

# *Forest Resource Management Plan*



## *North Central Landscape*

**Minnesota Forest Resources Council**

**March 25, 2003**

**Amended January 27, 2004**



Minnesota Forest Resources Council (MFRC)

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Document Prepared By: North Central Regional Landscape Committee.



# Table of Contents

<b>Section</b>	<b>Title</b>	<b>Page</b>
<i>Part 1: Where have we been and where are we today?</i>		
<b>1</b>	<b>Introduction</b>	<b>1 – 1</b>
	Sustainable Forest Resources Act	1 – 1
	Regional Forest Resources Committees	1 – 2
<b>2</b>	<b>Process Summary</b>	<b>2 – 1</b>
	Formation of the North Central Regional Landscape Committee	2 – 1
	Planning Process Overview	2 – 1
<b>3</b>	<b>Assessment Information</b>	<b>3 – 1</b>
	Current Trends and Conditions Assessment	3 – 1
	Issue Identification	3 – 1
	Ecological Analysis	3 – 2
<b>4</b>	<b>Decision Process</b>	<b>4 – 1</b>
<i>Part 2: Where do we want to go?</i>		
<b>5</b>	<b>Recommended Desired Outcomes, Goals and Strategies</b>	<b>5 – 1</b>
	Desired Future Forest Condition	5 – 1
	Recommended Goals and Strategies	5 – 2
	Boreal Hardwood-Conifer (1,324,000 acres; 26% of the landscape)	5 – 3
	Dry-Mesic Pine (654,000 acres; 13% of plant community)	5 – 4
	Mesic-Northern Hardwoods (188,000 acres; 4% of plant community)	5 – 5
	Dry-Mesic Pine-Oak (1,582,000 acres; 31% of plant community)	5 – 7
	Dry Pine (245,000 acres; 5% of plant community)	5 – 8

<b>Section</b>	<b>Title</b>	<b>Page</b>
	<i>Part 3: How will we get there?</i>	
<b>6</b>	<b>Coordination Framework</b>	<b>6 – 1</b>
<b>7</b>	<b>Monitoring Framework</b>	<b>7 – 1</b>
<b>8</b>	<b>References</b>	<b>8 – 1</b>
<b>9</b>	<b>Appendix</b>	<b>9 – 1</b>

## Section 1 Introduction

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### A. Sustainable Forest Resources Act

The Minnesota State Legislature enacted the Sustainable Forest Resources Act (Minn. Statutes, Chapter 89A) in 1995, which established the MN Forest Resource Council (MFRC) and formalized the state's policy to:

- pursue the sustainable management, use, and protection of the state's forest resources to achieve the state's economic, environmental, and social goals;
- encourage cooperation and collaboration between public and private sectors in the management of the state's forest resources;
- recognize and consider forest resource issues, concerns, and impacts at the site and landscape levels;
- recognize the broad array of perspectives regarding the management, use, and protection of the state's forest resources and establish processes and mechanisms that seek and incorporate these perspectives in the planning and management of the state's forest resources.

The purpose of the MFRC is to develop recommendations to the Governor and to federal, state, county and local governments with respect to policies that result in sustainable management of forests in the state. The policies must:

- acknowledge the interactions of complex sustainable forest resources, multiple ownership patterns, and local to international economic forces;
- give equal consideration to the long-term economic ecological, and social needs and limits of the state's resources;
- foster productivity of the state's forests to provide a diversity of sustainable benefits as site and landscape levels;
- enhance the ability of the state's forest resources to provide future benefits and services;
- foster no net loss of forest land;

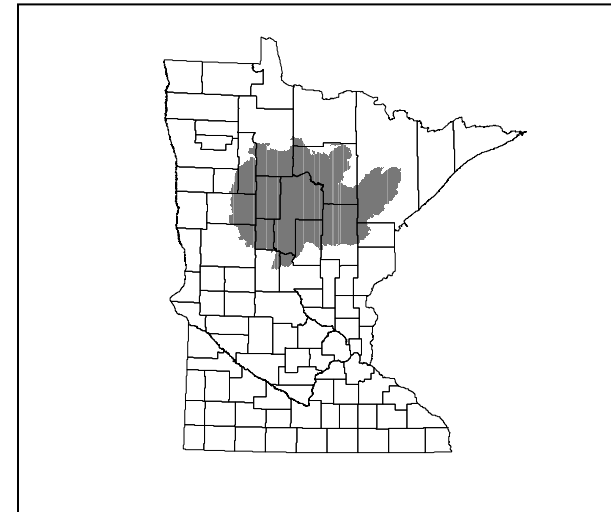
- encourage appropriate mixes of forest cover types and age classes within landscapes to promote biological diversity and viable forest-dependent fish and wildlife habitats;
- encourage collaboration and coordination with multiple constituencies in planning and managing the state’s forest resources; and
- address the environmental impacts and implement mitigations as recommended in the *Generic Environmental Impact Statement on Timber Harvesting and Forest Management*.

## B. Regional Forest Resources Committees

The MFRC Landscape Program establishes landscape committees on a regional basis to implement these state policies at the landscape level throughout the State.

The North Central Landscape Region includes Itasca, Aitkin, Cass, Becker, Clearwater, Crow Wing, Hubbard, Mahanomen, east half of Polk and south half of Beltrami counties (approximately 8.3 million acres). The North Central Landscape Regional Committee (the Committee) was organized in June, 2000 and began working to find agreement on how best to achieve long-term forest sustainability by determining the desired future forest conditions and developing goals and strategies to achieve the agreed-upon desired future conditions.

