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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LANDS AND FORESTRY

STATE OF MINNESOTA

FORESTRY IN MINNESOTA

DEPARTMENT OF NATURAL RESOURCES

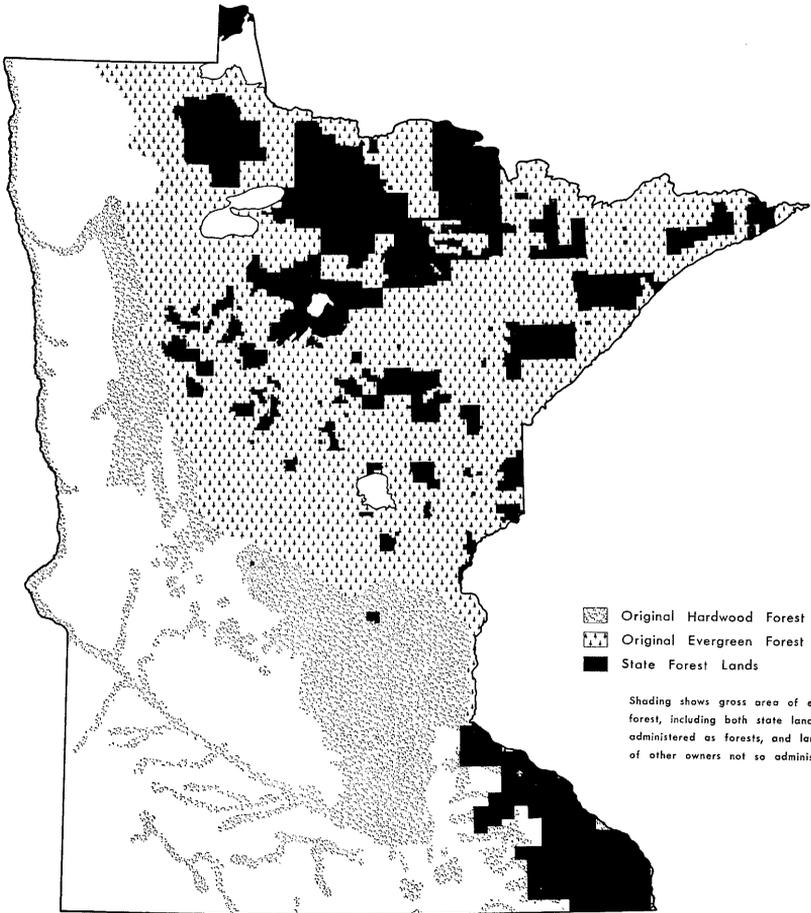
DIVISION OF LANDS AND FORESTRY

St. Paul, Minn.

1971



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STATE OF MINNESOTA



A FOREST MAP OF MINNESOTA
1969

FOREWORD

The forested area of Minnesota amounts to 19,047,000 acres, or 37% of the total land area. The commercial forest area (exclusive of such reservations as parks and recreational preserves) is 17,062,000 acres. Minnesota is unique among states east of the Great Plains in the large area of forest land in public ownership.

Ownership of Commercial Forest Land

Private — Farm	3,344,000 A.
Private — Industry	715,000
Private — Other	3,464,000
	<hr/>
Total Private	7,523,000 A. — 44%
Federal	2,819,000 A.
State of Minnesota	3,304,000
County & Municipal	3,416,000
	<hr/>
Total Public	9,539,000 A. — 56%

These forests constitute a most valuable and extensive crop growing basic material for numerous products. The forests also produce a highly important crop of wildlife and provide countless hours of priceless recreation for the citizens of Minnesota and other states.

Increasing values of our forests make it essential that all land owners become better acquainted with forestry practices. According to conservative projections in a review of our nation's timber resources recently completed by the U. S. Forest Service, our management practices on forest lands must be greatly intensified if we are to meet the demand for timber by the year 2000.

The Minnesota Department of Natural Resources, under a Commissioner appointed by the Governor, consists of five major Divisions and four Bureaus. The Divisions are: Lands and Forestry, Game and Fish, Enforcement and Field Service, State Parks and Recreation, and Waters, Soils and Minerals. The Bureaus are: Planning, Engineering Services, Information and Education, and Business Management. The Divisions and Bureaus work closely together on many of the Department's activities.

The Division of Lands and Forestry has a highly complex assignment in the State of Minnesota and is a vital component of state government. It is important that Minnesota's citizens be acquainted with their state agencies, and it is with this thought in mind that this booklet has been prepared.

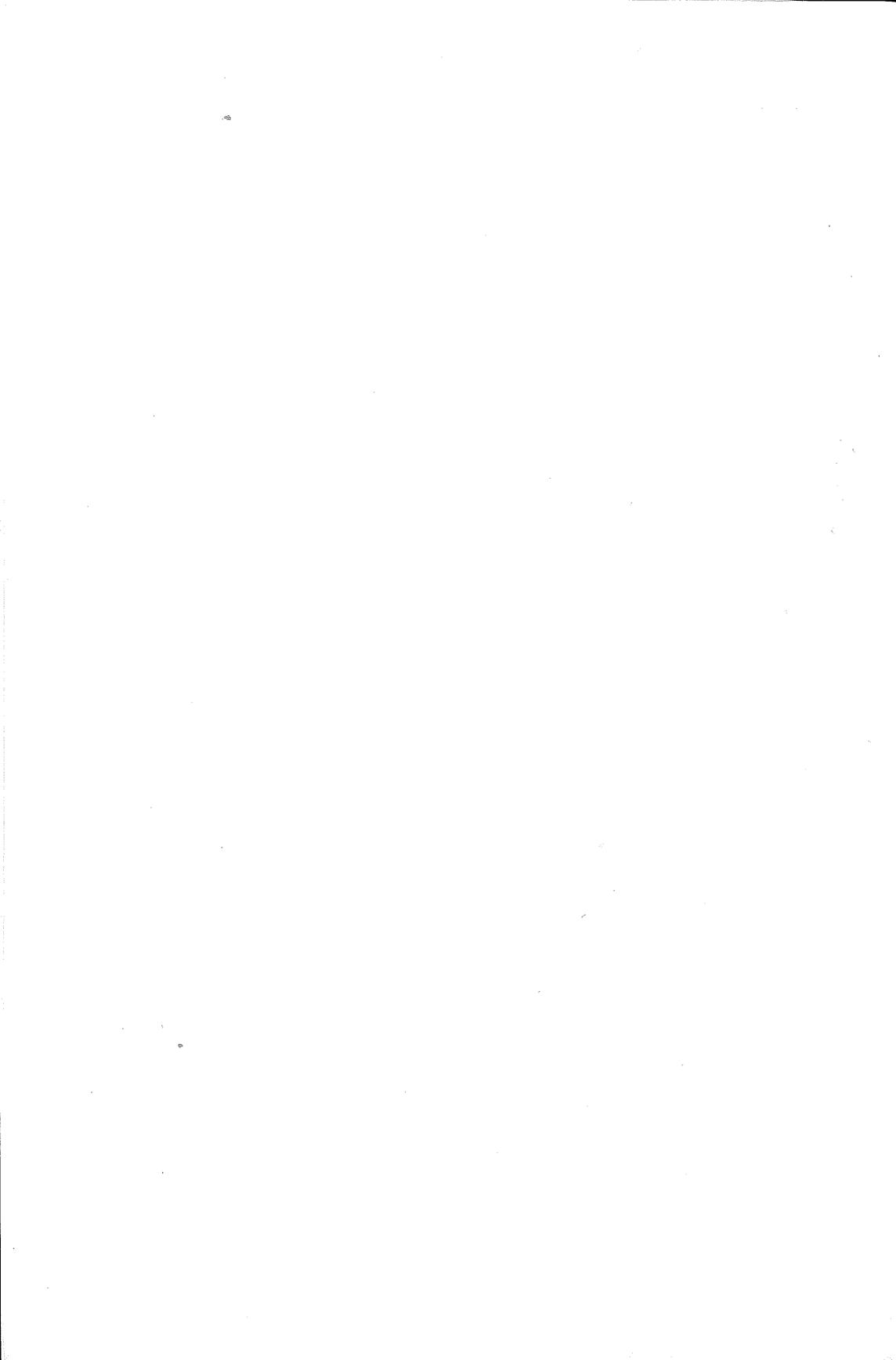
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HISTORY OF FORESTRY IN MINNESOTA

A Review of Minnesota Forestry

Vast forests covered much of the land that was to become Minnesota. The northern half, except for a narrow fringe of prairie on the western border, was covered with virgin white and Norway pine, interspersed with spruce and hardwoods. The southeastern section was clothed with magnificent hardwood forests. The rest was open prairie.

Explorers and missionaries came to the area in the seventeenth century. In 1689 it was claimed for France by Nicolas Perrot. By the Treaty of Versailles the area east of the Mississippi River was ceded to England. In 1783 it came under the jurisdiction of the United States. The country west of the river had been ceded to Spain, then France obtained it, and in 1803 it was included in the Louisiana Purchase.

At the beginning of the nineteenth century settlers began to drift into the hardwood forests in the southeastern part of the state. They immediately began to cut the timber. They needed it for building their log homes and they had to get rid of the forest to make room for their crops. Although the prairies were not far beyond, the Sioux Indians were still guarding that territory against invasion.

- 1821 All building material used by the settlers had to be cut with an ax or sawed by hand. Although the government had constructed the *first sawmill* at St. Anthony Falls in 1821 to supply timber for Fort Snelling, it was not until 1837 that the *first commercial sawmill* was built at Marine-on-the-St. Croix to saw white pine lumber.
- 1843 Many additional sawmills sprang up and lumbering inevitably became the leading industry of the state. Four mills were opened at Stillwater after 1843, and in 1847 a commercial sawmill was built at St. Anthony Falls.
- 1862 The *first railroad* came to Minnesota. By 1870 it had pushed as far north as Duluth, and after that the lumber from the north could come south to Minneapolis.

Paper mills followed the sawmills at Cloquet, Grand Rapids, International Falls, Brainerd, Little Falls and Sartell. This made a market for the smaller material of many species, such as spruce, jack pine and aspen.

Until the 1870's logging and lumbering, not forestry, typified the timber industry. About that time sentiment was growing in favor of a more sound policy in the utilization of

forest land. In 1862 the state timber lands had been broadly divided into pine lands and non-pine lands. The state land commissioner could sell *pine lands* in any manner he wished. The legislature of 1877, however, provided that lands should not be sold in the future until the timber on them had been estimated, appraised and sold.

- 1871 The first law pertaining in any way to forestry in Minnesota was the *tree bounty law* passed in 1871. It provided for paying a bounty for planting trees on the prairies, which resulted in the planting of many farm woodlots and windbreaks.
- 1876 The need for a rational program of forest use began to impress itself upon a small group of forward looking people, and in 1876 there was formed an organization known as the *Minnesota State Forestry Association*.
- 1891 *Itasca State Park* was established by an act of the legislature. It constituted the first positive step on the part of the state to preserve a part of its forest domain. The following year all government lands within the park were granted to the state by Congress.
- 1894 The rapid disappearance of the forests by the ax and fire attracted little attention. It took a catastrophe to shake people out of their complacency. When the great *Hinckley forest fire* of September 1st took the lives of 418 human beings it was brought tragically home to them.
- 1895 The legislature took the first small step toward preserving the forests and preventing forest fires by the appointment of the state auditor as *forest commissioner*. He was authorized to appoint a chief fire warden to enforce the laws which were passed for the preservation of forests and the prevention and suppression of forest and prairie fires.

General C. C. Andrews, long a pioneer in the fight for forestry, became Minnesota's *first chief fire warden*. In his first annual report he showed an area of 11,890,000 acres of forest lands in the state and nearly 25 billion board feet of timber, of which more than 18 billion were pine, three-fourths white pine.

- 1899 The *first forestry board* was created by the legislature. It had nothing to do with the prevention and suppression of forest and prairie fires. Its sole authority was the management of state lands granted to the state by the federal government or any private person for forestry purposes.

The following year Minnesota's *first forest reserve* was established when Governor John S. Pillsbury offered the

- state about a thousand acres of cut-over pine lands in Cass County. It was accepted and became the *Pillsbury State Forest*.
- 1903 Minnesota's *first tree nursery* was established on the Pillsbury Forest following a resolution by the forestry board. The following spring 86 pounds of seed were planted.
Burntside State Forest was established on 20,000 acres of rough rocky land north of Ely in St. Louis County deeded to the state by Congress.
- 1907 The *School of Forestry* of the University of Minnesota was given the use of a tract of land in Itasca Park for forest demonstration work.
 Governor *John A. Johnson*, the first governor to advocate forestry in his message to the legislature, became an ex-officio member of the forestry board.
- 1908 On the 4th of September a fire swept over the mining village of *Chisholm*, and another town was wiped out by a forest fire. At the legislative session the following year the forestry commissioner (the former chief fire warden) was authorized to appoint a corps of forest rangers in case of a dangerous fire season.
 The Chippewa National Forest, containing 190,000 acres, was established by an Act of Congress. The following year the Superior National Forest, containing 909,734 acres, was established by Presidential Proclamation. Their area has increased to 1,313,656 and 2,873,281 acres, respectively.
- 1910 About six weeks after the handful of rangers had been laid off because of lack of funds, another forest fire tragedy struck Minnesota. It had been the driest year ever recorded in the state. On October 9th a terrific wind fanned the many small fires into a holocaust and before the day ended *Baudette and Spooner lay in ashes*. Forty-two people perished in the fire.
- 1911 Following the tragedy the legislature enacted laws which marked the beginning of the present *Minnesota Forest Service*. All responsibility was transferred from the state auditor and placed under a forestry board. Only the management of state timber remained under the auditor. The board of nine members appointed Wm. T. Cox as Minnesota's *first state forester*, and General C. C. Andrews as secretary. Mr. Cox organized the state forest protection system with district rangers under whom worked state and federal patrolmen.
- 1914 A constitutional amendment (Sec. 7, Art. VIII) was passed which set aside *trust fund land as state forests*. In 1917 the

legislature set up some 350,000 acres of state lands in northern St. Louis, Lake and Cook Counties as state forests. That same year the first extensive tree planting was undertaken when wild stock dug up in the woods was planted on various types of land. The following year 200,000 3-year-old seedlings were planted on the Burntside State Forest.

