MOOSE LAKE AREA
DRAFT RESURCE ASSESSMENT

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INTRODUCTION

Most decisions regarding the management of forested lands have substantial long-term impacts on other renewable resources and, in a much broader sense, on the economy, the society, and on the natural environment. Consequently, it is important to base these decisions on factual and objective analyses of the present and prospective renewable resource situation.

The need for such "comprehensive" analyses has long been recognized by federal and state resource management agencies, and others, that share an interest in the administration, management and use of forest lands. State legislative interest was expressed in the Minnesota Forest Resource Management Act of 1982 (MN Laws, Chapter 511), which directed the Department of Natural Resources to conduct a statewide forest resource Assessment including (but not limited to) the following:

> (a) The present and projected use and supply of and demand for forest resources in the state;
>
> (b) The development of a forest resources data base, compatible with the data base of the Minnesota land management information center, capable of continuous updating and usable as a tool in effectively managing forest resources, utilizing existing data bases as much as practicable;
>
> (c) The current and anticipated reforestation needs for forest land, including the amount of backlog areas, current and anticipated allowable harvests, identifying poorly stocked forest land, and delineating those areas needing reforestation which are prime forest lands or otherwise likely to produce optimum public benefits from reforestation; and
>
> (d) An inventory and map of all existing state forest roads and classification by use, standard and condition.

In accordance with the provisions of this legislation, this Resource Assessment for the Moose Lake Administrative Area presents an analysis of the present situation and the outlook for outdoor recreation, wildlife and fish, forest aesthetics, timber and water. It includes detailed information on:

- Local and regional trends in the use of major forest resources and products, such as timber, water, wildlife, outdoor recreation and wilderness.

- Long-run supply and demand projections for these resources and products.
- The extent, location, ownership and productivity of the Moose Lake Area's approximately 1.5 million acres of forest land.
- Dominant uses of forest lands and waters including use for designated purposes such as state parks, wildlife management areas, state and county forests, trails, etc.
- The capacity of forest lands to meet projected demands for renewable resource products and outputs.
- Economic, social and environmental implications of increased levels of resource production and use.
- Discussions of agency programs, policy considerations, laws and administrative regulations are found throughout the Assessment Section.

Such material and data provide a factual basis for analyzing trends in markets and demand for resource outputs, for estimating future production levels and prices, and for evaluating the adequacy of existing programs and policies to achieve long-term land ownership and land management objectives.

PURPOSE

The purpose of this chapter is to review the historical, social, physical and economic character of the Moose Lake Area. This, in an effort to better understand the basic casual factors in its development, and to gain an appreication for those factors which ahve a continuing influence today, and which can be expected to continue to affect the area's future growth and development.

ASSESSMENT HIGHLIGHTS (to be written)

MAJOR FINDINGS:

1. Substantial growth anticipated in population, income and employment, and general economic activity.
2. Projections show increased demands for dispersed recreation opportunities.
3. Forest land ownership is divided primarily between state, county and private landowners.
4. Aspen resource is most extensive timber type.
5. Area's lakes, rivers and streams are major asset.
6. Fish and wildlife species are diverse, so are habitat needs.
7. Variety of federal, state, county and local programs influence forest management and development in the area.

OPPORTUNITIES:

Outdoor Recreation

Fish and Wildlife

Water

Timber

Land Use

General Opportunities

I. MOOSE LAKE AREA ASSESSMENT

A. SOCIAL PROFILE

HISTORY

The abundance of natural resources of the Moose Lake area dictated its development. Virgin white and Norway pine, interspersed with spruce and hardwoods, once covered the area. Many rivers and lakes dissected the expansive forest cover. Today, some of these natural resources have been depleted; slowly the agricultural land is being consumed by other users.

Prior to the 16th century, the Dakota or Sioux Indian tribe was the primary inhabitant of this region. Later, the Chippewa settled in the area after being forced westward in search of a new food supply and hunting grounds. Both tribes fished, hunted and trapped along the multitude of rivers and lakes. The Indians were slowly pushed westward as white explorers came to claim this land.

The first known explorers to the area were Radisson and Groseillers, Sieur de Luth, and Father Hennepin. In 1689, Nicholas Perrot claimed this land for France. In 1783, the land east of the Mississippi River was ceded to England by the Treaty of Versailles and in 1783 it came under the jurisdiction of the United States by the Treaty of Peace. In 1849, this land along with the land west of the Mississippi River became Minnesota Territory.

During this period of early settlement, fur traders rapidly moved westward in search of the valuable pelts that were in high demand in Europe. The Indians eagerly traded furs for treasured whiteman's articles such as knives, hatchets, needles, trinkets, cloth, guns and liquor. In 1804, Thomas Connor of the British Northwest Company established the first semi-permanent wintering post. This post was located on the banks of the Snake River by Cross and Pokegama lakes near Pine City. The post has been reconstructed and today is maintained by the Minnesota Historical Society.

By 1850 the demand for furs had slackened and the supply had dwindled. Lumber replaced the fur industry as the region's most important activity. Some of the finest white pine stands in the country were found here. Westward settlers and lumbermen pressured the powers in Washington to confiscate the Indian's land and to open the land for settlement and exploration. Lack of title to the land did not hinder the growth of lumbering. Scores of pineries developed, houses and sawmills were built on unowned lands, and lumbermen began marketing the valuable white pine forest that belonged to the government. The government provided for initial acquisition of land under the provisions of the Pre-Emption Act of 1841. In addition, the Homestead Act of 1862 enabled a man to pay a nominal filing fee for homesteading 160 acres. After the Civil War immigrants arrived in great numbers.

This area's lumber industry had a slow start because it lacked a market. Timber was needed to build houses for early settlers but the population of Minnesota was less than 5,000. Successful rafting of logs and lumber down the St. Croix and the Mississippi to points in Iowa and on down to St. Louis greatly increased the market for lumber, and lumbering quickly became the leading industry in the state.

The 1800's through 1890's were the peak economic development years for these counties. Numerous towns were founded as sawmilling centers or supply depots for the multitude of logging operations in existence. Many small communities such as Rock Creek and Rutledge had as many as five sawmills. Log drives were an annual spring occurrence on nearly every river and stream in the area.

The first and largest commercial sawmill was built in 1838 at Marine-on-the-St. Croix to saw pine lumber. It operated for three-quarters of a century. Four additional sawmills opened at Stillwater after 1843. (The foremost reason why lumbering began on the St. Croix instead of the Mississippi was because the triangle of land between the Mississippi, Rum, and St. Croix rivers contained the only white pine that was covered by treaties with the Indians.)

The St. Croix Valley remained a vital factor in building the west while there was timber to be cut. From 1840-1903, the estimated yield of St. Croix logs was 11,250,000,000 board feet. In the peak year, 1890, approximately 3,500,000 logs totalling over 452,000,000 board feet were guided through the Stillwater Boom.

As the government acquired more lands from the Indians, logging camps located along the Rum River as far north as Princeton and logging towns sprung up along streams throughout the area. By this time, the prejudice against the prairies (prairie land was infertile and not good for growning grain) had been overcome, resulting in a great influx of settlers. This brought a heavy demand for lumber and increased markets for the lumber of this area.

By 1870, a railroad had pushed north to Duluth along the St. Croix River. After that the lumber from this area could go south to Minneapolis by rail instead of east by steamer. Although Duluth was an ideal place from which to ship lumber, it was difficult to assemble logs there because of the falls in the St. Louis River. Mills were established above the falls at Cloquet. The first being built in 1878 above the big falls at Thomson. By 1926, this mill town led the whole state in lumber production. Today, it still supports many large wood-using industries.

As the forests were cut, settlers moved in to clear and till the land. Removing the stumps and boulders was a slow, laborious task. When the prairies opened settlers moved there where they could plow in the spring and have a crop in the fall; the land did not have to be laboriously cleared of stumps. As a consequence, vast areas of cutover forest lands were abandoned and became tax-delinquent lands. Very little of the land was ever used for farming.

By the close of the 18th century, diversified agriculture was gaining in importance in this area. The first major crop was potatoes. In the 19th century wheat, along with lumber, was an important product of the land. As the earth was unable to support the same crop year after year the wheat growing centers shifted westward and dairying began to increase in importance.

Prior to settlement on the prairies, settlers cleared forested lands to settle on and raise crops. Timber was something they had to get rid of. A surplus of lumber existed. Great piles of logs were burned to get rid of them. The cleared land was sold to settlers. Every lumber company had a land department for disposing of cutover lands. The great stands of pine disappeared and the lumber industry had reached its peak.

Until the 1870's, logging and lumbering, not forestry, typified the timber industry. Destructive logging methods were practiced. In the early days loggers took only the large white pine, Norway pine, jack pine and then the hardwoods. The logging was followed by fire. Sometimes the cutover lands were burned to protect the remaining stands of timber; often times the fires were accidental. Whatever the cause, the fires destroyed all reproduction and sources of seed. By 1950 nearly all of the region's pine forests had been cut or destroyed by fire.

In 1894, brush and stumps in the cutover areas and swamps that had been smoldering all summer burst into flame, resulting in the ravaging Hinckley Fire. Sparks and burning embers set the mill yard at Hinckley and the dry swamp to the west of the village afire. Eventually, the towns of Hinckley, Brook Park, Mission Creek, Friesland, Gronign, Finlayson and Sandstone were destroyed and 418 were dead. Later, these towns were completely rebuilt.

Another tragic fire occurring on October 12, 1918 destroyed the towns of Moose Lake and Cloquet. Fires lashed by gusts of wind up to 72 miles per hour raged over an area of more than 1,500 square miles. Property loss was estimated at $28,000,000 and lives lost numbered 438. The villages and farms destroyed by this fire were rebuilt.

Today, second growth forests have replaced the destroyed white pine forests. Farming, mainly cattle, now plays a large role in the economic stability of the area. Much of the remaining forest land is protected and managed for forest purposes as part of the state forest system. The following is a brief history of the establishment of the state forests in the Moose Lake Area.

General C.C. Andrews State Forest

Settlement of this forest area began in the late 19th century. Many settlers found the sandy soils unsuitable for growing crops and abandoned their farms, letting the land revert back to Pine County. In 1939 the state acquired the lands from the county and established the General Andrews State Forest Tree Nursery. The portion of the area not needed for the actual nursery operation is managed for recreation, wildlife and a continuous supply of timber.

Chengwatana State Forest

Chengwatana means "Town of Pines" and is derived from the old village and trading post organized in 1850 at the Cross Lake outlet of the Snake River. This village served as the county seat from 1860-1872. Millions of board feet of virgin pine were cut from the Chengwatana State Forest area in the late 1800's. Most of the timber was then floated down the Kettle and Snake rivers to the St. Croix and the large sawmills further downstream, such as Stillwater.

Nemadji State Forest

At the turn of the century this area was the scene of heavy logging. The Nemadji, Willow, and Tamarack watersheds were used to transport logs to mills downstream. Later, the area between Nickerson and Holyoke was crisscrossed with temporary railroad spurs bringing pine logs to a large mill east of Nickerson on Delongs Lake. The logging activity dwindled to small logging camps cutting railroad ties, cedar shingles, barrel hoops, pulpwood and fuelwood. A few hardy settlers moved in to farm the land and numerous large fires burned the cutover area. Nearly 90% of the forest has been tax-forfeited at one time or another. The counties turned over tax-forfeited land to the state to manage as state forest land in 1935.

St. Croix State Forest

The St. Croix River figured heavily in the movement of pine logs from Pine County to sawmills in the Twin Cities area. Evidence of numerous logging

dams on tributaries to the St. Croix River can still be found scattered throughout the St. Croix Forest. The small dams were constructed to hold back volumes of water so that sufficient flow would be available for floating the logs to the St. Croix. As the virgin pine became depleted, settlers moved into the area and began to further clear the forests for farming. During the late 1800's numerous land clearing activities were ongoing, with the Great Hinckley Fire of 1894 burning over parts of the forest. Continuing into the 20th century, smaller wildfires burned over most of the area until the 1930's. Much of the area held by settlers and large timber companies became tax-forfeited and was turned over to the state to manage as a state forest in 1933.

Rum River State Forest

The earliest cut saw logs were transported down the Ann and Rum rivers. Later temporary railroads were built and logs were taken to mills in Onamia and other locations. Settlements began with the construction of the railroads, but much of the land proved unsuitable for farming and was abandoned. The land was established as a state forest in 1935. Originally the forest contained only trust fund lands. In the 1950's tax-forfeited lands, the abandoned farms, were turned over to the state by the counties. The old farmsteads form the bulk of the state ownership within the state forest.

DEMOGRAPHICS

GENERAL POPULATION

The Moose Lake Area administrative unit is located in east-central Minnesota just north of the seven-county metropolitan area. It includes the entire area of Pine (862,363 acres) and Kanabec (333,070 acres) counties, and the southern two tiers of townships in Carlton County (275,825 acres).

The 1980 population of the Moose Lake Area was 39,301, an increase of 5,982 since 1970. This increase of 18 percent compares to a 7 percent increase statewide for the same period. Net increases between 1970 and 1980 for each county were: 8.1 percent for the southern half of Carlton County; 24.4 percent for Kanabec County; and 18.1 percent for Pine County. This increase in population included a rapid immigration of 15.3 percent in Kanabec County and 11.5 percent in Pine County.

Most of this population was considered to be living in rural areas*, except the 2,890 living in Mora. The greatest percentage increases occurred in the cities of Askov, Pine City, Sturgeon Lake and Barnum. Percentage decreases in population occurred in Brook Park, Denham, Kerrick, Grasston, Sandstone and Willow River.

POPULATION TRENDS

Carlton, Kanabec and Pine counties are projected to continue this rapid growth trend through the end of the century. The State Demographer forecasts that population of these counties will increase by 31.9 percent, to 81,758, by the year 2010: 14.2 percent for Carlton County, 60.4 percent for Kanabec County, and 41.3 percent for Pine County.

TRANSPORTATION SYSTEMS

HIGHWAYS

The Moose Lake Area is reasonably well served by existing transportation facilities due in part to its location midway between the metropolitan areas of Duluth and the Twin Cities. Interstate 35 runs the entire length of the area through Pine and Carlton counties. State highway 65 runs the entire length of Kanabec County and state highway 23 cuts diagonally across the area from southeastern Kanabec County to east-central Carlton County. Other state highways and county and township roads feed into these major arteries providing good access to the entire region.

Access to the area is also provided by 253 miles of state forest roads. State forest road maps, inventory information, and proposed maintenance and improvement projects are described in the State Forest Road Plan (MN DNR, Division of Forestry, 1982).

No major construction projects are planned on state highways in the area through 1989. Minor projects include those listed in Table ___.

Table ___. Road Construction Projects Planned for the Moose Lake Area, 1984-1989.

County	Highway	Type of Project	Year
Kanabec	#70 near Grasston	New alignment	1984
Kanabec	Junction of #65 and #23 in Mora	Improvement	1984
Pine	#48 near Danbury	Bridge replacement, new alignment	1984-85
Pine	#70	Bridge replacement, new alignment	1988-89
Carlton	#73 in Moose Lake	Bridge replacement	1986

Source: Minnesota Department of Transportation, 1984.

AIRPORTS

Additional access to this area is provided by local airports. A primary airport is located at Duluth. Intermediate airports (i.e., paved, lighted, and less than 5,000 feet long) are located at Cambridge, Princeton, Rush City, Sandstone, Cloquet and Duluth. Landing strips (i.e., unpaved, not lighted, and generally 2,500 to 3,500 feet long) are maintained at Milaca, Mora, Isle, Pine City, Moose Lake and McGregor. The landing strip at Mora is presently being upgraded to an intermediate airport with lights and a paved runway.

RAILROADS

Two rail companies service the Moose Lake Area. The Soo Line Railroad operates a line from St. Paul through Danbury, Wisconsin to Superior, Wisconsin and one from Brooten to Superior, Wisconsin through Moose Lake. Burlington Northern Railroad operates a line from the Twin Cities to Duluth paralleling Interstate 35 to Hinckley where it joins with a line which follows State Highway 23 from Brook Park to Superior, Wisconsin. An additional Burlington Northern line goes from Minneapolis to Brook Park through Grasston and Henriette. Milwaukee and Chicago Northwestern have trackage rights to travel over the Burlington Northern line but do not service the area. Amtrak provides daily passenger service on its Northstar Route between Duluth and Minneapolis/St. Paul via Cambridge, Sandstone and Superior, Wisconsin.

As profitability declines on individual rail lines they are identified by the rail companies for possible abandonment. Recent abandonments in the Moose Lake Area include the Soo Line from Carlton to Moose Lake and the Burlington Northern line from St. Cloud to Brook Park. The 1981-82 Minnesota State Rail Plan (Minn. Department of Transportation, 1982) identifies the Soo Line from Danbury to Superior as a proposed abandonment. The plan also identifies the recently abandoned line from Carlton to Moose Lake as a potential rail banking project. The purpose of a rail bank program is to preserve abandoned rail line rights-of-way for future public and commercial transportation use. The Moose Lake to Brooten line is scheduled for rehabilitation between 1985 and 1990.

TRANSPORTATION NEEDS

The East Central Region is reasonably well served by existing transportation facilities. Therefore, the basic regional plan is to maximize the use of existing transportation facilities recognizing that limited improvements may be necessary to correct isolated transportation deficiencies.

Certain improvements in transportation facilities are called for where the improvement will help to achieve desirable objectives. For example, citizens in Region 7E have identified the need for improved safety of existing transportation facilities as a primary concern. They have also suggested that certain state highways are upgraded to carry nine-ton axle loads. This action would promote increased economic development in several cities and improve goods movement along area highways.

An adequate transportation system is critical to both the location of industry and the ability of workers to reach places of employment. Industries, especially those that transport heavy inputs and outputs with great frequency, include an area's transportation system as a major variable in their location decision. Workers too, are an important consideration with regard to transportation as they consider travel time and road conditions when making job selection decisions.

Transportation investments also play a major role in influencing the pattern and intensity of regional development. In this regard it is important to recognize that any attempts to influence regional growth and development must consider the effects of transportation activities.

LAND USE AND OWNERSHIP

Forested lands comprise 51 percent of the total Moose Lake Area. Forested areas also make up 51 percent of the total land area in Pine County, 40 percent in Kanabec County and 63 percent in Carlton County. Of the forested land in Pine County, 97 percent is classified commercial forest land (capable of producing more than 20 cubic feet per acre of industrial wood under natural conditions); for Kanabec County 100 percent is classified commercial forest land; for Carlton County 98 percent is classified commercial forest land; and for the entire Moose Lake Area 98 percent is classified commercial forest land Table ___). Unproductive areas account for 89 percent of the noncommercial forest lands in Pine County, 100 percent in Carlton County and 91 percent in the entire Moose Lake Area.

Table ___. Land Use in the Moose Lake Area.

Land Use (acres)	Total	Carlton*	Kanabec	Pine
Commercial forest	734,187	171,612	134,428	428,147
Cropland with trees	2,820	0	2,820	0
Cropland-no trees	401,450	51,356	128,248	221,846
Farm-idle	4,411	0	0	4,411
Farm-idle with trees	1,550	0	0	1,550
Farm-other	12,522	5,552	4,182	2,788
Improved pasture	27,035	8,230	14,375	4,430
Marsh	180,257	18,080	33,564	128,613
Productive reserve forest	1,606	0	0	1,606
Unproductive forest	15,346	2,794	0	12,552
Urban and other	46,534	9,990	6,941	29,603
Water-census	19,460	2,384	4,269	12,807
Water-noncensus	5,194	1,378	1,272	2,544
Windbreaks	7,179	1,415	0	5,764
Wooded pasture	11,707	3,034	2,971	5,702
TOTAL	1,471,258	275,825	333,070	862,363

*Includes T46N and T47N, Range 15W to 21W.

Source:

Of the 1,471,258 acres in the Moose Lake Area, 320,350 acres are publicly owned including 223,748 acres of DNR land, 92,221 acres of county land and 4,381 acres of federal ownership. Private lands comprise 1,126,214 acres

or 77 percent of the total area. The Division of Forestry presently administers 172,403 acres and the Divisions of Parks and Recreation and Fish and Wildlife administer 36,784 acres and 11,700 acres, respectively. The remaining DNR land is administered by other units. Within the state forest boundaries, 82 percent of the land is state-owned, the rest is owned by the county and private interests. A complete description of DNR-administered lands is contained in Assessment Section C.1.

LAND USE TRENDS

Under current policies and assumptions regarding population growth, energy use, and economic development in the Moose Lake Area, the following projections describe expected land use trends.

Urban and Residential Development

Major urban and residential land demands will be experienced in future years throughout the Moose Lake Area, especially surrounding existing population centers, along major transportation routes, and in close proximity to environmentally aesthetic areas, e.g., forest and park lands, rivers, lakes. Permanent single family home development pressures are greatest in these areas, with seasonal home development occurring throughout the region. Conflicts between agricultural and residential land uses will continue.

Agriculture and Forest Lands

Historically productive agricultural and forest lands will continue to come under considerable development pressure resulting in forest land clearing and the drainage of some area wetlands. Continued development will also necessitate expanded municipal services and the provision of rural utilities to meet growing needs.

The southern part of the Moose Lake Area is likely to experience the greatest change, with some economically marginal farms going out of production. However, consolidation of smaller, existing farms into larger units and the development of "new" agricultural areas is also likely to

occur. Concerns over agricultural land use will prompt continued efforts to preserve and protect productive agricultural lands through the local land use planning process.

Recreational Land Use

The proximity of the Moose Lake Area to the Twin Cities metropolitan area means that increased recreational opportunities and facilities will be demanded and more seasonal homes will be constructed as urban residents seek outdoor recreational activities closer to home. Seasonal home development pressures are greatest near lakes, rivers and forested areas, specifically along the Snake River, Knife Lake, Fish Lake, and Ann Lake (Kanabec County); and the St. Croix, Kettle and Snake rivers, Sturgeon, Pokegama and Cross lake areas (Pine County).

Land Use Patterns

Because of expected population increases the general land use pattern in the area will substantially change over time, with the most drastic changes occurring in the southern part of the area, near cities and forests, lakes and rivers. Adequate local controls will need to be applied to guide proposed land use changes and to ensure protection of the natural environment.

B. ECONOMIC CONDITIONS

INCOME AND EMPLOYMENT

Unemployment rates in the Moose Lake Area have been running higher than the state average. The 1982 annual average unemployment rate was 7.8 percent for the state, 8.7 percent for Carlton County, 11.8 percent for Kanabec County and 11.8 percent for Pine County. The October 1983 figures do not show much improvement relative to the overall state rates: 6.4 percent for the state, 9.6 percent for Carlton County, 8.7 percent for Kanabec County and 8.9 percent for Pine County. Area employment is high in manufacturing and construction, and, consequently, the area experiences higher seasonal unemployment than the state as a whole. This is illustrated by high unemployment rates during the winter months: 16.8 percent for Carlton County, 17.8 percent for Kanabec County and 18.1 percent for Pine County.

The median family income in 1981 was $14,821 in Pine County, $15,220 in Kanabec County and $20,901 in Carlton County. The comparable median family income statewide in 1981 was $23,230.* All three counties had median family income increases of less than 12 percent for 1979-1981, among the smallest increases in the state. Statewide the increase in median family income for 1979-1981 averaged 16.4 percent.

In 1979, 15.3 percent of persons in Pine County, 14.8 percent of persons in Kanabec County and 8.8 percent of persons in Carlton County were estimated to be at or below the poverty level. This compares to 9.5 percent statewide.

DISTRIBUTION OF ECONOMIC ACTIVITY

The decentralized nature of economic activity within the Moose Lake Area is demonstrated by the lack of a single, identifiable economic center.

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*Federal adjusted gross income reported by the Minnesota Department of Revenue.

Instead, several cities within the area, each with significant economic development characteristics, are referred to as Primary Economic Activity Centers. The cities of Hinckley, More, Moose Lake, Pine City and Sandstone share a mix of employment, commercial, recreational, medical, cultural, governmental and educational activities. Each is located over a relatively large geographic area and each has a positive economic effect on surrounding smaller local communities.

With the steady loss of employment opportunities in the agriculture industry and recent increases in manufacturing, construction, retail trade and services, the labor force has begun to concentrate in and near the larger population centers. The spread of manufacturing employment has provided an opportunity for farm families to supplement their incomes with non-agricultural employment, thus stabilizing year-round earnings, increasing the number of wage earners per family, and reducing the pressure to consolidate small and medium-sized farms.

Energy, communications and access factors are expected to increase the importance of certain locations in the region as expanded employment centers. Ongoing economic development initiatives and the provision of public infrastructure improvements are also expected to generate increased economic activity in certain areas.

MANUFACTURING

Manufacturing employment in the three-county Moose Lake Area, as listed in the 1981 County Business Patterns (CBP), was 3,717 persons or 33.5 percent of total employment. According to the CBP there was more employment in this sector than in any other, followed by 26.5 percent employed in retail trade and 21 percent in services.