According to participants, the landscape planning processes have developed useful scientific approaches and information and valuable tools for landscape assessment; fostered working relationships with a diverse set of people; produced landscape direction for agencies and other landowners on a voluntary basis; developed strategies for implementing this landscape direction; and facilitated better communication between diverse groups. Also, the landscape planning processes have helped land managers recognize that individual land management choices must be viewed in the context of those of their neighbors and that the multiple management



objectives of the various land managers can provide for a diverse and balanced landscape condition in terms of ecological health and biodiversity.

This report summarizes the work of the North Central Regional Landscape Committee from 2000 through 2003.

## Section 2

### Process Summary

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This section provides an overview of the process used to develop this Plan as well as a brief description of the resources and documents that support the Committee's conclusions and recommendations.

#### **A. Formation of the North Central Regional Landscape Committee**

The Committee was organized in June of 2000 with 70 people expressing interest in participating. Currently there are over 40 people on the mailing list and a core, active group of 20-25 attending bi-monthly, all day meetings (see table to the right for mailing list). Small ad-hoc groups of committee members are used for specific tasks as needed.

#### **B. Planning Process Overview**

The Committee learned from the experience of the Northeast Regional Landscape Committee and as a result was able to complete the process in a shorter timeframe. Also, the Committee was able to apply the technical knowledge gained about landscape analysis in the Northeast Landscape Region to the North Central Landscape Region. Early in the process the Committee chose to concentrate on the first two bullets of the desired future forest condition statement and to follow an ecological approach based on native plant communities. Also, the Committee decided complete the ecological analysis first and then determine the economic impact of any proposed changes. The Committee did not develop explicit social and economic goals.

The Committee did not complete the goals and strategies for the third bullet of their desired future forest condition statement in time for the March 25, 2003, timeline for Council approval. Rather than delay the review and approval of the goals and strategies for the first two bullets, the North Central Committee decided to amend the plan once the third bullet goals and strategies were completed.



## Section 3 Assessment Information



### A. Current Trends and Conditions Assessment

Existing information on the social, ecological and economic aspects of the landscape was compiled by staff prior to organizing the Committee. This assessment served as a starting point for discussion, definition of new information, and initial issue identification (refer to MFRC web site, at [www.frc.state.mn.us](http://www.frc.state.mn.us) for the assessment).

### B. Issue Identification

Participants were asked to identify their highest priority issues when they decided to become a member of the Committee. The issues, grouped into broad categories, are summarized in the table below (number indicates how many individual people were concerned with that issue):

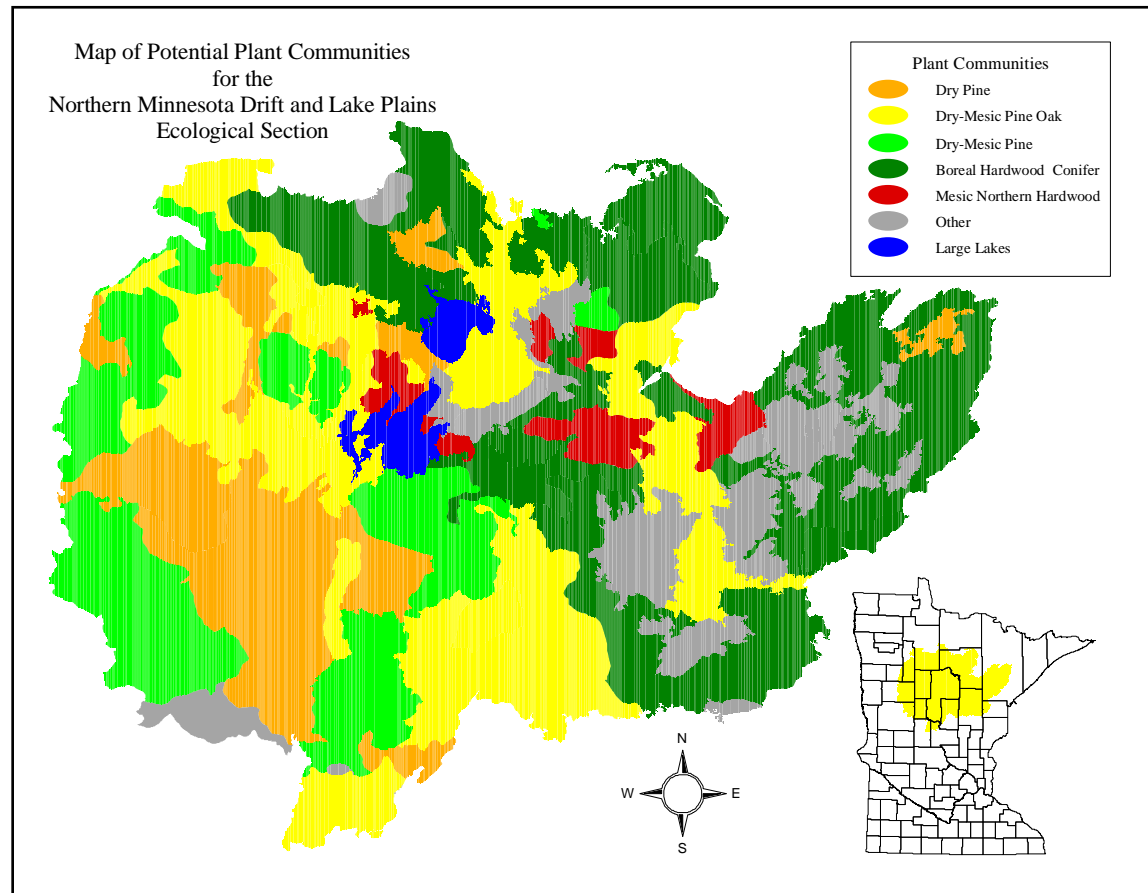
Fragmentation of Landscape by Development	<ul style="list-style-type: none"> <li>• Land taken out of production due to housing starts (3)</li> <li>• Fragmentation of forests</li> </ul>
Development of Riparian Corridors	<ul style="list-style-type: none"> <li>• Water quality (2)</li> <li>• Riparian and watershed management (2)</li> </ul>
Ecosystem Sustainability	<ul style="list-style-type: none"> <li>• Concerned about future sustainability of forests in regards to forest products, recreation, biodiversity and habitat preservation. (9)</li> <li>• Maintain forest health (2)</li> <li>• Maintain a broad distribution of species on landscape (10)</li> <li>• Public perception of biodiversity</li> <li>• Maintain healthy wildlife populations (2)</li> <li>• Old growth forestry (2)</li> </ul>

