MFRP

Minnesota Forest Resources Plan

1995 Assessment

Minnesota Forest Resources Plan

For information contact:
Thomas J. Polasik, Statewide Natural Resources Planner
Department of Natural Resources, Division of Forestry
500 Lafayette Road
St. Paul, MN 55155-4044

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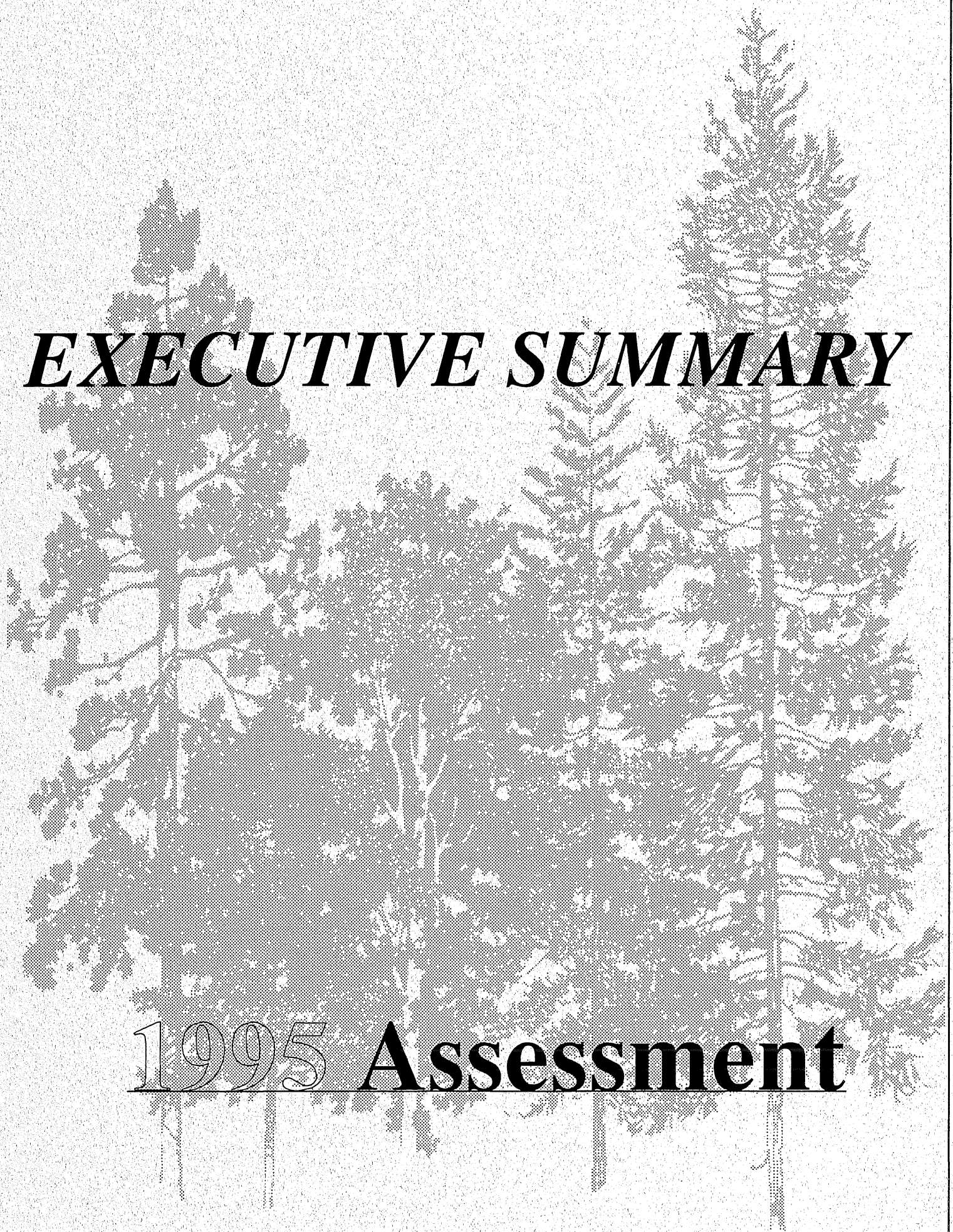

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

1.1
FOREST RESOURCES MANAGEMENT ISSUES

There are many competing interests relating to how Minnesota's forest resources are managed. Consequently, there are many issues and concerns relating to how the forest resources are managed. The following is a list of the larger issue areas that were identified in the scoping document of the Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (GEIS).

- *maintaining productivity of forests for timber production*
- *forest resource base*
- *forest soils*
- *forest health*
- *plant and animal diversity in forest ecosystems*
- *forest wildlife and fish*
- *water quality*
- *forest recreation*
- *economics and management*
- *aesthetics and unique historical and cultural resources*

Other areas identified for analysis were: (1) recycled fiber opportunities and their timber harvesting relationships; (2) possible impacts of global warming on Minnesota's forests; (3) Minnesota's public forestry organizations and policies; (4) harvesting systems; and (5) silvicultural systems.

1.1.1
Forest Resources

The total land area of Minnesota is 51 million acres, of which 33 percent is forested. The area of all forest land in the State in 1990 had increased by 0.7 percent from the previous forest survey in 1977 to 16.7 million acres. There were 14,773,400 acres of timberland in the state in 1990, an 8.5 percent increase from 1977. The percentage of timberlands remains high in the remainder of the northeast, averaging around 50 percent. Percentage of timberlands drops dramatically as the transition is made from the forested areas of the state to the prairie areas, where the percentage of timberlands drops to less than 2 percent along the state's western boarder.

The highest concentration of forest industry (pulp, saw and

fiberboard mills) is also in the north. The central portion of the state, which has the majority of the oak-hickory forest type, also plays an important role in the state's economy.

1.1.2 Land Use

As with forest cover, land use also varies widely across the state. The western and southern prairies have been extensively plowed and converted to cropland. Agriculture is the dominant land use in the prairie areas, while land use in the heavily forested northeast is dominated by forestry and recreation.

1.1.3 Water

Clean water is one of Minnesota's greatest resources and much of this water originates in forested areas. Water quality is affected only periodically by forest management, and usually for short periods of time, such as during harvesting, road building, and stand establishment. Protection of water quality during forest management operations will ensure a continuous supply of clean water.

1.1.4 Biodiversity

Biodiversity is a complex concept that encompasses genetic diversity of individual plant and animal species and the variety and abundance of those species in a community. Due to Minnesota's location at the junction of conifer forest, deciduous forest, and prairie, forest management activities have the potential to impact major species at the edge of their range. In addition, land management activities can affect rare communities.

1.1.5 Historical and Cultural Resources

Historical and cultural resources reflect the history, contributions, and ongoing cultures of the ethnic groups that created this state. They represent values that are important to Minnesotans.

Many cultural features are present within forested areas and could be adversely affected by recreational use and management activities. Based on estimates done for the GEIS, there are approximately 190,000 sites in the forested areas of the state.

1.1.6
Recreational and Aesthetic Resources

Minnesotans spend an average of 225 hours per person per year on outdoor recreation activities. Walking and hiking, bicycling, fishing, and driving for pleasure account for half of the annual outdoor recreation activity hours expended by Minnesotans.

The quality of recreation opportunities on forest land is highly dependent on the aesthetic quality of the forest setting. Minnesota forests are particularly vital to the health of both the tourism and forest products industries. While many of the demands on the forests are compatible and even complimentary, concern about the specific impacts of various forest management practices on forest aesthetics became the focus for a positive dialogue among tourism and forest products interests.

1.1.7
Forest Protection

Effective wildfire protection benefits almost every facet of the social and economic life in Minnesota. Wildfire directly impacts two of the three major industries in the forested areas of Minnesota, timber and tourism.

Insects and diseases are an important part of the forest ecosystem and are fundamental agents of change in long-lived communities such as forests. They are responsible for loss of productivity because they cause mortality, decay, reduced growth rates, and increased risk of fire, all negative impacts to timber management objectives. In addition, they can negatively impact recreational and aesthetic aspects of forest resources.

Positive effects include those on wildlife as insects and diseases can provide habitat such as tree cavities formed by fungal decay and/or food sources such as insect larvae.

Soil is one of Minnesota's most important natural resources. Soil protection and the reduction of extensive, deep rutting of the soil are serious resource concerns associated with harvest activity. Soil protection is a critical resource concern in Minnesota because many of its soils have low bearing strength and can be easily damaged by logging equipment.

1.1.8
Community (Urban) Forest Resources

Community forestry in Minnesota encompasses both natural and

planted environments. Boulevards, parks, school forests, municipal forests, greenbelts, residential dwellings, commercial and industrial sites, and undeveloped areas are places where trees and woodlands occur.

The majority of community street trees are in good to excellent condition, however most of these trees are small in diameter. Fifty percent of the available spaces for street trees in Minnesota remain unplanted. For every boulevard tree in a community there are 10 other trees in yards, commercial and industrial areas, and public parks and open space. In Minnesota communities, there is estimated growing space for planting an additional 3.6 million trees in these off-street locations.

1.2 CURRENT FOREST MANAGEMENT PRACTICES

1.2.1 Harvesting

In 1993, the DNR, Division of Forestry and the USDA Forest Service, North Central Forest Experiment Station estimated approximately 4.1 million cords of timber were harvested in Minnesota, up significantly from the 2.4 million cords harvested in 1980.

The most common methods of harvesting timber in Minnesota are clearcutting and clearcutting with residuals. These two methods accounted for 80 percent of the total wood volume harvested in the state in 1991.

1.2.2 Reforestation

Of the total timber harvested in 1991, 80 percent of the volume came from clearcuts and clearcuts with residuals, which in turn accounted for 71 percent of the area with logging operations. Vigorous root suckering occurs in aspen following harvest, but only if the stand is completely cut. The total area with logging operations was estimated to be 200,000 acres, of which 19,000 acres was thinning. Planting occurred on 32,600 acres, seeding on 6,000 acres, and natural regeneration on 142,000 acres.

1.2.3 Protection of Water Quality

Impacts on water resources are not confined to the site where disturbance has occurred. Therefore, it is important to develop and implement standards of practice that can reduce impacts

irrespective of ownership. Minnesota forest management agencies and industries have developed a series of voluntary forest water quality best management practices (BMPs). Using BMPs will reduce the likelihood of impacts resulting from forest management and timber harvesting. Effective and timely regeneration of the new forest cover represents a major way in which soil stability has been assured and therefore water quality values maintained.

1.2.4 Insect and Disease Control

Pest control strategies have primarily focussed on cultural measures. Cultural strategies typically include physical manipulation of stands, often by harvesting in order to remove infected trees or to promote vigorous growth in trees, thereby reducing opportunities for pests to become established. As with many silvicultural problems, health-related measures are typically employed only if low cost solutions are available. Many ownerships are simply unable to justify the expense of pest control measures.

Professional input is available on state, federal, county, and forest industry lands, but is less available or not available for non-industrial private forest lands.

There is no data available on the use of insecticides in Minnesota because of the very low level of use in commercial forests.

Biological control can often contribute to long-term pest management and seldom results in adverse environmental consequences. The potential exists to incorporate more biological control into pest management if benefits can be demonstrated to justify costs of research and implementation.

1.2.5 Protection of Historical Cultural Resources

Both state and federal laws control and guide the inventory and management of cultural heritage sites. The Minnesota Historical Society, the State Archaeologist, the Minnesota Indian Affairs Council , and the State Historic Preservation Officer help to monitor and maintain these laws.

Most historical and cultural resources are extremely fragile and can be seriously affected by timber harvesting and associated activities such as road construction. They are fragile because dislocation or destruction of artifacts and the sediments that contain them can destroy or seriously compromise the essential

information that they contain. Earth-disturbing activities do not have to be very intense to negatively affect such sites.

1.2.5 Aesthetics

As more and more demands are being placed on the state's forest resources, more emphasis is being placed on the need to protect the scenic or visual quality of the forest. In the past, the aesthetic qualities of the state's forested areas have been largely taken for granted. Aesthetic quality plays an important role in the value of forested land for other activities.

The effects of forest management activities such as timber harvesting and regeneration can change the appearance of the forest. Management activities could reduce aesthetic, recreation, and tourism values for a long time.

1.2.6 Biodiversity

Although terminology differs, the Division of Forestry, the National Forest System, and some counties are involved in various aspects of maintaining biodiversity. The primary method being used is practice of integrated resources management (IRM) on an ecological management unit basis. Potential impacts on management activities on endangered species and communities (e.g., old growth forests) are given careful consideration by most public land managers in Minnesota. Specific management actions are evaluated on an ecosystem basis with the aid of an ecological classification system. Restoration of ecological systems is promoted and cooperation with other agencies, the public and interest groups is stressed.

1.3 STATUS OF THE FOREST BASED ECONOMY

1.3.1 Forest Products Industry

Minnesota's forest products industries directly provide 58,960 jobs. If the indirect impacts of the forestry and forest products industries are considered, then they generate about 111,000 jobs, $2.8 billion in employee compensation, and $10.1 billion in total industry output. The importance and nature of the forest products industry varies from one part of the state to another.

1.3.2
The Logging Industry

The logging industry serves as the supplier of roundwood to all other primary forest products industries. The GEIS estimated that there are 1,300 logging companies in Minnesota. These organizations do not typically own substantial amounts of timberland and are small in size. A survey conducted for the GEIS found that 90 percent had 10 or fewer employees. Loggers may harvest timber under contract from both public and private land, including land owned by forest industry.

1.3.3
Primary Forest Products Industries

The major primary forest products industries in Minnesota include: (1) pulp, paper, and hardboard, (2) waferboard and oriented strand board (OSB), (3) lumber, and (4) other products including veneer and treated wood. The amount of wood consumption from Minnesota's forests as a raw material for these industries, including wood used primarily for fuel, totalled nearly 3.85 million cords in 1992. Much of this wood was aspen pulpwood. A relatively small portion of the wood used in Minnesota's mills comes from forests outside Minnesota.

1.3.4
Secondary Producers

Secondary forest products industries use the outputs from both primary and other secondary forest products industries as inputs to their production processes. These industries play an important role in the state's economy. In value terms, much of the contribution of secondary forest products industries is concentrated in the metro region.

Of all the wood harvested from Minnesota's forests, 15 percent is sawed into lumber that is used by secondary manufacturers, and distributors. The rest is utilized as follows; 38 percent is used by OSB and waferboard plants; 30 percent is used for pulpwood, paper, and paperboard production; and 13 percent is used for fuelwood.

1.3.5
Tourism and Recreation Industry

Minnesota's travel and tourism industry is responsible directly and

indirectly for approximately 4 percent of the total employment in the state, 3 percent of the wages and salaries, and 4 percent of industry output.

The seven county metro region (see figure 7.1) of the state accounted for over half of these economic impacts. The north region accounted for 29 percent of the jobs, compensation, and output in the state's travel and tourism industries.

1.3.6 Fish and Wildlife

According to recently released findings from the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, direct expenditures for hunting, fishing, and wildlife-associated recreation in Minnesota during that year topped $1.5 billion.

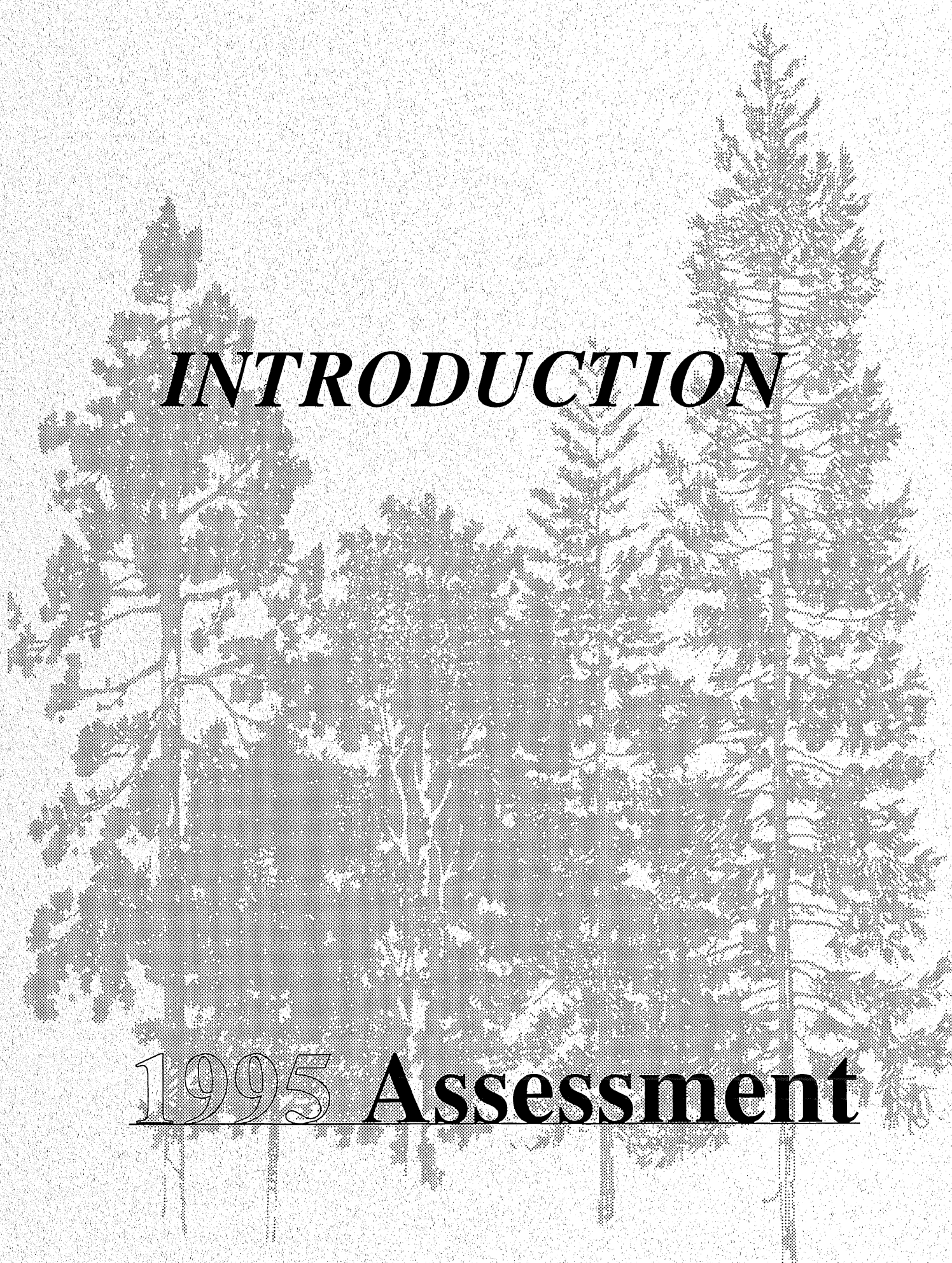
1.3.6.1 Fish

In 1991, the state's 1.1 million resident and 350,000 nonresident anglers age 16 and older spent 18 million days on Minnesota waters. They also spent an average of $643 each on fishing in Minnesota, for a total of $933 million.

1.3.6.2 Wildlife

The state's 458,000 resident and nonresident hunters age 16 and older spent an average of $607 each in Minnesota for a total of $278 million. Residents spent $193 million on equipment and $74 million on travel-related expenses. Out-of-state hunters spent $10 million in the state on travel.

Wildlife watchers spent hundreds of millions of dollars just to see animals in Minnesota. A total of $303 million was spent in 1991 to watch and photograph deer, ducks, eagles, bluebirds, and other species. Of these "nonconsumptive" wildlife activities, trip expenses accounted for $121 million and equipment expenses totaled $182 million.



INTRODUCTION

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INTRODUCTION

2.1
MFRP Legislation

Minnesota Statutes Section 89.011, Subd. 3 requires the program portion of the Forest Resource Management Plan to be updated every four years and the assessment portion to be updated every 10 years. The program is to describe specific actions to address the assessment and to implement the forest resources management policies laid out in Section 89.002.

This document is an update of the Minnesota Forest Resources Plan (MFRP) Assessment (the Program portion of this plan will be completed in 1995), originally released by the Department of Natural Resources, Division of Forestry on July 1, 1983. The statute states that the forest assessment shall include:

(a) The present and projected use and supply of and demand for forest resources in the state.
(b) The development of a forest resources database...
(c) The current and anticipated reforestation needs from forest land...
(d) An inventory and map of all existing state forest roads and classification by use standard and condition.

Since the first assessment was completed in 1983, maintenance of the forest resources database and the road inventory have been institutionalized in the division as ongoing programs. The detailed information in the two inventories is not included in this assessment.

2.2
Update Since 1983 Assessment

The 1995 Minnesota Forest Resources Plan Assessment is the second statewide forest assessment, the first having been completed in 1983. The Forest Resources Management Act (FRMA) of 1982 directs the Division of Forestry to update the assessment of Minnesota's forest resources every 10 years. Completion of the Assessment was delayed from 1993 to 1995 to take advantage of findings from several significant studies outlined in Sections 2.4 - 2.9.

Since the first MFRP Assessment was written in 1983, major changes have taken place in Minnesota. Among them are:

- timber harvest levels have grown from approximately 2.4 million cords annually to approximately 4 million cords per

year (this is still well within sustainable limits);

- demand for Minnesota's forest resources has increased substantially;
- the timber industry has invested over 2 billion dollars in new and modernized manufacturing facilities;
- the 1990 Minnesota Forest Inventory and Analysis (FIA) conducted jointly by the USDA, Forest Service, North Central Experiment Station and the Minnesota Department of Natural Resources, Division of Forestry provided the basis for both the LSA and the GEIS (see below);
- new information has become available to support management decisions including:
  - the Generic Environmental Impact Statement on Forest Harvesting and Management in Minnesota (GEIS),
  - the Lake States Assessment (LSA), and
  - the Sustainable Development Initiative (SDI);
- new environmental concerns have risen, including the concerns for:
  - loss of old-growth forests,
  - forest fragmentation,
  - reduced biodiversity,
  - loss of wildlife habitat;
- the movement toward integrated resources management.

2.3 Public Involvement

Interested publics were invited to comment on the first Minnesota Forest Resources Plan in 1993 and on subsequent program updates. Since the original MFRP was written in 1983 there has been increased interest by the public in how Minnesota's forest resources are managed. Interested publics will again be invited to comment on this MFRP Assessment update.

"The public" is generally considered a single entity, but is actually made up of any number of publics. The public includes large organized groups, a few individuals, or even a single person. (Not to be overlooked are the employees of the Department of Natural Resources, both inside and outside the Division of Forestry.)

The effectiveness of the Minnesota Forest Resources Plan depends, largely, upon success in planning and implementing an effective public participation program.

2.4
Process Used to Develop the MFRP

The FRMA requires the assessment to include the present and projected use, supply of, and demand for forest resources in the state.

The 1983 assessment was a plan driven by a wide variety of issues. In the 1983 MFRP, an issue was "any forest-related concern or conflict considered to be important by any segment of the public, any public agency, or any individual." Hundreds of issues surfaced during the identification process. The issues were then ranked and grouped into 10 categories or major issue areas.

As opposed to the 1983 assessment, the 1995 version focuses on a few large "policy issues," and takes advantage of ongoing independent issue generating programs such as the GEIS and to a less extent Lake States Assessment.

The 1995 MFRP Assessment identified major policy issues and opportunities for action that range from legislative initiatives to program changes within federal, state, or local governments. The MFRP also identified opportunities to cultivate and support private sector initiatives.

The Lake States Assessment and the GEIS have been used as much as possible to provide background information for the MFRP Assessment. The MFRP Assessment summarized and synthesized key findings from these studies by resource and issue areas. Additional assessment information specific to Minnesota was added as appropriate.

The department document, "Directions," will be very useful when the division's MFRP Program is updated in 1995. Directions did, however, identify many "generic" resource management issues that apply to how the state's forest lands are managed..

Since Minnesota has no state forestry board or commission, a subcommittee of the Minnesota Forestry Coordinating Committee (MFCC), and representatives of other key interest groups not represented by the MFCC, was asked to serve as the MFRP steering committee. A technical review committee with broad representation from the forestry community is needed to ensure ownership by key stakeholders in the planning process and the final products. This type of involvement is critical if the MFRP Assessment and Program are to realize their full potential.

Resource specialists from both the DNR and outside agencies and

organizations were used to review and write specific sections of the assessment.

2.5 Generic Environmental Impact Statement on Forest Management and Harvesting in Minnesota

The GEIS was prepared by a consulting firm (Jaakko Pöyry Consulting, Inc.) under the direction of the Environmental Quality Board (EQB). The purpose of the GEIS was to examine the impacts of timber harvesting on the state's environment and economy. Since the GEIS addressed most of the major environmental issues related to timber harvesting and forest management in the state, relevant information was used extensively as a background document for the MFRP Assessment. The GEIS contains five background papers and nine technical papers.

2.5.1 Background Papers

Recycled Fiber

Documents existing and potential opportunities for utilizing recycled fiber in the wood products manufacturing process in Minnesota.

Global Climate Change

Identifies the extent to which research has been conducted, or is currently under investigation, that describes the relationship and/or interaction between global climate change and Minnesota's forests.

Major Public Forest Land Management Organizations

Describes the major public forest land management organizations in Minnesota.

Harvesting Systems

Documents harvesting systems currently used in Minnesota and those potentially available for use were documented in this background paper.

Silvicultural Systems

Discusses existing and potentially available silvicultural systems in

terms of their suitability and applicability to the range of different forest covertypes as well as physical conditions in Minnesota.

2.5.2 Technical Papers

The following technical papers were written to provide background information for the GEIS: Maintaining Productivity and the Forest Resource Base, Forest Soils, Forest Health, Water Quality and Fisheries, Biodiversity, Forest Wildlife, Recreation and Aesthetics, Historic and Cultural Resources, and Economics and Management.

Each technical paper included the following:

1. a clear, concise discussion of each issue;
2. appropriate information source(s) and method(s) used to examine each issue and describe findings from the perspective of identifying impacts resulting from statewide timber harvesting activities;
3. possible actions to mitigate all significant impacts, including identification of those impacts that cannot be mitigated; and
4. preferred action(s) to mitigate those significant impacts.

2.5.3 Suggested Strategic Programmatic Responses

The GEIS presents a variety of recommendations to assure mitigation of the identified significant impacts. The GEIS serves the purpose of providing direction on the types of policy (programmatic) strategies the state should consider to help verify and effectively address and implement the recommended mitigation proposals. The various mitigation options can be integrated into a comprehensive set of policy strategies that can serve as the focus for an implementation program. This will require a well-coordinated statewide policy formulation effort aimed at establishment of the following recommendations:

Forest Resources Practices Program

The GEIS study team recommends that the most coordinated way to collectively consider the *site-level* recommendations is through a *state comprehensive Forest Resources Practices Program* (FRPP). Such a program would serve as an umbrella structure for the implementation of a wide range of specific management prescriptions.

Sustainable Forest Resources Program
The GEIS study team recommends that to successfully mitigate, in advance, unacceptable *landscape-level* impacts from timber harvesting and forest management activities, a statewide *Sustainable Forest Resources Program* (SFRP) should be adopted.

Forest Resources Research Program
In addition to recognizing specific gaps in the existing information relating to Minnesota's forest resources, the GEIS study process underscored the need to focus future forest resources research efforts in a *Forest Resources Research Program* (FRRP).

Minnesota Board of Forest Resources
The study considered a range of possible administrative and organizational structures to carry out the major strategic program recommendations (FRPP, SFRP, and FRRP). These include the identification of the advantages and disadvantages of the EQB, DNR, the MFCC, and a forestry board in this role.

2.6 Sustainable Development Initiative

The Minnesota Sustainable Development Initiative (SDI), sponsored by the Environmental Quality Board, was intended to change the fundamental way environmental and economic decisions are made in Minnesota. The initiative looked at policies to support sustainable development and how to build partnerships among Minnesota's business, environmental, and regulatory communities to carry them out.

Seven *Initiative Teams* were appointed by the governor and the Environmental Quality Board. The teams represented interests in agriculture, energy, forestry, manufacturing, minerals, recreation and settlement. Each team consisted of 15 people representing environmental, business, citizen, and government interests. The teams were charged with fact-finding tasks (defining the teams context, present incentives and disincentives, and innovations that might be employed in Minnesota) and strategy development tasks (defining the issue and the problem, identifying milestones appropriate to the issue, outlining future policies and other strategy elements needed to move toward sustainability, and integrating team strategies).

Six issues were common to all seven initiative teams if they are moving toward the vision of the Minnesota Sustainable Development Initiative. The issues are:

Education: Minnesotans need more information about how their

actions affect the long-term viability of their communities, the economy, and the environment.

Incentives and disincentives: The number and effect of existing incentives and disincentives for sustainable development are unknown.

Accounting of costs and benefits: Incomplete accounting of environmental costs and benefits leads to inefficient decisions by the public and private sectors, including consumers.

Knowledge and information management: Existing data and knowledge are inadequate to determine the extent to which Minnesota is on a sustainable course.

Land and natural resource use: Minnesota lacks a coordinated approach to the use of its land and related natural resources.

Roles of government, the private sector, and citizens: New roles and relationships must evolve among government, business, and citizen interests.

2.6.1 Sustainable Forestry

From a forestry perspective, the term "sustainable development" creates numerous meanings and interpretations. Recent focus, however, has broadened the more traditional definition of sustainable development that emphasizes wood fiber production to one that recognizes the complex relationships and interdependencies between forest ecosystems and economic and social systems. The range of interests represented by the SDI's Forestry Team reflects this contemporary definition by acknowledging the many "issues" involved with sustaining forest ecosystems for a wide range of uses and values. There is no consensus within the forestry profession or among its many stakeholders on a definition of sustainable forestry. Given this reality, the Forestry Team did not try to define sustainable development in concrete, measurable terms. Instead, they discussed forest resource sustainability as a concept relating to how forest ecosystems are managed in a manner that recognizes the dynamics of their interplay with economic and social forces in such a way as not to close off value options for future generations.

The term "forest resources," as defined by the Forestry Team, recognizes a range of outputs and services provided by forests that includes both commodity and other values attributable to consumptive as well as nonconsumptive uses. The Forestry Team

identified the following eight *issue areas* as being critical to sustaining the state's forest resources to achieve both economic and environmental goals:

- Improved resource information systems.
- Preparation for future demands/crises.
- Financial incentives for better sustainable management.
- Improved cooperative land management.
- Comprehensive stakeholder education.
- Enhanced forest biodiversity.
- Maintaining economic viability.
- Efficient/fair decision-making systems.

The Forestry Team identified a number of concerns as well as subsequent initiatives and actions that address sustainable development within the state. They are:

- Sustainable development needs to be institutionalized as a cornerstone from which future state economic development and environmental policies are developed and judged.
- The EQB and other state policymakers need to acknowledge the importance of the sustainable development initiative by allocating the resources necessary to implement the strategies suggested by this and the other six teams.
- There is a substantial need to educate business leaders and state policymakers at all levels of government about sustainable development concepts, as well as the specific information and recommendations contained in the SDI's team reports.
- The integrity of the Forestry Team's report on sustainable development needs to be maintained as the EQB prepares its integrated policy documents relating to the Sustainable Development Initiative.
- The Forestry Team considers its vision and guiding principles for sustainable development especially important outcomes of this initiative.
- Addressing broader (global) issues such as population growth are fundamental to fully achieving long-term sustainable development objectives.

2.7 Lake States Assessment

The other major source of information used for the MFRP Assessment is being prepared by the Lake States Forestry Alliance. This document, known as the Lake States Assessment (LSA), analyzes regional trends and opportunities associated with forest resources in the Lake States Region. Although the LSA is being

conducted for the entire Lake States Region, it provides valuable information for the MFRP Assessment. The LSA attempts to answer the following questions:

1. What is the long-term supply of timber and what is the capacity of the forests to support industrial growth and provide additional jobs?

2. How can management of resources be improved so as to increase this capacity for the benefit of Lake States citizens?

3. What can the forests provide in terms of hiking, camping, hunting, fishing, bird watching, and other kinds of outdoor recreation and what kind of opportunities for economic growth and diversification do these activities offer?

4. How can tourism and forest products industrial development together reinforce and diversify the region's economy?

5. How will carefully-planned programs for economic development in tourism and forest products affect the Lake States' environment?

The LSA also describes the history of the forests, both natural and human impacts, the physical environment, forest ecosystems, wildlife, special ecological resources, forest health, and current and potential environmental impacts. Although some parts of the LSA have not been completed, those parts that are available provided useful background material for the MFRP Assessment.

2.8
Lake States Ecoregion Map

A group known as the Upper Great Lakes Biodiversity Committee (UGLBC) is in the process of developing an Ecoregion Map for the Lake States Region. The Minnesota portion of the map is included as part of the assessment. The landscape ecosystems identified by the UGLBC provide a useful framework for integrated resource management and planning, biological conservation, and comparing differences in plant and animal communities across landscapes.

