	153	20.3			Commercial Thinning	2021	White Spruce	38
Mahnomen	Bemidji Area	143	40	13	154	8.0			Commercial Thinning	2021	White Spruce	31
Mahnomen	Bemidji Area	143	40	13	155	8.4			Commercial Thinning	2021	Norway Pine	25

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Mahnomen	Bemidji Area	143	40	13	157	8.7			Commercial Thinning	2021	Norway Pine	44
Mahnomen	Bemidji Area	143	40	14	181	38.7			Uneven-Aged Harvest	2015	Northern Hardwoods	112
Mahnomen	Bemidji Area	143	40	14	182	4.2			Clearcut- w/ Reserves	2015	Aspen	80
Mahnomen	Bemidji Area	143	40	14	184	26.0			Clearcut- w/ Reserves	2015	Aspen	79
Mahnomen	Bemidji Area	143	40	14	185	15.9			Clearcut- w/ Reserves	2015	Aspen	79
Mahnomen	Bemidji Area	143	40	15	141	9.8	Y		Manage for Understory	0	Aspen	82
Mahnomen	Bemidji Area	143	40	15	183	30.6			Uneven-Aged Harvest	2015	Northern Hardwoods	112
Mahnomen	Bemidji Area	143	40	23	195	15.2			Uneven-Aged Harvest	2015	Northern Hardwoods	112
Mahnomen	Bemidji Area	143	40	23	196	5.9			Uneven-Aged Harvest	2015	Northern Hardwoods	82
Mahnomen	Bemidji Area	143	40	23	197	34.4			Uneven-Aged Harvest	2015	Northern Hardwoods	82
Mahnomen	Bemidji Area	143	40	27	244	15.2	Y		Manage for Understory	0	Aspen	78
Mahnomen	Bemidji Area	143	40	29	252	22.7			Uneven-Aged Harvest	2014	Northern Hardwoods	72
Mahnomen	Bemidji Area	143	40	29	257	8.8			Shelterwood	2014	Oak	109
Mahnomen	Bemidji Area	143	40	32	312	57.9			Uneven-Aged Harvest	2014	Northern Hardwoods	82
Mahnomen	Bemidji Area	143	40	33	328	8.4	Y		Manage for Understory	0	Aspen	88
Mahnomen	Bemidji Area	143	40	33	349	7.8	Y		Manage for Understory	0	Aspen	78
Mahnomen	Bemidji Area	144	40	23	29	63.2			Uneven-Aged Harvest	2020	Northern Hardwoods	96
Mahnomen	Bemidji Area	144	40	26	39	9.6			Uneven-Aged Harvest	2020	Northern Hardwoods	96
Mahnomen	Bemidji Area	144	40	26	41	5.7			Uneven-Aged Harvest	2020	Northern Hardwoods	96
Mahnomen	Bemidji Area	144	40	26	45	5.3			Uneven-Aged Harvest	2020	Northern Hardwoods	110
Mahnomen	Bemidji Area	144	40	26	46	29.9			Uneven-Aged Harvest	2020	Northern Hardwoods	110
Mahnomen	Bemidji Area	145	40	6	3	42.0			Uneven-Aged Harvest	2014	Northern Hardwoods	82
Mahnomen	Bemidji Area	146	39	5	8	22.1			Uneven-Aged Harvest	2017	Northern Hardwoods	66
Mahnomen	Bemidji Area	146	39	5	9	41.7			Uneven-Aged Harvest	2017	Northern Hardwoods	158
Mahnomen	Bemidji Area	146	39	5	10	14.7			Clearcut- w/ Reserves	2017	Aspen	66
Mahnomen	Bemidji Area	146	39	33	52	5.8			Manage for Understory	0	Aspen	62

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Mahnomen	Bemidji Area	146	39	34	53	5.3			Manage for Understory	0	Aspen	69
Mahnomen	Bemidji Area	146	40	10	13	16.3			Shelterwood	2017	Oak	107
Mahnomen	Bemidji Area	146	40	12	1	21.3			Shelterwood	2017	Oak	82
Mahnomen	Bemidji Area	146	40	12	2	5.6			Clearcut- w/ Reserves	2017	Aspen	55
Mahnomen	Bemidji Area	146	40	12	115	9.1			Clearcut- w/ Reserves	2017	Aspen	84
Mahnomen	Bemidji Area	146	40	12	116	3.2			Clearcut- w/ Reserves	2017	Aspen	84
Mahnomen	Bemidji Area	146	40	12	123	30.3			Clearcut- w/ Reserves	2017	Aspen	53
Mahnomen	Bemidji Area	146	40	25	43	11.1			Uneven-Aged Harvest	2019	Northern Hardwoods	111
Mahnomen	Bemidji Area	146	40	25	47	12.6			SFRMP On-site Visit	2019	Oak	85
Mahnomen	Bemidji Area	146	40	26	38	5.3			SFRMP On-site Visit	2019	Oak	93
Mahnomen	Bemidji Area	146	40	26	40	8.8			Uneven-Aged Harvest	2019	Northern Hardwoods	67
Mahnomen	Bemidji Area	146	40	26	41	11.4			Uneven-Aged Harvest	2019	Northern Hardwoods	51
Mahnomen	Bemidji Area	146	40	26	46	6.9			Clearcut- w/ Reserves	2019	Aspen	85
Mahnomen	Bemidji Area	146	40	30	55	6.6			Clearcut- w/ Reserves	2016	Aspen	62
Mahnomen	Bemidji Area	146	40	31	87	34.3			Uneven-Aged Harvest	2014	Northern Hardwoods	84
Mahnomen	Bemidji Area	146	40	31	101	5.5			Uneven-Aged Harvest	2014	Northern Hardwoods	88
Mahnomen	Bemidji Area	146	40	31	110	33.3			Uneven-Aged Harvest	2014	Northern Hardwoods	83
Mahnomen	Bemidji Area	146	41	6	12	15.6			Manage for Understory	0	Aspen	81
Mahnomen	Bemidji Area	146	41	25	113	23.6			Clearcut- w/ Reserves	2016	Aspen	57
Mahnomen	Bemidji Area	146	41	25	155	3.9			Clearcut- w/ Reserves	2016	Aspen	57
Mahnomen	Bemidji Area	146	41	26	135	9.1			Clearcut- w/ Reserves	2016	Aspen	66
Mahnomen	Bemidji Area	146	41	35	186	37.4			Shelterwood	2016	Oak	87
Mahnomen	Bemidji Area	146	41	36	167	5.4			Clearcut- w/ Reserves	2016	Aspen	58
Mahnomen	Bemidji Area	146	41	36	169	8.9			Clearcut- w/ Reserves	2016	Aspen	57
Mahnomen	Bemidji Area	146	41	36	179	5.2			Clearcut- w/ Reserves	2016	Aspen	58
Mahnomen	Bemidji Area	146	41	36	207	24.6			Uneven-Aged Harvest	2014	Northern Hardwoods	84

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Morrison	Little Falls Area	128	31	20	33	9.9			SFRMP On-site Visit	2015	Northern Hardwoods	84
Morrison	Little Falls Area	128	31	31	62	44.7			Shelterwood	2015	Oak	106
Morrison	Little Falls Area	130	30	5	3520	19.5			Manage for Understory	2020	Oak	91
Morrison	Little Falls Area	130	31	19	36	13.5			Re-Inventory	2019	Aspen	16
Morrison	Little Falls Area	130	31	30	65	7.3			Clearcut- w/ Reserves	2019	Aspen	51
Morrison	Little Falls Area	130	31	30	66	17.4			Manage for Understory	2019	Aspen	53
Morrison	Little Falls Area	130	31	30	90	2.3			Clearcut- w/ Reserves	2019	Aspen	55
Morrison	Little Falls Area	130	31	31	74	11.0			Clearcut- w/ Reserves	2019	Aspen	56
Otter Tail	Detroit Lakes Area	131	36	9	20	14.9	Y		Clearcut- w/ Reserves	2014	Aspen	77
Otter Tail	Detroit Lakes Area	131	36	9	32	6.4	Y		Clearcut- w/ Reserves	2014	Aspen	81
Otter Tail	Detroit Lakes Area	131	38	36	39	3.2			Manage for Understory	2014	Oak	118
Otter Tail	Detroit Lakes Area	132	37	4	38	28.4			Re-Inventory	2020	Oak	92
Otter Tail	Detroit Lakes Area	132	37	5	24	30.0	Y		Clearcut- w/ Reserves	2022	Balm of Gilead	70
Otter Tail	Detroit Lakes Area	132	37	18	62	30.0			Shelterwood	2020	Oak	97
Otter Tail	Detroit Lakes Area	132	37	18	69	9.9			Clearcut- w/ Reserves	2018	Aspen	71
Otter Tail	Detroit Lakes Area	132	38	16	46	17.4			Shelterwood	2017	Oak	106
Otter Tail	Detroit Lakes Area	132	38	16	50	12.5			Shelterwood	2017	Oak	106
Otter Tail	Detroit Lakes Area	132	38	34	34	6.2			Shelterwood	2017	Oak	133
Otter Tail	Detroit Lakes Area	132	38	34	36	6.5			Shelterwood	2017	Oak	109
Otter Tail	Detroit Lakes Area	132	38	34	38	8.4			Shelterwood	2017	Oak	110
Otter Tail	Detroit Lakes Area	132	38	34	56	28.0			Shelterwood	2014	Oak	102
Otter Tail	Detroit Lakes Area	132	39	6	9	6.0			Manage for Understory	2014	Aspen	72
Otter Tail	Detroit Lakes Area	133	37	32	58	42.2	Y		Clearcut- w/ Reserves	2015	Aspen	77
Otter Tail	Detroit Lakes Area	133	37	33	44	33.4	Y		Clearcut- w/ Reserves	2018	Aspen	75
Otter Tail	Detroit Lakes Area	133	37	36	68	9.4			Clearcut- w/ Reserves	2016	Aspen	61
Otter Tail	Detroit Lakes Area	133	38	2	36	30.0			Shelterwood	2020	Offsite Oak - SI <= 39	98

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Otter Tail	Detroit Lakes Area	133	38	2	39	9.0			Clearcut- w/ Reserves	2020	Aspen	65
Otter Tail	Detroit Lakes Area	133	38	36	47	72.2			Shelterwood	2019	Oak	102
Otter Tail	Detroit Lakes Area	133	38	36	50	2.0			Shelterwood	2019	Oak	102
Otter Tail	Detroit Lakes Area	134	39	34	40	3.2			Shelterwood	2017	Oak	104
Otter Tail	Detroit Lakes Area	134	39	34	41	2.1			Shelterwood	2017	Oak	104
Otter Tail	Detroit Lakes Area	134	39	34	47	17.1			Uneven-Aged Harvest	2019	Northern Hardwoods	100
Otter Tail	Detroit Lakes Area	134	39	34	48	7.2			Clearcut- w/ Reserves	2019	Aspen	56
Otter Tail	Detroit Lakes Area	134	40	3	34	10.9	Y		Shelterwood	2018	Oak	106
Otter Tail	Detroit Lakes Area	134	40	5	10	20.0	Y		Shelterwood	2018	Oak	109
Otter Tail	Detroit Lakes Area	134	40	5	29	17.8			Manage for Understory	2020	Aspen	70
Otter Tail	Detroit Lakes Area	134	40	6	23	14.0			Clearcut- w/ Reserves	2021	Aspen	66
Otter Tail	Detroit Lakes Area	134	40	8	52	10.1			Manage for Understory	2020	Aspen	81
Otter Tail	Detroit Lakes Area	134	42	7	18	17.6			Clearcut- w/ Reserves	2021	Balm of Gilead	66
Otter Tail	Detroit Lakes Area	135	39	21	24	3.2	Y		Manage for Understory	2020	Aspen	73
Otter Tail	Detroit Lakes Area	135	40	22	27	5.0	Y		Manage for Understory	2017	Aspen	77
Otter Tail	Detroit Lakes Area	135	40	22	65	6.5	Y		Manage for Understory	2017	Aspen	79
Otter Tail	Detroit Lakes Area	135	41	18	22	7.6			Manage for Understory	2017	Aspen	73
Otter Tail	Detroit Lakes Area	137	40	18	23	29.4			Uneven-Aged Harvest	2019	Northern Hardwoods	84
Otter Tail	Detroit Lakes Area	137	40	18	25	7.3			Uneven-Aged Harvest	2019	Northern Hardwoods	40
Otter Tail	Detroit Lakes Area	137	43	22	32	10.6	Y		Manage for Understory	2014	Aspen	75
Polk	Bemidji Area	147	39	31	156	3.9			Manage for Understory	0	Aspen	75
Stearns	Little Falls Area	127	33	36	124	62.2			Shelterwood	2016	Oak	75
Stearns	Little Falls Area	127	33	36	136	26.3			Clearcut- w/ Reserves	2016	Aspen	71
Stearns	Little Falls Area	127	33	36	151	4.5			Clearcut- w/ Reserves	2016	Aspen	70
Stearns	Little Falls Area	127	33	36	164	8.4			Clearcut- w/ Reserves	2016	Aspen	71
Stearns	Little Falls Area	127	33	36	165	11.5			Clearcut- w/ Reserves	2016	Aspen	71

County	Forestry Area	Twp	Rng	Sec	Stand ID	Treat-ment Acres	ERF	White Pine Comp-onent	Preliminary Prescription	Exam Year	Cover Type	2011 Age
Todd	Little Falls Area	127	32	12	27	75.0	Y		Shelterwood	2022	Oak	71
Todd	Little Falls Area	127	33	8	138	20.0			Shelterwood	2013	Oak	82
Todd	Little Falls Area	127	33	9	143	4.4	Y		SFRMP On-site Visit	2013	Aspen	76
Todd	Little Falls Area	127	33	9	147	9.4	Y		SFRMP On-site Visit	2013	Aspen	76
Todd	Little Falls Area	127	33	10	33	11.3	Y		SFRMP On-site Visit	2013	Aspen	69
Todd	Little Falls Area	128	35	1	56	14.9			Clearcut- w/ Reserves	2018	Aspen	56
Todd	Little Falls Area	128	35	2	60	1.3			Clearcut- w/ Reserves	2018	Aspen	51
Todd	Little Falls Area	128	35	2	62	2.6			Clearcut- w/ Reserves	2018	Aspen	53
Todd	Little Falls Area	128	35	2	65	0.9			Clearcut- w/ Reserves	2018	Aspen	53
Todd	Little Falls Area	130	32	36	50	8.3			Commercial Thinning	2016	Oak	76
Todd	Little Falls Area	130	32	36	51	7.0			Clearcut- w/ Reserves	2016	Aspen	51
Todd	Little Falls Area	130	32	36	53	8.5			Shelterwood	2016	Oak	80
Todd	Little Falls Area	130	35	16	23	6.7			SFRMP On-site Visit	2017	Tamarack	89
Todd	Little Falls Area	130	35	16	24	62.5			Uneven-Aged Harvest	2017	Northern Hardwoods	80
Todd	Little Falls Area	130	35	16	29	12.3			Clearcut- w/ Reserves	2017	Aspen	63
Todd	Little Falls Area	132	34	16	20	10.9			Uneven-Aged Harvest	2016	Northern Hardwoods	78
Todd	Little Falls Area	132	34	16	23	14.4			Re-Inventory	2016	Oak	74
Todd	Little Falls Area	132	34	16	25	1.1			Manage for Understory	2016	Aspen	67
Todd	Little Falls Area	133	33	25	49	2.5			Clearcut- w/ Reserves	2014	Aspen	66
Todd	Little Falls Area	133	33	25	52	6.4			Clearcut- w/ Reserves	2014	Aspen	66
Todd	Little Falls Area	133	33	25	55	4.7			Clearcut- w/ Reserves	2014	Aspen	66
Todd	Little Falls Area	133	33	26	58	12.0			Clearcut- w/ Reserves	2014	Aspen	63
Wright	Cambridge Area	122	27	26	34	26.0	Y		Clearcut- w/ Reserves	2013	Aspen	73
Wright	Cambridge Area	122	27	26	36	11.4	Y		SFRMP On-site Visit	2022	Oak	79
Wright	Cambridge Area	122	27	27	38	5.1	Y		SFRMP On-site Visit	2013	Aspen	65
Wright	Cambridge Area	122	27	35	67	9.3			SFRMP On-site Visit	2022	Oak	107

Appendix E - Minnesota's list of rare species found in the Hardwood Hills Subsection

Rare Features Information

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

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

Purpose, Scope, and Relationships to Federal Laws

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota DNR to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern (ETS). The resulting List of Endangered, Threatened, and Special Concern Species (http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf) 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 a 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/le/pdffiles/ESA.pdf) 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. Five federally listed species occur or likely occur within the HH subsection. These include: Canada lynx, Sprague's pipit, Poweshiek skipperling, Dakota skipper, and Western prairie fringed orchid. See: http://www.fws.gov/midwest/endangered/lists/minnesot-cty.html

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 population of the ETS species on the site.

Survey Methods

Much of the information about rare features in the Minnesota Heritage Information System is the result of rare features survey work done by the Minnesota County Biological Survey since the 1970s. While survey processes 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; And,
- 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/eco/mcbs/index.html

Minnesota Listed Species

The rare features data included here were provided by the Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR), and were current as of May 2011. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present. In addition, there may be inaccuracies in the data, of which the DNR is not aware and shall not be held responsible for. Permission to use these data does not imply endorsement or approval by the DNR of any interpretations or products derived from the data. All data is under copywrite (2009), State of Minnesota, Department of Natural Resources.

The rare feature products prepared for the Hardwood Hills 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. Proposed revisions are currently awaiting approval from the Governor's Office. To understand the tables it is useful to understand what the state ranking of endangered, threatened, and special concern mean.

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.

Rank Key:	
PROP	Proposed
END	Endangered
SPC	Special Concern
THR	Threatened
NL	Not Listed
GNR	Globally Non-Ranked

Table E1: Minnesota Listed Species – Animals

Listed Animals found in the Hardwood Hills							
Taxa	**Latin Name**	**Common Name**	**State Rank**	**Proposed State Rank**	**Federal Rank**	**S Rank**	**G Rank**
Bird	Ammodramus henslowii	Henslow's Sparrow	END		NL	S1	G4
Bird	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	SPC		NL	S3	G5
Bird	Buteo lineatus	Red-shouldered Hawk	SPC		NL	S3	G5
Bird	Calcarius ornatus	Chestnut-collared Longspur	END		NL	S1	G5
Bird	Coturnicops noveboracensis	Yellow Rail	SPC		NL	S3	G4
Bird	Cygnus buccinator	Trumpeter Swan	THR	SPC	NL	S2	G4
Bird	Dendroica cerulea	Cerulean Warbler	SPC		NL	S3	G4
Bird	Haliaeetus leucocephalus	Bald Eagle	SPC		NL	S3	G5
Bird	Lanius ludovicianus	Loggerhead Shrike	THR	END	NL	S2	G4
Bird	Larus pipixcan	Franklin's Gull	SPC		NL	S3	G4-G5
Bird	Limosa fedoa	Marbled Godwit	SPC		NL	S3	G5
Bird	Phalaropus tricolor	Wilson's Phalarope	THR		NL	S2	G5
Bird	Sterna forsteri	Forster's Tern	SPC		NL	S3	G5
Bird	Sterna hirundo	Common Tern	THR		NL	S2	G5
Bird	Tympanuchus cupido	Greater Prairie-chicken	SPC		NL	S3	G4
Bird	Wilsonia citrina	Hooded Warbler	SPC		NL	S3	G5
Fish	Acipenser fulvescens	Lake Sturgeon	SPC		NL	S3	G3-G4
Fish	Couesius plumbeus	Lake Chub	**	SPC	**	**	**

Fish	Etheostoma microperca	Least Darter	SPC		NL	S3	G5
Fish	Lythrurus umbratilis	Redfin Shiner	**	SPC	**	**	**
Fish	Notropis anogenus	Pugnose Shiner	SPC	THR	NL	S3	G3
Insect	Cicindela lepida	Little White Tiger Beetle	THR		NL	S2	G3-G4
Insect	Cicindela limbata nympha	Sandy Tiger Beetle	END		NL	S1	G5
Insect	Cicindela patruela patruela	Northern Barrens Tiger Beetle	SPC		NL	S3	G3
Insect	Hesperia leonardus pawnee	Pawnee Skipper	SPC		NL	S3	G4
Insect	Oxyethira ecornuta	A Caddisfly	SPC	THR	NL	S3	G5
Insect	Oxyethira itascae	A Caddisfly	SPC		NL	S3	G3
Insect	Speyeria idalia	Regal Fritillary	SPC		NL	S3	G3
Mammal	Alces americanus	Moose	**	SPC	**	**	**
Mammal	Microtus ochrogaster	Prairie Vole	SPC		NL	S3	G5
Mammal	Mustela nivalis	Least Weasel	SPC		NL	S3	G5
Mammal	Perognathus flavescens	Plains Pocket Mouse	SPC		NL	S3	G5
Mollusk	Actinonaias ligamentina	Mucket	THR		NL	S2	G5
Mollusk	Lasmigona compressa	Creek Heelsplitter	SPC		NL	S3	G5
Mollusk	Lasmigona costata	Fluted-shell	SPC		NL	S3	G5
Mollusk	Ligumia recta	Black Sandshell	SPC		NL	S3	G5
Reptile	Emydoidea blandingii	Blanding's Turtle	THR		NL	S2	G4
Spider	Paradamoetas fontana	A Jumping Spider	SPC		NL	S3	GNR

Table E2: Minnesota Listed Species – Plants

Listed Plants in the Hardwood Hills							
Plant Type	**Latin Name**	**Common Name**	**State Rank**	**Proposed State Rank**	**Federal Rank**	**S Rank**	**G Rank**
Fungus	Buellia nigra	A Species of Lichen	END		NL	S1	G1-G2
Vascular Plant	Aristida purpurea var. longiseta	Red Three-awn	SPC		NL	S3	G5
Vascular Plant	Botrychium campestre	Prairie Moonwort	SPC		NL	S3	G3-G4
Vascular Plant	Botrychium mormo	Goblin Fern	SPC	THR	NL	S3	G3
Vascular Plant	Botrychium pallidum	Pale Moonwort	END	SPC	NL	S1	G3
Vascular Plant	Botrychium rugulosum	St. Lawrence Grapefern	THR	SPC	NL	S2	G3
Vascular Plant	Botrychium simplex	Least Moonwort	SPC		NL	S3	G5
Vascular Plant	Carex formosa	Handsome Sedge	END		NL	S1	G4
Vascular Plant	Carex obtusata	Blunt Sedge	SPC		NL	S3	G5
Vascular Plant	Carex sterilis	Sterile Sedge	THR		NL	S2	G4
Vascular Plant	Carex woodii	Wood's Sedge	SPC	NL	NL	S3	G4
Vascular Plant	Chamaesyce missurica	Missouri Spurge	SPC		NL	S3	G5
Vascular Plant	Cirsium hillii	Hill's Thistle	SPC		NL	S3	G3

Vascular Plant	Cladium mariscoides	Twig-rush	SPC		NL	S3	G5
Vascular Plant	Cypripedium arietinum	Ram's-head Lady's-slipper	THR		NL	S2	G3
Vascular Plant	Cypripedium candidum	Small White Lady's-slipper	SPC		NL	S3	G4
Vascular Plant	Drosera anglica	English Sundew	SPC		NL	S3	G5
Vascular Plant	Eleocharis quinqueflora	Few-flowered Spike-rush	SPC		NL	S3	G5
Vascular Plant	Eleocharis rostellata	Beaked Spike-rush	THR		NL	S2	G5
Vascular Plant	Gaillardia aristata	Blanket-flower	SPC		NL	S3	G5
Vascular Plant	Helictotrichon hookeri	Oat-grass	SPC		NL	S3	G5
Vascular Plant	Juniperus horizontalis	Creeping Juniper	SPC		NL	S3	G5
Vascular Plant	Malaxis monophyllos var. brachypoda	White Adder's-mouth	SPC		NL	S3	G5
Vascular Plant	Minuartia dawsonensis	Rock Sandwort	SPC	THR	NL	S3	G5
Vascular Plant	Najas marina	Sea Naiad	SPC		NL	S3	G5
Vascular Plant	Orobanche fasciculata	Clustered Broomrape	SPC	THR	NL	S3	G4
Vascular Plant	Oryzopsis hymenoides	Indian Ricegrass	END		NL	S1	G5
Vascular Plant	Panax quinquefolius	American Ginseng	SPC		NL	S3	G3-G4
Vascular Plant	Platanthera flava var. herbiola	Tubercled Rein-orchid	END	THR	NL	S1	G4
Vascular	Poa paludigena	Bog Bluegrass	THR		NL	S2	G3

Plant							
Vascular Plant	Potamogeton vaginatus	Sheathed Pondweed	SPC	END	NL	S3	G5
Vascular Plant	Potamogeton vaseyi	Vasey's Pondweed	SPC	NL	NL	S3	G4
Vascular Plant	Rhynchospora capillacea	Hair-like Beak-rush	THR		NL	S2	G4
Vascular Plant	Ruppia maritima	Widgeon-grass	SPC		NL	S3	G5
Vascular Plant	Sanicula trifoliata	Beaked Snakeroot	SPC		NL	S3	G4
Vascular Plant	Senecio canus	Gray Ragwort	END		NL	S1	G5
Vascular Plant	Shinnersoseris rostrata	Annual Skeletonweed	THR		NL	S2	G5
Vascular Plant	Stellaria longipes	Long-stalked Chickweed	SPC		NL	S3	G5
Vascular Plant	Trillium nivale	Snow Trillium	SPC		NL	S3	G4

Additional Species Data

In addition to information on listed species, the Hardwood Hills Subsection plan includes information on species labeled as Species in Greatest Conservation Need (SGCNs)."