	<ul style="list-style-type: none"> <li>• Fire suppression greatly reduces the natural role of fire</li> </ul>
Harvest Level Sustainability	<ul style="list-style-type: none"> <li>• Level of timber harvest (10)</li> <li>• Increased forest productivity (2)</li> </ul>

**C. Ecological Analysis**

UPM Kymmene Paper Company, with support from the MFRC, led the effort to consolidate public and some private forest inventory data across the landscape. This covered approximately half of the landscape. Frelich modeled the landscape age structure of different forest types in the Drift and Lake Plains Section of north central Minnesota under the natural disturbance regime in effect during pre-settlement times (1600-1900), and using recent studies of disturbance ecology (Frelich 2002). He based the forest types on data from land surveyor records and a recent classification of the new native plant communities by Minnesota DNR Natural Heritage and County Biological Survey staff. Eight plant communities were described (see appendix 2 for Frelich model description). The plant community map represents the ecological potential of the area; it does not represent what forest cover types are currently occupying the area. Refer to appendix 9 for a detailed description of each plant community (see map).

**Potential Ecological Plant Communities**  
(adapted from L. E. Frelich model - refer to appendix 2)



The data was analyzed by comparing current composition with historical composition as well as the range of natural variation (appendix 2, 3). Using this information as a guide, four ad-hoc groups developed alternative management goals and strategies for the five upland native plant communities. The Committee combined the results from the four groups into two and finally into one recommended set of goals and strategies for each plant community in the landscape.

In October, 2001 an ecological analysis for all ownerships in the Northern Drift and Lake Plains section landscape was completed at the Natural Resources Research Institute (NRRI) using the same methodologies developed for the Northeast Landscape Region (appendix 4, 5, 6).

The ecological analysis of the North Central Landscape Region did not include a spatial analysis of recommended patch sizes or how vegetation is spatially located on the landscape. This aspect of the ecological analysis is being conducted by the MFRC “Spatial Analysis Project”. The project is scheduled for completion in June, 2003. It will produce a variety of models and tools to begin to analyze spatial patterns on the landscape. The Committee will then decide how to conduct a spatial analysis for the Landscape.

### **Economic Impacts of Recommended Management Strategies**

An analysis of the overall economy of northern Minnesota, published in July 2001 by Lichty et al., found that the region is economically diverse (appendix 7). While very dependent on natural resources, primarily the mining and forest product industries, a significant share of the region’s economy is provided by the tourism industry, services, and government, followed by manufacturing, trade, and construction.

The UMD Bureau of Business and Economic Research (BBER) modeled potential impacts to the current economy of north central Minnesota if the wood supply were to change in volume and species mix due to ecological considerations (appendix 8). The study analyzed possible bottlenecks for forest products industries if appropriate species of trees are not available. The project analyzed various scenarios, both long term (15 years) and short term, to determine the impact from changing forest species mixes on the paper industry as well as on other wood product industries. BBER used the economic modeling software and data system known as IMPLAN to show bottlenecks in supply given changes in demand.

For north central Minnesota, five scenarios were modeled in addition to the current harvest level. Current harvest volume was determined by using three year averages of data collected by DNR mill surveys and growth data from 1990 (*Input data for IMPLAN Model*, Chad Skally June 12, 2002, Revised July 9, 2002).

- **Scenario 1:** Moving landscape toward desired forest conditions.
- **Scenario 2:** Harvest levels are above scenario 1 for the next 10-20 years, then decline; landscape moving toward desired forest conditions.
- **Scenario 3:** Total growth minus mortality based on 1990 FIA data.
- **Scenario 4:** Total growth minus 50% of the mortality based on 1990 FIA data.
- **Scenario 5:** Harvest all annual growth for all species; assumes all mortality is captured.

## Section 4

### Decision Process

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The Committee could not come to complete agreement on two points – use of the range of natural variation as tool and having specific, measurable targets to define the rate of movement toward the desired future forest condition over a specific time frame. Recommendations on these two points were referred to the Council’s Landscape Committee.

The Landscape Committee recommended the following:

- The North Central Regional Committee met the requirement of the Sustainable Forest Resources Act by describing current forest conditions, by reaching agreement on the long term “appropriate mix of species and age classes” and by developing draft regional goals and strategies for five major forest plant communities within each landscape.
- Not to have specific measurements as part of landscape goals, but that a high quality monitoring system is needed at five-year intervals to measure progress and analyze the rate of change relative to the landscape goals and strategies, as well as to measure long-term progress toward desired conditions.
- The historical context (Range of Natural Variation) be used as the benchmark and the current condition as a baseline. Each five-year assessment will use the current condition as a baseline and measure it against the RNV benchmark. Rate of change will be a comparison with the previous five-year baseline to the current five year baseline.