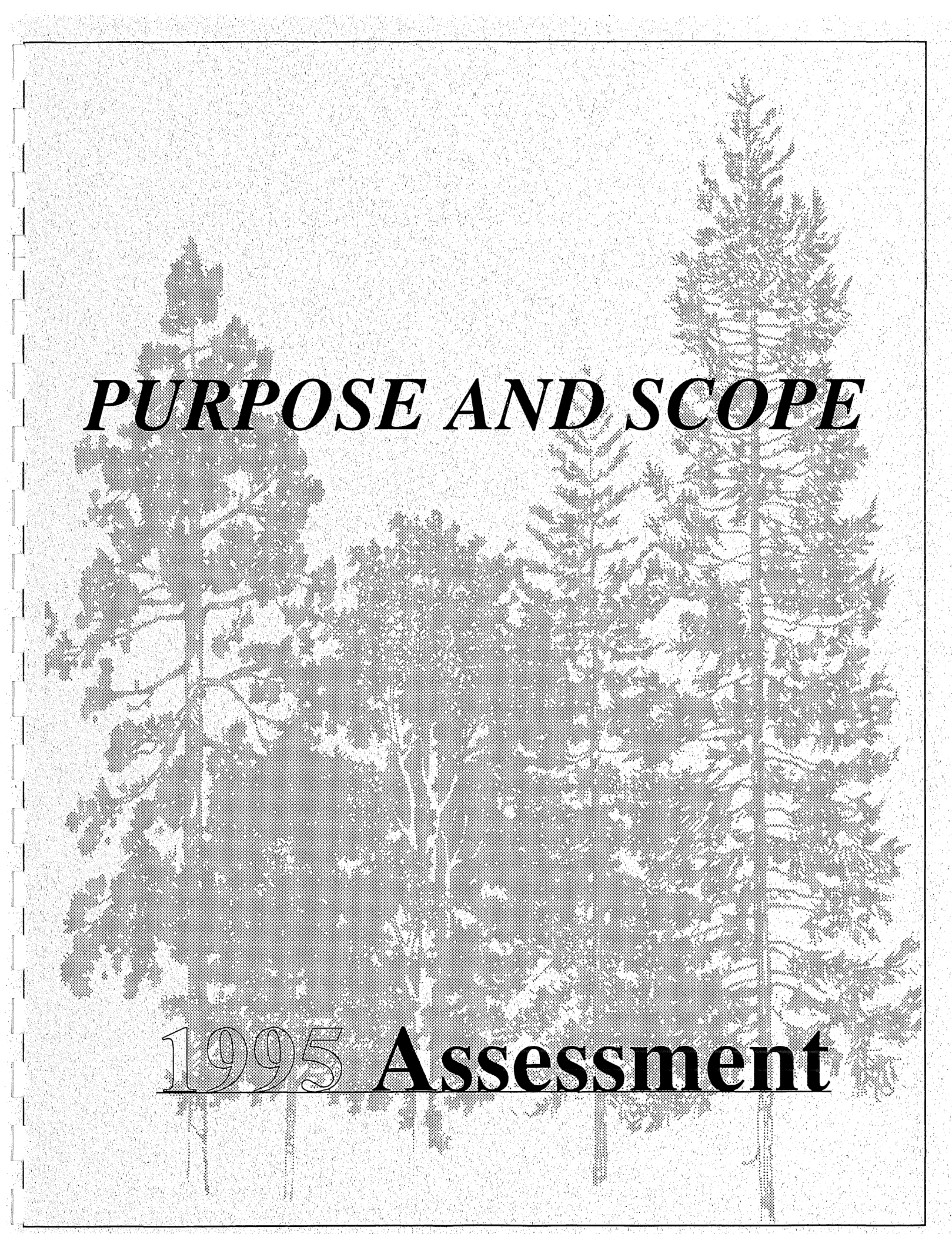
2.9
The Upper Levels of an Ecological Classification System for Minnesota

Similar to the map produced by the UGLBC for the Lakes States

Region, figure 5.1 illustrates the "Subsection" landscapes that are significant on a statewide basis and how they tie into resource management. The GEIS used the same ecosystem information, however they analyzed the ecosystem data at the "Section" level.

2.10 DNR Directions

The Department of Natural Resources identified department-wide issues as part of its 1991-93 Strategic Planning and Budgeting Process, "Directions '93." The issue identification process provided additional information for the MFRP Assessment.



PURPOSE AND SCOPE

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PURPOSE AND SCOPE

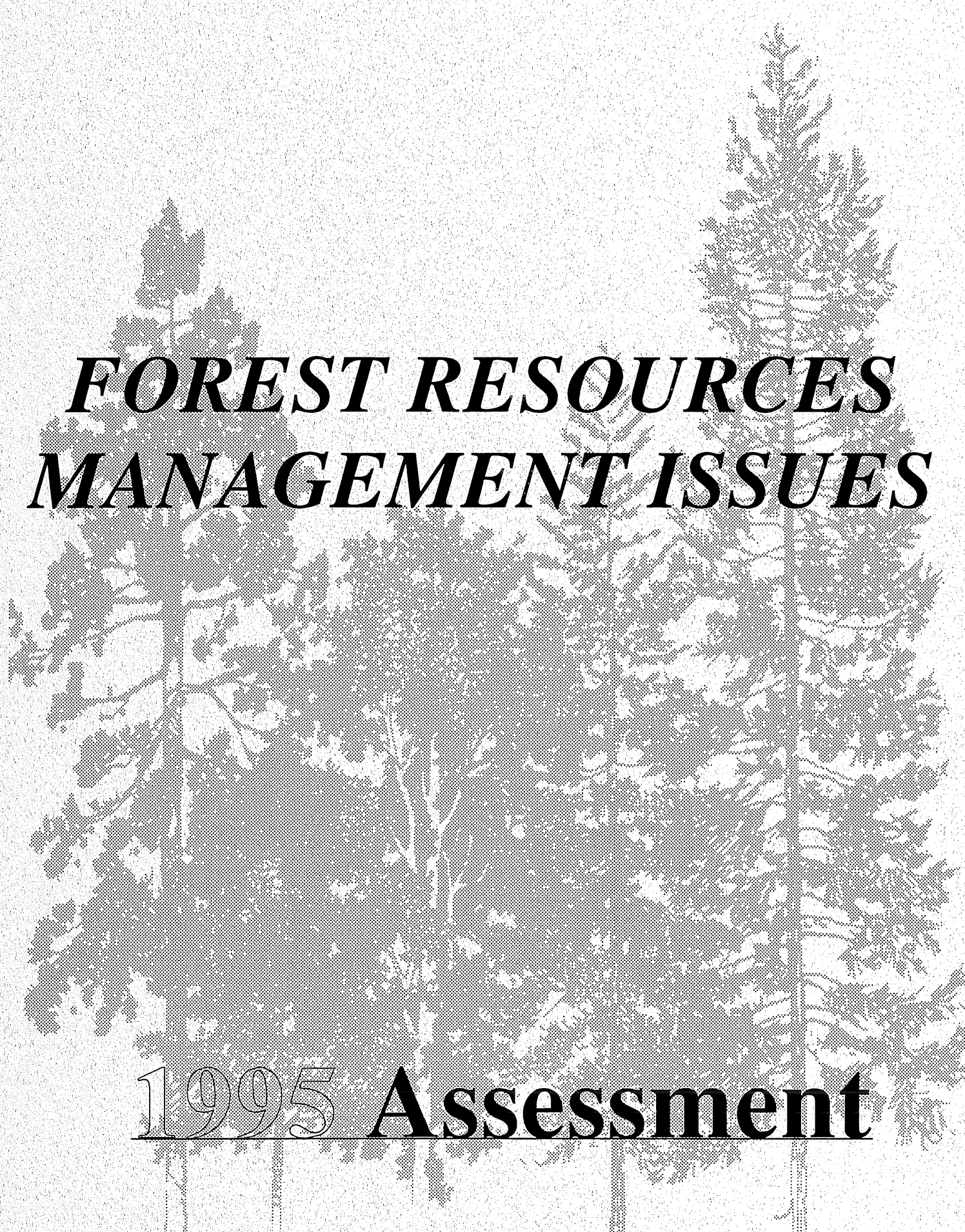
The purpose of the MFRP Assessment is to describe the status of Minnesota's forest resources, to project supplies and demands for forest-related goods and services, and to provide the basis for management policies and programs that will benefit all interests and ownerships. If the MFRP is to accomplish its purpose, its scope must be broad.

The MFRP Assessment's specific objectives are as follows:

- Identify and define important forest-related issues.
- Compile an inventory and provide an analysis of present and prospective forest resource conditions on all lands in Minnesota.
- Improve the existing data base and thus aid decisions by incorporating relevant data from other agencies and reports, and by developing new data where necessary.

The assessment will serve as the basis for developing the 1995 MFRP Program, which will provide strategic direction for use and conservation of Minnesota's forests. Specific goals of the program will be to:

- Set goals and objectives to measure the effectiveness of forestry programs in resolving issues.
- Develop a range of alternatives for managing forests in response to identified public issues and needs.
- Develop from those alternatives a long-range program to guide forest management activities in a manner that will balance economic, environmental and social benefits.
- Provide the policies and framework within which forest resources planning will take place.



FOREST RESOURCES MANAGEMENT ISSUES

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FOREST RESOURCES MANAGEMENT ISSUES

An issue is any forest-related concern or conflict considered to be important by any stakeholder. The identification of issues is an important step in the planning process because it determines the subjects to be addressed in the plan.

As part of the scoping process for the GEIS, the Advisory Committee identified issues associated with timber harvest in Minnesota that they felt the EQB should attempt to address in the GEIS.

The issues identified were:

- *Maintaining productivity of forests for timber production*: Making sure that forests are able to sustain (over long periods of time) the production of ample supplies of timber in an environmentally sensitive manner is of major importance to society.

- *Forest resource base*: Forests are dynamic ecosystems that change naturally and in response to human intervention (e.g., timber harvesting). Understanding the nature and extent of such change is important to the making of wise management and land use decisions.

- *Forest soils*: Forest soils are a fundamental resource on which rests the ability of forests to provide a wide variety of benefits.

- *Forest health*: The management of forests should be undertaken so as to ensure that they are sustained in a healthy condition over long periods of time.

- *Plant and animal diversity in forest ecosystems*: A diverse range of plants and animals are associated with forest ecosystems.

- *Forest wildlife and fish*: Forest wildlife and fish are an integral part of forest ecosystems.

- *Water quality*: Forests are capable of influencing the flow of significant quantities of water of various qualities.

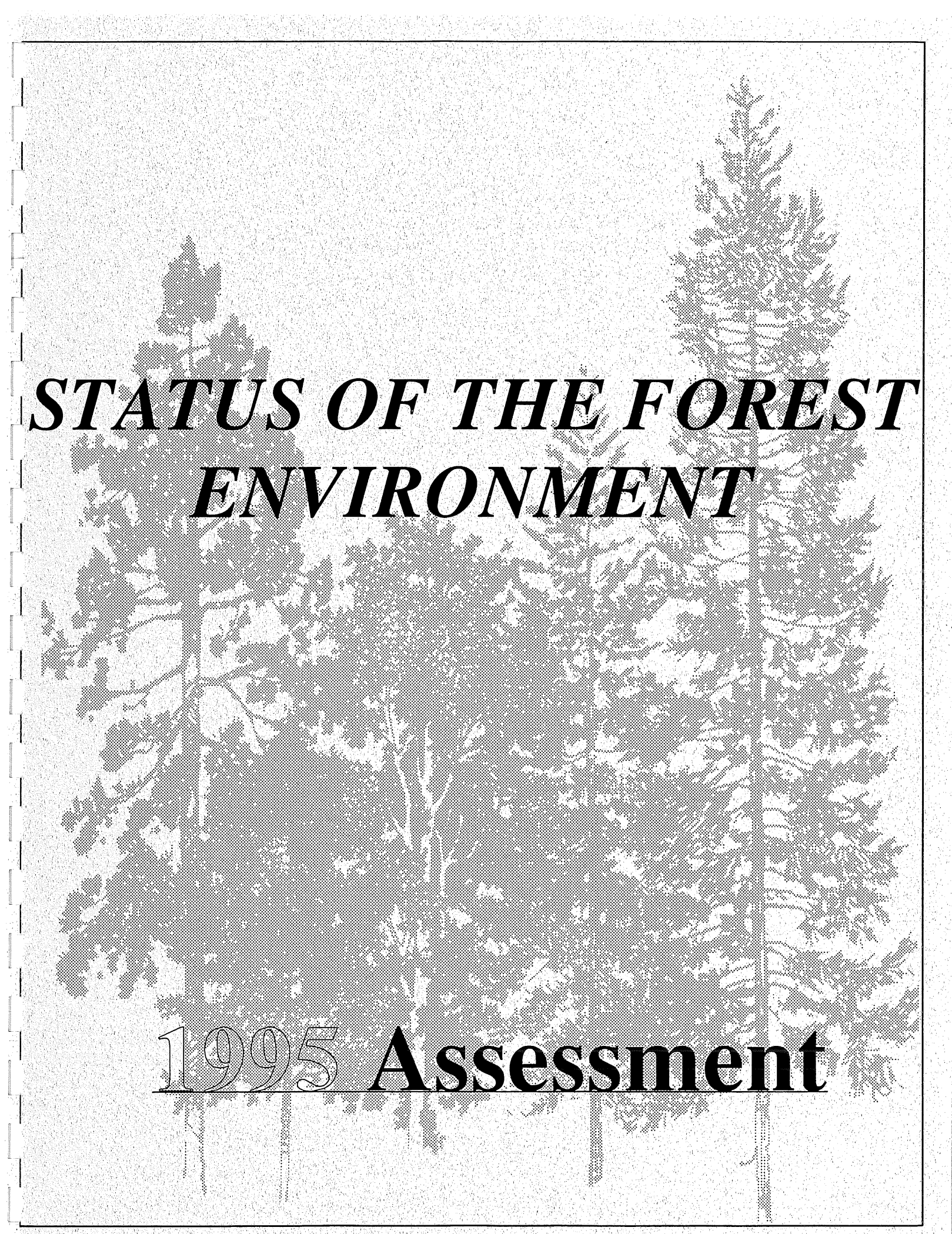
- *Forest recreation*: Forests provide significant opportunity for a wide variety of outdoor recreational experiences.

- *Economics and management*: Forests provide a variety of benefits that are critical to the economic and social health of regional and statewide economies.

- *Aesthetics and unique historic and cultural resources*: Forests provide a variety of scenic vistas and often are the setting for important cultural and historic resources.

By utilizing three levels of timber harvesting and their related forest management activities, the GEIS examined how current and increased levels of timber harvesting and forest management would affect the issues identified in the study's Final Scoping Document (FSD). These FSD issues identify important attributes and characteristics of Minnesota's forests which are collectively defined in the study as *forest resources*.

Other areas identified for analysis were: (1) recycled fiber opportunities and their timber harvesting relationships; (2) possible impacts of global warming on Minnesota's forests; (3) Minnesota's public forestry organizations and policies; (4) harvesting systems; and (5) silvicultural systems.



STATUS OF THE FOREST ENVIRONMENT

1995 Assessment

5
STATUS OF THE FOREST ENVIRONMENT

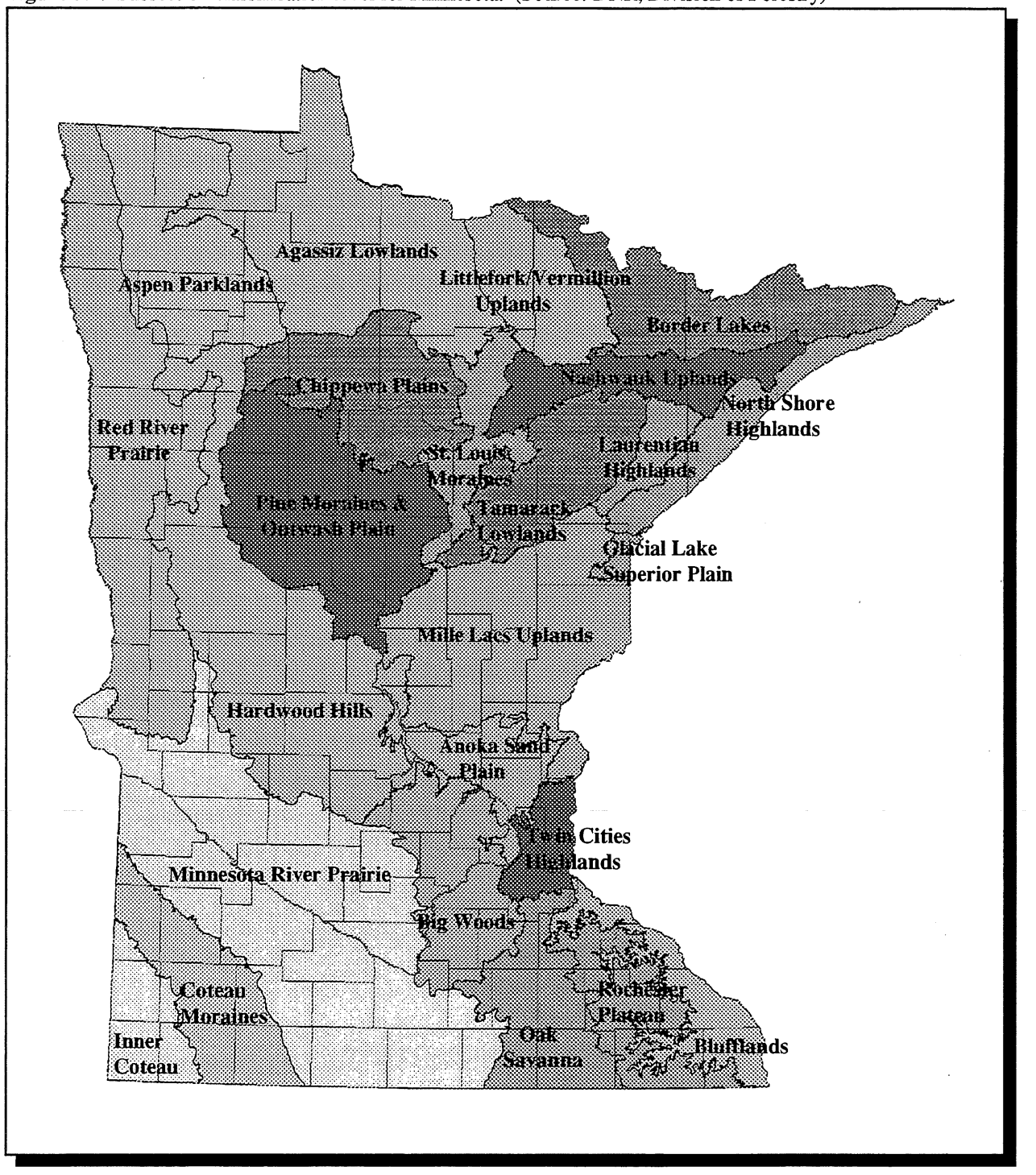
5.1
Ecosystem Types

Minnesota consists of a wide variety of ecosystems ranging from tallgrass prairies in the west, boreal forests in the northeast, and hardwood forests in the southeast. Human activities have greatly modified Minnesota's presettlement ecosystems, especially in southern and western Minnesota. A comparison of presettlement vegetation conditions and present vegetation and land use is made in Appendix B.

5.1.1
Size and Distribution

Geological history and variations in the state's climate are the primary factors responsible for the diversity of Minnesota's soil and vegetation types. The presettlement grasslands of the west occupied areas with low levels of precipitation, high levels of evapotranspiration, level to gently rolling topography, and frequent fires. In contrast, the forested areas of the northeast receive considerably more precipitation, the elevations are higher, and average temperatures during the growing season are cooler. Appendix B describes the Ecological Management Units (EMU), the presettlement vegetation, and existing vegetation and land use at the subsection classification level of the National Hierarchical Framework (NHF). The NHF classification system was developed by the USDA - Forest Service in 1993 and has been adopted nationwide. Figure 5.1 illustrates the subsection classification level for Minnesota.

Figure 5.1. Subsection classification level for Minnesota. (Source: DNR, Division of Forestry)



5.2
Forest Resources

5.2.1
Introduction

The subsections of the state illustrated in Figure 5.1 are characterized by differences in climate, vegetation, soils, bedrock geology, and other factors. These contrasts in the natural resource base have affected the course of frontier expansion and the development patterns of farms, mines, logging camps, towns, and cities. The same contrasts help to account for regional variation of lakes, the hardness of water supplies and the size and dependability of rivers. They also underlie some important regional variations in wealth, tax base, and the need for public services. (Note: the GEIS used the same hierarchial system of ecological units developed by the Upper Great Lakes Biodiversity Committee, however it used the section level for data analysis.)

5.2.2
Forest Types

Minnesota's forests are largely concentrated among 14 forest covertypes common to the Great Lakes Region. These types and their definitions, and the extent of their distribution in Minnesota, are described in Appendix C and D, respectively.

5.2.3
Forest Land Area

There were 14,773,400 acres of timberland in the state in 1990, an 8.5-percent increase from 1977.[1]

The highest concentration of timberland is in northeastern Minnesota (Figure 5.1, Appendix E and F). The Laurentian Highlands has the highest percentage of area in timberland (84 percent). The Northshore Highlands is second with 79 percent timberland followed by the Nashwauk Upland with 76 percent and the St. Louis Moraine with 72 percent. The percentage of timberlands remains high in the remainder of the northeast, averaging around 50 percent. Percentage of timberlands drops

[1] The 1990 forest survey defines timberland as forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of industrial wood crops drawn from timber utilization and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included.

dramatically as the transition is made from the forested areas of the state to the prairie areas, where the percentage of timberlands drops to less than 2 percent along the state's western boarder.

Forested lands in the prairie areas of the state are widely scattered, but are important for recreation, wildlife, and soil stabilization.

5.3 Land Use

As with forest cover, land use also varies widely across the state. The western and southern prairies have been extensively plowed and converted to cropland (Appendix B). Agriculture is the dominant land use in the prairie areas while land use in the heavily forested northeast is dominated by forestry and recreation. The central portion of the state is a transition area between the northeastern forested areas and the agricultural lands of the west and south. The counties of the central portion of the state are dominated by a pattern of dispersed recreational, agricultural, and forestry land uses. Land use in the seven county Twin City Metropolitan Area is dense urban development in the central core, gradually changing over to predominantly agriculture on the outer fringes. The southeastern portion of the state is primarily used for agriculture, intermixed with forest in the blufflands. A more precise description of existing vegetation and land use based on the Subsection Classification Level of the NHF is available in Appendix B.

5.4 Water

5.4.1 Introduction

Minnesotans enjoy an abundance of high quality water. The state has over 25,000 miles of fishable streams, over 15,000 lakes, 7 million acres of wetlands, and substantial groundwater supplies. These resources provide important economic benefits as well as wildlife habitat and scenic amenities that enhance the quality of life for Minnesotans and visitors.

5.4.2 Discussion of Water Quality

Clean water is one of Minnesota's greatest resources and much of this water originates in forested areas. Many of the activities

related to forest management have the potential to contribute some level of nonpoint source pollution to surface and groundwater.

Timber harvesting and forest management activities are extensive by nature. The combination of these extensive forestry operations and the abundance of water resources means that there will be many interactions between the two. However, water quality is affected only periodically and usually for short periods of time, such as during harvesting, road building, or stand establishment. These time periods are generally followed by long interludes with no disturbance from forestry activities. In contrast, agricultural land uses, which account for about half of Minnesota's land area, represent a more serious threat to water quality. Much of the state's cropland is disturbed and susceptible to erosion each year, and large quantities of fertilizer and pesticides are routinely applied.

The gentle topography and generally stable soils over much of the state reduce the risk of soil erosion and adverse impacts on water quality and aquatic ecosystems due to timber harvesting. However, poor timing and/or use of inappropriate techniques and harvesting systems can cause significant *localized* erosion adversely affecting both water quality and aquatic systems. If these poor practices were to be repeated elsewhere in the same catchment (body of water), the potential exists for cumulative impacts to occur.

Forest management also provides opportunities for improving water quality. Establishment of forest stands on abandoned farmland provides long-term stable cover of the soil. Establishment of forest cover in riparian areas (the banks of a stream, lake, or other body of water) areas can reduce erosion and the transport of chemicals from nearby agricultural lands. Integration of forest management with conventional farming activities can also mitigate the problems of providing shelter from wind erosion and can help foster retention of soil moisture.

5.5 Biodiversity

5.5.1 Introduction

Biological diversity or biodiversity is a complex concept that encompasses genetic diversity of individual plant and animal species and the variety and abundance of those species in a community. The interactions among species and between the

organisms and the environment is a component of biodiversity as well. Biodiversity can be assessed in a community, an ecosystem, a landscape (a section of natural inland scenery such as prairie or woodland), or even globally.

5.5.2 Definition of Biodiversity

The Society of American Foresters defines biodiversity as:

> *The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. It also refers to ecological structures, functions, and processes at all of these levels. Biological diversity occurs at spacial scales that range from local through regional to global.*

A community is often defined as a complex or group of species that occurs in a particular setting. The term ecosystem relates more to the interactions among plants, animals, and their environment. Ecosystems emphasize the properties and processes that occur in an area while community describes the inhabitants of an area. An ecosystem and a community may often describe the same area.

5.5.3 Discussion of Biodiversity

Two major biodiversity concerns are: 1) maintenance of rare species and habitats and 2) maintenance of genetic and species diversity. Two specific biodiversity issues are of particular concern in Minnesota. First, forest management activities impact major species at the edge of their range. Minnesota has an unusual number of these due to its location at the junction of conifer forest, deciduous forest and prairie. Second, many land management activities can affect rare communities (e.g., conversion of forest land to other uses, wildfire suppression, and replacement of old forest by younger forest).

In general, biological diversity can be conserved by first identifying all of the elements to be protected, then scheduling harvesting and other management actions so that adequate areas and variations of all the identified forest communities are maintained. These management practices also involve the use of harvest systems that minimize disruption of fundamental biogeochemical processes, including flow and filtration of water,

recycling of nutrients by decomposition, protection of the soil surface layer, and retention of many microhabitats such as dead and decaying trees that provide habitat for a host of plants and animals.

Some might argue that protecting biodiversity can be handled far more easily by simply identifying individual species that appear to be in jeopardy, then mitigating through narrowly directed actions to prevent the species' demise. This strategy does not always work for several reasons. First, when a species reaches a state of jeopardy, much of its genetic diversity may have already been lost; also, it may be too late and expensive by then to save the species regardless of the recovery strategy used. And finally, and perhaps most importantly, the species is not the proper unit around which biological conservation should be organized. The proper unit for such activity is a region's array of natural biotic communities.

5.5.4 Diversity of Plant and Animal Communities

The diversity of plant and animal communities is an indicator of the health of an ecosystem. However, the presence of a large number of rare, threatened, or endangered species in an ecosystem may be an indicator of a fragile ecosystem that is sensitive to how it is managed. Forest management agencies and private landowners and organizations are interested in knowing where species of special interest are located so they can be managed appropriately.

The Department of Natural Resources, through its Natural Heritage Program, Nongame Wildlife Program, and the Scientific and Natural Areas Program is implementing a comprehensive and coordinated strategy to save Minnesota's most threatened species and sensitive natural habitats.

Natural Heritage Program. Conducting research, taking assessment, and promoting wise stewardship of the state's native flora are the responsibilities of the Natural Heritage Program. At the heart of the program is the Minnesota Natural Heritage Database - the only centralized repository of information on the state's rare species and sensitive natural habitats. The database is valuable to planners, land managers, scientists and educators. The information it contains is available for conducting environmental review, implementing land conservation programs, selecting and designing nature preserves, promoting public awareness, and assisting with ecological research.

In 1987, the Natural Heritage and Nongame Wildlife programs

cooperated to initiate the Minnesota County Biological Survey, a systematic county-by-county inventory of Minnesota's threatened natural habitats and rare plant and animal species. Accurate and up-to-date biological data gathered by the survey expands the database and greatly enhances the ability to protect the state's endangered resources.

Nongame Wildlife Program. Minnesota's Nongame Wildlife Program has the responsibility of protecting and managing over 500 nongame wildlife species of birds, mammals, reptiles, amphibians, fish, and invertebrates.

A long-range plan guides efforts in habitat management, endangered species restoration, public education and research. To integrate nongame wildlife concerns into traditional resource programs, nongame staff work closely with foresters, wildlife managers, park specialists, and hydrologists to manage public and private lands for the benefit of all Minnesota's wildlife.

Scientific and Natural Areas Program. The primary goal of the Scientific and Natural Areas (SNA) Program is to protect and maintain critical habitat for rare species, natural communities, and geologic features of statewide significance in a system of natural areas. Qualifying sites are protected through land purchase, gifts of land, or conservation easements, dedication of existing state-owned land, and management agreements. Other lands with rare features are afforded protection by providing advise and assistance to private and public land managers on how to maintain rare features on lands under their jurisdiction. In addition to protecting scientific and natural areas, the SNA Program is entrusted with managing these lands on over 100 sites statewide and providing management advice on over 30 sites covered by management agreements.

5.5.4.1 Species of Special Concern

Many species at the edge of their range in Minnesota or species that are becoming increasingly rare are classified as of special concern. These species are monitored to ensure that actions on public and private lands do not further jeopardize their long term existence. Land managers take special steps when these species are known to occur on their lands to enhance and protect such populations when carrying out management activities.

5.6
Historical and Cultural Resources

5.6.1
Introduction

Historical and cultural resources reflect the history, contributions, and ongoing cultures of the ethnic groups that created this state. Thus, they represent values that are important to Minnesotans. They can be divided into five main categories: cultural landscapes, standing structures, archaeological sites, cemeteries, and traditional-use sites.

Cultural landscapes are a collection of features that represent interaction between humans and the environment. Cultural meaning can be assigned to natural features, or features that have been made or modified by humans.

Standing structures include things like buildings made and used by people, generally in the recent past. Standing structures are rare within timberlands.

Archeological sites are located on or below the surface of the ground or underwater. They include two major categories: 1) Indian sites such as the remains of large and small villages, camps, and processing sites; and 2) Euro-American sites such as fur trading posts, homesteads, and logging camps.

Most of these sites are not visible at the ground surface and can be located only by using special techniques. Many of them are present within forested areas and could be adversely affected by timber harvesting activities.

Cemeteries may contain the remains of one or more human beings and are common on forested lands in Minnesota. These include Indian and Euro-American cemeteries.

Traditional-use sites are locations that have been used in the past by one or more groups of people for some type of activity. They may lack the physical evidence of artifacts or structures and are often characterized by plants, animals, and/or topography of cultural and religious significance to Indians.

Heritage sites have been intermittently inventoried for over a hundred years, with most having been recorded over the last three decades. A listing of these known sites is maintained by the state archeologist's office and now contains over 3,000 records, but this is less than 1 percent of all sites estimated to be in Minnesota.

Besides being incomplete, this inventory contains numerous inaccuracies.

5.6.2 Site Location

Predictive models estimate the likelihood of specific types of cultural heritage sites occurring on particular types of landscapes. For example, they indicate that most pre-Euro-American sites are probably located within 1,000 feet of past or present water features (including swamps, marshes, and abandoned river channels).

5.6.3 Site Density and Size

Based on estimates done for the GEIS, there are approximately 190,000 sites in the forested areas of the state. Most archaeological sites are probably under 5 acres in size and appear to vary by ecoregion. Sites in the eastern prairie/forest transition zone may be the largest, generally occupying 5 to 10 acres. Sites in the central pine-hardwood forests are generally under 5 acres, but over 1 acre. Sites in the Lake Superior Highlands are frequently under 1 acre. Cemetery sites vary considerably in size, from less than 1 acre to 25 acres. Cultural landscapes range from small features such as portions of rock outcrops to large areas that include major topographic features. Traditional-use areas may be less than 1 acre to 100 acres.

5.7 Recreational and Aesthetic Resources

Demand for additional resource-based recreational facilities has not increased substantially since the last the Statewide Comprehensive Outdoor Recreation Plan (SCORP) was prepared for 1985 - 1990. However, most recreation planners expect significant changes in demand to take place as "baby boomers" reach middle age, and their recreation patterns change. What has changed in the last few years is that new forms of recreation have come on line as a result of new technology. Examples of new forms of recreation based on new technology include personal watercraft, in-line skates, and mountain bikes.

The 1995 SCORP prepared by the Minnesota Department of Natural Reources includes the issues and strategies that will guide recreation-related land acquisition, facility development and operations, and recreation programming for the period 1995- 1999. According to a recent recreation participation survey conducted by the DNR, Minnesotans spend a total of 847 million hours per year

participating in outdoor recreation activities. This is an average of 225 hours per person per year. Results of the survey show that walking and hiking, bicycling, fishing, and driving for pleasure account for half of the annual outdoor recreation activity hours expended by Minnesotans.

In Minnesota, summer is the season when over half of all outdoor recreation occurs. Conversely, winter accounts for only 19 percent of the activity hours.

Most natural resource-based recreational activity takes place in the northern half of the state. This is the region of the state where most state and federal forested lands and resorts are located. The Boundary Waters Canoe Area Wilderness (BWCAW), Voyageurs National Park, and many of the heavily used state parks such as Jay Cooke, St. Croix, Itasca, Cascade, and Gooseberry Falls are all located in the northeastern and north central regions of Minnesota. State parks serve as both destination sites—people travel to them to recreate solely in them—and as staging sites for recreational activities in the surrounding region.