Species in Greatest Conservation Need (SGCNs)

Species in greatest conservation need are animal species 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 this definition, 85 of which reside in the Hardwood Hills Subsection. These SGCNs include 28 species that are federal or state endangered, threatened, or of special concern. Key Habitats are defined as those habitats most important to the greatest number of SGCN in the subsection. Key Habitats found in this subsection are found in Table E3

Table E3: Hardwood Hills Subsection: Minnesota Species of Greatest Conservation Needs-Animals

Species of Greatest Conservation Need found in the Hardwood Hills		
Taxa	**Latin Name**	**Common Name**
Amphibian	Rana catesbeiana	Bullfrog
Bird	Ammodramus leconteii	Le Conte's Sparrow
Bird	Ammodramus savannarum	Grasshopper Sparrow
Bird	Cistothorus platensis	Sedge Wren
Bird	Dolichonyx oryzivorus	Bobolink
Bird	Gavia immer	Common Loon
Bird	Melospiza georgiana	Swamp Sparrow
Bird	Buteo lineatus	Red-shouldered Hawk
Bird	Contopus virens	Eastern Wood-Pewee
Bird	Empidonax minimus	Least Flycatcher
Bird	Sphyrapicus varius	Yellow-bellied Sapsucker
Bird	Catharus fuscescens	Veery
Bird	Coccyzus erythropthalmus	Black-billed Cuckoo
Bird	Dendroica cerulea	Cerulean Warbler

Bird	Seiurus aurocapilla	Ovenbird
Bird	Hylocichla mustelina	Wood Thrush
Bird	Vermivora chrysoptera	Golden-winged Warbler
Bird	Haliaeetus leucocephalus	Bald Eagle
Bird	Sterna forsteri	Forster's Tern
Bird	Troglodytes troglodytes	Winter Wren
Bird	Zonotrichia albicollis	White-throated Sparrow
Bird	Chlidonias niger	Black Tern
Bird	Cistothorus palustris	Marsh Wren
Bird	Pelecanus erythrorhynchos	American White Pelican
Bird	Coturnicops noveboracensis	Yellow Rail
Bird	Podiceps grisegena	Red-necked Grebe
Bird	Gallinula chloropus	Common Moorhen
Bird	Spizella pusilla	Field Sparrow
Bird	Pheucticus ludovicianus	Rose-breasted Grosbeak
Bird	Sturnella magna	Eastern Meadowlark
Bird	Toxostoma rufum	Brown Thrasher
Bird	Circus cyaneus	Northern Harrier
Bird	Larus pipixcan	Franklin's Gull
Bird	Cygnus buccinator	Trumpeter Swan
Bird	Sterna hirundo	Common Tern
Bird	Chordeiles minor	Common Nighthawk
Bird	Empidonax traillii	Willow Flycatcher
Bird	Grus canadensis	Sandhill Crane
Bird	Botaurus lentiginosus	American Bittern
Bird	Stelgidopteryx serripennis	Northern Rough-winged Swallow
Bird	Nycticorax nycticorax	Black-crowned Night-Heron
Bird	Rallus limicola	Virginia Rail
Bird	Podiceps nigricollis	Eared Grebe
Bird	Scolopax minor	American Woodcock

Bird	Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow
Bird	Melanerpes erythrocephalus	Red-headed Woodpecker
Bird	Phalaropus tricolor	Wilson's Phalarope
Bird	Caprimulgus vociferus	Whip-poor-will
Bird	Ixobrychus exilis	Least Bittern
Bird	Tympanuchus cupido	Greater Prairie-Chicken
Bird	Bartramia longicauda	Upland Sandpiper
Bird	Calcarius ornatus	Chestnut-collared Longspur
Bird	Spiza americana	Dickcissel
Bird	Limosa fedoa	Marbled Godwit
Bird	Ammodramus henslowii	Henslow's Sparrow
Bird	Wilsonia citrina	Hooded Warbler
Bird	Accipiter gentilis	Northern Goshawk
Bird	Lanius ludovicianus	Loggerhead Shrike
Fish	Couesius plumbeus	Lake Chub
Fish	Cyprinella lutrensis	Red Shiner
Fish	Lythrurus umbratilis	Redfin Shiner
Fish	Moxostoma valenciennesi	Greater Redhorse
Fish	Etheostoma microperca	Least Darter
Fish	Notropis anogenus	Pugnose Shiner
Fish	Acipenser fulvescens	Lake Sturgeon
Insect	Speyeria idalia	Regal Fritillary
Insect	Cicindela limbata nympha	A Tiger Beetle
Insect	Paradamoetas fontana	A Jumping Spider
Insect	Oxyethira ecornuta	A Caddisfly
Insect	Oxyethira itascae	A Caddisfly
Insect	Cicindela patruela patruela	A Tiger Beetle
Insect	Cicindela lepida	Little White Tiger Beetle
Mammal	Microtus ochrogaster	Prairie Vole
Mammal	Perognathus flavescens	Plains Pocket Mouse

Mammal	Mustela nivalis	Least Weasel
Mollusk	Lasmigona compressa	Creek Heelsplitter
Mollusk	Actinonaias ligamentina	Mucket
Mollusk	Ligumia recta	Black Sandshell
Mollusk	Lasmigona costata	Fluted-shell
Reptile	Chelydra serpentina	Snapping Turtle
Reptile	Heterodon platirhinos	Eastern Hognose Snake
Reptile	Emydoidea blandingii	Blanding's Turtle

Table E4: Key Habitats in the Hardwood Hills Subsection

Hardwood Hills Subsection

Key Habitat in the State Wildlife Action Plan (SWAP)	NPC Code	Native Plant Community (v. 2.0)
Forest-Upland Deciduous (Aspen)	MHc26a	Oak-Aspen-Red Maple Forest
Forest-Upland Deciduous (Aspen)	MHc37a	Aspen (Sugar Maple-Basswood) Forest
Forest-Upland Deciduous (Aspen)	MHn35a	Aspen-Birch-Basswood Forest
Forest-Upland Deciduous (Hardwood)	MHc36b	Red Oak-Basswood Forest (Calcareous Till)
Forest-Upland Deciduous (Hardwood)	MHc37b	Sugar Maple-Basswood (Aspen) Forest
Forest-Upland Deciduous (Hardwood)	MHc38a	White Pine-Sugar Maple-Basswood Forest (Cold Slope)
Forest-Upland Deciduous (Hardwood)	MHc47a	Basswood-Black Ash Forest
Forest-Upland Deciduous (Hardwood)	MHn45a	Paper Birch-Sugar Maple Forest (North Shore)
Forest-Upland Deciduous (Hardwood)	MHn45c	Sugar Maple Forest (North Shore)
Forest-Upland Deciduous (Hardwood)	MHn47a	Sugar Maple Basswood (Bluebead Lily) Forest
Forest-Upland Deciduous (Hardwood)	MHn47b	Sugar Maple Basswood (Horsetail) Forest
Forest-Upland Deciduous (Hardwood)	MHs39a	Sugar Maple-Basswood (Bitternut Hickory) Forest
Forest-Upland Deciduous (Hardwood)	MHs39b	Sugar Maple-Basswood-Red Oak (Blue Beech) Forest
Forest-Upland Deciduous (Hardwood)	MHs39c	Sugar Maple Forest (Big Woods)

Forest-Upland Deciduous (Hardwood)	MHs49a	Elm-Basswood-Black Ash (Hackberry) Forest
Forest-Upland Deciduous (Hardwood)	MHs49b	Elm-Basswood-Black Ash (Blue Beech) Forest
Forest-Upland Deciduous (Oak)	FDc25b	Oak-Aspen Woodland
Forest-Upland Deciduous (Oak)	FDc34b	Oak-Aspen Forest
Forest-Upland Deciduous (Oak)	FDn22c	Pin Oak Woodland (Bedrock)
Forest-Upland Deciduous (Oak)	FDs27c	Black Oak-White Oak Woodland (Sand)
Forest-Upland Deciduous (Oak)	FDs36a	Bur Oak-Aspen Forest
Forest-Upland Deciduous (Oak)	FDs37a	Oak (Red Maple) Woodland
Forest-Upland Deciduous (Oak)	FDs37b	Pin Oak-Bur Oak Woodland
Forest-Upland Deciduous (Oak)	FDs38a	Oak-Shagbark Hickory Woodland
Forest-Upland Deciduous (Oak)	FDw24a	Bur Oak (Prairie Herb) Woodland
Forest-Upland Deciduous (Oak)	FDw24b	Bur Oak (Forest Herb) Woodland
Forest-Upland Deciduous (Oak)	MHc26a	Oak-Aspen-Red Maple Forest
Forest-Upland Deciduous (Oak)	MHc26b	Red Oak-Sugar Maple-Basswood (Large-flowered Trillium) Forest
Forest-Upland Deciduous (Oak)	MHc36a	Red Oak-Basswood Forest (Noncalcareous Till)
Forest-Upland Deciduous (Oak)	MHn35b	Red Oak-Sugar Maple-Basswood (Bluebead Lily) Forest
Forest-Upland Deciduous (Oak)	MHs37a	Red Oak-White Oak Forest
Forest-Upland Deciduous (Oak)	MHs37b	Red Oak-White Oak (Sugar Maple) Forest
Forest-Upland Deciduous (Oak)	MHw36a	Green Ash-Bur Oak-Elm Forest
Prairie	UPn12a	Dry Barrens Prairie (Northern)
Prairie	UPn12b	Dry Sand-Gravel Prairie (Northern)
Prairie	UPn12c	Dry Sand-Gravel Brush-Prairie (Northern)
Prairie	UPn12d	Dry Hill Prairie (Northern)
Prairie	Upn23b	Mesic Prairie (Northern)
Prairie	Ups13a	Dry Barrens Prairie (Southern)
Prairie	Ups13b	Dry Sand-Gravel Prairie (Southern)

Prairie	Ups13c	Dry Bedrock Bluff Prairie (Southern)
Prairie	Ups13d	Dry Hill Prairie (Southern)
Prairie	Ups23a	Mesic Prairie (Southern)
Prairie	WPn53a	Wet Seepage Prairie (Northern)
Prairie	WPn53c	Wet Prairie (Northern)
Prairie	WPn53d	Wet Saline Prairie (Northern)
Prairie	WPs54a	Wet Seepage Prairie (Southern)
Prairie	WPs54b	Wet Prairie (Southern)
Prairie	WPs54c	Wet Saline Prairie (Southern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	LKu32b	Juniper Dune Shrubland (Lake Superior)
Shrub/Woodland-Upland (oak savanna, brush prairie)	Lku32d	Beach Ridge Shrubland (Lake Superior)
Shrub/Woodland-Upland (oak savanna, brush prairie)	Ron23a	Bedrock Shrubland (Inland)
Shrub/Woodland-Upland (oak savanna, brush prairie)	Ron23b	Bedrock Shrubland (Lake Superior)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn13a	Dry Barrens Jack Pine Savanna (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn13b	Dry Barrens Oak Savanna (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn13c	Dry Sand-Gravel Oak Savanna (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn13d	Dry Hill Oak Savanna (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn23a	Mesic Brush-Prairie (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn24a	Mesic Oak Savanna (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPn24b	Aspen Openings (Northern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPs14a	Dry Barrens Oak Savanna (Southern)
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPs14b	Dry Sand-Gravel Oak Savanna (Southern)
Shrub/Woodland-Upland (oak savanna, brush	Ups14c	Dry Hill Oak Savanna (Southern)

prairie)		
Shrub/Woodland-Upland (oak savanna, brush prairie)	UPs24a	Mesic Oak Savanna (Southern)
Wetland-Nonforested	APn90b	Graminoid Bog
Wetland-Nonforested	APn91b	Graminoid Poor Fen (Basin)
Wetland-Nonforested	APn91c	Graminoid Poor Fen (Water Track)
Wetland-Nonforested	MRn83a	Cattail-Sedge Marsh (Northern)
Wetland-Nonforested	MRn83b	Cattail Marsh (Northern)
Wetland-Nonforested	MRn93a	Bulrush Marsh (Northern)
Wetland-Nonforested	MRn93b	Spikerush-Bur Reed Marsh (Northern)
Wetland-Nonforested	MRp83a	Cattail-Sedge Marsh (Prairie)
Wetland-Nonforested	MRp83b	Cattail Marsh (Prairie)
Wetland-Nonforested	MRp93a	Bulrush Marsh (Prairie)
Wetland-Nonforested	MRp93b	Spikerush-Bur Reed Marsh (Prairie)
Wetland-Nonforested	MRp93c	Arrowhead Marsh (Prairie)
Wetland-Nonforested	MRu94a	Estuary Marsh (Lake Superior)
Wetland-Nonforested	OPn91b	Graminoid Rich Fen (Water Track)
Wetland-Nonforested	OPn92a	Graminoid Rich Fen (Basin)
Wetland-Nonforested	OPn92b	Graminoid-Sphagnum Rich Fen (Basin)
Wetland-Nonforested	OPn93a	Spring Fen
Wetland-Nonforested	OPp91a	Rich Fen (Mineral Soil)
Wetland-Nonforested	OPp91b	Rich Fen (Peatland)
Wetland-Nonforested	OPp91c	Rich Fen (Prairie Seepage)
Wetland-Nonforested	OPp93a	Calcareous Fen (Northwestern)
Wetland-Nonforested	OPp93b	Calcareous Fen (Southwestern)
Wetland-Nonforested	OPp93c	Calcareous Fen (Southeastern)
Wetland-Nonforested	WMn82b	Sedge Meadow

Wetland-Nonforested	WMp73a	Prairie Meadow/Carr
Wetland-Nonforested	WMs83a	Seepage Meadow/Carr
Wetland-Nonforested	WMs92a	Basin Meadow/Carr

DNR Rare Species Guide

The DNR's Rare Species Guide provides information on all listed species in Minnesota and is being expanded to include Species in Greatest Conservation Need (http://www.dnr.state.mn.us/rsg/index.html.) The Rare Species Guide provides information on each species, its distribution, habitat, life history, and conservation and management. The guide uses an interactive database approach that allows users to search on selected fields and create customized reports. Users are also able to perform alphabetical searches and generate standard printouts of rare species accounts.

In total, the Rare Species Guide provide accounts on about 200 endangered and threatened species and about 240 species of special concern.

Information Resources

The Minnesota (DNR) Natural Heritage Information System (NHIS) rare features database is the primary source for species occurrences information presented in tables 5.1 – 5.4.

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/.
4. DNR Data Deli – Department of Natural Resources Data Deli (http://deli.dnr.state.mn.us/.
5. See Tomorrow's Habitat for the Wild and Rare: http://files.dnr.state.mn.us/assistance/nrplanning/bigpicture/cwcs/tomorrows_habitat_overview.pdf

Appendix F - Monitoring of SFRMPs

As this Subsection plan is implemented, monitoring of forest management activities is critical to achieve the goals of the Hardwood Hills (HH) SFRMP Plan. Many DNR forest management activities are currently tracked, such as cover type acres treated; treatment methods and acres; timber volumes sold and harvested; and regeneration methods, species, and success. However, some management activities and objectives are not readily tracked, such as stand composition changes. Monitoring of forest activities includes both site-level monitoring ((*MFRC Voluntary Site-Level Forest Management Guidelines*[1]) (*MFRC Site-Level Guidelines*)) and landscape-level monitoring (forest management consistent with the goals of the HH SFRMP Plan).

Each year as Annual Stand Exam Plans are developed from the Subsection plan, the Divisions of Fish and Wildlife and Ecological and Water Resources will provide input to the Division of Forestry regarding selection of stands and stand treatments. The Annual Stand Exam Plans developed by each Forestry Area are based on the state's fiscal year, July 1 – June 30. These annual harvest plans are typically prepared and cruised during the fall and winter months leading up to the start of the fiscal year. During development of the HH SFRMP Stand Exam List and also during each Forestry Area's identification of their Annual Stand Exam Lists other Divisions are provided an opportunity to identify stands where they would like to participate in a joint field visit/stand evaluation. These joint visits allow all Divisions to affect the stand prescriptions applied and stand management objectives. These review opportunities are also provided for annual plan additions (i.e., stands added during the year due to windthrow salvage, new information about a stand, etc.). A public review process is included for both the annual plans and additions.

Approximately one-tenth of the stands selected for treatment, as identified in the HH SFRMP, will be field visited each year during the 10-year plan period. Final stand treatment prescriptions will be determined after the field visit/stand examinations are completed. Prescriptions and objectives assigned to stands during the HH SFRMP planning process are preliminary and may be adjusted based on current stand conditions and other information and input at the time of the stand examination.

Following timber sales or after forest development projects are contracted, Forestry staff administer timber harvest permits, forest development projects (e.g., site preparation and tree planting), and road projects as the work is completed. Forestry staff regularly monitors these activities to ensure that permit regulations and contract specifications are being met. In addition, standardized timber sales inspections are completed on at least 10 percent of active timber sales each year. The application of *MFRC Site-Level Guidelines* (e.g., riparian management zone guidelines) is monitored during permit and contract supervision and inspections. Wildlife habitat projects that are conducted on state lands will also contribute to plan goals. These projects will be administered, recorded, and monitored by Section of Wildlife staff.

[1] Minnesota Forest Resources Council. 2005. Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers. St. Paul, MN. 615pp.

In addition to Division of Forestry monitoring, the MFRC site-level monitoring program will also periodically sample sites in this Subsection as part of its overall statewide monitoring program. The objective of this statewide monitoring program is to evaluate the implementation of the *MFRC Site-Level Guidelines* through field visits to randomly selected, recently harvested sites across the various forest land ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.). The monitoring results from sites on state lands in this Subsection will be used to determine implementation of the *MFRC Site-Level Guidelines*.
To monitor landscape-level forest management by DNR against the goals of the HH SFRMP, two types of monitoring questions will be addressed:

Implementation Monitoring, which determines whether the management actions are being implemented as written in the HH SFRMP, meaning: Are management actions being carried out in a manner that is consistent with the HH SFRMP?; And,

Effectiveness Monitoring, which determines the appropriateness or effectiveness of specific management actions designed and implemented to accomplish specific objectives identified in the HH SFRMP, meaning: Are management actions having the desired on-the-ground effect?

It is often not possible to see the results of prescriptions and objectives assigned to stands, for many years. Many of the treatments assigned to stands in this plan may not be accomplished until after the 10-year plan is over. Some reasons are: A portion of the stands identified for treatment won't be field -examined (and for many, offered for sale) until late in the 10-year planning period; The harvest of timber sales occurs up to five years after the sale date; Forest development activities may be needed to regenerate the site to the desired species after the timber sale harvest is completed; Desired structural changes in stands may take many years or decades to occur; Forest inventory data may not capture the forest stand composition components or changes for many years or capture it at all; and, Desired conversions may take multiple treatments to complete.

Because of this, preliminary stand-management objectives (see *Appendix K: SFRMP Additional Field Names and Codes)* have been developed to record the intent or objectives of stand treatments. Preliminary objectives may be assigned to some stands during the SFRMP process to provide preliminary guidance for the appraiser to consider during the on-site stand evaluation. Final objectives will be assigned after the stand examination/appraisal for a timber sale or other treatment is completed. The assignment of objectives to stands allows recording of the various stand treatments on an annual basis to assist in monitoring the implementation of the HH SFRMP. This will help determine if strategies are being applied and if management objectives and goals are being met.

A significant portion of the data needed to monitor plan implementation and effectiveness will be collected from existing databases. Other data, especially those relating to effectiveness of management actions, are more difficult to obtain.