#### Plan Amendment

The Committee established a small working group to develop a draft of the goals and strategies for the third bullet. The working group circulated the draft for full Committee comment and then to the Council’s Landscape Committee for comment before it was recommended for approval. The Council approved the amendment to the plan at the January 27, 2004 Council Meeting.

## Section 5

### Recommended Desired Outcomes, Goals, and Strategies

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#### A. Desired Future Forest Condition

The future forest of the NC landscape will have the following characteristics when compared to the current forests of the year 2000:

- There will be an increased component of red, white and jack pine, cedar, tamarack, spruce and fir.
- The forest will have a range of species, patch sizes, and age classes that more closely resemble natural patterns and functions within this landscape.
- The amount of forestland and timberland will not decrease using FIA definitions for timberland and forestland. Large blocks of contiguous forest land that have minimal inclusion of conflicting land uses will be created and/or retained for natural resource and ecological benefits and to minimize land use conflicts

#### **Amended January 27, 2004:**

Modified the third bullet to read as follows:

- The amount of forestland and timberland will not decrease using FIA definitions for timberland and forestland. Large blocks of contiguous forest land that have minimal inclusion of conflicting land uses will be created and/or retained for natural resource and ecological benefits and to minimize land use conflicts (hereafter referred to as “natural resource emphasis areas”).

Added a fourth bullet to the Desired Future Forest Condition Statement:

- In large blocks of contiguous forestland retain critical natural shoreline on lakes for scenic, wildlife, water quality and other natural resource values.

## **B. Recommended Goals and Strategies**

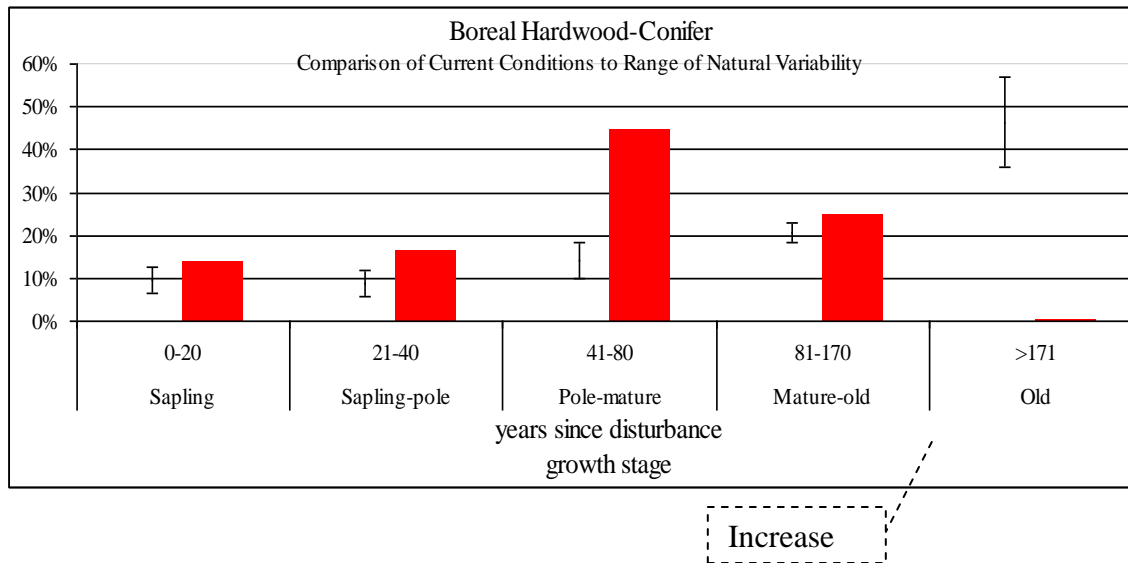
The following recommended goals and strategies are for the long-term (100+ years) management of the North Central Landscape Region and relate directly to the first two bullet statement of the desired future forest condition:

- There will be an increased component of red, white and jack pine, cedar, tamarack, spruce and fir.
- The forest will have a range of species, patch sizes, and age classes that more closely resemble natural patterns and functions within this landscape.

**Boreal Hardwood-Conifer (1,324,000 acres; 26% of the landscape)**

Long - term Goals:

- Increase >171 year growth stage.
- Restore historic components of white pine, upland tamarack and cedar; include spruce/fir
- Maintain a substantial amount in even-age aspen
- Emphasize mixed stands of spruce, balsam fir, aspen, birch, red maple in the plant community.