Minnesota has over 1,300 privately-owned resorts. The majority are located in the central pine-hardwood forest region of the state (north central Minnesota) and nearly all of them include lake, stream, or riverfront property. The variety of recreational activities that occur at these resorts includes all of the major outdoor recreational activities associated with Minnesota (e.g., camping, canoeing, fishing, boating, and hiking) and other activities that do not require a natural setting (e.g., golfing, volleyball, baseball, and tennis).

Resorts often depend on lands owned by others for their setting. In addition, many are adjacent to public lands such as state parks, state and federal forests, and county lands. The recreational opportunities available on these public lands serve as part of a resort's attraction. Owners typically advertise using these public lands as an important backdrop or attraction for their resorts.

The quality of recreation opportunities on forest land is highly dependent on the aesthetic quality of the forest setting. The GEIS describes the recreational opportunities and aesthetic features of forest lands in Minnesota, their distribution and current-use level. In developing descriptions and assessing impacts, a number of data sources were used including: 1) statewide forest inventories and associated plot records, particularly those for 1990 and projected to 2040 in the GEIS study; and 2) the Recreation Opportunity Spectrum (ROS) developed by the USDA Forest Service and available in the forest inventory data. (Note: the FIA no longer

uses the ROS because they consider it very limited in terms of applicability to this region of the country.)

The ROS suggests the following settings for recreational opportunities in forested areas:

1. **Primitive.** An area three or more miles from all maintained roads or railroads that has an unmodified natural environment. There can be evidence of foot trails for recreational use. Structures in use are rare. Contact with humans is rare and chances of seeing wildlife are good. Example: BWCAW.

2. **Semiprimitive Nonmotorized.** An area one-half to three miles from all maintained roads or railroads, but which can be close to primitive roads or trails used occasionally. Modifications to the environment are evident, such as old stumps from logging, but are not apparent to the casual observer. Structures in use are rare. Human contact is low and chances of seeing wildlife are good. Example: recently undisturbed state lands.

3. **Semiprimitive Motorized.** An area one-half to three miles from all maintained roads or railroads, but one-half mile or less from primitive roads or trails used by motorized vehicles. Modifications to the environment, human contact, and chances of seeing wildlife are the same as semiprimitive nonmotorized. Example: state lands with snowmobile trails.

4. **Roaded Natural.** An area less than one-half mile from maintained roads or railroads. Modifications to the environment may be obvious and buildings are occasionally seen. Chances of seeing wildlife are diminished by evidence of increased human contact. Example: private hunting lands.

5. **Rural.** An area close to maintained roads but not limited by distance, and in a setting that has been substantially altered by humans. Structures and houses are obvious and/or visible and human contact is frequent. Wildlife can be present, but sightings are rare. Example: farm woodlots.

6. **Urban.** An area close to maintained roads, but not limited by distance and surrounded by an urban-suburban setting. Substantial modifications to the environment may be apparent and buildings or structures can usually be seen.

Human contact is quite frequent and wildlife sightings are rare. Example: home development areas.

It is very difficult to evaluate the aesthetic values of forest lands statewide. However, when the ROS is applied to forest survey plots, the percent of land having various ROS qualities can be determined. The GEIS researchers felt the less disturbance on a forest survey plot, the less likely the aesthetic qualities of the plot had been impacted. Consequently, the more "primitive" the recreational value of a given plot, the more likely it will be found to be aesthetically undisturbed. Table 5.1. illustrates the percentage of state forest land that meets the various ROS classifications.

Minnesota forests are particularly vital to the health of both the tourism and forest products industries. While many of the demands on the forests are compatible and even complimentary, concern about the specific impacts of various forest management practices on forest aesthetics became the focus for a positive dialogue among tourism and forest products interests.

Representatives of the Minnesota Resort Association and Minnesota Forest Industries worked to develop a set of best management practices (BMPs) for visual quality management, and to implement a comprehensive information and education program.

Table 5.1. Recreational opportunities on timberlands and on all forest plots statewide.

Recreation Opportunity Spectrum (ROS) Class	Percent of Plots	
	Timberland (1)	All Forest (2)
Primitive	0.4	3.1
Semiprimitive nonmotorized	7.2	9.6
Semiprimitive motorized	25.4	25.2
Roaded Natural	41.7	38.7
Rural	25.0	23.0
Urban	0.3	0.4
Total	100.0	100.0

(1) Land capable of commercial production of timber.
(2) Timberland, reserved, and unproductive forest land.
(Source: GEIS)

Through the use of voluntary BMPs, cooperation, communication, and education, the timber and tourism industries believe both

industries will benefit.

5.8 Forest Protection

Minnesota has a history of large and destructive forest fires. These fires have resulted in the loss of property and natural resources. This same potential exists today. As recently as 1980, towns would have been destroyed without the suppression action provided by the DNR. The development of homes and properties in rural and semi-rural areas has made the protection of structures a normal circumstance in wildfire suppression.

The activities of pests such as the spruce and jack pine budworms, white pine blister rust, hypoxylon canker of aspen, dwarf mistletoe, oak wilt, bronze birch borer, and wood decayers result in the loss of about one-half of the annual forest growth in the state.

The productive capacity of forests is mainly defined by the physical and chemical characteristics of the soil. Soil and landform relationships directly influence the capacity of the land to provide for an optimum mix of such public benefits as timber, wildlife habitat, and high quality water resources.

5.8.1 Fire

Wildfire management is divided into prevention, presuppression, and suppression functions. Prevention is designed to reduce the number of fires and losses through public education, regulation of open burning, and law enforcement. Presuppression prepares suppression forces for the eventuality of fire and provides for maximum speed in detecting fires. Activities include training, establishing inter- and intra-state mutual aid agreements, developing local and statewide plans, dispatching procedures, and methods to organizationally cope with large, escaped fires, and monitoring weather and its related fire danger. Suppression is the extinguishment of fires at the minimum possible size in the shortest time possible, considering values at risk. This is accomplished through a balanced application of suppression forces including trained crews, crawler tractor and plow units, dozers, fire trucks, pumps and hose, hand tools, airtankers, fire retardants, and helicopters equipped for cascading water. Operations are often jointly accomplished with fire departments, the Department of Natural Resources, and federal agencies.

Effective wildfire protection benefits almost every facet of the social and economic life in Minnesota. Wildfire directly impacts two of the three major industries in the forested areas of Minnesota, timber and tourism.

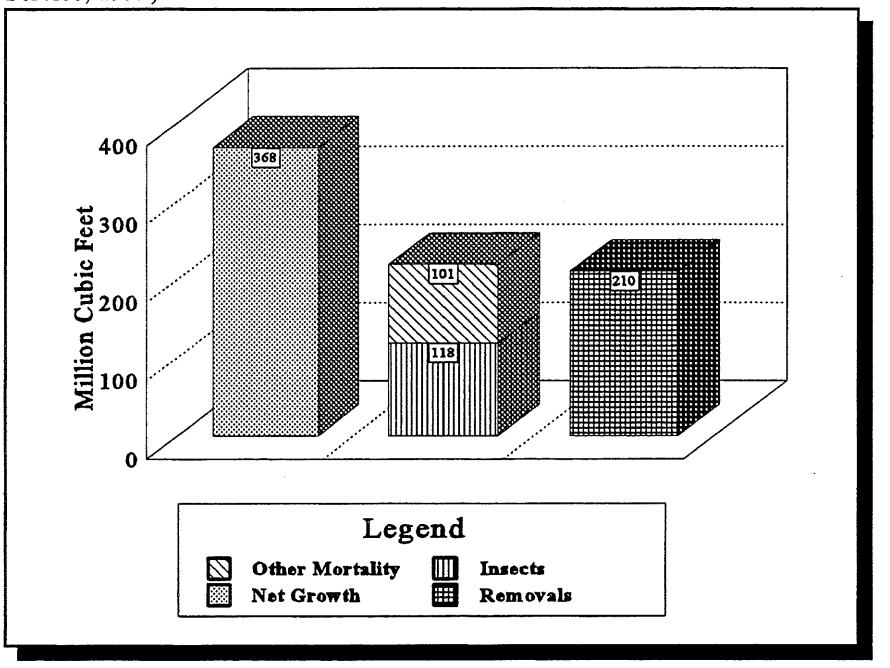
5.8.2 Forest Health

Insects and diseases are an important part of the forest ecosystem and are fundamental agents of change in long-lived communities such as forests. The effects they have on forests vary from tree mortality to poor tree form to reduced resistance to other stresses. These effects impact human uses of the forest in positive and negative ways depending on the objectives. Loss of productivity due to mortality, decay, reduced growth rates, and increased risk of fire are negative impacts to timber management objectives. In addition, insects and diseases can negatively impact recreational and aesthetic aspects of forest resources.

Positive effects include those on wildlife as insects and diseases can provide habitat such as tree cavities formed by fungal decay and/or food sources such as insect larvae. However, widespread pest outbreaks that kill many trees can reduce the value of habitat for some wildlife species. Severe outbreaks are possible where natural checks and balances controlling a pest population do not function, or where no natural controls for an introduced pest exist.

Figure 5.2. summarizes the average net annual growth, average annual removals, and average annual mortality of growing stock timber. Removals are defined as the volume of sound wood in growing stock or live sawtimber trees removed annually for forest products and those trees not utilized and removed from the commercial forest land classification.

Figure 5.2. Annual change in growing stock 1977-1990. (Source: USDA Forest Service, 1992)



5.8.3 Soils

Soil is one of Minnesota's most important natural resources, the base upon which the state's agricultural economy is built. Soil consists mostly of rock materials that have been weathered and worn over long periods of time. Except in southeastern Minnesota, most of these rock materials have been brought into the state by glaciers and deposited or smoothed out in the gently rolling glacial till plains. As the glaciers gradually melted and receded, and before much vegetation had developed, the finer soil materials were moved about and deposited on outwash plains, in stream valleys (alluvial soils), and glacial lake bottoms (lacustrine soils) by water, and on upland slopes mainly in southeastern Minnesota by wind (loess soils).

The weathering effects of temperature and precipitation gradually broke down the minerals in the parent material and established an environment suitable for vegetative growth. Vegetation, in turn, responding to the varying climatic conditions, has had an important influence on soil development.

The type and amount of organic material in the soil is related to the type of vegetation. In forested areas organic material is derived primarily from leaves, or needles, and wood. In prairie

areas many of the stalks and roots of grasses decay each year, supplying the soil with an abundance of organic matter. As a result, the prairie soils are the richest and most productive soils for agriculture in Minnesota. Soils that have developed under hardwood forests are intermediate in fertility, while those developed under the coniferous forest of north central and northeastern Minnesota tend to be acidic, the least fertile, and the least suitable for crop production. The differences in fertility and acidity, however, are often more the result of the parent material from which the soil was formed than the vegetation.

Topography and drainage also affect soil formation. Steep slopes on which runoff is rapid retain little moisture for plant growth, which is needed for soil development. Flat, poorly drained, continuously moist areas result in abundant plant growth, but slow deterioration—as in Minnesota's peat bog areas. Slope influences the rate of evaporation, with south-facing slopes receiving more direct sunlight than north-facing slopes.

Soils vary widely in texture and chemical composition. Loam is a soil of mixed sand, clay, and organic material that exhibits great differences in its suitability for agriculture or growing trees. Loam soils range from deep, dark colored topsoils formed under the prairie grasslands of southwestern Minnesota and rich in organic matter and high in soluble mineral plant food, to the thin, light colored, low fertility soils that developed beneath the coniferous forests of central and northeastern Minnesota. Sandy soils and clay soils are directly related to the location of outwash plains and lake plains, respectively. Other soils in Minnesota include alluvial soils, spread across the flat floodplains of present-day rivers and streams and loess (wind-blown soil) found mainly in southeastern Minnesota.

Soil protection and extensive deep rutting are serious resource concerns associated with harvest activity. Soil protection is a critical resource concern in Minnesota where many of the soils have low bearing strength and could be easily damaged by logging equipment.

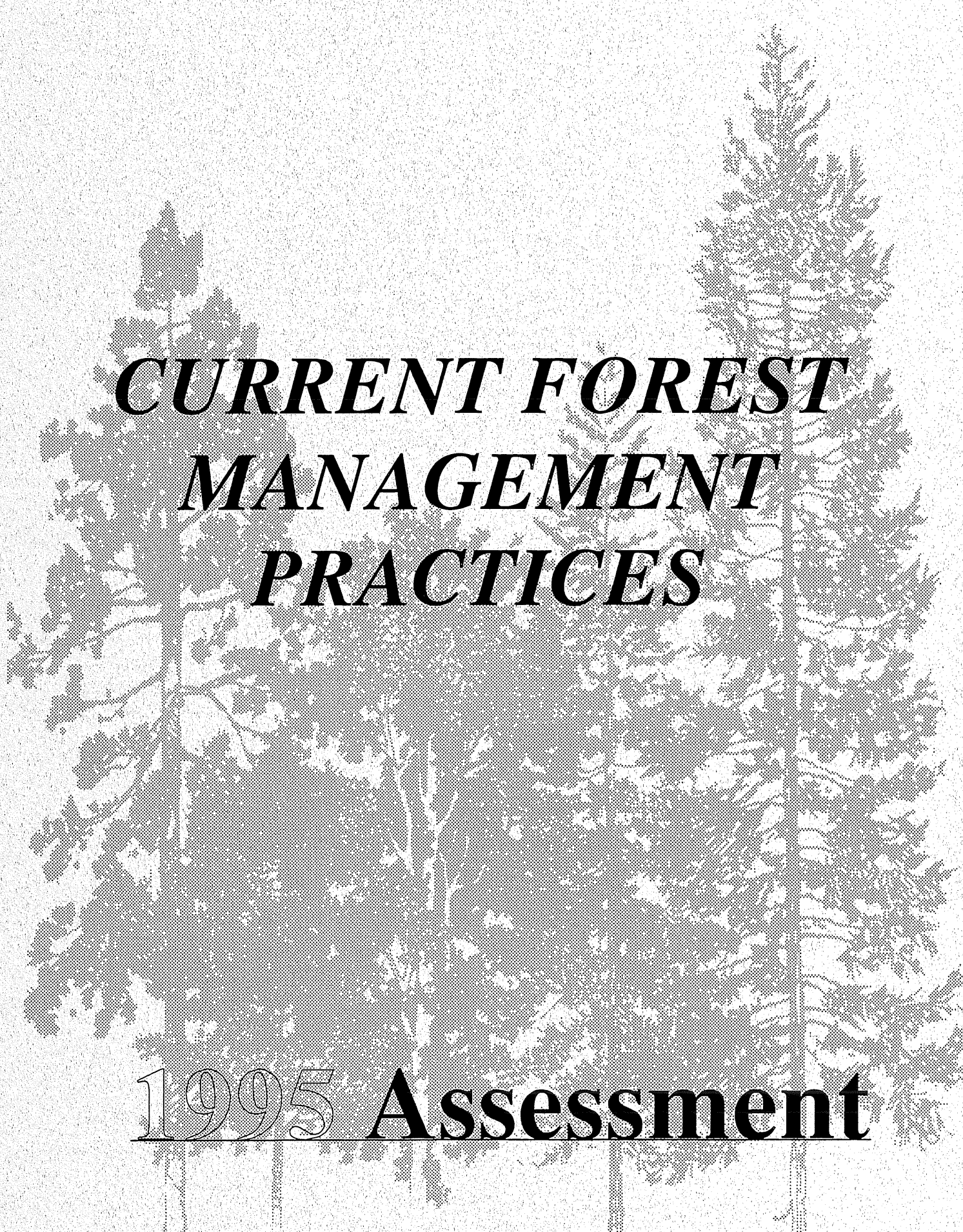
5.9
Community (Urban) Forest Resources

Community forestry in Minnesota encompasses both natural and planted environments. Boulevards, parks, school forests, municipal forests, greenbelts, residential dwellings, commercial and industrial sites, and undeveloped areas are places where trees and woodlands occur.

In 1989, a survey of 20 Minnesota communities was conducted by the Department of Natural Resources in cooperation with American Forests (formerly the American Forestry Association) to assess the condition of the state's community forests (specifically street trees). Sample plots were surveyed in communities as small as Kenyon and South International Falls and as large as St. Paul and Minneapolis. Results indicated that the majority of community street trees are in good to excellent condition. However, most of these trees are small in diameter as a result of the catastrophic losses to Dutch elm disease and a flurry of replanting aided by state cost share monies from 1976-82. Additionally, the survey found that in this rush to replace the elms, many communities so overplanted green ash that they began to approach a shade tree monoculture similar to the elm monoculture that paved the way the for the Dutch elm disease disaster.

The most significant finding was that 50 percent of the available spaces for street trees remain unplanted. This means that there is room for approximately 360,000 more trees along Minnesota community streets.

American Forests has estimated from earlier surveys that for every boulevard tree in a community there are 10 other trees in yards, commercial and industrial areas, and public parks and open space. In Minnesota communities, there is estimated growing space for planting an additional 3.6 million trees in these off-street locations. American Forests also estimates that the current average community tree cover is only 30 percent. For maximum environmental benefits, American Forests recommends average tree cover be doubled to 60 percent.



CURRENT FOREST MANAGEMENT PRACTICES

1995 Assessment

6
CURRENT FOREST MANAGEMENT PRACTICES

6.1
Harvesting

In 1993, the DNR, Division of Forestry and the USDA Forest Service, North Central Forest Experiment Station estimated approximately 4.1 million cords of timber were harvested in Minnesota, up significantly from the 2.4 million cords harvested in 1980.

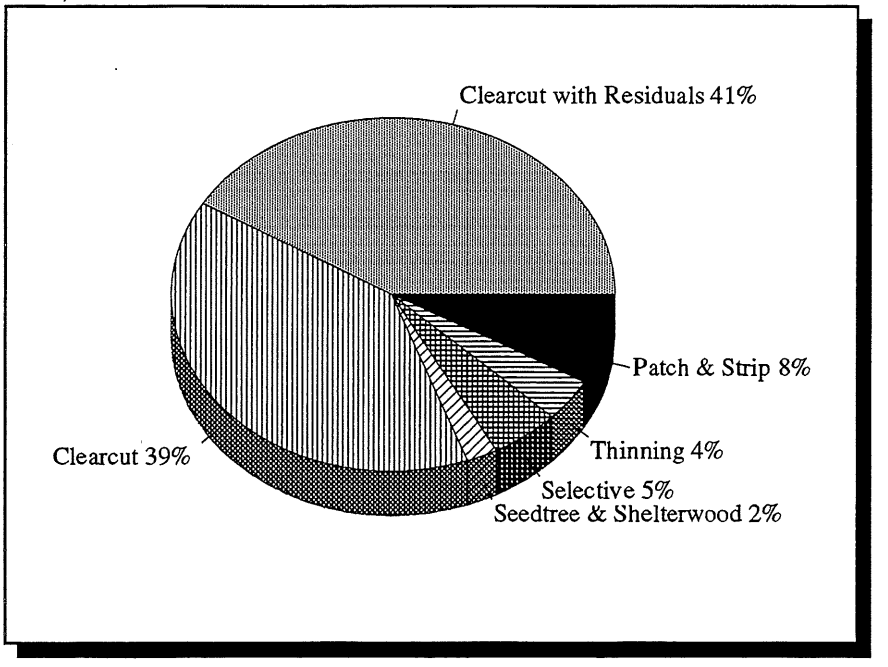
How timber is harvested is affected by a number of factors: stand location, sensitivity class, land-use designation, species of trees being cut, tree size, volume per acre, branchiness, logging area size, average and maximum off-road transport distance, distance to point of utilization, brush/undergrowth conditions, slope and position of slope, obstacles, snow depth, weather conditions, and visual and wildlife management requirements. All these factors influence logging costs and impacts on the site and residual trees. Each logging system fits specific conditions. For example, the full tree mechanized systems are most suited to large, concentrated harvesting operations. The small tree length or cut-to-length systems are better for small, widely dispersed logging operations. The choice of the logging method will also influence the amount of access roads required in the area.

Figure 6.1 shows that the most common methods of harvesting timber in Minnesota are clearcutting and clearcutting with residuals. These two methods accounted for 80 percent of the total wood volume harvested in the state in 1991.

6.2
Reforestation

Of the total timber harvested in 1991, 80 percent of the volume came from clearcuts and clearcuts with residuals, which in turn accounted for 71 percent of the area with logging operations. (Clearcutting is a silvicultural tool that is used effectively to regenerate shade intolerant species, specifically aspen. Vigorous root suckering occurs in aspen following harvest, but only if the stand is cut completely.) Patch, strip, and other modified cutting accounted for 8 percent of the volume and area logged. Seed tree and shelterwood cutting accounted for 2 percent of the volume and 4 percent of the area logged. Selective cutting accounted for 5 percent of the volume and 8 percent of the area logged. The volume removed in thinnings was 4 percent, and occurred on 10

Figure 6.1. Percentage of wood volume in 1991 by harvesting method. (Source: GEIS)



percent of areas with logging operations. The total area with logging operations was estimated to be 200,000 acres, of which 19,000 acres was thinning. Planting occurred on 32,600 acres, seeding on 6,000 acres, and natural regeneration on 142,000 acres. A summary of estimated annual silviculture operations on timberlands by ownership, 1990-91 can be found in Appendix H. Figure 6.2 illustrates the total amount of harvest and regeneration by ownership in 1991.

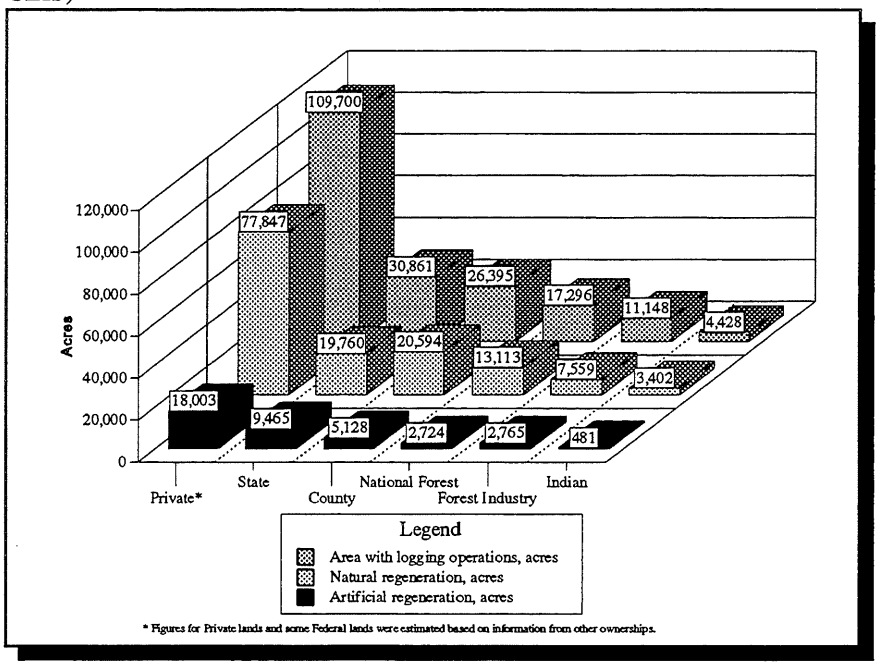
The estimated total site preparation (see appendix L) area in 1991 was 18,500 acres, of which 18,000 acres was mechanical site preparation. Site preparation occurred on 0.13 percent of the timberland area in the state. The estimated total area with timber stand improvements was 28,000 acres (0.20 percent of timberlands), of which 9,800 acres was chemical release (0.07 percent of timberlands). Logging operations occurred on 1.44 percent of the timberlands, of which 1.31 percent were regeneration cuts (see appendix L) and 0.13 percent thinnings.

6.3 Protection of Water Quality

Impacts on water resources are not confined to the site where disturbance has occurred. Therefore, it is important to develop and

implement standards of practice that can reduce impacts irrespective of ownership. Minnesota forest management agencies and industries have developed a series of voluntary forest water quality best management practices (BMPs).

Figure 6.2. Harvest and regeneration acreage by ownership, 1991. (Source: GEIS)



Using BMPs will reduce the likelihood of impacts resulting from forest management and timber harvesting. In addition to these practices, effective and timely regeneration of the new forest cover represents a major way in which soil stability can be assured and therefore water quality values maintained.

Field audits from 1991 to 1993 revealed compliance with BMP recommendations averaged 84 percent across all forest landowners. Where BMPs were properly applied, adequate protection to the water resource was found 99 percent of the time.

6.4
Insect and Disease Control

6.4.1
Silvicultural or Cultural Control Techniques

Pest control strategies have primarily focussed on cultural measures. Cultural strategies typically include physical

manipulation of stands, often by harvesting, in order to remove infected trees or to promote vigorous growth in trees, thereby reducing opportunities for pests to become established. As with many silvicultural problems, health-related measures are typically employed only if low cost solutions are available. This reflects the comparatively low timber values of many of the more vulnerable and susceptible stands, and the often extensive nature of outbreaks. Many ownerships are simply unable to justify the expense of pest control measures.

Many of the integrated pest management (IPM) guidelines are expressed in terms of practices or situations to be avoided so that no records of relative success or failure of the guidelines are available. Other guidelines prescribe methods of timber harvesting that also achieve objectives of insect and disease control. The recognition of the potential for pest and disease problems and the application of the most appropriate cultural measures often requires a stand level as well as forest-wide analysis (DNR 1990). This level of professional input is available on state, federal, county, and forest industry lands, but is less available or not available for (non-industrial private forestland) NIPF lands.

6.4.2 Direct Control

Direct control methods involve spraying to kill pests. Cost and the potential for controversy surrounding possible unintended side effects limit the choice of direct control methods that can be applied. The Water Quality and Fisheries Technical Paper of the GEIS (Jaakko Pöyry Consulting, Inc., 1992) discusses concerns regarding possible effects of insecticides on nontarget aquatic species. There is no data available on the use of insecticides in Minnesota because of the very low level of use in commercial forests. Insecticides might be used in the event of future gypsy moth or spruce budworm attacks. Possible insecticides include *Bacillus thuringiensis* (B.t.), a microbial insecticide used to control moth and fly pests in forests. Dimilin® (difenbenzuron) has been used in Maryland forests for control of gypsy moth.

6.4.3 Biological Control

Classical biological control is typically defined as the importation and release of native or exotic predatory, parasitic or pathogenic organisms (e.g., natural enemies) to control a targeted pest. Other biological control strategies include augmentation of existing populations of natural enemies or modification of habitat to favor natural enemies. Successful biological control is often constrained

by lack of knowledge of the attributes of the pest, its natural enemy, and their interaction. Acquiring such knowledge often entails intensive research efforts.

However, biological control has been implemented successfully in Minnesota forests for control of larch sawfly. Natural enemies and potential biological control agents of several forest insect pests including other sawfly species, spruce and jack pine budworm and forest tent caterpillar have been investigated. A recent study conducted in Minnesota with cooperation from the Minnesota Department of Agriculture involved successful establishment of an exotic parasitoid wasp in anticipation of gypsy moth establishment.

Biological control strategies are often compatible with other pest control or integrated pest management strategies. Biological control can often contribute to long-term pest management and seldom results in adverse environmental consequences. The potential exists to incorporate more biological control into pest management if benefits can be demonstrated to justify costs of research and implementation.

6.5 Protection of Historical/Cultural Resources

6.5.1 Introduction

Both state and federal laws control and guide the inventory and management of cultural heritage sites. The Minnesota Historical Society, the State Archaeologist, the Minnesota Indian Affairs Council, and the State Historic Preservation Officer help to monitor and maintain these laws.

Most historical and cultural resources are extremely fragile and can be seriously affected by timber harvesting and associated activities such as road construction. They are fragile because dislocation or destruction of artifacts and the sediments that contain them can destroy or seriously compromise the essential information that they contain. Earth-disturbing activities do not have to be very intense to negatively affect such sites.

Timber harvesting and forest management activities that account for most impacts to cultural resource sites include: construction of access roads, skid roads, trails, and landings; felling trees and skidding logs from the stand to the landing; and site preparation for regeneration or planting. Impacts that can occur as the result

of these activities include: soil compaction, soil erosion, streambank erosion, surface mixing of soils, and damage to above- and below-ground features. Traditional-use sites can be altered by modern harvesting operations through change of vegetative cover, reduction of availability of certain plants and animals, and changed frequency and mode of public access.

When threatened by development or other earth-disturbing activities, some sites significant for the scientific information they contain can be excavated to remove this information. Other sites, significant because of spiritual, aesthetic, or other values that cannot be saved by scientific recording, would be lost in whole or part if the property were adversely impacted.

6.5.2 National Forest

The Chippewa and Superior National forests conduct on-the-ground surveys of all timber sales wherein the entire sale area is surveyed, not just roads and landings. The type of survey coverage is determined by using the predictive models developed over the last 10 years specifically for the national forests. These predictive models were initially developed at a general level as a three-year project and are being continually refined as new site data becomes available.

To develop the initial model, an archaeologist and a geomorphologist reviewed all U.S. Geological Survey topographic maps for the national forest and all available site location data. All paleohydrographic features such as abandoned shorelines, former stream inlets, and outlets and channels were identified. These features require shovel testing at 15-meter intervals across the relevant paleofeature. When a timber sale is planned, these maps are consulted to determine if such subsurface shovel testing is needed in any part of the timber sale area.

Archive information is consulted for clues about the location of more recent sites, such as homesteads and logging camps. This includes such sources as maps compiled from the original land survey notes, as well as the earliest aerial photos from the area, which often show openings that may indicate homesteads. Areas that do not need shovel testing are traversed to detect surface features such as berms and cellar holes. Walk-over transects are spaced according to visibility. Generally they are at 15 to 20 meter intervals and cover the entire sale area. Walk-over surveys are done during leaf-off conditions, but with less than 1-inch of snow cover. The costs of conducting these surveys vary from an average of $3 per acre for large areas up to $4 per acre for smaller

blocks.

6.5.3
State and County Ownerships

There are no systematic, routine surveys for cultural or historical resources undertaken prior to harvesting operations by state or local resource management organizations. Where sites are known to exist on timberlands, modifications have been made to timber sales to protect these specific sites. This typically involves identifying the site boundaries and excluding logging. This situation will change somewhat for state-administered timberland as a contract archaeologist is being hired to conduct surveys on high priority sites and help develop cultural resource guidelines.

6.5.4
Private Ownerships

There are no systematic, routine surveys for cultural or historical resources undertaken prior to harvesting operations.

6.5.5
Indian Tribal Lands

Systematic, routine surveys are beginning to be conducted on tribal lands. Some tribal governments have passed historic preservation ordinances that require implementation of protective measures.

6.6
Aesthetics

As more and more demands are being placed on the state's forest resources, more emphasis is being placed on the need to protect scenic resources. In the past the aesthetic qualities of the state's forested areas have been largely taken for granted. Aesthetic quality plays an important role in the value of forested land for other activities.

The GEIS states that: "forest management activities have a direct impact on the aesthetic quality of an area." The effects of forest management activities such as timber harvesting and regeneration can change the appearance of the forest. Management activities can reduce recreation and tourism values for a long time. However, the impacts are not always negative. Through planning and design, forest management activities can actually be used to enhance the aesthetic value of a forest. For example, on most public land, timber sales are designed to enhance the long term

visual quality of the site.

For several years, the US Forest Service has used the Visual Opportunity Spectrum (VOS) System on national forest lands as a means of maintaining aesthetics. The state of Minnesota has also been moving in this direction by providing landscape management training to staff and is in the process of hiring an aesthetics management specialist in the Division of Forestry. Finally, visual management BMPs have been developed by a committee known as the Timber and Tourism Steering Committee for use on a voluntary basis on all forest lands in the state. The committee is a consortium of timber, recreation, forest industry, and government interests.

6.7 Biodiversity

Although terminology differs, the Division of Forestry, the National Forest System and some counties are involved in various aspects of maintaining biodiversity. The primary method being used is practicing Integrated Resources Management (IRM) on an ecological management unit basis. IRM activities include planning for desired future conditions and managing for ecological as well as social and economic benefits. Potential impacts on management activities on endangered species and communities (e.g., old-growth forests) are given careful consideration by most public land managers in Minnesota. Specific management actions are evaluated on an ecosystem basis with the aid of an ecological classification system. Restoration of ecological systems is promoted and cooperation with other agencies, the public, and interest groups is stressed.

6.8 Community (Urban) Forest Resources

Management of Minnesota's community forests is undertaken by various organizations. The Minnesota Department of Agriculture, Plant Industry Division certifies local tree inspectors, inspects nurseries, and directs management of regulated pests. The University of Minnesota provides the lead for research and professional education through the Institute of Agriculture, Forestry and Home Economics. The University's Minnesota Extension Service furnishes publications, community-based educational programs, and continuing education for professionals and field staff. The Minnesota Department of Natural Resources (DNR) administers the Tree City USA and Minnesota ReLeaf programs, coordinates Minnesota's Arbor Month Program, and provides technical assistance in community forest management.

The USDA Forest Service and DNR provide financial assistance to communities through cost-share programs and competitive grants. The Minnesota Department of Transportation provides technical assistance for plantings on trunk highways in and adjacent to communities through a partnership program and through state and federally funded landscape contracts. Private non-profit community corporations, youth organizations, and volunteer groups are working to plant, nurture, and protect community forests in Minnesota.