The following data sources and existing forestry management tools will be used to implement HH monitoring:

1. Forest Inventory Module (FIM):

   The primary source of information about the current condition of DNR forest lands is the Forest Inventory Module. FIM is a stand-level forest inventory. A stand is a contiguous group of trees similar in age, species composition, and structure; and growing on a site of similar quality, to be declared a distinguishable forest unit. A forest is comprised of many stands. FIM captures essential information about every forest stand on more than four million acres of DNR forest land. It is the basic data set from which decisions are made about if, when, where, and in what manner DNR forest stands will be treated. Information gathered includes overstory and understory tree species, stand age, timber volumes, site productivity, shrub and ground species, insects and diseases, and other specific site conditions. Native plant community (NPC) classification will be captured on stands for which evaluations have been completed.

2. Silvicultural and Roads Module (SRM):

   The Silviculture and Roads Module enables foresters to plan and record management objectives and actions on state lands. An SRM site is the piece of land for which the manager has developed a prescription (i.e., a series of actions). The site may be a FIM stand, part of a stand, or more than one stand. SRM allows for multi-year prescriptions for sites to manage the site for a specified objective. The site prescription consists of all the actions prescribed for a site to obtain a desired future condition. Actions include all the timber harvesting, site prep, planting, and seeding, timber stand improvement (TSI), and regeneration survey work needed to manage a stand for a specified objective. This long-range schedule and record of completed work helps track management activities, obligations, and management objectives. It is the foundation for budget requests and work plans.

3. Timber Sales Module (TSM):

   The Timber Sales Module includes the following functions: timber sales reporting, supports the appraisal and sale of timber harvest permits, tracking security provided by permit holders, accounting for harvested timber, and collecting revenue.

4. HH Stand Exam List Shapefile:

   The SFRMP shapefile includes FIM stand data for all state-administered forest lands in the subsection plans. Subsection boundaries may have been slightly adjusted to avoid splitting of stands for consideration of access, etc. Therefore, the SFRMP subsection shapefile boundaries may be somewhat different than the original ECS subsection shapefile.

   In addition to the standard FIM data fields, the SFRMP shapefile includes fields added during the planning process to identify stands for specific purposes (e.g., ERF, ecologically important lowland conifer (EILC), patches, preliminary objectives, new access data, and

stand-selection fields). This will make it possible to create a statewide shapefile and provide a uniform set of fields for importing into SRM, posting on the DNR data resource site (DRS), reporting, and monitoring purposes.

5. Annual Harvest List and Annual Plan Additions Shapefiles:

   Annual Harvest Lists and Plan Additions are drawn from SFRMP shapefiles and include additional information (including prescription, treatment acres, etc.). Adjustments can be made to add or remove stands, revise comment fields, or change joint visits (etc.).

6. DNR Data Resource Site (DRS):

   The Data Resource Site (DRS) is a standardized collection of GIS data, metadata and programs. A DRS is a place where geographic information system (GIS) resources are stored and made available to the users. The layers available on the DRS are designed such that use by DNR staff is intuitive and efficient. Many layers have been converted to shapefiles that are statewide in extent and targeted to a specific piece of information.

7. Internal Assessments and Inventories:

   Data from existing and pending assessments and inventories conducted by the Divisions of Ecological and Water Resources and Fish and Wildlife will be used. Examples of possible data sources include: wildlife population surveys (ruffed grouse, deer, goshawk, red-shouldered hawk, etc.); harvest reports; and water sampling results (impaired waters).

8. External Assessments and Inventories including resource management information, studies, and surveys conducted by other stakeholders.

9. Imagery available through the Division of Forestry, Resource Assessment Center.

Sampling of sites:

Because so much of the monitoring data comes from the SRM database, it is important to attempt to validate the accuracy of SRM data entry and consistency between the site objective and vegetation conditions (incorporating both implementation and effectiveness monitoring). The SFRMP Process Work Group will develop a method of site sampling (number of sites, site selection, techniques, etc.), emphasizing the application of existing survey tools/efforts such as timber sale inspections and regeneration surveys to gather validation data.

Baseline data:

Every effort will be made to identify baseline data for each indicator. The subsection assessments done at the beginning of the planning process contain all or most of the necessary data. Some indicators are tracked as a frequency or occurrence, for which there was not prior record keeping (e.g., the number of treatment deferrals). Although most pre-plan implementation data is lacking, data will be recorded annually so trend information during the plan's time frame will be available.

Data collection, analysis and interpretation:

Data from the SRM and FIM databases, and GIS shapefiles (primarily for implementation monitoring) will be collected periodically during the life of the plan. Effectiveness monitoring data will be collected and compiled at a mid point and at the end of a plan's time frame. This information will be provided to the subsection team for interpretation and analysis as the basis for preparing the landscape level monitoring of implementation of the HH Plan.

Data is entered into the FIM, SRM, and TSM continually. Fiscal year entries must be completed by September 1 of the following year. Data for the previous fiscal year can be extracted anytime after September. Plan shapefiles and DRS files are continually available.

For more information on monitoring of SFRMPs, please visit the DNR's SFRMP web page at:
http://www.dnr.state.mn.us/forestry/subsection/index.html

Hardwood Hills (HH) SFRMP Monitoring

Identified below is a table that outlines the HH SFRMP implementation monitoring questions and issues. Implementation of the HH SFRMP will be monitored at regular intervals over the course of the plan's implementation. Period monitoring reports will be prepared using information taken from SRM (or other accomplishment tracking system for wildlife staff). This table is included here to emphasize the importance of entering accomplishments into SRM.

SFRMP Monitoring: questions, indicators, outcomes, data sources, frequency and priority.

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
Implementation Monitoring: are management actions being carried out in a manner that is consistent with the plan? (numbers 1 – 27)						
1. Are the numbers of acres treated (by cover type) consistent with the plan?	Acres treated	Acres by cover type by type of treatment	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Location Detail Properties and Actual Actions	Annual	1
2. Which management actions (prescriptions) were carried out or scheduled (by cover type)?	Management actions (prescriptions) carried out	Actions by cover type and acres		SRM Location Detail Properties and Actual Actions	Annual	1
3. Are the numbers of acres reforested and the species used consistent with the plan (by cover type)?	Acres reforested and the species used	Acres and species by reforestation method		SRM Objectives and Actual Actions	Annual	1
4. Are the acres and age of ERF stands treated in a way that is consistent with the plan (by cover type)?	Acres and age of ERF stands treated	Acres and age by cover type		FIM SFRMP Shape File	Annual?	1
5. Are the numbers of "normal rotation" acres treated consistent with the plan (by cover type)?	"Normal Acres" treated	Acres by cover type	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	FIM SFRMP Shape File	Annual?	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
6. Were all selected stands field visited?	Stands field visited	Number of stands (percent)		SRM Actual Actions	Annual	1
7. What is the frequency of stand treatment being a deferral (by cover type)?	Stand treatment = deferral	Number of stands by cover type and acres		SRM Location Detail Properties Actual Actions	Annual	1
8. What is the frequency of stand treatment being a FIM alteration (by cover type)?	Stand treatment = alteration	Number of stands by cover type and acres		SRM Actual Actions	Annual	1
9. Is the number of stands managed to maintain cover type consistent with the plan (by cover type)?	Stands managed to maintain cover type	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
10. Is the number of stands managed to maintain cover type but increase stand species composition consistent with the plan (by species)?	Stands managed to maintain cover type but increase stand species composition	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
11. Is the number of stands managed to maintain cover type but change structural composition consistent with the plan (by type of change)?	Stands managed to maintain cover type but change structural composition	Number of stands by cover type and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
12. Is the number of stands managed to convert to another cover type consistent with the plan (by cover type)?	Stands managed to convert to another cover type	Number of stands by desired cover type and acres		SRM Objectives and Actual Actions	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
13. Is the frequency and location of stand management to maintain a large patch consistent with the plan?	Stand management to maintain a large patch	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
14. Is the frequency of stand management to increase patch size consistent with the plan?	Stand management to increase patch size	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
15. Is the frequency and location of stand management to enhance smaller patches consistent with the plan?	Stand management to enhance smaller patches	Number of instances and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
16. Are the numbers of RMZ acres managed for long-lived conifers consistent with the plan?	RMZ acres managed for long-lived conifers	Acres		SRM Objectives and Actual Actions, GIS	Annual	1
17. Are the numbers of RMZ acres managed to maintain shade to trout streams consistent with the plan?	RMZ acres managed to maintain shade to trout streams	Acres		SRM Objectives and Actual Actions, GIS	Annual	1
18. Is the frequency of stand management to maintain existing NPC and structure (by NPC) consistent with the plan?	Stand management to maintain existing NPC and structure	Number of stands by NPC and acres		SRM Objectives and Actual Actions	Annual	1
19. Is the frequency of stand	Stand	Number of stands	*This column will be filled in*	SRM Objectives	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
management to retain NPC older growth stage components consistent with the plan?	management to retain NPC older growth stage components	by NPC and acres	*with the measurable outcomes specified in the subsection plans.*	and Actual Actions		
20. Is the number of stands managed to protect rare plant and animal locations consistent with the plan (by species)?	Stands managed to protect rare plant and animal locations	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
21. Is the frequency of stands under special management for species or habitat consistent with the plan?	Stands under special management for species or habitat	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
22. Is the frequency of stand management to maintain adequate residual BA within an identified corridor consistent with the plan?	Stand management to maintain adequate residual BA within an identified corridor	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
23. Are the known locations of rare native plant considered and protected (by species)?	Stands managed to protect a rare native plant	Number of stands and acres	*This column will be filled in with the measurable outcomes specified in the subsection plans.*	SRM Objectives and Actual Actions	Annual	1
24. Is the frequency of use of prescribed burning as a management tool consistent with the plan?	Use of prescribed burning as a management tool	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
25. Is the frequency of use	Use of less	Number of		SRM Objectives	Annual	1

of less intensive TSI or site preparation techniques consistent with the plan?	intensive TSI or site preparation techniques	instances and acres		and Actual Actions		
26. Are the known locations of cultural resource considered and protected (by species)?	Stands managed to protect a known cultural resource	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
27. Is the number of new access miles built and closure methods used consistent with the plan?	New roads built and road closure methods used	Miles and methods		SRM	Annual	1
28. Change in the amount of forest land and timberland?	Amount of forest land and timber	Acres of forest land and timberland	Increase	FIM Satellite Imagery GIS/DRS	Plan Mid Point & Renewal	1
29. Change in representation of forest cover types?	Cover type representation	Total forest acres in each cover type and percent change	To be specified based on subsection plan	FIM Satellite Imagery	Plan Mid Point & Renewal	1
30. Change in forest size and age-class distribution?	Forest size and age-class distribution	Total forest acres in each size and age-class and percent change	Desired outcome varies; to be specified based on subsection plans	FIM	Plan Mid Point & Renewal	1
31. Change in percent of young forest?	Young forest	Acres and percent of total forest	Increase	FIM	Plan Mid-Point &	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
					Renewal	
32. Change in percent of old forest?	Old forest	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1
33. Change in the percent of effective ERF?	Effective ERF	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1
34. Change in the number of stands with long-lived conifers?	Stands with long-lived conifers	Total acres and percent change	Increase	FIM Possibly Satellite Imagery	Plan Mid-Point & Renewal	2
35. Change in area of forest affected by potentially damaging agents (tree mortality and damage, wildfire, flooding, invasive/exotic species, insects and diseases, animals, and utility/road construction)?	Area of forest affected by potentially damaging agents	Acres affected by agent and percent change	Decrease affected acres	FIM (look into surveys by Forest Health staff)	Plan Renewal	2
36. Change in forest spatial patterns (patch and connectivity)?	Forest spatial patterns	Number of and size (acres) of patch and index of connectivity	Larger patches with greater connectivity	FIM GIS/modeling	Plan Renewal	2
37. Change in miles of impaired streams within forests?	Miles of impaired streams within forests	Miles of impaired streams and change	Decrease in miles of impaired streams	Work with Waters GIS/DRS	Plan Renewal, when data is available	2
38. Change in forest-associated species of concern by taxonomic group?	Forest-associated species of concern	Indicator of population size and change	Healthier populations	Work with Wildlife & Eco Services, etc.	Plan Renewal, when data is available	2

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
39. Change in forest game populations?	Forest game populations	Population estimates	Healthier populations			
40. Change in forest bird populations?	Forest bird populations	Indicator of population size and change; possibly red-shouldered hawk, goshawk	Healthier populations	Collaborate, possibly with university study, Eco Services	Plan Renewal, when data is available	3
41. Change in known rare plant communities (number of sites, area, and composition)?	Known rare plant communities	Number of and size (acres) of sites, and measure (indices) of health	Maintain or enhance	Work with Eco Services	Plan Renewal, when data is available	3

*Priority rating : 1 - measurements we can do fairly easily and will start immediately; 2 - measurements we are currently working on and hope to do soon; 3 - measurements we want to do and will continue to investigate, but are currently not able to undertake.

Appendix G - Wildlife Species List and Habitat Relationships in the Hardwood Hills Subsection

Table G1: Terrestrial, Vertebrate Species List
Table G2: Mammal habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type
Table G3: Bird habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type
Table G4: Amphibian and Reptile habitat relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type.

Appendix G provides information on the occurrence, legal status and the population trends of wildlife species in this subsection. Species presence information is summarized from data collected by the Minnesota Gap Analysis Project (MN-GAP), a project organized to provide a state assessment on the conservation status of native vertebrate species and natural land cover types.

A recent initiative, *Minnesota's Comprehensive Wildlife Conservation Strategy*, is a strategic plan to better manage populations of "species in greatest conservation need (SGCN)". Species of greatest conservation need (SGCN) are defined as "animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability". Please see chapter 5 of this assessment document for additional information on SCGNs species in the Hardwood Hills Subsection.

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

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

Terrestrial, Vertebrate Species List

Hardwood Hills ECS Subsection

Information Source: The following information has been summarized from ongoing efforts of the Minnesota Gap Analysis Project (MN-GAP), a project to provide a statewide assessment on the conservation status of native vertebrate species and natural land cover types.

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

Species Group: Notes one of four major species groups - Amphibians, Reptiles, Birds, and Mammals.

Species Common and Scientific Names: Notes standard MN-GAP protocol based on NatureServe and its related searchable plant, animal and ecological database called NatureServe Explorer located at www.natureserveexplorer.org.

Resident Status: R=Regular occurring resident as Breeding, Nesting, or Migratory (acceptable records exists in at least eight of the past ten years); PR=Permanent Resident (exists year-round).

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

notation.

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

DISCLAIMER: Information and data listed in these tables has been produced by ongoing wildlife species assessment efforts conducted under the MNDNR Division of Fish and Wildlife's Minnesota Gap Analysis Project (MN-GAP). This effort and related tables noted here are unpublished products that are currently in various stages of literature and expert review.

Terrestrial, Vertebrate Species List
Hardwood Hills ECS Subsection

Information Source: The following information has been summarized from ongoing efforts of the Minnesota Gap Analysis Project (MN-GAP), a project to provide a statewide assessment on the conservation status of native vertebrate species and natural land cover types.
Species Criteria: Species criteria for MN-GAP includes the following: 1) Be known to breed in Minnesota (evidence of breeding 5 of the past 10 years) and be a regularly occurring non-accidental, 2) Be listed as state endangered, threatened, or special concern or as federally endangered or threatened, 3) Be listed as a furbearer, big game, small game, or migratory bird in Minnesota, and, 4) Be an exotic species in Minnesota that impacts native species or is of management interest.

Species Group: Notes one of four major species groups - Amphibians, Reptiles, Birds, and Mammals.

Species Common and Scientific Names: Notes standard MN-GAP protocol based on NatureServe and its related searchable plant, animal and ecological database called NatureServe Explorer located at www.natureserveexplorer.org.

Resident Status: R=Regular occurring resident as Breeding, Nesting, or Migratory (acceptable records exists in at least eight of the past ten years); PR=Permanent Resident (exists year-round).

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

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

DISCLAIMER: Information and data listed in these tables has been produced by ongoing wildlife species assessment efforts conducted under the MNDNR Division of Fish and Wildlife's Minnesota Gap Analysis Project (MN-GAP). This effort and related tables noted here are unpublished products that are currently in various stages of literature and expert review.

Table G.1: Terrestrial Vertebrate Species List

Species Common Name	*Scientific Name*	Resident Status	MN legal status	Federal legal status
AMPHIBIANS				
Blue-spotted Salamander	*Ambystoma laterale*	PR		
Tiger Salamander	*Ambystoma tigrinum*	PR		
Eastern Newt	*Notophthalmus viridescens*	PR		
American Toad	*Bufo americanus*	PR	PWA	

Canadian Toad	*Bufo hemiophrys*	PR	PWA	
Cope's Gray Treefrog	*Hyla chrysoscelis*	PR	PWA	
Gray Treefrog	*Hyla versicolor*	PR	PWA	
Western Chorus Frog	*Pseudacris triseriata*	PR	PWA	
Northern Leopard Frog	*Rana pipiens*	PR	PWA	
Mink Frog	*Rana septentrionalis*	PR	PWA	
Wood Frog	*Rana sylvatica*	PR	PWA	

REPTILES

Snapping Turtle	*Chelydra serpentina*	PR	PWA, SC	
Painted Turtle	*Chrysemys picta*	PR	PWA	
Blanding's Turtle	*Emydoidea blandingii*	PR	PWA, T	
Prairie Skink	*Eumeces septentrionalis*	PR		
Redbelly Snake	*Storeria occipitomaculata*	PR		
Plains Garter Snake	*Thamnophis radix*	PR		
Common Garter Snake	*Thamnophis sirtalis*	PR		
Smooth Green Snake	*Liochlorophis vernalis*	PR		

BIRDS

Common Loon	*Gavia immer*	R	PB	P
Pied-billed Grebe	*Podilymbus podiceps*	R	PB	P
Red-necked Grebe	*Podiceps grisegena*	R	PB	P
Eared Grebe	*Podiceps nigricollis*	R	PB	P
Western Grebe	*Aechmophorus occidentalis*	R	PB	P
Clark's Grebe	*Aechmophorus clarkii*	R	PB	P
Double-crested Cormorant	*Phalacrocorax auritus*	R	UB	P
American Bittern	*Botaurus lentiginosus*	R	PB	P
Least Bittern	*Ixobrychus exilis*	R	PB	P
Great Blue Heron	*Ardea herodias*	R	PB	P
Great Egret	*Ardea albus*	R	PB	P
Green Heron	*Butorides virescens*	R	PB	P
Black-crowned Night-heron	*Nycticorax nycticorax*	R	PB	P
Trumpeter Swan	*Cygnus buccinator*	R	PB, MW, T	P

Canada Goose	*Branta canadensis*	R	PB, MW	P
Wood Duck	*Aix sponsa*	R	PB, MW	P
Mallard	*Anas platyrhynchos*	R	PB, MW	P
Northern Pintail	*Anas acuta*	R	PB, MW	P
Blue-winged Teal	*Anas discors*	R	PB, MW	P
Northern Shoveler	*Anas clypeata*	R	PB, MW	P
Gadwall	*Anas strepera*	R	PB, MW	P
Canvasback	*Aythya valisineria*	R	PB, MW	P
Redhead	*Aythya americana*	R	PB, MW	P
Ring-necked Duck	*Aythya collaris*	R	PB, MW	P
Hooded Merganser	*Lophodytes cucullatus*	R	PB, MW	P
Ruddy Duck	*Oxyura jamaicensis*	R	PB, MW	P
Turkey Vulture	*Cathartes aura*	R	PB	P
Osprey	*Pandion haliaetus*	R	PB	P
Bald Eagle	*Haliaeetus leucocephalus*	R	PB, SC	P/T
Northern Harrier	*Circus cyaneus*	R	PB	
Cooper's Hawk	*Accipiter cooperii*	R	PB	
Red-shouldered Hawk	*Buteo lineatus*	R	PB, SC	
Broad-winged Hawk	*Buteo platypterus*	R	PB	
Red-tailed Hawk	*Buteo jamaicensis*	R	PB	
American Kestrel	*Falco sparverius*	R	PB	
Gray Partridge	*Perdix perdix*	PR	PB, SG	
Ring-necked Pheasant	*Phasianus colchicus*	PR	PB, SG	
Ruffed Grouse	*Bonasa umbellus*	PR	PB, SG	
Wild Turkey	*Meleagris gallopavo*	PR	PB, SG	
Virginia Rail	*Rallus limicola*	R	PB, SG	
Sora	*Porzana carolina*	R	PB, SG	
American Coot	*Fulica americana*	R	PB, SG	
Sandhill Crane	*Grus canadensis*	R	PB	
Killdeer	*Charadrius vociferus*	R	PB	
Spotted Sandpiper	*Actitis macularia*	R	PB	
Upland Sandpiper	*Bartramia longicauda*	R	PB	
American Woodcock	*Scolopax minor*	R	PB, SG	
Wilson's Phalarope	*Phalaropus tricolor*	R	PB, T	

Forster's Tern	*Sterna forsteri*	R	PB, SC	
Black Tern	*Chlidonias niger*	R	PB	
Rock Dove	*Columba livia*	R	PB	
Mourning Dove	*Zenaida macroura*	R	PB	
Black-billed Cuckoo	*Coccyzus erythropthalmus*	R	PB	
Yellow-billed Cuckoo	*Coccyzus americanus*	R	PB	
Eastern Screech-Owl	*Otus asio*	PR	PB	
Great Horned Owl	*Bubo virginianus*	PR	UB	
Barred Owl	*Strix varia*	PR	PB	
Long-eared Owl	*Asio otus*	PR	PB	
Short-eared Owl	*Asio flammeus*	R	PB, SC	
Northern Saw-whet Owl	*Aegolius acadicus*	R	PB	
Common Nighthawk	*Chordeiles minor*	R	PB	
Whip-poor-will	*Caprimulgus vociferus*	R	PB	
Chimney Swift	*Chaetura pelagica*	R	PB	
Ruby-throated Hummingbird	*Archilochus colubris*	R	PB	
Belted Kingfisher	*Ceryle alcyon*	R	PB	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	R	PB	
Red-bellied Woodpecker	*Melanerpes carolinus*	PR	PB	
Yellow-bellied Sapsucker	*Sphyrapicus varius*	R	PB	
Downy Woodpecker	*Picoides pubescens*	PR	PB	
Hairy Woodpecker	*Picoides villosus*	PR	PB	
Northern Flicker	*Colaptes auratus*	R	PB	
Pileated Woodpecker	*Dryocopus pileatus*	PR	PB	
Eastern Wood-Pewee	*Contopus virens*	R	PB	
Alder Flycatcher	*Empidonax alnorum*	R	PB	
Willow Flycatcher	*Empidonax traillii*	R	PB	
Least Flycatcher	*Empidonax minimus*	R	PB	
Eastern Phoebe	*Sayornis phoebe*	R	PB	
Great Crested Flycatcher	*Myiarchus crinitus*	R	PB	
Western Kingbird	*Tyrannus verticalis*	R	PB	
Eastern Kingbird	*Tyrannus tyrannus*	R	PB	
Horned Lark	*Eremophila alpestris*	R	PB	