The total payroll for manufacturing in 1981 was $69,569,000 or one percent of the total state payroll. This was the largest contributor to the total payroll for the three counties. The largest manufacturing category (as measured by employment) was paper and allied products. Other large categories are stone, clay and glass products, and coal products. These three sectors are represented only in Carlton County.

Other manufacturing in the area includes machinery, transportation equipment, food and kindred products, instruments and related products, apparel and other textile products, lumber and wood products, and rubber and miscellaneous plastics.

Gross manufacturing sales in Carlton County for 1982 were $102,752,509, or 34 percent of the total sales by businesses reporting sales tax in that county. Gross sales for the year in Kanabec County were $22,604,258, or 27 percent of the total county sales, and in Pine County were $3,643,037, or 4 percent of total county sales. The most significant classification within the manufacturing sector in terms of gross sales is machinery.

TRAVEL AND TOURISM

Total travel expenditures for the three county Moose Lake Area for 1979 were $30,940,000, or 0.8 percent of the state total. Travel is defined as those activities associated with overnight trips away from home and day trips to places 100 miles or more away from the traveler's origin. Economic impact is represented by measures of spending, employment, payroll, business receipts and tax revenue in each Minnesota county generated by traveler spending (Table ___).

The number of full-time jobs attributable to travel expenditures in 1979 was 742, or 0.7 percent of the state total. The total travel generated payroll in the three county area is $5,670,000, or 0.6 percent of the state total. This figure includes the payroll or wage and salary income attributable to travel expenditures. Payroll is reported before deductions for social security, income tax, insurance, union dues, etc.

The state tax revenue attributable to travel in this area in 1979 was $1,128,000 or 0.6 percent of the state total. Local tax revenue attributable to travel expenditures is $170,000 or .5 percent of the state total. Travel expenditures, as a percent of total sales by businesses, were 4 percent for Carlton County, 2 percent for Kanabec County, and 19 percent for Pine County.

Table ___. Economic Impact Generated by Travel Expenditures.

	State	Carlton*	Kanabec	Pine
Total Travel Expenditure ($1000)	4,001,724	11,900	1,962	17,078
Total Travel Generated Payroll ($1000)	876,469	2,269	337	3,064
Jobs in Travel	108,422	328	43	371
State Tax Receipts ($1000)	185,901	543	72	513
Local Tax Receipts ($1000)	32,704	68	10	92

*Figures are for all of Carlton County.

Source: Impact of Travel on State Economies, 1980. Study prepared for Minnesota Office of Tourism by U.S. Travel Data Center, December 1983.

The tourist-travel industry is now considered a major industry in east-central Minnesota, particularly in Pine and Kanabec counties. Not a substantial lake area by Minnesota standards, the region does have excellent rivers and streams, and contains sizable state parks and forests that are within a one to two hour drive of the Twin Cities metropolitan area. There are indicators that tourism is becoming more important as a source of regional income as energy costs inhibit long distance travel, and Twin Cities vacationers seek recreation closer to home. This trend is expected to continue.

AGRICULTURE, FORESTRY AND MINING

The proportion of Minnesota's total land area in farms, by county, averaged 56.5 percent in 1978. Land in farms for that year was 157,074 acres (28.5 percent of land area) in Carlton County; 185,494 acres (55.3 percent of land area) in Kanabec County; and 305,730 acres (33.8 percent of land area) in Pine County. The land area in farms increased from 1974 figures of 22.2 percent of Carlton County, 51.7 percent of Kanabec County; and 31.1 percent of Pine County. Farm land use by county is shown in Table ___.

Table ___. Farm Land Use by County, Moose Lake Area.

	Carlton	Kanabec	Pine
Harvested	48,281	66,040	105,880
Pasture	19,639	19,311	33,696
Cover crops	1,251	2,105	3,434
Crop failure	2,017	1,170	2,029
Cultivated summer fallow	495	537	631
Idle	3,677	3,683	5,697
Woodland-pastured	22,103	27,693	45,108
Woodland-not pastured	37,476	24,614	50,852
Other pastureland and rangeland	9,604	24,233	27,503
House lots, ponds, roads, etc.	12,531	16,108	30,900
TOTAL			

Source: 1978 Census of Agriculture.

The number of farms in the three-county Moose Lake Area with sales over $2,500* increased between 1974 and 1978 from 355 to 473 farms in Carlton County; from 538 to 638 farms in Kanabec County; and from 858 to 983 farms in Pine County. The value of agricultural products sold from these counties in 1978 was less than $20 million in Carlton and Kanabec counties, and between $20-49 million in Pine County. The state total for that year was $4,542,566,000. The relatively poor soils for crop production have increased the importance of livestock production in the area. In all three

*Data are available only for those farms with $2,500 or more in sales.

counties, the sale of livestock and poultry products contributed to the majority of the agricultural value. In 1974, between 80 and 92 percent of all agricultural products sold in all three counties were in the livestock-poultry category.

Agriculture remains an important factor in the region's economy even though the region has experienced significant non-agricultural growth and development during recent years. Preservation and proper management of the basic raw material of agriculture--good agricultural land continues to be a priority of all local planning. The major consideration must be the affect of any infringement on the long term ability of that and surrounding agricultural land to sustain production. Land development activity which is not consistent with the rural character should be discouraged. In addition to preservation, management of agricultural land must also be pursued by local governments and resource agencies.

WOOD PRODUCTS INDUSTRY

There are presently 39 active wood products mills in the three county area (Table ___). They consume approximately 776,000 cords per year; much of which is imported by Potlatch Corporation in Cloquet.

Table ___. Number of Primary Mills by Production Class and Quantity of Lumber Produced.

Active Sawmills (Volume in MBF/year)

Production Class	No. of Mills	Production	% of Production
10000+	1	24,800	71
1001-5000	3	6,400	18
251- 500	3	1,770	5
101- 250	8	1,140	3
51- 100	7	610	2
0- 50	15	308	1
TOTAL	37	35,028	100

Active Mills Excluding Sawmills (Volume in cords/year)

Production Class	No. of Mills	Production	% of Production
1001-5000	2	7,540	100

NOTE: North half of Carlton County included.

Source:

The majority of the sawlog resource harvested is presently processed into rough lumber at local mills. However, significant amounts of pulpwood are exported to other areas of the state and to Wisconsin mills.

Secondary wood processing firms, those that convert rough lumber to a finished or partially finished product, are presently lacking in Pine and Kanabec counties. Those existing in Carlton County are mostly confined to the northern portion of the county.

MINING

Most of the Moose Lake Area falls into the "B", "C", and "D" classes of mineral potential (MN DNR, Office of Planning, 1982). Class B represents geologic formations where metallic mineral bearing units are known to occur in the geologic formation, and areas where the geology is very similar to that in areas elsewhere in the world containing major metallic mineralization. Class C represents areas in which the geology is generally not well known, although it is similar to geologic environments in other areas of the world that are known to contain a variety of economic mineral deposits. Class D represents areas in which to the extent the geology is known and the possibility of metallic mineral deposits is present, but less likely than Class B or C formations. Table ___ profiles the active mining in the area for the years 1971, 1975 and 1980.

There is potential for a variety of minerals to occur in this area, depending on the underlying bedrock. Several quarries have produced dimension stone from the Keweenawan sandstones and from the Warman quartz monzonite. Traces of native copper are common in outcrops of the volcanic rock group. Several old copper mine workings exist in Pine County near Pine City and Hinckley. The volcanic rocks in Minnesota are the southwest continuation of the lava sequence in the Keweenaw Penninsula of Michigan, which has produced copper for more than a century. Future discovery of mineable copper is possible. Other metals or elements that could occur include gold, silver, zinc, lead, phosphorite, manganese, uranium, nickel and graphite.

Sand and gravel deposits are scattered throughout the three-county area. The most extensive deposit is along the St. Croix River in Pine County. Smaller deposits are found along the Snake River from Pine City to Mora; in the Moose Lake-Sturgeon Lake area, encompassing General C.C. Andrews State Forest; and west of Interstate 35 from Barnum to Cloquet. Significant gravel mining operations are established in the outwash along the Moose Horn River in Carlton County and the Willow River and Hinckley outwash deposits in Pine County. Lake Nemadji lacustrine clay is mixed at Wrenshall in Carlton County for processing into brick and tile products.

A large area of sandstone and quartzite close to the surface is found in western Pine County along either side of Interstate 35 from Beroun to Rutledge. This 10-mile wide area is the most significant deposit in the state outside of southeastern Minnesota.

The Moose Lake Area, particularly Pine and Carlton counties, was recently (1978-1982) intensively explored for uranium. All drilling conducted was on private lands, and a few walk-on permits were granted on state lands. No economic deposits were discovered, and there is no exploration being conducted at this time.

Another extractive resource found in the Moose Lake Area is peat. Real resources have a variety of potential uses including energy, chemicals, horticulture, agriculture, forestry and natural functions. Peat is found throughout the region with concentrations in northeastern and southern Pine counties. The peat resources of the region are shown in _____.

ANALYSIS

Agriculture, forestry and mining are considered basic to the economy of the Moose Lake Area. That is, these industries have long formed the backbone of the region's economy by exporting a portion of their products, by employing a large percentage of area residents, and by bringing dollars into the community.

However, with the continuing decline in agricultural employment, area residents can no longer depend on agricultural production to be a primary income producer for the region. Retail sales and services as well as the fast frowing manufacturing and construction industries can be expected to continue to increase their total employment and importance to the overall economy.

Table ___. Mining Activity, Moose Lake Area, Selected Years.

MINERAL PROFILE

	Carlton County (entire county)			Kanabec County			Pine County		
Active Mining	1971	1975	1980	1971	1975	1980	1971	1975	1980
Leading minerals in order of value	1. sand & gravel 2. peat 3. clay	1. sand & gravel 2. peat	1. peat 2. sand & gravel	1. sand & gravel	1. sand & gravel	1. sand & gravel	1. sand & gravel	1. sand & gravel 2. peat	1. sand & gravel
Sand and gravel production:									
number of mines	12	5	4	3	2	3	5	3	1
quantity in short tons (2000 lbs.)	699	278	77	77	NA	110	215	759	NA
value in $1000	527	193	102	38	NA	117	47	499	NA
Non-fuel mineral production value ($1000)	--	--	--	38	38	38	47	47	47
Total dollar value of mineral production ($1000)	527	193	102	76	38*	155	94	546	47*

*Excludes data not available.

Source:

B. ENVIRONMENT AND NATURAL RESOURCES

CLIMATE*

TEMPERATURE

The temperate, continental climate of the Moose Lake Area is characterized by moderate annual precipitation and seasonal extremes in temperature. The temperatures of the northern portion of the region can drop as low as -50° Fahrenheit. The highest temperature which can be expected is around 100° Fahrenheit. Mean daily maximum temperatures for July range from 67.5°F at the Moose Lake reporting station to 70.6°F in Mora. Summer temperatures in Moose Lake are tempered by its proximity to Lake Superior, and to a lesser extent by smaller inland lakes and vegetative cover. Winter temperatures range from an average 7.7°F January reading in Moose Lake to 9.4°F at the Mora station. The mean annual temperature for both areas is about 40°F.

PRECIPITATION

Precipitation varies slightly within the region. Average annual precipitation increases from west to east. Across the region the average is about 28 inches per year. The regional soil water profile is highly variable, but soil water levels are generally highest between May and September, when plant growth and precipitation levels are also at a maximum.

Annual snowfall totals can range from less than 50 to more than 70 inches. The area experiences an average of 120-125 snowcover days per year (one inch or more) beginning on about November 20 and extending through approximately April 10. However, the onset, depth and duration of snowcover varies widely from year to year and based on microclimatic features.

The average growing season within the region shows the most variation in terms of climatic characteristics. In the southern portion of the region the growing season averages 135 to 140 days, whereas in the northern sections the growing season can be as short as 95 days.

The relatively small land area of the Moose Lake Area indicates that wide variations in climatic conditions are not likely. However, the area lies within a transitional area between the northern Minnesota coniferous forest and those related climatic factors and prairie conditions of southern and western Minnesota.

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*This information was obtained from the Climate of Minnesota Series, University of Minnesota Agricultural Experiment Station (1983).

BEDROCK GEOLOGY

There are five major bedrock formations underlying southern Carlton, Pine, and Kanabec counties (see Bedrock Geology Map, 1970). From east to west, they are 1) an undivided (Chengwatana) volcanic rock unit, 2) the Hinckley and Fond du lac formations, 3) the Thomson formation, 4) the McGrath Granite Gneiss formation, and 5) an unnamed intrusive rock unit (dominantly quartz diorite, granodiorite, and quartz monzonite).

The volcanic rock unit on the eastern side of Pine County is associated with the Keweenawan period (1.1 billion years ago). Included are basalts, andesite, and minor felsite rocks. Some interbeds of conglomerate and sandstone are also present. Exposed areas of this formation can best be viewed at the St. Croix Dalles area around Taylors Falls, Minnesota.

The Hinckley and Fond du Lac formations are present in a line from southeastern Carlton County through central Pine and eastern Kanabec counties. The Hinckley formation overlies the Fond du Lac. It is dominantly well-cemented quartz sandstone, medium to very thick bedded, fine to coarse grained, and pale red to grey in color. The Fond du Lac formation is a feldspathic sandstone, with interbedded mudstone. Exposures of the Hinckley formation may be seen along the Kettle River from south of Rutledge down to Sandstone. Outcroppings of the Fond du Lac can be seen along the St. Louis River, west of Duluth. It also crops out north of Mora in Kanabec County along the Snake River.

The Thomson Formation is found in the southwestern part of Carlton County and the northwestern corner of Pine County. It consists dominantly of graywacke (an impure gray sandstone), siltstone, and shale. Locally there are some volcanic rocks. All of the formation is metamorphosed to some extent.

The McGrath Granite Gneiss Formation is a metamorphic rock formation occupying a very small area in the northwestern corner of Pine County. Known outcrops of this formation are relatively sparse and small. The rock is a coarse grained, pinkish grey biotite gneiss. The McGrath Gneiss is at least 2.7 billion years old, much older than the Thomson Formation.

The last major underlying hard rock formation in the Moose Lake Area is the Warmen quartz located in the western half of Kanabec County.

GEOMORPHIC REGIONS

A geomorphic region is defined as a broad physiographic feature such as a lake plain, glacial outwash plain, or moraine, etc. These regions were determined primarily by the contour or relief of a given parcel of land, together with the parent soil material. Within the Moose Lake Area, eight geomorphic areas have been defined.

Nickerson Moraine

This area covers approximately 31,000 acres in extreme northern Pine County. This moraine is characterized by extremely short and irregular topography. Small wet depressions and peat bogs are fairly common. On upland areas the water table is normally over 10 feet deep. In peat bogs it is surface to 3 feet deep. Textures of the till ranges from loam to clay. The drift includes areas of water sorted sand and gravel. The drift is reddish-brown and neutral to mildly alkaline. The water holding capacity ranges from high to low in most of the region.

Originally, the vegetation consisted of red and white pine with some upland spruce and fir in the eastern part of the region. Present forest cover is aspen, hardwoods, white spruce and fir. Only scattered areas are cultivated and pastured. Oats, brome, and alfalfa are the main crops. This region contains eight different soil landscape units.

McGrath Till Plain

This area encompasses approximately 55 percent of the region and covers 1,257,000 acres throughout the northeastern and central portions of the region. It is a gently rolling till plain containing many peat bogs. Peat occurs in about 20 percent of the region. Another 16 percent is somewhat poorly to poorly drained. In the northeast part of the region the ratio of peat to well-drained soils is higher than in the rest of the region. Several prominent eskers formed in tunnel valleys occur in the vicinity of

Finlayson, in northern Pine County, which are a good source of gravel. The water table on well-drained areas is normally over 6 feet deep. In the peat bogs and lower positions the water table is at surface to 6 feet deep. There are eleven lakes, of 160 acres or larger, totalling about 4,850 acres.

The glacial drift ranges from neutral to slightly acid and reddish-brown. Most of the till is fine sandy loam. A small area of clayey till in the Finlayson area is an exception. The eskers are composed of sand and gravel with some cobble. In a few places the eskers contain a thin veneer of till. The water-holding capacity of the till soils is high and of the coarse-textured soils, low.

The original vegetation was largely red and white pine, but includes areas of northern hardwoods, especially in Kanabec County. Present forest is aspen with some hardwoods, white spruce, balsam fir, and red pine. Tamarack and black spruce still occupy most peat areas. Cropland and pastures make up 5 to 15 percent of the region. Oats, brome, timothy and alfalfa are the main crops.

Fifteen soil landscape units are included in this geomorphic area.

Thomson-Cloquet Moraine

This area covers only 11,000 acres in northeastern Pine County.

The Cloquet Moraine was formed during the Split Rock phase and the Thomson during the Nickerson phase. The topography is rolling in most of the region but includes hilly land. Small wet depressions and peat bogs are common. In most of the region the water table is over 10 feet deep. The water-holding capacity ranges from high to low.

The original vegetation was mainly red and white pine. Present forest ocver is principally aspen with minor amounts of hardwoods, spruce and fir. Only scattered areas are in cultivation and pasture. Oats, alfalfa and brome are the main crops.

Sevel soil landscape units are found in this area.

Automba Drumlin Area

This area covers approximately 37,000 acres in northwestern Pine and northeastern Mille Lacs counties. This area contains drumlins which are oriented west and southwest.

In the northern part of the region the drumlins are oriented northwest. Toward the middle and southern portion they are oriented west and southwest. The individual drumlin averages ½ to 1 mile long, 1/8 mile wide and only 25 feet high. Poorly drained mineral and peat soils separate the drumlins.

Included in this region is the small Split Rock Drumlin Field, located near Finlayson in northern Pine County. This field contains about 59 drumlins, each averaging about 2,000 feet long, 500 feet wide, and 20 feet high with westward orientation.

The till is nonlimy, reddish-brown fine sandy loam. The soils have fragipan characteristics between about 16 and 60 inches. Peat makes up about 23 percent of the region. The water-holding capacity in most of the soils is high.

The original vegetation was principally red and white pine. Tamarack and black spruce occupied most of the peat bogs. At present, 75 to 85 is forested. Aspen, hardwoods, spruce and fir are the main species.

Twelve soil landscape units are included in this region.

Willow River Outwash Plain

This geomorphic region covers approximately 50,000 acres in north central Pine County.

The region is characterized by a nearly level to gently rolling plain. Near Sturgeon Lake it is a well-developed pitted outwash. The water table

is normally over 6 feet deep. In the peat bogs the water table is surface to 3 feet deep. Part of Sturgeon and two other major lakes are located in the region. Total water area is about 2,300 acres. The willow and Kettle rivers flow through the plain.

The outwash drift is reddish-brown acid sands. The soils are excessively drained and have a low water-holding capacity. Peat bogs make up about 10 percent of the region.

The original vegetation was jack pine. Present land use consists of 75 to 85 percent jack pine and aspen forest. The remaining 15 to 25 percent is cultivated land and pasture. Principal crops are otas, corn, brome, alfalfa and red clover.

Eight soil landscape units are located in this region.

Brainerd-Pierz Drumlin

This geomorphic region covers 283,000 acres in central Mille Lacs County. It is characterized by relatively low drumlins separated by poorly drained mineral and peat soils. The drumlins are oriented in a general east-west direction. They generally range from 1 to 2 miles long and to ¼ to ½ mile wide. The water table is normally more than 6 feet deep on the drumlins and surface to 3 feet deep in the low areas.

The till is brown, sandy loam, usually stony and often dense. The eastern part of the till is reddish-brown and in places capped with 1 to 3 feet of silt. There is medium water-holding capacity of the soils in most of the region.

Originally, the vegetation on the drumlins south of Mille Lacs Lake was northern hardwoods. Tamarack and black spruce occupied most of the peat bogs. An estimated 45 to 55 percent of the region is forested. Aspen dominates but the forest has other hardwoods and pines on drumlins. Tamarack and black spruce occur on most bogs. Cropland totals 25 to 35 percent and pasture is 15 to 25 percent. Crops are mostly oats, corn, brome, alfalfa and red clover.

This geomorphic region contains eight soil landscape units.

Hinckley Outwash Plain

This region covers approximately 177,000 acres primarily along the St. Croix River in Pine and Chisago counties.

The plain is nearly level to gently undulating and includes a few peat bogs. In most of the region the water table is normally over six feet deep, in the peat bogs it is surface to three feet deep. Total water area is about 950 acres not including the St. Croix River.

The drift is composed of reddish-brown, acid sand and gravel. Soils in most of the region are sandy loam to loam in the upper 18 to 30 inches. Sandy loam till is within 4 feet of the surface in a few places. The water-holding capacity ranges from moderate to low.

Original vegetation was largely northern hardwoods. Present land use is 45 to 65 percent forest, 25 to 35 percent cultivated land, and 5 to 15 percent pasture. Principal crops are oats, corn, brome, alfalfa and red clover. Aspen and other hardwoods dominate the forests.

Eight soil landscape units occur in this region.

Mille Lacs Moraine Complex

This geomorphic region covers approximately 158,000 acres in northern Mille Lacs and Kanabec counties.

The region is rolling to hilly, with knob and kettle topography. Many small wet depressions and peat bogs occur. Normally the water table is over 10 feet deep on the knobs and surface to 6 feet deep on lower positions and peat bogs.

The drift consists mostly of acid, reddish-brown till, however, sandy and gravelly pockets are common. Most of the soils contain fragipans. The water-holding capacity ranges from high to low.

The original vegetation was northern hardwoods south of Mille Lacs Lake. Oats, corn, brome and alfalfa are the principal crops. Aspen, maple, basswood and oak are the main forest species.

Seventeen soil landscape units are mapped in this geomorphic region.

SOILS*

A soil landscape unit is a group of soils generalized into a single identifiable unit based on soil texture, drainage and color.

The Minnesota Soil Atlas published by the University of Minnesota provides essential information for physical planning. Some of the uses of this information are:

1. To determine areas suitable for various specialty crops to enable processors to locate plants within areas of greatest potential.
2. To determine area potential for various types of farming, recreation.
3. To determine areas that would benefit from drainage or irrigation.
4. To locate sources of peat, sand and gravel.
5. To locate pulp and lumber mills within areas of greatest potential supply.
6. To locate feasible routes for utility lines and highways.
7. To serve as reference for local physical planning.

For specific planning of individual farms, cities, towns, recreation areas and road building purposes, more detailed surveys are necessary such as the individual soil interpretation sheets maintained by the Soil Conservation Service. However soil landscape units may point to priority areas where detailed surveys will be most useful.

Twenty-three soil landscape units have been delineated in the east central region and are shown on map ___. Soils are grouped into soil landscape units based on the following factors:

1. Texture of soil material below 5 feet into: sandy (S); loamy or silty (L); clayey (C); mixed sandy and loamy (X); mixed silty or loamy and clayey (Y); and bedrock (R).
2. Texture of the material above 5 feet, or a significant part of it, into sandy (S); loamy or silty (L) and clayey (C).

3. Drainage with moderately well, well, and excessively drained designated (W); and somewhat poorly, poorly, and very poorly drained designated (P). Units with (W) designation will normally have water tables below the rooting zone and units with (P), water tables within the rooting zone.
4. Color of the surface soil with dark color designated (D); and light color designated (L).

A complete description of each soil landscape unit is contained in the Minnesota Soil Atlas Duluth and Stillwater sheets, published by the University of Minnesota. This information is available in the EC RDC offices.

Table ___ identifies the soil landscape units within the region, according to the classification system identified above.

PEAT DEPOSITS

There is a significant acreage of peat (partially decayed organic material) in the Moose Lake Area. While there is growing interest in mining peat resources for energy, the suitability of peat deposits for this use is dependent on several factors. These include the depth and areal extent of the deposits, the humification and botanical origin of the peat, accessibility, and economic feasibility.

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*Information for this section is taken mostly from the Minnesota Soil Atlas Project, Duluth and Stillwater Sheets. University of Minnesota, Agricultural Extension Service. 1978.

WATERS

WATERSHEDS

The many lakes, streams and rivers of east central Minnesota give this region its particular character. Most of the rivers and streams are found in eastern Carlton and Pine counties. The remainder of the area is laced with tributaries of the Snake and Kettle rivers. There are 84 lakes (12,656 surface acres of water) within the area ranging in size from 8 to 1,536 acres. The majority of the lakes (56) are less than 100 acres in size. Thirty lakes range in size from 101 to 500 acres and 12 are over 500 acres. Concentrations of lakes are related to particular land forms. The location of lakes reflects the distribution of the major glacial moraines which were deposited throughout central Minnesota. Most of the lakes are concentrated in a band running from southwestern Kanabec County to just northeast of Barnum in Carlton County.

This region, known as the St. Croix Delta, forms a roughly triangular area between the Mississippi and St. Croix River drainages and contains five of Minnesota's 23 major watersheds (Waters, 1977). These include the Nemadji Basin, St. Croix, Snake and Kettle River drainages, and the Pine County Creeks.