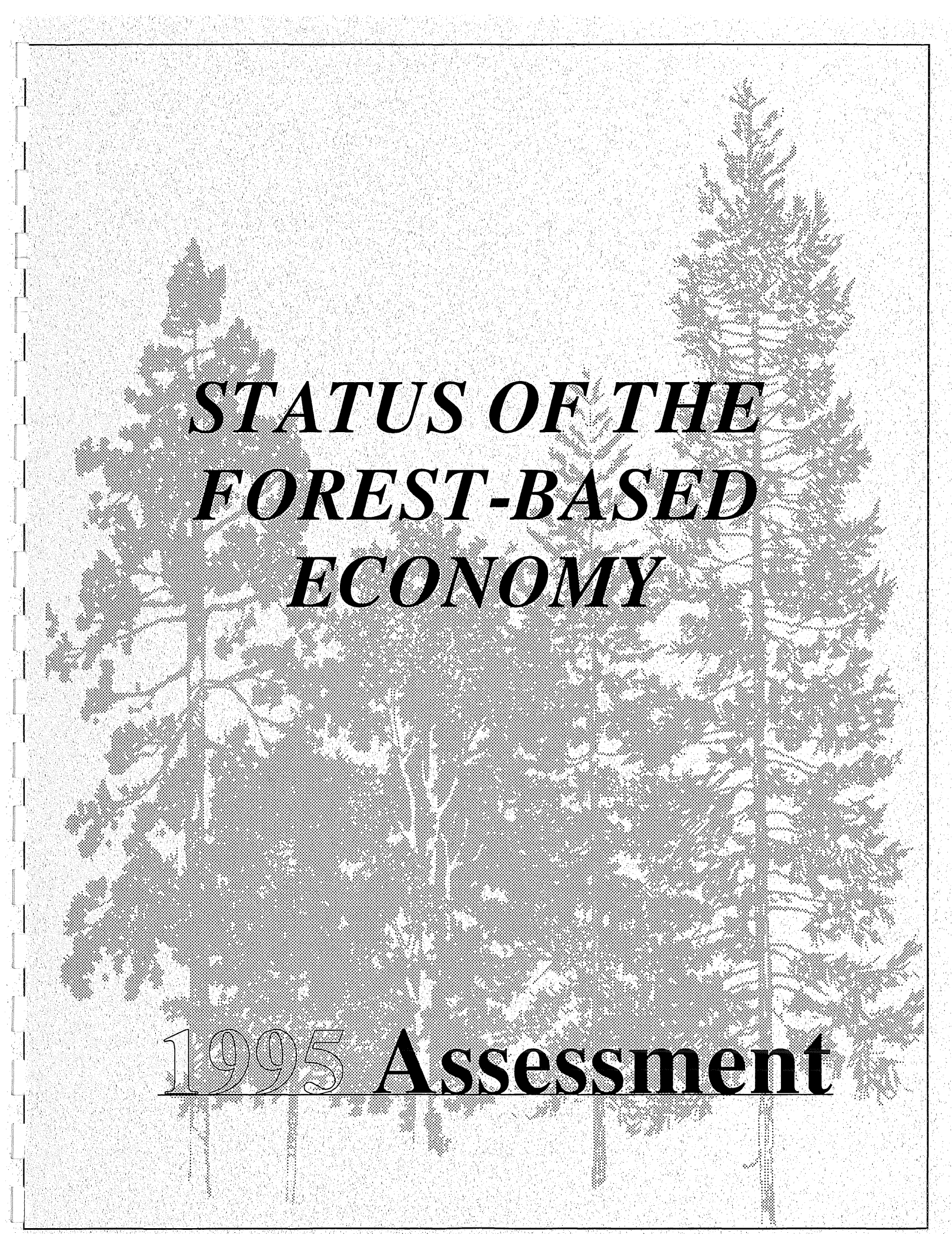
Since 1974, the Minnesota Shade Tree Advisory Committee (MnSTAC) has served as a forum where concerned people forge a collective vision for the future of Minnesota's community forests. MnSTAC is recognized as a national leader for its work in coordinating state agency and local programs and promoting the protection and expansion of Minnesota's community forests. Its diverse members represent nurseries, public utilities, community groups, non-profit organizations, academic institutions, the extension service, and local, county, state, and federal government agencies. They include arborists, consulting foresters, landscape architects, and private citizens. MnSTAC has been designated as the State Council to guide implementation of the America the Beautiful Initiative in Minnesota.

In 1989 the Minnesota Legislature directed MnSTAC to prepare a comprehensive analysis of community forestry issues. The resulting report, *Minnesota's Community and Urban Forests - Opportunities and Recommendations*, identified major urban urban forestry issues and opportunities, summarized relevant literature, and developed policy recommendations. The 1990 legislature responded by creating the Community and Urban Forestry Act. This act encouraged the development of community reforestation policies, called for expanded Arbor Day programs and advocated greater diversity in the species of trees planted.

The 1990 legislature also recognized the role of trees in balancing the earth's carbon cycle and passed legislation that required a study of carbon dioxide emissions and incentives to reduce emissions. *Carbon Dioxide Budgets in Minnesota and Recommendations of Reducing Net Emissions with Trees* was submitted to the legislature in January 1991 through a cooperative effort of a number of agencies and organizations. Recommendations for legislative considerations included tree planting programs to reduce carbon directly through carbon storage and indirectly through reduction of energy demand. Support for the establishment of a Minnesota ReLeaf program was included in these recommendations. Minnesota ReLeaf has been developed as part of the larger Global ReLeaf effort to promote community and

volunteer action (involving individuals and businesses) in tree planting and tree care programs.

Most recently, the Legislative Commission on Minnesota Resources (LCMR) approved a work "Tree and Shrub Planting for Energy in Minnesota Communities." An appropriation of $1,250,000 was made available from July 1991 to July 1993 to accelerate appropriate planting of trees and shrubs for energy conservation in Minnesota communities. This aspect of Minnesota ReLeaf was established to encourage, promote, and fund planting, maintenance, and improvement of trees to reduce atmospheric carbon and enhance energy conservation.



STATUS OF THE FOREST-BASED ECONOMY

1995 Assessment

7
STATUS OF THE FOREST BASED ECONOMY

7.1
Forest Products Industry

Minnesota's forest products industry directly provides 58,960 jobs. If the indirect impacts of the forestry and forest products industry are considered, the industry generates about 111,000 jobs, $2.8 billion in employee compensation, and $10.1 billion in total industry output. The importance and nature of the forest products industry varies from one part of the state to another.

7.1.1 The Logging Industry

The logging industry is the primary supplier of roundwood used by other primary forest products industries. The GEIS estimated that there are 1,300 logging companies in Minnesota. These organizations do not typically own substantial amounts of timberland and are small in size. A survey conducted for the GEIS found that 90 percent had 10 or fewer employees. Loggers may harvest timber under contract from both public and private land, including land owned by forest industry.

To describe geographic variation in the forest products industry, the state has been divided into four economic regions as shown in Figure 7.1. The north region is much more heavily forested than the rest of the state, with 45 percent occupied by timberland. The forest products industry is especially important to the economy of this region as it contains large pulp and paper producers and oriented strand board (OSB) and flakeboard mills. The forest products industry is influential in the southeast region where hardwood sawmills are important to the economy. There is significant employment in forest products industries in the metro region, but this is a relatively small proportion of the total employment in the area. Also, the forest products industry in the metro region consists mostly of secondary producers who do not directly purchase or process roundwood. There is relatively little forest land in the southwest region, so the forest products industry is a relatively small part of this region's economy. Table 7.2 shows the area of land, forest, and timberland within Minnesota's economic regions.

Figure 7.1. Economic development regions used in the GEIS.

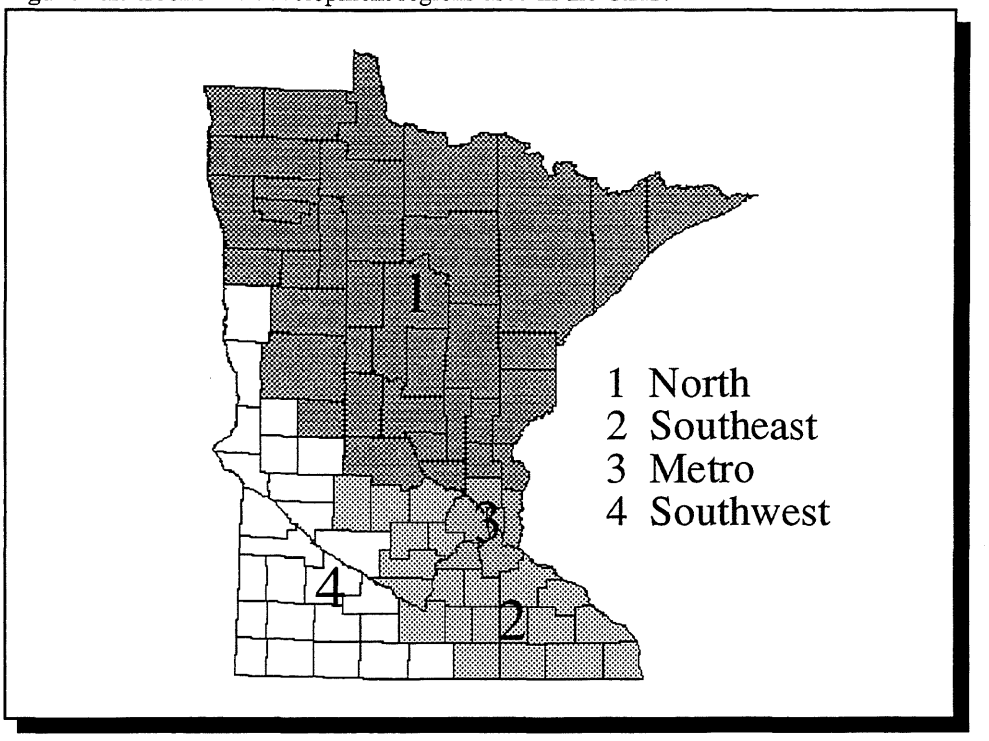


Table 7.1. Economic impacts of the forestry and forest products industries by economic region in Minnesota, 1988.

REGION	Economic Impact		
	Total Output ($millions)	Employee Compensation ($ millions)	Jobs
North	4,804	1,372	54,083
Southeast	1,255	341	13,483
Metro	3,879	1,066	41,645
Southwest	146	42	1,888
Total State	**10,084**	**2,820**	**111,054**

(Source: GEIS)

7.1.2
Primary Forest Products Industries

Minnesota has 13 mills that produce pulp, paper, and/or hardboard. Of these, 10 produce pulp and purchase pulpwood on the open market. In 1994, about 5,665 people were employed in the pulp and paper industries of Minnesota.

Table 7.2. Area of land, forest, and timberland within economic regions, Minnesota, 1990 (thousands of acres).

ECONOMIC REGION	Land Area	Forest Land			% of All Land in Timberland
		All Forest	Timberland	Reserved/Unproductive	
North	30,673	15,621	13,713	1,908	45
Southeast	7,694	797	786	11	10
Metro	1,791	133	115	18	6
Southwest	10,726	164	160	4	1
Total State	**50,884**	**16,715**	**14,774**	**1,941**	**29**

(Source: GEIS)

The waferboard and OSB industry also utilizes pulpwood. There are five OSB mills in Minnesota. In 1992, Trus Joist MacMillan began operating a new mill in Crosby, Minnesota, which makes parallel strand lumber, a new variant of oriented strand technology. In 1985, about 1,000 people were employed in the waferboard and OSB industries of Minnesota.

There are an estimated 700 sawmills scattered throughout Minnesota. All but three of these are small by national standards. They vary in size from 1 to 100 employees. In 1993, about 1,200 people were employed in sawmills in Minnesota. Approximately 892,000 cords of sawlogs, veneer logs, post and poles, and wood for chipping and shavings were cut in Minnesota in 1993. Although sawlog volume is small, sawlog values are relatively high. Thus, in value terms, the roundwood purchased by sawmills is as least as important as the roundwood purchased by either the pulp and paper industry or the waferboard and OSB industries.

Fuelwood may be considered another industry, but activity and employment is difficult to track. However, fuelwood consumption has recently been estimated by the DNR at 530,000 cords per year (Jaakko Pöyry 1992).

7.1.3 Secondary Producers

Secondary forest products industries use the outputs from both primary and other secondary forest products industries as inputs to their production processes. These industries include the following sectors: the display, fixture and shelving industry; the furniture

industry; the hardwood dimension and flooring industry; the kitchen cabinet industry; windows, doors, and millwork; pallets, skids, and containers; paper converting; paperboard containers and boxes; the plywood and laminated component industry; and prefabricated wood buildings, log cabins, and mobile homes (Jaakko Pöyry 1992). These industries play an important role in the state's economy. In value terms, much of the contribution of secondary forest products industries is concentrated in the Metro region.

Approximately 59,000 people employed by the forest products industry in Minnesota, roughly a third of them are employed in the manufacturing of lumber and wood products (16,380) or furniture and fixtures (5,112).

In terms of annual job growth of Minnesota's forest products sector, lumber and wood products industries grew at a rate of 5 percent in 1993, and furniture and fixtures grew at a rate of 4.6 percent. At the same time jobs in the paper and allied products sector grew at only 0.9 percent, compared with the national rate of 1.0 percent.

7.1.4 Recycling

The demand for recovered paper will play the greatest role in determining the impact of recycling on the state's wood products industry. Currently, most market wood pulp (pulp produced for sale on the open market) needed by Minnesota's paper and paperboard mills is brought in from outside the state. The new paper recycling plant at Duluth, Superior Recycled Fiber, sells recycled pulp to several Minnesota mills. In order to impact Minnesota's annual timber harvest, recovered paper must not only replace current or projected wood pulp demand, it must affect Minnesota's *wood* demand.

Increased collection and use of recovered paper in Minnesota could reduce the demand for wood in the future by as much as 400,000 cords. The most likely range will be 100,000 to 200,000 cords, however, due to several factors including economics, political influences (state laws and regulations), and the limitations connected to the recovery and processing of wastepaper and associated products.

7.1.5
Supply and Demand

7.1.5.1
Available Timber (Supply)

As pointed out in the GEIS, many factors influence how much wood is actually harvested from the forests of Minnesota in any period of time. The general level of harvesting is dictated by long-term economic conditions, legal restrictions, and biological and physical conditions. Annual fluctuations are more dependent on economic factors such as stumpage prices, taxes, and economics of other land uses.

Timber supply for industry expansion has traditionally been determined by subtracting the current demand for timber from what is available. As the state's timber resource surplus shrinks, sustainable harvest approaches have gained in importance. Forest management agencies in Minnesota have traditionally used simple area control methods to determine allowable cut levels by cover type to achieve a "regulated" forest condition. A regulated forest has an equal number of acres in each age class and no age class older than the desirable rotation age. In theory, harvesting the allowable (mature forest) would lead to a continuous flow of forest products where annual harvest is balanced by annual growth. The concept of an allowable cut is simple and appealing. In practice, many complicating factors make allowable cut estimates a very general management guide at best. The GEIS presents the following four questions that have enormous implications for the allowable cut:

- What is the ideal future forest management state?
- What is the cost of achieving the ideal state?
- How is changing technology accounted for?
- How should an allowable cut be implemented?

In recent times, some forest managers have been shifting from area control methods of determining allowable cut to volume control method using "harvest scheduling" as a tool to determine which stands will be harvested. Harvest scheduling typically uses complex models that can consider the existing forest and the above questions in detail. In particular, technology such as computers and geographic information systems have given managers new toolsfor use in determining which timber stands will be harvested. They can not only access a tremendous amount of data for making decisions on desirable future conditions for a landscape, but they also have the capabilities of analyzing the spatial relationships and long term impacts of their management decisions. These analyses

include economic and environmental concerns and trade-offs.

Table 7.3 and Figure 7.2 compare the total timber growing stock volume and the total mature timber (over rotation age) volume with the actual annual harvest of timber in the state for 1962, 1977, and 1990 (Minnesota forest surveys). The growing stock and mature timber volume data for the year 2000 reflects the

Table 7.3. Total timber growing stock volume compared to total mature volume and actual harvest in billion cubic feet. (Source: Minnesota statewide timberlands, all ownerships, FIA survey data.)

	1962	1977	1990	2000[a]
Total Timber Growing Stock Volume	9.8	12.4	15.1	15.1
Total Mature Volume[b]	5.6	7.04	9.05	9.05 ±0.15
Actual Harvest (Annual)	.125	.182	.273[c]	.368[d]

a Estimates
b Total volume of timber over rotation age.
c .273 billion cubic feet = 3.45 million cords
d .368 billion cubic feet = 4.66 million cords

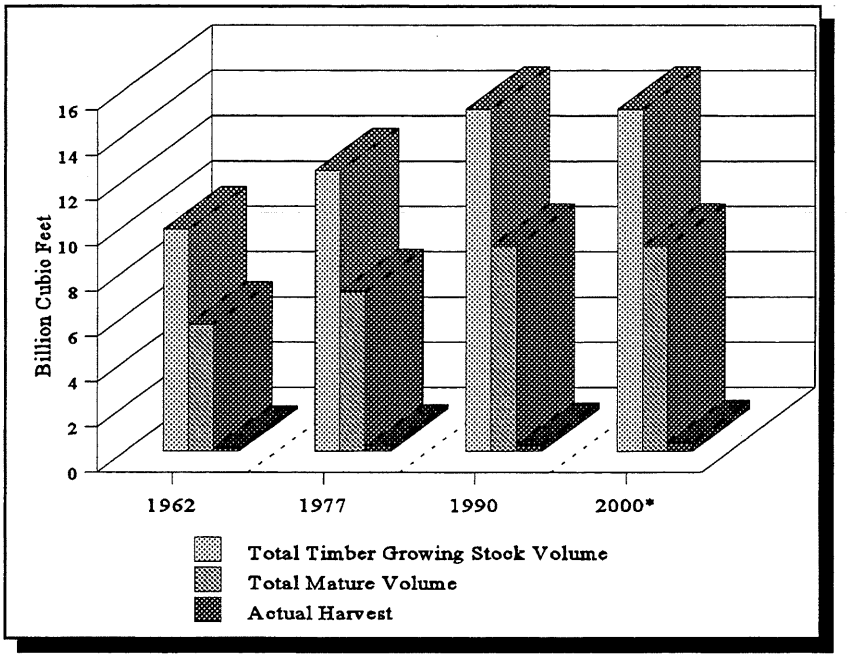


Figure 7.2. Total timber growing stock volume compared to total mature timber volume and actual harvest.
* Estimates

GEIS projected harvest data. Total timber growing stock volume and total mature timber volume are expected to level off by the year 2000. Most of the timber presently being harvested is coming

from older age classes with large diameter (high volume) trees. Although net annual growth is expected to increase with the harvest of the mature timber, it is increasing mostly in the younger age classes and not available for harvest. As these young stands grow older, they become the timber supply for future decades. This means the supply of timber available for harvest should remain steady in future years. Factors which might reduce that supply are greater environmental constraints upon harvesting and conversion of forest to other land uses. Increased investment in forest management could also increase the supply.

7.1.5.2
Expected Change in Harvest (Change in Demand)

Forest products mills in Minnesota are operating at or near capacity with approximately 324 million cubic feet (Table 7.4) of timber having been harvested in 1993. The amount of timber being harvested can roughly be equated to "existing demand." "Expected demand" can be viewed as anticipated consumption of existing mills, plus the additional wood that will be used in new mills and expansion of existing operations. The projected use of 368 million cubic feet of timber in the year 2000 (Table 7.3) is based on anticipated consumption. All existing mills are expected to be operating at capacity. One OSB mill is expected to expand and one pulpmill expansion is underway. Consumption of sawtimber is expected to increase slightly.

Table 7.4. Total wood harvest (thousand cubic feet) in Minnesota by species in 1993. (Source: Minnesota Department of Natural Resources, Division of Forestry.)

Species	Total*
Aspen	192,200
Birch	13,800
Balm of Gilead	7,400
Ash	5,500
Oak	23,500
Elm	6,900
Basswood	2,700
Maple	6,100
Cottonwood	900
Other Hardwoods	500
Sub-Total Hardwoods	**259,500**
Red Pine	10,500
White Pine	2,200
Jack Pine	20,700
Spruce	13,800
Balsam	16,600
Tamarack	300
Cedar	500
Sub-Total Softwood	64,600
Total	**324,100**

* The numbers in this table were converted from cords using 79 cubic feet per cord as the conversion factor. They were then rounded to the nearest hundred.

7.2
Tourism and Recreation Industry

Table 7.5 indicates that Minnesota's travel and tourism industry is responsible directly and indirectly for approximately 4 percent of the total employment in the state, 3 percent of the wages and

salaries, and 4 percent of industry output.

Table 7.5. Economic impacts of the travel and tourism industry by economic regions in Minnesota, 1989.

REGION	Economic Impact		
	Total Output ($millions)	Employee Compensation ($ millions)	Jobs
North	1,460	365	32,871
Southeast	634	163	14,718
Metro	2,743	685	61,805
Southwest	191	48	4,303
Total State	**5,028**	**1,261**	**113,697**

(Source: GEIS)

The five billion dollar total output figure attributed to travel and tourism in table 7.5 is somewhat misleading, because total output is dominated by business related travel. Any significant change in the total output figure would be based on a major shift in business travel patterns. According to the *1989, DNR Economic Report to the Governor*, approximately one billion dollars of the total output figure can realistically be assigned to leisure travel. Most of that occurs in the forested areas of the state.

Changes in the overall economic impact of the travel and tourism industry based on trends described on page 32 are likely to be very slight. However, as people pursue different types of activities due to changes in recreational technology and demographics, regional shifts in economic impact are likely to be more significant.

7.3 Fish and Wildlife[2]

According to recently released findings from the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, direct expenditures for hunting, fishing, and wildlife associated recreation in Minnesota during that year topped $1.5 billion.

Minnesotans spent money on a wide range of products and services related to fish and wildlife. Some examples from 1991:

- Bait: $34 million

[2] The following text describing the economic impacts of fish and wildlife resources on the state's economy comes directly from the DNR Division of Fish and Wildlife publication *Fish & Wildlife Today*.

- Bird food: $65 million
- Firearms: $39 million
- Boats and canoes: $117 million
- Rods and reels: $25 million
- Ice: $4.7 million

Fish and wildlife are big business throughout the state, from small communities that rely on the deer and walleye seasons to keep motels, restaurants, and gas stations in business, to the cities whose businesses thrive on tourists lured by a profusion of fish and wildlife. Most of the prime fishing and hunting spots are located in Minnesota's forested areas. Forests offer an abundance of clean lakes and rivers for fishing and millions of acres of publicly-owned land for hunting.

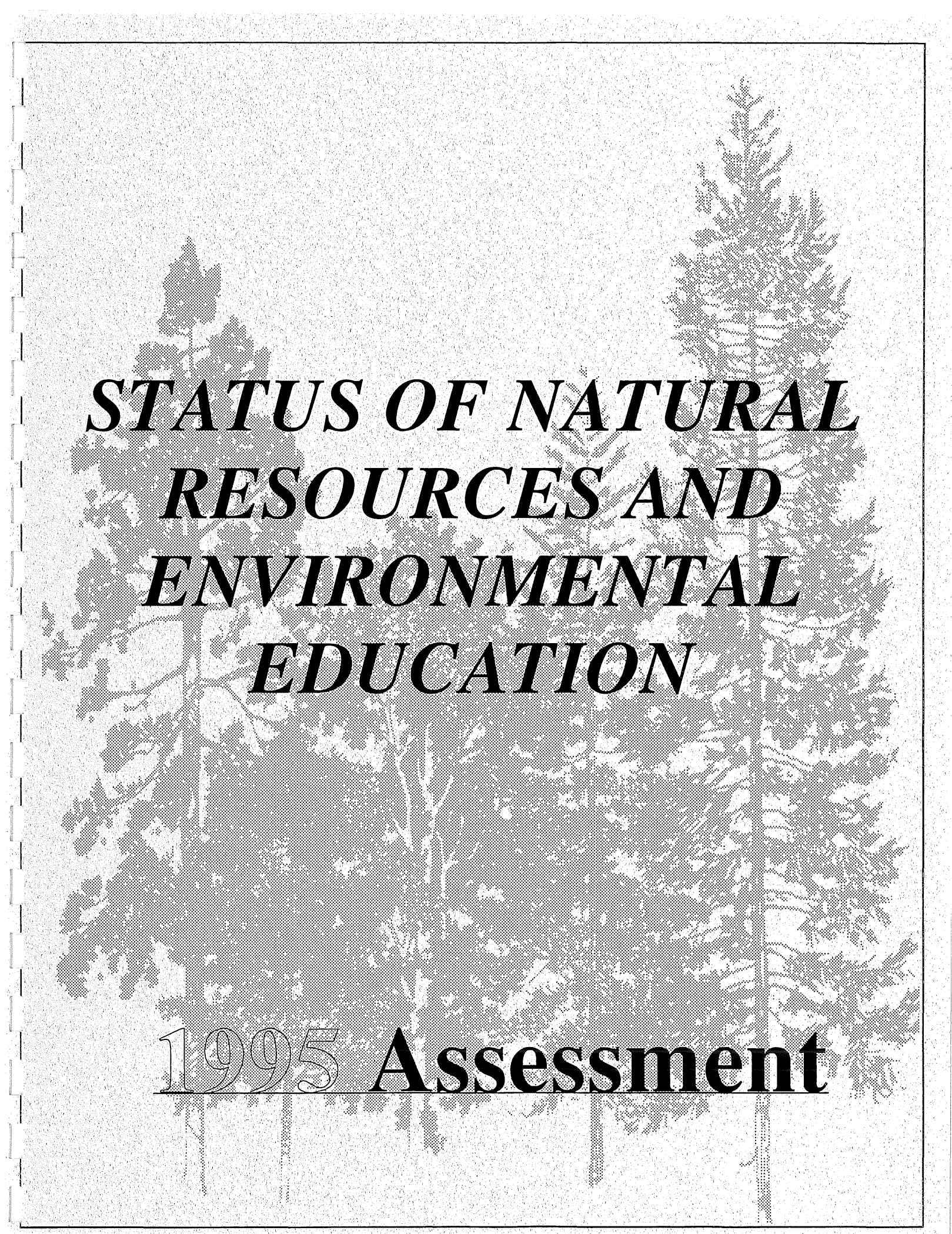
7.3.1 Fish

In 1991, the state's 1.1 million resident and 350,000 nonresident anglers age 16 and older spent 18 million days on Minnesota waters. They also spent an average of $643 each on fishing in Minnesota, for a total of $933 million. Of that, residents spent $476 on equipment and $338 million on trip-related expenses (food, lodging, transportation, bait, etc.). Nonresident anglers spent $120 million on fishing trip-related expenses.

7.3.2 Wildlife

The state's 458,000 resident and nonresident hunters age 16 and older spent an average of $607 each in Minnesota for a total of $278 million. Residents spent $193 million on equipment and $74 million on travel-related expenses. Out-of-state hunters spent $10 million in the state on travel.

Wildlife watchers spent hundreds of millions of dollars just to see animals in Minnesota. A total of $303 million was spent in 1991 to watch and photograph deer, ducks, eagles, bluebirds, and other species. Of these "nonconsumptive" wildlife activities, trip expenses accounted for $121 million and equipment expenses totaled $182 million.



STATUS OF NATURAL RESOURCES AND ENVIRONMENTAL EDUCATION

1995 Assessment

8
STATUS OF NATURAL RESOURCES AND ENVIRONMENTAL EDUCATION

8.1
Environmental Education

8.1.1
A GreenPrint for Minnesota

The state's environmental education plan, *A GreenPrint for Minnesota*, was prepared by the Minnesota Department of Education between July 1991 and June 1993. It outlines recommendations and strategies for achieving Minnesota's goals for environmental education over the next 10 years. As the *GreenPrint* explains, the plan is designed to foster and expand the partnerships involved in producing and delivering environmental education programs and materials to Minnesota citizens. Partnerships between public agencies and private entities are strongly encouraged.

8.1.2
Project Learning Tree

Project Learning Tree (PLT) is an environmental education program designed for teachers and other educators working with students in pre-K through grade 12. PLT is a volunteer program that works in conjunction with teachers, schools, state agencies, business and civic organizations, museums, nature centers, and youth groups.

Nationally, PLT is cosponsored by the American Forestry Foundation and the Western Regional Environmental Educational Council. In Minnesota it is sponsored by the Minnesota Department of Natural Resources, Division of Forestry

PLT uses forestry as a "window" into natural and built environments, helping people gain an awareness and knowledge of the world around them, as well as their place within it. It is a source of interdisciplinary instructional activities and provides workshops and in-service programs for teachers, foresters, park and nature center staff, and youth group leaders.

PLT has been active in Minnesota since 1978, and has reached over 3,500 teachers.

8.1.3
Environmental Education Centers

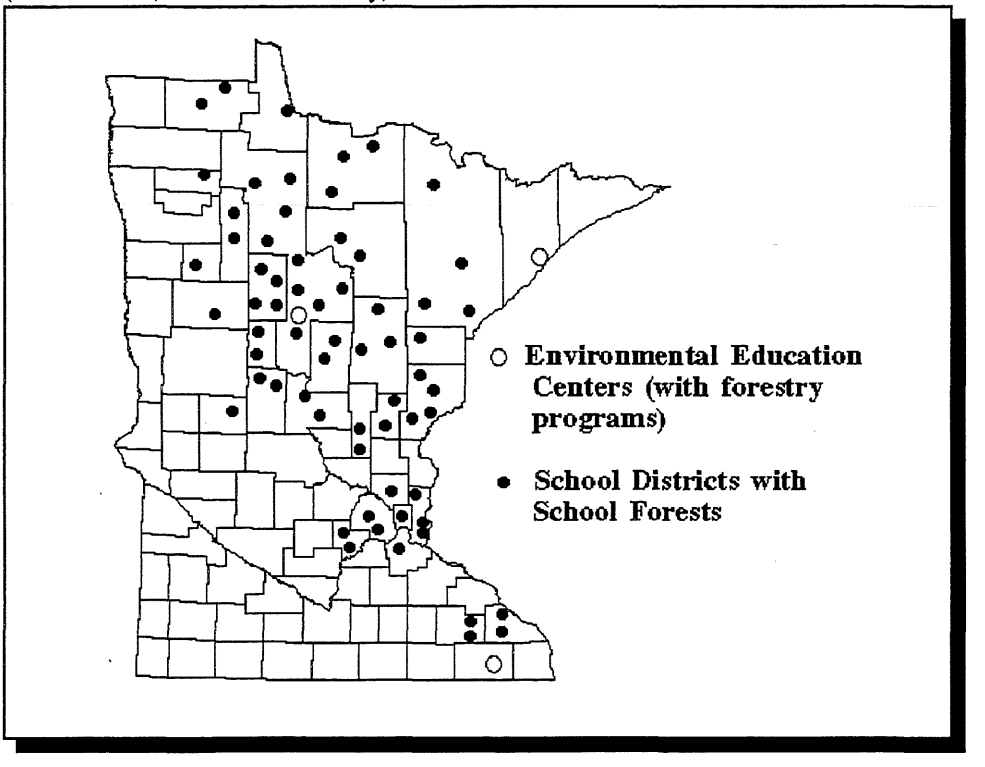
Environmental education centers (EECs) offer environmental education opportunities to a wide variety of individuals and groups. K-12 students comprise the largest number of people visiting the centers, with elementary students making up the majority. Of the 122 EECs identified in *A GreenPrint for Minnesota*, the largest number are day-use facilities located at parks and nature centers.

There are three EECs in Minnesota that present forest management as lesson components of their curriculum. They are Deep Portage Conservation Reserve near Hackensack, the Forest Resource Center near Lanesboro, and Wolf Ridge near Two Harbors, Figure 8.1.

8.1.4
School Forests

There are 64 school districts in Minnesota with school forests. The school forests total over 6,000 acres on 72 sites, Figure 8.1.