Purple Martin	*Progne subis*	R	PB	
Tree Swallow	*Tachycineta bicolor*	R	PB	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	R	PB	
Bank Swallow	*Riparia riparia*	R	PB	
Cliff Swallow	*Petrochelidon pyrrhonota*	R	PB	
Barn Swallow	*Hirundo rustica*	R	PB	
Blue Jay	*Cyanocitta cristata*	PR	PB	
American Crow	*Corvus brachyrhynchos*	PR	PB	
Black-capped Chickadee	*Poecile atricapillus*	PR	PB	
Red-breasted Nuthatch	*Sitta canadensis*	PR	PB	
White-breasted Nuthatch	*Sitta carolinensis*	PR	PB	
House Wren	*Troglodytes aedon*	R	PB	
Winter Wren	*Troglodytes troglodytes*	R	PB	
Sedge Wren	*Cistothorus platensis*	R	PB	
Marsh Wren	*Cistothorus palustris*	R	PB	
Blue-gray Gnatcatcher	*Polioptila caerulea*	R	PB	
Eastern Bluebird	*Sialia sialis*	R	PB	
Veery	*Catharus fuscescens*	R	PB	
Hermit Thrush	*Catharus guttatus*	R	PB	
Wood Thrush	*Hylocichla mustelina*	R	PB	
American Robin	*Turdus migratorius*	R	PB	
Gray Catbird	*Dumetella carolinensis*	R	PB	
Brown Thrasher	*Toxostoma rufum*	R	PB	
European Starling	*Sturnus vulgaris*	PR	UB	
Cedar Waxwing	*Bombycilla cedrorum*	R	PB	
Yellow-throated Vireo	*Vireo flavifrons*	R	PB	
Warbling Vireo	*Vireo gilvus*	R	PB	
Red-eyed Vireo	*Vireo olivaceus*	R	PB	
Golden-winged Warbler	*Vermivora chrysoptera*	R	PB	
Nashville Warbler	*Vermivora ruficapilla*	R	PB	
Yellow Warbler	*Dendroica petechia*	R	PB	
Chestnut-sided Warbler	*Dendroica pensylvanica*	R	PB	
Cerulean Warbler	*Dendroica cerulea*	R	PB, SC	
Black-and-white Warbler	*Mniotilta varia*	R	PB	

American Redstart	*Setophaga ruticilla*	R	PB	
Ovenbird	*Seiurus aurocapillus*	R	PB	
Northern Waterthrush	*Seiurus noveboracensis*	R	PB	
Common Yellowthroat	*Geothlypis trichas*	R	PB	
Scarlet Tanager	*Piranga olivacea*	R	PB	
Northern Cardinal	*Cardinalis cardinalis*	PR	PB	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	R	PB	
Indigo Bunting	*Passerina cyanea*	R	PB	
Dickcissel	*Spiza americana*	R	PB	
Eastern Towhee	*Pipilo erythrophthalmus*	R	PB	
Chipping Sparrow	*Spizella passerina*	R	PB	
Clay-colored Sparrow	*Spizella pallida*	R	PB	
Field Sparrow	*Spizella pusilla*	R	PB	
Vesper Sparrow	*Pooecetes gramineus*	R	PB	
Lark Sparrow	*Chondestes grammacus*	R	PB	
Savannah Sparrow	*Passerculus sandwichensis*	R	PB	
Grasshopper Sparrow	*Ammodramus savannarum*	R	PB	
Le Conte's Sparrow	*Ammodramus leconteii*	R	PB	
Nelson's Sharp-tailed sparrow	*Ammodramus nelsoni*	R	PB, SC	
Song Sparrow	*Melospiza melodia*	R	PB	
Swamp Sparrow	*Melospiza georgiana*	R	PB	
White-throated Sparrow	*Zonotrichia albicollis*	R	PB	
Bobolink	*Dolichonyx oryzivorus*	R	PB	
Red-winged Blackbird	*Agelaius phoeniceus*	R	UB	
Eastern Meadowlark	*Sturnella magna*	R	PB	
Western Meadowlark	*Sturnella neglecta*	R	PB	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	R	UB	
Brewer's Blackbird	*Euphagus cyanocephalus*	R	UB	
Common Grackle	*Quiscalus quiscula*	R	UB	
Brown-headed Cowbird	*Molothrus ater*	R	PB	
Baltimore Oriole	*Icterus galbula*	R	PB	
Purple Finch	*Carpodacus purpureus*	R	PB	

House Finch	*Carpodacus mexicanus*	PR	PB	
Pine Siskin	*Carduelis pinus*	R	PB	
American Goldfinch	*Carduelis tristis*	R	PB	

MAMMALS

Cinereus Shrew	*Sorex cinereus*	PR		
Water Shrew	*Sorex palustris*	PR		
Arctic Shrew	*Sorex arcticus*	PR		
Pygmy Shrew	*Sorex hoyi*	PR		
Northern Short-tailed Shrew	*Blarina brevicauda*	PR		
Star-nosed Mole	*Condylura cristata*	PR		
Little Brown Bat	*Myotis lucifugus*	PR		
Northern Myotis	*Myotis septentrionalis*	PR	SC	
Silver-haired Bat	*Lasionycteris noctivagans*	R		
Big Brown Bat	*Eptesicus fuscus*	PR		
Eastern Red Bat	*Lasiurus borealis*	R		
Hoary Bat	*Lasiurus cinereus*	R		
Eastern Cottontail	*Sylvilagus floridanus*	PR	PWA, SG	
Snowshoe Hare	*Lepus americanus*	PR	PWA, SG	
White-tailed Jackrabbit	*Lepus townsendii*	PR	PWA, SG	
Eastern Chipmunk	*Tamias striatus*	PR		
Woodchuck	*Marmota monax*	PR		
Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*	PR		
Franklin's Ground Squirrel	*Spermophilus franklinii*	PR		
Eastern Gray Squirrel	*Sciurus carolinensis*	PR	PWA, SG	
Eastern Fox Squirrel	*Sciurus niger*	PR	PWA, SG	
Red Squirrel	*Tamiasciurus hudsonicus*	PR		
Southern Flying Squirrel	*Glaucomys volans*	PR		
Northern Flying Squirrel	*Glaucomys sabrinus*			
Plains Pocket Gopher	*Geomys bursarius*	PR	UWA	
American Beaver	*Castor canadensis*	PR	PWA, SG, F	
Prairie Deer Mouse	*Peromyscus maniculatus bairdii*	PR		

White-footed Mouse	*Peromyscus leucopus*	PR		
Southern Red-backed Vole	*Clethrionomys gapperi*	PR		
Meadow Vole	*Microtus pennsylvanicus*	PR		
Prairie Vole	*Microtus ochrogaster*	PR	SC	
Muskrat	*Ondatra zibethicus*	PR	PWA, SG, F	
Meadow Jumping Mouse	*Zapus hudsonius*	PR		
North American Porcupine	*Erethizon dorsatum*	PR	UWA	
Coyote	*Canis latrans*	PR	UWA	
Gray Wolf	*Canis lupus*	PR	SC	
Red Fox	*Vulpes vulpes*	PR	PWA, SG, F	
Gray Fox	*Urocyon cinereoargenteus*	PR	PWA, SG, F	
American Black Bear	*Ursus americanus*	PR	PWA, BG	
Northern Raccoon	*Procyon lotor*	PR	PWA, SG, F	
Ermine	*Mustela erminea*	PR	UWA	
American Mink	*Mustela vison*	PR	PWA, SG, F	
American Badger	*Taxidea taxus*	PR	PWA, SG, F	
Striped Skunk	*Mephitis mephitis*	PR	UWA	
Northern River Otter	*Lontra canadensis*	PR	PWA, SG, F	
Bobcat	*Lynx rufus*	PR	PWA, SG, F	
White-tailed Deer	*Odocoileus virginianus*	PR	PWA, BG	

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

Wildlife Habitat Relationships - Hardwood Hills ECS Subsection

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

SPECIES GROUP / Species Common Name	Habitat feature	Non-Forested types>>> 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 shrub	Shrub: Lowland evergreen shrub	Aquatic: Water	Aquatic: Floating aquatic	Aquatic: Sedge Meadow	Aquatic: Broadleaf sedge/Cattail	Forest land cover types>>> 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 Cedar	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 mix	Lowland Deciduous Forest: Black Ash	Lowland Deciduous Forest: Silver Maple	Lowland Deciduous Forest: Cottonwood	Lowland Deciduous Forest: Lowland deciduous mix	Low. deciduous/coniferous mix	Forest size class: Seedling	Forest size class: Sapling	Forest size class: Pole timber	Forest size class: Saw timber	Forest size class: Uneven
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 Hardwood Hills ECS Subsection. 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.

Table G.2: Mammal Habitat Relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Wildlife Habitat Relationships - Hardwood Hills ECS Subsection

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

Non-Forest land cover types>>> (Barren through Broadleaf sedge/Cattail); Forest land cover types>>> (Jack Pine through Uneven)

			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
EVEN-TOED UNGULATES																																														
White-tailed Deer						Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
RODENTS																																														
Northern Flying Squirrel	CDMS															Y	Y	Y	Y	Y	Y	Y	Y	Y											Y						Y				Y	Y
Southern Flying Squirrel	CDMS																																Y	Y	Y	Y	Y	Y						Y	Y	Y
Woodchuck				Y		Y	Y		Y	Y																							Y	Y								Y				
Eastern Gray Squirrel	CDM			Y		Y																		Y									Y	Y	Y	Y	Y								Y	
Eastern Fox Squirrel	CDM			Y			Y																										Y	Y	Y	Y		Y							Y	Y
Franklin's Ground Squirrel				Y			Y	Y	Y																																			Y	Y	
Thirteen-lined Ground Squirrel				Y		Y	Y	Y	Y																																					
Eastern Chipmunk	DM			Y			Y		Y	Y							Y	Y		Y	Y	Y	Y	Y								Y	Y	Y	Y	Y			Y			Y	Y	Y	Y	Y
Red Squirrel	CDMS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y										Y			Y	Y	Y
American Beaver	R								Y	Y		Y																				Y				Y						Y	Y	Y	Y	Y
Plains Pocket Gopher						Y	Y	Y	Y																							Y	Y	Y	Y	Y						Y	Y			
Meadow Jumping Mouse							Y	Y	Y	Y	Y			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								Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Southern Red-backed Vole	DM								Y	Y	Y					Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Meadow Vole							Y		Y					Y	Y	Y	Y	Y														Y	Y	Y	Y	Y										
Prairie Vole							Y	Y	Y	Y				Y			Y	Y						Y									Y	Y	Y	Y										
Muskrat	R									Y		Y	Y		Y																															
North American Porcupine	CDS															Y	Y	Y	Y	Y	Y		Y	Y											Y	Y					Y			Y	Y	Y
RABBITS AND HARES																																														
Eastern Cottontail	E			Y		Y	Y	Y	Y	Y														Y								Y	Y	Y	Y	Y			Y	Y	Y	Y				
Snowshoe Hare									Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-tailed Jackrabbit							Y	Y	Y	Y																																				

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

Non-Forest land cover types>>>

SPECIES GROUP	habitat Feature		Urban/ Dev.			Ag./Grass			Shrub			Aquatic			
Species common name		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
INSECTIVORES															
Cinereus Shrew	D						Y	Y	Y	Y	Y			Y	Y
Water Shrew	DR									Y	Y	Y		Y	Y
Arctic Shrew	R						Y	Y		Y	Y			Y	Y
Pygmy Shrew	D						Y	Y	Y	Y	Y			Y	Y
Northern Short-tailed Shrew	D	Y		Y	Y	Y	Y	Y	Y	Y	Y			Y	Y
Star-nosed Mole	DR									Y	Y			Y	Y
BATS															
Big Brown Bat	CRS			Y			Y	Y				Y			
Silver-haired Bat	CRS											Y			
Eastern Red Bat	CR		Y	Y			Y		Y	Y		Y			Y
Hoary Bat	R			Y			Y		Y			Y			
Little Brown Bat	CRS						Y	Y	Y	Y		Y		Y	Y
Northern Myotis	CRS		Y	Y											
CARNIVORES															
Coyote	M	Y		Y		Y	Y	Y	Y	Y	Y			Y	Y
Gray Wolf	M					Y	Y		Y	Y	Y				
Gray Fox	CDM					Y	Y	Y	Y	Y					
Red Fox		Y		Y		Y	Y	Y	Y	Y				Y	Y
Bobcat	CD								Y	Y					
Northern River Otter												Y	Y	Y	Y
Ermine	DR								Y	Y					
American Mink	DR									Y		Y	Y	Y	Y
American Badger						Y	Y	Y	Y						
Striped Skunk	DM			Y		Y	Y	Y	Y						
Northern Raccoon	CMRS	Y		Y		Y	Y		Y	Y		Y		Y	Y
American Black Bear	CDMR								Y						

Forest land cover types>>>

SPECIES GROUP	Upland Coniferous Forest									Lowland Coniferous Forest						
Species common name	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
INSECTIVORES																
Cinereus Shrew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Water Shrew										Y	Y	Y	Y	Y	Y	Y
Arctic Shrew				Y		Y			Y	Y	Y	Y	Y	Y	Y	Y
Pygmy Shrew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern Short-tailed Shrew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Star-nosed Mole										Y	Y	Y	Y	Y	Y	Y
BATS																
Big Brown Bat	Y	Y	Y		Y	Y			Y							
Silver-haired Bat		Y	Y		Y			Y	Y	Y		Y		Y		
Eastern Red Bat					Y	Y										
Hoary Bat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		
Little Brown Bat	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y		Y		
Northern Myotis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y		
CARNIVORES																
Coyote	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Wolf	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Fox																
Red Fox	Y	Y	Y	Y	Y	Y	Y	Y	Y							
Bobcat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern River Otter																
Ermine	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
American Mink																
American Badger																
Striped Skunk	Y	Y	Y	Y	Y	Y	Y	Y	Y							
Northern Raccoon	Y	Y	Y	Y	Y	Y	Y	Y	Y							
American Black Bear		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

SPECIES GROUP	Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
Species common name	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
INSECTIVORES															
Cinereus Shrew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Water Shrew													Y	Y	Y
Arctic Shrew						Y			Y	Y	Y	Y	Y	Y	Y
Pygmy Shrew	Y				Y					Y	Y	Y	Y	Y	Y
Northern Short-tailed Shrew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Star-nosed Mole						Y	Y		Y	Y			Y	Y	Y
BATS															
Big Brown Bat	Y	Y	Y		Y			Y	Y	Y			Y	Y	
Silver-haired Bat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y
Eastern Red Bat	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Hoary Bat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
Little Brown Bat	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y				
Northern Myotis	Y	Y	Y	Y	Y	Y	Y		Y	Y				Y	Y
CARNIVORES															
Coyote	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Wolf	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gray Fox		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
Bobcat	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y
Northern River Otter															
Ermine	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
American Mink															
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
American Black Bear	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table G.3: Bird Habitat Relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Wildlife Habitat Relationships – Birds

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

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

SPECIES GROUP			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest							
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
LOONS AND GREBES																							
Common Loon												Y	Y										
Pied-billed Grebe												Y	Y	Y	Y								
Red-necked Grebe												Y	Y		Y								
Eared Grebe												Y	Y		Y								
Western Grebe												Y	Y		Y								
Clark's Grebe												Y	Y		Y								
PELICANS AND CORMORANTS																							
Double-crested Cormorant	RS											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 Egret	R						Y	Y				Y	Y	Y	Y								
Great Blue Heron	RS											Y	Y	Y	Y								
Green Heron	R								Y	Y		Y	Y	Y	Y								
Black-crowned Hight-heron	R									Y		Y	Y	Y	Y								
VULTURES																							
Turkey Vulture	S						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								

SPECIES GROUP		Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest						Forest size class				
Species Common Name	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
LOONS AND GREBES																								
Common Loon																								
Pied-billed Grebe																								
Red-necked Grebe																								
Eared Grebe																								
Western Grebe																								
Clark's Grebe																								
PELICANS AND CORMORANTS																								
Double-crested Cormorant									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
HERONS AND BITTERNS																								
American Bittern																								
Least Bittern																								
Great Egret										Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Great Blue Heron									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y
Green Heron				Y	Y									Y	Y	Y	Y	Y					Y	Y
Black-crowned Hight-heron														Y	Y	Y	Y	Y		Y	Y	Y		
VULTURES																								
Turkey Vulture									Y	Y	Y	Y	Y									Y	Y	
SWANS AND GEESE																								
Canada Goose																								
Trumpeter Swan																								

		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				
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
DUCKS AND MERGANSERS																																														
Wood Duck	CMRS									Y		Y	Y		Y																	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	Y
Mallard	RM			Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																						Y	Y	Y	Y	Y				Y	Y
Blue-winged Teal	R					Y	Y	Y	Y	Y		Y	Y	Y	Y																															
Norther Shoveler	R						Y	Y	Y	Y		Y	Y	Y	Y																															
Gadwall	R					Y	Y	Y				Y	Y	Y	Y																															
Canvasback												Y	Y		Y																															
Redhead												Y	Y	Y	Y																															
Ring-necked Duck										Y		Y	Y	Y	Y																															
Hooded Merganser	CRS									Y		Y	Y	Y	Y																	Y	Y	Y	Y		Y	Y	Y	Y					Y	Y
Ruddy Duck												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					
Cooper's Hawk							Y		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																																						
GROUSE AND TURKEYS																																														
Gray Partridge						Y	Y	Y	Y											Y																										
Ring-necked Pheasant	M					Y	Y	Y	Y	Y				Y	Y					Y				Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Ruffed Grouse									Y	Y														Y								Y	Y	Y	Y	Y						Y	Y	Y	Y	
Wild Turkey	M					Y	Y																										Y	Y		Y									Y	

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	Barren	Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest								Up. coniferous/deciduous mix	Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest				Low. deciduous/coniferous mix	Forest size class				
			High intensity urban	Low intensity urban	Transportation	Cropland	Grassland	Prairie	Upland shrub	Lowland deciduous shrub	Lowland evergreen shrub	Water	Floating aquatic	Sedge Meadow	Broadleaf sedge/Cattail	Jack Pine	Red Pine	White Pine mix	Balsam Fir mix	White Spruce	Upland Black Spruce	Up. N. White Cedar	Upland Conifer		Lowland Black Spruce	Stagnant black spruce	Tamarack	Stagnant tamarack	Low. N. White Cedar	Stagnant N. White Cedar	Stagnant conifer	Aspen/White Birch	Bur/White Oak	Red Oak	Maple/Basswood	Upland deciduous mix	Black Ash	Silver Maple	Cottonwood	Lowland deciduous mix		Seedling	Sapling	Pole timber	Saw timber	Uneven
RAILS AND COOTS																																														
Virginia Rail	R									Y		Y	Y	Y	Y																															
Sora	R									Y		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																															
American Woodcock							Y		Y	Y																						Y	Y	Y	Y	Y						Y				
Wilson's Phalarope							Y	Y				Y	Y	Y	Y																															
JAEGERS, GULLS AND TERNS																																														
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

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				
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
OWLS																																														
Eastern Screech-Owl	CMS			Y																													Y	Y		Y		Y	Y	Y					Y	Y
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
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
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
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

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	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
			Urban/ Dev.			Ag./Grass			Shrub			Aquatic				Upland Coniferous Forest									Lowland Coniferous Forest							Upland Deciduous Forest					Lowland Deciduous Forest					Forest size class				
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					
Eastern Wood-Pewee				Y													Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	
Alder Flycatcher	R									Y																																				
Willow Flycatcher	E								Y	Y				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
SHRIKES																																														
Northern Shrike							Y		Y																							Y	Y	Y	Y	Y						Y	Y			
Loggerhead Shrike						Y	Y	Y	Y																							Y	Y	Y	Y	Y										
VIREOS																																														
Yellow-throated Vireo	R			Y					Y	Y														Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y
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																																														
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
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
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																															

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				
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
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
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			
Winter Wren	DS															Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y			Y		Y	Y	Y	Y	Y		Y	Y				Y	Y
Sedge Wren							Y	Y		Y				Y	Y											Y		Y		Y	Y															
Marsh Wren	R									Y		Y		Y	Y																															
KINGLETS																																														
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
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			
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

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				
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
WARBLERS																																														
Golden-winged Warbler	R								Y	Y						Y	Y	Y	Y					Y								Y	Y	Y			Y	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	
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			
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
Common Yellowthroat	R								Y	Y				Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y											Y	Y			
TANAGERS																																														
Scarlet Tanager																Y								Y								Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y	
TOWHEES AND SPARROWS																																														
Dickcissel						Y	Y	Y	Y																																					
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 sparrow							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		

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				
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			
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
American Goldfinch				Y			Y		Y	Y																						Y	Y	Y	Y	Y						Y				

Table G.4: Amphibian and Reptile Habitat Relationships by Minnesota Gap Analysis Project (MN-GAP) land cover type

Wildlife Habitat Relationships - Amphibians and Reptiles

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
Canadian Toad								Y	Y				Y		Y																																	
Cope's Gray Treefrog								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	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	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	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	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																																																
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																																

Appendix H - Ecologically Important Lowland Conifer (EILC) Stand Selection Process

Background: Lowland confers (specifically, black spruce, tamarack, and white cedar) were not evaluated when the original designations for old growth were done in the 1990's. To rectify this, the Department has charged each Subsection Forest Resource Management Planning (SFRMP) team to select representative high quality lowland conifer plant communities to be reserved from treatment during the 10-year planning period. This selected group is called Ecologically Important Lowland Conifers (EILC).

EILC are defined as stands of black spruce, tamarack, and cedar, including stagnant lowland conifers that are examples of high quality native plant communities (NPCs) representative of lowland conifer NPCs found in the subsection. The designated EILC stands will be reserved from treatment during the 10-year planning period. These reserved stands should be reviewed for continued protection at the beginning of the next cycle of subsection planning based on the Old Growth Guidelines or other guidelines in place at that future date.

The SFRMP Guidebook (version IV) has defined a process by which the team can determine a minimum acreage of ecologically important lowland conifers (EILC) to reserve in the subsection. Following this process, the Hardwood Hills (HH) SFRMP team determined that a minimum of 160ac of EILC needed to be selected for this reserve.