1918 Another frightful forest fire disaster occurred. On October 12 a hurricane of fire wiped out the town of *Cloquet*, most of *Moose Lake* and more than a dozen smaller villages. Four hundred thirty-eight people lost their lives. Even this tragic demonstration of the need for more funds for fire protection made little impression. However, one important law was passed, namely the *burning permit law*. Previous to its passage, anyone could start a fire wherever and whenever he felt so inclined.

1924 The enactment of the federal *Clarke-McNary Act* provided the state with increased funds for fire prevention work, and has continued to provide financial assistance to the present time.

1925 The first *Conservation Commission* was created and the first Department of Conservation set up. The state forester became the commissioner of forestry and fire prevention.

The *forestry laws* were reorganized and *codified*. The *forest area* of the state was defined as any county having 1,000 acres or more of timber or unbroken prairie land or of cutover land not cleared of combustible material.

1927 The first *Christmas tree* law was enacted, governing the cutting of Christmas trees. In 1935 the law was strengthened by providing that all Christmas trees must be tagged.

1929 The first *land exchange law* in the form of an amendment to the constitution was proposed. Time after time it failed to pass. Not until 1938 was it adopted.

1931 *Reorganization* of the Department of Conservation took place. The three-man Conservation Commission was abolished. The new department functioned under a five-man commission appointed by the governor, and was empowered to employ a Commissioner of Conservation for a six-year period. All the powers and duties formerly vested in the state auditor regarding public lands, waters, minerals and timber were conferred on the Commissioner of Conservation. The administration of state forests and the sale of state timber on state forest lands were put under the control of the Division of Forestry in that timber was to be sold by the auditor only upon the recommendation of the Director of Forestry.

All *state parks* were put in charge of the Division of Forestry.

The legislature authorized the production of tree planting stock, limited to native conifers for planting on state owned lands. The *Badoura Nursery* near Akeley had actually made a beginning several years before, and seedlings were soon available for planting.

- 1933 The legislature passed a law providing that all income from acquired lands within state forests was to be credited to the general revenue fund of the state, and that *50 per cent of the gross receipts* from such lands was to go to the counties in which the lands were situated.

The *Civilian Conservation Corps* camps were established, and practically overnight thousands of young men were available for work in fire protection, fire fighting, forest management and nursery work. An additional *thirteen state forests* were set up by the legislature upon which CCC work could be done.

- 1935 A separate *State Parks Division* was set up. However, the timber in Itasca Park remained under the jurisdiction of the Division of Forestry.

One by one the needed laws were enacted. *Wilful burning* was changed from a misdemeanor to *third degree arson*. Cities were authorized to obtain lakeshore lands for *municipal forests*. *Peat lands* were withdrawn from sale. Again *thirteen state forests* were established. The Director of Forestry was empowered to *acquire tower and ranger station sites, to close roads and trails* through forest areas when fire conditions warranted, and to *clear up fire hazards* along roadsides.

- 1937 *Reorganization of the Conservation Department* took place again. The Conservation Commission was abolished and replaced by a Commissioner appointed by the governor. This system prevails at present.

- 1939 A forward step in the administration of *tax-forfeited lands and timber* was taken by the passage of a law providing for the classification of the lands and the appraisal of the timber and its approval by the Commissioner of Conservation before the land could be sold.

County land zoning also was authorized. Eight counties subsequently zoned their lands and established boundaries between conservation and non-conservation lands.

A second *forest tree nursery* was started near Willow River, and named for General C. C. Andrews, Minnesota's first chief fire warden. It was developed largely with WPA labor.

1943 Throughout the years, state forests had been established under various laws. In 1943 the state forest laws were codified and 29 state forests reestablished under one act. Three of the original forests, namely the Burntside, Bowstring and the Minnesota State Forests were not included in the new law.

Minnesota's first *minimum cutting regulations* law was enacted. It regulated the size of trees to be cut and provided for leaving seed trees.

1944 The *Keep Minnesota Green* movement was organized in Minnesota, and it became the third state in the Union to inaugurate such a movement, having been preceded only by Washington and Oregon. KMG, Inc., has become an important factor in the forest fire prevention education program in this state. It also sponsors the *Tree Farm program* which was inaugurated nationwide the previous year. More than a thousand tree farms were set up by 1958 and over 600,000 acres of private forest land placed under forest management.

1945 The establishment of tax-forfeited lands as *county memorial forests* was authorized by the legislature. Twenty-seven such forests have been set up, covering 840,000 acres.

1946 *Private forest management assistance* to owners of forest land was begun with the employment of two trained foresters with funds in the amount of \$8,000 provided by forest industries. The following year, 1947, a legislative act provided for private forest management service to owners of not more than 1,000 acres, and the work continued.

1947 After an unsuccessful attempt to provide *planting stock* to land owners through contracts with commercial nurseries, the Division of Forestry was authorized to produce stock of all species for use on *privately owned lands*. Production of trees was immediately accelerated.

1949 The *Christmas tree tagging* law was repealed. A new law provided for a *transportation permit and the written consent* of the land owner.

1953 The *Norway pine* was designated as the official Minnesota *state tree* by the legislature.

The Division of Forestry was empowered to furnish *tree planting stock* free of charge for use on auxiliary forests owned by social, educational, or charitable organizations.

The *Chengwatana State Forest* in Pine County was established, bringing the number of state forests to 33.

1955 Another state forest was established in Aitkin County, the *White Pine State Forest*, bringing the total to 34.

The \$800 *auction timber sale* was authorized. This provided a timber sale between the large auction sales and the small permits.

An *inventory of the timber* on the 4,750,484 acres of state land owned or administered by the Department of Conservation was completed and published. It was the first such inventory in the history of the state.

1956 *Reorganization* of the Division of Forestry was completed. Since 1911 it had operated on a functional staff basis. The reorganization resulted in a modified line-and-staff organization. The functions of the division were divided into two sections, State Land Management, and Cooperative Forestry, each in charge of a Section Chief. The following year the field was reorganized into four Regions, each in charge of a Regional Forester; 18 Administrative Areas, each in charge of an Area Forester; and 74 Ranger Districts, each in charge of a District Ranger.

The *Carlos Avery Nursery* near Forest Lake, developed by the Game and Fish Division, was transferred to the Division of Forestry for the purpose of consolidating all tree nurseries under one division.

The Division entered into agreements with the U. S. Forest Service for cooperation in the federal *Soil Bank Conservation Reserve* program and the *Agricultural Conservation* program. The Division agreed to grow forest planting stock for use in the programs and to provide technical forestry assistance. As a consequence all three state nurseries were expanded considerably.

1957 The first Friday in May was designated permanently as *Arbor Day* in Minnesota by the state legislature.

The *Minnesota Tree Growth Tax Law* was passed. It permitted privately owned lands suitable for the growing of forest products to be taxed on the basis of the annual increase in value, to encourage land owners to retain and improve their timber lands and keep them on the tax rolls.

1958 A special session of the legislature provided \$1,500,000 to the Commissioner of Conservation for unemployment relief in certain areas of the state, particularly the Iron Range. A great many *conservation work projects* were accomplished.

The first *intensive forest fire protection in Southeastern Minnesota* under the direct supervision of the division was inaugurated.

- 1959 The so-called *dump ground fire law* was passed which permitted the Commissioner of Conservation to stop dumping in an area when deemed necessary and to require a firebreak around the dumpground or such other measures as to prevent the spread of fire to adjacent forest land.

On May 1st the 14,000-acre *Badoura fire* occurred. It was of incendiary origin and endangered the Badoura nursery. Damage to reproduction and plantations was very extensive.

Prompted by the Badoura fire, at the special session of the legislature, *wilful burning of pine lands* was made a *felony*, punishable by a year's imprisonment and a \$1,000 fine or both.

The former maximum limit of \$250 in appraised value on *small timber sale permits* was increased to \$350.

By order of the Commissioner of Conservation 830,116 acres of state land were reserved from sale and *set aside as state forests* to be added to existing state forests.

- 1961 \$1,500,000 was appropriated by the Legislature for conservation work in depressed areas. The appropriation provided relief for unemployed persons and at the same time resulted in the accomplishment of much needed conservation work projects.

- 1963 In 1963, the Legislature established and re-established 54 state forests which included 2,926,570 acres of state-owned forest land.

The Minnesota Outdoor Recreation Resources Act was passed which gave impetus to the development of numerous recreation facilities within the state.

- 1965 *Arbor Day*, which had been observed on the first Friday in May since 1959, was changed to the last Friday in April.

A bill was passed by the Legislature prohibiting the Land Exchange Commission's approval of acquisition by the United States of land within the boundaries of Superior National Forest in Cook, Lake, and St. Louis Counties. It also prohibited the approval of any exchanges between the state and the United States in this area and required that any exchanges already approved were to be held in abeyance until July 1, 1967. This did not apply to exchanges with the state or private interests where the purpose of the exchanges was related to development of taconite, semitaconite, copper, copper-nickel, or nickel projects.

1967 The Department of Conservation was reorganized by the Legislature. The Division of Forestry now known as the *Division of Lands and Forestry*. State land leases, sales and land records now a part of the division.

The scaling of cut forest products was assigned to the Department of Conservation. The timber laws were updated. The minimum cutting law, identification of timber products during transit, and the \$800 auction sale were repealed. The railroad fire laws and the Minnesota fire laws were updated and improved.

1969 Timber laws concerned with the sale and removal of state timber again amended to include *consumer scaling*.

Beginning in 1895 with a single employee whose salary was \$1,200 per year, and an appropriation of \$5,000 for forest fire prevention, Minnesota's Division of Lands and Forestry has developed into an organization of some 331 permanent employees and an annual budget of over four million dollars.

Its duties are complex and cover not only forest fire protection, suppression and education, but the management of state lands, timber and forests, state land leases, sales and records, operation of state tree nurseries, tree planting, supervision of auxiliary, municipal and school forests, recreational area development, forest insect and disease control, private forest management service, marketing and utilization, and many related activities. Each major activity is described in this booklet.

MINNESOTA LANDS AND FORESTRY ORGANIZATION

The Director of the Division of Lands and Forestry has his office in the Centennial Building in St. Paul. The Division is a line and staff organization consisting of a staff located in St. Paul and an operating group in the field. To assist him in carrying out his many duties, his staff in St. Paul is comprised of a Deputy Director, Foresters, an executive assistant, stenographers, typists, and clerks. The total complement includes 331 permanent positions, 55 seasonal forest guards, several intermittent classified positions, and numerous temporary laborers and fire fighters employed in the nurseries, on fires, and on field projects as needed.

The Division's programs are grouped into four Sections: State Land Planning and Forest Management; Forest Protection and Public Relations; Technical Forestry Programs; and State Land Leases, Sales and Land Records. The staff work likewise is grouped into these four Sections.

Policies and programs are formulated by the staff. The Section Supervisors, with the aid of their staff foresters, recommend policies to the Director and outline programs planned. The Director approves all policies and programs, consulting with the Commissioner of Natural Resources as needed. Once policies and programs are approved, procedures in line with them are usually established by the staff men concerned. The policies, programs, and procedures established are then passed on to the field operating group.

The State Land Planning and Forest Management Section consists of a Section Supervisor assisted by a Staff Forester for timber sales and reforestation, and a Staff Forester for land planning and inventory. Other staff foresters include an Assistant Staff Forester for forest inventory, an Assistant Staff Forester for reforestation, and an Assistant Staff Forester for recreation. Also in this Section are a Scaling Specialist and three Land Exchange Appraisers headquartered in the Grand Rapids Services Center.

The Forest Protection and Public Relations Section consists of a Section Supervisor assisted by an Assistant Staff Forester for fire prevention and law enforcement. Included in this Section is fire prevention education.

The Technical Forestry Programs Section consists of a Section Supervisor assisted by a Staff Forester for county and private forest management, and a Staff Forester for nursery and seed development, who directs the operation of three nurseries with help of three Nursery Superintendents. This Section also includes a Staff Forester to promote utilization and marketing of forest products produced on both private and state lands.

The State Land Leases, Sales and Land Records Section consists of a Section Supervisor assisted by an Assistant Staff Forester for special land projects and a Staff Assistant.

The Deputy Director serves as operations officer for the Division and also directs the service functions, which include personnel management, fiscal control, equipment, buildings, roads and communications necessary to maintain operations. He is assisted by a Staff Forester for special projects and an executive assistant in St. Paul, and a Field Services Supervisor in Grand Rapids who supervises the Services Center.

The field operating group is composed of four Regions, 18 administrative Areas and 92 Districts.

The Regional Forest Supervisor directs the work of the Areas assigned to his Region with assistance of Regional Staff Foresters. He is the direct link between the Director and his staff and the field Areas and Districts. He participates in staff meetings, presents annual work plans and budgets to the Director and staff for approval, participates in personnel management decisions for the Region, advises Area Forest Supervisors on their problems, and inspects for compliance with work plans, programs, and policies.

The Area Forest Supervisor is responsible for directing and accomplishing all of the Division's programs in his assigned Area. He has an Area Staff Forester to assist him. Eighteen Area Forest Supervisors and the Area Staff Foresters provide administrative direction to Area operations.