Figure 8.1. School forests and environmental education centers with forestry programs. (Source: DNR, Division of Forestry)



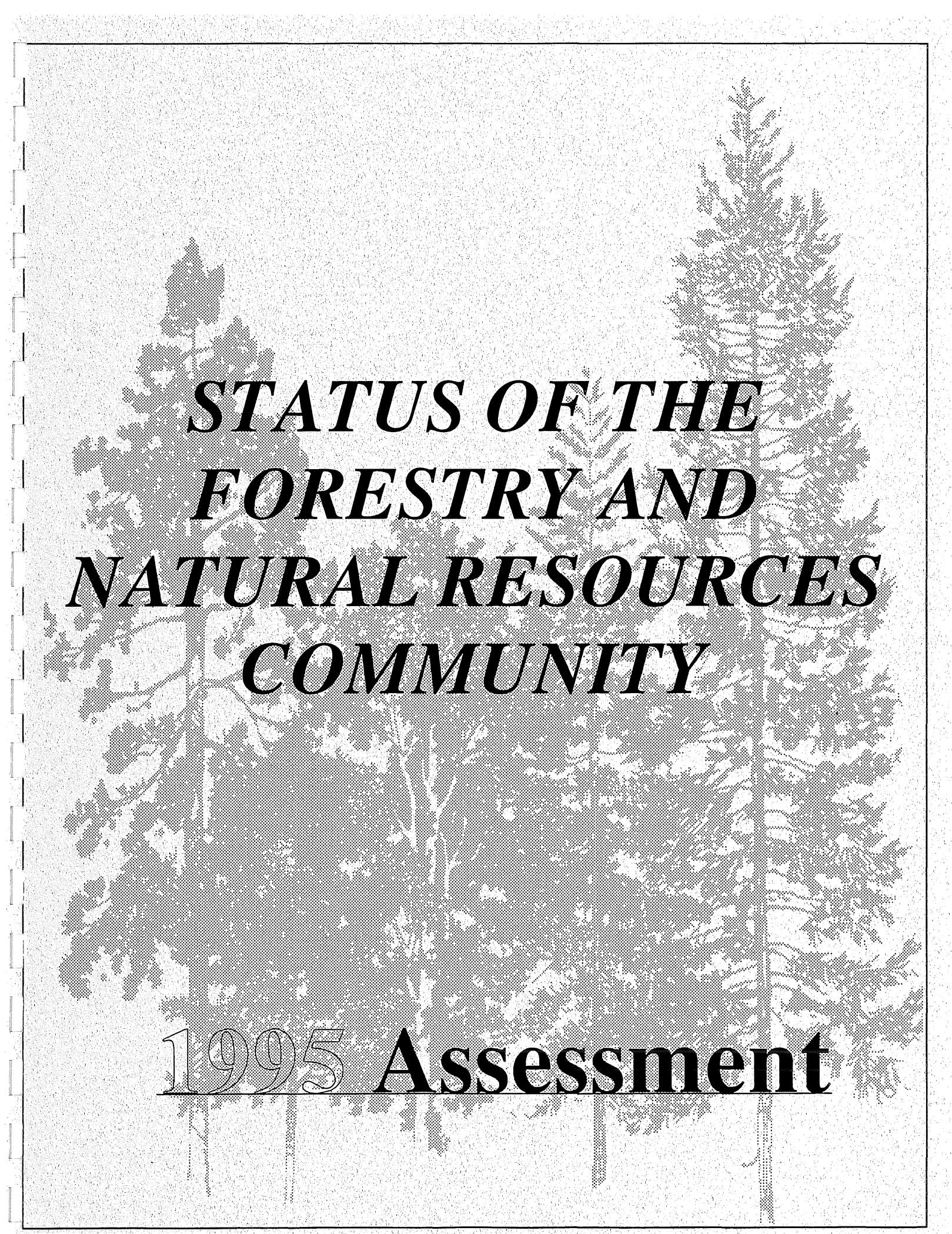
School forests provide a natural setting for students to learn about

the environment. In these outdoor classrooms, students can learn first-hand about the complex interrelationships between soil, water, air, trees, wildlife, and people. With the knowledge and guidance of professional natural resource personnel and teachers, students can learn how to care for and manage the state's natural resources.

Since most teachers have relatively little training in forest ecology, the partnerships fostered by the Minnesota School Forest Program provides them with the needed assistance in determining what and how to teach in an outdoor classroom. Resource personnel from the Department of Natural Resources, Woodland Councils, Society of American Foresters, US Forest Service, Minnesota Forest Industries, Minnesota Association of County Land Commissioners, Soil and Water Conservation districts, and local service and civic organizations provide assistance.

8.2 Research

Forestry and forest products research in Minnesota is conducted largely by three organizations: 1) the University of Minnesota through its College of Natural Resources, 2) the Natural Research Institute of the University, and 3) the North Central Forest Experiment Station of the USDA Forest Service. Industry cooperates in research conducted by these organizations. In addition, they do a considerable amount of applied research on their own. A brief description of their programs can be found in Appendix I.



STATUS OF THE FORESTRY AND NATURAL RESOURCES COMMUNITY

1995 Assessment

9
STATUS (DESCRIPTION) OF THE FORESTRY AND NATURAL RESOURCES COMMUNITY *(Institutional Arrangements)*

9.1
Nonindustrial Private Forests[3]

Nonindustrial private forests (NIPF) comprise the smallest ownership class individually, the largest in aggregate. Individual ownerships range from just a few acres to several hundred acres, and in a small number of cases to thousands of acres (maximum 5,000). There are 5.9 million acres of NIPF lands in Minnesota owned by 130,800 landowners. The average size ownership is 39 acres, with 70 percent owning parcels 50 acres or less.

Nonindustrial private forests characteristically have higher average productivity than public forests. Much of the public landbase came into public ownership because it was very poor farmland and subsequently went through tax forfeiture. In Minnesota, nearly half the public land is in a low productivity class capable of producing less than 50 cubic feet of timber per acre per year. Much of the NIPF land stayed on the tax rolls, in part because its productivity was high enough to make it profitable to keep it in agriculture and other uses.

9.1.1
Nonindustrial Private Forest Landowners

NIPF landowners are private owners who do not own or operate wood using manufacturing plants. They include individuals such as farmers, housewives, executives, and those from just about every walk of life imaginable. This class of owners also includes groups such as clubs and associations, undivided estates, and corporations not engaged in the manufacture of forest products.

Owners of these forests have historically been older and poorer than the average U.S. population. This pattern may be changing. Increasing acreage of NIPF lands is being shifted into ownership of people both younger and with higher incomes than the previous owners. This may be one result of ongoing shifts from ownership by farmers to ownership by urban people. This shift may be among different generations of the same family.

NIPF owners acquired and hold their lands for a wide range of purposes. Overwhelmingly, the primary reasons people own forest

[3] The text relating to private ownership in Minnesota was derived from the Lake States Forest Regional Resources Assessment.

land are for such things as aesthetics, a place to hunt or camp, or personal satisfaction holding land to produce timber is usually way down the list. Yet, on a state or regional basis, NIPF owners have historically provided their proportionate share of timber to forest industry.

There is increasing pressure on public ownerships to supply more intangible benefits such as recreation, wildlife habitat, and scenery at the expense of commodity production. The prospect is that in future years, these ownerships, federal in particular, and perhaps state as well, will not be able to contribute the same share of the timber supply as they have in the past. This means that the private sector will be look more and more at as the major timber supplier in Minnesota. NIPF ownerships already contribute a larger proportionate share of timber than public ownerships do. On NIPF land in the Lake States, annual removals account for approximately 58 percent of net annual growth, while on national forest and state lands, annual removals are 32 percent and 34 percent of net annual growth, respectively. NIPF ownerships are the least likely of all ownership categories to be actively managed. Much of the harvesting on these ownerships is simply a case of cut it when it's mature with no thought to regenerating the stand. In addition, many of the ownerships in this category are too small for active management or for harvesting. Research indicates that as stumpage prices go up, more NIPF landowners will harvest their timber.

Several assistance programs provide an incentive for landowners to manage in a way that ensures that the public interest and values inherent in all privately-owned land are protected. The alternative is to employ zoning and other forms of regulation such as those used in urban areas. These can be brought together in the form of forest practices acts that are the regulatory alternative to assistance programs for governing how private lands are managed. With the help of incentives, NIPF lands are meeting the current needs of forest industry. However, forest practices legislation may be necessary in the future to realize the potential of NIPF lands as demand continues to increase. The GEIS Roundtable recommended voluntary practices as opposed to regulatory.

9.2 Forest Products Industry

Minnesota's forest products industry comprises primary (resource is roundwood) and secondary (resource is wood processed by primary producers) manufacturers, as well as wood products distributors.

There are an estimated 1,300 logging companies, more than 800 small sawmills, and 12 primary wood manufacturers of paper, particle board, wafer board, oriented strand board (OSB), and reconstituted and sawn lumber in the state.

According to the Minnesota Wood Promotion Council, about 15 percent of wood from Minnesota's forests goes into lumber that supplies distributors and secondary manufactures; 38 percent goes to OSB and waferboard production, some of which supplies Minnesota secondary manufacturers; 30 percent to pulpwood, paper, and paperboard; 13 percent to fuelwood; and 4 percent to other uses.

The larger land-owning companies employ professional foresters to manage their lands. Several companies allow public use of their land for recreation and provide recreation facilities. Others operate forest tree nurseries and provide professional forest management assistance to private landowners.

9.2.1 Timber Producers Association

Established in 1937, Minnesota Timber Producers Association (TPA) members are loggers, truckers, sawmill operators, and manufacturers throughout Minnesota. TPA promotes close working relationships among forest product firms, forest owners and producers, conducts educational activities, promotes conservation and wise use of natural resources, and represents members on issues that may affect the timber industry.

9.2.2 Minnesota Forest Industries

Minnesota Forest Industries (MFI) is an association representing the state's six major pulp, paper, or board companies as well as Minnesota's two largest sawmills. Members are Boise Cascade, Potlatch, Blandin Paper, Champion International, Lake Superior Industries, Georgia Pacific, Rajala Companies, and Hedstrom Lumber. MFI encourages conservation, proper forest management, and industry development that fosters sound environmental stewardship, multiple use of timber lands, and long-term timber supply.

9.2.3 Minnesota Wood Promotion Council

The Minnesota Wood Promotion Council (MWPC), established in 1985, is an association of Minnesota wood products companies

(primary and secondary manufacturers and distributors) with over 120 members. Principle activities are education, industry communications, promotion, and cooperative efforts directed towards effective public policy and legislation. MWPC promotes environmental stewardship among members and others in the industry.

9.3 Environmental Groups

Many environmental groups are interested in how the forest resources of Minnesota are managed. Five particularly active groups that have joined together to form the Forest Action Network: Minnesota Audubon Council, Minnesota Center for Environmental Advocacy, Minnesota Public Interest Research Group, Izaak Walton League of America, and Sierra Club, North Star Chapter. The Forest Action Network has been involved in review of the GEIS and has recently made some major proposals for legislation regarding forest management and planning in Minnesota.

The Nature Conservancy and Friends of the Boundary Waters Canoe Area have also been involved in monitoring the management of the state's forest resources and in representing the interests of their members.

Small grass roots groups have become more active in recent years and are influencing forest management (e.g., Save our Lands, whose members initiated original petition for the GEIS).

9.4 Recreational Groups

The recreational groups that have historically been interested in how Minnesota's forest resources are managed include trail users and hunting and fishing groups. These groups could also be considered environmental groups, however, the main purpose of their existence is to promote their specific sport. Trail users have usually been represented by wide variety of cross country ski, snowmobile, horse rider, motorcycle, off-road vehicle (ORV), and bicycle clubs. Hunting groups are generally interested in effects forest management activities have on wild turkeys, deer, bear, ruffed grouse, and sharp tailed grouse. Fishing groups are primarily interested in protection of trout streams and spawning areas, along with access to fishing waters.

Although trail and hunting interest groups are the most common

recreational stakeholder groups concerned about how the state forest resources are being managed, numerous other groups are also interested. Some of the wide variety of other recreational interests include berry picking, bird watching, rock climbing, orienteering, scenery viewing, and pleasure driving.

Although there is a lot of room to accommodate the various recreational interests on the state's forest lands, some of the activities come in conflict with forest management and in many cases with each other. Many times, however, the conflicts can be resolved through planning and careful land-use management.

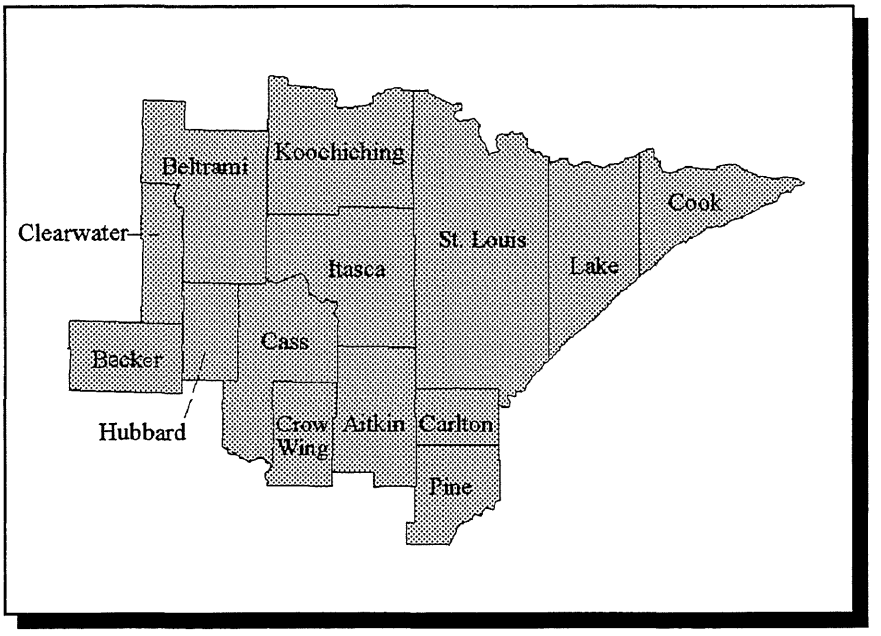
9.5 County

Minnesota is one of only two states in the U.S. with an extensive county-managed land base. Counties and municipalities (municipal land is usually included in the county land base) manage 2.8 million acres of forest land, 2.5 million acres being timberland. St. Louis County has the largest county land system at 744,800 timberland acres, followed by Koochiching wiyh 278,800, Itasca with 255,700, and Cass with 232,900. Four additional counties manage at least 100,000 acres, and four manage between 50,000 and 100,000 acres. Title to these lands is held by the state under a trust in favor of the local taxing districts as specified in MINN Stat. 282.01 [1] [2]. There is a separate trust in each county where such lands exist. Unlike the state holdings, that were acquired through a variety of means, almost all the lands that now comprise the county land base became county land through tax forfeiture. The state annually makes payments to counties in lieu of taxes that would otherwise be generated by these lands.

Each county's land base is managed by a land commissioner, county auditor, or the DNR (for counties with small amounts of forest land). Those counties containing a large amount of county-administered forest land have land commissioners. The vast majority of county forest land is concentrated in relatively few counties, and most county-administered lands are managed through a county land department. Land commissioners are appointed by their respective county boards and function as the administrators of the county land system. Fourteen counties have land commissioners (Figure 10.1). These commissioners are members of the Minnesota Association of County Land Commissioners (MACLC). As is evident from timber acreage in Table 9.1, county land is not evenly distributed among the counties. St. Louis , Koochiching and Itasca counties contain 51 percent of all county land. If Cass County is also included, the amount of county timberland included in these four counties is 60

percent of the total.

Figure 9.1. Minnesota Association of County Land Commissioners member counties.



In counties with large timberland bases, these lands are often subdivided into districts or areas, with management of each under the supervision of a resource manager. The majority of counties, however, manage their land area as one unit under the supervision of the land commissioner.The fourteen counties having land commissioners employed 128 people in county land departments as of 1991 (MACLC 1991). Of these, 106 people are associated with managing timberland, approximately 75 percent of their time devoted to this activity. The balance of time is spent on other programs such as nontimberland management and totally unrelated activities.

Timber sales are the biggest revenue producer for county land departments. Leases of land for various purposes, easement payments, and sale of land contribute lesser amounts of revenue.

9.6 Mineral Estates

The bedrock geology present in Minnesota is similar to certain areas in Canada, Australia, South Africa, South America, and Scandinavia where many ore deposits occur.In addition to Minnesota's well-established taconite and iron ore industry,

Table 9.1. Timberland area managed by MACLC member counties.

County	Timberland Acreage
St Louis	744,800
Koochiching	278,800
Itasca	255,700
Cass	232,900
Aitkin	197,800
Lake	143,600
Beltrami	140,000
Hubbard	121,200
Crow Wing	89,600
Becker	87,600
Clearwater	66,800
Carlton	58,000
Pine	33,700
Cook	9,200
TOTAL	**2,459,700**

(Source: GEIS)

the potential exists to find economic deposits of precious metals such as gold, silver, platinum and palladium, chromium, titanium, cobalt, and vanadium. Deposits of dimension stone and kaolin clay also demonstrate significant development potential.

Mineral rights in Minnesota may be owned by the surface owner, or the ownership may be "severed," which means the owner of the minerals is different from the owner of the corresponding surface. Private parties or the federal government may own mineral interests where surface interests are managed by the state.

The scope of rights associated with severed mineral interest ownership is defined by the language in the deed describing the severance. Although the issue has not been addressed by the Minnesota Supreme Court, the general rule developed in other

parts of the country is that a mineral rights owner can use as much of the surface as is reasonably necessary to explore for, mine, and remove the minerals unless it is specifically stated otherwise in the deed.

Including severed and non-severed mineral interests, private parties hold approximately 69 percent of the mineral rights in the state, the federal government owns approximately 7 percent and the state owns 24 percent.

State owned mineral rights are managed by the Department of Natural Resources in trust for schools; the university; local taxing districts consisting of counties, cities, and school districts; the state general fund; and other acquired land funds. Royalties and taxes from state and private minerals provide important sources of public revenues.

9.7 State

9.7.1 Department of Natural Resources

Virtually all state administered forest land in Minnesota is managed by the Department of Natural Resources (DNR). The DNR manages 5.3 million acres. Of this, 4.4 million acres is managed by the Division of Forestry (3 million acres of dedicated state forest lands and 1.4 million acres of scattered parcels outside state forest boundaries), 0.6 million acres is managed by the Division of Fish and Wildlife (state wildlife management areas) and 0.2 million acres is managed by the Division of Parks and Recreation (state parks). Much of this acreage has been in state ownership since the 1940s.

Even though the Division of Forestry administers a large share of the state land base, other DNR divisions are involved in management of these lands in a significant way. Numerous agreements exist and cooperative efforts are undertaken among various DNR divisions to ensure state forest lands are managed in a manner that promotes ecosystem integrity and stability.

Lands in state ownership became part of the system in a variety of ways that affect how they are managed as well as disposition of income from the lands.

Trust Fund Lands are received by the state via grant from the public domain. There are several types of trust fund lands in Minnesota, but two types predominate: school and swampland.

School lands originally consisted of two sections in each township that could be sold or managed by the state with proceeds to go to the support of a public school system. Approximately two-thirds of the original grants have been sold. The state still manages approximately 2.5 million acres of these lands. *Swamplands* were granted to the state with the provision that sale proceeds be used for drainage and improvement. Many of these lands were not actually swampland although they were supposed to be. Approximately 1.1 million acres of today's state forest land originated from this grant.

The designation of lands as trust fund lands places an additional burden on land managers to promote the economic benefit of the trust.

Consolidated Conservation Lands (or Con-Con lands as they are commonly called) reverted to the state through forfeiture when landowners failed to pay a special assessment levied specifically for construction of drainage ditches. The state obtained absolute title to these lands in exchange for paying off drainage bonds in default. County boards oversee any sale of these lands but they are managed by the state. Approximately 1.6 million acres of the state forest system are lands of this type. In addition, significant acres of Con-Con lands are managed by the DNR Division of Fish and Wildlife.

Land Utilization Projects Lands (LUP Lands) were originally purchased by the federal government during the Great Depression and were administered by the state under a 50-year lease. This lease expired in 1990 but was automatically renewed for another 50 year period. The state holds title to about 81,000 acres of this type of land.

"50-50" Lands were transferred to the state from county boards. These transfers occurred in the 1960s. Approximately 359,000 acres were relinquished to the state as part of the 50-50 agreements made between several county boards and the state commissioner of conservation. They are called 50-50 lands because 50 percent of the gross revenue from these lands goes to the county in which the land is located and the other 50 percent goes to the state. The state now holds title to all of this land.

Volstead Lands were acquired by the federal government under the 1908 Volstead Act and subsequently sold to the state. There are only 31,000 acres of this type of land in Minnesota's system.

Acquired Lands came into state ownership through purchase, gift, exchange, or any of several other methods. Acquired lands

account for 1.1 million acres of state land, only about half of which is in the state forest system. The other half is in state wildlife management areas, state parks, and other types of state owned land.

9.7.1.1 Division of Forestry[4]

The Division of Forestry is headed by a director in St. Paul. The division is divided into four sections: administration, forest resource management, cooperative programs, and youth programs. Other initiatives including information and education, and forest information systems falls under the responsibility of the director. Each section is headed by an assistant director and each is responsible for the staff work necessary for program operations, implementation, and support of field personnel.

Although the Department of Natural Resources has the state divided into six administrative regions, the division operates only five regional offices. Region I, Bemidji, is subdivided into nine areas, Region II, Grand Rapids, is subdivided into nine areas, Region III, Brainerd, is subdivided into 10 areas, Region V, Rochester, is subdivided into eight areas, and Region VI, Metro, has one area office. The Division of Forestry staff located in Region IV report to the forestry supervisor in Region V.

The regional administrative level provides centralized administration services, specialist services, and policy implementation and supervision for the areas within the region. The area administrative level carries out the on-the-ground management activities of the Division of Forestry. These management activities involve all program areas although, based on the characteristics of the particular area, some programs may be emphasized more than others. As of fiscal year '94, the Division of Forestry had 503 (includes overtime) full time equivalents (FTEs) distributed among many different programs. Of these FTEs, over 52 percent were natural resource professionals/managers.

9.7.2 Pollution Control Agency

The Minnesota Pollution Control Agency (MPCA) establishes

[4] A detailed structural history of the Department of Natural Resources and the Division of Forestry is available in the GEIS Public Forestry Organizations and Policies background paper for readers who would like more information on the evolution of the agency.

standards for air quality and water pollution control. It is responsible for adopting standards and regulations for collection, transportation, and disposal of solid waste, noise pollution, and toxic and hazardous waste regulation. Major programs include environmental monitoring, enforcement, emergency response, and technical assistance and planning.

9.7.3 Minnesota Planning

The Minnesota Planning Office is organized around a number of work teams that carry out a variety of strategic and long-range planning activities. These include conducting public meetings to gather information from Minnesotans about their vision for the state's future, researching and analyzing statistics, and providing useful information about those issues to policy-makers and the public.

9.7.4 Environmental Quality Board

The Minnesota Environmental Quality Board (EQB) is the state's principal forum for discussing environment issues and provides an opportunity for the public to have direct input into the development of the state's environmental policy. The EQB is an independent decision making body and is staffed by Minnesota Planning. Its membership consists of nine state environmental agencies, five citizens, and a representative of the governor serving as chair.

9.8 Federal

9.8.1 Introduction

Federally-owned land in Minnesota is managed primarily by one agency—the United States Department of Agriculture (USDA), Forest Service. The USDA Forest Service's holdings are divided into two national forests, the Superior and the Chippewa. The Superior National Forest contains just over 2.1 million acres of land in Koochiching, Cook, Lake and the northern half of St. Louis counties. The Chippewa National Forest contains 663 thousand acres of land in scattered holdings in Beltrami, Itasca, and Cass counties. Most lands designated as national forest originated from two different ownership classes. The first national forest lands were public domain lands not granted to the state and/or individuals. Expansion from this base has been primarily

through purchase from individuals and to a lesser extent, exchanges with other public agencies.

The federal agency with the second largest land holdings in Minnesota is the National Park Service. Voyageurs National Park, lying along the Canadian border in St. Louis County, covers 218,000 acres—134,000 acres of land and 84,000 acres of water. Management policies of the park forbid timber harvesting. Other federal agencies with small *forest* holdings in Minnesota include the Bureau of Land Management, Department of Defense, Fish and Wildlife Service, and Bureau of Reclamation. Timber harvesting and management are not major program areas within these agencies.

9.8.2 USDA Forest Service

Minnesota is located in administrative region nine of the USDA Forest Service headquartered in Milwaukee, Wisconsin. Each national forest in Minnesota is headed by a forest supervisor who reports to the regional forester in Milwaukee. The supervisor's office for the Chippewa National Forest is located in Cass Lake and the supervisor's office for the Superior is located in Duluth. Forest Supervisors have a number of responsibilities including:

1. Providing leadership to and supervision of forest staff;
2. Participating in the formulation of regional and forest level policies, programs, and objectives;
3. Working toward the accomplishment of State and Private Forestry program objectives and the dissemination of research information; and
4. Meeting regionally-allocated production targets for goods and services produced on the forest and planning objectives.

Each forest is subdivided into districts—five on the Chippewa and five on the Superior. District offices on the Chippewa are located at Blackduck, Cass Lake, Deer River, Marcell, and Walker. The Superior has them at Aurora, Grand Marais, Ely, Cook, and Tofte. Each district is headed by a district ranger whose primary responsibility is on-the-ground management of national forest programs. This level of the national forest system generally has the most direct contact with local government officials, forest users, and other segments of the public.

All positions described previously are line positions. The incumbents in these positions are responsible for policies, decisions, orders, instructions, and directives. In addition, all

levels above the district level have staff personnel who are responsible for support, advice, assistance, services, and reports.

9.8.3 National Park Service

The National Park Service (NPS) protects and preserves nationally significant cultural and natural sites for the use and enjoyment of present and future generations. In Minnesota, the National Park Service provides outdoor recreation at Voyageurs National Park, the St. Croix National Scenic Riverway, and the North Country National Scenic Trail. It also administers two cultural resource areas in Minnesota, the Grand Portage and the Pipestone National monuments. All of the lands administered by the NPS are reserved forest lands and are withdrawn from timber utilization.

9.8.4 Bureau of Land Management

The Bureau of Land Management (BLM) controlled 26,100 acres of federal public domain lands in Minnesota in 1990. This is down from the 64,000 acres identified in the 1977 forest survey. The majority of these lands are located in north central Minnesota, but there are also islands and other small tracts in other areas of the state. The BLM is in the process of transferring most of the lands under its control to the US Forest Service for management or disposal.

9.8.5 Fish and Wildlife Service

The regional office of the Fish and Wildlife Service located at Fort Snelling is responsible for managing the Agassiz, Tamarac, Rice Lake, Big Stone, Sherburne, Upper Mississippi, Mille Lacs, Sandstone, and Minnesota Valley national wildlife refuges and nearly 700 waterfowl production areas. The primary management goal for these lands is to provide fish and wildlife habitat. Recreation and other uses are permitted if they do not interfere with fish and wildlife management.

9.8.6 Natural Resources Conservation Service (Soil Conservation Service)

On October 20, 1994, the Secretary of Agriculture made the Soil Conservation Service (SCS) a part of the newly established Natural Resources Conservation Service (NRCS). The

reorganization assigns to the NRCS the authority for the Wetlands Reserve Program, Water Bank Program, Colorado River Basin Salinity Control Act Program, Forestry Incentives Program, and Farms for the Future Program. The NRCS will retain the SCS's authority for the Great Plains Conservation Program and the Small Watershed Program.

The NRCS provides national leadership in the conservation, development, and productive use of soil, water, and related resources. It functions primarily as a source of technical assistance for farmers, ranchers, and land management agencies. In addition to providing technical assistance to individual landowners, the NRCS is involved in the Resources Conservation and Development (RC&D) Program and the Rural Clean Water Program. The NRCS cooperates with the USDA Forest Service and the Minnesota Department of Natural Resources, Division of Forestry in carrying out the forestry aspects of these programs.

NRCS programs in Minnesota are administered by the State Conservationist. Most counties have a local NRCS office to provide technical services. NRCS personnel work closely with the local Soil and Water Conservation District. The NRCS has developed management plans for Division of Forestry administered agricultural lands in the Richard J. Dorer Memorial Hardwood State Forest. There are three Resource Conservation and Development areas in Minnesota. The plans for these areas include provisions for forest resource development. The NRCS is also involved in preparation of Minnesota's Resource Conservation Act (RCA) Plan.

The NRCS is one of the agencies involved in surveying and mapping the soils of Minnesota. The Division of Forestry is working with the NRCS and other agencies to develop soil survey interpretations that are applicable to forest lands.

9.8.7 Agricultural Stabilization and Conservation Service

The Agricultural Stabilization and Conservation Service (ASCS) administers a variety of financial assistance programs for farmers and other landowners, including two forestry cost-sharing programs—the Agricultural Conservation Program (ACP) and the Forestry Incentives Program (FIP). The local ASCS committee determines the cost-sharing rate for various forestry practices. The Division of Forestry can provide technical assistance to landowners who want to participate in ACP or FIP.

9.9 Indian

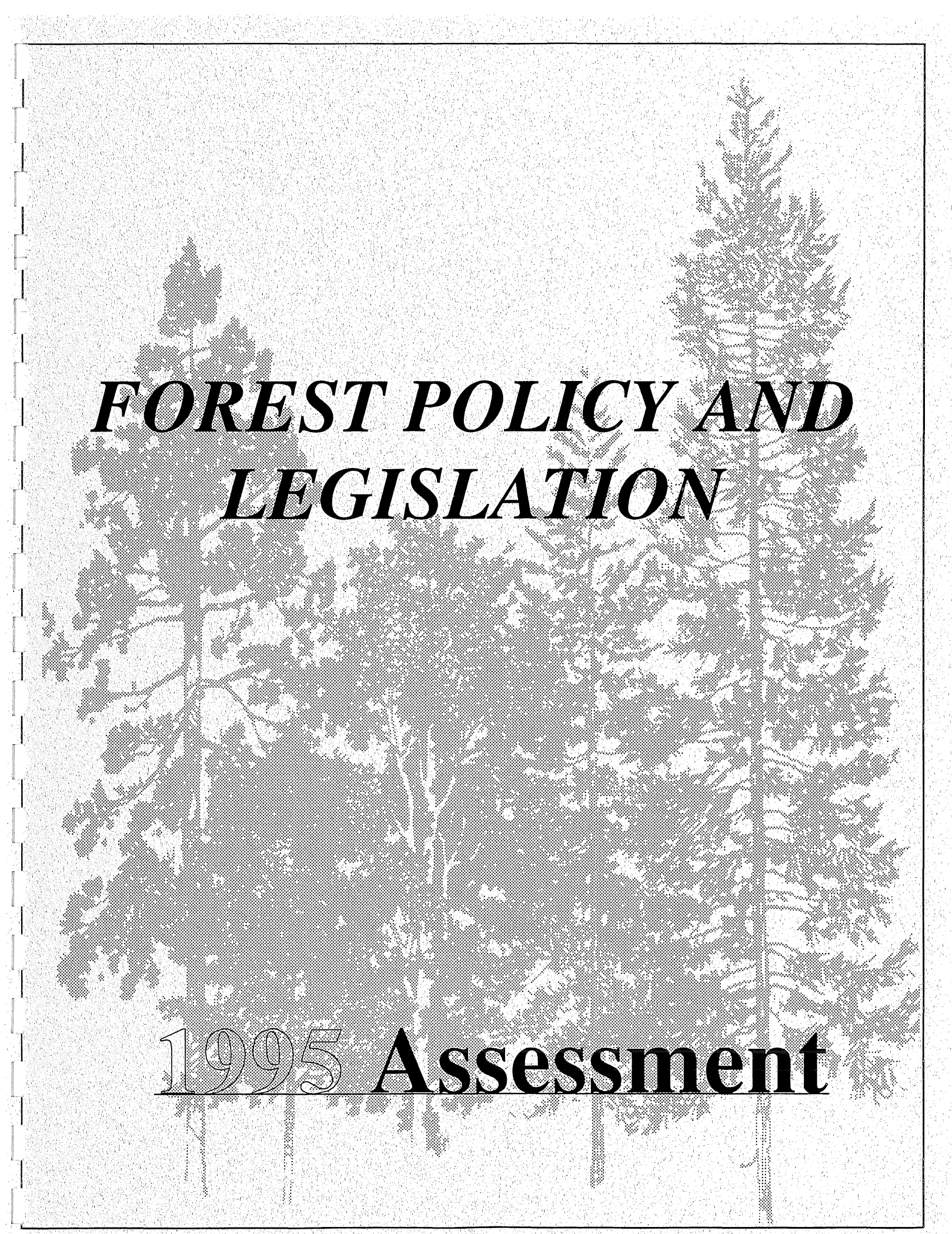
Indian lands are private lands owned by Indians, held in trust by the United States, and administered by the Bureau of Indian Affairs (BIA) for the various tribes. Ownership can be of two types, individual or tribal. Allotted lands are individually-owned lands held in trust by the BIA. Lands that are not allotted are tribe or band owned. Tribes have the authority to allow allotment or retain reservation land as tribal or band owned. The governing body for the reservation in which the lands are located has the primary decision on management. In Minnesota, 92.5 percent of Indian-owned forest lands are tribal or band lands. The majority of these belong to the Red Lake Band, which does not have any allotted lands. All BIA activities are approved by the owners. While forest land on reservations is managed cooperatively by BIA and Indian owners, Indians have exercised an increasing amount of responsibility over the management of their forest land.

Minnesota reservations currently contain 498,883 acres of commercial forest land. For harvest data collection and management purposes, the BIA divides Indian bands in Minnesota into four groups: the Minnesota Sioux, the Wisconsin Winnebago, the Red Lake Agency, and the Minnesota Agency.

The Minnesota Sioux and the Wisconsin Winnebago are small commercial forest land owners, owning 837 acres and 200 acres, respectively. The vast majority is owned by the Red Lake Agency and the Minnesota Agency.