Selection Process: The team used the following criteria by which to evaluate all lowland conifers within the subsection:

- Stands spread across the subsection; ie, not concentrated in one work area over another.
- Stands adjacent to designated or pending old growth stands.
- Stands that are large and/or in large blocks of forest already planned to be managed for older attributes or have other protection buffers.
- Stands that are part of one of the proposed, interim High Conservation Value Forests (HCVF).
- Stands that are part of one of the proposed Representative Sample Areas (RSA).
- Stands that are dominated by globally rare plant communities (G1/G2 communities), specifically Southern Rich Conifer Swamp (FPs63a).
- Stands ranked highly by the Minnesota County Biological Survey (MCBS) for their biodiversity significance (specifically High or Outstanding sites).
- Stands that fit many of the above attributes, are large, and are non-manageable due to access and other issues. And,
- Stands recommended by site managers based on local and current knowledge.

Other stand values that were noted, but not given priority in the final team selection are stand status as either acquired or trust fund, age, and rarity of cover type across the subsection (example: black spruce).

The team applied all of these values to each of the lowland conifer stands in the Hardwood Hills subsection. They then ranked each stand as:

- 1 – Recommend as EILC (keep); the stand contains many of the criteria.
- 2 – Recommend stand has potential; needs input from area staff.
- 3 – Recommend do not consider for EILC.

A total of 19 stands for 341 acres met the criteria to keep as EILC (1 rank). Seventeen of these stands are tamarack and two are black spruce. Out of the remaining 34 lowland conifer stands considered for management in this plan, 26 were given a rank of 2 covering 324 acres and 8 were given a rank of 3 covering 93 acres. Additional things the team recognized through this process are that 211 acres of the 1 rank stands are administered by Wildlife, while 130 acres are administered by Forestry. Of those administered by Forestry, 80 acres is non-accessible for management.

The team carefully evaluated the ranked stand list, and recommended that all of the stands that ranked as 1 be reserved from treatment through this planning period. It is important to note that although the final EILC acreage is higher than the goal, the team determined that the uniqueness and relative rarity (<2000 acres) of lowland conifer NPCs in the subsection warranted additional EILC selection.

High Conservation Value Forests (HCVFs) — FACT SHEET

What Are HCVFs?

As a Department, MN DNR is committed and required by statute *(MS 89 & MS89A)* to manage for a broad set of objectives and forest resources, including the management and protection of rare species, communities, features, and values across the landscape. This commitment coincides with Principle 9 in the Forest Stewardship Certification Council (FSC) Forest Management Standard, which requires certificate holders to identify High Conservation Value Forests (HCVFs) and manage such sites to "maintain or enhance" identified High Conservation Values (HCVs). FSC broadly defines HCVFs as *"areas of outstanding biological or cultural significance."* Certificate holders are required to develop a practical definition and process for implementing the HCVF concept, relative to their scope and scale of operations.

MN DNR has emphasized the biological components of the HCVF concept, in part because FSC provides clearer guidance relative to the ecological components and there is more information available. In the future, MN DNR will place more emphasis on cultural values in defining and identifying HCVs.

What Does This Mean for Me?

MN DNR is currently operating in an interim period and few final decisions regarding HCVFs have been made. All decisions regarding MN DNR's HCVF interim approach have been based on the interpretation that most sites managed as HCVFs will remain working forests. This interpretation and expectation was based on a careful review of Principle 9 and the HCVF Assessment Framework in the FSC-US National Forest Management Standard, Draft 7. Principle 9 states: *"Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach."*

MN DNR and others have struggled to operationalize this "Precautionary Principle." FSC suggests the following application: *"This principle establishes that a lack of information does not justify the absence of management measures. On the contrary, management measures should be established in order to maintain the conservation of the resources." (FSC HCVF Toolkit)* As outlined in the Directors' Memo (May, 2009) management decisions must be documented and management should maintain or enhance the HCVs.

Background – MN DNR's Early Efforts

MN DNR has received several corrective action requests (CARs) related to HCVFs. Earlier CARs required MN DNR to operationally define the HCVF concept, identify HCVFs, and implement appropriate management to maintain or enhance the HCVs. As noted in MN DNR's Minor CAR 2006.10, *"Identifying, conserving, and monitoring HCVFs is an ongoing process, especially for managers of large public forests. Arguably, the most important aspect of this work is developing and implementing necessary guidelines to ensure proper management of High Conservation Values (HCVs) within high and outstanding MCBS sites, ecologically important lowland conifers, and old forest management complexes."*

Note: MN DNR has addressed old growth issues separate of its HCVF interim approach. See MN DNR's 2008.2 CAR response.

In 2006, MN DNR began a comprehensive approach to operationally define the HCVF concept. The Department created a HCVF workgroup to develop a systematic approach to identify, conserve, and monitor HCVs within already established special management and protected areas. Wherever possible, the HCVF workgroup referenced existing policies, directives, stand designations, and interdisciplinary processes to address the above requirements. In 2007, the Department developed a document titled *"Framework for Identifying, Managing, and Monitoring High Conservation Value Forests on State Lands."* This working document identified several priority actions and provided the initial framework for resource managers to begin identifying, managing, and monitoring HCVF sites. This report, which may need to be updated, is posted on the I:drive and intranet.

HCVF Major CAR (2008.1)

By the 2008 annual surveillance audit, MN DNR was required to develop guidelines to ensure appropriate management of HCVs within *high* and *outstanding* MCBS sites. However, by the 2008 audit, DNR had not identified or begun to manage specific sites as HCVFs. Therefore, the auditors concluded that there had been insufficient progress in specifying which *high* or *outstanding* areas were to be managed under the HCVF principle. As a result, the Department's minor CAR 2006.10 was replaced with Major CAR 2008.1.

Prepared by: Rebecca Barnard
Forest Certification Coordinator

High Conservation Value Forests (HCVFs) — FACT SHEET

Interim Approach – Major CAR Requirements

MN DNR's HCVF Major CAR (2008.1) required the Department to develop an interim approach to identify and appropriately manage HCVFs to ensure the maintenance or enhancement of HCVs. MN DNR's interim period will conclude when MN DNR formally defines HCVs and demonstrates which sites, or portions of sites, will be managed as HCVFs.

MN DNR's HCVF Framework report, mentioned above, identifies MCBS sites of *outstanding* and *high* biodiversity significance as candidates to manage in accordance with FSC-US' HCVF Principle. Therefore, as an interim approach, MN DNR is required to:

1) Manage all MCBS *Outstanding* Sites as HCVFs;
2) Manage all MCBS *High* Sites as HCVFs until MN DNR identifies a subset of *high* sites to manage as HCVFs; and
3) Conduct an analysis to identify which *high* sites will be treated as HCVFs *(thereby meeting #2)*

MN DNR's Recent Progress

Since the 2008 audits, MN DNR has made significant progress towards meeting the above requirements.

1) Directors Epperly, Schad and Hirsch sent a Memo (May 6, 2009) to Regional and Area staff, outlining a process for determining management of stands that occur within *high* or *outstanding* MCBS sites.
2) MN DNR developed a gap analysis process *(see below)* to determine which *high* sites will be managed as HCVFs during the interim period.
   a) MCBS plant ecologists reviewed and updated information for all *outstanding* and *high* sites that include DNR Forestry and Wildlife land.
   b) Based on this MCBS information, Ecological Resources' GIS Specialist generated Site summaries for all *high* and *outstanding* sites. Site summaries include a list of the rare species and NPCs present, and summarize the biodiversity values within each MCBS site.
   c) Using this information, along with GIS maps and imagery of MCBS Sites in each ECS Section, Ecological Resources staff identified gaps in the coverage of biodiversity values within *outstanding* sites and recommended *high* sites to fill those gaps.

   Note: Steps a-c are complete for the MDL and NSU Sections. Sites not included in Eco's recommendations no longer need to be treated as HCVFs.

MN DNR's Next Steps

MN DNR has made great progress since 2006, however, there is still work to be done to fully address the HCVF concept. Next steps are outlined below:

Step 1 – Interdisciplinary Review of Eco's Recommendations of *High* Sites – MDL & NSU:

- Interdisciplinary teams will review and refine the list of *high* sites in the MDL and NSU Sections that Ecological Resources recommended for continued treatment as HCVFs *(see Recent Progress #2c)*.
- Determine structure, representation, and decision authority for these interdisciplinary teams.
- Only those *high* sites included in MN DNR's recommendations will continue to be managed as HCVFs during the remainder of the interim period.

Note: Until this is completed (Spring, 2010), high sites appearing on Eco's recommendations and on annual stand exam lists (ASEL) or proposed as an annual planned addition will be managed as HCVFs to maintain/enhance the biodiversity values.

Step 2 – Subset of *High* Sites – Statewide:

Using the same process described above, Ecological Resources staff will review all MCBS sites of *outstanding* and *high* biodiversity significance in the remaining ECS sections and look for gaps in rare features or lack of sufficient representation of *outstanding* sites. Ecological Resources staff will then recommend which *High* sites to continue considering as HCVFs. Interdisciplinary teams will review these recommendations before final decisions are made on which sites to continue managing as HCVFs.

Step 3: Identification of HCV attributes:

HCVF attributes will be developed and defined by FCIT and the HCVF Work Group, based on existing written guidance from FSC-US. HCVs will be identified in HCVFs via interdisciplinary discussions.

Step 4: Management of HCVFs:

Appropriate management of HCVFs and prescriptions to maintain and enhance HCVs will be determined through interdisciplinary discussions and consensus. This process will be ongoing, likely handled at the Area/Region level. As MN DNR moves forward, a practical HCVF definition will be developed that also incorporates additional social and cultural values.

Step 5 – Provide Information & Guidance to Field:

Ecological Resources staff have developed a MCBS Site Information Access Tool that allows DNR staff to access site summaries and generate information on each MCBS high and outstanding site.

High Conservation Value Forests (HCVFs) — FACT SHEET

MN DNR's Long-term Approach *(proposed)*

Step 1 – Continue Providing Guidance to Field:

Step 2 – Stakeholder Consultation:
Indicator 9.2.a of the newly revised FSC-US Draft Forest Management Standard requires certificate holders to *"hold consultations with stakeholders and experts to confirm that proposed HCVF locations and their attributes have been accurately identified and that appropriate options for the maintenance of their HCVF attributes have been adopted."* Based on a review of this language and discussions with MN DNR's auditor, MN DNR intends to focus the stakeholder consultation process on developing management guidance for sites being considered as HCVFs. Stakeholder consultation will likely be obtained through a variety of existing avenues, including MFRC Landscape Committee Meetings, Minnesota Forest Industry (MFI) meetings, SFRMP public comment periods and meetings, and information accessible on MN DNR's website.
Note: Per FSC, "experts" may include DNR employees "who possess the requisite expertise, but external stakeholders with experience pertinent to the HCVF attribute must always be consulted."

For more details on this process and requirement, please refer to MN DNR's response to FSC CAR 2008.3.

Step 3 – Establish a consensus-based process and a threshold for identifying HCVs and HCVFs:
A variety of information and resources will be referenced when determining HCVs for future HCVFs site identification. This process will be ongoing, likely starting in late winter/early spring, 2010.

Step 4 – Monitoring Plan for HCVs:
Certificate holders are also required to conduct monitoring to ensure that the HCVs are being maintained or enhanced. MN DNR has not yet developed a specific monitoring plan and this will likely be contingent upon when and how MN DNR transitions from an interim into a long-term HCVF approach.

It has been suggested that MN DNR develop a short-term and a long-term monitoring process. Short-term monitoring could include additional (i.e., more frequent) sale supervision and/or possible follow-up joint-site visits to ensure the maintenance or enhancement of HCVs. Possible longer-term monitoring may include a re-analysis of HCVs at periodic intervals (e.g., 3, 5, 10 years).

Answers to Common Questions:

- HCVFs are not intended to be static, "set-asides," or "preservation / wilderness" areas.
- MN DNR is not planning to create new designations or polygons for HCVFs. It has not been decided how HCVFs will be identified in lieu of this.
- MN DNR is working to effectively address HCVFs by building on existing policies.
- Management objectives in HCVFs will be established through the existing planning and management processes. Specific management objectives may include a variety of multiple uses applicable to State Lands.
- The overall goal in HCVFs must be to maintain or enhance the site's HCVs. Prescriptions may need to be adjusted in order to meet this goal.
- Definitive HCVs have not yet been determined via an interdisciplinary process for most HCVFs sites. However, Appendix F of the FSC-US Forest Management Standard (Draft 7) and FSC's HCVF Assessment Framework list a variety of features that may have HCV attributes for the Lakes States.
- The HCVF concept offers a great opportunity for MN DNR to demonstrate how it integrates multiple purposes/objectives into resource management.

Additional Resources

- MN DNR's CAR Responses (2006.10, 2008.1 & 2008.3)
  - I:\FOR\Forest Certification\DNR's CAR Responses & Memos\2008 CAR Responses
  - DNR Intranet
- MCBS Information @
  - ftp://ftp.dnr.state.mn.us/pub/eco/HCVF/
  - MCBS Site Information Access Tool
- Additional Documents:
  - Directors' Memo *(Signed May 6, 2009)*
  - MN DNR's *"Framework for Identifying, Managing, and Monitoring High Conservation Value Forests on State Lands"* 2007 report
- FSC-US Standard & Website @ www.fscus.org

Contacts

For questions regarding interpretation of this information or the attached materials, please contact Kurt Rusterholz (651-259-5135), Rebecca Barnard (651-259-5256) or Mike Locke (218-308-2368).

Appendix J - SFRMP Additional Field Names and Codes

Non-standard FIM Field Names and Codes Used in the Hardwood Hills Subsection FIM Shapefile.

Field Name and Codes	Description
UNIQUE_ID	**Unique identifier for each polygon in the shapefile**
ADMIN	**Land Administrator**
Wildlife	Section of Wildlife
Forestry	Division of Forestry
ECS_NAME	**"Working" Subsection stand is assigned to**
NEW_AGE_11	**Stand age modeled forward to 2011**
NAGE_CL_11	**NEW_AGE_11 grouped into 10 year age periods**
INOPERABLE	**Not used in this plan**
MAN_ACRES	**Stand Acres available for management**
PAT_NOM	**Not used in this plan**
PAT_NAME	**Not used in this plan**
SMA	**Special Management Areas – Codes may be used in combination**
RGMA	Ruffed Grouse Management Area
WTMA	Wild Turkey Management Area
ERF	**Extended Rotation Forest (ERF). Value of 1 = ERF**
ERF_OBJ	**ERR Objective codes, multiple may be assigned.**
A	Adjacent to areas being managed as old forest on other ownerships or DNR units (e.g., state parks, SNAs)
C	Part of a corridor linking other old forest areas.
D	Within a deer yard or other special management area
E	Within a targeted ECS LTA (i.e., with ability or history of supporting older forest)
L	Part of a large patch
N	Within an area containing rare and distinctive species or native plant communities
O	Within an OFMC or otherwise adjacent to designated old growth stands

Field Name and Codes	Description
R	Within or adjacent to a riparian area
V	Within a visually sensitive travel corridor or view shed
W	White pine policy
X	Other
ERF_REAS	**Main reason why ERF was selected for this stand.**
EILC	**Ecologically important lowland conifers – Reserve during this 10-year plan. Value of 1 = EILC**
EILCREAS	**Reasons why EILC was selected for this stand.**
OG_SMZ	**Old Growth Special Management Zone. Value of 1 = OG_SMZ**
OFMC	**Old Forest Management Complex. Value of 1 = OFMC**
CRITERIA	**Not used in this plan**
PRESCRIP	**Preliminary assigned stand prescription**
1111	Clearcut with Reserves
1130	Shelterwood
1300	Uneven-aged Management
1810	Commercial Thinning
1940	Manage for Understory
9100	SFRMP On-Site Visit
9110	Reinventory
T_ACRES	**Treatment acres. If stand has a valid PRESCRIP field, then this is the number of acres in the stand to be treated. May be less than MAN_ACRES due to only a partial stand treatment.**
SE_YEAR	**Planned year (FY) to complete the stand examination/appraisal**
MGMT_CT	**Cover type to manage for in the future (Cover type code) – *Preliminary estimate*.**
OBJECTIVE	**Coding used to assign preliminary objectives to stands. Multiple codes may be assigned.**
CON1	Maintain existing NPC composition and structure
CON2	Protect rare plant or animal location
CON3	Special management consideration for species or habitat
CON4	Protect a known rare native plant community

Field Name and Codes	Description
CON5	Use prescribed fire
CON7	Retain NPC older growth stage components
COV20	Convert to Northern Hardwoods
INC30	Increase Oak
INC31	Increase Northern Red Oak
INC35	Increase Burr Oak
INC52	Increase Norway Pine
INC53	Increase Jack Pine
MA1	Similar species mix and stand structure
FOR_COM	**Forestry comments regarding the stand management**
WLD_COM	**Wildlife comments regarding the stand management. In addition to comments added by Wildlife staff during the stand swapping meetings, this field was also calculated for stands that overlapped Wildlife burn units, Special Management Areas and TNC study plot comment for the Karlstad Area.**
ECO_COM	**Ecological and Water Resources comments regarding the stand management. In addition to comments added by Eco staff during the stand swapping meetings, this field was also calculated for stands that overlapped or were adjacent to rare features, HCVF, G1G2, RSA and EILC.**
FSH_COM	**Not used in this plan.**
COMMENT	**General comments assigned to a stand during the planning process. In addition to general comments during stand swapping, this field was also calculated with status of old growth designation and changes to stand acres based on stands overlapping outside of DNR administered lands represented in the DNR Acres field.**
JT_VISIT	**If coded, joint field visit desired by personnel from other Divisions. Stands may be tagged during the 10-year stand selection process or during annual harvest plan reviews.**
FSH	Not used in this plan.
WLD	Contact Area Wildlife personnel prior to the field visit. Wildlife personnel will tag stands with WLD that they want to do a joint site visit.
ECO	Contact Ecological and Water Resources (EWR) representative prior to the field visit. EWR personnel will tag stands with ECO that they want to do a joint site visit.

Field Name and Codes	Description
NEW ACCESS NEEDS	**Coding for new access needs in SFRMP. Only assigned to stands where new access is needed.**
NA_TYPE	**Type of new access – Only Temporary Access assigned in this plan.**
Temporary Access Route	No plans to keep access open for future management. **Temporary access route** will be abandoned and the site reclaimed so that evidence of a travel route is minimized.
NA_MILE	**New access miles only (estimate to nearest 0.1 mile)**
NA_SW	**New access season of use. S = summer; W = winter**
NA_POST	**Post management activity road treatment – Only A used in this plan.**
A	Abandon (applies to all new temporary access routes)
RD_PERMIT	**New access requires – Only Z used in this plan.**
Z	Access information assigned to another near-by stand

Appendix K - School Trust lands in Hardwood Hills Subsection

HH SFRMP Designation	[A] Total Acres Designated in the Subsection	% of Total Acres ([A]/46,099)	[B] School Trust Acres Designated in the Subsection	% of School Trust Acres Designated ([B]/9,423)
EILC	341	0.7%	104	1.1%
Old growth	2,509	5.4%	627	6.7%
Proposed RSA[1]	121	0.3%	0	0%
Total reserved acres[2]	2,929	6.4%	731	7.8%
ERF prescribed[3]	4,123	8.9%	413	4.3%
HCVF acres[4]	5,696	12.4%	1,506	16.0%
Managed acres[5]	15,832	34.3%	4,812	51.1%
10-year stand exam acres	3,785	8.2%	1,195	12.7%

DNR Lands included in the Hardwood Hills SFRMP	Total DNR Acres in the HH SFRMP	School Trust Acres	% School Trust
Total	46,099	9,423	20.4%

[1] Representative Sample Areas (RSA) boundaries are not yet finalized.
[2] Includes EILC, old growth, and RSA designated stands (with overlap removed).
[3] Excludes ERF acres also designated as EILC, old growth, or RSAs.
[4] Excludes acres within HCVFs also designated as EILC, old growth or RSAs. Includes 1,727 acres that are also designated to be managed as ERF, of which 176 acres are school trust lands.
[5] Total acres of productive (i.e., commercially viable) forest stands available for management in this planning period. Excludes non-productive forest, non-forest and acres with designations that generally prohibit commercial development (i.e. old growth, RSA and EILC).

Ecologically Important Lowland Conifers (EILC) - All trust land EILC acres are classified as critically imperiled/imperiled (G1/G2) community according to a global ranking system developed by NatureServe. The Southern Tamarack Swamp – FPs63a is at a very high risk of extinction. These stands are considered to be of low quality for timber harvest. There are a very limited number of lowland conifer acres in this subsection. As a result, the proportion of lowland conifers designated as EILC is high but the total acreage involved is very low.

Old Growth - Acreages include designated and pending old growth. Old growth designations were made prior to the SFRMP planning process. Decisions on pending old growth designations in this subsection will be made outside of the SFRMP process. The department will be addressing old growth designations on trust lands through a statewide effort separate from SFRMP.

Representative Sample Areas (RSA) – There are no school trust acres involved in proposed RSAs in this subsection at this time.

Extended Rotation Forest (ERF) - The proportion of trust lands identified to be managed as ERF is less than one-half that for non-trust lands (4.3% for trust lands, 10.1% for non-trust lands). Approximately 25% of the trust lands designated to be managed as ERF are on non-productive forest or non-forest lands. On productive timber lands, ERF designation had minimal effect on proposed timber harvest levels during the current planning period due to the large proportion of over mature forests currently existing on DNR lands in this subsection. Rather proposed treatment levels of mature forests were largely determined (i.e., limited) by the desire to establish a more even age-class distribution, resulting in a more even and predictable flow of timber volumes and revenue in the future.

High Conservation Value Forests (HCVF) - There are 1,506 acres of trust lands within proposed HCVF areas in the HH subsection, excluding those HCVF trust acres also identified with a more restrictive designation (e.g., EILC, old growth, RSAs). Of these acres, 69% (1,036 acres) are productive timberlands (i.e., capable of growing timber for commercial markets). Final HCVFs on DNR lands are still in the process of being identified. The numbers presented in the above table represent acres included in current proposed HCVF areas in the HH subsection. It is unknown at this time specifically how HCVF designation will affect long-term revenue production on trust lands. For some high conservation values, there may be little or no effect. For other HCVs the effect may be significant. DNR will better understand the effect on long-term revenue production once more site-specific management direction is developed for each HCVF area. If DNR determines that management for HCVs restricts or prohibits long-term revenue generation on school trust lands in a way that conflicts with its Trust obligations, the DNR will seek a way to compensate the school trust via exchange, purchase or other acceptable method.