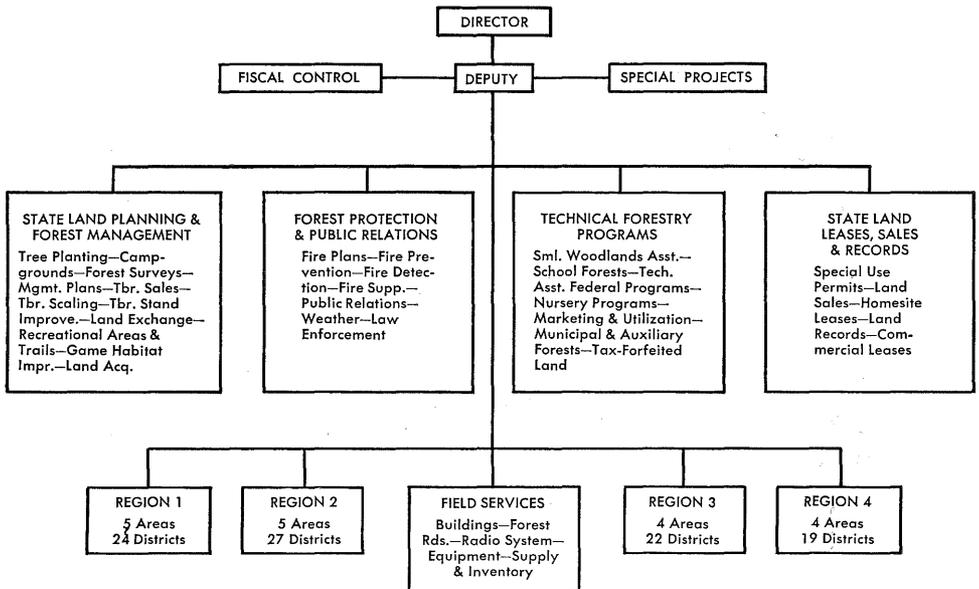
The District Forester is assigned to administer a District within the Area. The District Forester may or may not have a District Assistant or a Forest Guard to assist him in his work, depending upon the work load indicated by the work load analysis for his District. Since this is the level at which all program field work is accomplished, the majority of the complement is assigned to District operations.

Each Area has an Office Assistant who maintains records, prepares various reports, and types correspondence. Fifteen Areas and the three Nurseries have Forestry Repairmen assigned to perform local repairs on equipment and to see that this equipment is properly maintained. In addition, the Forestry Repairmen operate heavy equipment on fires and construction projects of various types.

The Field Services Supervisor directs the activities of the Grand Rapids Services Center to provide the great variety of services required to carry on the field operations. He has the assistance of a Supply and Inventory Supervisor for the supply operation; an Equipment Supervisor for equipment maintenance and replacement; a Build-

ing Supervisor for building maintenance, remodeling, and construction; a Forest Road Supervisor for maintenance, reconstruction, and construction of forest roads; and a Radio Engineer to supervise the radio communication network of the Division. Each supervisor has a complement of clerical and trades personnel for his assigned service work.

DIVISION ORGANIZATION CHART





White Pine near Cass Lake, 1898.

STATE LAND PLANNING AND FOREST MANAGEMENT

Timber has played an important part in making Minnesota a great state.

The rapid development of Minnesota was largely due to the lumber industry. In 1850 Minnesota Territory had a population of only about six thousand, but in 1857 more than a hundred fifty thousand people claimed Minnesota as their residence. The lumber industry gave employment, provided relatively cheap building material, and produced capital for the development of other important industries.

The first lumbermen in the St. Croix Valley were sure that the pine forests of Minnesota would last for centuries. An early timber cruiser said that along the Rum River alone he saw enough white pine timber "to keep seventy sawmills busy for seventy years." But



Wilson Brothers logging camp, 1901.

these prophets were mistaken. The peak of the pine lumbering came about 1900. Not long after that began the decline of this giant industry for most of the best pines were gone. The great demand for lumber, the thousands of skilled lumberjacks, and the capital and shrewd business judgment of the lumbermen combined to reduce a vast natural resource in less than a century. The problem of cutover and burned-over land remained.

Gradual progress has been made in rebuilding forest lands, following the rapid liquidation of timber resources by logging and destructive burning.

Management of State-Owned Forest Land

The State of Minnesota is the largest single land owner in the state, with more than five million acres of state-owned land, and must assume a leading role in the rebuilding of forest lands to maximum productivity. Periodic forest inventories are necessary to evaluate constantly changing forest conditions. The volume of state timber is constantly influenced by growth on the one hand and losses from logging, fire, wind, insects, and disease on the other. Current information concerning forest conditions is essential in sound forest management planning to assure a sustained maximum production of forest products and other multiple use benefits.

During the past 30 years considerable technical progress has been made in the development of new and improved forest inventory techniques. The use of aerial photography for mapping forest areas has greatly reduced the amount of necessary field work. Modern business machines are used to compile field data at great savings in time.

Present State-Owned Timber Supply

The most recent forest inventory shows that state timber volume has been increasing in recent years due to natural growth encouraged by improved fire protection and other forest management practices. There is a present growing stock of approximately 15 million cords, plus 1,300 million board feet on state lands. This volume of timber at present stumpage prices is valued at approximately 37 million dollars. This is the value of the standing timber. It is worth many times more by the time it is cut and processed.

The present desired cut from state lands, based on condition, growth, and age of present stands is 460,000 cords, plus 85 million board feet annually. Cutting within this limit will assure a continuing yield of forest products and result in even greater yields in future decades.

Management Planning by Districts

In addition to statewide timber information necessary for adequate planning, much more detailed information is required within each of the 92 individual forestry districts to put long range plans into operation. Each forester must know exactly *where* mature timber stands are located, *when* they should be harvested, and *how* they should be harvested. Obviously, such detailed information requires intensive field examination. At the present time, the Division of Lands and Forestry is actively engaged in district forest inventory work in all districts.

Timber Harvest

Methods have changed drastically since the early days. The logging camp is mostly history, with only a few isolated camps left. The bow and cross-cut saws have long since been replaced by the chain saw.

In the past few years, mechanization has caused even greater changes in logging. The chain saw is being replaced by mechanical harvesters that shear or saw off the trees and cut the trees into lengths. Whole trees are debarked and chipped into small pieces in the woods.

These modern methods move wood very fast with little labor. Tracts of timber that required many men to cut are now harvested within a very few days by several men. This has required a complete change in the concept of measuring timber. Units of measure, such as cords and board feet, are being replaced by pounds and tons. Instead of being measured in the woods, products are measured at the consumer's plant.

Timber Sales from State Lands

In early years, timber was harvested from all lands with little regard for the future. With much of the timber removal, improved



Aspen (poplar) pulpwood ready for hauling to paper mill. This kind of timber was wasted in the early Minnesota logging days.



Load containing 9,000 small sized black spruce Christmas trees for processing. Such trees are cut only from stagnant swamp areas that will not produce larger sized trees.

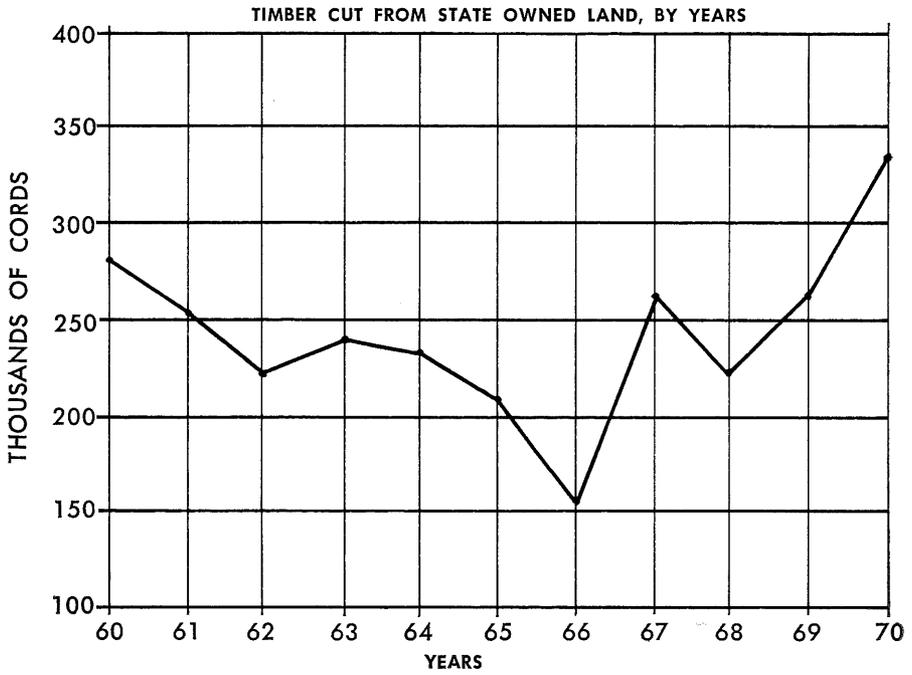
cutting practices which would assure regeneration of timber stands and improved growth rates become imperative. Along with the recognition of the need, research has provided increased knowledge of tree growth and reproduction.

Today, careful attention is given to each timber sale to assure that trees are harvested in accordance with the best forestry principles. Research continues to unlock more of nature's secrets, and further improvement in cutting and reforestation methods are expected to increase tree growth rates in the future. The proper treatment of each timber stand according to age, density of the timber, type of soil and species of trees, and other growth facts requires forestry skill and knowledge.

State laws prescribe the manner in which State timber may be sold. Large tracts of timber with values of up to \$15,000 may be sold at public auction. Small, informal sales may be made in amounts not exceeding \$500 in appraised value.

Timber harvested from State-owned land contributes greatly to the support of the forest industry which is the third largest industry in the State, exceeded only by mining and agriculture. This harvest has remained fairly constant over the past decade, but all indications point to a substantial increase in the coming decade.

FIGURE 1



Stand of young white pine thinned to proper density for maximum growth.

Receipts from the sale of state timber are deposited in the various state trust funds. The totals deposited in recent years are as follows:

TABLE I
RECEIPTS FROM SALE OF STATE TIMBER

<i>Fiscal Year</i>	<i>Receipts</i>
1960	\$ 936,358.01
1961	688,461.26
1962	831,889.89
1963	734,836.27
1964	800,587.36
1965	670,907.62
1966	546,872.80
1967	809,929.95
1968	636,012.94
1969	637,490.54
1970	852,975.65

Annual fluctuations in income from timber sales are a reflection of changes in general business activity and the demand for forest products.

While the receipts from state timber sales are an important source of revenue, the amount received from the sale of stumpage is small when compared to the total value of such sales in added employment and income to northern Minnesota residents. Each cord of pulpwood, for example, provides employment for the cutter, skidder, trucker, and millworker. Money earned by those employed in the timber industry help to support local businesses in the various com-

TABLE II
SMALL TIMBER SALES ISSUED

<i>Fiscal Year</i>	<i>Number</i>
1960	2,970
1961	2,741
1962	2,601
1963	3,028
1964	2,912
1965	2,742
1966	2,348
1967	2,714
1968	2,304
1969	2,230
1970	2,477

munities of the state. It is estimated that the total value of forest products harvested and processed from all ownerships of forest land in Minnesota exceeds \$340 million annually.

Declining farm income has greatly added to the importance of timber as an additional source of revenue to farmers and settlers in the forest area. In this connection it should be noted that informal timber sales have been issued in increasing numbers to small operators.

The Future

In tracing the slow but steady progress in forest management throughout the years, foresters are heartened by the increased public awareness of the extreme importance of proper management of our forest resources for the future. Recent projections of the Census Bureau indicate the total population of the United States will be 240 million by 1980 and will reach 300 million by the year 2000. Such large population increases will result in greatly increased demands on our state's timber and recreational resources. The future of land management depends on all of us — the industries and citizens who are part owners of so much public land.

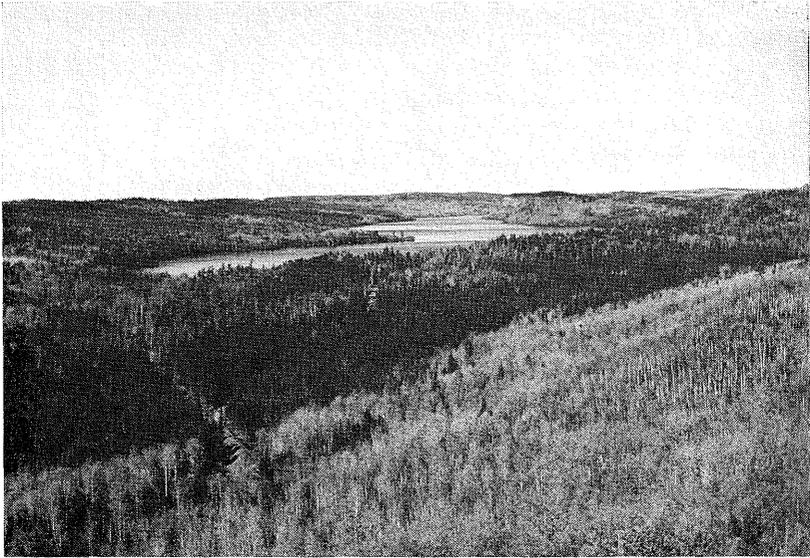


Future crop of Norway pine growing under older trees on state land.

State Forests

No provision was made in the state constitution for holding in state ownership lands best suited for forestry purposes. In 1914 an amendment was adopted which provided for the establishment of state forests.

The location and boundaries of state forests that were established after the Pillsbury State Forest in 1899 and the Burntside State Forest in 1905, were determined primarily on one or both of two factors — the first being the concentration of state land ownership in the area, and the second, the presence in large quantities of lands which were unsuited for agricultural use and which were tax-delinquent to such



A view of the Grand Portage State Forest.

a degree that forfeiture to the state was inevitable. Subsequent legislation placed the sale and management of tax-forfeited lands in the hands of the counties, with a provision, however, for the counties to turn lands over to state agencies if they desired.

As the state forests are scattered throughout the northern part of the state, a great variation is found in the topography as well as in the land itself. The forest land in the northeastern section of the state is characterized by hills of almost mountainous proportions, steep rock cliffs and many small swamps. The same territory has numerous lakes, both large and small, some of which are the deepest in the state.

The land within the forests of the north-central part of the state, east of the prairie region, is much less hilly. The soil is usually sand or sandy loam and there is little or no rock outcrop. In this area the lakes are as numerous as in the northeast.

In the state forests of the northwestern part of the state the land differs greatly from the other two areas. There are localities where the soil is very sandy, but the chief characteristic is the enormously large peat swamps. Fairly good soil is found under the peat in certain areas. Outside of Lake of the Woods, the only lakes worthy of mention in this area are Upper and Lower Red Lakes.