The Red Lake Agency, which includes the Red Lake Band of Chippewa Indians, has 336,803 acres of commercial forest land. As of January 1991, the sustained yield cut from these lands was 69 million board feet of timber. The actual harvest was about one-half that amount.

The Minnesota Agency includes the Fond Du Lac Band of the Lake Superior Chippewa Indians, the Grand Portage Band of the Lake Superior Chippewa Indians, the Leech Lake Band of Chippewa Indians, the Mille Lacs Band of Chippewa Indians, the Bois Forte and Vermillion Lake Superior Band of Chippewa Indians (Nett Lake), and the White Earth Band of Chippewa Indians. The Minnesota Agency has 161,243 acres of commercial forest land, with a sustained yield of 28,200 cords cut as of January 1991. The actual harvest was a little more than one-half of that amount.



FOREST POLICY AND LEGISLATION

1995 Assessment

10
FOREST POLICY AND LEGISLATION

10.1
Relationship to the MFRP Program

Since the MFRP Assessment is a statewide document that serves as a background piece for all statewide forestry programs, the MFRP Program will provide comprehensive direction for forestry policies and programs statewide. It will document policies identified by the Strategic Development Initiative, the Generic Environmental Impact Statement Roundtable, and the Lake States Assessment, and propose strategies for implementation of these policies.

A major function of the 1995 MFRP Program will be providing context and direction for a variety of the organization's plans, including national forest plans, DNR regional plans, DNR Division of Forestry operational and work plans, county land management plans, and possibly forest industry land management plans. A landscape planning concept and context will be emphasized in the MFRP as part of the direction for these individual organizations' plans.

10.2
Minnesota Forest Resources Laws

Management of Minnesota's forest resources is founded either explicitly or implicitly on state law. The basic authority for all management actions by the Division of Forestry is the Minnesota Constitution. A wide range of laws affecting the activities of the Division of Forestry are in the Minnesota statutes. They include:

- acquisition, leasing, exchange, and sale of forest lands,
- management and use of forest lands,
- tax-forfeited lands,
- forest land taxation,
- wildfire control,
- timber sales and scaling, and
- forest roads.

A comprehensive summary of Minnesota's State Forest Resources Laws can be found in Appendix A.

10.3
County Forest Management Authority

Authority to manage tax-forfeited land by counties is also based on Minnesota statutes. Unlike the state holdings that were acquired

through a variety of means, almost all the lands that now comprise the county land base came through tax forfeiture. Title to these lands is held by the state under a trust in favor of the local taxing districts as specified in MINN Stat. 282.01 [1] [2]. See Appendix A for state statutes that relate to management of county forest lands.

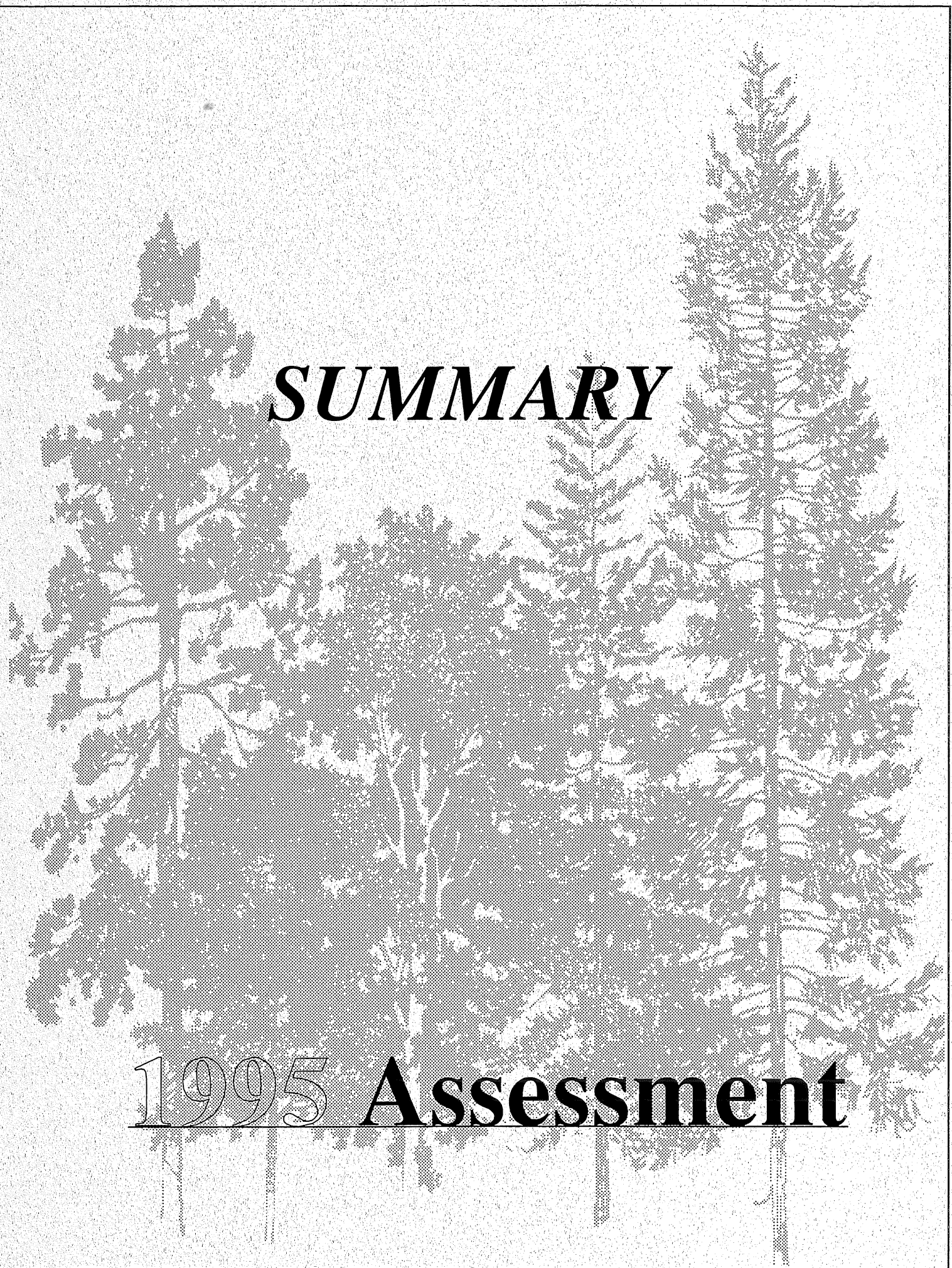
10.4
National Forest System Management Authority

National forest lands are managed by the USDA Forest Service, under the authority of the Public Laws of the United States. Details can be found in the USDA Forest Service publication, *The Principle Laws Relating To Forest Service Activities, 1993.*

Preparation of Land and Resource Management Plans for each national forest is required by the Forest and Rangeland Renewable Resources Planning Act (RPA), as amended by the National Forest Management Act (NFMA). Assessment of the environmental impacts is required by the National Environmental Policy Act (NEPA) and the implementing regulations of NFMA, 36 Code of Federal Regulations, Part 219.

10.5
GEIS Implementation Process

The Minnesota Environmental Quality Board recently approved a plan for implementing the GEIS titled, *Minnesota's Timber Harvesting GEIS: A Process for Recommendation Implementation.* The plan consists of three major programs for implementation: the Forest Practices Program, Sustainable Forest Resources Program, and Forest-based Research Program. A description of the plan is included in Appendix J.



SUMMARY

1995 Assessment

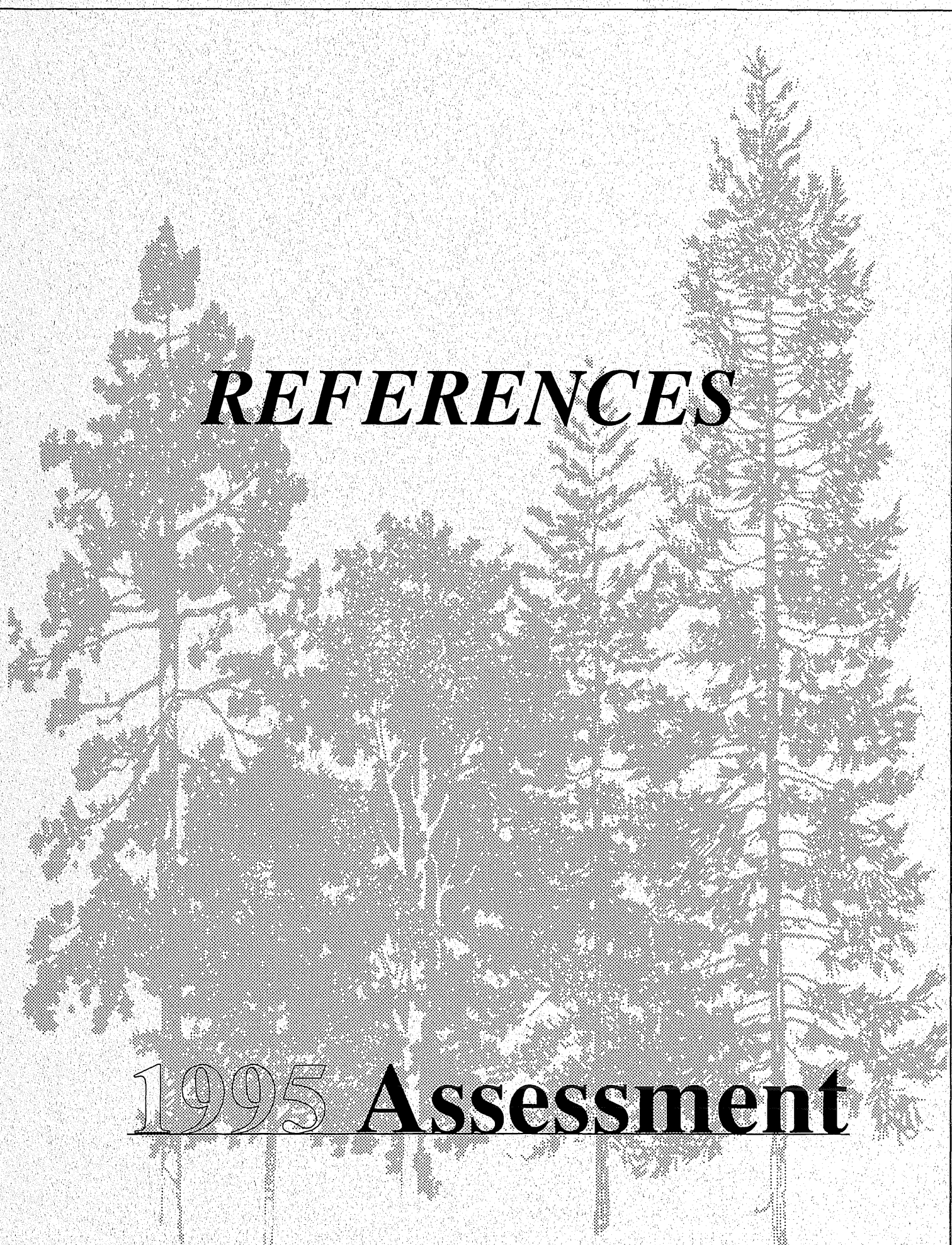
11
SUMMARY

11.1
Vision Statement

Based on the existing situation, here is one vision statement for the future of forestry in Minnesota based on the work done by the Sustainable Development Initiative (SDI) Forestry Team.

> *In future generations, Minnesota's forest lands will encompass 18+ million acres. Forest ecosystems will be more healthy and productive than they are today. They will also be more diverse in the type and size of the tree species present to maintain the natural plant and communities associated with the state's ecoregions.*
>
> *Minnesota's forests will be managed for a variety of stakeholders. They will make a significant contribution to the people's needs through both consumptive and nonconsumptive means. Minnesota's forests will provide the raw materials needed for a strong and diverse forest products manufacturing sector, and support a vibrant outdoor recreation and tourism industry, while addressing environmental imperatives from a local to global perspective. This state will be characterized as one that will optimize efficient use of its forest resources.*
>
> *The owners and managers of Minnesota's forests will conduct management practices that recognize long-term land stewardship goals. Our management will reflect our understanding that the most effective way to sustain the multitude of forest products and services is to maintain the health of the ecosystems that produce them. To that end, both public and private managers will work cooperatively to ensure that forest practices address both site-specific and larger landscape-level management goals that protect the overall integrity of the range of forest ecosystems found in Minnesota.*

Following the writing of the vision statement, the SDI Forestry Team went on to develop a set of guiding principles and strategies for sustainable development (Appendix K). Along with many other proposals for managing Minnesota's forest resources, the SDI strategies will be reviewed as part of the process of preparing the program portion of the MFRP.



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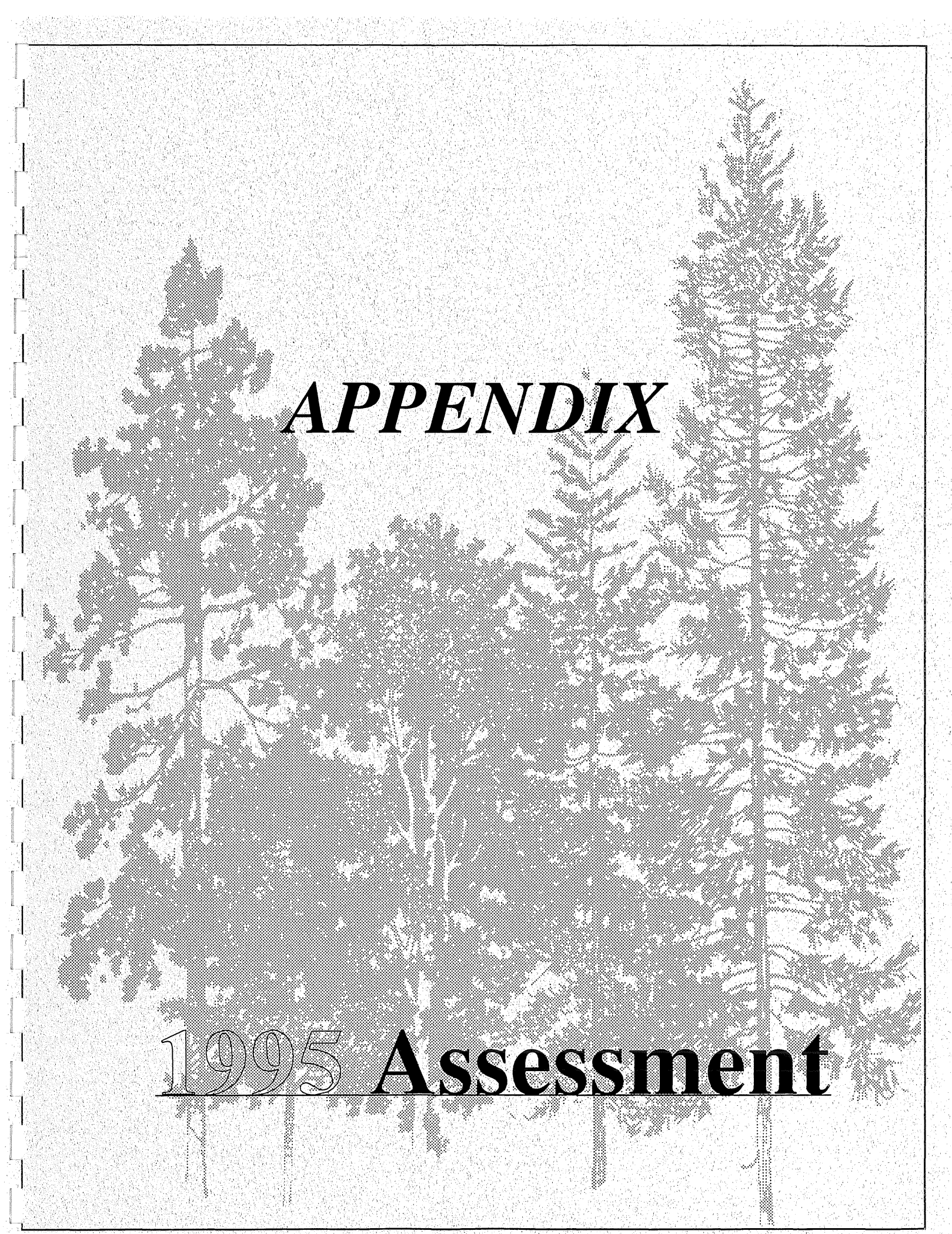

APPENDIX

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APPENDIX A

SUMMARY OF MINNESOTA STATE FOREST RESOURCE LAWS

The Constitution of the State of Minnesota and the Minnesota statutes provide the basic authority for all actions taken by the Division of Forestry on forest lands within the state. Each of the policy statements that guides the Division of Forestry is founded either explicitly or implicitly upon state law.

Because of the diverse nature of forest resources, a wide range of laws affects them. It would be impractical to attempt to include all of these laws here. Therefore, particular laws have been selected and cited in a topical index for reference purposes. This index is organized by seven topics:

I. Acquisition, Leasing, Exchange, and Sale of Forest Lands
II. Management and Use of Forest Lands
III. Tax-Forfeited Lands
IV. Forest Land Taxation
V. Wildfire Control
VI. Timber Sales and Scaling
VII. Forest Roads

I. Acquisition, Leasing, Exchange, and Sale of Forest Lands

A. Constitution of State of Minnesota
Article I, Section 13
Article XI, Section 5
Article XI, Section 10
Article XI, Section 11
Article XIII, Section 4

B. Minnesota Statutes

1. Acquisition
Concurrent Jurisdiction of State and United States (1.041)
State Consent to Acquisition of Lands (1.045)
Lands Selected in Lieu of Grants from United States (84.027, subd. 8)
Property Grants from United States (88.063)
United States Lands (94.47)
Condemnation of Real Estate (84.027, subd. 9)

Procedures for Acquiring Land (84.0272)
Landowner's Rights (84.0274, subd. 6)
Acquisition for Trails (84.029, subd. 2)
Outdoor Recreation System (86A.07)
Tax-Forfeited Land for Reforestation Projects (84A.20, 84A.31---see Topic III)
State Reforestation Projects; Gifts (84A.28) and (84A.38)
State Reforestation Projects; Eminent Domain (84A.29) and (84A.39)
Land Suitable for Fire Protection (88.09)
Suitable Timber Lands (89.01, subd. 6)
Lands Within State Forests (89.032)
Lands Within State Forests (89.033)
Tax-Forfeited Lands; Inclusion in State Forests (89.034---see Topic III)

2. Leasing

Conservation Purposes (84.153)
Suitable Uses (89.17)
Cultivation of Stagnant Swamp Trees (90.50)
Permits for Utility Companies (84.415)
Leases for Cottages and Camps (92.46)
Unsold Lands May be Leased (92.50)

3. Exchange

Executive Council (92.31)
Conditions for Land Exchange (94.341 - 94.349)
Minnesota Land Exchange Board (94.341)
Classes of Land for Exchange (94.342)
Class A Exchanges (92.343)
Class B Exchanges (94.344)
Transfers of Title Between State and Local Units of Government (94.349)
Tax-Forfeited Lands; Classification, Use, and Exchange (282.01, subd. 1)

4. Sale

Richard J. Dorer Memorial Hardwood Forest (89.022)
Lands Suitable for Agriculture (89.01, subd. 5)
Procedures for Sale of State Lands (92.01 - 92.29)
Lands Within National Forests (92.30)
Lands Suitable for Private Forest Management (92.321)
Discretion of Commissioner (94.50)
Tax-Forfeited Land Sales (Chapter 282---see Topic III)
Lands Near Water-Powers (89.26)
Lands Suitable for Forestry (89.27)

Lands Bordering on Public Waters (92.45)
Lands Valuable for Peat Deposits (92.461)

II. Management and Use of Forest Lands Within the State

A. Constitution of State of Minnesota
Article XI, Section 5
Article XI, Section 11

B. Minnesota Statutes

1. State Forest Policy and Planning
State Reforestation Projects (84A.21) and (84A.32)
Forest Resource Management Policy (89.002, subd. 1)
Reforestation Policy (89.002, subd. 2)
Forest Road Policy (89.002, subd. 3)
Commissioner's Duties (89.01, subd. 1)
Cooperative Planning (89.01, subd. 4)
Forest Resource Management Plan (89.012)
Unit Forest Resource Plans (89.013)
Realignment of State Forests (89.015, subd. 1)
Realignment of Administrative Units (89.015, subd. 2)
State Forests (89.021)
Forest Management Fund (89.04)
Commissioner's Regulatory Power (89.19)
Forestry Education (89.65)
Tax-Forfeited Lands, Inclusion in State Forests (89.034---see Topic III)
Funds Apportioned to County (89.036)
Tax-Forfeited Lands; Classification (Chapter 282---see Topic III)

2. Municipal, Memorial, and School Forests
Municipal and Memorial Forests for Timber Production (459.06, subd. 1)
Tax-Forfeited Lands for Memorial Forests (459.06, subd. 2)
Withdrawal of Tax-Forfeited Lands from Memorial Forests (459.06, subd. 3)
Cities May Establish Municipal Forests (459.07)
Educational Units May Establish Forests (89.41)

3. Private Forests
Private Forest Policy; Tree Growth Tax Law (270.32)
Auxiliary Forests; Taxation (88.47 - 88.53)
Auxiliary Forests; Restrictions (88.491)
State Forest Service to Private Forest Owners (88.79)

4. Recreation

Purpose of Omnibus Natural Resources and Recreation Act (86.02)
Policy Statement of Outdoor Recreation Act (86A.02, subd. 3)
Composition of Outdoor Recreation System (86A.04)
State Forest Sub-Areas Established by Outdoor Recreation Act (86A.05, subd. 7)
Policy Statement of the Minnesota Wild and Scenic Rivers Act (104.32)

5. Soil and Water

Policy Statement on Soil and Water Conservation (40.02)
Cooperation of State Agencies with Soil and Water Conservation Districts (40.13)
Policy Statement of Floodplain Management Act (104.01, subd. 3)
Policy Statement on Water Resource Conservation (105.38)
Drainage: Powers of County Boards and District Courts (106.22)
Policy Statement of the Minnesota Watershed Act (112.34)
Water Resources Board Authority over Watershed Districts (112.36)

III. Tax-Forfeited Lands

A. Constitution of State of Minnesota

Article XI, Section 5
Article XI, Section 10
Article XI, Section 11

B. Minnesota Statutes

1. Classification of Tax-Forfeited Lands

Classification; Use; Exchange (282.01, subd. 1)
Conservation Lands Under the Supervision of County Board (282.01, subd. 2)
Duties of Commissioner of Revenue; Issuance of Conveyance (282.01, subd. 6)
Sales, When Commenced, How Land is Offered for Sale (282.01, subd. 7)
Non-Agricultural Lands, Classification; Sale, Conditions (282.011)
Prior Owner May Purchase; Conditions (282.012)
Placed in Auxiliary Forest by Purchaser (282.013)
Completion of Sale and Conveyance (282.014)
Proceeds of Sale (282.15)
Prohibited Purchasers (282.16)
Conveyance of Interests in Tax-Forfeited Lands to State and Federal Governments (282.017)

Tax-Forfeited Land; Meandered Lakes; Sale Exception (282.018)

2. Non-Conservation Area Lands

Sale of Non-Conservation Lands (282.01, subd. 3)
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Limitation in Use of Lands (282.03)
Veteran's Credit for Land in Agricultural Use (282.038)
Timber Sale; Tax-Forfeited Lands, Lease, Partition, Easements (282.04---see Topic VI)
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Apportionment of Proceeds (282.08)
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Certain Powers and Duties May be Delegated (282.131)
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Consolidated Conservation Areas Fund (84A.51)
Certain Game Preserves, Areas, Projects; Control (84A.55)
Tax-Forfeited Lands, Inclusion in State Forests (89.034)
Timber Trespass on State Lands; Unlawful Possession and Sale; Rewards; Records (90.301)
Structures, Standing Timber, or Minerals not to be Removed (272.38)
Structures, Timber, or Minerals May be Seized (272.39)
Removal (272.40)
Tax-Forfeited Lands for Memorial Forests (459.06, subd. 2)
Withdrawal of Tax-Forfeited Lands from Memorial Forests (459.06, subd. 3)

IV. Forest Land Taxation

A. Constitution of State of Minnesota
Article X, Section 2

B. Minnesota Statutes

1. Minnesota Tree Growth Tax Law
Policy Statement of the Tree Growth Tax Law (270.32)
Growth Rate Determination (270.34)
Stumpage Value Determination (270.35)
Computation of Tax (270.36, subd. 1)
Tax Rates (270.34, subd. 2)
Tax Credit (270.37)
Application under Tree Growth Tax Law (270.38)

2. Auxiliary Forest Taxation
Tax Rate on Land (88.51, subd. 1)
Yield Tax (88.51, subd. 2)
Payment of Yield Tax (88.52, subd. 1)
Cutting Procedure (88.52, subd. 2)
Assessment of Yield Tax (88.52, subd. 3)
Yield Tax Constitutes a Lien (88.52, subd. 5)
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3. Class 3 Property: Agricultural-Nonhomestead Land and Seasonal Recreational-Residential Land (273.13, subd. 4)

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5. Class 4b Property; Vacant Land (273.13, subd. 9)

6. General Tax Provisions
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V. Wildfire Control

A. Constitution of State of Minnesota
Article XI, Section 5

B. Minnesota Statutes

1. Commissioner's Authorities and Responsibilities
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State and Federal Relief Agencies (88.06)
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VI. Timber Sales and Scaling

A. Constitution of State of Minnesota
No sections relate to this topical area

B. Minnesota Statutes

1. Policy Statement

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2. Authorities of the Executive Council and the Commissioner of Natural Resources
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   Establishment of Rules and Regulations (90.031, subd. 4)
   Investigative Agents (90.031, subd. 5)
   Commissioner's Duties (90.041, subd. 1)
   Annual Reports (90.041, subd. 3)
   Annual Public Meetings (90.041, subd. 4)

3. Appraisals
   Timber Appraisal Standards (90.045)
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   Authorities and Duties of a State Appraiser (90.061)
   Value Estimates (90.061, subd. 4)
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   Supervisory Powers of State Appraiser (90.061, subd. 8)

4. Public Auction Sales
   Regular Auction Sales (90.101)
   Intermediate Auction Sales (90.121)
   Auction Sale Procedure (90.14)
   Permits to Cut and Remove Timber (90.151)
   Permits (90.151, subd. 1)
   Permit Specifications (90.151, subd. 2)
   Security of Permit Compliance (90.151, subd. 3)
   Suspension of Permits (90.151, subd. 8)
   Extensions of Permits (90.151, subd. 13)
   Bonding of Purchaser (90.161, subd. 1)
   Assignment of Permit (90.171)
   Annual Sales Report (90.172)
   Cash Deposits in Lieu of Bond (90.173)
   Billing Statements (90.181, subd. 1)
   Deferred Payments (90.181, subd. 2)

5. Informal Sales
   Informal Sales (90.191)
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   Scaling Requirement (90.191, subd. 3)
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   Final Examination of Lands After Cutting (90.251, subd. 2)
   Authority of the Scale (90.251, subd. 4)
   Consumer Scaling (90.252)
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7. Violations and Penalties
   Conditions for Trespass (90.301)
   Timber Trespass (90.301, subd. 1)
   Taking Unlawfully Cut Timber (90.301, subd. 2)
   Unlawful Possession of Land (90.311)
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8. Timber Sales on Tax-Forfeited Lands; County Timber Sales
   Timber Sold for Cash (282.04, subd. 1)

VII. Forest Roads

A. Constitution of State of Minnesota
   Article I, Section 13
   Article XIII, Section 4
   Article XIV, Section 1

B. Minnesota Statutes
   Roads Within Reserved Areas (84A.55, subd. 10)
   Road Closures (88.22, subd. 1)
   Forest Road Policy (89.002, subd. 3)
   Road Inventory (89.012, subd. 2d)
   Prioritization for Road Policy (89.012, subd. 3e)
   Forest Management Fund (89.04, subd. 2b)
   Public Highways Through State Forests (89.18)
   Statutory Dedication of Roads (160.05, subd. 1)
   Recovery of Real Estate, 15 Years (541.02)

APPENDIX B

MINNESOTA SUBSECTION LEVELS, SIZE IN ACRES, PRESETTLEMENT VEGETATION, PRESENT VEGETATION AND LAND USE.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Red River Prairie	4,541,213	Tallgrass prairie and wet prairie were the dominant vegetation communities present (Marschner, 1974). Theupland prairie was dominated by bluestems, Indian grass, and several other grasses; Wet Prairie was dominated by bluejoint grass, cordgrass, cattails, rushes, and sedges. Narrow, forested floodplains were common along larger streams and rivers. Broader zones of woodland or brushland were common along "fire shadows" of streams; size and configuration depended on prevailing wind and stream alignment (Robert Dana, personal communication).	The most important land use is agriculture. The lakeplain has been intensively ditched for agriculture. Native flora persists in fragments (though some are of moderate size) east of the beach ridges and in the interbeach zone (Albert, 1993).
Minnesota River Prairie	7,745,787	The presettlement vegetation was primarily tallgrass prairie, with many islands of wet prairie (Kratz and Jensen 1983, Marschner, 1930). Forests of silver maple, elm, cottonwood, and willow occurred along the Minnesota River and other streams. Portions of the Big Stone Moraine supported dry and dry-mesic prairie (Wheeler et al. 1992). There were also dry gravel prairies on kames (Albert, 1993).	Agriculture is the dominant land use. The subsection is the heart of the Minnesota Cornbelt (Wright, 1972). Wheeler et al. (1985) found upland prairie species to be common throughout most of the subsection (based on herbarium records). Remnants stands of tallgrass prairie are rare.