Nemadji Basin

The Nemadji Basin, the part that lies in Minnesota, is a comparatively small, unspoiled river basin covering only 270 square miles. The Upper Nemadji is a western extension of the glacier carved trough that flows northward from Maheu Lake in northern Pine County to Lake Superior, a distance of some 65 miles.

Formed beneath glacial waters, the surface of the Nemadji plain is generally flat with little slope. However, the narrow, steep-sided gorges and slumping red clay banks that characterize the Nemadji River account for its warm, red and turbid waters. In all, the Nemadji drops 608 feet in elevation from Lake Maheu to Lake Superior causing periodic stormflows to produce flash floods and severe erosion.

Major tributaries include the Net and Little Net rivers, North Fork and South Fork rivers, and the Blackhoof River, the largest and longest Minnesota tributary of the Nemadji. A number of smaller streams that, because of their size or other ecological characteristics, play an important role in the watershed include Hunters Creek, Skunk Creek, Deer Creek, Mud Creek and the State Line Creek.

St. Croix Basin

Formed during the glacial epoch when glacial Lake Duluth poured meltwater down its outlet, the St. Croix river basin covers 7,650 square miles, about one-half of which is in Minnesota. It includes major drainages of the Snake, Kettle and Lower Tamarack rivers. The uppermost section of the St. Croix Basin forms the eastern edge of the Moose Lake Area, as well as the border between Minnesota and Wisconsin.

Major tributaries of the St. Croix River include the Namekagon River, Lower Tamarack River, Snake and Kettle rivers, and the Sunrise River near Taylors Falls. The St. Croix drops a total of 325 feet over its 150 mile route, making for some of the most spectacular river scenery in the midwest.

Snake and Kettle River Basins

The high divides of east central Minnesota which separate the Mississippi River drainage from Lake Superior's drainages contain the watersheds of the Snake and Kettle rivers, two of Minnesota's most beautiful and impressive waterways. Both rivers and their watersheds contain extremely diverse and outstanding geology, topography, stream bank vegetation and overall recreation opportunities.

In all, the Snake River drains 1,020 square miles. It drops a total of 500 feet in elevation from its origin in the Solana State Forest to its mouth some 100 miles east on the St. Croix. The Snake has many tributaries including Hay and Spring creeks, and Bergman, Chesley, Cowan and Snowshoe brooks. Just north of Mora, the Knife River joins the Snake, and later both are joined by the Ann River, Pokegama and Cross lakes. Below Pine City there are no major tributaries.

Peak flows on the Snake River are usually caused by spring snow melt and accompanying spring rains. Flooding in the watershed is not serious because most stream banks in the lower watershed are high and because numerous lakes and wetlands collect and store runoff, releasing it slowly to the streams.

The Kettle River and its tributaries drain 1,060 square miles. The Kettle flows some 80 miles to the St. Croix dropping a total of 500 feet in elevation. The watershed includes approximately 80 lakes with a total area of 10,000 acres. The watershed also includes all or part of six state forests. Major tributaries of the Kettle include the Split Rock and Moose Rivers, Birch Creek, and the Willow, Pine and Grindstone Rivers.

Streamflow is normally highest at spring breakup and lowest in late fall or winter. Flooding is uncommon because of the deeply incised channel throughout much of the lower reaches of the Kettle River.

Pine County Creeks

The St. Croix River flows south in a great sweeping curve, forming the border with Wisconsin. From north of this rough westerly curve, a number of small streams drain a portion of Pine County, flowing south to the St. Croix. These small streams--more than 40 in all--comprise a drainage distinct from the Kettle River watershed to the northwest and the Nemadji to the northeast.

Subsurface topography, formed as the glaciers retreated long ago, left this small, elevated zone of bedrock with a low ridge from which streams now flow north and south. The four primary streams in the area are the Lower Tamarack River, and Crooked, Sand and Bear Creeks.

GROUNDWATER

Groundwater is generally available from aquifers located throughout the Moose Lake Area. An aquifer is defined as a geologic formation, group of formations, or part of a formation that will yield sufficient water to be

considered a source of supply. Major aquifers in the area occur in two broad geologic categories: 1) glacial deposits and 2) bedrock.

WATER QUALITY

The natural quality of water in the Moose Lake Area is, in large part, a reflection of the characteristics of the land and vegetation from which the water flows. Because of the natural variation in land and vegetation, the natural quality of water in area lakes and streams is neither uniform nor static.

Water quality is influenced by a variety of natural features including soil, vegetation, geological features and wildfire. It is also subject to the actions of man. These include road construction, urban development, farming, mining, timber harvesting, livestock grazing, and the dumping of municipal and industrial wastes. The quality of water in undisturbed watersheds is very high. Following disturbance it is typically less so. The continued re-use of water for various purposes depends in large part, on the ability to maintain high quality water in streams and lakes.

PROTECTED WATERS, WETLANDS AND STREAMS

Minnesota's waters have been grouped into two categories for purposes of regulating and encouraging the wise use and development of major waterbasins and watercourses. The waters involved are identified either as "protected waters" or "wetlands" depending on their size, physical characteristics and ownership of surrounding lands. Any person, agency or organization proposing to alter the course, current or cross-section of the state's protected waters or wetlands must first obtain a permit from the Department of Natural Resources (MN Statutes, Chapter 105). An inventory of the protected waters, wetlands and streams within the Moose Lake Area is provided in Table ___.

Table ___. Protected Waters, Wetlands and Streams within the Moose Lake Administrative Area.

County	Number of Protected Water/Wetland Basins Greater Than 10 Ac.	Total Acreage of Protected Water/ Wetland Basins	Length of Streams Designated as Protected Waters
Carlton County*	47	2,282 ac.	254 mi.
Kanabec County	107	6,257 ac.	236 mi.
Pine County	202	13,173 ac.	588 mi.
TOTALS	356	21,712 ac.	1,078 mi.

*Includes only those basins and streams within townships 46 north and 47 north.

Source: MN DNR, Division of Waters 1984.

These are water resources which the DNR has direct jurisdiction over. Additionally, most of the basins over 25 acres in size are subject to DNR minimum standards related to shoreland development. These standards are administered by county zoning officials, subject to DNR monitoring. Shoreland districts include all lands within 1,000 feet of the water basins and within 300 feet of streams. Shoreland management regulations can affect the choice and application of various forest management practices including clear-cutting, herbicide use and other forms of vegetation control.

Also notable is that both the Kettle and the St. Croix rivers have been designated as part of the National Wild and Scenic Rivers System (P.L. 90-542). Regulations pertaining to these waterways are generally more stringent than state shoreland regulations with regard to management and development activities.

FOREST COVER TYPES*

Due to land clearing for agriculture and urban development, the extent of forest in the area has been reduced significantly since presettlement times, especially in southern Kanabec and Pine counties. Both the entire Moose Lake Area and Pine County are 51 percent forested. Forest land comprises 40 percent of Kanabec County and 63 percent of southern Carlton County.

Of the area's 751,000 acres of forest land, less than 10 percent is covered by softwoods (mainly Black Spruce, Balsam Fir, Tamarack, and Jack Pine). About 54 percent of the forest land is covered by Aspen, 15 percent by Northern Hardwoods, 7 percent by Lowland Hardwoods, 6 percent by Paper Birch, 5 percent by Oak, and 2 percent by Balsam Poplar.

Cropland accounts for 27 percent of the Moose Lake Area's acreage (39 percent in Kanabec County, 26 percent in Pine County, and 19 percent in southern Carlton County). Twelve percent of the area is marsh (non-wooded wetland), including 15 percent of Pine County, 10 percent of Kanabec County, and 7 percent of Carlton County. The remainder of the area's land is made up of urban areas (3 percent), pasture (3 percent), water (2 percent), and windbreaks, idle farmland, and other farmland (2 percent).

COMMERCIAL FOREST AREA

Total land acreage within the Moose Lake Area is approximately 1,471,258 acres, including water. Of the total land area, 734,000 acres are considered commercial forest land, with an additional 15,000 acres classified as unproductive forest land and 2,000 acres classified as productive-reserved.

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*Cover type information was collected by the U.S. Forest Service as part of the periodic inventory of Minnesota forest resources. The Resources Evaluation Unit of the North Central Forest Experiment Station determined cover types between spring 1975 and summer 1977 by interpreting the most recent aerial photographs for each county.

Commercial Forest Land Ownership

Public owners hold 28 percent (207,000 acres) of the Moose Lake Area's commercial forest land (CFL). The State of Minnesota is the largest public commercial forest landowner with 18 percent. County and municipal governments own 10 percent of the CFL, and miscellaneous federal owners own less than 1 percent.

The remaining 72 percent (527,000 acres) of CFL is held by private owners. Farmers are the largest group of private landowners in the southern half of Carlton, Kanabec and Pine counties, accounting for roughly 40 percent of the CFL. Miscellaneous private individuals own approximately 27 percent, private corporations hold about 4 percent and forest industries hold approximately 2 percent (Table ___).

Table ___. Ownership of Commercial and Unproductive Forest Land, Moose Lake Area.

Ownership Class	Comm. Forest (1,000 acres)	Unproductive (1,000 acres)	Total (1,000 acres)
County-Municipal	72	2	74
Forest Industry	17	0	17
Indian Land	3	0	3
Miscellaneous Federal	1	0	1
Other Private	507	8	515
State Land	134	5	139
TOTAL	734	15	749

Source:

Commercial Forest Types*

In the 1977 Forest Survey, 13 forest types were recognized in addition to nonstocked commercial forest land. Tables ___ and ___ show the area of commercial forest land by forest type.

*Detailed reports containing statistical highlights and tables on the timber resource of Carlton, Kanabec and Pine counties are available from the Forest Inventory Unit of the Division of Forestry.

Softwood Forest Types - Softwood forest types cover 9.4 percent of the commercial forest land in the Moose Lake Area. Acreages for the softwood types are shown in Table ___.

Table ___. Area of Commercial Forest Land by Forest Type.

Forest Type	Area (acres)
Black Spruce	27,000
Balsam Fir	15,000
Tamarack	12,000
Jack Pine	8,000
White Pine	3,000
Red Pine	3,000
White Spruce	1,000
TOTAL SOFTWOODS	69,000

Hardwood Forest Types - Hardwood forest types cover 89.6 percent of the commercial forest land in the Moose Lake Area. Acreages for the hardwood types are shown in Table ___.

Forest Type	Area (acres)
Aspen	393,000
Northern Hardwoods	112,000
Lowland Hardwoods	53,000
Paper Birch	44,000
Oak	39,000
Balsam Poplar	17,000
TOTAL HARDWOODS	658,000
GRAND TOTAL	734,000

Source:

Age Class Distribution of Forest Types

Age class distributions reveal the acreages within the various stand-age classes of a forest type. A balanced age class distribution, one in which each age class has the same number of acres, is ideal from a timber production standpoint for types managed on an even-aged basis. As forest stands reach maturity and are harvested, an equivalent acreage of stands replaces them to provide for a sustained yield of timber products.

Age class distributions of the more prominent forest types are shown in Figures 1 and 2. A horizontal line, labelled "recommended level" appears

Table ___. General Description of Soil Characteristics for the Moose Lake Area

Geomorphic Areas	Landscape Features	Dominant Soils*	Texture	Soil Drainage	Water Supply	Root Restrictions	Soil Fertility	Vegetation
Brainerd-Pierz Drumlin Area (W. Kanabec Co.)	Level to rolling, ridges separated by swampy low-lands. Local relief 10-50', slopes 1-15%.	LLWL NP	Sands Silts Loams	Well drained (LLWL) Poorly drained (NP)	Medium (4-8")	Dense till layers, water movement restrictions	LLWL-med. to high NP-low	LLWL-No. Hdwds. NP-Blk. Spruce, Tamarack
Mille Lacs Moraine Complex (N. Kanabec Co.)	Rolling to hilly, wet depressions and peat bogs. Local relief 10-60', slopes 1-20%.	LLWL LLPL NP	Sands Silts Loams	Well drained (LLWL) Poorly drained (LLPL)	Medium (4-8")	Dense till layers, water movement restrictions	LLWL-med. to high LLPL-low to med. NP-low	LLWL-No. Hdwds. LLPL-Lo. Hdwds. NP-Blk. Spruce, Tamarack
Nemadji-Duluth Lacustrine Plain (SE Carlton Co.)	Flat dissected plain. Local relief 5-10', slopes 0-5% (25-60% in dissected areas).	CCWL SSWL CCPL SSPL	Sands Loams Silts Clay	Well drained (CCWL, SSWL) Poorly drained (CCPL, SSPL)	CCWL, CCPL-high 8-12" SSPL, SSWL-low-up to 4"	None	CCWL, CCPL-mod. to high SSPL, SSWL-low to mod.	Mixed hardwoods and conifers.
Willow River Outwash Plain (North-Central Pine Co.)	Level to rolling sand plain. Local relief 5-20', slopes 1-10%.	SSWL AP	Sands Loamy sands	Well drained (SSWL) Poorly drained (AP)	Low (up to 4")	None	SSWL-low to mod. AP-low	SSWL-Pine and Aspen AP-Blk. Spruce, Tamarack
Automba Drumlin Area (SW Carlton Co.)	Gently rolling, low relief. Local relief 10-40', slopes 1-10%.	LLWL LLPL AP	Sands Silts Loams	Well drained (LLWL) Poorly drained (LLPL)	Medium (4-8")	Dense till layers, water movement restrictions	LLWL-mod. to high LLPL-low to mod. NP, AP-low	LLWL-No. Hdwds. LLPL-Lo. Hdwds. NP, AP-Blk. Spruce, Tamarack
Thompson-Cloquet Moraine Complex (NW Pine Co.)	Rolling to hilly moraine, wet depressions. Local relief 10-50', slopes 1-20%.	LLWL SSWL NP	Sands Loams	Well drained (LLWL, SSWL) Poorly drained (NP)	LLWL-medium SSWL-low	Dense till layers (LLWL)	LLWL-mod. to high SSWL-low to med. NP-low	LLWL-No. Hdwds. SSWL-Pine, Aspen NP-Blk. Spruce, Tamarack
Nickerson Moraine (SE Carlton Co.)	Rolling to hilly, wet depressions, small bogs. Local relief 10-70', slopes 1-30%.	LLWL SSWL XLWL CCWL	Sands Loams Silt loams	Excessively to moderately well drained	SSWL, XLWL-low LLWL, CCWL-moderate	None	SSWL-low to med. LLWL, CCWL-mod. to high	SSWL-Pine Others-No. Hdwds.
McGrath Till Plain (Pine and Kanabec co.)	Rolling till plain with many peat bogs. Local relief 5-40', slopes 1-20%.	LLWL LLPL LP AP	Sands Loams Silt loams	Well drained (LLWL) Poorly drained (LLPL) Very poorly drained (LP, AP)	LLWL-moderate LLPL-moderate to high	Dense till layers, water movement restrictions	LLWL-mod. to high LLPL-low to mod.	LLWL-No. Hdwds. LLPL-Lo. Hdwds. LP, AP-Blk. Spruce, Tamarack
Hinckley Outwash Plain (So. Pine Co.)	Level to rolling sand plain. Local relief 5-50", slopes 1-15%.	SLWL SSWL LSWL LP	Sands Loams	Well drained (SLWL, LSWL) Excessively drained (SSWL) Poorly drained (LP)	SLWL, LSWL-low to mod. SSWL-low	None	SLWL, SSWL, LSWL-low to moderate LP-low	SLWL, SSWL, LSWL-No. Hdwds., Pine LP-Blk. Spruce, Tamarack

Soils are grouped into "soil landscape units" and characterized by a four-letter code based on the following factors:

1. Texture of the soil material below 5 feet into sandy (S); loamy or silty (L); and bedrock (R).
2. Texture of the material above 5 feet, or a significant part of it, into sandy (S); loamy or silty (L); and clayey (C).
3. Drainage with moderately well, well, and excessively drained designated (W); and somewhat poorly, poorly, and very poorly drained designated (P). Units with (W) designation will normally have water tables below the rooting zone and units with (P), water tables commonly within the rooting zone.
4. Color of surface soil with dark color designated (D); and light color designated (L).

Some areas on the map do not have a four letter symbol of a soil landscape unit. These are land types such as P for peat or muck; M for marsh; R for rocky land; A for floodplains; SSR for steep, stony, rocky land; UC for unclassified city land; and M-D for mines and dumps.

Source: Minnesota Soil Atlas, Duluth and Stillwater Sheets, University of Minnesota, Agricultural Extension Service, 1978.

on each of these figures. It indicates the acreage to harvest over a ten year period to establish an even-age class distribution within that respective forest type at the conclusion of one technical rotation period.

Figure 1. Area of commercial forest land by aspen forest type and stand-age class.

Figure 2. Area of commercial forest land by northern hardwoods forest type and stand-age class.

Stand-Size Class

During the Phase I Forest Survey, forest lands were separated into four stand-size classes: sawtimber, poletimber, seedling and sapling (restocking) stands, and nonstocked areas. This classification is useful in determining a stand's stage of development, the forest products it can produce, and whether or not deforested areas are being restocked.

Of the total 734,000 acres of commercial forest land in the Moose Lake Area, 16 percent of the area is sawtimber, 59 percent poletimber and 23 percent seedling and sapling stands. Only 1 percent of the commercial forest land is nonstocked.

Hardwood forest types account for 90 percent of the sawtimber stand acreage, 93 percent of the poletimber stands and 85 percent of the seedling and sapling stands. Softwood forest types comprise the remainder of each stand-size class.

Of the total 658,000 acres covered by hardwood forest types, 16 percent is classified as sawtimber, 62 percent poletimber and the remaining 22 percent seedling and sapling stands. In a similar comparison, 16 percent of the total 69,000 acres covered by softwood forest types is sawtimber stands, 45

FIGURE 1 ASPEN

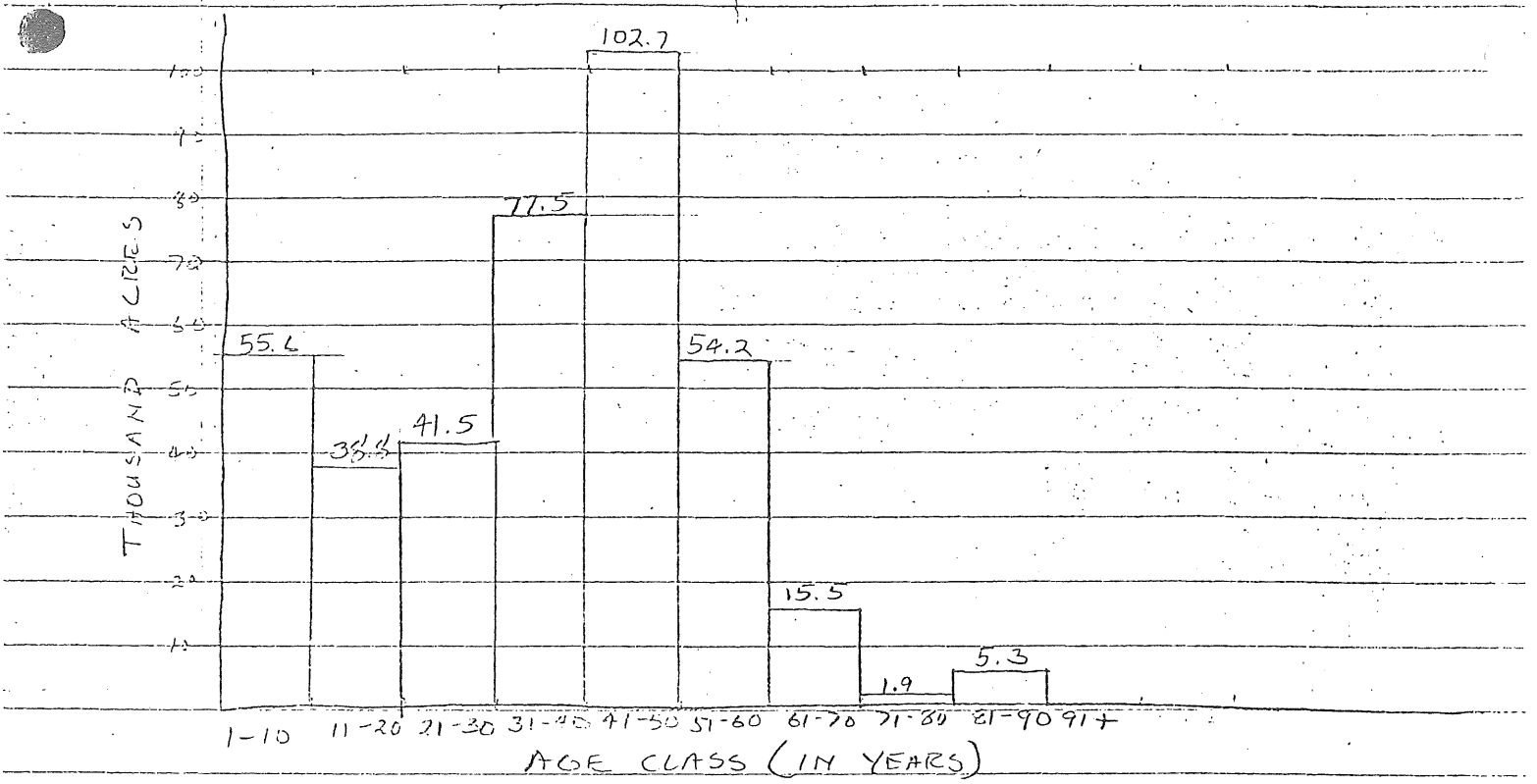


FIGURE 2 NORTHERN HARDWOODS

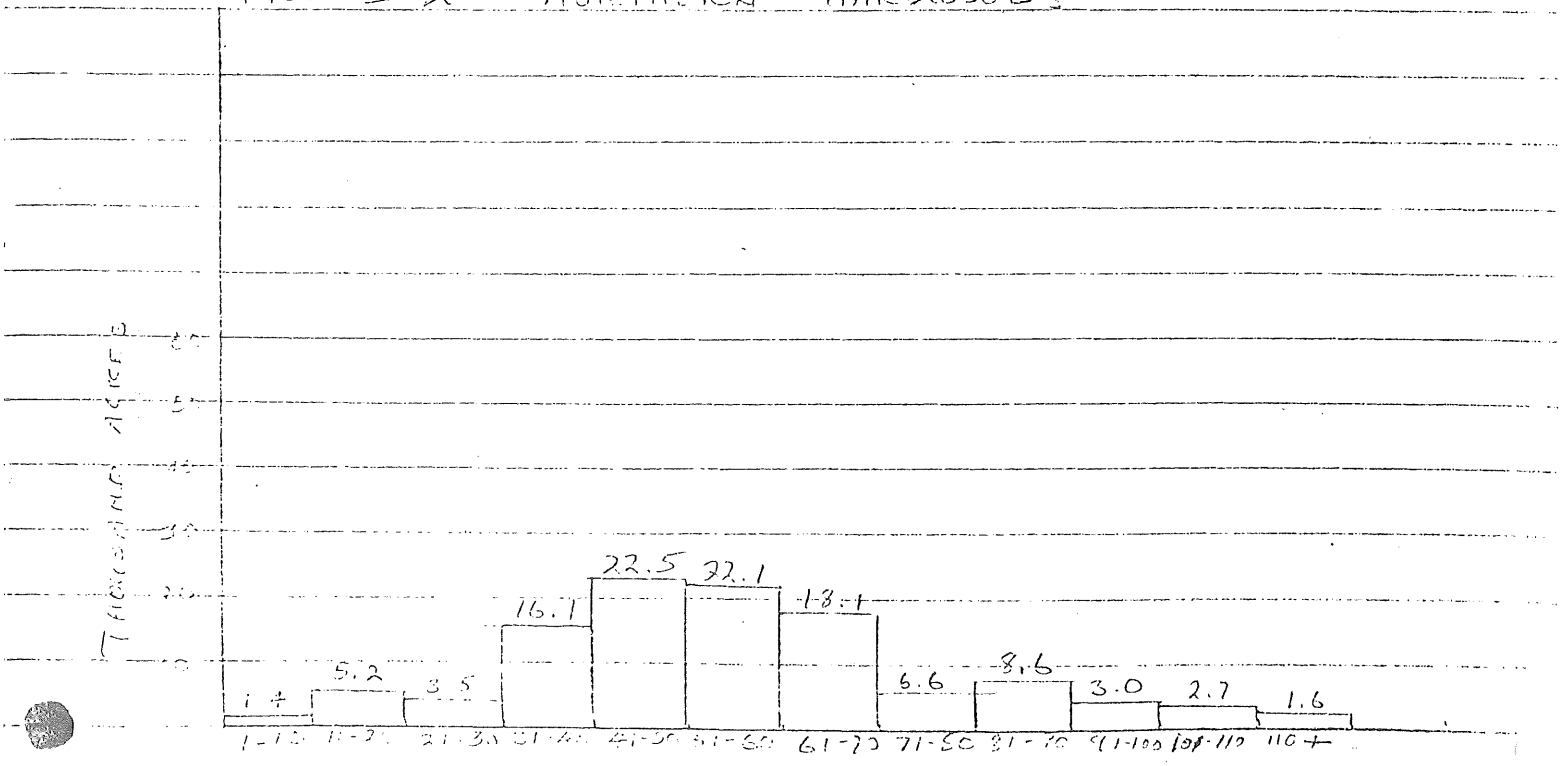


TABLE 3

TOTAL VOLUME AND AREAS BY COMM. COVER TYPE AND SIZE CLASS.