Within the exterior boundaries of the state forests, land ownership can be grouped into four major classifications, namely state, federal, private and tax-forfeited. The gross area of the land within these 55 state forests, not including lakes and rivers, is 8,321,104 acres. There are 3,000,374 acres of state owned land within the forest boundaries. Such ownership is gradually being increased by purchase, gifts, and land exchange.

Recreation

The forests and lakes of Minnesota give to the state a characteristic and peculiar charm that is unsurpassed anywhere. It is for this reason that people from many parts of the United States spend their summer vacations here. Some people enjoy camping in the out-of-doors, others prefer to stay at modern resorts, and many have built summer homes on the numerous lakes where they may spend the entire summer. There are still large areas of undeveloped wilderness. Much of this will always remain so, and furnish unexcelled recreation for the person who loves to travel by canoe or on foot.



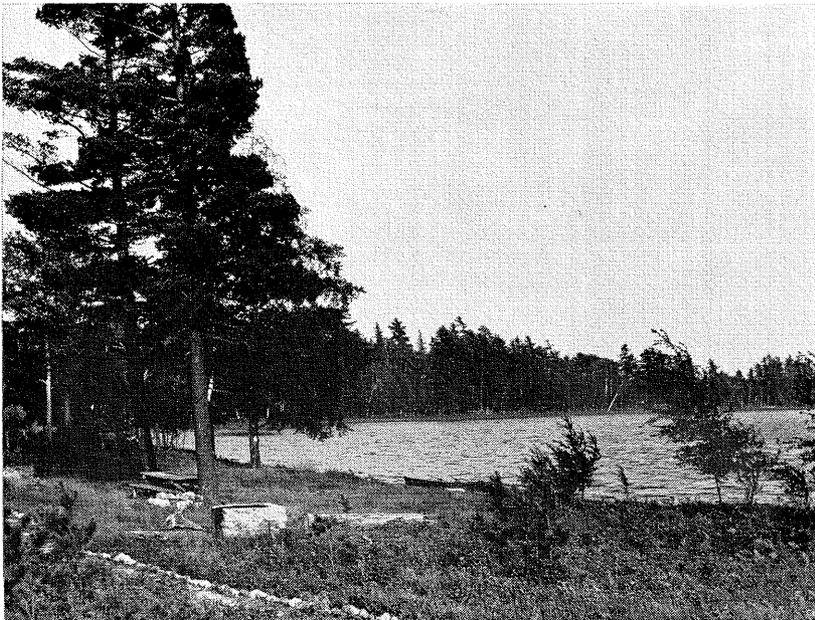
A state forest road.

TABLE III
STATE FORESTS OF MINNESOTA

<i>State Forest</i>	<i>State-Owned Acreage</i>	<i>Gross Area Acres</i>
Badoura	4,401	15,224
Battleground	9,413	12,868
Bear Island	24,345	141,187
Beltrami	502,405	669,032
Big Fork	45,020	124,270
Birch Lakes	437	637
Blackduck	40,380	123,116
Bowstring	117,829	414,090
Buena Vista	18,883	104,073
Burntside	24,673	62,782
Chengwatana	13,308	28,004
Cloquet Valley	38,357	316,467
Crow Wing	5,415	31,307
D.A.R.	360	640
Emily	640	640
Finland	98,401	307,648
Fond du Lac	41,027	59,745
Foothills	18,588	45,125
General C. C. Andrews	5,188	7,540
George Washington	93,775	306,828
Golden Anniversary	1,844	6,811
Grand Portage	31,934	98,700
Hill River	75,632	111,392
Huntersville	14,373	33,222
Insula Lake	485	485
Kabetogama	172,906	697,363
Koochiching	224,735	352,582
Lake Isabella	66	66
Lake Jeanette	1,357	10,725
Land O'Lakes	29,935	50,895
Lyons	560	640
Minnesota Memorial Hardwood	21,327	1,978,819
Mississippi Headwaters	9,865	44,919
Nemadji	90,518	96,270
Northwest Angle	14,442	79,169
Pat Bayle	39,676	170,644
Paul Bunyan	60,772	102,440
Pillsbury	7,883	14,756
Pine Island	655,345	878,039
Red Lake	64,120	66,055
Remer	2,440	12,774
Rum River	16,591	33,180

TABLE III — (Continued)
STATE FORESTS OF MINNESOTA

<i>State Forest</i>	<i>State-Owned Acreage</i>	<i>Gross Area Acres</i>
St. Croix	26,030	42,105
Sand Dunes	3,837	10,805
Savanna	121,622	218,451
Smokey Bear	11,017	12,238
Smoky Hills	13,869	23,791
Snake River	8,266	9,160
Solana	58,026	68,176
Sturgeon River	52,107	142,868
Two Inlets	13,836	26,225
Wealthwood	8,111	14,053
Welsh Lake	6,060	16,336
White Earth	28,472	113,338
Whiteface	2,480	4,480
Sub-Totals	2,993,384	8,313,195
Administrative & Scattered.....	6,990	7,909
Totals	3,000,374	8,321,104



A state forest campground.

The use of state forests for recreation has increased rapidly as more roads made them accessible by automobile. The roads also made possible numerous resorts on privately owned lands within the forest. On State land, it was found advisable to provide facilities for the many people who do not go to commercial resorts. These facilities consist of campgrounds, picnic areas, hiking and riding trails, boat accesses, and swimming beaches.

Recreational Areas

Even before the major state forests were established, state owned lakeshore was used for camping and lake access. Some of these areas were used so much that when the land became part of a state forest the Division began maintaining them and doing some improvement work. The first campgrounds prepared were therefore rather primitive and had few improvements except that the area was cleared of brush and the location designated as a public campground. As time went on many of the campgrounds were supplied with water, fireplaces, tables, and toilet and refuse disposal facilities.

During the period from 1933 to 1941 when the Civilian Conservation Corps camps were in operation, new campgrounds were prepared and some of the existing ones improved. Most of these are still in use and are maintained as well as available funds will permit. The Division now lists 51 so-called "primitive" campgrounds in various parts of northern Minnesota. These campgrounds have a minimum of facilities and are designed primarily for the tent camper. A charge of \$1.00 per night is made at 24 of the campgrounds.

In addition to campgrounds, the Division of Lands and Forestry maintains 33 picnic areas with 204 picnic sites, 31 swimming beaches, 169 boat accesses, and 1,016 miles of hiking and riding trails for public use.

TABLE IV
STATE FOREST CAMPGROUNDS

<i>Name</i>	<i>Nearest Town</i>	<i>County</i>
Ann Lake	Zimmerman	Sherburne
Ash River	Orr	St. Louis
Bear Den Landing (On Mississippi River)	Solway	Beltrami
Bear Lake	Nashwauk	Itasca
Bemis Hill	Warroad	Roseau
Ben Linn Landing (On Big Fork River)	Big Falls	Koochiching
Birch Lake	Melrose	Stearns
Blueberry Hill	Williams	Lake of the Woods
Boulder (On Rock Lake)	Sandstone	Pine
Cedar Bay (On Bear Lake)	Brimson	St. Louis
Coffee Pot Landing (On Mississippi River)	Lake Itasca	Clearwater
Cottonwood Lake	Deer River	Itasca
D.A.R.	Askov	Pine
Eckbeck (On Baptism River) ..	Finland	Lake
Faunce	Williams	Lake of the Woods
Finland (On Baptism River) ..	Finland	Lake
Gafvert (On Pickerel Lake)	Duquette	Pine
Gappa's Landing (On Kabetogama Lake)	Orr	St. Louis
Greer Lake	Crosby	Crow Wing
Gulch Lakes	Lake George	Hubbard
Harrison Landing (On Big Fork River)	Wirt	Itasca
Hay Lake	Jacobson	Aitkin
Hungry Man Lake	Park Rapids	Becker
Huntersville Forest Landing (On Crow Wing River)	Menahga	Wadena
Indian Lake (On Cloquet River)	Wales	St. Louis
Iron Bridge Landing (On Mississippi River)	Bemidji	Beltrami

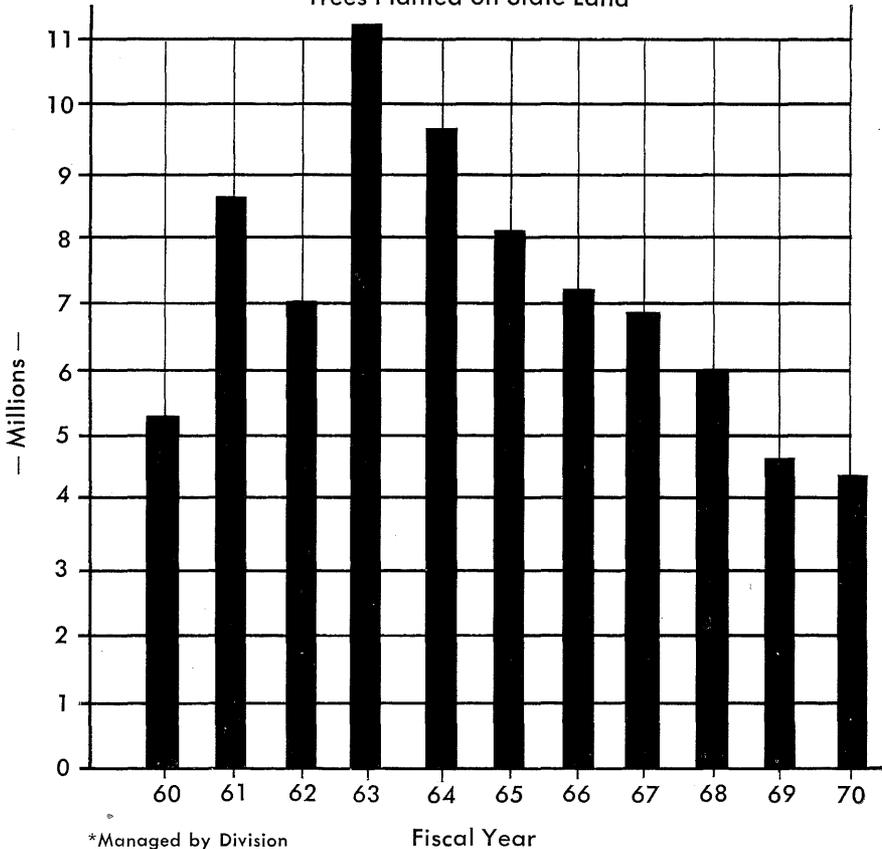
Island Point Landing (On Mississippi River)	Bemidji	Beltrami
Johnson Landing (On Big Fork River)	Big Falls	Koochiching
King William Narrows (On Crane Lake)	Crane Lake	St. Louis
Kruger	Wabasha	Wabasha
Larson Lake	Effie	Itasca
Long Lake	Talmoon	Itasca
Lost Lake	Bigfork	Itasca
Lougee Lake	Merrifield	Crow Wing
Mantrap Lake	Park Rapids	Hubbard
Moose Lake	Deer River	Itasca
Mukooda Lake	Crane Lake	St. Louis
Owen Lake	Bigfork	Itasca
Pine Point Landing (On Mississippi River)	Becida	Beltrami
Rock Lake	Pillager	Cass
Rocky Shores (On Greenwood Lake)	Two Harbors	Lake
Shell City Landing (On Crow Wing River)	Menahga	Wadena
Sturgeon River Landing	Big Falls	Koochiching
Thistledew Lake	Togo	Itasca
Wakemup Bay (On Lake Vermilion)	Cook	St. Louis
Wannagan Landing (On Mississippi River)	Lake George	Clearwater
Washburn Lake	Outing	Cass
Waskish (On Tamarac River)	Waskish	Beltrami
Whiteface River	Biwabik	St. Louis
Willow River	Willow River	Pine
Woodenfrog (On Kabetogama Lake)	Orr	St. Louis

Tree Planting on State Land

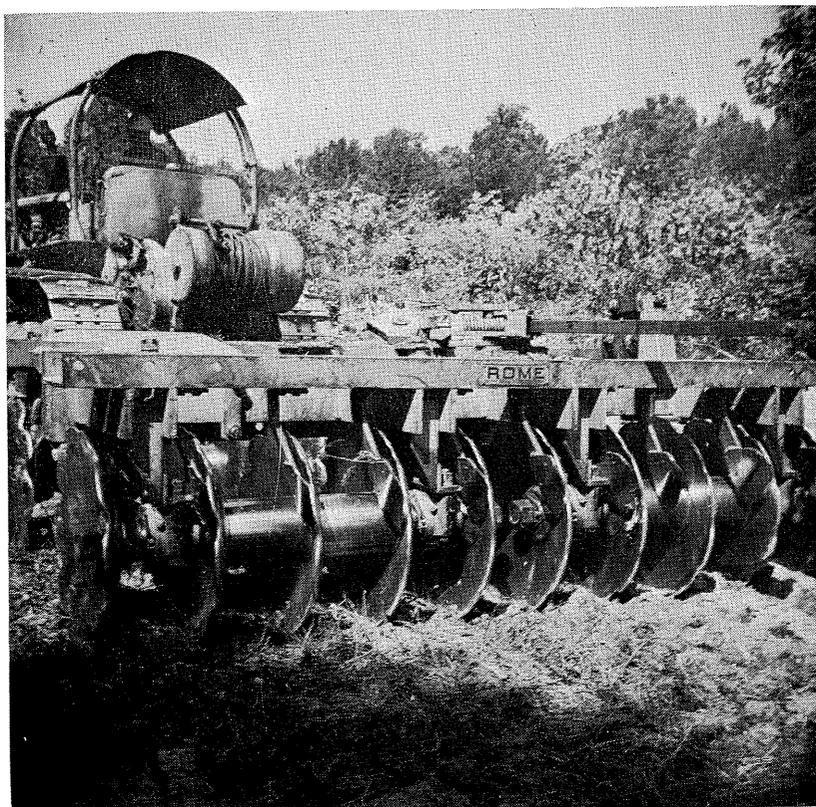
During the past 50 years more than 130 million trees have been planted on state lands in Minnesota, covering about 113,000 acres. The first planting dates back to 1914 when 160,000 trees were carried on men's backs and in canoes to sites within the Burntside State Forest. This ambitious beginning did not initiate a steady program. The number of trees planted on state land varies from none at all to over seven million in a year, with the actual start being in the early 1930's.