Strategies:

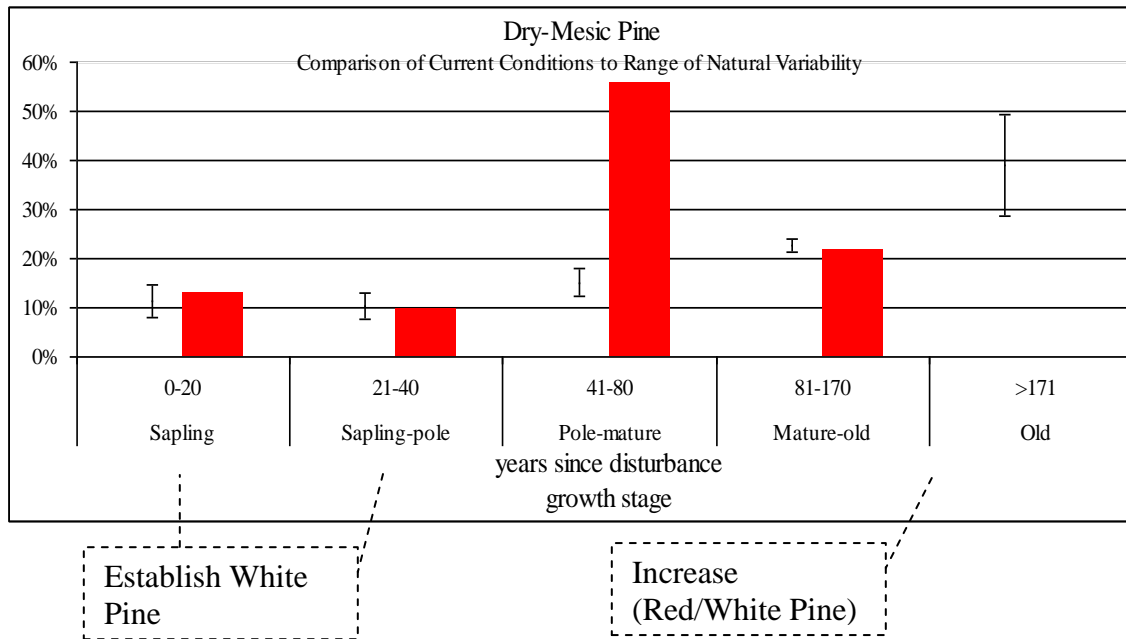
- Underplant aspen with white pine, balsam fir, white spruce in the 21-40 year growth stage.
- Examine aspen stands over 70 years of age for natural conifer regeneration, access difficulty, local soil and edaphic conditions and other evidence that suggests the stand should be advanced to later successional stages - those lacking these traits should be regenerated to aspen type.
- Focus short-term management on 81+ old aspen (70-100).
- Perform shelterwood harvests in old northern hardwood stands and underplant white spruce, pines and upland tamarack.



**Dry-Mesic Pine (654,000 acres; 13% of plant community)**

Long-term Goals:

- Increase red and white pine and tamarack
- Increase >171+ year growth stages
- Increase oak/hardwood composition



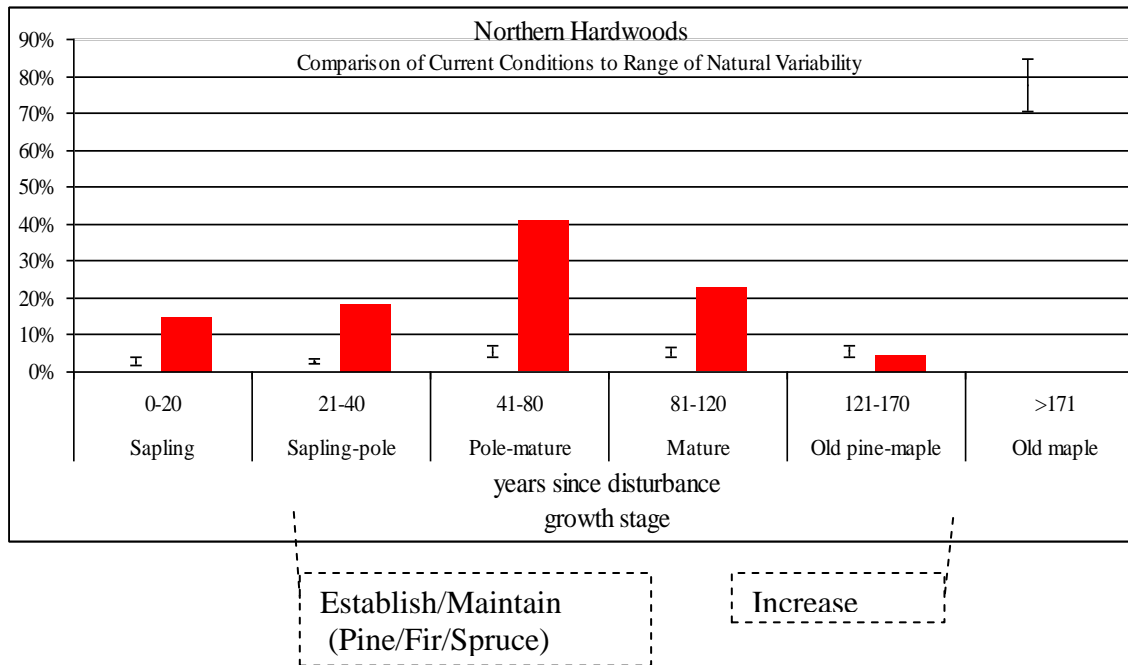
Strategies:

- Restore white pine in aspen stands in the 41-80 year growth stage
- Introduce white pine in red pine 21-40 year growth stage

**Mesic-Northern Hardwoods (188,000 acres; 4% of plant community)**

Long-term Goals:

- Increase >171 year growth stage
- Maintain some better quality aspen stands; use even-age management
- Establish or maintain white pine, balsam fir and white spruce as stand components starting at the 21-40 growth stage.
- Create a more natural composition of plant community starting at the 40-80 year growth stage.