Appendix L - Rare Native Plant Communities of the Hardwood Hills Subsection

Rare Native Plant Communities of the Hardwood Hills Subsection

Community Name	Community Code	State Rank	Global Rank
Jack Pine - (Yarrow) Woodland: Bur Oak - Aspen Subtype	FDc23a2	S1S2	G2
Red Pine - White Pine Forest	FDc34a	S2	
Elm - Ash - Basswood Terrace Forest	FFs59c	S2	
Tamarack Swamp (Southern)	FPs63a	S2S3	G2G3
Gravel/Cobble Beach (Inland Lake)	LKi32b	S2	
Sugar Maple Forest (Big Woods)	MHs39c	S2	
Cattail - Sedge Marsh (Northern)	MRn83a	S2	
Cattail Marsh (Northern)	MRn83b	S2	
Spikerush - Bur Reed Marsh (Northern)	MRn93b	S2	
Cattail - Sedge Marsh (Prairie)	MRp83a	S1	
Cattail Marsh (Prairie)	MRp83b	S1	
Spring Fen	OPn93a	S2	
Calcareous Fen (Northwestern)	OPp93a	S2	G2
Calcareous Fen (Southeastern)	OPp93c	S1	G2
Crystalline Bedrock Outcrop (Transition)	ROs12b	S2	
Dry Sand - Gravel Prairie (Northern)	UPn12b	S2	
Dry Hill Prairie (Northern)	UPn12d	S1	
Dry Barrens Oak Savanna (Northern)	UPn13b	S1S2	G2
Dry Sand - Gravel Oak Savanna (Northern)	UPn13c	S1	G1G2
Dry Hill Oak Savanna (Northern)	UPn13d	S1	G1G2
Mesic Prairie (Northern)	UPn23b	S2	G2G3
Dry Sand - Gravel Prairie (Southern)	UPs13b	S2	
Dry Hill Prairie (Southern)	UPs13d	S2	
Dry Barrens Oak Savanna (Southern)	UPs14a	S1S2	
Dry Sand - Gravel Oak Savanna (Southern)	UPs14b	S1S2	
Mesic Prairie (Southern)	UPs23a	S2	G1G2G3
Black Ash - (Red Maple) Seepage Swamp	WFs57a	S1S2	
Wet Prairie (Southern)	WPs54b	S2	

Appendix M - Priority Open Landscape Areas-Hardwood Hills Subsection

One part of the SFRMP process is to identify areas that may be appropriate for openland management and designate Priority Open Landscape Areas. In cases where designating most of or an entire Land Type Association (LTA) is inappropriate, Special Management Areas (SMAs) can be delineated as subunits within LTAs. General management goals within designated portions of a LTA or SMAs differ from that of the rest of the LTA. Listed in the table below are LTAs with recommended Priority Open Landscape Areas designation (see accompanying spreadsheet/shapefile).

Table 12: LTAs and SMAs in the Hardwood Hills Subsection

LTA	% LTA in Openland	% LTA in Brushland	LTA Designation or Special Management Area (SMA)
Vawler Moraine (222Ma04)	0%	83.4%	LTA
Randall Sand Plain (222Ma06)	0%	45.9%	SMA
Long Prairie Sand Plain (222Ma07)	100%	0%	LTA
Clarissa Drumlin Plain (222Ma08)	0%	21.1%	SMA
Luxemburg Sand Plain (222Ma09)	25.7%	74.3%	LTA
Rose Sand Plain (222Ma10)	0%	60.8%	LTA
Perham Sand Plain (222Ma12)	0%	92.9%	LTA
Detroit Lakes Sand Plain (222Ma13)	0%	54.2%	LTA
Underwood Moraine (222Ma15)	0%	76.7%	LTA
Roscoe Moraine (222Ma17)	0%	100%	LTA
McIntosh Moraine (222Ma18)	0%	100%	LTA
Erskine Till Plain (222Ma20)	0%	100%	LTA
Cormorant Sand Plain (222Ma21)	100%	0%	LTA

Management Agreement:

Most of the land area designated in these LTAs and SMAs for openlands management is on private land. On state lands in this subsection, the intent is these designations will guide vegetation management and planning.

These Priority Open Landscape Areas were classified as either Openland (a habitat consisting of an open complex of vegetation with <1/3 total cover by shrubs and/or trees) or Brushland (a habitat consisting of a semi-open complex of vegetation with >1/3 total cover by shrubs and/or 1/3-2/3 total cover by trees). These definitions can be found on pages 14-15 of Wildlife's 2002 Assessment of Open Landscapes. The intent is the openlands management recommendations listed under private land and public land headings below will be followed more closely in Openland portions of Priority Open Landscape Areas.

It is important to note that wooded or forested cover types can be appropriate in both Brushlands and Openlands, especially in riparian areas or riverine systems depending on the NPC.

As per the Forest Management Coordination Framework, project desires on wildlife and forestry lands will be run past the other Divisions for discussion/approval—also, communication re: project desires and work on other lands will occur as directed by policy.

Private Land:

1) When landowners within an openland SMA or LTA request DNR advice in managing their land, or in some cases contacted by DNR, we are asking that they be advised of the potential, where appropriate, to enhance the openland habitat on their property. Staff involved in the DNR's Private Lands Program and Forest Stewardship Program can provide assistance. As an example, the Private Land Specialists can work on openlands management plans and/or seek public funds for openlands management projects.

2) Due to negative effects on openlands species, we ask that tree planting within an openland SMA or LTA generally be discouraged. However, ultimate recommendations should be site and context specific. Land managers should provide recommendations that are consistent with immediate surrounding landscape, native plant communities, land ownership patterns, and management goals or priorities on any adjoining or nearby public lands, regardless of any openland designation the larger landscape may carry. DNR Private Land Specialists are working with local Soil and Water Conservation Districts to provide guidance to their programs. It is recognized that the ultimate decision resides with the landowners: the main goal here is to insure that where appropriate they understand what potential their land has for open landscape species and the negative impacts of tree planting on those species.

Public Land:

1) Use of shorter rotation ages for species normally managed under even-aged harvest systems (e.g. aspen, Balm of Gilead, birch) will be generally encouraged.

2) ERF designation should be avoided in designated Openland SMA's and LTA's, although ERF may be appropriate in riparian areas and other special circumstances.

3) Snags and leave trees will generally be discouraged to the extent possible in cover types that are usually managed with even-aged harvest systems (e.g. aspen, Balm of Gilead, birch). MN Forest Resources Council Site-Level Guidelines allow for flexibility in snag/leave tree application where open landscape concerns are documented. Individual site implementation will be discussed during annual stand review meetings. Where a decision is made that snags and or leave trees may occur within an openlands LTA/SMA, we are likely to suggest that they be left in clumps, and preference be given to placement on the edge of sales.

4) Attempts may be made to increase the average size of harvest areas within designated LTAs and SMAs in an attempt to increase the size of young patches—primarily within stands in cover types usually managed with even-aged harvest systems.

5) Foresters may be encouraged to drop slightly below normal rotation ages on some stands to increase patch size and create younger patches. Some aspen stands in Brushland areas will be managed above merchantable and below normal rotation age.

6) Conifer planting within Priority Open Landscape Areas on public lands will generally be discouraged to prevent harm to openlands species.

7) Conversion of forested cover types to non-forested ones will occur in Priority Open Landscape Areas, but will occur primarily on lands classified as Openlands.

8) Direction from the "Interdisciplinary Forest Management Coordination Framework" will apply with respect to coordination on potential open lands management projects on public lands. Forestry and Ecological Resources will be coordinated with prior to implementation of proposed open lands projects within the SMA, with project review and approval requirements from the policy applied where needed (e.g. where wildlife may desire an openlands project on forestry administered land).

To view a map of priority open landscape and SMA designations,
please see Map 4 in Appendix P.

Appendix N - Glossary

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

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

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

Age-class distribution: The proportionate amount of various age classes of a forest or forest cover type within a defined geographic area (e.g., ecological classification system subsection).

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

Animal aggregations: A concentration of animals 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.

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.

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 SFRMPs 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 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 like 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 can develop 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 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.

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

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 and 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: Changing a stand or site from one cover type to another through active management. Conversions can be accomplished via restoring or enhancing a stand or site.

Cooperative Stand Assessment (CSA): The forest stand mapping and information system used by the Minnesota Department of Natural Resources to inventory the approximately five million acres (7,800 square miles) owned and administered by the state. The spatial information and stand attributes are now maintained in the Forest Inventory Module (FIM).

Cord: A pile of wood four feet high, four feet wide, and eight feet long, measuring 128 cubic feet, including bark and air space. Actual volume of solid wood may vary from 60 to 100 feet 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 tree species is aspen would be considered an aspen cover type.

Cover type distribution: The location and/or proportionate representation of cover types in a forest or a given geographic area.

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 Condition (DFC): Broad vision of landscape vegetation conditions in the long-term future. For the purposes of the initial round of subsection planning, DFFCs will focus on future desired forest composition looking ahead 50 years. DFFCs 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 successional forests commonly depend on and develop first following disturbance events (e.g., fire, windstorms, or timber harvest). Examples of *early successional forest* tree species are aspen, paper birch, and jack pine. Each stage of succession provides different benefits for a variety of species.

Ecological Classification System (ECS): A method to identify, describe, and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil, and vegetation data. (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 Minnesota County Biological Survey (MCBS) at the completion of MCBS work in a given county or ecological classification system (ECS) subsection, and are generally reserved for those sites with the highest biodiversity significance in a geographic region, regardless of ownership.

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

Ecologically Important Lowland Conifers (EILC): includes stands of black spruce, tamarack, and cedar, including stagnant lowland conifer stands, which are examples of high quality native plant communities (NPCs) that are representative of lowland conifer NPCs 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 (EBM): 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.

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

Even-aged: A forest stand composed of trees of primarily the same age or age class. A stand is considered even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years).

Evenflow: Providing a relatively consistent amount of timber (or other products) in successive management periods.

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 non-timber values. Additional detail 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.

Fen: Peatlands that receive water both from precipitation and ground water, which has percolated through mineral soil, are classified as *fens*. The water supply in a fen is only slightly acidic or nearly neutral, and it carries minerals and other nutrient content. Fens look like watery meadows, with sedges, reeds, grass-like plants, occasional shrubs, and scattered, stunted trees.

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 Minnesota Department of Natural Resources and the U.S. Department of Agriculture—Forest Service that periodically, through a system of permanent plots, assesses the current status of, and monitors recent trends in, forest area, volume, growth, and removals.

Forest Inventory Module (FIM): The FIM provides a database and application through which field foresters can maintain an integrated and centralized inventory of the forests on publicly owned lands managed by the Division of Forestry and other 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).

Forestland: 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**y**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 the 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 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 an exemplary representative of the native plant community diversity prior to European settlement.

High-Risk, Low-Volume (HRLV): HRLV stands are identified based on one or more of the following: 1) stands coded as high risk in CSA 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), 4) or very old stand, e.g., aspen over 80 years old.

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

more simplified monotypic stand such as mostly pure aspen regeneration or high-density pine plantations. Examples where more intensive management may be needed are: to regenerate a site successfully to a desired species, control 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 Minnesota Department of Natural Resources (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 Ecological Classification System (ECS), and Minnesota Forest Resources Council (MFRC) regional landscapes. The issue being addressed usually defines the type and size of landscape to be used.

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 Ecological Classification System.

Land Type Association(LTA): Divisions within Subsections that are delineated using glacial landforms, bedrock types, topographic roughness lake and stream distributions, wetland patterns, depth to the groundwater table, soil parent material, and pre-European settlement vegetation.

Landscape Study Area (LSA): A large geographic area identified by the Minnesota County Biological Survey (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 Ecological Classification System). 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 which exhibit repeatable patterns at the landform or ecological landtype 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. An LSA may encompass portions of one or more ecological landtype associations (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, an LSA becomes a macrosite, two or more sites, or a combination of macrosites and sites. In some cases an 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 2000 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.

Marketable timber: Merchantable timber that is accessible now.

Mast: Nuts, seeds, catkins, flower buds, and fruits of woody plants that provide food for wildlife.

Mature tree: A tree that has reached the desired size or age for its intended use. Size or age will vary considerably depending on the species and the intended use.

Maximum Rotation Age (MRA): 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.

Minnesota County Biological Survey (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 MCBS site provides a geographic framework for recording and storing data and compiling descriptive summaries.

Minnesota Forest Resources Council (MFRC): The Minnesota Forest Resources Council is a state council established by the Sustainable Forest Resources Act (SFRA) of 1995 to promote long-term sustainable management of Minnesota's forests.

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 Division of Ecological and Water Resources.

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 (NPC): A group of native plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms. These groups of native plants form recognizable units, such as an oak forest, prairie, or marsh that tend to reoccur over space and time. Native plant communities are classified and described by 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 s*ite* of Outstanding or High biodiversity significance is often recommended for nomination as a natural area. For these MCBS sites, an MCBS *Ecological Evaluation* is written to characterize the ecological significance of the MCBS site as a whole and to serve as a guide for conservation action by the various landowners. MCBS sites (or portions of MCBS 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 and Water Resources Division and another governmental unit. The other governmental unit can be Division of Forestry, Fish and Wildlife, or Parks and Trails, 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 ramshead 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.

Non-forestland: 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, *nongame species* include amphibians, reptiles, and those mammal and bird species that are not hunted or trapped.

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

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

Normal Rotation Age (NRA): 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 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 (OFMC): 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.

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 Forests Guidelines* (1994) and amendments.

Operational planning: The specific actions (i.e., projects, programs, etc.) that will be taken to move toward 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 specify 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 five to 12 inches diameter 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:

> **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.
>
> **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.
>
> **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.

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.

Rare species: A plant or animal species that is designated as ***endangered, threatened,*** or a species of ***special concern*** by the state of Minnesota (this includes all species designated as endangered or threatened at the federal level), or an uncommon species that does not (yet) have an official designation, but whose distribution and abundance need to be better understood.

Refuge/refugia: Area(s) where plants and animals can persist through a 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: The Minnesota Forest Resources Council (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.

Release: Freeing a tree, or group of trees, from competition that is overtopping or closely surrounding them.

Releve': Vegetation survey plot.

Reserved forestland: Forestland withdrawn from timber utilization through statute, administrative regulation, or designation.

Restore: To return a stand, site, or ecosystem to its original structure and species composition through active management actions.

Riparian area: The area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands.

Riparian Management Zone (RMZ): That portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. It is the area where riparian 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 fact

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 one to five 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 Area (SNA): Areas established by the Minnesota Department of Natural Resources, Division of Ecological and Water Resources, to preserve natural features and rare resources of exceptional scientific and educational value.

Seedbed: The soil or forest floor on which seed falls.

Seed tree: Any tree that bears seed; specifically, a tree left standing to provide the seed for natural regeneration.

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.

Species of Greatest Conservation Need (SGCN): Animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long term health and stability.

Stand: A contiguous group of vegetation similar in age, species composition, and structure, and growing on a site of similar quality, to be a distinguishable unit. A forest is comprised of many stands. A ***pure stand*** is composed of essentially a single species, such as a red pine plantation. A ***mixed stand*** is composed of a mixture of species, such as a northern hardwood stand consisting of maple, birch, basswood, and oak. An ***even-aged stand*** is one in which all of the trees present are essentially the same age, usually within 10 years of age for aspen and jack pine stands. An ***uneven-aged stand*** is one in which a variety of ages and sizes of trees are growing together on a uniform site, such as a northern hardwood stand with three or more age classes.

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

Stand density: The 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, and 11) etc.

State forest road: Any permanent road constructed, maintained, or administered by the Minnesota Department of Natural Resources for the purposes of accessing or traversing state forestlands.

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). 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 Ecological Classification System (ECS). From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province --> Section --> **Subsection** --> Land Type Association --> Land Type --> Land Type Phase. 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 Department of Natural Resources (DNR) plan for vegetation management on forestlands 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 forestlands 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 non-forestland.

Timber management plan: If used with the SFRMP process, a timber management plan means the same thing as the vegetation management plan described below.

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 classes 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 management: Forest management that results in forest stands comprised of intermingling trees or small groups that have three or more distinct age classes. Best suited for shade tolerant species.

Uneven-aged stand: A stand of trees of a variety of ages and sizes growing together on a uniform site. A stand of trees having three or more distinct age classes.

Variable density: Thinning or planting in a clumped or dispersed pattern so that tree spacing more closely replicates patterns after natural disturbance (e.g., use gap management, vary the residual density within a stand when thinning, or plant seedlings at various densities within a plantation).

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

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 forests, extended rotation forests, ecologically important lowland conifers, patches, special management areas, visually sensitive travel corridors, etc., all of which are intended to address wildlife habitat, biodiversity, 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 Department of Natural Resources, Section of Wildlife, to manage, preserve and restore natural communities, perpetuate wildlife populations, and provide recreational and educational opportunities.

Windthrow: A tree pushed over by the wind. Windthrows are more common among shallow-rooted species.

APPENDIX O - Acronyms

AFRMP	Area Forest Resource Management Plan
AMA	Aquatic Management Area
BMP	Best Management Practices
BT	Bearing Tree
CAR	Corrective Action Request
CMAI	Culmination of Mean Annual Increment
CMT	Commissioner's Management Team (DNR)
CO_2	Carbon Dioxide
CSA	Cooperative Stand Assessment
CWCS	Comprehensive Wildlife Conservation Strategy
DBH	Diameter at Breast Height
DFC	Desired Future Condition
DMT	Division Management Team (DNR)
DNR	Department of Natural Resources
DOF	Division of Forestry (DNR)
DOQ	Digital Orthophoto Quadrangle
DRG	Digital Raster Graphics
DRS	Data Resource Site
EAB	Emerald Ash Borer
ECS	Ecological Classification System
EERF	Effective Extended Rotation Forest
EILC	Ecologically Important Lowland Conifers
ELCP	Ecological Land Classification Program
ERF	Extended Rotation Forestry
ETS	Endangered, Threatened, or Special Concern
FHM	Forest Health Monitoring
FIA	Forest Inventory and Analysis
FIM	Forest Inventory Module
FORIST	Forest Information System
FRIT	Forest Resource Issues Team
FSC	Forest Stewardship Council

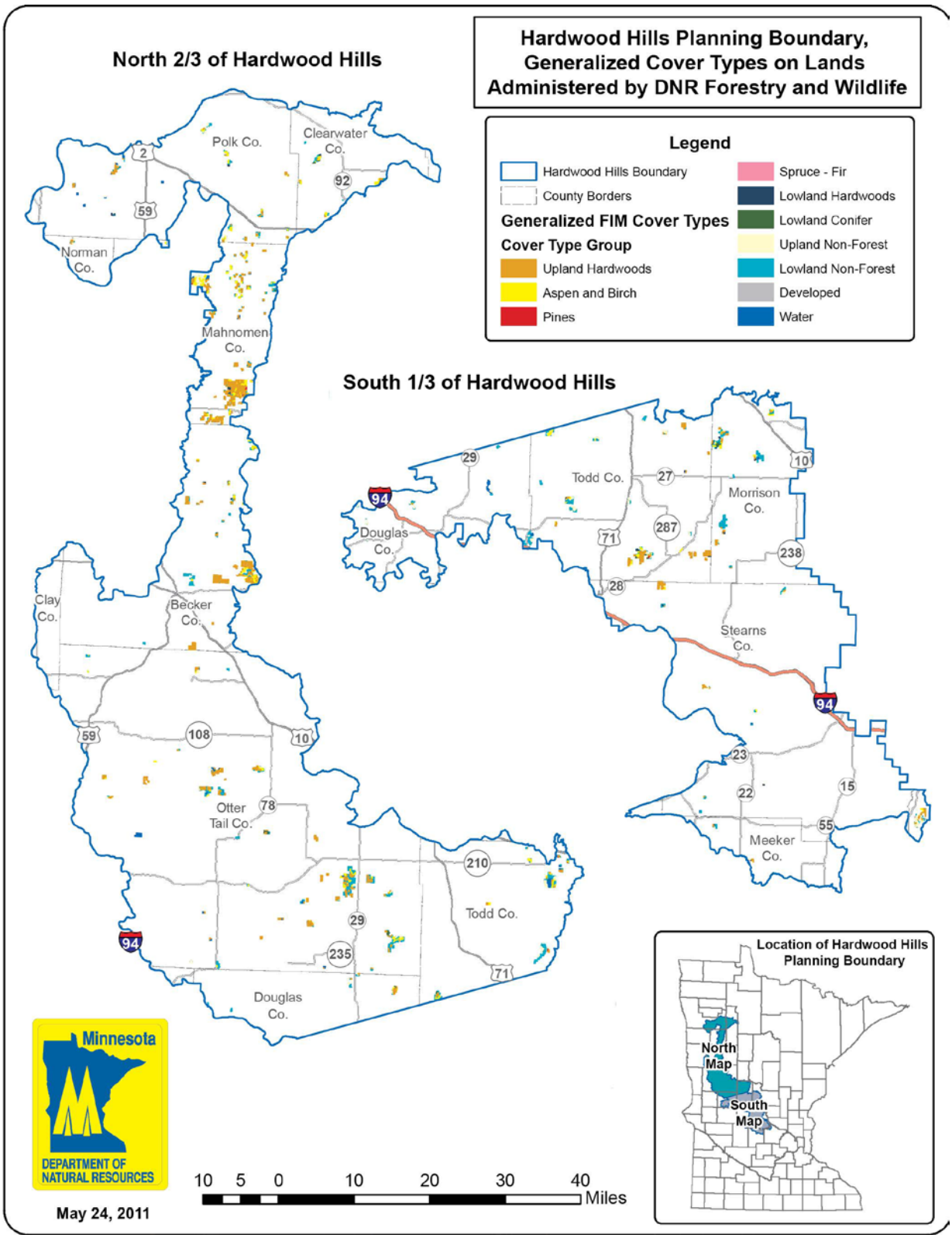
FTC	Forest Tent Caterpillar
FY	Fiscal Year
GAP	Gap Analysis Program
GDS	General Direction Statement
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GM	Gypsy Moth
HCVF	High Conservation Value Forest
HRLV	High-Risk/Low-Volume
HWDs	Hardwoods
HH	Hardwood Hills Subsection
JPBW	Jack Pine Budworm
LCMR	Legislative Committee on Minnesota Resources
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
MDA	Minnesota Department of Agriculture
MFRC	Minnesota Forest Resources Council
MFRP	Minnesota Forest Resources Plan
MIM	Minnesota and Northeast Iowa Morainal Section
MnTAXA	Minnesota Taxonomy Database
MnWRAP	Minnesota Wildlife Resource Assessment Project
MRA	Maximum Rotation Age
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