FIGURE 2

Trees Planted on State Land*



Beginning in the 1930's, the Civilian Conservation Corps started planting trees, which by 1942 totaled some 25 million on state owned lands. The trees were all hand-planted. On many sites the ground had to be prepared by scalping or furrowing to give the small seedlings a better chance to survive.



Brush disc used for preparing planting site.

About 1941 the planting machine was developed. However, it was not until the late 1940's that its influence was felt to any appreciable degree. This machine made possible the planting of over 10,000 trees in a day on favorable sites, such as old fields and abandoned farms. Planting machines have now come into common use.

As planting conditions became more difficult, machine design and construction of necessity have become more rugged. Larger tractors are being used to pull these machines, and sometimes especially constructed equipment is used to facilitate planting. There is, however, a limitation to what machines can plant, particularly on difficult terrain.

The easy planting sites were naturally planted first, and they are now almost a thing of the past. Many thousands of acres of brushy and other nonproductive cover still remain to be planted in order to make them productive. They can and should be made to contribute to the economy of the State.



Disc plow pulled by Crawler tractor making furrow for hand planting.



"Two-Woman" crew hand planting in furrow.

About two-thirds of the 4,560,000 acres of forest land managed by the Division of Lands and Forestry is in swamps. This large ratio of swamp to highland is unique as far as land ownership is concerned, and yet forest products from these swamplands have a very significant value. Reforestation of swamplands presents more problems than upland. However, a start has already been made to reclaim these sites by hand planting, machine planting, and direct seeding.

The goal of the Division is to plant an increasing amount of the non-productive acreage during the next 25 years at a planned rate of approximately five million trees a year.



Area newly planted with machine and scalpers.

Land Exchange

Minnesota has an extremely complex pattern of land ownership which tends to increase the management costs for both publicly and privately owned lands.

The land exchange program is designed to consolidate State lands in State forests, State parks, wildlife areas, or other conservation areas,

and, at the same time, consolidate other public and private land for more efficient management.

The first legislative reference to land exchange is to be found in the 1929 session laws. This legislation was ruled unworkable. On November 8, 1938, an amendment to the Constitution was adopted, creating the Land Exchange Commission composed of the Governor as chairman, the State Auditor as secretary, and the Attorney General, and providing for the exchange of State lands for federal or private land. The land exchange law under which the program operates today was enacted in 1939.

This law provides for the exchange of any of the public lands of the State, including lands held in trust for any purpose. Land owned by the state and controlled by the Commissioner of Natural Resources is called Class A land. Land acquired through tax-forfeiture and held in trust in favor of the taxing districts in Class B land. Class B land is administered by the various counties in which it is located. Land in State parks or bordering on or adjacent to public waters is called Class C land. Class A and Class B land, and Class C land bordering on or adjacent to public waters and in the same general vicinity, may be exchanged subject to the unanimous approval of the Land Exchange Commission. An appraisal deposit fee is required of the applicant for Class A and Class C state land. This fee is refunded upon consummation of the exchange or if the Commissioner refuses to accept the offer.

The State reserves all mineral and water power rights in State land conveyed by exchange and may accept land subject to mineral or other reservations. Public hearings must be held before final approval is given to the exchange of State land. The value of the State land and land proposed to be exchanged therefor must be substantially equal. For purposes of determining values, two bonded State appraisers determine the fair market value of the lands involved.

The 1967 Legislature created the Land Exchange Review Board which is concerned with recommendations for or against each exchange proposal and good land use adjustments.

As of March 31, 1970, 194 land exchanges have been completed involving 104,306 acres of state and county lands and 96,492 acres of private and federal lands.

Wildlife

Until recent years, not much thought had been given to the preservation of the conditions or environment necessary for all species of wildlife. Each species of bird, animal, and fish thrives best under certain conditions. Each must have suitable food, protection and

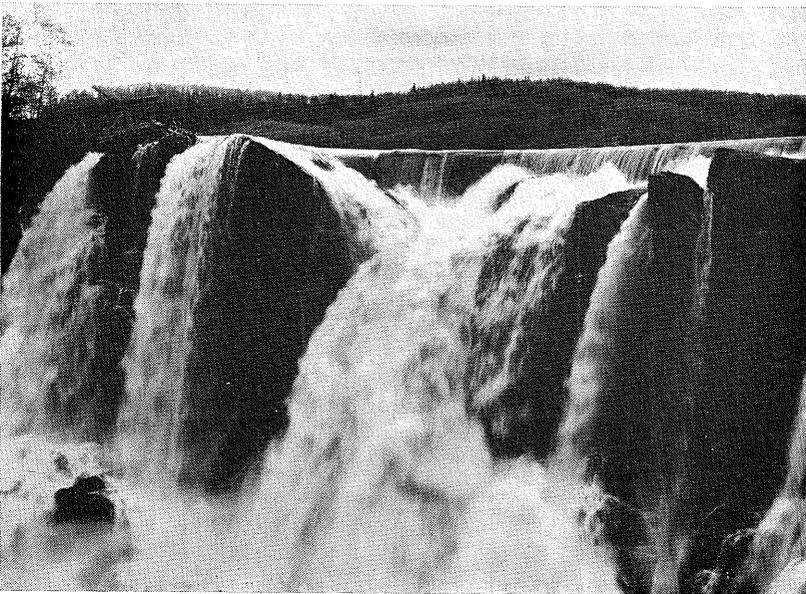
living conditions. For nearly a hundred years we have been changing, damaging, and destroying natural conditions without concern about what effect it would have on wildlife.

The logging of spruce thickets has taken from deer, moose, and other animals the winter protection they must have. The burning of a meadow may destroy nests of eggs or young birds in addition to berries, fruits, and seeds which birds and small animals live on. The drainage of swamps with the resultant drying up of streams has destroyed the homes of many fur-bearing animals. The lowering of lake levels and irregular flow of streams has meant destruction of fish life.

The restoration of animal and fish populations depends almost entirely upon the reestablishment of natural forest conditions. Proper control and management of state forests can provide the best environment for all wildlife of the region.

Erosion Control

It is a well known fact that forests reduce the rapid runoff of surface water after heavy rains and thus help to prevent floods. The force of the rain is broken by the leaves and branches of trees and bushes and the water reaches the ground in the form of a fine spray. On the ground it is absorbed by the thick layer of leaf mold and humus, from where it is carried away underground to feed the springs.



Waterpower — High Falls of the Pigeon River.

When the timber has been removed a great change takes place. The rain now beats directly onto the ground with force. Drop joins drop and soon a torrent rushes down the hill, washing out a channel and flooding the stream below.

Erosion is also a very serious nuisance in the operation of irrigation projects. The silt fills up the reservoir and destroys the value of the dam, often the only suitable dam site available. It fills up the ditches and sometimes spreads a layer of sterile sand over a fertile field.

Navigation

River navigation which has played such an important part in our national transportation is greatly impeded on streams which are subject to floods. In the spring the water is so high that navigation is dangerous. During the dry season the shallowness of the water makes the crossing of sandbars not only dangerous but often impossible.

Power Development

Water power is affected in much the same way as navigation. During the flood season much of the water overflows the dam in such volume as to frequently cause great property damage. In the dry season there is not enough water left to turn the wheels of power plants. A steady, uniform streamflow such as comes from well forested watersheds is far better for both navigation and water power. The average flow of the stream is unimportant — it is the steady, uniform flow that determines a river's usefulness.

FOREST PROTECTION AND PUBLIC RELATIONS

The Protection Area

Of the 51,749,120 acres in Minnesota, more than 31 million acres are in need of some phase of organized protection from fire. Various localities demand different degrees of consideration from a protection standpoint, depending upon the hazard, risk and value involved. In certain areas intensive protection is necessary the greater portion of the time while in other areas extensive protection is needed only during periods of unusually high fire hazards.

Fire suppression is only part of the protection program. Division personnel carry on a continuous public information program by lectures and the use of movies, radio, television, newspapers, and exhibits. They attend meetings and furnish programs to promote forestry, fire prevention and conservation education.

Intensive Protection Area. The bulk of the nearly 17 million acres now under intensive protection by the state Division of Lands and Forestry includes the counties between the Twin Cities and the Canadian border, except for a narrow fringe of prairie along the western boundary of the state. This is the area in which 907 human lives were lost in forest fires during the past decades since 1894, and is the only part of the state where it is likely that such disasters could occur again. It was the original coniferous timber belt and now contains the greater part of our remaining timber stands. It is also the region in which most of Minnesota's approximately 15,000 lakes are situated which make it an important recreational area. Also included in the intensive protection area is the region in Southeastern Minnesota along the Mississippi River to the Iowa border. Much more timber remains here than is generally known, and due to the greater local need, nearness to markets, and the quality of the products, it is an important asset to the local communities.

Extensive or Cooperative Protection Area. This area is mainly in the southern half of the state in the original hardwood belt, and in general lies east of the western prairie region and between the highly developed farming section in the southern and south-central part of the state and the present intensive protection area.

Risk and Hazard

In the development of a fire protection program the risk of fires starting and the hazard conditions must be carefully studied. The risk must be ascertained from information obtained by keeping a complete fire occurrence record and from the knowledge of those working in the locality. The intensity of risk shifts from time to time due to changing conditions, and men and equipment must be shifted accordingly.

Risk of Fires Starting. The risk of fires starting is an indication of the degree of effort required in prevention measures to assure reasonable protection. Most of the fires in Minnesota are man-caused, and broadly speaking, the degree of and the actual need for organized protection can be roughly measured by the number of people in the area during the fire season and their general attitude toward fire prevention. The type of fuel and the condition of the ground cover also have an important bearing on fires starting.

In the older and more highly developed farming territory the change in population is slow and few land clearing operations are engaged in, consequently the risk remains about the same. Some land clearing, and the promiscuous and uncontrolled burning of meadows and open grass areas, however, is continually to be reckoned with.

It is estimated that approximately 4½ million people visit Minnesota's forested areas each year, which more than doubles the population of the protection areas during the months when the fire danger is at its peak, thus increasing the risk of fires starting.

Hazard. It is generally understood that the term hazard as applied to forest fire protection refers to fuel, timber and soil types, as well as climatic and topographic conditions. Considering the protection area of the state as a whole, it is conceded that the hazard is unusually high as compared to most of the other timbered states.

Fire Weather

Climatic factors which most affect forest fire protection are wind, precipitation, relative humidity, and temperature. Due to the location of the state in relation to the Western Plains and the Great Lakes the weather conditions are exceedingly variable. Strong westerly winds accompanied by high temperatures are frequent and the relative humidity is generally quite low during much of the burning periods, all of which are unfavorable to fire control.

Because of the decidedly uneven distribution of the rainfall, the general weather records do not show the true value of the precipitation as it affects protection. Frequently rains reaching flood proportions cover only comparatively small areas while at the same time other parts of the state remain dry. Under normal conditions the rainfall is heaviest during mid-summer which confines the most hazardous burning periods to spring and fall. This does not mean that there is no fire danger during the so-called rainy season. It merely indicates that fires occur less frequently and are more easily controlled. The fire season usually starts shortly after the snow leaves the ground in the spring and continues until it again covers the ground in the fall. The length of the average fire season is about seven months.

The Division of Lands and Forestry has established 78 stations throughout the protection area for recording and computing weather observations. These are known as danger stations and are equipped with the proper instruments for making the various observations. Close cooperation is maintained with the U. S. Weather Bureau and the weather readings are submitted to the Chicago office of the bureau where a special daily fire weather forecast is made and sent to each of the protection headquarters.

Soil and Forest Types

Due to the fact that the timber types follow the soil types quite closely, the two factors are considered jointly in planning protection. Three general classifications are recognized, as follows:

1. *Light Sandy Soil with Jack and Norway Pine Timber.* The hazard in this type is extreme due to the high inflammability of the fuels, susceptibility to crown fires, and the rapid absorption and evaporation of the surface moisture which materially shortens the safety period following each rain. About one-fourth of the northern half of the state falls within this classification.

2. *Swamp Areas.* These can be grouped into two distinct subclasses, the open lowland such as peat bogs and muskeg, and the timbered swamps. The open muskegs when drained or during extended periods of drouth create a most difficult problem, while the timbered portions are normally wet. The greater portion of Minnesota's open swamp land is north of the Red Lakes in the extreme north-central part of the state, with smaller scattered areas throughout the remainder of the northern half. There are approximately 1½ million acres of grass and marsh lands intermingled with and complicating the fire control problems of forest land.

3. *The Clay Belt.* This includes portions of the intensively protected area in the north and a large part of the extensively protected area in the south. It comes within two broad timber classifications, the northern section being mixed hardwoods and conifers, and that in the south mixed hardwoods. In the hardwood-conifer territory the hazard is high due to the excessive amount of litter and the inflammable nature of the fuels found on the floor of this type of forest. In the pure hardwood stands fires do not start as readily and the burning period is normally confined to early spring and late fall with comparatively low risk and hazard during mid-summer or when the vegetation is fully grown.

The Peat Fire Problem

Peat is found in nearly every county in the state but the most extensive desposits are in the muskeg swamps or open bogs of the

northern part of the state, chiefly in Beltrami, Lake of the Woods, Koochiching, St. Louis, Itasca, Roseau, Aitkin, Crow Wing, Cass and Clearwater Counties.

Farm crops can be successfully raised on the properly drained bogs where the peat deposits are shallow, provided the top soil is of such character that it does not require an excessive amount of fertilizer and the sub-soil is of a fertile nature. The length of time the soil will remain productive is questioned by some agriculturists, however. Because the land is level and easily broken it appears unusually attractive and many farms have been developed on this type of land.