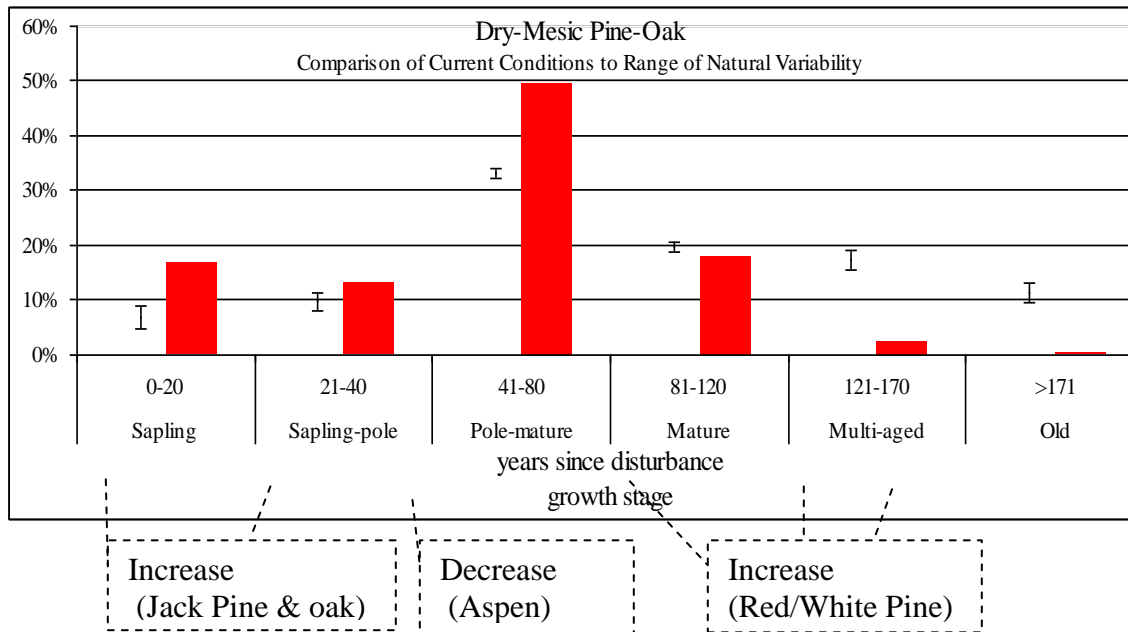
Strategies:

- Manage rich basswood/maple to older growth stages
- Manage on an uneven age system
- Manage richer sites for yellow birch component.
- Selectively harvest northern hardwoods stands as they age.
- Perform shelterwood harvests in northern hardwoods and underplant with pine and spruce where site aspect and soils are appropriate.
- Maintain aspen inclusions on good sites to provide age class and structural diversity.

**Dry-Mesic Pine-Oak (1,582,000 acres; 31% of plant community)**

Long-term Goals:

- Increase jack pine and oak in 1-20 and 21-40 year growth stages
- Decrease aspen in 41-80 year growth stage and restore red, white and jack pine
- Increase red/white pine in 81+ year growth stages
- Increase 81+ year growth stages



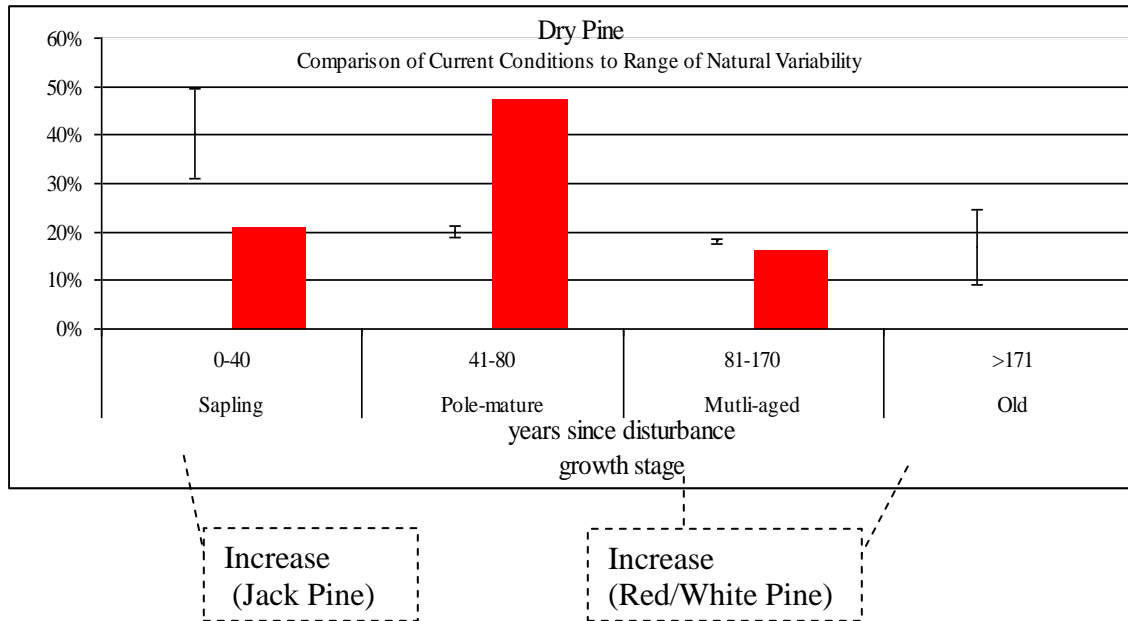
Strategies:

- Manage pine and longer-lived hardwood by maintaining trees already present and/or underplanting
- Manage pine and hardwood in mixed stand condition.
- Underplant aspen with white spruce
- Underplant red pine in 21-40 year growth stage with white pine
- Focus short term harvest on regenerating 60-70 year old jack pine and aspen.