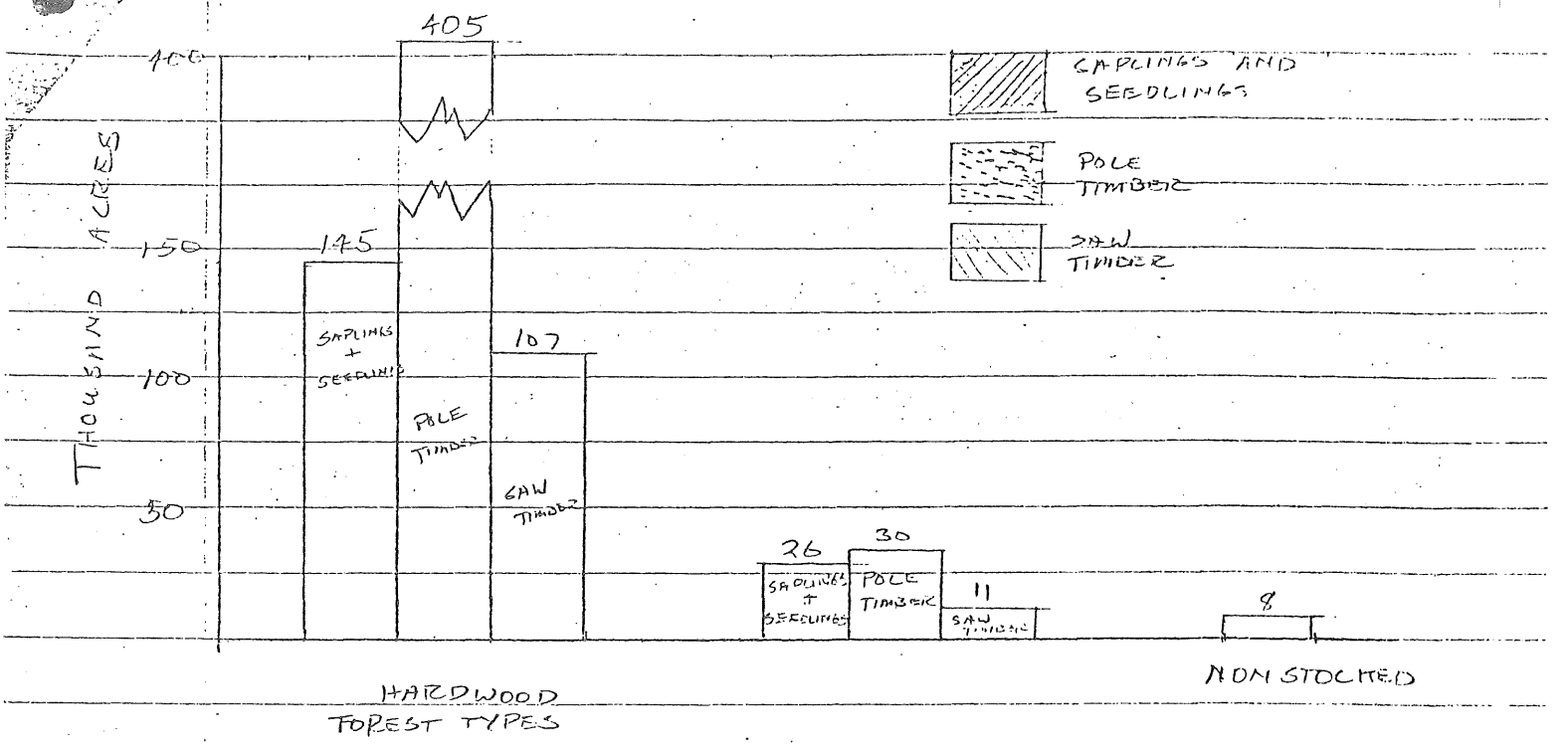
...(AREA IN 1,000 ACRES AND VOLUME IN 1,000 CORDS)...

NOTE: PHASE I FOREST INVENTORY IN MOOSE LAKE.

COMMERCIAL COVER TYPE	SAPLING/SEEDLING AREA	SAPLING/SEEDLING VOLUME	POLE TIMBER AREA	POLE TIMBER VOLUME	SAWTIMBER AREA	SAWTIMBER VOLUME	UNKNOWN CODE AREA	UNKNOWN CODE VOLUME	TOTAL 1000 ACRES	TOTAL 1000
ASPEN	109	487	237	2,661	47	636	0	0	393	3
BALSAM FIR	2	3	9	101	4	21	0	0	15	
BALSAM POPLAR	6	25	7	82	4	63	0	0	17	
BLACK SPRUCE	17	44	9	64	0	0	0	0	27	
JACK PINE	0	0	5	65	3	38	0	0	8	
LOWLAND HDWS.	10	32	41	335	1	22	0	0	53	
NONSTOCKED	0	0	0	0	0	0	0	0	8	
NOTHERN HDWS.	12	43	64	738	36	527	0	0	112	1
OAK	4	21	24	365	11	153	0	0	39	
PAPER BIRCH	4	8	32	428	8	111	0	0	44	
RED PINE	0	0	1	9	1	34	0	0	3	
TAMARACK	6	18	6	52	0	0	0	0	12	
WHITE PINE	0	0	0	0	3	67	0	0	3	
WHITE SPRUCE	1	9	0	0	0	0	0	0	1	
TOTAL	172	690	436	4,901	118	1,673	0	0	734	7,

reports info from table on p. 24

FIGURE 3


405
145
107
26
30
11
8
150
100
50
THOUSAND ACRES
SAPLINGS + SEEDLINGS
POLE TIMBER
SAW TIMBER
SAPLINGS AND SEEDLINGS
POLE TIMBER
SAW TIMBER
NON STOCKED
HARDWOOD FOREST TYPES

percent poletimber and 39 percent seedling and sapling stands (see Figure 3 and Table 3).

Figure 3. Area of commercial forest land by stand-size class and hardwood and softwood forest types.

Table 3. Volume and areas by commercial type and size class.

TIMBER VOLUME

In 1977 (the most recent survey) total net volume on commercial forest land in the Moose Lake Area was 7,277,000 cords including approximately 1,673,000 cords in sawtimber. Net volume averaged 14.18 cords per acre.

Hardwood Volume

Hardwood species make up 93 percent (6,737,000 cords) of the total net volume. Volumes for the major hardwood species are:

Species Group	Net Volume (cords)
Aspen	3,784,000
Horthern Hardwoods	1,307,000
Paper Birch	547,000
Oak	540,000
Lowland Hardwoods	389,000
Balsam Poplar	170,000
TOTAL	6,737,000

About 68 percent of the hardwood volume is poletimber and an additional 22 percent is sawtimber. In sawtimber volume, the major hardwood species are:

Species Group	Volume (cords)
Aspen	636,000
Northern Hardwoods	527,000
Paper Birch	111,000
Oak	153,000
Lowland Hardwoods	22,000
Balsam Poplar	63,000
TOTAL	1,512,000

Softwood Volume

Softwood species make up 7 percent (526,000 cords) of the total net volume on commercial forest land. Volumes for the major softwood species are:

Species Group	Net Volume (cords)
Balsam Fir	124,000
Black Spruce	109,000
Jack Pine	104,000
Tamarack	70,000
White Pine	67,000
Red Pine	43,000
White Spruce	9,000
TOTAL	526,000

Total net volume of softwood is 55 percent poletimber and 30 percent sawtimber. Sawtimber volumes for the major softwood species are:

Species Group	Volume (cords)
Balsam Fir	21,000
Jack Pine	38,000
White Pine	67,000
Red Pine	34,000
TOTAL	160,000

The Phase I Forest Inventory described above is an inventory of all land ownership classes and does not provide detailed information on a stand by stand basis, but rather a general description of timber resources using statistical sampling techniques. This information is excellent for analysis of all commercial forest land in the area, but it is not accurate or detailed enough for managing individual stands. Phase I is based on an

individual tree sample with deductions made for cull. Phase II is based on a stand by stand inventory with no deductions for cull. To provide the detailed information field managers need, the Phase II Forest Inventory was begun in 1976. The Phase II Inventory presently collects data on each stand of trees located on state and county owned lands. A similar inventory of nonindustrial private forest lands is scheduled to begin in 1985. Individual management decisions for state owned commercial forest land including timber regulation and allowable cuts in the land management plan will be done using Phase II.

TIMBER DEMAND AND HARVEST

The pulp and paper industry generates the major demand for forest products harvested in the Moose Lake Area. Projected demand for wood resources from commercial forest land in Minnesota is projected to increase steadily from the current 2.4 million cords to 3.8 million cords by 1990 and then more gradually to 4.2 million cords by the year 2000.

Although less than 50 percent of the Moose Lake Area's allowable cut is currently being harvested, this trend is expected to change as other areas in the state experience greater pressure. Wood procurement demands are expected to gradually shift to the under-utilized Moose Lake Area resource. The newly established and expanding waferboard industry and projected expansions in the paper and related industries will be the areas of most pronounced increase (Figure ___).

The Outlook

Timber demand and supply projections are not necessarily intended to convey what is desirable from silvicultural, economic, or social viewpoints, but are meant simply as indicators of what is likely to happen if forests are managed as they have been in past years. Projections for the first 10-year period are the most meaningful, because fast-changing market and economic conditions can quickly nullify longer-term assumptions.

According to recent research and trend analyses done by DNR the existing low level harvest trends will continue for the next ten year period.

Inventory, then, is likely to continue accumulating at a rate similar to that of recent years.

A coniferous or shade tolerant understory is present on a major portion of the aspen stands. Unless they are logged or burned, many of these stands could be converted by natural succession to softwood types such as balsam fir, or northern hardwoods. Aspen volumes are expected to stagnate somewhat in the future as stands shift to older age classes. Recent inventory data indicate that there is a major age class distribution problem on public land, with a large supply of both overmature timber and a relatively small supply of middle-age stock.

Because of a dwindling land base, increased need for raw materials and identification as a renewable resource, forested lands will be subjected to increasing pressure for a variety of uses. The task will be to derive the most benefit in terms of economics, recreation and preservation, etc. It is recognized that through proper planning many of the demands on forestry resources can be adequately met through multiple use management. However, it must also be recognized that many of the values of forested areas cannot be properly managed through multiple use plans. For this reason, private and public action should be directed to identification of certain forested areas for specific uses and management including natural preservation, wildlife management, and scientific and natural areas.

The quality of water bodies depends to a great extent on the quality of the terrestrial environment in which they are located. Lakes and streams in forested areas tend to have higher water quality and larger, more diverse fish populations than lakes and streams in agricultural areas. Regardless of the primary vegetative cover type, maintenance of forest or other vegetative buffer strips along streams and around lakes is highly beneficial to fish. These buffer strips help shade the water, control erosion, and maintain water quality.

Major Fish Species

Minnesota waters contain 151 speices of fish. Table ___ lists 31 species of game fish found in the area.

Table ___. Game Fish Found in the Moose Lake Area.

Northern pike	Brown bullhead
Walleye	Black bullhead
Sauger	Yellow bullhead
Muskellunge	Lake sturgeon
Largemouth bass	Shovelnose sturgeon
Smallmouth bass	Smelt
White crappie	Rainbow trout
Black crappie	Brown trout
Green sunfish	Brook trout
Pumpkinseed	Yellow perch
Bluegill	Flathead catfish
Rock bass	Channel catfish
White bass	

Source: MN DNR, Fish and Wildlife 1982.

Of the game fish listed in Table ___, several species may be affected by forest management. The northern pike is particularly dependent on temporary spawning marshes for its existence. Major alterations of spawning marshes could eliminate northern pike in a given area. Rainbow, brown, and brook trout are all dependent on cold, clear water. Shade from overstory vegetation and consistently high quality water supplies from forest watersheds are of particular importance. All three species of trout are sensitive to siltation, temperature variations, and excessive runoff, especially during spawning.

WILDLIFE RESOURCES

INTRODUCTION

Wildlife Habitat

The presettlement vegetation of the Moose Lake Area was a mosaic of five major vegetation types--Aspen-Birch Forest, White and Red Pine Forest, Northern Hardwood-Conifer Forest, Bog, and Swamp. Floodplain Forest and Jack Pine Forest were minor components. The White and Red Pine and the Northern Hardwood-Conifer Forest have undergone the greatest alteration and old growth stands of these communities are now rare in the region.

The major causes of alteration to these forest communities were logging and subsequent intense fires. Many of the presettlement vegetation types were maintained by occasional fires, but these fires in most cases were not as intense as those which followed logging. Much of the land formerly covered by pine forest today supports stands of Aspen-Birch and Jack Pine.

Approximately 51 percent of the area's 1.5 million acres is forested, or nearly 751,000 acres. Likewise, approximately 51 percent of Pine County is forested while forest land comprises 40 percent of Kanabec County and 63 percent of southern Carlton County. More than one-half (54%) of the area is in the Aspen type of which _____ acres (%) are a minimum of 40 years of age. These overmature and high risk stands are being replaced by Northern Hardwoods, which currently comprise 15 percent of the total forest.

In some parts of the area, most notably southern Carlton and northeastern Pine counties, the succession of hardwood stands is skewed toward the Spruce-Fir complex. Approximately 10 percent of the area is covered by natural softwood stands of Black Spruce, Balsam Fir, Tamarack and Jack Pine. Another _____ percent of the area consists of conifer production sites. The remaining cover types, Lowland Hardwoods, Paper Birch, Oak, and Balsam Poplar, comprise 7 percent, 6 percent, 5 percent, and 2 percent, respectively of the area's forest land. Several factors including the maturing of the forest, conversion of old fields (openings) and hardwood stands to conifers, and improved wildfire control place distinct

limitations on the production potential for wildlife, especially those game species heavily utilized by sportsmen (i.e., white-tailed deer and ruffed grouse).

The most extensive forest cover types in the area occur in southeastern Carlton and eastern Pine counties where there are sizeable holdings of state and county land. The extent of these types is shown by the remote "remnant wilderness" areas in the Nemadji State Forest which still support marginal populations of moose and timber wolves. Such large tracts of public ownership provide wildlife management opportunities not available on private land.

Recent studies suggest that many wildlife species require contiguous and extensive forest systems (Robbins 1979; Burgess et al. 1981). Bond (1957) reported that many songbird species adapted to living in forest interiors need large tracts of forest during the nesting season. When a forest area is fragmented due to suburban sprawl, super highways, pipelines, transmission lines, surface mining, and agriculture, many of these birds disappear. The implications of such findings are significant if we want to maintain the native wildlife species associated with the forest community.

The last major habitat component in the Moose Lake Area is marshland. Twelve percent of the area is marsh (non-wooded wetland), including 15 percent of Pine County, 10 percent of Kanabec County, and 7 percent of Carlton County. In the Moose Lake Area there are 21,712 acres of wetlands. Many values of wetlands have been documented but wildlife values are perhaps the most visible, particularly for waterfowl and furbearers. These species are normally associated with the type 3, 4, and 5 wetlands (10 acres or larger).* Many of the wetlands in the Moose Lake Area are type 2, which are particularly important for sharp-tailed grouse and sandhill cranes. As these wetlands convert from type 2 to type 6 (shrub swamp) largely due to fire control, habitat for these species is reduced.

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*Wetland types are defined in Circular 39, Wetlands of the United States, 1971 Edition, U.S. Department of the Interior.

Wildlife Habitat Trends

Major land conversions and habitat changes have altered the composition and distribution of wildlife species that occurr in the Moose Lake Area. Moose formerly ranged throughout Pine and Kanabec counties. The peripheral range of caribou used to extend southward through northern Pine and Kanabec counties, and elk ranged from the prairie to the hardwoods in the southern part of the Moose Lake Area. Prior to 1860, white-tailed deer were rare.

Logging, subsequent fires and settler activity changed the habitat to types that favor transitional zone, prairie, and farmland species of wildlife (e.g., sharp-tailed grouse, white-tailed deer, and ring-necked pheasant). These habitat conditions persisted until the mid 1960's when maturing forests, improved fire control, and farm abandonment in the forested parts of the Moose Lake Area again began to favor presettlement wildlife species. These habitat changes are still occurring; present day logging practices have not offset the trend.

Better soils, primarily in the southern part of the area, have favored continuance of agricultural operations. Although some drainage occurred in the period 1900-1925 which affected wetlands in the area, some legal ditches were filled or became blocked over the years, partially reclaiming wetland habitat. Ditch cleaning operations, however, have increased within the last 10 years and new private ditches have been dug.

Agricultural operations have been modified greatly from the first "stump" farms. Within the past 10 years row crop production has increased greatly, in many cases providing supplemental food for wildlife. Row crop production has not pre-empted nesting cover as agricultural practices are diversified to include both dairy and crop operations. Nevertheless, woody cover and forest land in the agricultural areas are continually subject to pressures from clearing, resulting in a loss of wildlife cover.

Fire control affects habitat in the agricultural areas as well as in forested areas. In addition, Type 1 and 2 wetlands are gradually converting to Type 6 (shrub swamps). As a result, open wetlands that

provide habitat for sharp-tailed grouse and sandhill crane are deteriorating due to natural succession.

Trends in Use of Wildlife Resources

Wildlife provides diverse opportunities for hunting, trapping and nature observation in the Moose Lake Area. In 1982 21,210 resident hunting licenses, 814 trapping licenses, 169 nonresident hunting licenses and 1,591 state waterfowl stamps were sold in Pine, Kanabec and Carlton counties. Revenues from these sales totaled $327,512. In conjunction with these sales figures, the issuing fee revenue has an immediate impact on the local economy. In 1982 this represented a $22,000 direct return to the economy in these three counties. In addition to the sales in Pine and Kanabec counties many of the Carlton County sales and a good number of license sales in the Twin Cities area can be attributed to hunters who use the Moose Lake Area.

Because of its proximity to the Twin Cities the Moose Lake Area receives a considerable number of hunters from the metropolitan area. According to data collected from deer registration stations from 1972 through 1977, hunters from Anoka, Chisago, Dakota, Hennepin, Isanti, Ramsey and Washington counties accounted for a harvest ranging from 43 percent to 48 percent of the total deer taken and registered in Pine and Kanabec counties. During this same period the deer taken by county residents ranged from 38 percent to 45 percent of the total.

Firearms deer hunter car counts indicate an apparent increase in the numbers of deer hunters from 1977 through 1981 in east-central and southern Pine County with numbers of cars decreasing in 1982. These car counts act as an index of use on public land. In the Chengwatana State Forest on the first day of the firearms deer season, the average number of cars on a four mile segment of road has been 99 with a range from 65 in 1977 to 145 in 1982.

Generally the numbers of big game licenses sold in the Moose Lake Area have been on an upward trend with firearm deer licenses increasing from 9,141 in 1977 to 12,657 in 1982 due to a higher deer population. Hunting deer with

bow and arrow has become increasingly popular with license sales climbing from 511 in 1977 to 1,351 in 1982. Some bear hunting is done with archery equipment but the majority of bear are hunted with firearms, with license sales increasing from 216 in 1977 to 750 in 1981. Beginning in 1982, bear licenses were allocated under a permit system.

In contrast small game license and trapping license sales peaked in 1980. In 1977 small game license sales totaled 6,963. In 1980 they totaled 9,077. By 1982 they had dropped to 6,837, with the largest decrease in 1982. In 1981 the largest drop in sales occurred in Carlton County, probably as a result of the cyclical low in the ruffed grouse populations. The same grouse cycle occurred in Pine and Kanabec counties but hunters probably tended to shift to pheasants.

Trapping license sales followed the same pattern as small game, increasing from 408 in 1977 to 917 in 1980, then decreasing to 673 in 1982. During this time period a separate beaver trapping license was required, with sales rising from 281 to 574 in 1977 and 1980, respectively and decreasing to 465 in 1981. The peak license sales in 1980 coincided with a drop in the price of furs.

Waterfowl stamp sales figures were not available for 1977, but in 1978 they totaled 2,169 and peaked at 2,235 in 1979. In 1980 they decreased to 2,087. There was a further decrease in 1981 to 1,595 stamps. 1982 was very similar with 1,591 stamps sold.

Data documenting the nonconsumptive use of wildlife in the Moose Lake Area are extremely limited. The St. Croix River Valley with its numerous parks and rivers attracts numerous year-round visitors, many of whom spend considerable time enjoying wildlife, particularly birdwatching. Birdwatching, a fast growing wildlife recreation activity, is estimated to account for expenditures in excess of $30 billion dollars annually in North America.

Wildlife in the Moose Lake Area

Approximately 207 species of birds, 49 species of mammals, and 24 species of reptiles and amphibians have been reported in the Moose Lake Area. An additional 23 species of birds can be considered as casual migrants or nesters, irregular migrants, or accidental.

Because of the large number of wildlife species, it is impractical to consider each species individually. The following discussion is limited to major game species and certain species that receive special consideration, such as those on Minnesota's official endangered species list. Complete species lists for the area are presented in Appendix 1.

Major Game Species

White-tailed Deer

White-tailed deer are commonly found throughout the Moose Lake Area, although densities vary depending on habitat. Deer were scarce in presettlement times but populations increased following extensive logging and fires. Due to forest successional trends and adverse winters deer populations decreased in the late 1960's. After 1975 deer populations increased primarily due to harvest limitations and less severe winters.

The Moose Lake Area lies within three Deer Management Units: Itasca, Mille Lacs, and Big Woods North. Since deer census information is based on these units, it is difficult to assign deer population figures to the area on a county basis. Harvest data is available by county. In Pine and Kanabec counties the firearms deer harvest has increased from 1,174 deer (antlered bucks) in 1975 to 4,606 (2,961 antlered and 1,645 antlerless deer) in 1982. Archers took 235 deer in 1982 compared to 40 deer in 1977. More intensive harvesting of overmature hardwoods, especially aspen, is needed to increase deer populations in the Moose Lake Area.

Black Bear

The black bear became a game animal in 1971. In the Moose Lake Area the bear harvest has increased from 15 in 1972 to 100 in 1978. In 1979 bear hunting was restricted to a special season and 48 animals were taken. In 1981 the harvest increased to 109 animals. At that time a concern that overharvest might be occurring resulted in a limited permit system of licensing which decreased the harvest to 31 in 1982 and 83 in 1983.

Along with increasing bear populations in recent years increasing amounts of corn and other crops have been grown on farms in central and northern Pine and Kanabec and western Carlton counties. This has led to problems with bear in farm crops especially during berry crop and mast failure years. Management for bear should include early fall seasons, maintenance of oak stands and openings in the forest for mast and berry production, and increased aspen harvest.

Moose

Moose are not considered a game species in the Moose Lake Area. The population is low in Pine County, probably not exceeding 12 animals in the northeast part. The integrity of the present habitat could be maintained by limiting access and development.

Timber Wolf

The population of the timber wolf, a threatened species, is low in the Moose Lake Area. Although the center of this population is primarily the Nemadji State Forest, individuals may range from this area in any direction. Management includes maintaining the integrity of the "remnant wilderness" by limiting access and development.

Snowshoe Hare

This species inhabits spruce swamps, alder thickets, and adjacent woodlands throughout the area. Although no direct data is available, population cycles in the Moose Lake Area have most likely followed statewide trends

with a population high in 1980 and a low at present. Data indicates that approximately 1,500 hunters harvested about 5,000 hares in 1982. The hare is an important food source for species such as the bobcat, coyote, and great horned owl. Primary management for hare is aspen harvest providing a variety of age classes.

Bobcat

In general the bobcat uses the same habitat as the snowshoe hare: spruce swamps, alder thickets, and adjacent uplands. Harvest by both hunting and trapping from 1978 to 1982 totaled 244 animals with the greatest take occurring in 1979 at 68 animals. Population trends on a county basis are not available. In general, management that benefits showshoe hare will benefit bobcats.

Coyote

The coyote is a totally unprotected species and is found throughout the Moose Lake Area, inhabiting virtually all habitat types in varying densities. No population or trend figures are available on a county basis. 1982 data indicate that 386 hunters and trappers took 648 coyotes in the Moose Lake Area. Coyote hunting with dogs is very popular in this area among both local and metropolitan hunters. Management needs include maintenance of a diversity of timber age classes.

Raccoon

The raccoon inhabits lowland forest areas near wetlands, streams, and lakes throughout the Moose Lake Area. No data is available on populations on a county basis but it is likely that local populations have followed statewide trends. 1982 harvest data indicate approximately 450 hunters and trappers took about 1,300 raccoon. Management needs are continued wetland protection and den tree protection during timber harvests.