It is generally considered necessary that the top layer of peat be burned off before it is suitable for cultivation, and because of the difficulty and expense involved in controlling a fire once it is started in peat soil, many of those engaged in this type of clearing are unwilling to assume the responsibility for the burning. As a result a large number of fires are set illegally, with no effort made to confine them to the tracts desired cleared. The extinguishing of such fires is a long, tedious job and because of this many of them reach dangerous proportions before they can be controlled.

When these burning conditions are considered favorable, fires seem to start simultaneously over the entire region, creating the con-



Burned-over area in Aitkin County.

dition most feared by the forest officer — that of numerous fires burning at the same time and scattered over a large area. The only requirement under these conditions to set the stage for a conflagration is a day of cyclonic wind accompanied by extremely low relative humidity. It was under such circumstances that nearly all of Minnesota's large disastrous fires occurred. Over 50 percent of all fires which have burned in the state during the past decade were caused by debris and grass burning, a large number of which were in this peat region.

Organization

The general administration of the present fire control organization is conducted through the office of the Director of the Division of Lands and Forestry with field administration under the general supervision of the Regional Forest Supervisors and closer supervision of the Area Forest Supervisors. These men have been given sufficiently broad authority to handle whatever fire problems may arise. The District Foresters have the most critical position in the fire protection program. Temporary men such as forest guards, towermen, smoke chasers, standby crews, keymen and township fire wardens, work under the direct supervision of the District Foresters.

Township Fire Wardens. The auxiliary fire protection organization consists of various volunteer or cooperative agencies or individuals pledged to assist in controlling fires. One of the most important is the township fire warden or key unit. This force of 1,800 men are unpaid except when they are actually engaged in fire work. In some cases, they are members of the township board or members of city or village councils. Any citizen of the state, however, may be appointed to this position.

The state law provides that one of the regular duties of the township board is to take all necessary steps to prevent the start and spread of forest or prairie fires, within their respective townships. After the board members have been appointed as special wardens they act as both township officials and as state forest officers with limited authority.

The state law further provides that a burning permit must be secured before any burning may be done within the protection area of the state unless the ground is snow-covered, except that no permit is required for the burning of grass, leaves, rubbish, garbage, branches and similar combustible material in an approved incinerator. Another important duty of the township fire warden is to issue these permits. There is at least one warden strategically located in each geographical township within the protection area so that burning permits may be conveniently procured by those requiring them, as well as to increase the protection facilities in territories of extremely high hazard.

Auxiliary Organization. It is not considered practical to maintain as a state organization a large enough group of men to actually extinguish all forest and grass fires. The objective is to build up a permanent, moderately sized force of well trained experts who can devote their entire time to the fire problem.

The men holding key positions are called upon at times to assume considerable responsibility. They constitute a skeleton or supervisory force designed to organize and direct the work of fire protection within the area assigned to them. Most of the labor used in fire fighting comes from the local communities. The law provides that any able-bodied male citizen over 18 years of age must assist in fire fighting when called upon to do so by an authorized forest officer. Automobiles, tractors, and other property may be commandeered if needed in fire protection work. Compensation must be paid by the state in all cases, however.

Fire control is usually considered as three separate activities — prevention, pre-suppression, and suppression. There would be little need for the other two if prevention could be made wholly efficient. Due to the element of carelessness this is not possible and plans must be made and funds provided for carrying out the entire fire program. The extent and effectiveness of prevention governs more or less the amount of funds required for presuppression and suppression.

After the fire actually starts, the most important requisites are quick, hard-hitting action by the suppression organization if the damage and area are to be held to a reasonable minimum. This means that the detection or lookout tower system must first be made adequate in size and effectiveness, communication facilities must be developed to a satisfactory degree, a sufficient number of trained men must be available to organize, coordinate, and supervise the combat forces, and sufficient fire fighting equipment must be on hand.

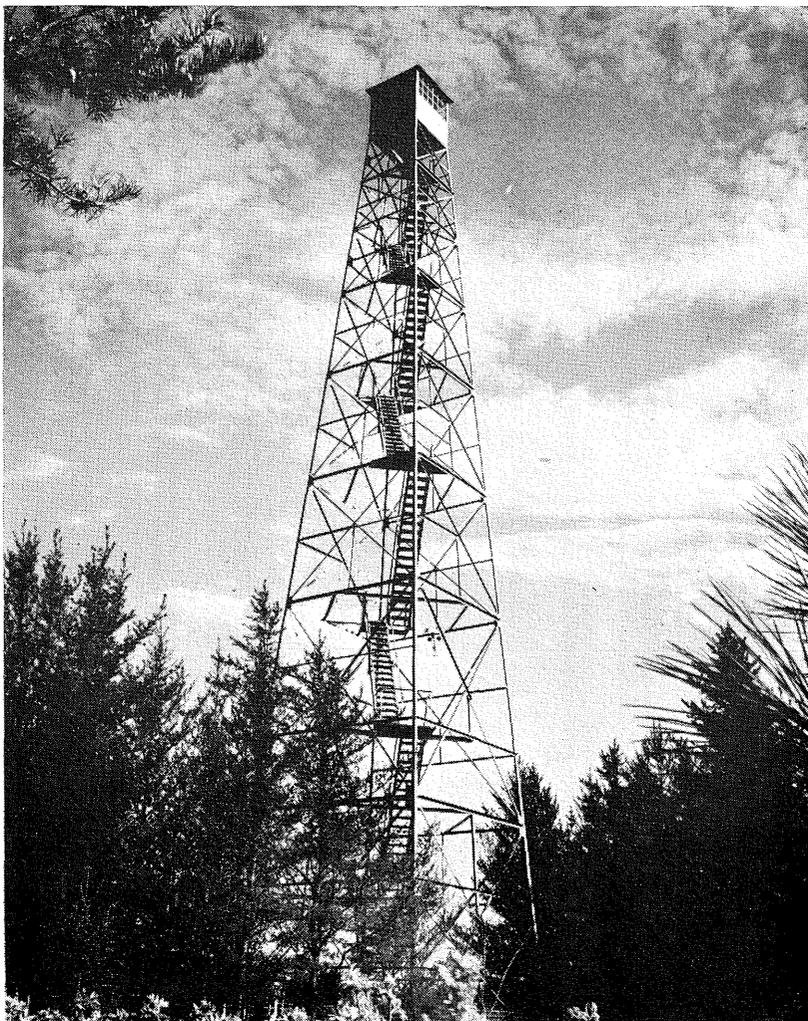
Fire Detection

When the present lookout tower system is completed in Minnesota, there will be approximately 130 steel towers in the protection area, each of which will overlook an area of about 125,000 acres. These structures, which are from 60 to 120 feet in height, have a glassed-in "crow's nest" on top. They are strategically located on the highest convenient point in each protection area.

The equipment in each crow's nest consists of a fire finder or glass-covered mapboard, with a map of the area which is under observation on which is placed a graduated circle directly over the location of the tower, an alidade or sight instrument to determine the exact angle or direction of the fire, a telephone or radio which is connected with headquarters, a scale or ruler which is used for measur-

ing distances on the map, and a pair of specially tinted goggles which are used to assist in spotting smokes. Binoculars are used in certain cases, particularly in the hilly areas.

The duties of the towerman are to determine by means of instruments the exact direction of any fire which may occur, estimate the distance and size and make a report to his superior officer, either by telephone or by radio. After the report reaches the area headquarters and the exact location of the fire is determined, the dispatcher contacts the forest officer nearest to the fire, provides him with the details and directs him to take the necessary action. If there is a township fire



Modern stairway lookout tower.

warden or keyman living near enough to the location of the fire to enable him to take quicker action than the forest officer he is also dispatched to the scene and instructed to organize a crew and start work immediately. Due to prearranged plans the entire procedure usually requires only a few minutes.

The airplane plays an important part in fire detection as well as suppression. Air patrol detection has replaced the lookout tower system in the two National Forests in Minnesota, principally because of the rugged terrain and inaccessibility of vast areas. Often fires are reported by private and commercial pilots who detect smoke in remote and unsettled areas.

Airplanes are used for scouting, transportation of crews and equipment and in recent years for drops of chemical fire retardants in fire suppression work.

Classes of Fires

Fires are classified into three general types; namely, surface fires, ground fires, and crown fires.

Surface Fires. As the name implies, these fires burn into the inflammable material on the surface of the ground. Nearly all fires are at their inception surface fires, but may develop into either ground or crown fires. Under normal conditions the surface fire is perhaps the easiest to control but in cases of extreme drouth, high winds, and dense cover, they travel very rapidly and are often very difficult to extinguish. This type of fire burning in grass or in the litter found on the forest floor can usually be extinguished by direct attack,

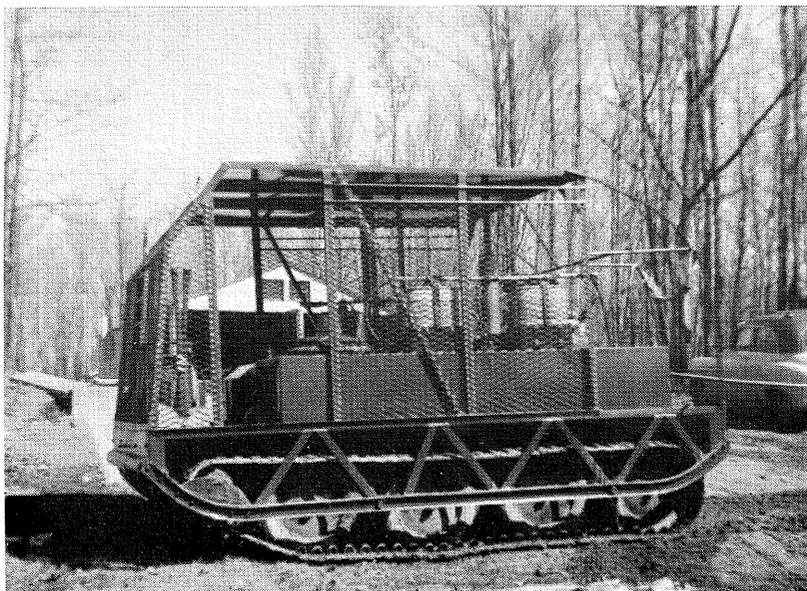


Fire fighting unit in action.

such as throwing sand or water on the edge of the fire by hand or with mechanical equipment. It is sometimes advisable to plow one or more furrows as closely as possible to the edge of the fire and either allow it to burn to the line formed or clear off the unburned area by means of a small backfire.

Ground Fires. These are the fires which burn in peat beds or in the humus or top layer of decayed or partially decayed vegetable matter on the forest floor. The ordinary ground fire in the woods is not as difficult to extinguish as that in peat, since the humus is usually quite shallow, thus making it possible to check the fire by means of a plowed furrow or with water used either by hand or mechanical pumpers. Power equipment, such as bulldozers, tractors, and graders, is used wherever possible in this type of control.

The fires in peat bogs, while handled in a manner similar to the shallow duff fires, are more difficult to combat because of the need for deeper trenching, more water, and longer patrol. Where an adequate water supply is available the use of large mechanical pumpers is the most practical method of extinguishing fires in deep peat bogs. Sand is sometimes used in the bottom of the trench to retard the fire where water is not available. In cases where neither can be obtained it is necessary to patrol the trenches and edges of the burning



Bombardier—Special type of equipment used in combating fires in lowland areas, equipped with two 300-gallon tanks, Panama pump, live hose reel, six back-pack pumps, four axes and four shovels. This unit has high mobility and can traverse areas where a man cannot walk.

area and to continually throw back the smouldering embers until such time as all of the inflammable material is consumed.

Crown Fires. These fires burn and travel through the tops of trees. They usually occur during periods of high winds, in dense timber, on steep slopes where the branches of the trees are near the ground or where there is a large amount of debris on the forest floor. During the time high winds prevail, crown fires are usually attacked on the flank. Work is started on the front line of the fire as soon as the wind drops, by trenching, backfiring or by some other practical combat method. The setting of backfires is a dangerous practice unless done by experienced fire fighters. It should be employed only after all other methods fail.

It is difficult to definitely outline the actual methods of fire fighting since almost every fire presents a different problem and the procedure employed depends upon the topography, cover, weather, and various other conditions and for this reason experience is the prime requisite in supervising this kind of work.

During recent years the use of mechanical equipment has become more and more popular in fighting forest fires, and all types of machinery are now used in Minnesota, from the light 23-lb. gasoline-driven pumper which pumps 15 to 20 gallons per minute, to the heavy duty type which will pump 140 gallons per minute. Bulldozers, tractors, heavy duty plows and graders are also used when they can be transported to the fire areas. In addition to this, aircraft, radio, weather instruments, and various other scientific implements are a part of the fire fighting setup.

Fire Damage

Minnesota history indicates that great forest fires were recorded by the explorers, fur traders, and voyageurs as early as 1803. The areas covered by these fires were very large but of course no estimate was made of the damage done. During the last 20 years records show that an average of 901 fires per year have occurred in Minnesota on which control action was required. The area burned over is 39,694 acres, with an estimated damage of \$106,529 per year.

Since the beginning of the present state fire control organization the amount of money expended for suppressing forest fires exceeds 12 million dollars, and almost two and one-half million dollars has been spent for the relief of fire sufferers. The total loss to the state during this period in property damage, relief to fire sufferers, and money expended for the prevention and control of fires was over 62 million dollars.

Since 1894 forest fires in Minnesota have claimed the lives of more than 900 human beings. The following is a list of the most disastrous fires occurring in the state:

TABLE V
FOREST FIRES IN MINNESOTA

<i>Date</i>	<i>Name of Fire</i>	<i>Lives Lost</i>
1894 – Sept.	Hinckley	418
1908 – Sept.	Chisholm	
1910 – Oct.	Baudette	42
1918 – Oct.	Cloquet-Moose Lake	438
1929 – May	Mud Lake	1
1931 – Oct.	Red Lake	4
1933 – Sept.	Roseau County	1
1934 – Oct.	Warroad	1
1936 – Aug.	Palo-Markham	1
1938 – Sept.	Badoura	1

Slash Disposal

The term “slash,” or “slashing,” is generally applied to the branches of trees or debris left in the woods after logging operations. The presence of this slash may create a fire menace in which case the operator or owner of the land on which it is located must, under the law, take the necessary steps to remove the hazard. The method employed in doing so and the time and extent of the disposal is one of the responsibilities of the forest officer. The slash disposal policy now in effect in Minnesota is as follows:

The state law provides that the state forester shall direct the disposal of slashings, debris and refuse from timber operations wherever there is or may be danger of starting and spreading of fires. The law further directs certain measures to be followed when no specific directions are given by the state forester or area forester.