**Dry Pine (245,000 acres, 5% of plant community)**

Long-term Goals:

- Increase younger age classes of jack pine (0-40).
- Increase older growth stages (81+) dominated by red and white pine.



Strategies:

- Concentrate harvests in the 41-80 year growth stage and regenerate to jack pine.
- Where possible regenerate to a jack/red/white pine mixed stand; harvest jack pine and hold red and white pine for older growth stages on moister sites.

The following recommended goals and strategies relate directly to the third and fourth bullet statements of the desired future forest condition:

- The amount of forestland and timberland will not decrease using FIA definitions for timberland and forestland. Large blocks of contiguous forest land that have minimal inclusion of conflicting land uses will be created and/or retained for natural resource and ecological benefits and to minimize land use conflicts (hereafter referred to as “natural resource emphasis areas”).
- In large blocks of contiguous forest land retain critical natural shoreline on lakes for scenic, wildlife, water quality and other natural resource values.

**Definitions:**

*Conflicting land uses:* Land uses that conflict with natural resource management and/or ecological benefits. Examples include but are not limited to residential development, agriculture, industrial sites, amusement parks, golf courses, airports, etc. Harvest of timber and associated activities (hunting, trapping, reforestation, etc) are not considered a conflicting land use in this document. The intent is to promote land uses that are more compatible within natural resource areas so the net effect is greater ecological and natural resource benefit to society than having a similar acreage that is dispersed. The intent is not to favor one type of natural resource benefit over another, or to dictate what the balance between different types of natural resource benefits should be.

*Fragmentation:* Interspersing contiguous tracts of forest with conflicting land uses.

*“Natural resource emphasis areas”:* Large blocks of contiguous forest land that have minimal inclusion of conflicting land uses. They have been created and/or retained for natural resource and ecological benefits and to minimize land use conflicts.

**Goal: Minimize the loss of forestland and timberland.**

*Strategy:* Educate landowners on the value of forests to society, the economy, and the environment (including wildlife), and the importance of not reducing current acreage and tract sizes.

- Encourage incentives for both forest retention and forest management.
- Provide educational material on the positive benefits of larger parcel sizes on forest values and their management.

*Strategy:* Encourage use of conservation easements and similar conservation tools.

*Strategy:* Where appropriate, encourage the establishment of forests in areas previously forested (ie. abandoned cropland) and retain natural openings, brushland, etc.

**Goal: Retain contiguous blocks of forest land.**

*Strategy:* Encourage creation and/or retention of “natural resource emphasis areas” which encompass national forests, state forests, county memorial forests, and other large, contiguous blocks of forest land through mutual agreement. Manage “natural resource emphasis areas” in the following way:

- Discourage development of properties within these areas to minimize conflicting land uses.
- Encourage the retention of public lands within “natural resource emphasis areas”, except small tracts needed to provide public services, or isolated tracts too small to manage effectively.
- In cases where a government entity wants to dispose of lands within a “natural resource emphasis area” and those lands are desired by another public agency, encourage exchange of natural resource emphasis areas (NREA) lands for non-NREA lands held by the interested public entity.
- Encourage the State to acquire in-holdings of private lands within “natural resource emphasis areas” as they become available in exchange for disposal of isolated parcels that are better suited for development or private ownership leading to no net loss of public land.
- Encourage the exchange of federal, state, and county tax-forfeited lands lying outside of “natural resource emphasis areas” for private lands lying within “natural resource emphasis areas” where both parties agree.
- Minimize further fragmentation and loss of forest land within “natural resource emphasis areas” by:
  - Minimizing cross-country overhead lines.
  - Encouraging private landowners to keep their lands in forest use.
  - Encouraging interagency cooperation and coordination in road planning and design.
  - Encouraging road corridors to be the minimum size necessary to provide public service
- Manage roadsides within “natural resource emphasis areas” to retain natural beauty and to reflect the natural variation in forest age and composition.
- Encourage the use of MN Forest Resource Council Site-Level Guidelines and Landscape-Level goals and strategies for forest management.

*Strategy:* Minimize fragmentation of forests by encouraging innovative development that keeps forestland intact.

- Encourage residential and commercial development to occur in areas already fragmented by housing, urban uses and existing road corridors.
- Encourage cluster development.

**Goal: Minimize the loss of publicly held shorelines.**

*Strategy:* Discourage the sale and development of publicly held shorelines.

*Strategy:* Exchange land for critical shoreline when available.

**Goal: Increase the natural benefits of developed shorelines**

*Strategy:* Educate lakeshore owners and lake associations on the environmental benefits of natural shorelines and available cost share programs to improve shorelines.

*Strategy:* Encourage private shoreline owners to practice “lakescaping” (maintaining/ creating natural habitat along shoreline) or retain natural shoreline.

**Goal: Protect sensitive and/or undeveloped shoreline**

*Strategy:* Encourage local, grassroots government, and organizations (townships, lake associations, etc.) to identify and promote protection of these shorelines.



## Section 6

### Coordination Framework

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The Committee previously established an ad-hoc group of landowners to complete several specific tasks. It is recommended that this group as well as any additional members of the Committee who would like to participate be designated as the permanent Coordination Work Group for the landscape. The primary purpose of the Coordination Work Group is to coordinate the voluntary implementation of the landscape goals and strategies across the landscape.