Note: The text in Appendix B was adapted from the DNR Division of Forestry report titled: The Upper Levels of an Ecological Classification System for Minnesota.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Inner Coteau	948,486	Tallgrass prairie covered almost the entire landscape. Wet prairies covered a much lower proportion of the landscape than in the Minnesota River Prairie. Wet prairie was restricted to narrow stream margins in much of the subsection. Forest was similarly restricted to ravines along a few streams, such as the Rock and Redwood rivers. The prairies were drier is this subsection, accounting for the prevalence of prairie plants characteristic of midgrass prairies further to the west (Albert, 1993). These were especially common in Pipestone and Rock Counties, where soils are shallow over bedrock (Beckert, 1986).	Agriculture is the most important land use in this subsection. There are few remnants of presettlement vegetation left.
Coteau Moraines	1,787,541	Tallgrass prairie covered virtually all of this landscape. Wet prairies covered a much smaller proportion of the unit than in the Minnesota River Prairie. Wet prairie was restricted to narrow stream margins. Forest was similarly restricted to ravives along a few streamssm, such as the Redwood river.	Agriculture is the most important land use in this subsection. There are few remnants of presettlement vegetation left.
Aspen Parklands	2,596,823	Presettlement vegetation consisted of a combination of aspen savannah, tallgrass prairie, wet prairie and dry gravel prairie (on gravelly beach ridges). Floodplain forests of silver maple, elm, cottonwood, and ash occurred along the rivers and streams.	Agriculture is the dominant land use in the southern half. In the north, extensive areas have been cleared for farming recently. Remnants of presettlement vegetation are more common and in larger blocks than many other subsections where agreculture is important.
Hardwood Hills	4,842,344	Irregular topography and the presence of numerous lakes and wetlands provided a partial barrier to fire, resulting in woodland or forest rather than prairie vegetation. Along the prairie boundary to the west is a mosaic of tallgrass prairie, aspen-oak land, and oak openings or savanna (Marschner, 1974). Mixed forests of oaks, sugar maple, basswood, and other hardwoods were found in fire protected sites farther east. Tallgrass prairie grew on more level terrains within the subsection.	Agriculture is the major land use, but many poorly-drained potholes remain for either recreational or wildlife use; some upland forests adjacent to lakes or on steep landscapes also remain. Tourism is important, especially in areas with concentrations of lakes.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Big Woods	1,978,560 sq. mi.	Oak woodland and maple-basswood forest were the most common vegetation types on the irregular ridges of this subsection. Based on his study of the General Land Office notes, Grimm (1984) found that the actual order of dominance in the sugar maple-basswood forest was elm (27%), basswood (14%), sugar maple (12%), bur oak (10%), ironwood, red oak, and aspen (7%). He also found that along the western margin of the subsection, aspen was most common (53%), followed by bur oak (22%), on all other margins of the subsection, the oak woodland was dominated by a mix of aspen, red oak, bur oak, and to the east, white oak.	Greater than 75% of the subsection is cropland, with an additional 5-10% pasture. The remaining 10-15% of the subsection remains as either upland forest or wetland (Dept. of Soil Science, Univ. of Minnesota 1979, 1980b, 1981a).
Anoka Sand Plain	1,254,552	The predominant vegetation on the droughty uplands was oak barrens and opening. Characteristic trees included bur oak and northern pin oak that are small and misformed (Kratz and Jensen, 1983). Jack pine was present locally along the northern edge of the subsection. Brushland characterized large areas of the sandplain. Upland prairie formed a narrow bank along the Mississippi River, as did areas of floodplain forest (Marschner, 1974).	Sod and vegetable crops are extensively grown on drained peat and muck areas (Dept. of Soil Science, Univ. of Minnesota, 1980). Urban development is rapidly expanding into the subsection. Wheeler et al. (1985) found species associated with oak openings and oak barrens to be abundant in the sandplain.
Oak Savanna	1,692,191	Bur oak savanna was the primary vegetative community, but areas of tallgrass prairie and maple-basswood forest were common. Tallgrass prairie was concentrated on the least dissected portions of the landscape, in the center of the subsection. Bur oak savanna was concentrated on the rolling moraine ridges at the western edge of the subsection and in the dissected ravines at the eastern edge. Maple-basswood was restricted to the portions of the landscape with the greatest fire protection, either in steep, dissected ravines or where stream orientation reduced fire frequency or severity (Albert, 1993).	Presently, most of the area is farmed. Urban development is accelerating along the northern boundary.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Twin Cities Highlands	607,213	There was a mosaic of vegetative communities across this unit. Oak and aspen savanna were the primary communities, but areas of tallgrass prairie and maple-basswood forest were common. Tallgrass prairie was concentrated on level to gently rolling portions of the landscape. Bur oak savanna grew on rolling moraine ridges at the western edge of the subsection and in dissected ravines at the eastern edge. Maple-basswood was restricted to the portions of the landscape with the greatest fire protection, either in steep, dissected ravines or where stream orientation reduced fire frequency or severity (Albert 1993).	Urban development is the primary land use. There are small areas of forest present in the eastern portion of the unit, although this is becoming scarce as the urban development continues. There is significant recreational activity along the Mississippi and St. Croix corridors.
Rochester Plateau	1,301,281	Tallgrass prairie and bur oak savanna were major vegetation communities.	The majority of this unit is heavily farmed, with approximately 80% in crops, 10% in pature, and 5-10% in woodland. (Dept. Of Soil Science, Univ. Of Minnesota 1973). In Minnesota, Wheeler et al. (1985) found species characteristic of oak openings and barrens to be abundant (based on herbarium collections).
Blufflands	1,198,090	Tallgrass prairie and bur oak savanna were major vegetation types on ridge tops and dry upper slopes. Red oak-white oak-shagbark hickory-basswood grew on moister slopes, and red oak-basswood-black walnut forests in protected valleys. Prairie was restricted primarily to the broader ridge tops, where fires could carry, but also occurred on steep slopes with south or southwest aspect.	About 30 percent of this subsection is cropped, 20 percent is in pasture and 50 percent is in woodland (Dept. of Soil Science, Univ. of Minnesota, 1973). In Minnesota, Wheeler et al. (1985) found species characteristic of oak openings and barrens to be abundant (based on herbarium collections). People are finding good recreational opportunities in this subsection.
Mille Lacs Uplands	3,870,770	The original vegetation consisted of a mosaic of forest types. Along the southern boundary, maple-basswood forests were prevalent. The rest of the subsection was a vast mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum, or white cedar-black ash communities.	Agriculture is concentrated in the western and southern portions of this subsection. Forestry and recreation are the most important land uses in the central and eastern part. There are large areas in eastern Pine County that are still heavily forested and relatively undisturbed, although there are no significant examples of large white pine stands still present.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Agassiz Lowlands	4,449,815	Marschner (1974) mapped most of this subsection as peatland. Plant communities included in this classification were sedge fen, black spruce-sphagnum bog, and white cedar-black ash swamp. There were also low moraines and beach ridges dominated by jack pine forest or trembling aspen-paper birch forest. Recent ecologists have classified the peatland as a number of plant communities-the plant species present in each community respond to differences in water flow and water chemistry (Heinselman, 1963, 1970; Glaser et al. 1981; Glaser, 1983).	Forestry and recreation are the major land uses. Black spruce, jack pine, and quaking aspen are the most common species utilized for paper making and sawlogs. Recreation and tourism are associated with the three large lakes.
Littlefork-Vermillion Uplands	1,406,000	Marschner (1974) mapped much of the subsection as aspen-birch that would eventually become conifer dominated (white pine, white spruce, and balsam fir). The eastern portion was dominated by white pine, red pine, and jack pine. Lowlands were occupied by sedge fen, black spruce-sphagnum bog, and white cedar-black ash swamp. There were also low moraines and beach ridges dominated by jack pine forest or trembling aspen-paper birch forest.	Quaking aspen is the most common species of tree in this subsection. It is found in both pure and mixed stands. It is heavily harvested for pulp (Grigal, personal communication). Aspen is probably the best developed forest type on the uplands, and it probably was similarly common before settlement. Logging of conifer forests also occurred. In the past, attempts were made to farm portions of the peatlands. (Heinselman, 1963). Ditches were dug along section lines, but were not effective. The other important land use is recreation, particularly in the southeastern section where there are several prominent lakes and reservoirs.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
St. Louis Moraines	990,292	White pine-red pine forest covered large portions of the steep moraines and portions of the pitted outwash along the eastern edge of the subsection. South of Grand Rapids, there was an area of the moraine dominated by northern hardwoods. Aspen-birch forests also grew on the moraines, but were more common on the outwash, which had excessively well drained sandy soils. Mixed hardwood-pine forest was locally found on the moraines, generally near large lakes. Conifer swamp and bogs were scattered throughout the subsection, occupying both kettles and linear depressions in the pitted outwash and moraines (Albert, 1993).	The most important land used in this subsection are forestry and recreation. This area is heavily forested and timber harvesting is extensive. Quaking aspen is the primary species harvested. Recreation is primarily associated with the unit's lakes and the areas around them. Fishing, hunting, snowmobiling, and skiing are popular.
Pine Moraines and Outwash Plains	3,585,423	Jack pine, in a mix with northern pine oak, was the most common species on excessively drained portions of broad outwash plains. Large areas of the other landforms were dominated by aspen-birch and pine forests (mixture of red and white pine). Red pine-white pine forests, occupied the rolling to irregularly sloped end moraines. Mixed hardwood and pine forests, dominated by a diverse mix of northern hardwoods and white pine, were found int he most fire protected areas at the northern and eastern edges of the subsection. Fire protection was offered by irregular topography, broad wetlands, and relatively large lakes. Some of the hardwood-pine forests mapped by Marschner may have dominated by red oak and basswood, without sugar maple (Albert, 1993).	Forest management and tourism are the most important land uses. agriculture is common in the west, where center pivot irrigation of corn and potatoes is common. Tourism is common where there are concentrations of lakes. Summertime swells the population of these areas significantly. Brainerd, a community of 14,000, absorbs more than ten times that number within a 30-mile radius during summer weekends.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Chippewa Plains	2,079,379	Presettlement vegetation was a mixture of deciduous and conifer trees. White pine and red pine were present on the moraines. Jack pine was the dominant covertype on outwash plains and sandy lake plains. Hardwoods (red oak, sugar, maple and basswood) grew in sheltered areas of the moraines, generally close to large lakes. Forested lowlands were occupied by black spruce, tamarack, white cedar, and black ash. Non-forested wetlands were dominated by sedge meadow communities.	Much of this subsection is presently forested and forestry is one of the most important land uses. Aspen is the most common tree species. It is found in both pure stands and mixed stands with birch, maple, oak, white spruce, jack pine, and red pine. Tourism and recreation is the other important land use. There are many lakes present and most are developed with summer homes. Agriculture is important locally, particularly in the western part.
Tamarack Lowlands	1,788,277	Vegetation in the lowlands were dominated by lowland conifers (black spruce, tamarack, and white cedar) and lowland hardwoods (black ash). Sedge meadows were also extensive. Uplands supported aspen-birch and upland conifer forest. White pine-red pine forests were located on the ground moraine at the edges of the lake plain, but were not extensive.	Forestry is the most important land use within the Tamarack Lowlands. There are some areas in the lake plain where agriculture is important, although most of the subsection is marginal for this land use. Locally, tourism is important around Sandy Lake in Aitkin County
Nashwauk Uplands	1,356,619	Forest types represented within the subsection include white pine-red pine forest, aspen-birch forest, mixed hardwood-pine forest, and jack pine barrens on the uplands (Marschner, 1974). Wetland vegetation included conifer bogs and swamps and open muskeg.	Forest management is the most important land use in this subsection. There are extensive areas of forested public land which are managed for wood products and recreation. Quaking aspen is the dominant tree species presently.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
Border Lakes	2,303,881	Heinselman (1974) describes the major forest communities as jack pine forest, white pine-red pine forest, and hardwood-conifer forest. The latter community was dominated by balsam fir, white spruce, paper birch, and trembling aspen. Fire dependance characterizes all of these forest types. Jack pine is most prevalent in the two areas where the landscape is lease dissected by small lakes, north of Vermilion Lake and within and north of the Sawbill Outwash Plain. Areas most dissected by lakes are where white pine-red pine forests are most common, probably as a result of partial fire protection (Albert, 1993).	Most of the subsection remains forested, with most forest types persisting with stand composition and structure similar to that present originally. Logging occurred within the subsection, but large areas remain unlogged. Heinselman (1973) maintained that this was because of the relatively sparse densities of forest stands, particularly white and red pines. Grigal (personal communications), however, maintains that the lack of logging was also partially the result of two other factors. The first of these was inaccessibility. The second was that by the time timber harvesting began here, public sentiment for preservation had begun to be heard.
Laurentian Highlands	467,572	The major forest type found on drumlin ridges was aspen-birch with only small areas of white pine-red pine forest (Marschner, 1974). Mixed hardwood-pine was infrequent. Conifer swamp or bog occupied the depressions between most of the drumlins. White pine-red pine grew on the outwash plain, where it was the most common forest type. At the northeastern end of the plain, jack pine barrens dominated an 8-10 mile long and 1-3 mile wide strip. Small conifer bogs or swamps were scattered across the outwash. Aspen-birch was also present on the outwash.	This unit is still dominantly forested. Most of the land is in public ownership. The most important land use is forestry. Much of the upland sites are occupied by quaking aspen, either in mixed stands or in relatively pure stands. Balsam fir is a significant component in many of the stands. Recreation is important around areas where there are lakes and rivers. Hunting attracts a lot of people because of the extensive amount of public land in this unit.

Name	Acres	Presettlement Vegetation	Present Vegetation and Land Use
North Shore Highlands	1,122,154	Marschner (1974) recorded aspen-birch forest, white pine-red pine forest, mixed hardwood-pine forest, and conifer bogs and swamp. White pine-red pine forest was most common on the clay lake plain and on thin soil over bedrock in the southern half of the subsection. Mixed hardwood-pine forest, with sugar maple, was concentrated on the ridges of the dissected clay lake plain and the Highland Flutes. In the northern half of the subsection, aspen-birch was dominant, with very little white pine-red pine forest or mixed hardwood-pine forest. Mixed hardwood-pine forest persisted in areas within 6-10 miles of the shoreline on ridgetops.	Almost the entire subsection remains forested, with forest management and recreation as the major land uses. Following logging, the extensive white pine-red pine forests have been replaced by forests of trembling aspen-paper birch. Tourism and mining are the other important land uses. There are no mines within the subsection, but ports were set up to get the iron ore from the range to steel mills in Indiana and Ohio. The City of Duluth has a large port area and ships significant amounts of agricultural commodities, as well as iron ore.
Glacial Lake Superior Plain	118,480	This subsection was virtually totally forested. Marschner (1974) classified the presettlement vegetation in this unit as pine flats, consisting of hemlock, spruce, fir, cedar, and white pine. This was the western extent of eastern hemlock.	Forestry is the most important land use. Significant portions of the unit are totally undeveloped. Following logging, trembling aspen is a common dominant throughout the subsection. Yellow birch is more common in this subsection than elsewhere in the state. Presence of a significant trout population in the Nemadji River and its tributaries draws many people.

Source: DNR Division of Forestry, The Upper Levels of an Ecological Classification System for Minnesota

APPENDIX C

FIA DEFINITIONS OF MINNESOTA'S FOREST COVERTYPES.

Forest Type	Description
Jack pine	Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)
Red pine	Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)
White pine	Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)
Black spruce	Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)
Balsam fir	Forests in which balsam fir and white spruce comprise a plurality of stocking with balsam fir the most common. (Common associates include aspen, maple, birch, northern white-cedar, and tamarack.)
Northern white-cedar	Forests in which swamp conifers comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)
Tamarack	Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)
White spruce	Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include aspen, maple, birch, northern white-cedar, and tamarack.)
Oak-hickory	Forests in which northern red oak, white oak, bur oak, or hickories singly or in combination, comprise a plurality of the stocking. (Common associates include jack pine, elm, and maple.)
Elm-ash-soft maple	Forests in which lowland elm, ash, red maple, silver maple, and cottonwood, singly or in combination, comprise a plurality of the stocking. (Common associates include birches, spruce, and balsam fir.)
Maple-basswood	Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine, elm, and basswood.)
Aspen	Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)
Paper birch	Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)
Balsam poplar	Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

APPENDIX D

FOREST TYPE ACREAGE FOR FIA TIMBERLAND, RESERVED AND UNPRODUCTIVE PLOTS, STATEWIDE (THOUSAND ACRES).

Forest Type	1977	1990			
	Timberland	Timberland	Reserved	Unproductive	Total
Jack pine	504.4	447.5	131.5	0	579.0
Red pine	246.9	301.6	80.4	0	382.0
White pine	65.6	63.2	3.8	1.3	68.3
Black spruce	1,041.8	1,322.1	126.6	533.7	1,982.4
Balsam fir	859.1	734.3	93.1	12.5	839.9
Northern white cedar	498.6	680.5	25.1	38.3	743.9
Tamarack	465.4	705.1	8.9	110.7	824.7
White spruce	79.2	93.8	39.9	0	133.7
Oak-Hickory	893.9	1,190.4	9.5	13.4	1,213.3
Elm-Ash-Soft maple	738.1	1,291.5	42.8	33.1	1,367.4
Maple-Basswood	1,283.9	1,396.7	17.0	0	1,413.7
Aspen	5,302.3	5,115.4	422.1	30.3	5,567.8
Paper birch	997.6	834.7	94.9	2.1	931.7
Balsam poplar	548.9	427.7	7.1	8.4	443.2
Other	0	0	10.4	1.0	0
Nonstocked	169.4	169.9	0	43.5	222.8
Total	13,695.1	14,773.4	1,113.1	828.3	16,714.8

Source: Timberland acreage by forest type for 1977 was drawn from Jakes (1977). Timberland figures for 1990 were developed from survey unit reports by Kingsley (1991), Murray (1991), Leatherberry (1991), and Roussopoulous (1992). Reserved and unproductive acreage was developed from FIA test data.

APPENDIX E

TOTAL AREAS (IN 1,000 ACRES) BY LANDSCAPE AND LANDUSE CLASS.

LANDSCAPE CLASS	TIMBERLAND	RESERVED TIMBERLAND	OTHER FOREST	RESERVED OTHER	NONFOREST LAND	CENSUS WATER	TOTAL
Red River Prairie	84.5	0	0	0	4389.1	36.9	4510.5
Aspen Parkland	321.4	2.8	14.5	0	2228.2	19.7	2586.6
Agassiz Lowland	2063	0	436.1	9.2	1336.9	549.6	4394.8
Littlefork\Vermillion Uplands	1059	11.5	73.1	3.1	194.8	59.9	1401.4
Border Lakes	750.7	918.4	12.1	16.9	187.6	497.6	2383.3
Pine Moraine & Outwash Plains	1791.3	28.8	15.4	1.4	1439.4	276.9	3553.2
Chippewa Plains	1174.4	4.5	35.1	0	523.5	363.7	2101.2
St. Louis Moraine	774.7	0.8	18.6	0	189	95.2	1078.3
Nashwauk Upland	1005	11.4	40.2	0	195	66.1	1317.7
Tamarack Lowland	1119.6	1	129.3	0	513.4	71.3	1834.6
Laurentian Highland	373.2	0	5.7	0	41	23.4	443.3
North Shore Highlands	848	27	9	0	160.8	32.2	1077

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LANDSCAPE CLASS	TIMBERLAND	RESERVED TIMBERLAND	OTHER FOREST	RESERVED OTHER	NONFOREST LAND	CENSUS WATER	TOTAL
Glacial Lake Superior Plain	68.7	6.9	0	0	36.8	8	120.4
Hardwood Hills	580.9	6.3	7.7	0	3878.1	383.9	4856.9
Mille Lacs Uplands	1660.2	39.6	24.7	0	1916.1	188.1	3828.7
Anoka Sand Plain	177.5	3.9	3.5	0	1043.1	52.2	1280.2
Twin Cities Highlands							
Couteau Moraines	7.2	1.4	0	0	2711.6	39.8	2760
Inner Coteau							
Minnesota River Prairie	152.6	0.7	0	0	7409.1	147.4	7709.8
Big Woods	148.3	6.8	0	0	1695.2	119.6	1969.9
Oak Savanna	75.1	8.4	1.5	0	2184.6	42.4	2312
Rochester Plateau	536.8	5.5	1.8	0	1915.2	29.1	2488.4
Blufflands							
TOTAL	14772.1	1085.7	828.3	30.6	34188.5	3103	54008.2

APPENDIX F

PERCENT OF TIMBERLAND BY COVER TYPE BY LANDSCAPE

LANDSCAPE CLASS	COVER TYPE															
	Jack Pine	Red Pine	White Pine	Scotch Pine	Balsam Fir	Black Spruce	White Cedar	Tamarack	White Spruce	Oak	Lowland Hardwoods	Northern Hardwoods	Aspen	Birch	Balm of Gilead	Non-stocked
Agassiz Lowland	12.39	6.97	4.89		12.94	24.61	28.79	26.15	11.14	3.13	12.26	4.02	12.40	5.89	27.08	25.38
Red River Prairie	1.72	3.12	1.44		1.43	1.34	1.01	1.08		3.64	2.96	3.89	1.61	1.53	0.99	1.12
Aspen Parkland	0.32	0.81	0.86		2.34	3.05	1.97	1.73	2.67	2.78	3.28	2.03	5.11	1.75	8.27	5.06
Border Lakes	9.62	8.59	26.58		15.02	10.92	5.94	2.66	12.06	0.61	2.66	2.42	6.91	10.77	2.19	4.95
Littlefork/ Vermillion Uplands	4.60	5.22	6.90		9.31	10.80	9.98	4.15	8.56	0.44	5.49	3.15	7.85	7.68	9.00	4.12
North Shore Highlands	1.03	1.87	3.59		12.30	2.93	7.52	0.83	19.06	1.30	4.52	6.30	4.12	14.89	4.60	1.83
Chippewa Plains	10.33	12.12	10.63		6.78	4.84	9.28	8.30	7.83	1.45	6.00	6.83	7.88	7.78	10.37	2.77
St. Louis Moraine	2.17	4.78	10.49		4.01	4.04	7.16	5.43	5.25	2.10	4.91	4.92	4.81	6.07	2.90	1.47
Nashwauk Upland	9.81	14.84	4.74		10.39	12.56	6.71	4.12	14.46	0.51	3.49	1.83	5.83	9.39	3.43	4.83
Hardwood Hills	0.34	2.81		46.67	1.02	0.83		1.77	1.66	10.85	6.69	11.37	2.14	1.19	1.57	3.65
Pine Moraine/ Outwash Plains	26.24	15.59	22.27	8.33	3.87	1.25	1.60	6.85	3.87	14.08	5.05	6.21	12.41	10.11	3.89	3.06
Tamarack Lowland	2.10	3.16			6.83	8.30	3.84	15.67	1.29	1.63	8.01	4.69	5.69	4.38	4.51	5.71

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LANDSCAPE CLASS	COVER TYPE															
	Jack Pine	Red Pine	White Pine	Scotch Pine	Balsam Fir	Black Spruce	White Cedar	Tamarack	White Spruce	Oak	Lowland Hardwoods	Northern Hardwoods	Aspen	Birch	Balm of Gilead	Non-stocked
Laurentian Highlands	0.88	1.06	0.14		4.60	2.77	3.00	1.24	6.81	1.73	0.93	1.08	2.17	3.92	0.73	0.77
Mille Lacs Uplands	1.93	3.62	2.87		2.53	4.01	0.87	8.11		11.07	14.38	17.06	9.58	6.54	2.30	12.72
Glacial Lake Superior Plain		1.03			0.65	0.30		0.15		0.06	0.51	0.28	0.52	0.35	0.69	0.71
MN River Prairie	7.24	5.22			1.68	2.59	4.17	4.19	1.93	5.67	7.60	6.50	4.37	3.52	6.01	3.53
Anoka Sand Plain	0.86	2.03		45.00				0.39	0.18	7.75	1.09	2.54	0.50	0.10		0.65
Big Woods	2.45	2.56			0.55	0.34	0.56	1.02		3.16	2.71	5.08	1.48	1.57	2.50	7.66
Twin Cities Highlands	2.45	0.97			0.23	0.29	0.50	0.12		1.35	0.46	0.81	0.33	0.60		
Couteau Moraines	0.47	0.37			1.20	0.86	1.78	1.24		0.27	1.07	0.66	0.92	0.53	1.72	0.94
Inner Couteau	1.10				0.34	0.15	1.07	0.67			0.18	0.16	0.38		1.88	3.42
Oak Savanna	0.34	0.44			0.89	1.19	1.35	1.78	1.20	1.88	1.12	1.06	0.99	0.13	1.66	2.30
Rochester Plateau	0.84	1.00	2.30		0.96	1.03	1.24	1.54	1.01	5.72	1.55	2.68	0.78	0.26	1.55	2.00
The Blufflands	0.77	1.81	2.30		0.14	0.98	1.67	0.79	1.01	18.80	3.08	4.45	1.23	1.06	2.17	1.35
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
(in 1,000 acres):	447.5	301.6	63.2	6.0	734.3	1322.1	680.5	705.1	93.8	1184.3	1291.5	1402.9	5114.2	835.8	427.7	168.9

Source: DNR Forestry

APPENDIX G

SUMMARY OF ESTIMATED ANNUAL SILVICULTURE OPERATIONS ON TIMBERLANDS BY OWNERSHIP, 1990–91.

DATA SOURCE	Survey					Estimate	
OWNERSHIP	State	County	National Forests	Forest Industry	Indian	Private & Other	Total Estimate
Area of ownership, ac	2,584,000	2,226,506	1,705,000	834,479	498,046	6,023,800	13,871,831
Total volume harvested, cord	685,900	553,071	344,000	214,635	86,692	1,959,002	3,843,300
Area with logging operations, ac	30,861	26,395	17,296	11,148	4,428	109,700	199,828
Natural regeneration area, ac	19,760	20,594	13,113	7,559	3,402	77,847	142,275
Artificial regeneration area, ac	9,465	5,128	2,724	2,765	481	18,003	38,566
SILVICULTURAL SYSTEMS AND THINNING, % by volume							
- clearcutting (area > 5ac)	55	60	0	95	93	26	39
- clearcutting with standing residuals	38	29	97	1	0	42	42
- patch cutting (0.25-5ac)	3	5	0	0	0	7	5
- strip or other modified clearcut	1	2	0	0	2	6	3
- seed tree cutting	0	0	0	0	0	1	1
- shelterwood cutting	0	0	0	0	0	3	1
- selective logging	1	3	0	0	0	9	5
- thinning	2	1	3	4	5	6	4
SILVICULTURAL SYSTEMS AND THINNING, % by area							
- clearcutting (area > 5ac)	52	56	0	91	83	21	34
- clearcutting with standing residuals	36	30	91	1	0	35	37
- patch cutting (0.25-5ac)	2	5	0	0	0	6	5
- strip or other modified clearcut	1	2	0	0	1	5	3
- seed tree cutting	0	0	0	0	0	1	1
- shelterwood cutting	1	0	0	1	1	5	3
- selective logging	2	5	0	0	0	13	8
- thinning	5	3	8	7	15	13	10

DATA SOURCE	Survey					Estimate	Total Estimate
OWNERSHIP	State	County	National Forests	Forest Industry	Indian	Private & Other	
REGENERATION AREAS, acres							
- planting	4,750	4,948	1,979	2,442	481	18,003	32,603
- seeding	4,715	180	745	323	0	0	5,963
- natural regeneration	19,760	20,594	13,113	7,559	3,402	77,847	142,275
- TOTAL	29,225	25,722	15,837	10,324	3,883	95,850	180,841
SITE PREPARATION AREAS, acres							
- chemi-aerial	402	0	0	54	0	399	855
- chemi-ground	1,402	1,369	0	191	0	2,593	5,555
- prescribed burning	825	120	192	100	0	1,083	2,320
- mechanical	3,553	1,360	2,431	1,831	444	8,421	18,040
- mechanical with band spraying	0	0	0	932	0	816	1,748
- TOTAL	6,182	2,849	2,623	3,108	444	13,313	28,519
TIMBER STAND IMPROVEMENTS, acres							
- chemical release - aerial	535	2,715	0	2,002	0	366	5,618
- chemical release - ground	675	1,877	0	1,362	0	273	4,187
- hack and squirt	20	0	0	0	0	1	21
- mechanical/manual release	808	455	3,782	53	408	383	5,889
- noncommercial thinning	427	164	60	203	590	172	1,616
- residual stem felling	570	271	7,686	474	0	1,071	10,072
- pruning	150	28	13	10	0	24	224
- slash disposal (burn brush piles)	50	41	0	0	0	11	102
- TOTAL	3,235	5,550	11,541	4,104	998	2,301	27,729

Source: GEIS

APPENDIX H

AREAS OF ANNUAL SILVICULTURAL OPERATIONS AS PERCENTAGES OF TOTAL TIMBERLAND.

(Percentages should not be added directly to get an overall total effect since a number of operations could occur on the same site. Includes all timberlands, but results for other ownerships extrapolated from silviculture survey.)

	SILVICULTURE SURVEY		TOTAL ESTIMATED	
	Annual forest operations in analysis, acres	Annual forest operations as a percent of timberlands	Annual forest operations in analysis, acres	Annual forest operations as a percent of timberlands
Area of timberland ownership	7,848,031		13,871,831	
Area with logging operations	90,128	1	199,828	1
Natural regeneration area	64,428	1	142,275	1
Artificial regeneration area	20,563	<1	38,566	<1
REGENERATION AREAS				
- planting	14,600	<1	32,603	<1
- seeding	5,963	<1	5,963	<1
- natural regeneration	64,428	1	142,275	1
- TOTAL	84,991	1	180,841	1
SITE PREPARATION AREAS				
- chemi-aerial	456	<1	855	<1
- chemi-ground	2,962	<1	5,555	<1
- prescribed burning	1,237	<1	2,320	<1
- mechanical	9,619	<1	18,040	<1
- mechanical with band spraying	932	<1	1,748	<1
- TOTAL	15,206		18,519	
TIMBER STAND IMPROVEMENTS				
- chemical release - aerial	5,252	<1	5,618	<1
- chemical release - ground	3,914	<1	4,187	<1
- hack and squirt	20	0	21	0
- mechanical/manual release	5,506	<1	5,889	<1
- noncommercial thinning	1,444	<1	1,616	<1
- residual stem felling	9,001	<1	10,072	<1
- pruning	201	0	224	0
- slash disposal (burn brush piles)	91	0	102	0
- TOTAL	25,428		27,729	

Source: GEIS

APPENDIX I

RESEARCH

College of Natural Resources

The University of Minnesota's College of Natural Resources houses the **Departments of Forest Resources, Forest Products, and Fisheries and Wildlife**. The College and these units are in turn part of the University's Agricultural Experiment Station. The Department of Forest Resources is primarily concerned with basic and applied research directed at meeting the needs of forest land management. Research encompasses forest management, economics, policy, ecology, tree physiology, genetics and tree improvement, ecology, silviculture, urban forestry, resource assessment including remote sensing, geographic information systems, water quality management, tourism and recreation resource management. The Department of Forest Products focuses on basic and applied research on utilization from the standpoint of primary and secondary manufacturing. Ongoing research involves composite products, chemicals and energy from wood, biopulping, wood drying, lumber manufacturing, wood mechanics and structural engineering, wood deterioration, process control, cold climate housing, and paper recycling. The emphasis is on improvement of utilization technologies and new products or ways to use the wood resource. The Department of Fisheries and Wildlife focuses on basic and applied research central to the management of fisheries and wildlife and their habitats. Forestry related research includes the ecology of forest animals and integrated forestry/wildlife management. The faculty of the College of Natural Resources number approximately 53 PhD scientists. They are assisted by a technical research support staff and by over 130 graduate students, many of whom serve as part-time research assistants.

The College of Natural Resources is the only institution in the state offering BS, MS, and PhD programs in forestry. Thus, the program both conducts research and trains scientists to do so. These departments also have faculty members with joint appointments in the University of Minnesota Extension Service (MES). These Extension faculty conduct applied research and convey research knowledge to individuals, industry, and public agencies in Minnesota through programs and continuing education. These departments also draw on faculty talent from other departments (such as Entomology, Plant Pathology, and Soil Science) in the College of Agriculture and Agricultural Experiment Station. The College of Natural Resources has staff and facilities located in St. Paul, at the Cloquet Forestry Center, and at the North Central Experiment Station of the University in Grand Rapids.

Direction for the research program comes from priorities established through the USDA Cooperative State Research Service and the Agricultural Experiment

Station. The College of Natural Resources also derives a portion of its research and extension direction from the 1982 Minnesota Forest Management Act.

Natural Resources Research Institute

The Natural Resources Research Institute (NRRI) was established in 1983 at the University of Minnesota, Duluth to assist in efforts to bolster Minnesota's economy through commercial development of natural resources in an environmentally acceptable manner. Organizationally, NRRI consists of the Center for Applied Research and Technology Development (CARTD), the Center for Economic Development (CED), and the Center for Water and Environment (CWE). NRRI provides technical and business assistance to economic development efforts, emphasizes applied research and the development of technology leading to improved products and processes, and conducts basic research in environmental areas to assist informed decision making in economic development.

Forestry research is conducted in both the Center for Applied Research and Technology Development (CARTD) and Center for Water and the Environment (CWE). Programs in the CARTD focus on aspen management, short rotation forestry, wood industry assessments, secondary solid wood products, and manufacturing and development of composite wood products. Programs in the CWE encompass studies on forest ecology, ecosystem studies, landscape issues, forest wildlife, water quality, wetlands, environmental chemistry, and resource analysis. The NRRI employs about 180 individuals including 18 PhD scientists. Forestry-related research activity includes about 25% of the NRRI program with an extramural budget of about $2-3 million per year. The NRRI has cooperative projects with many industrial partners, government agencies, and other University programs including the College of Natural Resources, the College of Biological Sciences, and the College of Science and Engineering at the University of Minnesota, Duluth. Many of the scientific staff of the NRRI are on the graduate faculty of various university departments including those on both the Duluth and St. Paul campuses. On an annual basis, approximately 6-10 graduate students are involved in forest-related research.

The NRRI is funded by a state appropriation and various federal and state granting agencies, Minnesota Technology, Inc. foundations, and industry. Overall direction is provided by the NRRI Advisory Committee, and direction for forestry research is provided by internal committees which seek input from groups such as the Minnesota Forestry Coordinating Committee.

USDA Forest Service, North Central Forest Experiment Station

The Station conducts research in forestry and related fields through a seven state area in the north central United States. It is also responsible for Forest Survey in an eleven state area. The Station has nineteen research projects at nine forestry sciences laboratories throughout the region. Research encompasses forest silviculture and ecology, forest modeling, biotechnology, genetics, forest regeneration processes, landscape ecology, forest economics, resource evaluation, research evaluation, urban and high-use recreation, forest engineering, wood utilization, fire, insects and disease, water quality, and wildlife and fish habitat management. Station staff consists of about 70 scientists of which about 50 are PhDs. About 30 scientists (half PhDs) are located in Minnesota. The Station scientists are assisted by a support staff of 150. About 100 of the support staff are located in Minnesota. The Station derives its direction from the Forest and Rangeland Renewable Resources Research Act of 1978, the Forest and Rangeland Renewable Resources Planning Act of 1974, and other federal policies as administered through the USDA.

The North Central Forest Experiment Station has its main offices on the University of Minnesota St. Paul Campus in conjunction with the College of Natural Resources. The Station also maintains a Forestry Science Laboratory in Grand Rapids, Minnesota. It also maintains fourteen experimental forests and watersheds, five of which are located in Minnesota.

Minnesota Forest Industries (MFI)

Minnesota Forest Industries is an association of the primary forest products manufacturing companies in the state. In Minnesota, the forest products industry owns approximately 850 thousand acres of forest land. Thus, being large forest landowners and providing markets for raw materials the presence of the forest products industry is felt directly or indirectly throughout the forest lands of Minnesota. Having strong ties to the forest, the member companies of MFI are committed to conducting and supporting research activities that have the potential to improve forest resource production, health and values.

Several member companies of MFI are involved in cooperative or individual research programs. Cooperative efforts that MFI companies are involved in include the Tree Improvement Cooperative, research on the genetic improvement of conifer species; Forest Vegetation Management Cooperative, research on the use of herbicides in controlling competing vegetation in plantations; Aspen/Larch Genetics Cooperative, research on the hybridization and genetic improvement of aspen and larch; Great Lakes Forest Growth and Yield Cooperative, research on forest growth and yield models; and Lake States Forest Resource and Environmental Management Cooperative, research on silvicultural practices and forest resources.