The Need for Forest Fire Prevention Cooperation

During the most recent ten-year period, control action was taken on approximately 9,000 fires in Minnesota. Of this number, one percent was caused by lightning and most of the remaining 99 percent was the result of human carelessness and could have been prevented. The wholehearted cooperation of the public is necessary and the assistance of everyone is therefore solicited in order to reduce losses from forest fires to the minimum.

Minnesota forests are producing more products, employment, recreation, and wildlife each year because of the improved fire prevention and suppression efforts.

TECHNICAL FORESTRY PROGRAMS

Private Forest Management Services

The Division of Lands and Forestry assists small owners with holdings of less than 1,000 acres of forest land. Foresters help the small owner realize a greater return and, at the same time, improve his land.

In Minnesota, approximately seven million acres is in small owner-ships. There are about 150,000 owners providing a good share of the State's forest production. Experts predict that the demand for timber will increase about 80 percent by the year 2000. We must prepare now for this increase in the demand for wood.

Foresters with the Division of Lands and Forestry not only assist owners in the development of their timber resources, but also in wildlife habitat improvement, recreational development, water protection, aesthetic improvement and other benefits.

Whenever possible, foresters integrate woodland management with crop or other management to achieve total management of the land. Owners are first contacted and their objectives determined. Management plans are then prepared which are tailored to the intent and capabilities of the owner. Finally, the forester guides the owner in "carrying out" these plans.



Private Forest Management Services.

The Legislature passed M.S.A. 88.79 in 1947, which provides that foresters be employed for the purpose of furnishing owners of less than 1,000 acres of forest land with forest management services. The State has an agreement with the U. S. Forest Service whereby matching funds are available under the Cooperative Forest Management Act (federal).

The Division is certain that the many owners will respond to the needs of tomorrow, whether for fiber, recreation, water protection, or other. As a rule, these lands are among the more productive.

One of the major tasks is to build up the growing stock for the future. Additional markets are also needed to encourage owners to manage their woodlands.

Our goal is to annually assist about 7,000 owners with 140,000 acres of forest land. At present, we are providing services to about 4,000 owners with 90,000 acres of woodland yearly.

Demonstration Woodlands

Eight demonstration woodlands have been established for public education. The purpose is to show the benefits that can be obtained from the land.

These demonstration areas are located in Aitkin, Fillmore, Houston, Mahnomen, Mille Lacs, and Pine counties. More are being planned and will be established.

The demonstration woodlands, which average about 60 acres in size, are located on State-owned land. This is necessary to insure a continuance of policy. To date, all of these woodlands have had some kind of treatment or development. Timber has been harvested and stands have been improved. Some areas are being managed for the production of maple syrup. Nature trails have been constructed to provide self-guided tours. Picnic areas and other recreational facilities have been developed.

It is planned to include wildlife habitat improvement and water protection structures. Scenic developments will be made to improve appearance. Annual field days to demonstrate the various multiple benefits that can be obtained from the land have been initiated and carried out.

Tree Farms

The Division of Lands and Forestry cooperates closely with the American Forest Institute, forest industry, in the Tree Farm program. This is an important tool in the promotion of sound woodland management.

As of May 1, 1970, there are about 1,750 established tree farms, comprising 792,974 acres in Minnesota. Personnel with the Division of Lands and Forestry have examined and prepared plans for the major portion of these woodlands.



A Typical Tree Farm.

Agricultural Conservation Program

The Agricultural Conservation Program is a federally-sponsored program and is an important "tool" that increases the productivity of small, private woodlands. The program pays a share of the cost of

certain forest practices, such as tree planting, site preparation, thinning, pruning, and release.

Division personnel determine the need for these practices and provide forestry advice and assistance. After the practice has been completed, a check is made by Division personnel to insure that the work has been carried out satisfactorily.

In 1968 approximately 6,600 acres of forest land was planted and about 500 acres received timber stand improvement under the Agricultural Conservation Program.

Tax-Forfeited Land

Following the logging of the original stand of timber in northern Minnesota, timber companies, or their holding companies, realized that they were unable to sell the land to prospective farmers. The settlers found that in many places farming was not only very difficult but, because of the soil and climate, was not a profitable venture. Many of the large companies and farmers ceased to pay their taxes. This created an extra problem and resulted in tax increases to those on tax rolls left to pay them. The result was further non-payment of taxes. Improvements, ditches, and similar work increased the amount of money that the counties had to raise by taxes or assessments.

With large acreages not returning taxes, counties were placed in a precarious position. Perhaps equally bad was the clouded ownership status of such a large portion of tax-delinquent land. Many schemes and laws were used to allow the redemption of land by partial payments of taxes, but this did not answer the need. Tax-forfeiture laws were passed and promptly amended by following Legislatures.

At the present time, Minnesota real estate, with delinquent taxes for five years, forfeits to the State by action of county officials. Theoretically, this land is held by the State in trust for the taxing districts. Actually, with some exceptions, it is handled by the counties.

The exceptions include tax-forfeited lands in the Red Lake Game Preserve and Consolidated Conservation Areas, which go to the State in absolute title without liens or special assessments. The law stipulates that these lands shall be used by the State for the production of timber, or game, or the regulation of water.

Sale of Tax-Forfeited Land

The land held by the county may be sold at public auction after complete appraisal by the county board. The timber values on these lands must be approved by the Commissioner of Natural Resources. If the county wishes to sell only the merchantable timber on the land, it may do so with Division of Lands and Forestry approval of

timber values and cutting practices. When tax-forfeited land with forfeited mineral rights is sold, these rights are reserved to the State.

Approximately 200,000 acres of tax-forfeited land is appraised annually for approval of timber values by Division personnel. Division personnel also appraise timber for the many counties without forestry personnel. Foresters with the Division approve or disapprove cutting practices before timber sales are made. This has improved the forest management on county land.

Forest Taxation

The normal annual taxation of property which is assessed on the value of existing property has resulted in a pyramiding of taxes against a forest crop. Eventually, all value that can be realized by an owner has been consumed in annual tax bills. This practice resulted in large-scale tax delinquency following the removal of the virgin timber stands.

Minnesota Tree Growth Tax Law

The Legislature of 1957 passed the Minnesota tree growth tax law which was later amended by subsequent legislatures. The owner must make application to the county board specifying the legal description of the land and listing the acres of each forest type and the dominant species of each type.

The land must be used exclusively for the growing of continuous forest crops in accordance with sustained yield practices, and it must be open to the public for hunting. After acceptance by the county board, the land will be taxed each year in the amount of 30 percent of the value of the estimated annual growth. Temporarily nonproductive land is taxed annually at five cents per acre, providing it is reforested within the time specified. Permanently nonproductive land is subject to an annual tax of five cents per acre.

The minimum size of a tract of land placed under the Minnesota tree growth tax law may be all or part of a governmental subdivision containing not less than five acres. At present, there are about 300,000 acres under this law.

Auxiliary Forest Tax Law

After considerable thought and study, a bill was introduced and passed by the Legislature of 1927. The bill acknowledged tax inequality and set up the auxiliary forest tax law. It provided that forest land owners, with the consent of the county board, could enter into a contract.

The law was amended several times in the years following. Currently, it provides for a ten-cent-per-acre land tax and a graduated yield tax starting at 40 percent of the value of the merchantable timber on the stump at the time of cutting, and reduced by 2 percent each year of the contract until it becomes 10 percent. Land placed in auxiliary forests must be used exclusively for the production of continuous forest crops and must be open to the public for hunting and fishing.

Class 3e Land

Real estate, rural in character, and used exclusively for the purpose of growing trees for timber, lumber, wood, and wood products, constitutes Class 3e land for purposes of taxation and is valued and assessed at 20 percent of the full and true value thereof.

Community Forests

In 1913 the Minnesota State Legislature, appreciating the value of community or municipal forests, passed an act providing for the establishment of community forests. The Legislature of 1949 passed an act providing that any school district or any public educational institution may establish and maintain forests.



Forest management on a community forest.

School Forests

Schools wishing to establish a forest or to affiliate their present forest with the Division of Lands and Forestry program, should request their school district officials to make application to the Commissioner of Natural Resources and include the following information:

1. The legal description of the land.
2. The agency to be responsible for the management of the forest.
3. The name and address of the individual acting for the agency.
4. Proof of ownership or evidence of action being taken toward acquisition of land.
5. A brief management plan.

Foresters of the Division help schools select suitable forest sites and prepare management plans. In selecting the property to use for a school forest, there are many points to be considered. A portion of the area should be in need of planting. Most of the forest should be used for the production of trees as a crop with other multiple uses.

A wilderness area includes considerable virgin timber, but, in a school forest, a small area should be set aside to be left to develop by itself into a natural state.

In the development and management of a school forest, students can become acquainted with seed production, seeding and forest nursery activities, planting and plantation maintenance, inventory and management, growth studies and predictions, and harvesting and marketing. Recreational development and wildlife habitat improvement should also be included. A forest will demonstrate the soil-protective and water-retentive properties inherent in well-managed woodlands.

The school forest should be considered as a living laboratory. Constant observation of natural phenomena will be possible and may be blended with classroom studies. To those who will probably spend much of their lives in or near the forest, its value is readily demonstrated. To those who only occasionally come in contact with a forest, the school forest serves to provide an understanding and appreciation of the forces of nature. There are now 45 school forests comprising 3,798 acres distributed throughout Minnesota.

Municipal Forests

Municipal, or town forests, have existed in the United States since 1710 and in Europe far longer. They have provided revenue for use by towns or cities. These forests have protected the cities' watersheds or reservoirs, provided materials for construction of public buildings and bridges, furnished recreational areas, and served as places where recipients of local welfare aids could be employed.

In planning for municipal forests, thought should be given to these purposes. They can also be used for concealment of unsightly areas and for separation of industrial and residential areas. The use of forests should be considered in noise abatement planning.

Marketing and Utilization

In order to promote better, more complete utilization of Minnesota's forest resources, the Division of Lands and Forestry disseminates information and technical advice to the 3,211 primary producers and 1,070 secondary wood-using industries. This assistance means a greater marketing potential for state, private, and other timber land owners for their wood products, resulting in improved economy for the timbered areas of the State.

The Division of Lands and Forestry disseminates information concerning new and innovative developments and methods employed in harvesting and processing of forest products; assists in locating, improving, or developing markets for timber products; collects information for supply and feasibility studies; and provides, or assists in providing, training to loggers and processors. Close cooperation is maintained with State Technical Services personnel at the University of Minnesota and Federal Government programs.

The following figures indicate the numbers of producers and processors assisted with technical advice:

1967 — 959 cases
1968 — 2,110 cases
1969 — 3,300 cases
1970 — 5,400 cases

The Division objectives are to promote and develop markets for the utilization of all forest products that can be harvested from Minnesota's forest lands and furnish forest resource information and technical assistance to 3,211 primary producers and 1,070 secondary wood-using industries. Forest land owners, state, county, federal, and private, would indirectly benefit through increased markets for their timber.

The timber industry will continue to need technical advice and assistance at a steadily increasing level for the future.

Watershed Program

The influence of forests on the quality and seasonal quantity of water must not be underestimated. Properly managed forests in the upper regions and upon the steeper slopes of a watershed can prevent the washing away of top-soil and the resulting sedimentation of rivers,

even to the point where the need for a dam and reservoir may not arise.

Forests on a watershed can fulfill other needs at the same time. Recreation in these areas is superior because of the naturally controlled water flow, and timber production can continue by using selective cutting, well placed roads, and other tools of good forest management.

Since watersheds are usually on lands of many ownerships, and their protection affects people far downstream, financial and technical assistance for such protection may become a public function.

The Minnesota Watershed Act provides for watershed management by local elected groups who receive federal approval and assistance for watershed projects. Such assistance may be financial for some types of installations, or it may be technical regarding engineering or forest management practices. The local managing group, under the act, has certain taxing powers for the affected land through the county auditor.

Tree Nurseries

The planting of forest trees is not new in Minnesota. Its beginning dates back to the early years of the twentieth century. Reforestation by artificial means has mushroomed into a very large business in the last few years and has reached an all-time high during the current decade. Only through the practice of proper forestry techniques can land owners meet today's demands for wood.

Our supply of wood is dependent upon the establishment of new forests. The Division has available a staff of trained foresters who can give assistance regarding forest management problems. In addition, the Extension Service of the University of Minnesota, as well as consulting foresters and private industry foresters, will render aid.

In 1931 the Commissioner of Conservation was authorized by the legislature to establish, maintain, and operate nurseries for the production of forest tree planting stock in the state. This law limited production to native coniferous stock for planting *on state lands only*. The Badoura Nursery was established by the Division that same year with an appropriation of \$6,000.

In 1939 a second forest tree nursery, the General C. C. Andrews Nursery near Willow River, was established under the same provisions.

The nursery law was amended in 1941, permitting the distribution of state nursery stock to any political subdivision of the state for use on public lands dedicated to forestry and conservation purposes. It

was still illegal for the Division to furnish planting stock to private owners who were willing and desirous of reforesting their lands.

The pressure for low-cost planting stock for privately owned lands was becoming greater. In 1945 the Commissioner was authorized by law to make contracts with commercial nurserymen for the procurement of nursery tree planting stock to be sold by the state for planting on any auxiliary forest, woodlot, shelterbelt, or for erosion control and similar uses on public or private land. This law was a concession although it proved unsatisfactory because commercial nurseries were unable to produce sufficient planting stock at a low enough cost.