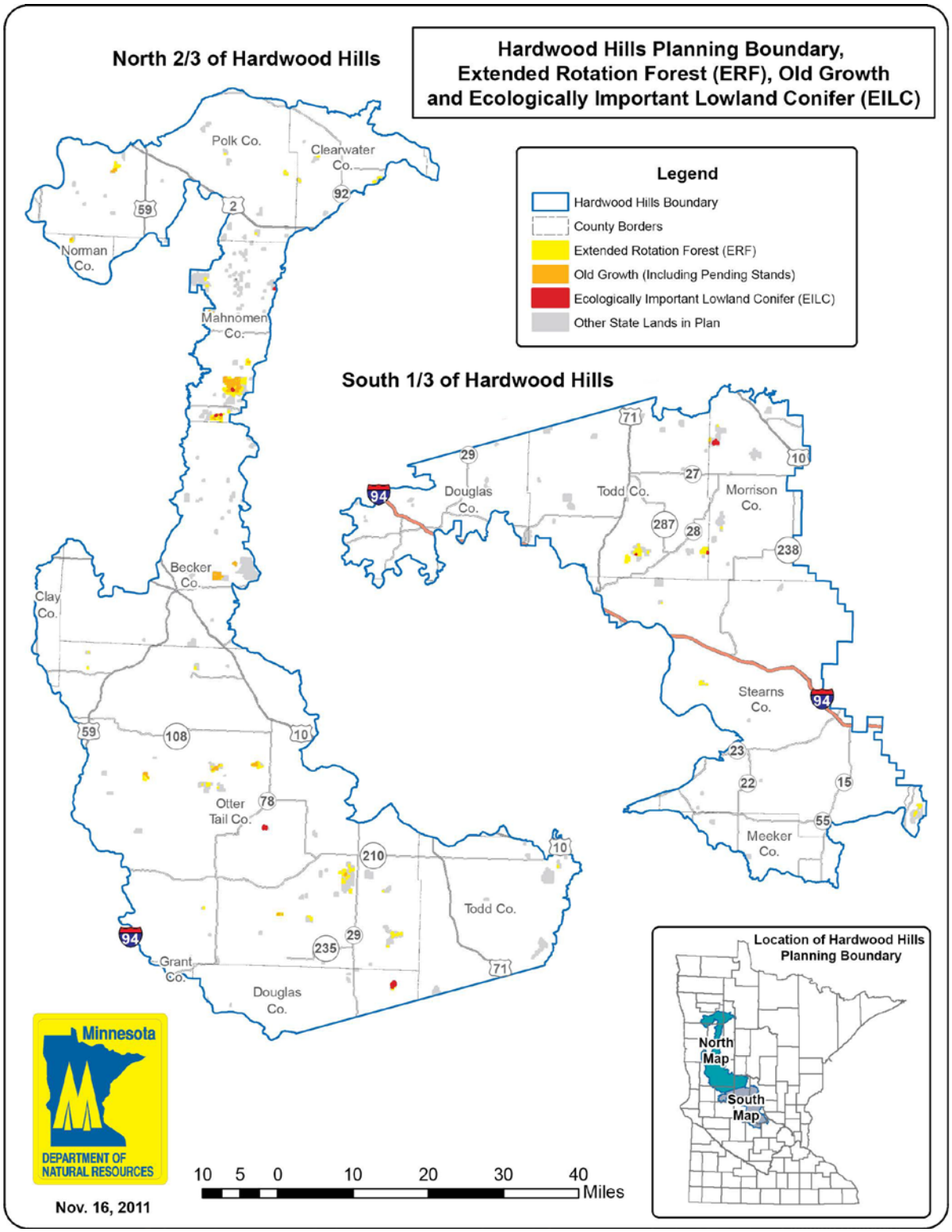
NPC	Native Plant Community
NRA	Normal Rotation Age
NRCS	Natural Resource Conservation Service
O_3	Ozone
OFMC	Old Forest Management Complex
OF	Old Forest
OG	Old-growth
OHV	Off-Highway Vehicles
OLA	Open Landscape Area
OSB	Oriented Strand Board
RMT	Regional Management Team
RMZ	Riparian Management Zone
RNAs	Research Natural Areas
RNV	Range of Natural Variability
RSA	Representative Sample Area
RSPS	Remsoft Spatial Planning System
SBW	Spruce Budworm
SFRMP	Subsection Forest Resource Management Plan
SFI	Sustainable Forestry Initiative
SGCN	Species in Greatest Conservation Need
SI	Site Index
SMA	Special Management Area
SMC	Special Management Complex
SMZ	Special Management Zone
SNA	Scientific and Natural Area
SNN	Shipstead-Newton-Nolan Act
SONAR	Statement of Need and Reasonableness
SPP	Species
SRM	Silviculture and Roads Module
SWG	State Wildlife Grant
TLCB	Two-lined Chestnut Borer
TMP	Timber Management Plan

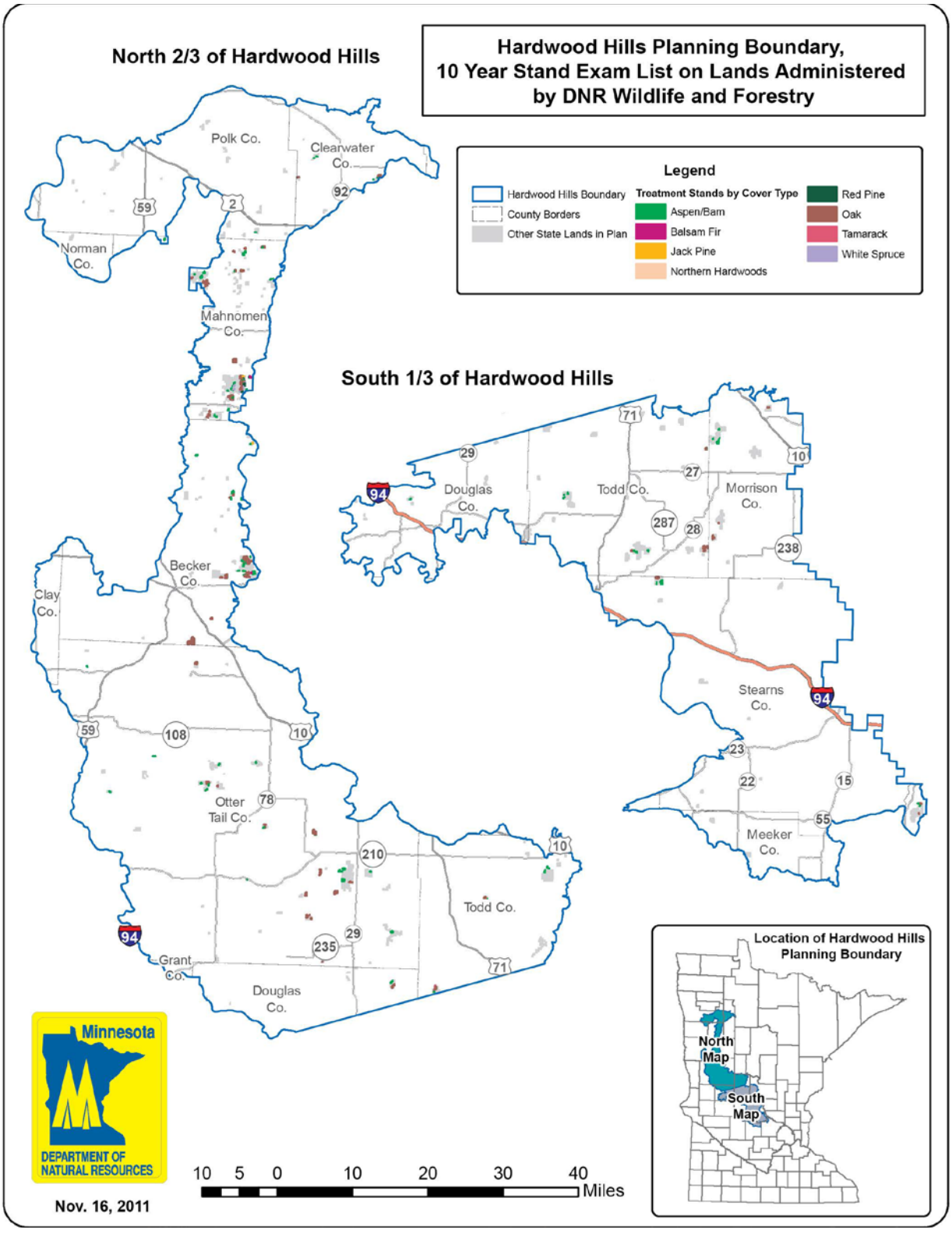
TMPIS	Timber Management Plan Information System
TNC	The Nature Conservancy
TSI	Timber Stand Improvement
TSM	Timber Stand Module
USDA-FS	Unites States Department of Agriculture – Forest Service
USDA-APHIS	Unites States Department of Agriculture – Animal and Plant Health Inspection Service
USFS	United States Forest Service
USFS-NRS	United States Forest Service-Northern Research Station
WMA	Wildlife Management Area
WPA	Waterfowl Production Area

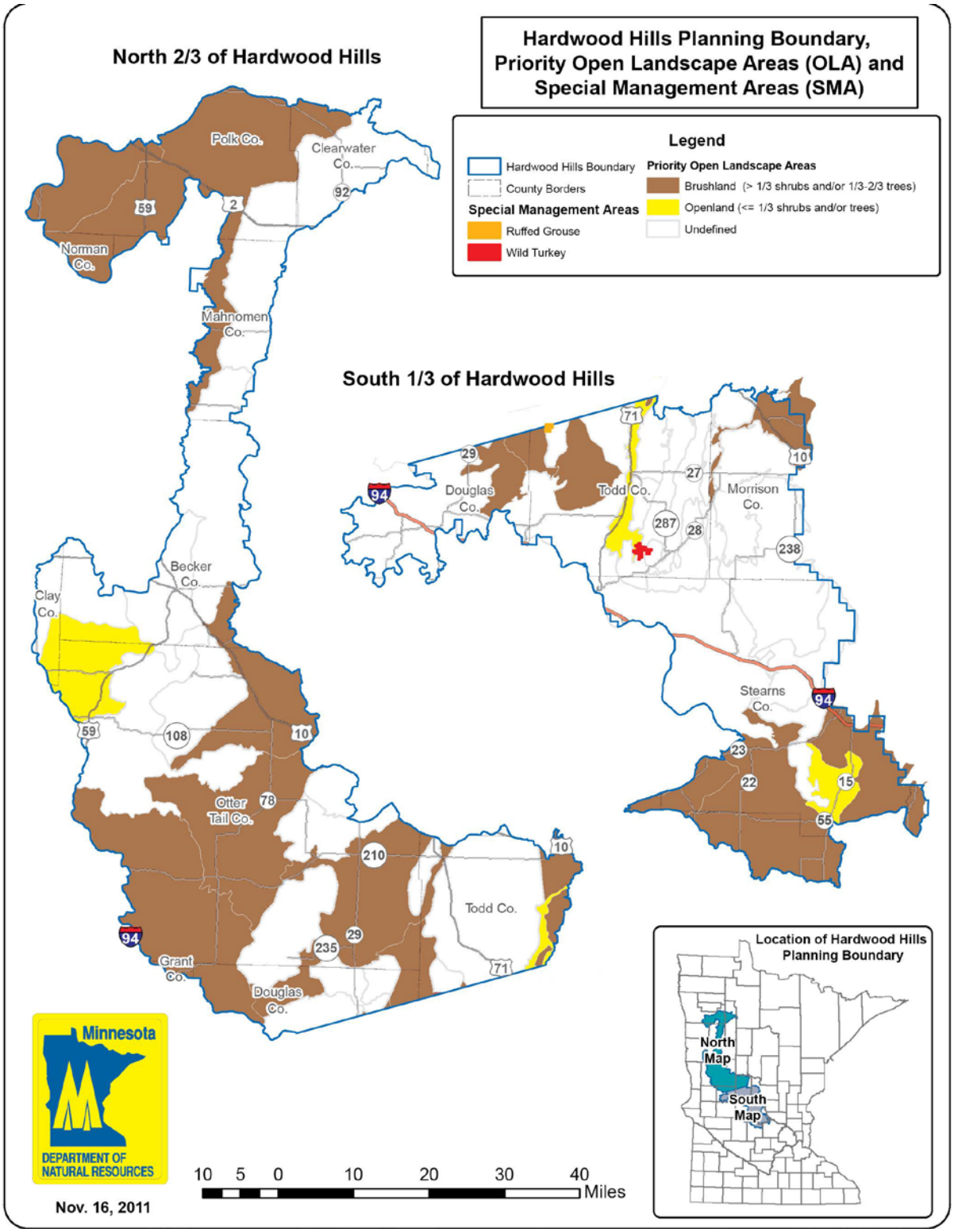
Appendix P - Maps

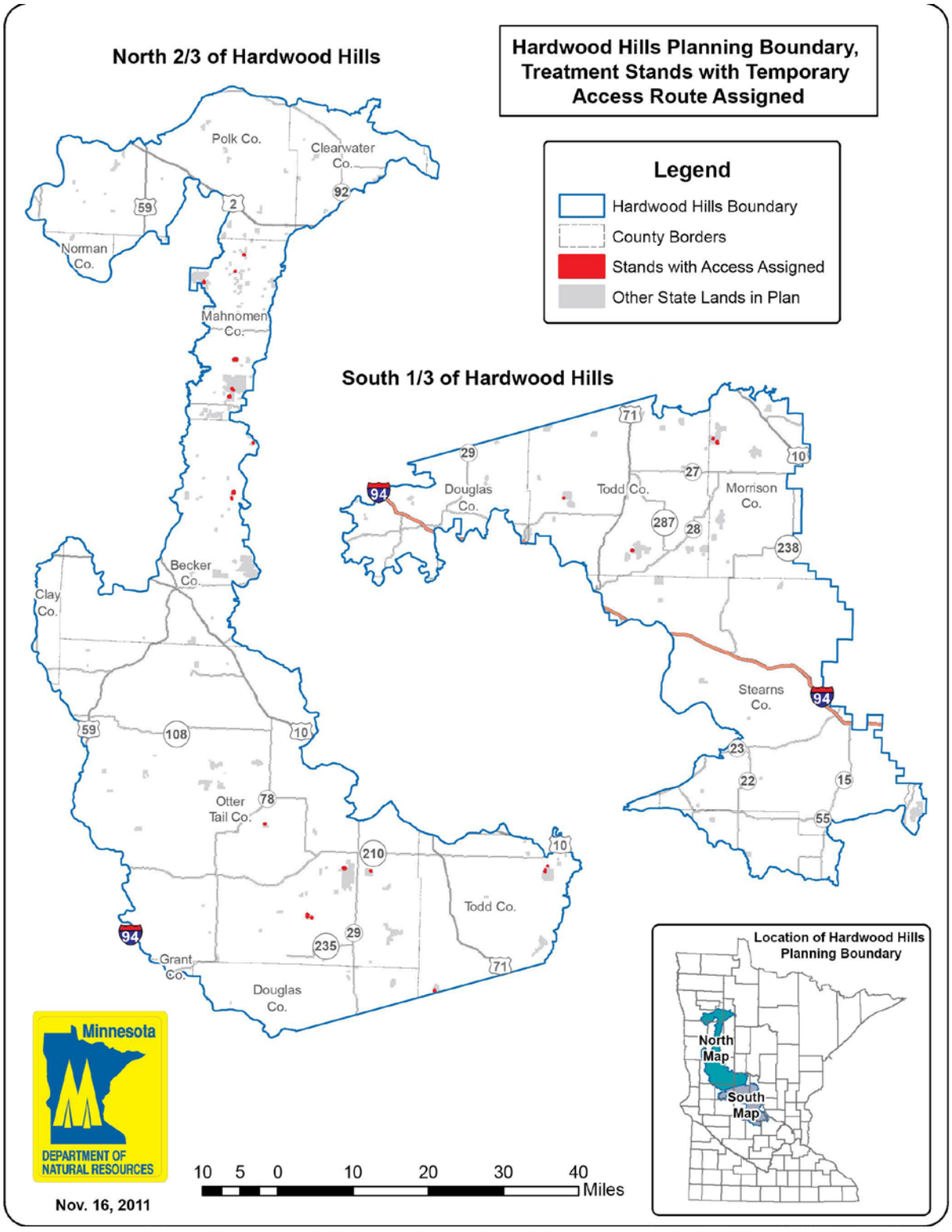
The following maps are found below in this appendix:

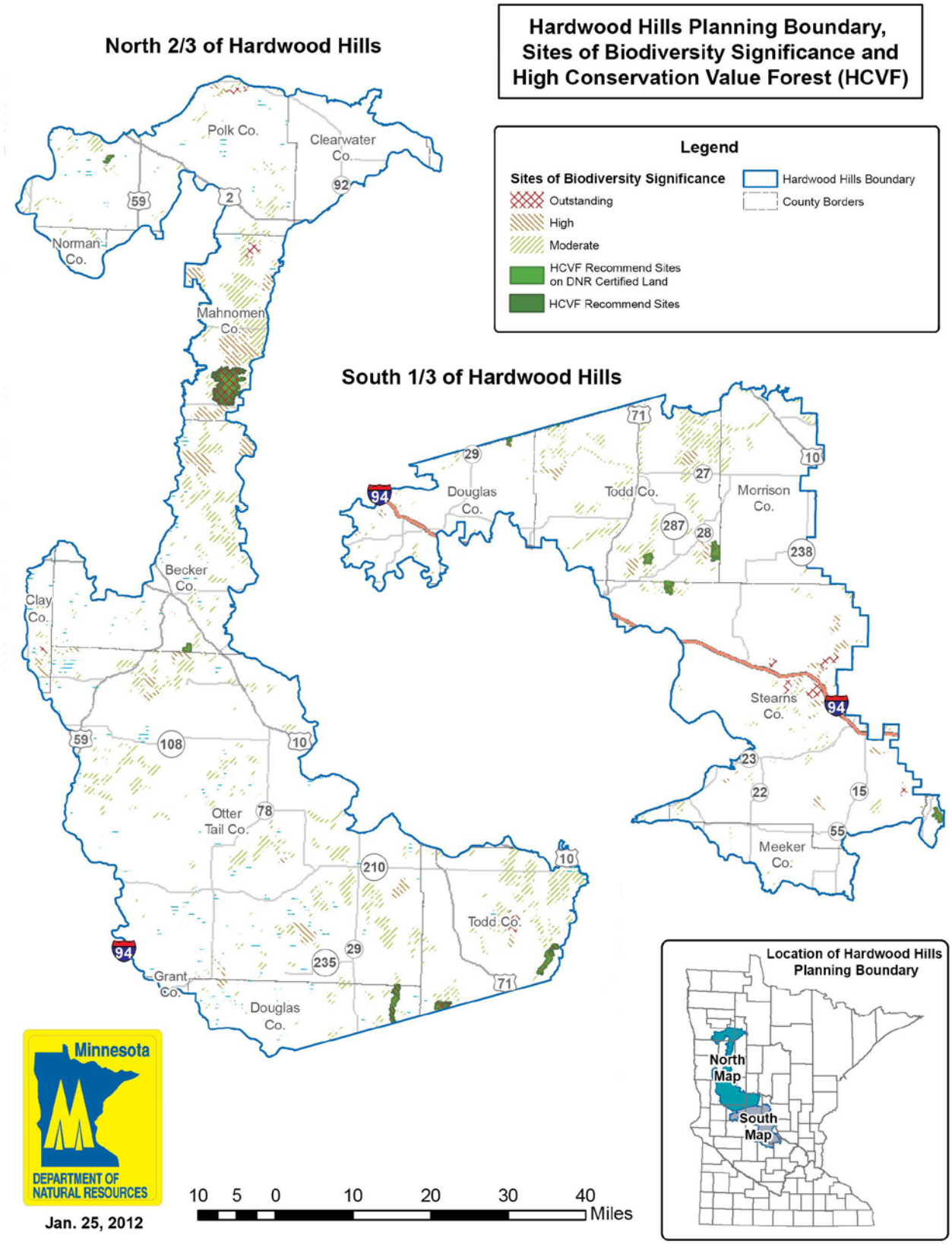

Hardwood Hills Planning Boundary, Generalized Cover Types on Lands Administered by DNR Forestry and Wildlife
North 2/3 of Hardwood Hills
South 1/3 of Hardwood Hills
Legend
Hardwood Hills Boundary
County Borders
Generalized FIM Cover Types
Cover Type Group
Upland Hardwoods
Aspen and Birch
Pines
Spruce - Fir
Lowland Hardwoods
Lowland Conifer
Upland Non-Forest
Lowland Non-Forest
Developed
Water
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
Clay Co.
Becker Co.
Otter Tail Co.
Todd Co.
Douglas Co.
Morrison Co.
Stearns Co.
Meeker Co.
2
59
92
108
10
78
210
29
235
94
71
27
287
238
28
23
22
15
55
Minnesota
DEPARTMENT OF NATURAL RESOURCES
May 24, 2011
10 5 0 10 20 30 40
Miles
Location of Hardwood Hills Planning Boundary
North Map
South Map


Hardwood Hills Planning Boundary, Extended Rotation Forest (ERF), Old Growth and Ecologically Important Lowland Conifer (EILC)
North 2/3 of Hardwood Hills
South 1/3 of Hardwood Hills
Legend
Hardwood Hills Boundary
County Borders
Extended Rotation Forest (ERF)
Old Growth (Including Pending Stands)
Ecologically Important Lowland Conifer (EILC)
Other State Lands in Plan
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
Becker Co.
Clay Co.
Otter Tail Co.
Grant Co.
Douglas Co.
Todd Co.
Morrison Co.
Stearns Co.
Meeker Co.
Minnesota
DEPARTMENT OF NATURAL RESOURCES
Nov. 16, 2011
10 5 0 10 20 30 40 Miles
Location of Hardwood Hills Planning Boundary
North Map
South Map


North 2/3 of Hardwood Hills
Hardwood Hills Planning Boundary,
10 Year Stand Exam List on Lands Administered
by DNR Wildlife and Forestry
Legend
Hardwood Hills Boundary
County Borders
Other State Lands in Plan
Treatment Stands by Cover Type
Aspen/Barn
Balsam Fir
Jack Pine
Northern Hardwoods
Red Pine
Oak
Tamarack
White Spruce
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
South 1/3 of Hardwood Hills
Douglas Co.
Todd Co.
Morrison Co.
Stearns Co.
Meeker Co.
Becker Co.
Clay Co.
Otter Tail Co.
Grant Co.
Douglas Co.
Todd Co.
Location of Hardwood Hills Planning Boundary
North Map
South Map
Minnesota
DEPARTMENT OF NATURAL RESOURCES
Nov. 16, 2011
10 5 0 10 20 30 40 Miles


Hardwood Hills Planning Boundary, Priority Open Landscape Areas (OLA) and Special Management Areas (SMA)
North 2/3 of Hardwood Hills
South 1/3 of Hardwood Hills
Legend
Hardwood Hills Boundary
County Borders
Special Management Areas
Ruffed Grouse
Wild Turkey
Priority Open Landscape Areas
Brushland (> 1/3 shrubs and/or 1/3-2/3 trees)
Openland (<= 1/3 shrubs and/or trees)
Undefined
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
Becker Co.
Clay Co.
Otter Tail Co.
Grant Co.
Douglas Co.
Todd Co.
Morrison Co.
Stearns Co.
Location of Hardwood Hills Planning Boundary
North Map
South Map
Minnesota
DEPARTMENT OF NATURAL RESOURCES
10 5 0 10 20 30 40 Miles
Nov. 16, 2011


North 2/3 of Hardwood Hills
Hardwood Hills Planning Boundary, Treatment Stands with Temporary Access Route Assigned
Legend
Hardwood Hills Boundary
County Borders
Stands with Access Assigned
Other State Lands in Plan
South 1/3 of Hardwood Hills
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
Becker Co.
Clay Co.
Otter Tail Co.
Todd Co.
Grant Co.
Douglas Co.
Douglas Co.
Todd Co.
Morrison Co.
Stearns Co.
Location of Hardwood Hills Planning Boundary
North Map
South Map
Minnesota
DEPARTMENT OF NATURAL RESOURCES
10 5 0 10 20 30 40 Miles
Nov. 16, 2011


Hardwood Hills Planning Boundary, Sites of Biodiversity Significance and High Conservation Value Forest (HCVF)
North 2/3 of Hardwood Hills
South 1/3 of Hardwood Hills
Legend
Sites of Biodiversity Significance
Outstanding
High
Moderate
HCVF Recommend Sites on DNR Certified Land
HCVF Recommend Sites
Hardwood Hills Boundary
County Borders
Polk Co.
Clearwater Co.
Norman Co.
Mahnomen Co.
Becker Co.
Clay Co.
Otter Tail Co.
Grant Co.
Douglas Co.
Todd Co.
Morrison Co.
Stearns Co.
Meeker Co.
Minnesota
DEPARTMENT OF NATURAL RESOURCES
Jan. 25, 2012
10 5 0 10 20 30 40 Miles
Location of Hardwood Hills Planning Boundary
North Map
South Map

Appendix Q – Comments Received and Prepared Responses for the Draft Hardwood Hills Subsection Forest Resources Management Plan

The draft Hardwood Hills (HH) Subsection Forest Resources Management Plan (SFRMP) was released for public review and comment on February 14, 2012. The 30-day comment period ended on March 15, 2012. Comments on the draft plan were accepted via e-mail, letter, or fax.