Research that is being conducted independently by MFI member companies includes ecosystem management implementation, neo-tropical bird abundance

on forested lands, watershed analysis and riparian zone management, aspen strip thinning, use of peat compost in the production of tree seedlings, application of ash to study the effects on plantation establishment, hybrid aspen planting trials and genetic research, hybrid cottonwood planting trials and genetic research, herbicide application rates and timing, and the effect of thinning on volume production in pine plantations.

APPENDIX J

MINNESOTA'S TIMBER HARVESTING GEIS: A PROCESS FOR RECOMMENDATION IMPLEMENTATION

Minnesota Environmental Quality Board (EQB)

The following describes a process for implementing the Timber Harvesting GEIS recommendations once the EQB approves the final document later this spring. This process is based on the general premise that while the GEIS provides a wealth of good technical information regarding interactions between timber harvesting and forest resources as well as a general framework for developing programmatic responses to address the environmental concerns identified, it does not adequately describe how to implement its major recommendations. Therefore, in order to move forward to implement the study's broad recommendations, additional information on specific types of policies, programs and administrative mechanisms necessary for implementation is required.

This process also recognizes that equally important to identifying the *substance* of various policies and programs is securing agreement from affected interests as to which mix of policy and program options is *acceptable* for implementation. Thus, a key component of this process is directly involving the affected stakeholders in selecting those policy and program options that are workable and broadly acceptable.

It is important to note that this process will not actually begin until the final Timber Harvesting GEIS is approved by the EQB later this spring. The EQB believes, however, that such a process be developed now so that implementation discussions and decisions can be made without delay once the study is completed.

BACKGROUND

The Timber Harvesting GEIS identifies three major programmatic responses and a supporting administrative structure for implementing the identified mitigation recommendations. The three programs suggested are a:

1) ***Forest Practices Program*** -- a comprehensive set of voluntary Best Management Practices to address site-level timber harvesting and related activities that could adversely affect resource or environmental quality;

2) ***Sustainable Forest Resources Program*** -- a process that, through broad stakeholder representation, identifies forest resource concerns that are geographically broad in nature and develops strategies to address these

landscape-level forest resource issues.

3) ***Forest-based Research Program*** -- a program that identifies forest resources research needs in Minnesota, and better coordinates among the various natural resources research units in the state the delivery of such research programs.

The GEIS describes these three programs and a recommended supporting administrative structure in fairly general terms. However, the specific details regarding the types of policy instruments, corresponding levels of financial and human resource investment needed, and linkages of these proposed programs to existing agencies, their mandates and existing policies and programs are not specified in the GEIS. For example, what specific "tools" should be used to develop and implement a Forest Practices Program? Should the focus be on educational training, financial or technical assistance, new regulations, etc.? What is the best mix of these or other programs to develop the most effective forest practices program possible, and what resources (human, financial, administrative) are needed for their implementation? Because this information is *not* provided in the GEIS, additional research/background information must be gathered before the three GEIS program recommendations can be implemented.

OBJECTIVES

The objectives of a GEIS implementation strategy will be to develop a process that: 1) can be supported by the EQB and interested forest resource stakeholders; 2) evaluates the study's major findings and recommendations; 3) identifies possible policy and program alternatives for implementation; 4) selects a comprehensive set of policies and programs that have broad stakeholder support; and 5) develops a strategy for successful implementation of the selected package of policies and programs.

TIMETABLE

Several factors have substantial influence over the timing of this implementation strategy. These include: 1) the EQB will not likely issue an Adequacy Decision on the Final GEIS until Spring 1994; 2) additional information/research regarding specific policies, programs, staffing, budgets, etc. is needed to fully implement the three programmatic and administrative recommendations; and 3) any legislative proposal for implementing the GEIS recommendations will likely include a request for state investments in forest resource management and protection. ***Recognizing these constraints, this process will target late 1994 as the point where a comprehensive GEIS implementation package will be identified. Completing this process at such a time will allow for the development of any specific legislation needed to implement the GEIS recommendations prior to the beginning of the 1995 Legislative Session.***

Administration of Implementation Process

Laws of Minnesota, 1992, Chapter 513, Article 4, Section 11 states: "...upon completion of the study (GEIS), responsibility for analyzing and implementing study recommendations is transferred to the Department of Natural Resources under Minnesota Statutes, Section 15.039..." This language transfers both the authority for and personnel required to implement the GEIS recommendations from the Minnesota Planning Office to the DNR at the time the EQB approves the Final GEIS. Given this legislative directive, the DNR will be the agency with primary responsibility for administering this GEIS implementation process, as well as the recipient of its outcomes. The EQB will, however, continue to monitor and participate in this process.

FRAMEWORK FOR IMPLEMENTATION

In general, the GEIS implementation process will focus around accomplishing the following five tasks:

1) Considering input from affected interests, secure agreement among the EQB regarding a **process** for implementing the GEIS recommendations.

2) Convene a GEIS Implementation "Roundtable" of affected key forest resource stakeholder interests.

3) Evaluate the GEIS's major findings and recommendations, and formulate alternative policy and program options to implement the program responses suggested in the GEIS.

4) Select, via the Roundtable, an appropriate mix of policy and program options that should be used to implement these programs.

5) Translate the Roundtable's recommended GEIS package of policies and programs into appropriate actions needed for their implementation.

IMPLEMENTATION PROCESS DETAILS

Details of the aforementioned process for implementing the GEIS recommendations are as follows:

1) Considering input from affected interests, secure agreement among the EQB regarding a **process** for implementing the GEIS recommendations. Working through the EQB, a process for implementing the GEIS recommendations will be defined and agreed to. Such an approach will be developed in the Fall 1993 and early 1994 as follows:

   - A draft proposal identifying a process for implementing the GEIS

recommendations was presented to the EQB at its September 1993 meeting.

- The EQB solicited oral testimony and comments on its proposed GEIS implementation process at its October 1993 meeting. Written comments on the proposal could be submitted to the EQB up through its November 1993 meeting.

- Considering the comments received, the EQB will finalize a general process framework for developing mechanisms to implement the major GEIS recommendations at its January 1994 meeting.

Once authorized, the Board's GEIS implementation process will be articulated via preparation of a work plan. This plan will identify in greater detail the process and format to be used, timeline for completion, major participants, administrative responsibilities and staffing and budget requirements needed to conduct this process.

2) Convene a GEIS Implementation "Roundtable" of affected key forest resource stakeholder interests. Once a process for implementing the GEIS recommendations is finalized, the EQB/DNR will solicit nominations for individuals and/or organizations interested in participating on the Roundtable. Giving consideration to the nominations received, the GEIS Implementation Roundtable will be identified and convened. This Roundtable will reflect a wide cross-section of interests associated with or affected by the management, use and protection of Minnesota's forest resources. Roundtable membership ***may*** include some groups of interests currently represented on the GEIS Advisory Committee. The Roundtable's purpose will be to advise the DNR on the appropriate means of implementing the GEIS's strategic program recommendations.

3) Evaluate the GEIS's major findings and recommendations, and formulate alternative policy and program options to implement the program responses suggested in the GEIS. An initial step in formulating policy and program options will be to carefully review and evaluate the major program responses identified in the GEIS (e.g., Forest Resources Practices Program). Upon completion of this review, a broad framework for addressing site- and landscape-level forest resource concerns and forest-based research will be developed. Within this general framework, innovative policy and program options to effectively implement this framework will be identified by staff using a variety of techniques that may include reviewing pertinent literature, conducting workshops with

policy experts, surveying natural resource administrators and managers, preparing case studies, and conducting on-site visits. This process will result in identifying a wide range of policies, programs and administrative structures that could be used to implement the strategic program recommendations identified in the GEIS.

4) Select, via the Roundtable, an appropriate mix of policy and program options that should be used to implement these programs. Once developed, the policy and program options will be forwarded to the GEIS Implementation Roundtable for their consideration. The Roundtable will review the policy and program options prepared by staff in step #3 above, and recommend to the DNR which elements are judged to be the most effective and acceptable in implementing the GEIS's major recommendations addressing site- and landscape-level and research concerns. This Roundtable will also recommend the appropriate administrative structures and linkages (existing or otherwise) to assume responsibility for implementing any site-, landscape-level or supporting research initiative suggested, as well as the mechanisms and processes required to address implementation of the many specific mitigation strategies also identified in the GEIS. Once the Roundtable's recommended policy and program directions are submitted to and supported by the DNR, follow-up analysis will be conducted by staff to identify additional information regarding the human and financial resources and administrative requirements associated with the policy and program options selected. *A critical element of any agreed-to implementation package will be that the Roundtable supports it as a comprehensive strategy, not selected components.*

5) Translate the Roundtable's recommended GEIS package of policies and programs into appropriate actions needed for their implementation. For each of the major policy or program elements included in the agreed-to implementation strategy, appropriate mechanisms (e.g., laws, rules) to secure their implementation will be identified. upon their identification, the DNR, EQB, and Roundtable participants will work with appropriate lawmakers, agency administrators and others to develop the legislation, rules, administrative actions required to implement the identified package of policies and programs. Any legislative initiatives needed to support the Roundtable's GEIS implementation package will be drafted in time for introduction in the 1995 Legislative Session, and include the detailed administrative, human and financial resources and policy and program needs.

APPENDIX K

PRINCIPLES FOR SUSTAINABLE DEVELOPMENT AND SUSTAINABLE DEVELOPMENT STRATEGIES

Principles for Sustainable Development

In developing a set of guiding principles, the Forestry Team felt it was important that certain underlying assumptions associated with these principles be articulated. While the strategies for sustainable development developed by the Forestry Team and identified in a latter section will be guided by these principles, certain underlying assumptions need to be explicit. One assumption of particular note is the assumed scale of irreversibility. The Team recognized that sustainability questions focused on forest resource issues are most appropriately addressed within the context of large geographic areas defined by particular analyses and based on sound science. As such, the principles developed are intended to be used as a broad framework with which forest resource decision making is applied at a landscape level and not on a site-by-site basis.

Similarly, the Forestry Team believed it was important that these principles be considered as a framework for evaluating the long-term health and sustainability strategies for the forest resource, rather than making short-term judgements. The Team also emphasizes that these principles should be considered in aggregate in order to serve as a useful framework for sustainable forest resource decision making. Finally, the principles (as well as strategies) were developed with the recognition that various levels of government assume the authority and responsibility for making decisions that affect the sustainability of the forest resource over which they have jurisdiction.

Forest Resource Base

Increased Resource Base

- Actions that increase the forest land base should be supported.

Forest Productivity

- Promote the long-term productive capability, quality and capacity of Minnesota's forests.

Landowner Rights

- Society shall consider landowner rights in exercising its interests in forest stewardship.

Flexibility

- Resource policies and actions that prevent irreversible outcomes for forest uses should be supported.

Diversity

- Forest resource diversity shall be managed on the appropriate geographically-broad basis.

Forest Health

- Encourage the maintenance, restoration and enhancement of Minnesota's forest ecosystems.

Forest Resource Use

Balancing Objectives

- Economic, social and environmental consequences shall be considered in the use of forest resources.

- Responsibility and accountability for sustaining the environment and economy in a spirit of partnership and open cooperation should be acknowledged.

Efficient Resource Use

- The use of wood fiber should be optimized through efficient harvest and utilization, through recycling processes, and through extended life of wood materials.

- Both renewable and non-renewable resources should be wisely and efficiently used.

Global Considerations

- Local actions should take into account global consequences.

Human Actions

- Humans are part of natural systems including the forest environment, and this linkage should be acknowledged in policies affecting forest resources.

Value Added Processing

- Minnesota should maximize intra-state, value-added processing from its forest resources.

Forest Resource Management

Forest Stewardship

- Forest resources shall be managed for the benefit of present and future generations.

- Ecological processes and biological diversity shall be maintained and enhanced.

- Use of renewable forest resources shall be on a sustainable basis.

- Landowners should be encouraged to consider the public's interest in applying wise stewardship on their lands.

- Adverse impacts on wildlife, biodiversity, water resources, soils and nontimber and timber resources should be minimized.

Landscape Management

- Multiple ownership cooperation in addressing forest resource management should be encouraged.

Forest Resource Economic Potential

- Forest management should take into account the full range of forest products, values and uses.

Information Management

- Management decisions should be based on scientifically sound, accurate and up-to-date information.

Public Education

- Public understanding of natural and human-induced actions on forest ecosystem processes shall be achieved as an essential basis for attaining sustainable forest resource management objectives.

Sustainable Development Strategies

Using the principles as a framework for decision making, the Forestry Team examined alternative actions that could be recommended as a means of addressing the eight major forest resource issue categories. Specifically, emphasis was placed on identifying actions that would move Minnesota's forests towards the future vision developed by the Team in a manner consistent with the guiding principles. The following identifies six major strategies to attaining forest resource sustainability, along with their corresponding specific attributes and elements.

1) **Develop a forest resources assessment and evaluation program sensitive to Minnesota needs.**

   - Develop an ecologically-based classification system useful to landscape-level planning efforts that can be applied and used across ownerships.

   - Establish continuous monitoring and evaluating methods for determining existing forest resource processes and conditions, and means of incorporating the results into forest management decision making.

   - Encourage strong interaction between research and resource managers to promote the relevance of research as well as the rapid transfer of science and technology to forest practices and techniques.

   - Coordinate such a program with resource information available from states and Canadian provinces with similar forest environments.

   - Identify opportunities for developing improved measures for evaluating long-term forest resource sustainability.

2) **Develop means to coordinate the design and implementation of policies and practices that address identified forest resource issues.**

- Establish an on-going process and mechanism (e.g., board, commission, council, committee) that involves stakeholder input to evaluate and provide direction for public policy regarding integrated resources management.

- Examine existing state programs directed at forest resources to ensure they support practices consistent with the guiding principles for sustainable development, and encourage federal and local governments to initiate the same reviews.

- Examine the adequacy of existing programs, policies and funding directed at private forest management, with a focus on identifying ways of encouraging sustainable forest resource practices.

- Examine ways of improving the delivery of public programs directed at private forest owners and managers, and making these programs more client-oriented.

- Examine the adequacy of existing programs, policies and funding directed at state and county forests to assure adequate funding to ensure sustainable forest resource practices.

- Seek opportunities to coordinate cross-ownership planning and management of forest resources.

- Review past studies of Minnesota's forest resources for proposals consistent with sustainability principles.

3) **Identify needed changes in the state's policies, programs and infrastructure that would improve the delivery of sustainable forest resource education.**

- Require all publicly funded K-12 environmental education programs include a sustainable forestry component in their curriculum.

- Establish a task force to work with Minnesota's Department of Education and Natural Resources as well as other affected agencies to develop natural resource sustainable development curriculum.

- Develop programs that educate the public on resource sustainability concepts.

- Develop an education program for use within the natural resource profession, including loggers, resource managers, wood-using industries and related economic sectors.

- Seek opportunities to identify the resources needed to adequately support environmental education.

- Develop programs to educate the public on ways to extend the useable life of forest resources, including means to extend the timber resource base (see strategy #6 below).

4) **Increase urban forestry programs.**

- Review the adequacy of existing programs and agency coordination in administering urban forestry programs, as well as the need to establish more uniform urban forestry program standards among local units of government.

- Evaluate the adequacy of federal, state and county highway standards as they impact urban forests.

- Identify incentives that will encourage urban forestry programs to diversify native tree specie plantings.

- Encourage the state to establish a "no-net-loss" policy for its urban forests.

- Encourage adequate financial support for the state's urban reforestation programs.

5) **Maintain or improve the economic viability of forest resources by:**

- Encouraging public forest resource agencies to place greater emphasis on economic stability in developing management plans.

- Encouraging public resource agencies to provide predictable, affordable supplies of timber resources.

- Identifying opportunities that encourage expansion of value-added enterprises.

- Encouraging public resource management and economic development organizations to recognize the full spectrum of forest resource values in the development of their resource planning and economic development programs.

6) **Provide incentives to extend the timber resource base by:**

- Increasing manufacturing efficiency in wood use.

- Reducing construction waste.

- Reducing the use of disposable products.
- Increasing recycling.
- Encouraging research in new building product technology.
- Increasing long-term productivity of timberlands.
- Increasing the useable life of wood products.

APPENDIX L

GLOSSARY

AREA

A Division of Forestry administrative unit determined on the basis of workload, geography, resource characteristics and socio-political boundaries. There are currently 18 Forestry Areas statewide.

ATV

All Terrain Vehicle (See ORV).

BIODIVERSITY

A community is often defined as a complex or group of species that occurs in a particular setting. The term ecosystem relates more to the interactions among plants, animals, and their environment. Ecosystems emphasize the properties and processes that occur in an area while community describes the inhabitants of an area. An ecosystem and a community may often describe the same area.

CLONE

Collection of genetically identical trees.

TIMBERLAND

Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation (Jakes 1980a).

CONSERVATION RESERVE PROGRAM (CRP)

A provision of the 1985 Farm Bill which is designed to protect highly erodible and other marginal farmlands by removing them from cultivation; placing them instead into grass or trees.

CONSOLIDATED CONSERVATION (CON-CON) LANDS

Refers to approximately 1.6 million acres of lands (all but 67,000 acres are administered by DNR Forestry) which were forfeited due to tax-delinquency as a result of drainage projects in Beltrami, Lake of the Woods and Koochiching counties. The state holds title to the lands, and

has assumed responsibility for paying off the drainage bonds.

COOPERATIVE STAND ASSESSMENT (CSA)

The CSA a detailed timber stand inventory conducted by the Department of Natural Resources, Division of Forestry on all state owned forest lands.

CORD

A pile of stacked wood with standard dimensions of 4 by 4 by 8 feet. A stacked cord contains 128 cubic feet of wood (including air space), which is equivalent to approximately 79 cubic feet of solid wood.

COUNTY TAX-FORFEITED LAND

Lands forfeited to the state for non-payment of taxes, to which the state holds title impressed with a trust in favor of counties and local taxing districts. These lands are administered by the counties with certain oversight functions assigned to the state.

DEVELOPED (or Concentrated) RECREATION

Outdoor recreation requiring significant capital investment in facilities to handle a concentration of visitors on a relatively small area (see Dispersed Recreation).

DISPERSED RECREATION

Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the people.

ENDANGERED SPECIES

Any species of animal or plant which is in danger of extinction throughout all or a significant portion of its range.

EVEN-AGED MANAGEMENT

The actions that will result in a forest, crop, or stand composed of trees having no or relatively small differences in age (Ford-Robertson, 1971).

EXOTIC SPECIES

All non-native species -- those species introduced or potentially introduced after European settlement (unless experts have determined a natural range expansion has occurred from an adjacent state or country) including unnaturally occurring hybrids, cultivars, genetically selected strains, and genetically altered species.

FEATURED SPECIES

Preeminent wildlife species/community that management activities focus on (i.e., furbearers, owls).

FOREST INVENTORY AND ANALYSIS (FIA)

FIA is a national program of periodic forest inventories of all ownerships conducted by the research branch of the US Forest Service. In Minnesota, FIA is conducted by the USDA Forest Service, North Central Forest Experiment Station and The Department of Natural Resources, Division of Forestry.

FLAKEBOARD

A general term usually referring to waferboard or oriented strand board.

FOREST LAND

Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams and clearings in forest areas were classed as forest if less than 120 feet wide.

FOREST RESOURCES

Those natural assets of forest land, including timber and other forest crops, recreation, fish and wildlife habitat, wilderness, rare and distinctive flora and fauna, air, water, soil, and educational, aesthetic and historic values.

FOREST ROAD

Any permanent roadway constructed and maintained for the purpose of accessing forest lands. Forest roads may be administered by the state, by counties, by townships or local units of government, by private industry, by federal agencies, or by private landowners (Minnesota DNR, Forestry

1982d).

FOREST SITE PRODUCTIVITY CLASS

A classification of forest land in terms of potential volume growth per acre in fully stocked natural stands.

FUELWOOD

Wood or wood energy products used to generate heat energy for commercial or residential purposes.

GOAL

A concise statement expressed in terms of a desired state or process that operating programs are designed to achieve. A goal is normally expressed as a broad, general statement; is usually not quantifiable; and is timeless in that it usually has no specific date by which it is to be completed. Often, it would not be expected that a goal could ever by completely achieved. The goal is the principal statement from which objectives must be developed (USDA Forest Service 1980c).

GROWING STOCK TREES

All live trees of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

GROWING STOCK VOLUME

Net volume in cubic feet of growing stock trees 5.0 inches D.B.H. and over, from 1 foot above the ground to a minimum 4.0 inches top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

HARDBOARD

A generic term for a panel product manufactured from wood fibers and resins under heat and pressure.

HARDWOODS

Dicotyledonous trees, usually broad-leaved and deciduous.

HARVESTING

A loose term for the removal of produce (i.e., a merchantable material) from the forest for utilization; comprising therefore cutting, sometimes further initial processing (e.g., with trees, topping, and trimming) and extraction (removal from the forest). When "harvesting" timber, "harvesting" is a rough or quasi-synonym with logging (Ford-Robertson, 1971).

INDUSTRIAL WOOD

All commercial roundwood products except fuelwood.

INTENSIFIED FOREST MANAGEMENT

A forest management regime under which wood fiber production and other forest outputs (i.e., water, wildlife, fish, recreation) are maximized through the application of scientific forest management techniques.

LAND UTILIZATION PROJECT (LUP) LANDS

Refers to approximately 218,000 acres of marginal farmland purchased in the 1930s by the Federal government and leased to the State of Minnesota under a 50-year lease agreement that expired in 1990. The LUP lease agreement has a provision for two 15-year extensions, and it was extended for the first 15-year period. The state holds title to 21,000 of these acres.

MDF

Medium Density Fiberboard.

MIXED STANDS

Forest stands composed of more than one commercial or non-commercial tree species.

MORTALITY

The volume of sound wood in growing stock trees dying annually.

MULTIPLE-USE

The principle of forest management by which forest resources are utilized in the combinations that will best meet the needs of the people of the state; including the harmonious and coordinated management of the forest resources, each with the other, without impairment of the productivity of the land and with consideration of the relative values of the resources, and not necessarily the combination of uses resulting in the greatest economic

return or unit output (Forest Resource Management Act of 1982; Minn. Laws 1982, Chapter 511).

NATIONAL FOREST SYSTEM LAND

Federal lands which have been designated by Executive Order oR statute as National Forests or purchase units, and other lands under the administration of the Forest Service including experimental areas and Bankhead-Jones Title III lands.

NET ANNUAL GROWTH

The net increase in the volume of trees during a specified year. Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that die during the year, and minus the net volume of trees that become rough or rotten trees during the year.

NET VOLUME IN BOARD FEET

The gross board-foot volume of trees less deductions for rot or other defect affecting use for lumber (see Sawtimber Volume).

NET VOLUME IN CORDS

Gross volume in cords less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

NONCOMMERCIAL SPECIES

Tree species of typicalLY small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

NONFOREST LAND

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of Census as nonforest land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as

nonforest land.

NONPOINT POLLUTION SOURCES

Those sources of pollution that are diffuse in both origin and in time and points of discharge, and depend heavily on weather conditions such as rainstorms or snowmelt. Pollutants can originate on natural source areas as well as areas affected by man's activities.

NONSTOCKED FOREST LAND

Timberland on which stocking of trees is less than 16.7 percent.

OBJECTIVE or Target

A clear and specific statement of planned results to be achieved within a stated time period. The results indicated in the statement of objectives are those which are designed to achieve the desired state or process represented by the goal. An objective is measurable and implies time-phased steps to be taken and resources to be used which together represent the basis for defining and controlling the work to be done (USDA Forest Service 1980c).

OFF-ROAD VEHICLES (ORV's)

Vehicles such as motorcycles, all-terrain vehicles, four-wheel drives, and snowmobiles.

OLD-GROWTH FOREST

Old-growth forest stands have developed over a long period of time essentially free from catastrophic disturbances. Old-growth stands contain large, old trees of long-lived species that are well past economic rotation ages. Typical old-growth forests experience frequent ongoing mortality, with some canopy trees dying. Such stands contain a relatively high frequency of large snags and a relatively large number of large-diameter downed logs in various states of decay.

ORIENTED STRAND BOARD (OSB)

A panel product made from wood flakes or wafers aligned in layers and bonded with resins under heat and pressure. The linear alignment of the wafers in layers of opposing direction increases the strength of the product.

OUTDOOR RECREATION ACT (ORA)

Minnesota Statutes, Chapter 86A defines the Outdoor Recreation System.

OUTDOOR RECREATION SYSTEM

The outdoor recreation system consists of all natural state parks; recreational state parks; state trails; state scientific and natural areas; state wilderness areas; state forests; state wildlife management areas; state water access sites, which include all lands and facilities established by the commissioner of natural resources or the commissioner of highways to provide public access to water; state wild, scenic, and recreational rivers; state historic sites; and state rest areas, which include all facilities established by the commissioner of highways for the safety, rest, comfort, and use of the highway traveler, and shall include all existing facilities designated as rest areas and waysides by the commissioner of highways. Each individual natural state park, recreational state park, and so forth, is called a "unit." (Minn. Statutes, Chapter 86A)

OVERSTORY

That portion of the trees in a forest, with more than one roughly horizontal layer of foliage, which forms the upper or uppermost layer (after Ford-Robertson, 1971).

PARTICLEBOARD

A generic term for a panel product made from discrete particles of wood rather than from fibers. The wood particles are mixed with resins and formed into a solid board under heat and pressure.

PASTURE

Land which is currently improved for grazing by cultivation, seeding, fertilization, or irrigation.

PHENOTYPICALLY SUPERIOR

A forest tree exhibiting superior growth form and desirable growth characteristics (i.e., wood quality, straightness).

POINT POLLUTION SOURCES

Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft.

POLETIMBER TREES

Live trees of commercial species at least 5.0 inches in diameter at breast height but smaller than sawtimber size, and of good form and vigor.

PRIMARY MANUFACTURING PLANTS

Plants using roundwood products such as sawlogs, pulpwood bolts, veneer logs, etc.

PRODUCTIVE-RESERVED FOREST LAND

Productive public forest land withdrawn from timber utilization through statute or administrative regulations.

PROGENY TEST

Means of determining the genetic worth of parent trees by measuring the performance of their offspring.

RMV

Recreational Motor Vehicle (See OFF-ROAD VEHICLE).

REGENERATION

The rejuvenation of forest trees by natural (i.e., seeded by nearby mature trees) or artificial (i.e., planting of tree seedlings) means.

REGENERATION CUTS

Areas harvested where regeneration is planned, either natural or artificial.

REINVEST IN MINNESOTA (RIM)

A program designed to promote fish and wildlife habitat improvements in Minnesota.

REMOVALS

The net volume of growing stock or sawtimber trees removed from the inventory by harvesting; cultural operations, such as timber stand improvement; land clearing; or changes in land use.

RESOURCE MANAGEMENT UNIT (RMU)

A geographical sub-division based upon significant differences in natural resources or resource characteristics. Factors considered include: surficial geology, land use and ownership patterns, physical and biological factors, and political and administrative boundaries.

ROAD

A general term denoting a public way for purposes of vehicular travel, including the entire area within the right of way.

ROTTEN CULL TREES

Live trees of commercial species that do not contain a saw log now or prospectively, primarily because of rot (e.g., when rot accounts for more than 50 percent of the total cull volume).

ROUGH TREES

(a) Live trees of commercial species that do not contain at least one 12-foot saw log, or two noncontiguous saw logs, each 8 feet or longer, now or prospectively, primarily because of roughness, poor form, splits and cracks, and with less than one-third of the gross tree volume in sound material; and (b) all live trees of noncommercial species.

ROUNDWOOD

Logs, bolts, pulpwood, or other round sections cut from trees.

ROUNDWOOD EQUIVALENT

The volume of logs or other round products required to produce the lumber, plywood, woodpulp, paper, or other similar products.

SALVABLE DEAD TREES

Standing or down trees that are considered currently or potentially merchantable by regional standards.

SAPLINGS

Live trees of commercial species 1.0 inch to 5.0 inches in diameter at breast height and of good form and vigor.

SAWTIMBER TREES

Live trees of commercial species containing at least one 12-foot saw log

or two uncontiguous 8-foot logs, and meeting regional specifications for freedom from defect. Softwood trees must be at least 9 inches in diameter and hardwood trees 11 inches in diameter at breast height.

SAWTIMBER VOLUME

Net volume of the saw log portion of live sawtimber trees in board feet.

SCIENTIFIC AND NATURAL AREAS (SNA)

An administrative designation applied to preserve and protect Minnesota's rare and unique natural resources for nature observation, education, and research.

SEED COLLECTION ZONES

Specific geographic zones from which forest tree seed is collected, and where seedlings grown from this seed are planted, that tend to show favorable tree form, vigor, growth, insect and disease resistance, etc. Zones are variable by species.

SEEDLINGS

1) Containerized seedlings - forest tree seedlings grown in a greenhouse for 1-2 years in small containers ready for planting. 2) Bareroot stock - forest tree seedlings grown in an outdoor seedbed, sometimes in a transplant bed as well, and lifted for planting.

SEED ORCHARD

Plantation of genetically superior trees isolated to reduce pollination from genetically inferior outside sources, and intensively managed to produce frequent, abundant, easily harvested seed crops.

Clonal Seed Orchard

Seed orchard established using clones through the use of grafting or rooted cuttings.

SELECTION CUTTING

Removal of mature timber, usually the oldest or largest trees, either as single scattered trees or small groups at relatively short intervals, commonly 5 to 20 years, repeated indefinitely, by means of which the continuous establishment of natural reproduction is encouraged and an uneven-aged stand is maintained (Ford-Robertson, 1971).

SHEATHINGBOARD

A generic term for lumber or panel products used to cover the exterior frame of a building. Siding or finish material is then applied over the sheathing.

SILVICULTURAL PRESCRIPTION

Forest management methods and techniques to be applied to a forest stand in order to achieve a specified result (see Silviculture).

SILVICULTURE

The theory and practice of controlling the establishment, composition, constitution, and growth of forests.

SITE INDEX

An expression of forest site quality based on the height of a free- growing dominant or co-dominant tree of a representative species in the forest type at age 50.

SITE PREPARATION

Any means used to prepare a forest site for natural or artificial regeneration (i.e., fire, mechanical, chemical). Usually involves the exposure of mineral soil and the elimination or reduction of competing vegetation.

SOFTWOODS

Coniferous trees, usually evergreen, having needles or scalelike leaves.

STAND-SIZE CLASSES

A classification of forest land based on the predominant size of timber present, that is: sawtimber, poletimber or seedlings and saplings.

STATE FORESTS

State forests are legislatively established units managed by the Division of Forestry on a multiple-use, sustained-yield basis. There are 55 state forests. (Minn. Statutes, Chapter 89).

STATE FOREST ROAD

Any permanent road constructed, maintained, or administered by the Department of Natural Resources (DNR) for the purposes of accessing or traversing state forest lands.

STOCKING

The degree of occupancy of land by trees, measured by basal area and/or number of trees by size and spacing, compared to a stocking standard, i.e., the basal area and/or number of trees required to fully utilize the growth potential of the land.

SUSTAINED YIELD

The principle of forest management for the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of forest resources without impairment of the productivity of the land; allowing for periods of intensification of management to enhance the current or anticipated output of one or more of the resources (Forest Resource Management Act of 1982; Minn. Laws 1982, Chapter 511).

SWAMP LANDS

Lands received from the federal government (1.6 million acres remain) to encourage drainage and improvement. Receipts from these lands are deposited in a permanent trust fund and the interest allocated to public educational institutions on a per-pupil basis. About 1.1 million acres are within state forests.

THREATENED SPECIES

Any species of animal or plant which is likely to become an endangered species within the foreseeable future throughout all or a portion of its range.

TIMBER SCALING

The practice of measuring quantities of timber stumpage to determine its volume, grade, and value for forest products.

TIMBERLAND

Forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber utilization, and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included.

TIMBER STAND IMPROVEMENT (TSI)

Timber stand cultural practices designed to produce improved forest crops, including thinning, pruning, and the release of crop trees from competing (non-commercial) vegetation.

TMPIS

Timber Management Planning Information System.

TRUST FUND LANDS

State-administered public lands received from the federal government upon statehood with the condition that receipts from them be permanently used for specified purposes.

UNDERSTORY

The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portions of adjacent trees and other woody growth (after Ford-Robertson, 1971).

UNEVEN-AGED MANAGEMENT

The course of actions involved in maintaining a forest or stand, composed of intermingling trees that differ markedly in age (after Ford-Robertson, 1971).

UNMERCHANTABLE TIMBER

Timber species of no commercial value due to low quality, insufficient quantity, inaccessibility, lack of markets, or other reasons.

UNPRODUCTIVE FOREST LAND

Forest land stocked by stagnant spruce, stagnant tamarack, stagnant cedar, offsite aspen, or offsite oak.

VISITOR DAY

The use of an area for a total of 12 person-hours by one or more people, either continuously or spread over several visits.

WAFERBOARD

A panel product made from randomly aligned wood flakes bonded by resins under heat and pressure.

WILDERNESS (Federal)

An area of undeveloped land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value (Wilderness Act 1964).

WILDFIRE

Any fire other than a controlled burn (prescribed burn) (Ford-Robertson, 1971).