Red and Gray Fox

Red fox are more numerous than gray fox in the Moose Lake Area, particularly in the agricultural and semi-agricultural habitats. No population data is available on a county basis. Combined harvest figures for 1983 hunting and trapping indicate 298 red fox taken by 91 individuals.

Mink

Mink inhabit wetlands and forests close to streams and lakes throughout the area. Lakeshore and streamfront development can have adverse effects on mink habitat. No census information is available but harvest data for 1982 indicate 154 trappers took 536 mink. Protection of wetlands and maintenance of diverse habitat are management needs for mink.

Muskrats

Muskrats inhabit wetlands, streams, and suitable lakes throughout the area. Muskrat habitat in certain lakes has been affected because of shoreline development. There is no population data on a county basis available in this area and harvest data is limited so trends cannot be established. However, data for 1982 indicates 4,457 muskrats taken by 181 trappers. Management needs include continued protection of wetlands.

Gray and Fox Squirrels

Gray and fox squirrels occur in hardwood stands throughout the area with fox squirrels more abundant in the southern part of the area than the north, but overall less abundant than gray squirrels. Approximately 4,000 hunters harvested about 23,000 squirrels in 1982. Population trends are difficult to predict because of these species' dependence on mast crops. Squirrels near agricultural lands have benefitted from increased corn production. Management needs include maintenance of oak stands and the protection of den trees.

Cottontail Rabbit

The cottontail rabbit is more an inhabitant of brushy field edges in agricultural land than of forest. Information obtained during the August roadside counts indicates that populations started to increase in 1976 and peaked in 1978 and 1981 following mild winters. However, population trends cannot definitely be established because the species appears to be weather dependent. 1982 harvest figures indicate that approximately 1,200 hunters took about 3,500 cottontails in the Moose Lake Area. A management need is maintenance of brushy edges along openings and fields.

Game Birds

Sharp-tailed Grouse

This species has gone from abundant numbers following logging, fires, and early settlement to low populations primarily as a result of forest succession and fire control. At the present time sharp-tailed grouse are associated with tame hay meadows, type 2 wet meadows, and brush land. The census method is spring dancing ground counts and location of new grounds to establish population trends; at present only limited population data has been collected. Management needs include controlled burning of type 2 marshes to inhibit succession to type 6 marshes.

Ring-necked Pheasant

The pheasant is not a forest game bird but occurs within the Moose Lake Area, primarily in southern Pine and Kanabec counties on agricultural land. This area is the northern fringe of pheasant range and populations are dependent to a great degree on winter severity. Populations were high from 1960 to 1963, when censuses showed an average of 168 birds/100 miles. Due to adverse conditions populations were at a low level until 1977 and then peaked in 1981 at 213 birds/100 miles. Poor nesting and wintering conditions have depressed the populations since 1981. Management should include plantings of winter cover and winter food in agricultural areas.

American Woodcock

The woodcock is common in this area which is located on one of the main migration routes for woodcock to and from wintering areas in Louisiana. No population or trend data is available on a county basis. Harvest data indicates that approximately 3,200 woodcock hunters bagged about 17,000 birds in the Moose Lake Area in 1982. Habitat management needs for this species are timber harvest that maintains a variety of age classes in close proximity to openings and maintenance of forest openings as singing grounds.

Waterfowl

The 2,805 acres of type 3, 4, and 5 wetlands and smaller wetlands, including beaver dams found in the area, do not provide the habitat base needed to produce numerous waterfowl. However, ducks are produced--primarily mallards, blue-winged teal, and wood ducks in the marshes, beaver dams, and streams. There is also some production on the marginal habitat of fish lakes. Canada goose production is present but not widespread, and is generally associated with the semi-agricultural areas.

No production data is available, but 1982 harvest data indicate that approximately 13,650 ducks and 450 geese were bagged by 1,800 hunters. Most of the harvest consists of local birds with the exception of diving ducks which use northern lakes during migration.

Management needs include continued protection of wetlands, management of water levels where feasible, retention of nesting cavity trees, artificial nest box placement, and development of grassland nesting cover.

Nongame Wildlife Species

Little intensive survey work directed specifically at the nongame wildlife resource has been conducted either recently or historically within the Moose Lake Area. Consequently, much of what follows is based on recent but limited studies, old records, state park inventories, and/or an assessment

of what is likely to occur in the area (see Appendix 3 for list of references and sources of information).

Endangered and Threatened Species

Peregrine Falcon (Falco peregrinus)

Endangered (federal and state). Although this falcon no longer nests in Minnesota, it is a regular migrant in the St. Croix River Valley. It is unlikely that forest management activities would affect this species.

Bald Eagle (Haliaeetus leucocephalus)

Threatened (federal and state). No active eagle territories are currently known within the Moose Lake Area, but there are frequent summer reports of the species in the area, especially along the St. Croix River Valley. The bald eagle is increasing in numbers and expanding its range in Minnesota, reoccupying areas that it formerly occupied in the early 1900's. Portions of Pine, Kanabec and Carlton counties may provide nesting habitat, especially if red and white pines are allowed to mature to nest-tree size. Two active eagle territories are presently known from northern Carlton County and another two from Chisago County.

Gray Wolf (Canis lupus)

Threatened (federal and state). Occasional sightings of wolves have been reported from remote, heavily forested areas in the Nemadji State Forest.

Loggerhead Shrike (Lanius ludovicianus)

Threatened (state). This species has undergone a dramatic decline in the last 15 years. It was formerly considered a regular breeding species in the St. Croix River Valley and surrounding counties. It is now considered a rare migrant. Survey work needs to be conducted to determine if this species still occurs in the Moose Lake Area. The shrike's preferred habitat is open country, farmsteads, and shelterbelts.

Wood Turtle (Clemmys insculpta)

Threatened (state). There are three records of this species from Pine County between 1936 and 1977 (Table 1). The Wood Turtle is semi-terrestrial preferring small, fast-moving streams in relatively undisturbed areas of deciduous and coniferous forests. It seems that much available habitat for this turtle still remains in east-central Minnesota, especially in the Moose Lake Area. Survey work needs to be done to determine the distribution and abundance of this species in Pine County and surrounding areas.

Blandings Turtle (Emydoidea blandingii)

Threatened (state). There are also three records of this turtle available for Pine County from 1937 to 1980 (Table 1). This species is a marsh inhabitant requiring large expanses of marsh and floating sedges with adjacent elevated sand dunes for nesting. Survey work is also needed on to determine its occurrence and abundance.

Special Species of Concern

American Bittern (Botaurus lentiginosus)

This inconspicuous marsh bird is considered a regular nester in the Moose Lake Area. It has declined in numbers statewide in recent years.

Red-shouldered Hawk (Buteo lineatus)

Although this species has never been common in Minnesota in historical times, it has declined markedly since the 1940's. The decline is attributed largely to the conversion of expansive forested bottomlands into transitional habitats dotted with large pastures and clearings. The species is considered a regular nester in the St. Croix River Valley but on the northern edge of its range in Pine and southern Carlton counties.

Table .. Known occurrences in the Moose Lake Area of plant communities, wildlife species, and plant species that are threatened or of special concern in Minnesota.

Plant Community or Species	County	Area of Occurrence	Legal Description	Threatened[2]	Special Concern[2]	Comments
Floodplain Forest[1]	Pine	Kettle River SNA	T141N R20W - Secs 10, 15, 22			195 acres
Red Pine Forest	Pine	Kettle River SNA	T141N R20W - Secs 10, 15, 22			30 acres
Floodplain Forest	Pine	St. Croix St. Park	T41N R17W - Secs 32, 33, 34			560 acres
Deciduous Swamp	Pine	St. Croix St. Park	T41N R17W - Secs 32, 33, 34			acreage unknown
Forested Bog	Pine	Kerrick Bog	T45N R18W - Secs 35, 26			300 acres
Northern Hardwoods	Pine	Adjacent to Banning St. Park	T43N R20W W1/2 - Sec 13			acreage unknown
White & Red Pine Forest	Pine	SE of Sturgeon Lake	T45N R19W - Sec 21			50 acres
Bog	Pine	Black Lake	T45N R16W - Secs 25, 24 T45N R15W - Secs 18, 19, 30			acreage unknown
Water-willow	Pine	Upper Pine Lake	T43N R21W NE1/4, NE1/4 - Sec 20		X	
Halberd-leaved Tearthumb	Pine	St. Croix St. Park	T40N R17W NW1/4, SW1/4 - Sec 4			
Eastern Hemlock	Pine	-	T43N R21W SW1/4, NE1/4 - Sec 8		X	
Eastern Hemlock	Pine	-	T45N R16W SW1/4, NE1/4 - Sec 30		X	
Eastern Hemlock	Pine	-	T41N R17W		X	
Eastern Hemlock	Kanabec	-	T42N R24W - Sec 21		X	
American Bittern	Pine	Chengwatana St. Forest	-		X	
Great Blue Heron	Pine	McDermott	NW 27 T44N R16W			7 nests
Great Blue Heron	Pine	Nemadji	T44N R16W - Sec 24			15-25 nests
Great Blue Heron	Pine	Ditchett	T44N R16W - Sec 18			25 nests

Continued

Table 1. Continued.

Plant Community or Species	County	Area of Occurrence	Legal Description	Threatened[2]	Special Concern[2]	Comments
Great Blue Heron	Pine	Kettle River 1	SW NW23 T41N R20W			17 nests
Great Blue Heron	Pine	Kettle River 2	SW26 T41N R20W			12 pairs
Great Blue Heron	Carlton	Hillman	T41N R24W			size unknown
Sandhill Crane	Kanabec	Pomroy Township	T41N R22W		X	
Sandhill Crane	Kanabec	Whited Township	T40N R23W		X	
Sandhill Crane	Kanabec	Kroschel Township	T42N R22W		X	
Sandhill Crane	Pine	Sandstone Township	T42N R19W		X	
Sandhill Crane	Pine	Danforth Township	T42N R18W		X	
Sandhill Crane	Pine	Clover Township	T41N R18W		X	
Sandhill Crane	Pine	Wilma Township	T42N R17W		X	
Sandhill Crane	Pine	Pine City Township	T38N R20W - Sec 20		X	
Sandhill Crane	Pine	Ogema Township	T41N R16W - Sec 16		X	
Sandhill Crane	Pine	Arma Township	T42N R16W - Sec 16		X	
Osprey	Pine	St. Croix St. Forest	T41N R17W - Sec 24		X	
Louisiana Waterthrush	Pine	St. Croix St. Park	T40N R17W - Sec 33		X	
Louisiana Waterthrush	Pine	St. Croix St. Forest	T41N R16W - Sec 7		X	
Louisiana Waterthrush	Pine	Kettle River SNA	T41N R20W - Sec 23		X	
Louisiana Waterthrush	Pine	Nemadji State Forest	T44N R16W - Sec 28		X	

Continued

Table 1. Continued.

Plant Community or Species	County	Area of Occurrence	Legal Description	Threatened[2]	Special Concern[2]	Comments
Wood Turtle	Pine	Hay Creek	T42N R16W	X		
Wood Turtle	Pine	St. Croix St. Park	T40N R18W	X		
Wood Turtle	Pine	Upper Tamarack River	T42N R16W - Sec 25	X		
Blanding's Turtle	Pine	Bear Creek	-	X		
Blanding's Turtle	Pine	Pine City	NE27 T39N R21W	X		
Blanding's Turtle	Pine	St. Croix State Park	NW33 T41N R17W	X		
Bat Cave	Pine	Banning State Park	NW10 T42N R20W			Winter hibernacula for Keen's Myotis, Little Brown Bat, and Big Brown Bat

[1] Ranks for natural community types are program - defined and do not represent an official federal or state status (i.e., no legal status exists). As was stated in the text, too little information is available on these sites in the Moose Lake Area to determine their program - defined status.

[2] Threatened and Special Concern are both legal status categories in Minnesota.

Osprey (Pandion haliaetus)

Nesting has been documented in Pine County with one active nest on the south boundary of St. Croix State Forest (Table 1). Much of the Moose Lake Area contains habitat suitable for ospreys and it is likely that there are other active territories not yet documented.

Sandhill Crane (Grus canadensis)

Although it formerly occupied much of the western and central portions of the state, the sandhill crane's range is now considerably reduced and limited to portions of extreme northwest Minnesota and east-central Minnesota. Much of the Moose Lake Area lies within the center of the east-central population. Numerous summer reports are available from Pine and Kanabec counties with confirmed or inferred breeding in Pine County (Table 1).

Upland Sandpiper (Bartramia longicauda)

Green and Janssen (1975) considered the upland sandpiper "very scarce" in Pine County. Whether it currently occurs in the county or not has not been well-documented. Preferred habitat is grasslands and low grass meadows.

Wilson's Phalarope (Phalaropus tricolor)

In 1971 and 1972 this species was found nesting in rice paddies in Aitkin County. Records from Crex Meadow (Burnett Co., WI) indicated it nested there in 1972 and 1974 (Faanes 1981). No records are available for Pine, Kanabec, or Carlton counties. Preferred habitat is shallow water of ponds or lakes interspersed with wet-meadow vegetation.

Short-eared Owl (Asio flammeus)

The short-eared owl was a common and widespread summer resident in the first half of this century when it occurred widely and was frequently observed throughout much of the state. It is now uncommon to rare in the summer. It is not known if this owl now occurs in the Moose Lake Area.

Louisiana Waterthrush (Seiurus motacilla)

This is another species whose range and abundance has declined dramatically in Minnesota in the last 50 years. Recent reports have documented this species' occurrence in Pine County (Table 1).

Snapping Turtle (Chelydra serpentina)

The snapping turtle has been reported in both Pine and Carlton counties. There is concern for this species regarding the effects of commercial harvest on local populations and the effects of PCB contamination on turtle consumers. The preferred habitat of this turtle is slow-moving, quiet water with muddy bottoms.

Fox Snake (Elaphe vulpine)

The fox snake has been reported in Pine County. It is associated with woody rock bluffs along larger streams and adjacent moist lowlands. There is a lack of information on this species.

Eastern Hognose Snake (Heterodon platyrhinos)

This snake has also been reported in Pine County. It occurs in deciduous forest, mixed deciduous and coniferous forest, sandy regions and river valleys. There is a lack of information on this species as well.

Colonial Waterbird Nesting Sites

Six small Great Blue Heron colonies have been identified in the Moose Lake Area, five in Pine County and one in Carlton County (Table 1). Because of the general inaccessibility of these colonies, most have not been inventoried recently. It is possible that other small colonies may be present and/or that some of these sites may no longer be active. The Great Blue Heron is not a state listed species but is included here because its colonial nesting habits cause it to be vulnerable to disturbance.

Bat Caves

Recent survey work has identified Robinson's Ice Cave within Banning State Park as an active winter hibunacula for three bat species: the little brown bat (Myotis lucifugus), the big brown bat (Eptesicus fuscus), and Keen's myotis (Myotis keeni). The latter is officially listed as a species of special concern in Minnesota. In general, bat caves are a feature of special interest in the state.

Native Plants and Natural Communities of Special Concern

Natural Communities

The Moose Lake Area has not received a complete plant community survey, in part because the majority of the vegetation types here are not considered endangered. Future inventory efforts in the region should concentrate on old growth stands of White or Red Pine Forest and Northern Hardwood-Conifer Forest.

Five occurrences of special natural community types are registered in the Natural Heritage Program's database. In a number of cases too little information is available on the sites to determine if they are of high enough natural quality to be considered ecologically sensitive. Each occurrence is listed in Table 1 and discussed in Appendix 2.

Native Plants

Historically the Moose Lake Area has received only casual attention by botanists. Until recently very little floristic data has been available. Since 1980 there has been three intensive, but limited floristic surveys. This recent research, coupled with the meager historical data available, documents the occurrence of three plants officially listed as special concern species in Minnesota Decodon verticileatus (Water-willow), Ploygonum arifolium (Halberd-leaved tearthumb), and Tsuga canadensis (Eastern Hemlock). Each occurrence is listed in Table 1 and discussed in Appendix 2.

Fish and Wildlife Needs

There are three major ways to meet prospective demands for fish and wildlife conservation, fishing, hunting, and wildlife observation in the Moose Lake Area: 1) habitat retention, 2) habitat management, and 3) research.

Habitat Retention

Maintaining high water quality is especially important in retaining fisheries and also benefits wildlife that live in the water or feed on fish. Maintaining forest or other vegetative buffer strips along streams and around lakes is highly beneficial to fish as well as to aquatic and riparian wildlife. These buffer strips help shade the water, control erosion, maintain water quality, and provide habitat.

Type 3, 4, and 5 wetlands less than 10 acres in size in rural areas need legal protection. Because of their importance to many kinds of fish and wildlife, protection should be expanded to include other wetland types, especially type 2 and 6 wetlands.

Wildlife and fisheries managers and foresters could become more involved in influencing local planning decisions and increasing the awareness of developers, farmers, and local planning commissions about the effects of forest land conversion on fish and wildlife. Nonindustrial private forest landowners could be encouraged to maintain the forest cover on their land through improved property tax incentive programs and increased financial and technical assistance using fish and wildlife as well as forestry cost-share programs.

Habitat Management

Coordination of timber, wildlife, and fisheries management activities in the Moose Lake Area is extremely important in maintaining and improving fish and wildlife habitat. Northern pike spawning marshes and trout streams are especially vulnerable and should be protected during forest management activities. The DNR's Forestry/Wildlife Guidelines to Habitat

Management should be followed to as great an extent as possible in forest and wildlife management, especially on state land. The effects of wildfire control on forest and wetland habitats in the Moose Lake Area should receive more research emphasis, particularly with respect to impacts on sharp-tailed grouse and sandhill crane populations. A greater effort should be made to use and evaluate the effects of prescribed burning in selected habitats in the Moose Lake Area.

"Remnant wilderness" in the Nemadji State Forest has been mentioned previously in the context of habitat for moose and timber wolves. It is important to maintain this habitat for those species less tolerant of human activity as well as for those people who enjoy solitude in the outdoor experience. The Moose Lake Area is heavily used during the hunting season, with most of the forested land accessible through road and trail systems. In a "remnant" wilderness area access should be limited and any trails or development work carefully planned.

Research

Additional inventory work is needed on virtually all of the plant and animal species in the Moose Lake Area that are endangered, threatened, or of special concern. Surveys of remnant old growth stands of White and Red Pine Forest and Northern Hardwood-Conifer Forest are also needed. Forest managers need to be informed about the location of unique natural features in order to protect them during management activities.

RECREATION

The Moose Lake Area lies between the two largest population centers in Minnesota, the Twin Cities metropolitan area and Duluth. Major access to the area is provided by Interstate Highway 35, with driving times ranging from one to two hours, depending on destination, from both cities. The area itself is sparsley populated and its forested lands and water resources provide an excellent base for outdoor recreation.

RECREATIONAL AMENITIES

The area's large public land base, most of which lies in 8 state forests, provides opportunities for dispersed recreation activity such as hunting and nature observation, as well as providing the land area necessary for trail networks.

The major recreational amenities in the area include the St. Croix, Kettle, and Snake rivers. The St. Croix is a National Wild and Scenic River, the Kettle is a State Wild and Scenic River, and all three rivers are state canoe and boating routes. Small lakes in the area also provide recreation opportunities. Major recreational amenities in counties surrounding the Moose Lake Area include the St. Louis and Rum rivers, Lake Superior and Lake Mille Lacs.

AREA RECREATION FACILITIES

The Moose Lake Area contains a number of well developed recreational facilities (Table ___). Most major public facilities are administered by the Minnesota Department of Natural Resources. The DNR, Division of Parks and Recreation administers the 31,482 acre St. Croix State Park, the 4,351 acre Banning State Park, and the 951 acre Moose Lake State Recreation Area. The DNR's Trails and Waterways Unit has responsibility for most area public water accesses, the Minnesota/Wisconsin Boundary Trail, canoe and boating route rivers and campsites, and many miles of grants-in-aid trail. The DNR, Division of Forestry administers 6 campgrounds, one day use area and 130 miles of trail.

Other major public recreation providers include the National Park Service, which administers the St. Croix National Wild and Scenic River; the Minnesota Department of Transportation, which provides highway rest areas; and local units of government, which provide county and municipal parks. The National Park Service is also the lead agency for the North Country Trail which is proposed to pass through the Moose Lake Area.

Private sector recreation includes 18 campgrounds and 3 group camps with 825 and 467 sites, respectively. Private resorts are few.

Major recreation facilities in counties surrounding the Moose Lake Area include Jay Cooke, Wild River, Father Hennepin and Mille Lacs Kathio state parks and the Spirit Mountain recreation area which is administered by the city of Duluth.

Table ___. Summary of Moose Lake Area Recreation Facilities.

Type of Facility	Carlton County*	Kanabec County	Pine County	Total
State Forests	2 - 9,712 ac.	2 - 11,176 ac.	5 - 128,766 ac.	8 - 149,654 ac.
Wildlife Management Areas	1 - 160 ac.	8 - 9,076 ac.	9 - 1,388 ac.	18 - 10,624 ac.
Wildlife Refuges (Nat.)	---	---	1 - Sandstone NWR	1
Trails				
X-C Skiing	1 - 4.0 mi.	---	3 - 34.0 mi.	4 - 38.0 mi.
Interpretive	---	---	3 - 12.0 mi.	3 - 12.0 mi.
Hunting	---	---	---	40 - 963.5 mi.
Horseback Riding	---	---	5 - 149.8 mi.	5 - 149.8 mi.
Biking	---	---	1 - 6.0 mi.	1 - 6.0 mi.
Snowmobiling	6 - 204 mi.	2 - 22.9 mi.	10 - 289.0 mi.	18 - 515.9 mi.
Hiking	1 - 1.0 mi.	1 - 1.0 mi.	7 - 239.8 mi.	9 - 241.8 mi.
State Parks	1 - 951 ac.	---	2 - 35,832 ac.	3 - 36,783 ac.
Rest Areas	1 - 11.0 ac.	2	9	12
County Parks	1	1	---	2
Municipal Parks	1	7	9	17
Campgrounds				
Public	2	---	9	11
Private	2	6	10	18
Public Group	---	---	3	3
Private Group	2	---	7	9
Canoe Campsites	---	---	5	5
Campsites				
Public	58	---	309	367
Private	55	365	405	825
Public Group	---	---	467	467
Private Group	247	---	427	674
Canoe Public	---	---	---	---
Beaches				
Public	3	---	1	4
Private	5	---	16	21
Picnic Grounds				
Public	4	---	13	17
Private	3	---	6	9
Picnic Sites				
Public	74	---	114	188
Private	8	---	99	107
Monuments	1	---	4	5
Wild and Scenic Rivers	---	---	2	2 - Snake-Kettle
Canoe and Boating Routes	---	---	3	3
Scientific and Natural Areas	---	---	1	1 - Kettle River
Public Accesses	---	11	28	42

*T46N and T47N, Range 15W-21W.

Source: MN DNR, Office of Planning. State Comprehensive Outdoor Recreation Plan (SCORP) 1978.

PROJECTIONS FOR FUTURE RECREATIONAL DEMAND

The State Comprehensive Outdoor Recreation Plan (MN DNR, Office of Planning, 1979) projects the needs for outdoor recreation in Minnesota and for eleven economic development regions within the state. These projections must be considered along with the existing supply of and demand for recreational facilities and amenities in the area in order to accurately determine development needs and priorities. A summary of some of the projected recreational needs and opportunities for the Moose Lake Area as listed in SCORP follows in Table ___.

Table ___. Projections of Summer and Winter Recreation Occasions Occurring in Region 7E*

Activity	1978	1980	% Change 78-80	1985	% Change 80-85	1990	% Change 85-90	1995	% Change 90-95
Backpacking	15763	16000	1.5	16389	2.4	16596	1.3	16432	-1.0
Recreation Bicycling	1319822	1316521	-0.3	1381994	5.0	1549162	12.1	1711415	10.5
Camping	372990	379783	1.8	398585	5.0	421857	5.8	441220	4.6
Stream Canoeing	63851	66133	3.6	69566	5.2	72283	3.9	74700	3.3
Hiking	195059	200532	2.8	212371	5.9	229971	8.3	247155	7.5
Horseback Riding (trail)	67117	68196	1.6	73799	8.2	87190	18.1	98050	12.5
Picnicking	331162	339004	2.4	365198	7.7	397433	8.8	416265	4.7
Swimming	917577	917071	-0.1	928493	1.2	998241	7.5	1081171	8.3
Trail Biking	25154	24234	-3.7	25972	7.2	30259	16.5	33662	11.2
Cross Country Skiing	73853	77190	4.5	83087	7.6	92987	11.9	95542	2.7
Snowmobiling	656448	566719	0.2	618897	9.2	692591	11.9	742894	7.3

*Region 7E includes Pine, Kanabec, Mille Lacs, Isanti and Chisago counties.

Source: MN DNR, Office of Planning, 1978. State Comprehensive Outdoor Recreation Plan (SCORP).