In 1947 the state was authorized by the legislature to produce planting stock for use on privately owned land and there was no longer a restriction to native coniferous stock. This law specifically prohibits the use of such planting stock for ornamental purposes, and no person may sell, give away, or remove such planted stock with roots attached for replanting on any ground other than his own.



Seedbeds at the General Andrews Nursery

In March, 1956, in a move by the Commissioner of Conservation to consolidate all tree nursery activities of the department under one agency, the Game and Fish Division tree nursery program was transferred to the Division of Forestry. As a result, two small Game and Fish nurseries were liquidated, and the 8½-acre Carlos Avery Nursery near Forest Lake was taken over and its expansion immediately began.

The total area of the three state nurseries is 615 acres. This includes the area devoted to seedbeds, land occupied by buildings,

roads, pathways, windbreaks, and new land cleared and under various stages of development.

TABLE VI
NURSERY AREA

<i>Nursery</i>	<i>Seedbed Acres</i>	<i>Gross Nursery Area Acres</i>
Badoura	81.12	228.65
General Andrews	102.68	266.22
Carlos Avery	36.10	120.00
	-----	-----
	219.90	614.87

Prior to the fall of 1956 the combined seedbed area of the three state nurseries was 91½ acres. In the fall of 1956 a cooperative agreement was entered into between the U. S. Forest Service and the Division for the expansion of state nurseries for the purpose of producing planting stock for the Soil Bank Conservation Reserve program. With the assistance of federal funds provided under the Soil Bank Act, state nursery facilities were expanded and developed accordingly, and the seedbed area was increased to 142 acres. With the termination of the Conservation Reserve Program, additional development of nursery facilities was carried on in a limited manner with nursery personnel. In 1964, the Natural Resources Act provided funds which enabled the nurseries to complete their land development program. Total seedbed area now available for production amounts to 219.90 acres. With this acreage available for production, the nurseries now have the capacity to produce 50 million trees annually, should the demand for planting stock reach this level.

During this period of nursery expansion, extensive building construction was carried on simultaneously with the land development program to take care of expanding production. These additions have included the following: 5 warehouses, 1 office, 1 cone shed, 2 additions to cold storage and packing room facilities, 1 seed storage room and a new office. Future plans call for the additional construction of a new cone storage and extractory combination and remodeling of cold storage facilities at one nursery.

The present production from the three state nurseries consists predominantly of conifer stock, approximately 97 percent, with only 3 percent in hardwood stock. The distribution of tree stock has been approximately 45 percent to public lands and 55 percent to private lands.

TABLE VII
NURSERY PLANTING STOCK

Tree Distribution

<i>Year</i>	<i>Private Land</i>	<i>Public Land</i>	<i>Total Shipped</i>
1947	—	869,404	869,404
1948	1,095,403	992,151	2,087,554
1949	1,250,000	1,685,369	2,935,369
1950	2,432,220	1,049,393	3,481,613
1951	1,830,319	1,772,140	3,602,459
1952	2,682,572	4,513,398	7,195,970
1953	3,883,301	6,887,153	10,770,454
1954	4,782,234	6,721,957	11,504,191
1955	6,292,030	7,091,304	13,383,334
1956	7,777,000	6,408,000	14,185,000
1957	8,432,295	6,476,246	14,908,541
1958	10,393,005	9,160,310	19,553,315
1959	10,799,350	10,288,462	21,087,812
1960	17,304,000	9,848,000	27,152,000
1961	27,720,531	13,572,651	41,293,182
1962	24,745,923	12,135,348	36,881,271
1963	18,875,360	16,172,902	35,048,262
1964	13,391,705	14,216,530	27,508,235
1965	16,082,720	12,321,285	28,404,005
1966	13,170,600	11,958,815	25,129,415
1967	10,803,900	10,514,565	21,378,465
1968	10,428,895	9,522,462	19,951,357
1969	8,522,750	7,122,415	15,645,165
1970	7,667,595	6,979,235	14,646,830

STATE LAND LEASES, SALES, AND LAND RECORDS

The Division of Lands and Forestry serves as the official land record bank for all the lands under the jurisdiction of the Department of Natural Resources. It administers the leasing of Division lands where they are compatible with multiple-use management. It is charged with administering the sale of State land according to law and the policies of the Department. It handles specific leases for other divisions of the Department. It provides land information to the general public when requested.

Early Land Ownership in Minnesota

During the first years of Minnesota's statehood, most of the land in the state still belonged to the United States, although considerable portions had been homesteaded or had come into private ownership in some other manner. About this time large tracts of this government-owned land were granted to the state for various purposes.

All of Sections 16 and 36 were granted to the state for schools. When it was found that some of these sections had already gone into private ownership, the state was given what was known as "lieu selection." This meant that the state could select other government lands that were not within Sections 16 and 36 in place of the so-called school sections which were no longer available.

Land was also granted to the University and to various institutions. In addition to this, a grant was made to the state of large areas of swamp land, 50 per cent or more of which had to be so-called swamp. In many cases this was not true swamp, but flat lands with poor drainage which produced swamp conifers.

The state was granted 8,455,702 acres of land in total. Of this, 2,896,142 acres were deeded by the state to various companies to help finance the construction of railroads, roads, and similar improvements which were needed in the opening up and development of the state. The remaining 6,550,560 acres could be sold for not less than five dollars per acre. Timber on the lands could be sold independently.

The Congress of the United States also conveyed to the state 8,313,880 acres specifically for railroads. This land the state reconveyed as directed.

In the early 1930's much of the less valuable private land in northeastern Minnesota became tax-delinquent. Beginning by about 1938, many thousands of acres forfeited to the state in trust for the counties. Such forfeiture continues today but at a much slower rate.

Some counties had an extremely large bonded indebtedness for the construction of huge systems of drainage ditches. These counties

requested help from the state, and as a result laws were passed whereby the state agreed to pay the ditch bonds, and in return for this payment the lands forfeited to the state in full title with no equity for the taxing districts. Such lands were later termed conservation area lands and placed under the jurisdiction of the Commissioner of Conservation. Some lands were also designated as game refuges and public hunting areas and are in the custody of the Division of Game and Fish.

Leases

Over 5,000 private leases are presently being handled by the Division of Lands and Forestry; 1,950 are lakeshore cabin sites, 1,500 rights of way for utility lines, 500 commercial leases, 400 agricultural leases, 150 gravel pits, and 3 peat leases. These leases are to individuals, companies, and governmental agencies. The Division also processes many leases for other divisions of the Department.

Sales

The State law provides for the sale of State lands. This is a function of the Division of Lands and Forestry when Trust Fund lands and Consolidated Conservation Area lands are involved. The lands are subject to restrictions and therefore only surplus lands, or lands best suited for agriculture, or substantial commercial development, are offered for sale. Annually, the Division holds from 15 to 20 sales in mostly northern counties. The sale of these lands is based upon appraisals made by Division personnel where use and market values are prime factors in considering sales.

Land Records

The Division of Lands and Forestry maintains the official Department of Natural Resources land records for over 9.1 million acres of State-owned lands and State-owned mineral rights. It provides land record data for the Department, as well as servicing private requests for land information. Presently, this data is being incorporated into the State's data processing system. This will enable the Department to maintain more efficient records and provide better land record service.

Land Use Classification

The Commissioner of Conservation in August of 1968, assigned the Division of Lands and Forestry the function of classifying all State lands into the highest and best use. This project is designed to work with other divisions of the Department and the counties in making such a determination. Approximately 1.8 million acres have been classified with completion scheduled for July 1, 1971. The data this project will furnish will be basic in the Department's goal of providing multiple-use management of lands under its control.

FOREST INSECTS AND DISEASE

Insects and disease are now the number one destroyers of trees and forest products. In the past, fire has been the greatest enemy of the forest. Through effective fire protection, these losses have been drastically reduced. The danger is still here; its potential should not be underestimated. It is estimated that the losses from these forest pests is about one million cords annually in Minnesota.

Today, direct control by chemicals is only undertaken when there is actual and immediate danger that the timber will be destroyed. Control is now being directed toward cultural means. Good care of forests develops healthy and vigorous trees which are less susceptible to attacks by insects and disease.



Red-headed Pine Saw Fly.

Forest Insects

Trees are constantly being assaulted by insect enemies. Given favorable conditions, the insect population suddenly builds up and epidemics are born.

One of the more destructive of forest insects today is the spruce budworm. It has destroyed millions of cords of balsam and white spruce in the nation. Major stands of these species in our State have been completely decimated.

Another important forest pest is the larch sawfly. This insect virtually eliminated the tamarack in 1910. Periodic outbreaks of this insect in Minnesota continue to occur throughout this tree's range.

There are insects that defoliate trees, some that girdle stems and roots, and others that bore or penetrate the wood and cones. It is predicted that these outbreaks will increase as the numerous man-made tree plantations grow older.

Forest Disease

Disease is constantly killing or rotting our trees and forest products causing great damage and loss of timber. One of the most destructive to the forest is white pine blister rust which has caused widespread damage to our white pine. The best cultural practices is to plant this pine in the low hazard areas where there is little incidence of disease.

A serious disease that is found in town and country is the Dutch elm disease which attacks our elms. There is no cure for a diseased tree. At present, the best control is to destroy the beetle that transmits this disease. This is done through sanitation or destruction of dead woody material and the use of chemicals.

Oak wilt disease is causing considerable anxiety to the foresters and arborists. It is endangering the oak in forest stands and also prize shade and ornamental trees in the cities. The disease spreads through root grafts from tree to tree. One of the simplest methods of control is to pour chemical in holes in a band around diseased trees thereby killing roots.

There are many other diseases that affect forest trees. Probably the most effective way to meet our future timber requirements in Minnesota is through improved protection from pests.

FORESTRY RESEARCH

Current forestry research programs are obviously inadequate in both scope and intensity to provide information needed now in planning public and private forest land policies and to meet every-day problems in actual management of our forest resources — let alone providing for the future.

The vast commercial acreage of Minnesota's forests brings into focus a number of problems in the administrative sense, but more important, from the operational aspect.

The management of a large forest area can be effected by policies, procedures, laws and regulations. However satisfactory this may be, it does not give us the answer to the many problems confronting us in every-day operations of forest management. Answers to all problems cannot be expected. But it should be recognized that "it is later than you think." Steps should be taken now to initiate a coordinated research program.

What applies to research generally applies to all phases of forest management and forest products research. The forest products industries of Minnesota are an important factor in the state's economy because of the research investments and progress made by some of the larger companies, particularly in the pulp and paper field. This research made possible the use of aspen and jack pine for a wide variety of wood fiber products, such as insulation materials, hardboards, and paper products.

The progress made in forest management to a large extent is due to the research contributions of the Lake States Forest Experiment Station of the U. S. Forest Service, the School of Forestry, University of Minnesota, recent increased activity of the forestry departments of the larger industries of the state, the Iron Range Resources and Rehabilitation Commission, and the Division of Lands and Forestry itself.

Expansion of research is urgently needed in all fields of forestry and forest products. This need exists in connection with the growing of seedlings in the state nurseries. There is need for improvement in production methods and how to grow planting stock more rapidly and of better quality. The need also exists in connection with determination of planting sites, so as to know what species to plant and which will do best on given areas.

Without expansion of research on forest insects and diseases the state may suffer added severe losses from epidemic outbreaks. Research is urgently needed in connection with control of brush and replanting problems on thousands of acres of land in Minnesota.

Utilization research is essential if it is to be learned how to use large amounts of excess low quality aspen of pulpwood size and other hardwoods now growing. Marketing research is essential if markets are to be expanded and producers assured of maximum returns on timber grown.

The need for an expanded program of fire research is immediate and imperative if real progress is to be made toward the ultimate goal — mastery of fire. An adequate approach to the task ahead can be formulated only through increased participation and contribution by all agencies concerned with the fire problem. Future research should be concerned with the understanding of the physical processes involved in the ignition and spreading of fires and their relation to weather factors. Research is needed on the after-effects of fire, loss of timber quality and growth, rate of recovery, relation to wildlife, insects and disease, and effects on stand composition, reproduction, and other ecological changes.

Because of the extensive public ownership of forest lands the public has an especially heavy responsibility for forestry research. The state must recognize its obligation to provide research protection for its large ownership of forest resources and must make research funds available to the established research agencies.

In addition to providing research for the large forest resources it owns, the state must assume major responsibility for providing research for the thousands of small woodland owners, farmers, and others who own a total of more than seven million acres of forest land. The state's responsibility is great. It should not continue to shirk this responsibility.

LOCATIONS OF DIVISION OF LANDS AND FORESTRY OFFICES

Report all unattended fires to the nearest forester or local telephone operator. Following is a list of stations where foresters are located:

Aitkin	Effie	Mora
Alborn	Elbow Lake	Nickerson
Alexandria	Eveleth	Nimrod
Backus	Faribault	Northome
Badoura Nursery	Finland	Onamia
Bagley	Floodwood	Orr
Baudette	Gaylord	Park Rapids
Bemidji	Gen. Andrews Nursery	Pequot Lakes
Benson	Grand Marais	Perham
Big Falls	Grand Rapids	Pillager
Birchdale	Greenbush	Pine Island
Blackduck	Grygla	Preston
Bowstring	Guthrie	Red Wing River
Brainerd	Hibbing	Rochester
Burntside	Hill City	Rock Cut
Caledonia	Hinckley	Roy Lake
Cambridge	Hovland	Sandy Lake
Carlos Avery Nursery	International Falls	Side Lake
Cass Lake	Itasca Park	Slayton
Clear River	Jacobson	Smoky Hills
Cloquet	Kabetogama	Thistledeew
Cloquet Valley	Kelliher	Tower
Cold Spring	Lewiston	Two Harbors
Cook	Link Lake	Wabasha
Cotton	Litchfield	Waconia
Crane Lake	Little Falls	Warroad
Cromwell	Littlefork	Washburn Lake
Crosby	Loman	Waskish
Deer River	Mankato	Williams
Dentaybow	McGrath	Zimmerman
Duluth	Moose Lake	
Eaglehead		