The DNR received two (2) comment letters from the public during the comment period. Comments were received from the following:

Thomas Kroll - Land Manager and Arboretum Director - Saint John's Abbey and University; And,

Willis Mattison - Osage, Minnesota - Becker County Resource Stewardship Board of Directors - member.

The comments have been summarized, and responses to the comments and any changes to the draft plan resulting from the comments are listed below in this appendix. The DNR would like to thank the interested parties for taking the time to review and comment on the draft SFRMP.

Format of the draft HH SFRMP:

1. Comments were received regarding the format of the draft plan. Specifically, one commenter stated that the draft plan was:

   "… (P)rohibitively foreboding and would be overwhelming to all but the most ardent and dedicated reviewer."

   The commenter also stated that it was very difficult to determine what responses (General Direction Statements (GDSs) and strategies) applied to the various issues identified in the draft plan. The commenter suggested that the entire plan be reformatted to make linkages between the issues and their corresponding GDSs/strategies more clear. The commenter also requested that the draft plan be revised and reissued for public comment.

DNR Response:

The DNR is in the process of updating the Subsection Forest Management Planning (SFRMP) process. Part of this redesign process is a reformatting of the actual subsection plans. The Hardwood Hills SFRMP is one of the first planning efforts to use a draft of the newly formatted plan. One of the goals of the reformat effort was to hopefully increase usability and understandability of the SFRMP's. SFRMP plans are complex due to the fact that they attempt to address multiple objectives for an entire subsection. The current SFRMP format lists identified issues in chapter 2 and their associated General Direction Statements (GDSs) and strategies in chapter 3. The plan could be formatted differently, however this format was used due to the fact that other previous plans had a similar format. It is extremely unfortunate that you found the new format to be difficult to follow. The DNR will continue its efforts at improving the

SFRMPs and will hopefully craft a more user friendly format for use in future planning efforts. However, those SFRMP redesign decisions are outside of the scope of this SFRMP.

Scope of the draft HH SFRMP:

1. Comments were received questioning the scope of the draft SFRMP. Due to the fact that the state administers such a small percentage of lands (<2%) in the Subsection, the commenters questioned how the draft SFRMP could be considered a landscape level plan.
   One commenter stated:

   > "The real problem I feel exists is that despite identifying early on that state lands in the plan were only 1% of the landscape, the plan really only emphasizes those state acres even though it is also intended to cover the condition and management of non-state lands."

DNR Response:

The DNR developed goals and objectives for the Hardwood Hills SFRMP while considering the full landscape for the Hardwood Hills Subsection. However, the Hardwood Hills SFRMP (as with all SFRMPs) is a vegetative management plan designed to guide management decisions on *State administered lands* in the Subsection. This management directive is clearly stated in the Scope of the Subsection Management Plan section contained in the introduction (chapter 1 – page 1.8) of the SFRMP. While it is true that the age class goals (and many other goals) of the draft SFRMP cannot be considered landscape level goals (due to the fact that the State administers such a small percentage of the total lands contained in the Subsection), they remain goals that were established to guide management decisions on the State administered lands in the Subsection. The SFRMP does state that coordination with outside interested parties is encouraged and desired, when mutual goals can be determined and achieved for lands outside of the State's jurisdiction. One part of the SFRMP that specifically attempts to create this coordination and understanding between interested parties is the Priority Open Landscape Areas (Appendix M) of the draft SFRMP. The DNR plans to use this document to inform other land owners in the Subsection interested in developing common goals and strategies to address resource management issues on their lands.

The Minnesota Forest Resources Council (MFRC) oversees a Landscape Program to support a broad perspective and a collaborative approach to sustainable forest management. Central to this program is the establishment of regional committees to solicit the input of diverse forest resource interests within a particular forested landscape. The objective is to have the regional committees collectively identify, discuss, and resolve important locally-based forest resource management issues. The MFRC West-Central Landscape Committee coordinates cross-ownership/interest landscape-level planning for a majority of the Hardwood Hills Subsection's land base. The MFRC West-Central Landscape plan was used as a reference in developing the more detailed SFRMP direction for DNR forest lands in that landscape. For more information about the MFRC West-Central Regional Landscape committee and plan, visit the MFRC web site

at http://www.frc.state.mn.us/initiatives_llm.html or contact Lindberg Ekola, MFRC Landscape Program Manager, at ekola.mfrc @ charter.net

Forestry products bias:

1. A comment was received stating what the commenter believed to be a forestry products bias of the draft plan. The commenter stated:

> "I found the subject plan to be rather narrowly focused on forest product objectives and significantly constrained by demonstrating adherence to stilted production goals based on rather biased re-definition of ecological terms like *biodiversity* and *old growth forests.* By redefining biodiversity in *forestry* terms of *age classes* and *growth stages* instead of ecological concepts of species and habitat diversity the narrative presented in the plan is constricted to various forestry *treatments* which prove to simply be variations on *logging practices* that favor timber products production. *Old growth forest* is redefined in the plan as *Stands that exceed their normal rotation age rather than more conventional ecological definitions of mature forests where tree species are allowed to live through their complete life cycle and actually die natural death ultimately decaying back into and nourishing the forest soils.* Such bias of definition with logging jargon or *old school forestry terms* distracts from more conventional ecological definitions of forest ecosystems where biodiversity refers more to fully functioning biological community structure and filled niches rather than by tree species age or growth stage. This stilted writing style misleads the unsophisticated reader to believing that appropriate safeguards of ecosystem integrity are taken in proper account in the plan. This does not appear to be the case."

DNR Response:

Creation of forest products is one of the many goals contained in the draft SFRMP. Issue B of the SFRMP (page 2.4) describes how forestry management activities have been designed to address issues of biodiversity significance in the Subsection. As stated previously, SFRMP plans are complex due to the fact that they attempt to address multiple objectives for an entire subsection. This SFRMP states in several sections how Native Plant Communities (NPCs) will be used to assist with development of site specific goals on State administered lands. The draft SFRMP contains more than 30 references providing guidance on how NPCs should be used to inform decisions made on managing stands in the Subsection. For example: the decision whether or not to convert a stand to another cover type may be suggested through the planning process, but will be determined when the stand is field visited. The outcome of a NPC-ECS field evaluation will determine the appropriate species conversions; This GDS (1A) differs from GDS-1B in that it emphasizes managing for the suite of species, growth stages, and disturbance regimes appropriate to the NPC class or type identified using the NPC Field Guide. Whereas GDS-1B emphasizes species, age, and structural diversity in and of itself without direct connection to the native plant community; etc.).

The DNR also has a formal policy directive guiding management on State administered lands that have been identified as High Conservation Value Forest (HCVF). These lands have been designated HCVF based initially on their Minnesota County Biological Survey (MCBS) biodiversity significance rankings. The necessary criteria include: a combination or concentration of High Conservation Values (HCVs) on the site, the site containing some of the best known examples of an identified HCV or combination of HCVs in the Subsection, and DNR ownership within the site being adequate to maintain or enhance the identified HCVs. The policy directive states that management on lands defined as HCVF must consider the biodiversity significance criteria and ensure that the biodiversity significance of each criterion is maintained or enhanced post management.

In addition, the DNR believes that the commenter has misinterpreted the definitions of old forest and old-growth forest contained in the draft SFRMP. The commenter states that old-growth forest had been redefined as stands that exceed their normal rotation age. This is not an accurate interpretation. Old forest is simply defined in the draft plan as stands that exceed their normal rotation age while old-growth forest is defined as: "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 Forests Guideline* (1994) and amendments. It is also important to point out that while management is allowed in old forest stands, stands that have been designated as old-growth stands (or potential old-growth stands) remain protected until delisted or released. Potential old-growth stands will be reviewed in the future and a final determination will be made to include the stands as old-growth or release the stands for management. These stands will not be managed until a final determination has been made regarding their old-growth status.

Coordination with interested parties (external):

A comment was received regarding coordination between the DNR and interested parties outside of the DNR. Specifically the commenter questioned whether such coordination is likely to take place:

> "In Section N1 the plan calls for coordination across ownership boundaries but the intent to do this coordination is not supported by any specific action. The statement that: *Every attempt will be made to coordinate with other land owners in the subsection* is an empty commitment meaning virtually nothing. Without specific coordination goals objectives and detailed strategies this *coordination* will likely not be effectively accomplished if done at all. The result will be as predicted in the issue statement. This section needs to be expanded with commitment to specific actions that have been demonstrated as effective."

The commenter went on to state:

1. "… Of these, probably the most egregious deficiency of the plan is the failure to assess the overall cumulative effects of the implementation of these divergent resource use planning activities not only at the watershed level but at the ecosystem level as well. Ecologists have known and have consistently admonished natural resource managers that management activities applied to the land and water have cumulative ripple effects throughout the ecosystem. For at least several decades now the MDNR has publically touted its ever increasing acknowledgement of this ecological principle and pledged the Department's intentions to manage that state resources with a more comprehensive and holistic systems approach. The term *ecosystem based management* was often held out as a reflection of this high MDNR management goal. The draft HH SFRMP represents a failure of the Department to live up to that pledge."

In addition, the commenter stated:

> The plan cites two other plans or *agendas A Strategic Conservation (Agenda) 2009-2012 and Tomorrow's Habitat for the Wild and Rare: an Action Plan for Minnesota Wildlife* as evidence that there is coordination across ownership boundaries but fails to point out a single example of how this *coordination* is actually accomplished in practice. It is confounding to a citizen observer that the MDNR's Division of Forestry can unilaterally excuse itself from the obvious need to coordinate its forest management plans externally with adjoining land owners or internally with other MDNR Division and Sections that have impact and possibly conflicting and cumulative impacts on the same natural resource in their trust. Operating at cross purposed or conflicting impact by decisions within the Department and without consideration for adjoining landowner's goals and activities can at very least be a waste of effort and at worst can have cumulative adverse effects on the resource, and most of it at taxpayer expense."

DNR Response:

> The DNR is interested in coordinating forest management activities between the Department and any outside party where mutual goals and objectives can be met. The draft plan stated: 'Every attempt will be made to coordinate management activities with other land owners in the Subsection." The DNR believes that considering current staffing levels (as well as likely future staffing) that the draft plan may have overstated the DNRs ability to coordinate with outside interests. The DNR remains committed to coordinate management activities with outside interests "to the extent possible in the future". The two plans mentioned in the comments above as well as the Priority Open Landscape Areas management agreement (as stated previously) were designed to assist with creation of common goals between interested parties throughout the State. Due to the reasons stated above the draft plan has been revised on page 2.30 (other jurisdictions) to reflect the DNRs commitment to work with outside interests.
>
> Implementation of the draft SFRMP will be accomplished by management activities coordinated by DNR staff located in the Subsection. Coordination of the SFMRP management activities beyond State administered lands ultimately resides with these area staff forming partnerships

with other entities in their representative area. The DNR has experienced significant reductions in staffing at the field and programmatic level that are likely to continue for some time. This reduction in staffing has forced the Department to reprioritize our work, thus making it very challenging to maintain, let alone increase, current coordination efforts across the landscape.

In addition the DNR has reviewed the MFRC's landscape level plans for the area and has attempted to incorporate goals from those planning documents. As other opportunities arise, the DNR will continue to attempt to coordinate management across all ownerships in the Subsection.

Coordination with interested parties (internal):

1. A comment was received regarding coordination with-in the DNR. Specifically the commenter stated:

   "It is very disconcerting that the MDNR staff has decided that internal coordination of important resource management planning activities affecting ecosystem integrity and health are beyond the scope of this plan. This inexplicable decision by the MDNR means that the current plan excludes any consideration for impacts … of the Department's planning activities listed below. Each of these MDNR planning activities determine, direct and/or control competing uses for public forest lands. The impacts of these competing uses often can and do conflict with the goals and objectives of the current plan. Some of these uses may actually have the potential to offset or completely negate the strategies in the SFRM plan. These planning activities include:

   1. Off-Highway-Vehicle Trail system planning;
   2. Comprehensive road access plan;
   3. State Park land management planning;
   4. Old-growth forest designation;
   5. Scientific and Natural Area (SNA) establishment;
   6. Wilderness designation;
   7. Wildlife population goals;
   8. Cumulative effects analysis at the watershed level;
   9. Fire management; and,
   10. Recreation facilities management.

DNR Response:

The DNR acknowledges the fact that the activities listed in the comment do affect the forest throughout the State. However, the DNR has made a conscious effort to separate many of the planning efforts for these various activities from the SFRMP process. The SFRMP is not intended to be a comprehensive resource management plan that addresses all of the planning efforts conducted by the Department under one guidance document or plan. Many DNR staff who are involved with the SFRMP planning process are also involved with the other planning efforts listed in the comment. Even though these

planning efforts may be separate, staff that are involved in multiple planning efforts use their knowledge of those planning activities to inform decisions that are made for the HH SFRMP.

A great deal of coordination has taken place within the Department (i.e. Interdivisional coordination between DNR Divisions of Forestry, Ecological and Water Resources and the Section of Wildlife.) The Hardwood Hills SFRMP Team contained representation from all of the disciplines listed above. In addition, the SFRMP Team sought advice from additional members of each Division when the team deemed it necessary during the planning process. Lastly, the DNR has an official policy detailing interdisciplinary coordination between the Divisions of Forestry, Ecological and Water Resources and Fish and Wildlife. DNR staff involved in vegetation management planning are also involved in other planning efforts that address most of the activities listed in the comment. These efforts require interdivisional coordination on a frequent basis. The DNR tracks that coordination between Divisions on an annual basis. The guidance document for implementing the policy attempts to ensure that all interested internal (DNR) staff have an opportunity to provide input/direction for resource management activities on State administered lands. A majority of lands in the Subsection are administered by the Section of Wildlife. Department guidance documents require that all land managers coordinate project management activities with other DNR Divisions. This coordination is frequent and on-going.

Failure to address cumulative impacts on a watershed/sub-watershed level:

1. Comments were received regarding the fact that the plan states that addressing cumulative impacts of forest management on a watershed and/or sub-watershed level is beyond the scope of this planning effort. Specifically one commenter stated:

   > "… The claim that such landscape level management is beyond the scope of the SFRM(P) is an admission on the part of the MDNR that it is systematically unwilling or unable to coordinate with private landowners, local, state, federal and/or tribal governments to strive for improvements toward ecosystem based management through cooperation. A less-than-convincing argument is offered in the plan claiming that uniform evaluation of cumulative effects is not feasible because definitions of *young forests* and threshold amounts of young forests and open forests have not yet been established. Young forests and forest openings are most often associated with species specific wildlife and managed age forest logging criteria. These definitions are not necessary for establishing cumulative impact assessments. A biological reference indicator can be established for a fully functioning forest community. A defensible attempt at cumulative impact criteria could be developed for incremental departures from this indicator based on a degraded acreage per management unit basis no matter what private of public entity was managing the component parcels.
   >
   > This attempt at assessing cumulative impacts may be a bold departure from past practice and efforts at doing so are not yet well established in the literature. However, Minnesota has long prided itself as being a leader in many areas of resource

management and environmental protection measures so this only represents but another leadership challenge that committed resource managers might accomplish if they had the inclination to do so. The plan seems to abrogate that responsibility committing only to cooperate or participate in this effort by some other entity. And then this commitment is conditioned on prerequisite development of a *uniform* cumulative impact monitoring process by someone else. This is unacceptable. The MDNR has lead responsibility for providing the best method of assessing these cumulative impacts and then using it. The method can always be improved upon with practice but refusing to assess the impacts because the department refuses to develop methods does not serve the citizens of Minnesota or the forest resources very well at all."

DNR Response:

The DNR agrees with the comment that coordinating management activities across ownerships in order to ensure integrity of watersheds and sub-watersheds in the Subsection is an admirable goal in many forested landscapes. In fact, the DNR attempts to minimize impacts on watersheds in their regular management activities on state administered lands in the Subsection through implementation of MFRC site-level forest management guidelines that ensure application of best management practices for aquatic resource protection. However, the fact remains that the State administers too little land in the Subsection (<2%), and the Department believes this precludes the ability to effectively address cumulative impacts on watersheds in the Subsection within the scope of the SFRMP. As stated previously, the DNR is interested in coordinating common goals and objectives for resource management activities with all interested parties whenever common goals and objectives can be attained and will pursue that end whenever possible.

The DNR would also like to point out that the State is currently in the process of developing policies and actions to safeguard the watersheds contained in the State. This planning process is called the Watershed Restoration and Protection (WRAP). The planning effort is being led by the State's Pollution Control Agency with participation from several local, county, state and federal government entities participating in the planning effort (including the DNR). Any tools or methodologies that are developed as a part of that planning process could be incorporated into the DNR SFRMP process as appropriate in the future.

Climate change:

A comment was received stating that the plan did not adequately address issues related to climate change in the Subsection. Specifically the commenter stated:

1. "… Furthermore, the HHSFRMP is particularly devoid of any strategies to respond to predictable impacts of climate change on the forest ecosystems in the planning area. There are opportunities to create forest migration corridors that may provide increase(d) probability of

important species and biological community survival with the onset of climate change that should be included in the plan."

The commenter goes on to describe their desire for the DNR to commit to a *Forest Stewardship Summit* with other property owners (in the northeast section of Becker County).

2. "The purpose of the summit would be to provide a public forum where the opportunities for protecting and restoring the biodiversity that still exists in this migratory corridor could be identified. If the various government and private entities could establish common goals and consistent forest stewardship policies and practices for the corridor a larger contiguous forest ecosystem could be re-established in the area. The benefits to the species of importance, the preservation of biological communities found here, the increased resilience of the larger diverse forest ecosystem as important ecological buttress or adaption against the stresses of climate change.

   If the MDNR would commit to participate in the proposed forest stewardship dialogue for this portion of the HHSFRMP the *forest stewardship summit* described above could be added to the SFRM Plan as a specific strategy to realize the coordination across ownership lines that was identified as a need in the plan but was not well developed there. It is the fervent request of this reviewer as a citizen and a member of the Becker County Resource Stewardship Board of Directors that the MDNR amend the draft HHSFRMP to recognize the opportunity for desired intergovernmental cooperation across property boundaries represented by this proposal. This summit could mark an important milestone in intergovernmental efforts in Minnesota to achieve the necessary impetus for protection, preservation and restoration of forests with biodiversity or statewide significance."

DNR Response:

The DNR believes that SFRMP strategies to create a more healthy and diverse forest (i.e., structure, composition and spatially) are congruent with many of the climate change adaptation strategies that are being forwarded at this point in time. For example, the DNR has stated in GDS-8; item c (page 3.76) how maintaining connectivity that permits the migration of plants and animals in a changing climate is a goal of this SFRMP.

The DNR (as well as other natural resource agencies and organizations) is engaged in tracking climate change issues, legislation, and the scientific literature as a basis for developing recommendations and coordinating activities for mitigating and/or adapting to the effects of climate change on natural resources. As part of this ongoing effort, the DNR is currently involved in several climate change mitigation and adaptation initiatives. A couple examples are:

- The DNR is participating in an MFRC effort to develop a Climate Change Response Framework (CCRF) for northern Minnesota. The CCRF is a collaborative effort among scientists, managers, and landowners to inform, communicate, and apply the results of several related climate change assessments. The overall goal of the CCRF is to identify broad strategies and more specific approaches to climate change adaptation for forest

ecosystems in northern Minnesota, and help forest managers apply these approaches across all ownerships;

To learn more about the CCRF please visit the MFRC's site at the link below: http://www.frc.state.mn.us/initiatives_policy_carbon.html

- The DNR has formed a Climate and Renewable Energy Steering Team (Team) to provide agency-wide coordination and guidance on climate change and renewable energy strategies. The Team has created a framework for integrating and improving climate change and renewable energy strategies as they are developed over time.

The HH SFRMP Team will integrate additional climate change adaptation strategies into our planning efforts, if appropriate, as they continue to develop and evolve over time.

The commenter goes on to state that the DNR should participate in a "summit" with various property owners in order to create and/or improve corridors in the northeast section of Becker County that may facilitate wildlife and plant movement to cope with a changing climate. The commenter asks that the DNR list the results of this summit in the draft plan prior to its implementation.

As stated previously, the DNR is interested in developing partnerships with all interested parties in the Subsection whenever common goals and objectives between the interested parties can be developed, however the DNR is not able to delay implementation of this SFRMP. It should be noted that the DNR updates SFRMP plans over time. If and when a summit is held, the outcomes of the summit can be incorporated in management decisions in the Subsection at that time.