Based on these projections the SCORP report recommends substantial increases in snowmobile and hiking trail mileage, hunting availability, swimming and bicycling opportunities, and in the development of camping and picnic facilities. Also recommended are efforts to increase the number and awareness of public water accesses for canoe and boating use.

Proposals to develop additional recreation facilities and expand recreational opportunities in the Moose Lake Area must consider current and potential use of existing facilities, natural features in the area, emerging social and economic trends, and changing public preferences for outdoor recreation. Opportunity also exists to increase public awareness of existing recreational facilities through advertising, signing, mapping and better information distribution.

RECREATION POTENTIALS

The recreation resources of the Moose Lake Area differ greatly from those found in other parts of the state. Given current trends concerning the desired recreational outings, energy availability and pricing, and this region's relatively close proximity to the metropolitan area, the resources of this region may be given a second look by recreators, both regional citizens and tourists.

The region's woodlands offer a wide range of recreation potentials. A good portion of this area is presently in state forests and wildlife management areas. The Snake River State Forest in Kanabec County and the Nemadji State Forest in Pine County have recreation potential in terms of additional trail development, both summer hiking and winter cross-country skiing. Northern Kanabec County contains extensive mixed forested areas of rolling topography, with outstanding potential for cross-country ski trail development. An annual ski race drawing international competitors is held in this area.

The Snake River, St. Croix and Nemadji state forests exhibit potential as overnight camping areas. The numerous smaller pools and streams of these areas have value as semi-primitive campgrounds. This type of camping

experience with emphasis on nature observation and limited dependency on motorized recreation is increasing in popularity.

Statewide interest in cross-country skiing indicates that additional facilities are necessary. The St. Croix State Forest in Pine County as well as the Chengwatana State Forest in Pine County have potential for additional trail development for cross-country skiing.

Another major water related resource of the region is its many miles of rivers. Their recreation potential lies in their development as canoeing routes for nature observation and fishing. The potentials of the St. Croix have been realized for some time. The designation of the St. Croix as a National Scenic Riverway should assure that the river will be able to accommodate the recreation use given it, while not suffering from overuse.

The region contains two designated State Wild and Scenic Rivers, the Kettle River and the Rum River. The Snake River in Pine and Kanabec counties should be considered for improved management practices.

In addition, Pine and Kanabec counties contain many smaller lakes with potential as fishing lakes. Many of these lakes are too small for active recreation associated with larger lakes, such as water skiing and pleasure boating. Their greatest potential lies in retainment as exclusively fishing lakes. Quite often the atmosphere and surroundings desired by the fisherman are different than that desired by the recreation boater, and quite often the two are incompatible. Public access development on many of the region's smaller lakes would provide expanded facilities for local and non-local fishermen.

Opportunities for Future Recreation Development

Forestry administered lands in the Moose Lake Area offer a number of potential recreation opportunities. Some of these opportunities have the ability to fulfill immediate recreation needs. Others are available if future recreation demand indicates. Before any new development of a substantial nature can take place the Minnesota Outdoor Recreation Act (MN Stat. 85A) requires that a Recreational Sub-Area Plan be completed.

o St. Croix State Forest Backpacking System

The opportunity exists in St. Croix State Forest to provide an excellent backpacking and remote camping system along the Lower Tamarack River. A system similar was called for in the Upper St. Croix Resources Management Plan which was prepared by the Minnesota Department of Natural Resources in 1974. There are only a few facilities in the state of Minnesota that have been specifically developed for backpacking. Most of these are beyond the weekend driving range of most potential users. If developed, the St. Croix system would be in easy weekend reach of Twin Cities metropolitan area residents.

o Canoe and Boating Route Campsites

Division of Forestry lands along the St. Croix and Upper Snake rivers have potential to be developed as canoe campsites. Locations in the Nemadji and Snake River state forests should be surveyed by the DNR, Trails and Waterways Unit for possible development.

Campground and Day-Use Areas

The following sites show potential for development as campgrounds and day-use areas because of a geographic proximity to open water, topographical characteristics, drainage characteristics and vegetative makeup. Included with each site location is a generalized description of the type of recreational facility which may be possible.

Body of Water	State Forest	Twp. & Range	Possible Use
Delong Lake	Nemadji	T45 R17 Sec. 10	Small campground
Little Tamarack Lake	St. Croix	T42 R17 Sec. 33	Campground-12 to 15 sites
Graces Lake	St. Croix	T42 R17 Sec. 36	Small campground
Hay Creek Flowage	St. Croix	T42 R16 Secs. 19-20 and 29-30	Campground
St. Croix River	St. Croix & Chengwatana	---	Canoe campsites, NPS cooperation
Kettle River	Chengwatana	---	Canoe campsites
Snake River	Snake River	---	Canoe campsites
St. Croix River	Chengwatana	T38 R20 Secs. 24-26-34	Campground, NPS cooperation
Dago Lake	C.C. Andrews	T45N R19E Sec. 30	ORV campground

Dispersed Recreational Activities

Much of the land which lies in the Moose Lake Area's state forests is found in large, contiguous administrative blocks. Most of these blocks presently have some type of trail development. However, there is potential to substantially increase trail mileage for all types of use if need warrants. The development of individual campsites along these trails is also a possibility. Areas that have no trails presently and show good potential for development are the Snake River State Forest and scattered forestry parcels along the Nemadji River. These parcels are separated largely by county and tax-forfeited lands administered by Carlton County.

Insect and Disease Management Guidelines

Direct control of insect and disease agents in established stands can be a controversial, difficult, and expensive process. The proper implementation of silvicultural guidelines can reduce the severity of insect and disease outbreaks. Integrated pest management (IPM) is an approach to insect and disease control that utilizes a combination of cultural, biological, chemical, and/or mechanical techniques to achieve economical control in an environmentally sound manner. Integrated pest management can reduce the

occurrence, severity, and spread of insect and disease problems and thereby lessen the problems associated with direct control.

The difficulty in instituting an integrated pest management program is that each stand must be considered both individually and as a part of the whole forest. Stand planning and regeneration is an extremely important aspect of cultural control. All stand manipulations affect the occurrence and severity of insects and disease. Once a stand is established many of the parameters governing insect and disease control are unalterable. In developing silvicultural guidelines species selection, regeneration methods, site characteristics, potential and historical pest problems, future stand manipulations, desired products, economics, rotations, and harvesting techniques must be considered. Prevention or suppression of future pest problems by integrated pest management techniques must be a major goal in forest management.

Specific pest management guidelines must be developed for individual stands. However, some general integrated pest management guidelines exist:

1. Consult with regional insect and disease specialists in future stand management planning, or when problems occur in established stands.
2. Check all stands routinely for insects and disease. Promptly remove, destroy, or chemically treat infested material where economically feasible.
3. Utilize regeneration methods that reduce or eliminate insect and disease potential for attack of young seedlings.
4. Favor insect and/or disease resistant species, or varieties.
5. Avoid replanting susceptible species in areas of historical insect or disease problems without an evaluation of cause.
6. Do not mix species which have common insect and disease problems.
7. Match tree species to the planting site.
8. All management practices must be aimed at promoting stand vigor:
   a. use proper planting techniques
   b. manipulate rotation age
   c. maintain proper stand density
9. Avoid planting in frost pockets.

10. Avoid wounding growing stock during thinning or harvesting operations.
11. Diversify species whenever possible.

II. ADMINISTRATION OF RESOURCES AND PROGRAMS

A. LAND ADMINISTRATION

DEPARTMENT OF NATURAL RESOURCES

The DNR administers 223,748 acres of land in the Moose Lake Area. This includes 19,127 acres in southern Carlton County, 23,547 acres in Kanabec County, and 181,074 acres in Pine County. Approximately 90 percent of the DNR administered lands are included in management units such as state forests, state parks, and wildlife management areas. Table ___ lists the DNR management units located in the Moose Lake Area. The 10 percent of the DNR administered lands outside of management units consists of tracts ranging in size from a few hundredths of an acre to several hundred acres. The lands outside of management units are administered by the Division of Forestry. The lands administered by the various DNR divisions are described in greater detail below.

Division of Forestry

The Division of Forestry administers all or part of eight state forests located in the Moose Lake Area. There are also nine parcels of Administrative and Scattered State Forest land in the area. The Administrative and Scattered parcels are office and fire tower sites. The division administers 149,713 acres, or 82 percent of the land within the statutory boundaries of the state forests. The remaining land within state forests is primarily private land. The current boundaries of all state forests are described in Minnesota Statutes Section 89.021.

The Chengwatana State Forest is located along the Kettle and St. Croix rivers in southeastern Pine and northeastern Chisago counties. The Chengwatana State Forest was established by the legislature in 1953 (Minn. Laws 1953, Chapter 292). At that time the forest consisted of portions of Chengwatana and Munch townships. In 1963 the forest was expanded (Minn. Laws 1963, Chapter 332) to include land along the St. Croix River in southeastern Pine and northeastern Chisago counties. The Pine County portion of the forest contains approximately 23,360 acres, of which 16,377

are administered by the Division of Forestry. Over 12,000 acres are tax-forfeited lands managed by the state (50-50 lands). The remaining division administered lands consist of gift, trust fund and purchased land. The 600 acre Rock Wildlife Management Area administered by the Division of Fish and Wildlife is located within the forest boundary.

The Daughters of the American Revolution (D.A.R.) State Forest is located north of Askov on State Trunk Highway 23 in Partridge Township. The D.A.R. was instrumental in the establishment of this forest in 1943 (Minn. Laws 1943, Chapter 171). The division administers 360 of the 640 acres within the statutory boundary. All of the state land in the forest is school trust fund land.

There is a 40 acre portion of the Fond du Lac State Forest in the Moose Lake Area. The rest of this forest is located in northern Carlton and southern St. Louis counties. This parcel in Skelton Township was acquired as a Land Utilization Project.

The General C.C. Andrews State Forest is located along Interstate 35 between Willow River and Sturgeon Lake. There is also a non-contiguous section lying about 4 miles east of the main part of the forest. Established in 1943 (Minn. Laws 1943, Chapter 171), the forest was named for Christopher Columbus Andrews, a Civil War veteran and an early proponent of forestry in Minnesota. One of the two state tree nurseries is located in the forest. The division administers 5,213 of the 7,760 acres within the statutory boundary. The division administered land consists of purchased land (2,253 acres), 50-50 tax-forfeited land (1,653 acres), and school trust fund land (1,307 acres).

The Nemadji State Forest is located along the Minnesota-Wisconsin boundary in southern Carlton and northern Pine counties. The forest was originally established in 1935 (Minn. Laws 1935, Chapter 372). The forest boundary encompasses 97,040 acres of which 90,480 are administered by the Division of Forestry. Almost all of the division's land in the forest is either 50-50 tax-forfeited or trust fund land.

The Rum River State Forest is located in western Kanabec and eastern Mille Lacs counties. The Kanabec County portion of the forest consists of 4,000 acres in Kanabec and Ann Lake townships. There is a non-contiguous section of the forest lying within the boundaries of the Mille Lacs Wildlife Management Area. The Division of Forestry administers 3,357 acres in the Kanabec County portion of the forest including 2,387 acres of trust fund land and 970 acres of 50-50 tax-forfeited land.

The St. Croix State Forest is located along the St. Croix River in east central Pine County, north of State Trunk Highway 48. The St. Croix State Forest was established in 1931 (Minn. Laws 1931, Chapter 124). The forest contains 42,105 acres of which 26,048 are administered by the division. The division administered lands include 4,339 acres of trust fund land, 21,703 acres of 50-50 tax-forfeited, and 6 acres of purchased land.

The Snake River State Forest is located in northern Kanabec County. Established in 1969 (Minn. Laws 1969, Chapter 257), the Snake River is Minnesota's newest state forest. The Division of Forestry administers 7,819 of the 8,320 acres within the forest boundary. There are 7,497 acres of 50-50 tax-forfeited land, 282 acres of trust fund land, and 40 acres of purchased land administered by the division. The 200 acre Bean Dam Wildlife Management Area is also located within the state forest boundary.

There are 22,690 acres of Division of Forestry administered land outside of state forests in the Moose Lake Area. This includes 7,429 acres in southern Carlton County, 3,246 acres in Kanabec County, and 12,015 acres in Pine County. All of this land is school, swamp, or indemnity school trust fund land.

There are 1,091 acres of land in Pine County that are coded as "Department Administered" on the DNR Land Ownership/Classification Report. These parcels are primarily located in the St. Croix State Forest and were acquired as a gift.

Division of Fish and Wildlife

The Division of Fish and Wildlife - Section of Wildlife manages 19 Wildlife Management Areas (WMA) within the Moose Lake Area. Wildlife Management Area boundaries are established by Commissioner's Order issued pursuant to Minnesota Statutes Sections 97.48, Subdivision 13 and 97.481. The WMA's are managed in accordance with Department Policy #15 entitled Wildlife Management Areas.

The only WMA in southern Carlton County is the 160 acre Dye WMA in Barnum Township. The lands in this WMA were acquired through transfer of administrative control.

There are nine WMA's in Kanabec County with a total of 12,134(?) acres inside their boundaries of which the Division of Fish and Wildlife administers 9,077 acres (see Table ___). These lands were acquired by condemnation (5,173 acres), county board resolution (758 acres), purchase (2,718 acres), transfer of administrative control (11 acres), federal deed or patent (40 acres), and condemnation of state land (377 acres).

Pine County has nine WMA's with a gross acreage of 1,389 acres, all of which are administered by the division. These lands were acquired by county board resolution (1,301 acres), purchase (42 acres), and transfer of administrative control (46 acres).

The Division of Fish and Wildlife administers the Kettle River Scientific and Natural Area (SNA) in Pine County. The division administers 593 of the 761 acres within the SNA. All of the land in this SNA was acquired as a gift.

The Division of Fish and Wildlife - Section of Fisheries administers certain lands in the Moose Lake Area as spawning areas, lake or stream improvement projects, and fish rearing ponds. Fisheries administered lands include 781 acres in southern Carlton County, 34 acres in Kanabec County, and 275 acres in Pine County. These lands were acquired by county board resolution (909 acres), gift (20 acres), and purchase (161 acres).

Division of Parks and Recreation

There are three state parks within the Moose Lake Area. The Division of Parks and Recreation administers 36,783 acres within these parks. The boundaries of state parks are established by the legislature. The lands within each park are described in the session laws establishing or changing park boundaries. State parks are managed in accordance with Department Policy #13 entitled Natural State Parks or Department Policy #14 entitled Recreational State Parks and the management plan for each park.

Banning State Park is located along the Kettle River between Sandstone and Rutledge. The park was established in 1963 and expanded in 1965, 1967, and 1969. The DNR administers 4,351 of the 5,899 acres within the statutory boundary. The method of acquisition of the park lands are gift (166 acres), county board resolution (634 acres), purchase (3,384 acres), and federal deed or patent (167 acres). Recommended park management activities are described in A Management Plan for Banning State Park (MN DNR, Office of Planning, 1980).

The Moose Lake State Recreation Area is located along Interstate Highway 35 east of the city of Moose Lake. This state recreation area was established in 1971 when custodial control of surplus Moose Lake State Hospital lands was transferred to the DNR. The DNR Office of Planning is currently developing a management plan for the recreation area.

The St. Croix State Park is located along the St. Croix River south of Trunk Highway 48. The St. Croix State Park was established in 1943 when the National Park Service transferred its interest in the St. Croix Recreational Development Project lands to the state. There have been subsequent additions to the park which now has 34,037 acres within its boundary. The land status of division administered lands in the park is gifts (6,439 acres), condemned land (40 acres), county board resolution (4,414 acres), purchase (670 acres), federal deed or patent (18,488 acres), and condemned state land (1,520 acres). Proposed management activities for St. Croix State Park are listed in the Upper St. Croix Resource Management Plan (MN DNR, 1974).

Trails and Waterways

The Trails and Waterways Unit is responsible for administering state trail, water access site, and wild and scenic river lands in the Moose Lake Area. The Minnesota-Wisconsin Boundary Trail right-of-way in Pine and Carlton counties currently consists of 605 acres. Proposed development of the trail is outlined in the Master Plan for the Minnesota-Wisconsin Boundary Trail and West Addition (MN DNR, Trails and Waterways, 1982). There are 497 acres in Pine County that have been acquired along the Kettle Wild and Scenic River. There are 16 DNR administered water access sites outside of other DNR management units in the Moose Lake Area (see Table ___).

Other DNR Administered Lands

There are 5.81 acres of Division of Waters administered land at the dam on the Willow River in the city of Willow River.

Table ___. DNR Management Units in the Moose Lake Area.

Management Unit Type and Name	County	Boundary Acreage(10)	DNR Acreage(1)
STATE FORESTS			
Chengwatana[2]	Pine	23,360	16,377
D.A.R.	Pine	640	360
Fond du Lac[2]	Carlton	40	40
General C.C. Andrews	Pine	7,680/ 7,760(?)[11]	5,213
Nemadji	Carlton/ Pine	97,040	90,480[3]
Rum River	Kanabec	4,000	3,357
St. Croix	Pine	42,105[13]	26,048
Snake River[2]	Kanabec	8,320	7,819
Administrative and Scattered	Carlton/ Kanabec/ Pine	0[5]	19[4]
STATE PARKS			
Banning	Pine	5,899[12]/ 5,877(?)	4,351
Moose Lake	Carlton	965	951
St. Croix	Pine	34,037	31,482
WILDLIFE MANAGEMENT AREAS			
Ann Lake	Kanabec	2,006	1,614
Bean Dam	Kanabec	1,216(?)	200
Dye	Carlton	160	160
Five Lake	Kanabec	280	280
Gravel Pit #3084	Kanabec	11	11
Hay-Snake	Kanabec	880	240
Kettle River	Pine	22	22
Mark	Pine	80	80
McGowan	Pine	124	124
Mille Lacs[2]	Kanabec	6,295	5,655
Moose	Pine	46	46
Pine V&S 1	Pine	76	76
Pine V&S 2	Pine	80	80
Pine V&S 3	Pine	80	80
Pine V&S 4	Pine	281	281
Rice Creek[2]	Kanabec	636	599
Rock	Pine	600	600
Tosher Creek	Kanabec	535	306
Whited	Kanabec	275	173

FISHERIES MANAGEMENT AREAS			
Barnes Spring Pond	Pine	(?)	120
Big Pine Lake Flowage[2]	Pine	(?)	51
Blackhoof River Improvement	Carlton	(?)	781
Cross Lake Spawning Area	Pine	(?)	16
Fish Lake Improvement	Kanabec	(?)	1
Grindstone River Improvement	Pine	(?)	54
Hinckley Bass Rearing Pond	Pine	(?)	33
Knife Lake Improvement and Spawning Area	Kanabec	(?)	17
Quamba Lake Spawning Area	Kanabec	(?)	16
SCIENTIFIC & NATURAL AREAS			
Kettle River	Pine	761	593
STATE TRAILS			
Minn-Wisc Boundary Trail[2]	Pine/ Carlton	(?)	605[6]
WILD AND SCENIC RIVERS			
Kettle River	Pine	(?)	497
WATER ACCESS SITES[7]			
Ann Lake (south shore)	Kanabec	NA[8]	1
Bass Lake	Pine	NA	3
Fish Lake (south shore)	Kanabec	NA	2
Grindstone Lake	Pine	NA	2
Island Lake	Pine	NA	1
Lake Eleven	Kanabec	NA	1
Lake Twenty-nine	Carlton	NA	12
Lewis Lake	Kanabec	NA	4
Mod Lake	Kanabec	NA	1
Oak Lake	Pine	NA	2
Pokegama Lake	Pine	NA	3
Pomroy Lake	Kanabec	NA	1
Sand Lake	Pine	NA	1
Snake River	Kanabec	NA	3
Snake River	Pine	NA	2
Sturgeon Lake	Pine	NA	1
DEPT. ADMINISTERED LANDS			
NA	Pine	NA	1,091
WATERS OR MINERALS LANDS			
NA	Pine	NA	6
FORESTRY ADMINISTERED LANDS NOT IN STATE FORESTS			
Undedicated lands	Carlton/ Kanabec/ Pine	NA	22,690[9]

Notes:

[1] DNR administered acreage as listed in Table 2 of the "DNR Land Ownership/Classification Report" dated 7-1-83. Rounded to nearest acre.
[2] Moose Lake Area portion only. Parts of this management unit are located outside of the Moose Lake Area.
[3] Carlton County = 9,712 acres and Pine County = 80,768 acres.
[4] Carlton County = 9 acres, Kanabec County = 3, and Pine County = 7 acres.
[5] None of the sites listed as Administrative and Scattered State Forests in the Land Ownership/Classification Report are included in MS 89.021, Subd. 56 which describes the statutory boundaries of Administrative and Scattered State Forests.
[6] Pine County = 572 acres, Carlton County = 33 acres.
[7] DNR administered water access sites outside of other DNR management units only.
[8] NA = Not Applicable.
[9] Carlton County = 7,429 acres, Kanabec County = 3,246 acres, Pine County = 12,015 acres.
[10] Boundary Acreage as listed on Minnesota Outdoor Recreation Area Inventory maps unless otherwise noted.
[11] Statutory description assuming 640 acres per section.
[12] Boundary acreage listed in Banning State Park Management Plan.
[13] Minnesota SCORP, Table 3-S.06

Source: MN DNR, Bureau of Land, 1984.

B. FOREST RESOURCE MANAGEMENT PROGRAMS

DEPARTMENT OF NATURAL RESOURCES

The Division of Forestry is the state agency most involved in the protection and management of forest resources. However, several other DNR units also administer programs that influence the use of forest resources. The following sections explain the purpose and accomplishments of DNR programs affecting forest resources in the Moose Lake Area.

Division of Forestry

The Minnesota Forest Resources Plan (MN DNR, Division of Forestry, 1983) describes 19 programs administered by the Division of Forestry. Table ___ lists the time spent by Division of Forestry personnel assigned to the Moose Lake Area on various programs in fiscal years 1981 through 1983. This information provides only a rough indication of the relative emphasis placed on each program. Some programs are sensitive to outside factors such as weather (e.g., fire) or economic conditions (e.g., timber sales). Other programs rely heavily on contracted labor (e.g., reforestation, recreation) that is not reflected in the time summaries.

County Assistance Program The goal of the County Assistance Program (CAP) is to provide professional forest management support to counties in their efforts to intensify the multiple-use, sustained-yield management of county administered tax-forfeited lands. This assistance is tailored to meet a variety of needs, and is intended to complement the management efforts of the counties involved. The CAP program fosters improved cooperative relations between the state and counties in the management of Minnesota's public forest lands. In addition to CAP, region, area and district forestry personnel are available to assist with county land and timber sale appraisals, timber sale reviews and timber trespass.

CAP foresters' duties vary widely in scope and may include assisting counties with land or timber sale transactions, tree planting, forest inventory, ownership mapping, aerial photo interpretation, or forest road development. CAP foresters also provide useful guidance to county land

departments in the use of Timber Development Funds and BWCAW forest intensification funds for continued resource development.

There are no full-time CAP foresters assigned to the counties in the Moose Lake Area. Pine County is currently using a temporary CAP position to develop a management plan for its 45,000 acres of tax-forfeited land. In fiscal year 1983 Moose Lake Area personnel administered 37 timber sales valued at $19,000 for Pine County. Division of Forestry personnel also work with the Kanabec County Auditor to manage that county's 10,500 acres of tax-forfeited land. Carlton County's Land Commissioner is responsible for all tax-forfeited land management in that county.

Table ___. Time Spent on Division of Forestry Programs by Moose Lake Area Personnel - Fiscal Years 1981 - 1983.

Program	Full Time Equivalents (1) F.Y. 1981	F.Y. 1982	F.Y. 1983
County Assistance Program	0.47	0.43	0.60
Economics and Statistics (2)	X	X	X
Environmental Review (2)	X	X	X
Fire Management	3.58	4.07	2.99
Fish and Wildlife Habitat Mgmt.	0.18	0.22	0.27
Forest Mgmt. Infor. Systems (2)	X	X	X
Forest Pest Management (2)	0.15	0.15	0.11
Forest Recreation Management	1.28	1.16	0.90
Forest Resource Inventory (2)	0.63	1.08	1.64
Forest Resources Planning (2)	X	X	X
Forest Soils (2)	X	X	X
Land Administration	0.14	0.14	0.19
Maintenance and Administration	1.74	2.29	1.88
Nursery and Tree Improvement (2)	0.11	0.08	0.06
Private Forest Management	1.60	2.12	2.17
State Forest Roads	0.93	1.07	0.69
Timber Management	7.00	6.79	6.46
Urban Forestry	0.10	0.11	0.10
Utilization and Marketing (2)	0.04	0.01	0.03
TOTAL	17.95	19.72	18.09

(1) A full time equivalent is equal to 2,920 hours/year (365 x 8), which is the minimum that a full time employee must report on the monthly time summary. This includes both hours worked and time off.
(2) These programs are primarily staffed by personnel outside of the Moose Lake Area.

Source: MN DNR, Division of Forestry Annual Time Summary (unpublished).