The Coordination Work Group will meet on a quarterly basis, as needed, to do the following:

- Look at existing plans and see how they fit with landscape goals – for example National Forest Plan, DNR Sub-section etc. Highlight the opportunities for cooperation and the areas of challenge.
- Determine how much each landowner can voluntarily contribute toward the landscape goals on a yearly basis.
- Look for ways to cooperate and coordinate on the ground management activities to achieve landscape goals.
- Analyze the cumulative effects of current and planned activities across the landscape.
- Assist MFRC Staff in collecting necessary monitoring information as described in the “Monitoring Framework” section of this report.

## Section 7 Monitoring Framework



The MFRC Landscape Committee agreed that a high quality monitoring system is needed to measure progress at five-year intervals and analyze the rate of change relative to the landscape as well as to measure long-term progress toward desired conditions. The MFRC Landscape Committee recommends that the historical context (Range of Natural Variation) be used as the benchmark and the current condition as a baseline. Each five- year assessment would use the current condition as a baseline and measure it against the Committee’s desired future forest conditions, goals and strategies. Rate of change would be a comparison with the previous five-year baseline to the current five-year baseline.

The MFRC Landscape Committee recommends that the following measures and measuring protocols be used as part of the monitoring process:

Measurement	Protocol
<p>Acres of each major forest plant community by species.</p> <p>Acres of each major forest plant community by growth stage.</p>	<ul style="list-style-type: none"> <li>• Forest Inventory and Analysis Data The following technical papers (Appendix 3,4,5) will be used:</li> <li>• <i>Mapping Range of Natural Variation Ecosystem Classes for the Northern Superior Uplands, Draft Map and Analytical Methods.</i> Mark A. White and George E. Host. August 9, 2000.</li> <li>• <i>Northeast Landscape – Range of Natural Variation Analysis: Methods, Data and Analysis.</i> Mark A. White, George E. Host, Terry N. Brown. January 25, 2001.</li> <li>• <i>Drift and Lake Plains: A Comparison of Range of Natural Variation and Current Conditions.</i> Terry N. Brown and Mark A. White. October 11, 2001.</li> </ul>
<p>Acres goals for each major forest plant community specified in public agency land management plans and in other plans if available.</p>	<p>MFRC Staff and Coordination Work Group review plans and compile acreage goal summary for landscape</p>

Harvest goals for each major forest plant community specified in public agency plans and in other plans if available.	MFRC Staff and Coordination Work Group review plans and compile acreage goal summary for landscape
Acres affected by specific silvicultural practices	GEIS Silviculture Technical Paper and 1996 Survey Report (appendix 10, 11) should be used as a baseline. MFRC Staff compile data for landscape
Number of land managers trained at silvicultural workshops	MFRC Staff and Coordination Work Group survey agencies, organizations and companies and compile data
Number of conifer seedlings produced by species at Minnesota tree nurseries.	DNR nursery records

The Minnesota Forest Resources Council will have overall responsibility for implementing the monitoring framework, including:

- Preparing the five-year monitoring report.
- Keeping landowners, agencies, non-government organizations, private consultants, participants in the North Central Regional Committee and other interested parties informed of the results of implementation and monitoring activities in the landscape.

The MFRC Landscape Committee recognized that models will change and improve in the future, and that landscape goals should be adjusted based on improved models.

## Section 8 References

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Natural Range of Variability Estimates for Forest Vegetation Growth Stages of Minnesota's Drift and Lake Plains; Lee E. Frelich; Final Version, April 16, 2000

Model by George Host that gave numbers to Frelich's ecosystems and growth stages (available on CD – various Power Point presentations)

Mapping Range of Natural Variation Ecosystem Classes for the Northern Superior Uplands: Draft Map and Analytical Methods. Mark A. White and George E. Host. August 9, 2000.

Northeast Landscape - Range of Natural Variation Analysis: Methods, Data and Analysis. Mark A. White, George E. Host, Terry N. Brown. January 25, 2001.

Growth Stage Summaries for Drift and Lake Plains Upland Landscape Ecosystems;. Mark A White, February 18, 2002

Drift and Lake Plains: A Comparison of Range of Natural Variation and Current Conditions. Terry Brown and Mark White, NRRI, October 11, 2001

Northern Minnesota Forestry Analysis. Richard Lichty et al. July 2001. UMD Bureau of Business and Economic Research

Forestry Bottleneck Analysis. September 2002. UMD Bureau of Business and Economic Research

Input data for IMPLAN Model being developed in the MFRC Northeast and North Central Landscape Regions, Chad Skally, June 12, 2002, Revised July 9, 2002

## Section 9 Appendix

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1. Mailing list of North Central Regional Landscape Committee participants
2. Range of Natural Variability Estimates for Forest Vegetation Growth Stages of Minnesota's Drift and Lake Plains. Lee E. Frelich. April 16, 2000.
3. Vegetation Comparisons of Current Conditions to RNV and Historical Conditions on Public and selected Private Land in Drift and Lake Plains. A combination of forest inventory data compiled by MFRC and UPM Kynnine Paper Company, 2000.
4. Northeast Landscape Range of Natural Variation Analysis: Methods, Data and Analysis. Mark A. White, George E. Host and Terry Brown.
5. Mapping Range of Natural Variation Ecosystem Classes for the Northern Superior Uplands: Draft Map and Analytical Methods. Mark A. White and George E. Host. August 9, 2000.
6. Drift and Lake Plains: A Comparison of Range of Natural Variation and Current Conditions. Terry Brown and Mark White. October 11, 2001 (Introduction, methodology and one plant community)
7. Executive Summary, Northern Minnesota Forestry Analysis. Richard Lichty et al. July 2001. UMD Bureau of Business and Economic Research
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