Enforcement.* The Division of Forestry is charged with the enforcement of certain Minnesota Statutes, as well as various DNR administrative rules and regulations. Enforcement activities on forestry-administered lands are conducted with the assistance of DNR Conservation Officers and may also involve state or local law enforcement officials.

An effective enforcement program is necessary to provide adequate protection for forest visitors, natural resources, and public and private property. The objective of the program is to gain compliance with that which is considered to be an acceptable standard of public conduct and behavior. State laws passed by the legislature and rules and regulations promulgated by the Department of Natural Resources establish bounds of acceptable behavior and provide a legal framework for initiating enforcement actions.

Enforcement responsibilities may be grouped into five key areas. These are: 1) forest fire laws, 2) timber sales and timber trespass, 3) Christmas tree laws, 4) forest recreation, and 5) lands, leases and permits. A brief description of each follows.

Forest Fire Laws (Minn. Stat. Chapter 88.03 - 88.22)

The enforcement of fire laws focuses primarily on burning permit regulations, wildland arson and on railroad caused fires. The statutes also outline the authority of Forest Officers to arrest and prosecute fire law violators, to close forest roads and trails, to regulate certain public and private dumping areas, and to enlist suitable persons and comandeer private property to fight forest fires.

Forest Officers work closely with DNR Conservation Officers and state fire wardens in efforts to reduce the number of wildfires, the loss of property and resources, and fire suppression costs.

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*Time spent on enforcement activities by Division of Forestry personnel is included in the fire, timber, recreation and land management programs in Table ___.

Timber Sales and Trespass (Minn. Stat. Chapter 90)

Field enforcement of state timber sale regulations and timber trespass laws is the responsibility of the Division of Forestry. DNR enforcement officers assist the division by conducting in-depth investigations designed to establish basic facts and liability. Minnesota Statutes, Chapter 90 sets forth timber sale permitting procedures, timber appraisal and scaling regulations, and timber trespass provisions.

Christmas Tree Laws (Minn. Stat. Chapter 88.641 - 88.648)

The enforcement of Christmas tree laws pertains to the cutting, removal and transport of decorative trees. Enforcement provisions and permitting procedures are specified.

Recreation Regulations (NR-1)

Certain Forest Officers have been delegated specific authority by the Commissioner of Natural Resources to enforce NR-1 Rules in State Forest Campgrounds and forest day-use areas. These are basically peace-keeping rules which specify appropriate personal conduct, public safety measures, environmental protection guidelines, motor vehicle use regulations and other standards for those areas under the control of or operated by the Commissioner of Natural Resources.

Lands, Leases and Permits (Minn. Stat. Chapters 89, 90.311 and 282)

These laws pertain to the acquisition, use, management and control of state lands, and to some extent, tax-forfeited lands. Forest Officers carry out inspections, enforce rules and regulations, and oversee provisions of these statutes with the assistance of DNR enforcement officers or Land Bureau specialists, if needed.

Fire Management Program. The goals of the fire management program are to provide effective wildfire control and to promote the safe and effective use of fire as a resource management tool. The program consists of three major components: 1) fire prevention, 2) presuppression, and

3) suppression. Prevention involves efforts to inform the public of the dangers and potential losses that can result from uncontrolled forest fires. Presuppression focuses on the need to adequately prepare and maintain fire suppression forces for the eventuality of fire outbreak. This is done through extensive planning, training, fire detection and inter-agency cooperation. Suppression activities involve controlling and extinguishing forest and grass fires with a minimum of damage to property and natural resources, loss of life and personal injury.

The Moose Lake Area Fire Plan (MN DNR, Division of Forestry 1984) contains a detailed analysis of fire information for the period 1971-1981. It also proposes a balanced fire control program including prevention, presuppression, and suppression activities. The area fire plan contains the operational dispatching plan and will be updated as necessary to reflect changing conditions and the overall direction set in this plan.

The Moose Lake, Hinckley, and Mora districts generally have adequate access for wildfire control purposes. These districts are well served by state, county, and township roads, allowing use of four-wheel drive pickups with slip-on pumps for initial attack on most wildfires. The Nickerson and Eaglehead districts are less accessible, especially the area between State Trunk Highway 23 and the Wisconsin border. When fires occur in off-road areas the Bombardier, crawler tractor and helicopter are frequently used for fire control.

The major wildland cover types in the Moose Lake Area are hardwood and conifer forests and marsh. Southern Pine and Kanabec counties have major concentrations of agricultural land. Aspen, birch, northern hardwoods, and lowland hardwoods are found in either mixed or relatively pure stands throughout the area. Fires in the hardwood types are usually confined to surface or duff fires. The Nickerson and Eaglehead districts have the largest unbroken tracts of hardwood cover. Conifer types include jack and red pine, white spruce, and balsam fir on upland sites and black spruce and tamarack on lowland sites. There is potential for crown fires in the jack and red pine types. Increased residential development in pine types has increased the chance of man-caused fires. This trend is evident in the pine areas surrounding the General C.C. Andrews State Forest. Other large

areas of pine type include the Nickerson-Holyoke area and parts of the St. Croix State Park. Marsh is a common cover type in the Moose Lake Area. During years of normal moisture, fires in the marsh type burn only surface fuels, mainly grass, cattails, sedges, and lowland brush. During dry periods the fires burn into the peat soils commonly found in marsh areas. Agricultural lands are most prevalent in the Mora, Hinckley and Moose Lake districts. Wildfires in these types often result from land clearing, equipment use, burning of low areas and pastures to get rid of brush, and burning uncut hay fields.

Grass is the most common fuel type burned in the Moose Lake Area, accounting for 1,297 fires between 1971 and 1981. This amounts to 81 percent of all fires and 83 percent of all acreage burned. The grass fuel type includes marsh areas, where most of our fires occur, as well as upland grass areas. Shrub and brush areas, which are often associated with grass areas, have the second highest fire occurrence for a total of 71 fires during the 11 year period. The young hardwood fuel type has the third highest fire occurrence with 37.

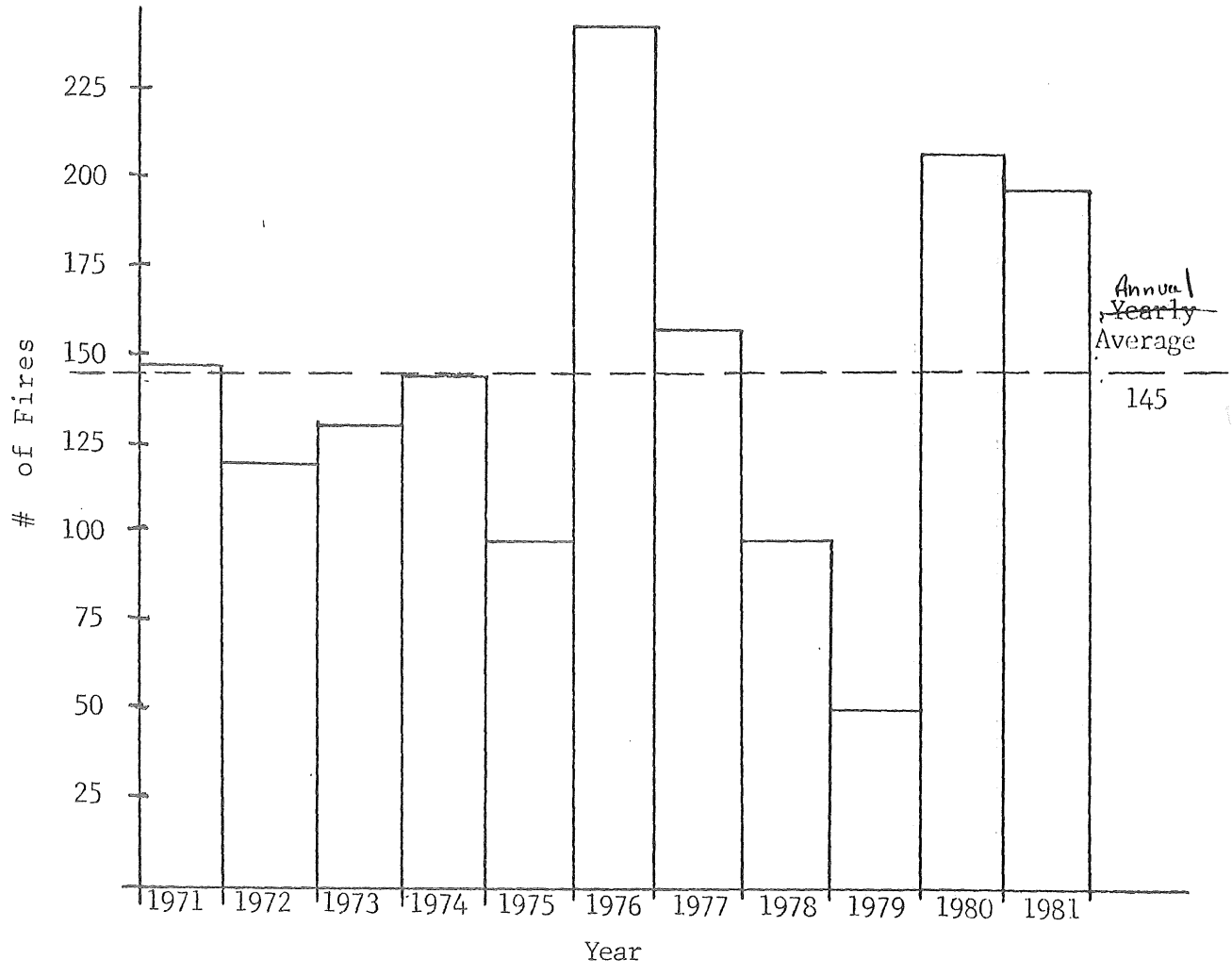
From 1971 through 1981 the Moose Lake Area experienced 1,595 fires, for an average of 145 fires per year. Figure ___ shows that the actual number of fires per year ranged from a high of 245 fires in 1976 to a low of 52 fires in 1979.

Spring is the most severe fire season accounting for 70 percent of all fires. Broken down by month, 7 percent of the fires occur in March, 36 percent in April and 27 percent in May.

The summer fire season is the least severe accounting for 12 percent of the fires in the area. Broken down by month, 4 percent of the fires occur in June, 2 percent in July, 3 percent in August and 3 percent in September. The summer fire season runs from greenup around June 1 until the first killing frost in late September. The severity of the summer fire season is directly dependent on the amount of rainfall received during these months.

The fall fire season is the second most severe fire season in the area, accounting for 17 percent of all fires. Broken down by month, 8 percent of

Figure ~~11~~ Number of Fires by Year



all fires occur in October and 9 percent occur in November. The fall fire season begins with the first killing frost in late September and lasts until snow cover comes in November.

Figure ___ shows the causes of fires in the area for the period 1971 through 1981. Incendiarism, debris burning, and railroads account for 77 percent of the fires.

Anticipated expenses for an average fire year in the Moose Lake Area are:

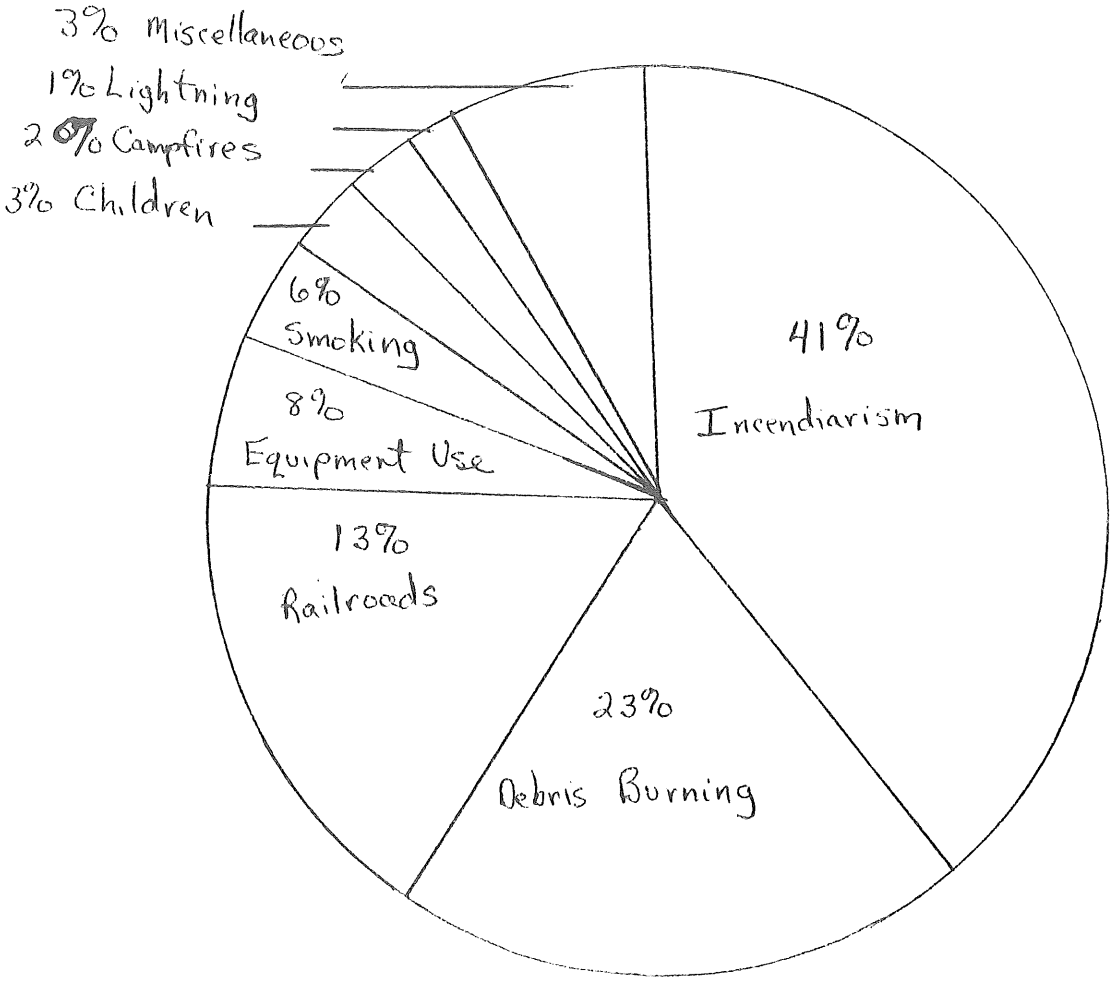
Prevention	$ 1,100
Detection	13,300
Pre-suppression	74,171
Suppression	31,225
TOTAL	$119,796

The DNR maintains cooperative agreements with ___ fire departments in the area and has organized strike teams of fire department and DNR personnel to respond to wildfires. There are ___ commissioned fire wardens in the area who issue burning permits and cooperate in fire control activities. The General Andrews Nursery acts as a statewide receiving and repair depot for excess federal property that the DNR assigns to rural fire departments.

Prescribed burning can be an effective resource management tool. The DNR uses prescribed fire in the Moose Lake Area to _____. In recent years approximately _____ acres per year have been burned.

In 1983 there were 87 fires that burned 834 acres in the Moose Lake Area. There is an increasing wildfire risk in the area due to rural development and conversion of hardwood forests to pine types. The DNR maintains cooperative agreements with ___ fire departments in the area and has organized strike teams of fire department and DNR personnel to respond to wildfires. Combinations of up to two aircraft and ___ towers are used to detect wildfires. The Willow River Nursery acts as a statewide receiving and repair depot for excess federal property that the DNR assigns to rural fire departments.

Figure —. Wildfire Cause, Moose Lake Area 1971-1981.
(Total number of wildfires = 1,594)



Fish and Wildlife Habitat Management. The goal of the Division of Forestry fish and wildlife habitat management efforts is to ensure that integration of forestry and wildlife management takes place on state administered lands in accordance with the Wildlife/Forestry Coordination Policy. Typical activities include modifying the following forestry practices on lands under Division of Forestry jurisdiction to assure that fish and wildlife habitat is maintained or improved: timber harvest, reforestation, timber stand improvement, construction of openings, roads and trails, wildfire control, and prescribed burning. Other activities include assisting wildlife managers to achieve wildlife objectives through forestry practices wherever possible on state wildlife management areas. Regular meetings between the staffs of the Division of Forestry and the Section of Wildlife are an important part of maintaining coordinated management efforts.

Forest Pest Management. The role of the division's forest pest management program is to provide management guidelines, standards, examples, and risk evaluation systems for addressing forest pest management on public and private lands in the state. The forest pest management program seeks to reduce resource losses to acceptable levels by integrating forest pest management techniques into silvicultural practices.

Forest pest management activities can be divided into four categories: survey, evaluation, prevention and control. Forest pest survey provides information on the extent and importance of pest problems. Evaluation includes activities which determine the impact of forest pests (such as risk rating and loss assessment) and the esamination of management options for preventing, mitigating, or controlling these agents. The prevention phase of the program concentrates on implementing management techniques to restrict the establishment and expansion of pest problems. This requires review of management practices, development of management guidelines, training forest managers in implementing the guidelines, and demonstrating the capabilities of these options. Control efforts are directed at reducing losses to forest pests through application of specific management techniques.

Area and district forestry personnel are trained to identify forest pests and to modify forest management practices to reduce losses. The Brainerd

Region I&D specialist serves the Moose Lake Area. Sites requiring special pest management attention in the area include the Willow River Nursery, seed orchards, and recreation areas. The pine tussock moth has been a severe problem in the General C.C. Andrews State Forest. In recent years approximately ___ acres per year have been treated with herbicides to control competing vegetation in forest plantations.

Insects and Disease

The canker disease, White Pine Blister Rust Cronartium ribicola, and shoot boring insect, white pine weevil Pissodes strobi Peck; have caused extensive seedling mortality and stem deformation in the Moose Lake Area.

The pine tussock moth Dasychira pinicola (Dyar) and jack pine budworm Choristoneura pinus Freeman have periodically caused extensive defoliation and top kill to pine stands in and around the General Andrews State Forest (see map). This major softwood production area surrounds the state forest nursery and contains numerous overstocked natural jack pine stands on droughty soils that are susceptible to defoliator buildup due to numerous stand openings and an abundance of male cone producing trees. Outbreaks in the 60's and 70's resulted in direct control operations and salvage harvests to avoid additional tree mortality and product loss due to bark beetles.

Existing unmanaged plantations of scots, austrian and ponderosa pine on private land proximal to the nursery currently contain numerous needlecast and insect problems. An active Christmas tree industry exists in the Moose Lake Area. Growers often import stock from out of state nurseries and these plantings could be a potential source for pest introduction.

The forest tent caterpillar Malacosoma disstria (Hubner) has periodically caused extensive defoliation, growth loss and limited tree mortality in aspen and mixed hardwood stands throughout the Moose Lake Area (see maps). The gypsy moth Lymantria dispar (Linnaeus) has been collected in urban areas to the east, south and west of the Moose Lake Area. In the next ten years it could become a serious threat to oak stands in the Mora, Hinckley

and Eaglehead districts. High hazard areas for early introduction and spread include parks and scenic areas along river corridors.

Forest Recreation Management. The role of the forest recreation program is to provide dispersed outdoor recreational opportunities and facilities characterized by solitude, natural conditions, and minimum levels of development.

The program's goal is to fulfill the outdoor recreation potential of Minnesota forest lands by providing developed recreational areas and opportunities for dispersed recreational activities. Recreational developments are generally limited to primitive, minimum impact campgrounds, day-use areas and recreational trails. Division recreation facilities are managed in accordance with DNR Policy No. 8, "Recreational Use of State Forests."

Forest recreation management activities include planning, development, rehabilitation, maintenance, and enforcement of rules and regulations. Planning for recreation sites as required by the ORA (MS 86A) is done on a sub-area or unit planning basis and involves the writing of a management plan which assesses the need for the area, describes the type of facility to be provided, and gives the public a chance to comment on the proposal. Development and rehabilitation involve construction or reconstruction of the facility as outlined in the sub-area or unit plan. Enforcement is a major problem for the division due to the remote location of many facilities and the unsupervised nature of forestry facilities.

Recreation Facilities in the Moose Lake Area

The DNR, Division of Forestry administers 6 campgrounds, one horse camp, and a day-use area in the Moose Lake Area (Table ___).

The Division of Forestry in the Moose Lake Area administers a number of recreational facilities other than campgrounds, picnic areas and trails (see forestry recreation map for location). These facilities consist of recreational (associated with trails) and hunter parking lots, primitive

Table ___. State Forest Campground and Day Use Facilities in the Moose Lake Area.

		Existing Facilities					
Name	Campsites	Picnic Sites	Toilets	Water	Miscellaneous	Level of Use	Condition
D.A.R.	6 Drive In	5	2 Pit Toilets	1 Hand Pump	Metal Gate	Light	Good
Boulder Lake	16 Drive In 3 Tent Only	8	2 Handicapped Accessible Vault Toilets	1 Hand Pump	Public Access and Parking Area (tent only sites)	Moderate	Good
Snake River	26 Drive In	---	4 Handicapped Accessible Vault Toilets	2 Hand Pumps	---	Moderate	Good
Gafvert	9 Drive In	1	2 Handicapped Accessible Vault Toilets	1 Hand Pump	Public Access and Parking Area Swimming Beach	Moderate	Good
Willow River	32 Drive In	---	8 Pit Toilets	2 Hand Pumps	Public Access and Parking Lot	Moderate	Needs Repair*
Tamarack River Horse Camp	3 Tent Only	3	2 Handicapped Accessible Vault Toilets	---	Parking Area Horse Corral Council Ring	Heavy	Good
Rum River Day Use Area	---	2	2 Pit Toilets	---	Parking Area	Light	Good

*Renovation specified in Willow River Rehabilitation Plan (DNR Forestry, 1983).

Source:

campsites and trail shelters. The following is a list of other recreational facilities by state forest.

Chengwatana

- Four primitive campsites with table and fire ring, one site has toilets
- Two 100 car parking lots
- Eight turn-out parking lots for 3 to 12 cars

St. Croix

- Eight primitive campsites with tables and fire rings, five have open air pit toilets and one has an enclosed pit toilet
- Six parking lots

Nemadji

- Ten parking lots
- Two trail shelters

General C.C. Andrews

- One parking lot, snowmobile trail head

Recreational Trails

The Division of Forestry administers 226 miles of trail in the Moose Lake Area. This mileage includes 131 miles of forestry administered unit trails (within state forests), 78 miles of the Minnesota/Wisconsin Boundary Trail, and 17 miles of the Range Line Snowmobile Trail* (Table ___). The vast majority of Division administered trails are available for snowmobiling only because of the amount of wet areas they cross. Only in St. Croix and General C.C. Andrews state forests are there substantial mileages of summer use trails. These trails are multiple-use trails on which hiking, horseback riding and ORV use presently occur. This is not the most desirable situation as recreational trail uses often conflict with one another.

*A portion of the trail mileage of the Minnesota/Wisconsin Boundary Trail and all of the Range Line trail mileage lies outside of state forest boundaries.

DNR Forestry Administered Unit Trails in the Moose Lake Area:

Pine County

Chengwatana - 23.2 miles
- 7.0 Hiking
- 7.0 X-C Skiing
- 16.2 Snowmobiling

St. Croix - 32.3 miles
- 32.3 Hiking
- 32.3 Horseback Riding Trails
- 25.2 Snowmobiling

General C.C. Andrews - 9.4 miles
- 9.4 Hiking
- 9.4 Horseback Riding
- 9.4 Snowmobiling

Nemadji - 43.1 miles
- 43.1 Hunting
- 43.1 Snowmobiling

Kanabec County

Kanabec - 15.0 miles
- 1.0 Hiking
- 15.0 Snowmobiling

Chelsey Brook - 7.9 miles
- 7.9 Snowmobiling

Other Trails

Minnesota/Wisconsin Boundary Trail
- 78.0 Snowmobile, X-C Skiing, Hiking, Equestrian

Range Line - 17 miles
- 17.0 Snowmobile

Source: MN DNR, Trails and Waterways Unit. Registry of Trail Mileage.

Forest Resource Inventory. The forest inventory program is designed to collect and maintain the data needed to develop effective forest management plans and programs. The division's forest inventory unit examines forest lands to determine the location and condition of various forest resources. On timbered lands species distribution, size class, density, productivity, and operability are recorded.

The division maintains two distinct forest inventories. The "Phase I" inventory is a cooperative effort with the U.S. Forest Service's North Central Forest Experiment Station. The objective of this inventory is to obtain periodic estimates of the extent and condition of forest resources and of the rates of timber growth and removals on all land ownerships. The estimates are based on measurements and remeasurements of a statistical sample of permanent plots. The 1977 inventory was the fourth for Minnesota. Earlier surveys are dated 1936, 1953, and 1962. The results of the 1977 inventory are contained in numerous reports published by the Department of Natural Resources and the North Central Forest Experiment Station.

The "Phase II" inventory is based on a field examination of each stand on 6.9 million acres of state and county administered land. The primary outputs of the "Phase II" inventory are township maps showing the location of each stand and computerized files of inventory data. An important feature of this inventory is the capability to record changes in the forest cover due to harvest, fire, planting, and other activities.

The Phase II inventory of the Moose Lake Area was recently completed. The inventory information is being used to develop timber management plans for the area. Area personnel will also be responsible for keeping the inventory up to date.

Land Administration. The goal of the Division of Forestry's land administration program is to maintain a state forest land ownership pattern that will provide for efficient multiple-use management of forest resources. The achievement of this goal will require not only an integrated effort among all administrative units of the division, but a close working relationship with the DNR Land Bureau, other DNR divisions, the U.S. Forest Service, other public land agencies, the state legislature, and the private sector. The State Forest Management and Policy Supervisor is the main liaison with the Land Bureau. Field staff are involved in identifying proposed acquisition, sales, leases, or exchanges, inspecting leases, and maintaining contacts with other agencies and individuals. Once the division has determined its land administration priorities and projects, the Land Bureau assumes follow-up responsibilities for negotiations, appraisals, record keeping, and other services.

Land administration involves land acquisition, exchange, sales, and leasing; land classification; and maintaining land records. Field personnel are involved in identifying potential acquisitions, sales, leases, or exchanges. They also inspect leases and maintain contact with other land management agencies. State statutes provide much of the authority for the division's land administration activities, other authorities are contained in the state constitution.

Maintenance and Administration. The major activities included in this program are building and equipment maintenance and non-program related

training. The goal of this program is to provide the basic level of administrative support needed to achieve the goals of other division programs. The division maintains office complexes at Duxbury, Hinckley, Moose Lake, Mora, and Nickerson (Table ___). There is a General Repair Worker stationed at Moose Lake to maintain area equipment.

Nursery and Tree Improvement. The goal of the Nursery Program is to produce tree planting stock for use on public and private land for afforestation, reforestation, windbreaks, shelterbelts, erosion control, soil and water conservation, wildlife habitat, and environmental education. Primary activities in the nursery program include the production and distribution of bareroot seedlings. When the seedling stock attains a desirable size it is lifted, sorted by grade, packaged, and shipped. The nursery program also contracts with private greenhouses to meet the division's containerized seedling needs.

The goal of the Tree Improvement Program is to increase the productivity of public and private forest lands in Minnesota through the use of genetic principles. The program will result in the production or acquisition of genetically superior seeds, or cuttings, for use in the growing of planting stock or other regeneration activities. The target is the highest level of genetic improvement possible within the restrictions of available resources, current information, and probable economic returns. Major activities include seed source selection, seedling distribution, seed production area development, and seed orchard development, including first generation, seedling, clonal, and advanced generation seed orchards.

The Willow River Nursery is located in the General C.C. Andrews State Forest. The nursery is not administered as part of the Moose Lake Area. Area personnel are involved in location of superior trees and certification of seed collection sites.

Private Forest Management (PFM). The PFM program promotes multiple-use management on non-industrial private forest lands. Typical PFM activities include: 1) promoting forest management through personal contacts with landowners and the use of the media; 2) conducting educational workshops, clinics, and field days; 3) developing multiple-use management plans for

Table ___. Moose Lake Area Administrative Office Locations and Facilities.

Facility/Location	Construction	Size (Sq. Ft.)	Current Use	Repair	Remarks
1. Moose Lake Area and District					
a. Area and District Offices	two-story wood frame	2,912	reception area office space meeting room file and radio rooms	Good	inadequate office space, heating system improvements needed
b. Shop/Warehouse	one-story cement	2,952	storage garage/shop	Fair	heating system improvements needed
c. Fire Tower (Moose Lake)	stairway type	---	fire detection	Good	tower is manned only during severe fire seasons
d. Fire Tower (Willow River)	ladder type	---	none	Good	unused for many years
2. Eaglehead District (Duxbury)					
a. Office/Warehouse	one-story wood frame	1,860	office space garage/shop	Fair	inadequate weatherization and heating system
b. Warehouse	one-story wood frame	1,207	storage	Poor	structurally unsound, beyond repair
c. Residence	two-story wood frame	2,080	residence (3 br)	Poor	substantial renovation needed
d. Outhouse	wood frame pit toilet	---	seasonal	Fair	
e. Fire Tower (Duxbury)	ladder type	---	none	Poor	unused since 1979
f. Fire Tower (Askov)	stairway type	---	fire detection	Fair	steps need repair
3. Nickerson District					
a. Office/Warehouse	one-story wood frame	2,064	office space warehouse garage/shop	Fair	no hot water
b. Residence	two-story wood frame	2,304	residence	Poor	major repair and remodeling is needed
c. Storage Shed	wood frame	120	misc. storage	Fair	
d. Outhouse	wood frame pit toilet	---	none	Poor	consider for removal
e. Fire Tower	stairway type	---	fire detection	Good	receives heavy use by tourists

4. Hinckley District					
a. Office/Warehouse	one-story wood frame	1,860	office space garage/shop warehouse	Fair	heating and insulation are inadequate, foundation is cracked
b. Fire Tower (St. Croix State Park)	stairway type	---	none	Fair	consider for removal
5. Mora District					
a. Office/Warehouse	one-story wood frame	1,860	office space warehouse garage/shop	Fair	new heating system needed, hot water heater and paint
b. Warehouse/Storage	one-story cement	1,800	misc. storage	Poor	structural improvements needed
c. Fire Tower (Woodland)	stairway type	---	none	Fair	consider for removal
d. Fire Tower (Pomeroy)	stairway type	---	fire detection	Fair	used during severe fire weather

landowners; 4) providing technical and financial assistance for certain management practices; and 5) providing utilization and marketing assistance associated with timber harvesting.

PFM assistance in the Moose Lake Area is provided by district foresters and the area PFM specialist. There are currently ___ active management plans covering ___ acres in the area. Fiscal 1983 PFM accomplishments included ___ management plans for ___ acres, reforestation of ___ acres, timber stand improvement on ___ acres, and assistance with ___ timber sales. There are ___ certified Tree Farms in the area.

State Forest Roads. The goal of the state forest road program is to develop and maintain Minnesota's state forest road system to facilitate the protection, management, and recreational enjoyment of state forest lands. This 1,800 mile system of roads also provides for public transportation, commerce, and development activities on several million acres of county, federal, and private forest lands.

The Moose Lake Area contains 253.2 miles of Division of Forestry administered forest roads (Table ___). Sixty-eight miles of this total are considered permanent, all-weather road. The remaining road miles exist primarily for timber harvest and can be used only during dry periods or in the winter. These roads may be temporary. The permanent forest road system which will allow access to most Division of Forestry administered lands in the Moose Lake Area is close to complete with only an additional 26 miles contemplated. Another 13.5 miles are scheduled for major upgrading. Roads used primarily for timber harvesting will have to be developed on an as needed basis. Maintenance of the forest road system is a continuing concern. In the past adequate funding has not been available for proper road maintenance.

Timber Management. It is the goal of the Division of Forestry to maintain state forest lands in the appropriate cover types, degree of stocking, and rate of growth to secure optimum public benefits according to multiple-use sustained yield principles consistent with appropriate forest management plans.

The timber management program includes two major functions: timber stand regeneration and regulation of harvest. The basic function of the timber stand regeneration program is to coordinate timber harvest and regeneration plans to assure state lands are maintained in appropriate cover types to meet future multiple-use demands. The major function of regulating harvests is to promote sustained yields of forest products. Basically these functions are accomplished through coordination of various aspects of timber scaling, sales, timber harvest, stand regeneration, and stand maintenance.

There are approximately 134,000 acres of state owned commercial forest land in the Moose Lake Area. Timber management accomplishments in fiscal year 1983 include administration of 64 timber sales with a stumpage value of $22,500; site preparation on ___ acres; reforestation of ___ acres by natural regeneration (___ acres), seeding (___ acres), and planting (___ acres); release of ___ acres, and timber stand improvement on ___ acres.

Urban Forestry. The urban forestry program provides assistance with community projects that involve local units of government, on lands within municipal boundaries that are maintained for public use, and with shade or ornamental trees regardless of their location.

The program assists the community with the planning of its overall forestry program, including the development of tree inventories, management plans, city tree ordinances, and budgets. Advice and training are given in the selection of plant materials, planting techniques, and spacing and location of trees in urban areas. This advice and training help the community develop wildlife habitat within its urban environment, improve its watershed areas, minimize soil erosion, and establish windbreaks where needed. The division also provides management assistance for school and municipal forests.

Utilization and Marketing (U&M). The twofold goal of the U&M program is to improve the utilization of the forest resource through increased harvesting and processing efficiency, and to increase the utilization of forest resources through marketing and economic development of wood products industries. Major program areas include primary wood processing, resource

analysis and industrial development, marketing, wood fuel and byproducts, timber harvesting and secondary processing of timber products. The major U&M activity of area personnel is assisting landowners in finding markets for their timber. It has been difficult to find markets for balsam and spruce. Special resource analyses and market development work are provided by the Brainerd Region U&M specialist.

Table ___. State Forest Roads in the Moose Lake Area.

Road No.	Road Name	County	C1* Miles	C2 Miles	C3 Miles	C4 Miles	C5 Miles	Total Miles
005	Park Trail	Pine				12.0	36.0	48.0
004	Net Lake	Pine			20.5		33.0	53.5
226	Harlis-Holyoke	Carlton			3.5		11.3	14.8
257	Chengwatana	Pine				4.8	37.0	41.8
232	Tamarack	Pine				5.1	4.7	9.8
247	St. Croix	Pine				7.5	16.0	23.5
003	Beldon	Pine				5.8	2.9	8.7
002	Kanabec	Kanabec				4.3	4.5	8.8
270	Chelsey Brook	Kanabec				2.5	6.8	9.3
339	Bruno	Pine					1.5	1.5
365	Mud Lake	Carlton					0.8	0.8
364	Firewood Road	Carlton					1.7	1.7
338	Duquette	Pine				1.5	3.0	4.5
337	Kerrick Road	Pine					3.6	3.6
363	Blackhoof	Carlton					1.3	1.3
362	Holyoke	Carlton					1.6	1.6
361	Split Rock Road	Carlton					1.0	1.0
247	Snake River Campground Road	Pine				0.8		0.8
340	General Andrews Road System							
348	Unnamed	Pine					3.0	3.0
342	Unnamed	Pine					2.5	2.5
343	Wilma Trail	Pine					1.0	1.0
344	Unnamed	Pine					1.2	1.2
345	Unnamed	Pine					0.8	0.8
347	Unnamed	Pine					1.5	1.5
349	Graces Lake Trail	Pine					0.5	0.5
346	Basswood Trail	Pine					2.5	2.5
359	Unnamed	Kanabec					0.5	0.5
358	Unnamed	Kanabec					1.5	1.5
357	Unnamed	Kanabec					2.1	2.1
006	Unnamed	Pine					1.1	1.1
TOTALS					24.0	44.3	184.9	253.2

*DNR State Forest Road Classifications:
Class 1 - Multi-purpose, all weather, two lane, hard surfaced, two foot shoulder (minimum), 26' roadway width.
Class 2 - Multi-purpose, all weather, two lane, gravel surfaced, no shoulder, 22' roadway width.
Class 3 - Multi-purpose, all weather, one or two lanes, gravel surface, 18' roadway width.
Class 4 - Multi-purpose, one lane, 14-16' roadway width.
Class 5 - Minimum design for intended use during winter or dry periods only.

Source: State Forest Road Plan, MN DNR, 1982.

Division of Fish and Wildlife

The DNR Section of Fisheries has primary responsibility for managing the area's fish resources. Public waters are managed to protect existing fish habitat from deterioration or destruction and to protect fish populations from over-exploitation. Lakes and streams are managed for the species of fish for which they are best suited. Public waters are stocked with fish where appropriate to maintain a sport fishery.

Only limited management has been attempted on the warm water streams in the past. Activities have primarily been limited to some stocking and to stream surveys. The major management activities that impact the warm water streams are environmental review of development projects and review of permit applications.

Division of Parks and Recreation

The Division of Parks and Recreation administers 3 state parks and waysides covering about _____ acres in the Moose Lake Area. The Division of Forestry provides fire protection and vegetation management assistance (timber cutting, prescribed burning) in state parks. State parks provide interpretive programs and semi-modern campgrounds that are not available in state forests. Three state parks are found in the Moose Lake Area: St. Croix State Park (31,481 acres), Banning State Park (4,351 acres) and Moose Lake Recreation Area (951 acres).

Trails and Waterways Unit

The Trails and Waterways Unit was created in 1979 to administer the state trail, grants-in-aid trail, water access, and canoe route programs. Funds for development and maintenance of trails and water access sites within state forests are not administered by this unit. New trails in state forests must meet the criteria contained in the DNR Trail Policy statements. Two state trails, the Minnesota/Wisconsin Boundary Trail and the Hinckley to Moose Lake railroad grade are found in the Moose Lake Area. Seven unit trails in area state forests receive funding for development and maintenance from the Trails and Waterways Unit. Numerous miles of

grants-in-aid snowmobile trail receive funding from the grants-in-aid program. Three rivers, the St. Croix, the Kettle and the Snake are state canoe and boating routes. Thirty-three accesses are the responsibility of the Trails and Waterways Unit (see recreation section for more information).

Division of Waters

The Division of Waters administers a number of programs that have impacts on forest resources. The Division of Forestry must apply for a permit from the Division of Waters when installing bridges, culverts, and water access sites. Shoreland and floodplain management regulations limit forest management practices along streams.

Division of Enforcement

The Division of Enforcement's areas of responsibilities and duties in the Moose Lake Area are similar to those of the division statewide. The division is responsible to the Commissioner for the enforcement of all DNR related statutes and Commissioner's Orders. Enforcement efforts are concentrated on the following major areas:

1. Game and fish laws
2. Watercraft safety
3. Snowmobile enforcement
4. Public access enforcement
5. Division of Waters
6. Forestry laws
7. Trails and Waterways Unit
8. State Parks
9. Federal statutes (when appropriate)
10. Assist PCA
11. Assist other law enforcement agencies

Additional responsibilities include firearm and snowmobile safety, nuisance animal complaints, removal of car killed animals, public access, public relations and enforcement assistance.

All of the division officers are by law licensed peace officers in accordance with state statutes. Within the Moose Lake Area, Enforcement has conservation officers stationed at Willow River, Hinckley, Pine City and Mora, all of these are within Region 3. There is also a conservation officer at Moose Lake who is in Region 2. The area supervisor for Region 3 is Gerald Peterson in Princeton.

FEDERAL AGENCIES

Introduction

Several federal agencies have a role in determining how the Moose Lake Area forest resources are used. This section describes those programs dealing with forestry in the area. Some of the agencies deal exclusively with forestry, while others have only secondary or peripheral involvement, but all have an ability to influence the use of forest lands.

U.S. Department of Agriculture

Forest Service

Forest Service activities are divided into three major program areas: forestry research, state and private forestry, and national forest management. With the exception of national forest management, most Forest Service programs have some impact on the Moose Lake Area.

Forest Service Research. The Forest Service research program seeks to develop new knowledge and technologies that will enhance the management, productivity, and use of forests and the utilization of the products and services derived therefrom.

The North Central Forest Experiment Station headquartered in St. Paul serves Minnesota and six other states. Current research efforts include evaluation of intensively cultured plantations for energy production, economic analysis of timber demand, land treatment of sewage effluent and sludge, forest tree genetics, ecology of northern forest types, and backcountry river recreation management. A new research effort focusing on the aspen-birch-conifer ecosystem is currently being developed.

State and Private Forestry. This branch of the Forest Service administers programs to encourage and assist in the management of non-federal forest lands. The Forest Service cooperates with the Department of Natural Resources to provide services to non-industrial private forest landowners who control the majority of the area's commercial forest land.

Minnesota is one of 20 states served by the Northeastern Area State and Private Forestry (S&PF) office in Broomall, Pennsylvania. The Division of Forestry and the Forest Service currently have cooperative programs in Rural Forestry Assistance, Insect and Disease Management, Rural Fire Prevention and Control, and Forest Planning. All of these programs impact the area to some degree.

The Northeastern Area S&PF office also handles the federal funds for the BWCA forestry intensification effort on state, county, and private lands. The BWCA Wilderness Act of 1978 authorized the expenditure of 3 million dollars per year from 1980 through 1991 on state, county, and private lands to replace timber lost when the BWCA was expanded. The program is authorized for 11 years, although funds must be appropriated each year.

S&PF is also involved in the administration of certain cost sharing funds available from other agencies. Private landowners can receive financial assistance to complete certain forestry practices under the Agricultural Stabilization and Conservation Service's Forestry Incentives Program (FIP) and Agricultural Conservation Program (ACP). The Forest Service and the Division of Forestry develop program standards and provide technical assistance to landowners.

The Forest Service and the Division of Forestry help rural fire departments apply for Rural Community Fire protection grants from the Farmers Home Administration. The Forest Service also participates in the Job Corps, Young Adult Conservation Corps (YACC), and Senior Community Service programs funded through the Department of Labor.

Soil Conservation Service

The Soil Conservation Service (SCS) provides national leadership in the conservation, development, and productive use of soil, water, and related resources. The SCS 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 SCS is involved in the PL-566 Small Watershed Program, the Resource Conservation and Development Program, and the Rural Clean Water Program. Many of these

programs influence forested lands. The SCS cooperates with the Forest Service and the Division of Forestry in carrying out the forestry aspects of these programs.

SCS programs in Minnesota are administered by the State Conservationist. Most counties have a local SCS office to provide technical services. SCS personnel work closely with the local Soil and Water Conservation District. The SCS is also involved in preparation of Minnesota's Resource Conservation Act (RCA) Plan, which is the soil resources equivalent of the Minnesota Forest Resources Plan.

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

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 wish to participate in ACP or FIP.

U.S. Department of the Interior

National Park Service

The National Park Service protects and preserves nationally significant cultural and natural sites for the use and enjoyment of present and future generations. In the Moose Lake Area the National Park Service provides outdoor recreation on the St. Croix National Scenic Riverway. The forest environment is a major attraction to the area.

Fish and Wildlife Service

The Regional Office of the Fish and Wildlife Service located at Fort Snelling is responsible for managing the Sandstone National Wildlife Refuge located near the Moose Lake Area. The primary management goal for this land is to provide fish and wildlife habitat.

Bureau of Indian Affairs

The Bureau of Indian Affairs (BIA) provides technical assistance to improve the management and utilization of forest resources on non-allotted Indian lands. The agency provides forest land management services such as fire protection and reforestation as well as assistance in developing forest products industries. There are approximately 3,000 acres of commercial forest land managed by the BIA in the Moose Lake Area.

Bureau of Land Management

The Bureau of Land Management (BLM) controls 64,000 acres of federal public domain lands in Minnesota. The majority of these lands are located in north central Minnesota, but there are also islands and other small tracts in other areas. The BLM is in the process of transferring most of the lands under its control to the U.S. Forest Service for management or disposal.

COUNTY ADMINISTERED FORESTRY PROGRAMS

County governments in the Moose Lake Area manage 92,051 acres of forest land (Table ___). The majority of this land is actually state-owned, tax-forfeited land administered by the counties. This land, and the resources it offers, provides an important source of revenue to local governments, income and employment for the regional economy, and public recreation opportunities for the entire state.

Carlton County

Carlton County, with a total of approximately 72,500 acres (51 percent of which or 36,831 acres is located within the Moose Lake administrative area), has the most active county forest land management program in the Moose Lake Area. The scope of Land Department activities includes land and timber sales, reforestation, site preparation, and various other resource management and development programs. The Carlton County Land Department also administers 18,918 acres of dedicated memorial forest lands.

The Carlton County Land Department is staffed by a full-time Land Commissioner and professional forester, as well as clerical support. Periodic (part-time) technical assistance is obtained through the County Assistance Program (CAP) administered by the DNR, Division of Forestry.

Kanabec County

Kanabec County administers 10,540 acres of tax-forfeited forest land. No formal Land Department organization or land management programs currently exist, nor are any such programs pending or proposed. The Kanabec County Auditor does receive periodic DNR technical assistance through the CAP program for land management and timber sales.

Pine County

Pine County administers 44,850 acres of tax-forfeited forest lands. Responsibility for the management of an additional 118,000 acres has, over

the years, been transferred to DNR under a revenue sharing agreement. Much tax-forfeited land has also been sold to private landowners.

Since 1979, when the Pine County Land Commissioner was appointed, a timber sales program has begun, aerial photographs of Pine County lands have been purchased and the DNR's Phase II Forest Inventory has been successfully completed on all of Pine County's county forest lands. In January of 1984 efforts began to develop a comprehensive forest resource management plan for Pine County's tax-forfeited forest lands. Planning is being conducted with CAP assistance.

Table ___. County Administered Acreage in the Moose Lake Area (includes Carlton, Kanabec and Pine counties).

Land Class	Carlton*	Kanabec	Pine	Moose Lake Area Total
1. Tax-Forfeited Lands				
a. Inside State Forests	--	--	1,482	1,482
b. Outside State Forests	17,913	10,540	43,368	71,821
2. County Forests (Dedicated)				
a. Inside State Forests	--	--	--	--
b. Outside State Forests	18,918	--	--	18,918
3. County Lands (Total)				
a. Inside State Forest	--	--	1,482	1,482
b. Outside State Forest	36,831	10,540	43,368	90,739
			GRAND TOTAL	92,221

*T46N and T47N, Range 15W-21W. The Moose Lake Area includes approximately 51 percent of lands administered by Carlton County.

Source: MN DNR, Bureau of Land 1984.

LOCAL GOVERNMENT PROGRAMS

East Central Regional Development Commission

The East Central Region encompasses an area of 3,450 square miles and has a population of 90,300 distributed through five counties, 40 cities, 88 townships, 18 school districts and 10 special districts, for a total of 161 political subdivisions. Having grown by 19% since 1970 makes the East Central Region the fastest growing region in the state.

The East Central Regional Development Commission (EC RDC) is a five-county regional planning agency organized in 1973 by public officials from Chisago, Isanti, Kanabec, Mille Lacs and Pine counties, pursuant to the Regional Development Act of 1969. The EC RDC is comprised of 17 elected officials and 5 public interest representatives. The immediate past Chairman of the Commission and State Legislators whose districts include any part of the region serve as "ex-officio" members of the commission. A professional planning staff assists in carrying out administrative and planning activities.

Purpose and Responsibility

The purpose of the EC RDC is to serve as a forum wherein local government, public and private interests and citizens can come together to plan for the orderly social, economic and governmental development of the region through:

1. Establishment of regional goals and policies which identify desired physical, social, and economic conditions and strategies needed to achieve these conditions.
2. Determination of the need for initiating or improving programs relating to water, land use, economic development, government problems, housing, human and natural resources, transportation and other local issues.
3. Promotion of intergovernmental communication and coordination.
4. Collection, storage and dissemination of information for use by the EC RDC and other public and private sector users.

5. Facilitating multi-county planning and development by combining and decentralizing state and federal programs.
6. Provision of technical assistance to local units of government in the conduct of local planning and development activities.
7. Development of a continuous program of research and study concerning matters of regional significance.
8. Appointment of advisory committees composed of citizens interested in assisting in the review and preparation of plans, programs and activities.
9. Support and encouragement of plans, policies or programs of local, state and federal units of government which are consistent with EC RDC goals, policies and plans.

The EC RDC is charged with preparing and adopting a comprehensive regional development guide, with ensuring coordination with other agencies operating in the region, and with reviewing the plans and proposed actions of other public and private agencies determined to have a substantial effect on regional development.

Regional agencies (excluding the EC RDC) are created under State and Federal statute and are only indirectly responsible to local general purpose governments. Almost all of their activities indirectly affect regional growth and development. These regional agencies include the Lakes and Pines Community Action Agency, Five County Human Development Center, Onanegozie Resource Conservation and Development District, and Central Minnesota Health Systems Agency. The primary influence they are able to bring to bear on regional development is through the provision of regional and local services and facilities. There does not, however, currently exist a mechanism at the regional level for ensuring that regional plans are implemented.

Local Governments

Historically, local governments, both special purpose and general purpose, have had the responsibility of providing necessary services and regulating urban and rural development. While other levels of government have been

more active than in the past, local governments remain the principal public sector actors managing urban and rural development.

The primary tools used by local governments have been development regulations. These include zoning, subdivision regulations, building codes, housing codes and other health and safety regulations. Those regulations are the only direct way that public agencies can guide the pattern, type and intensity of private developments.

Local government capital improvement programming is another mechanism for shaping and staging urban growth. Special districts (especially schools) and general purpose governments can locate and time their major facilities to influence growth patterns, although the history of such facility development has been more oriented towards following growth rather than directing it.

While many actions of government at all levels influence the growth and development in the Moose Lake Area, very few of these actions are consciously coordinated into a management system. The basic mechanisms that can be used to manage growth--regulation, taxation, provision of services, and government ownership--are being used by one level of government or another. In many cases, new versions of these mechanisms are possible and will be suggested. However, the major need is for a structure which relates all of these mechanisms to the regional and local policies.

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