STATE OF MINNESOTA

Luther W. Youngdahl, *Governor*

Department of Conservation

Chester S. Wilson, *Commissioner*

Tenth Biennial Report

1949-1950

Section II

DIVISION OF FORESTRY

Clarence Prout, *Director*

This report is published in six sections as follows:

I. Commissioner's Report, covering general departmental activities and summarizing the data and recommendations pertaining to the several divisions
II. Division of Forestry
III. Division of Game and Fish
IV. Division of Lands and Minerals
V. Division of State Parks
VI. Division of Waters

January, 1951

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January, 1951

LETTERS OF TRANSMITTAL

To the Honorable Luther W. Youngdahl, Governor
and
To the Legislature of the State of Minnesota:

I have the honor of transmitting herewith the report of the Division of Forestry of the Department of Conservation for the biennium ending June 30, 1950, being Section II of the Tenth Biennial Report of the entire department.

For the convenience of those who may be interested only in certain particular conservation subjects but not in the entire field, the reports of the commissioner and the five divisions are published separately instead of in a single volume as in former years.

Respectfully submitted,

Chester S. Wilson
Commissioner of Conservation

January, 1951

Hon. Chester S. Wilson

Commissioner of Conservation

St. Paul 1, Minnesota

Dear Sir:

I have the honor of transmitting herewith the report of the Division of Forestry for the biennium beginning July 1, 1948, and ending June 30, 1950.

Respectfully submitted,

Clarence Prout, Director
Division of Forestry

January, 1951

ADMINISTRATIVE STAFF

Clarence Prout	Director
Elizabeth Bachmann	Secretary to Director
Anson E. Pimley	Assistant in Fire Control
Raymond Clement	In Charge of Nurseries and Planting
J. C. Gannaway	In Charge of State Timber
Anastasia M. Gorman	Secretary
Edward L. Lawson	In Charge of Forest Management
Howard B. Munson	Executive Assistant
Arthur F. Oppel	In Charge of Special Projects
Harold Ostergaard	In Charge of Recreation and Lands
Lloyd G. Owen	In Charge of Inventory
Roger Williams	Civil Engineer
L. B. Ritter	In Charge of Co-operative Blister Rust Control

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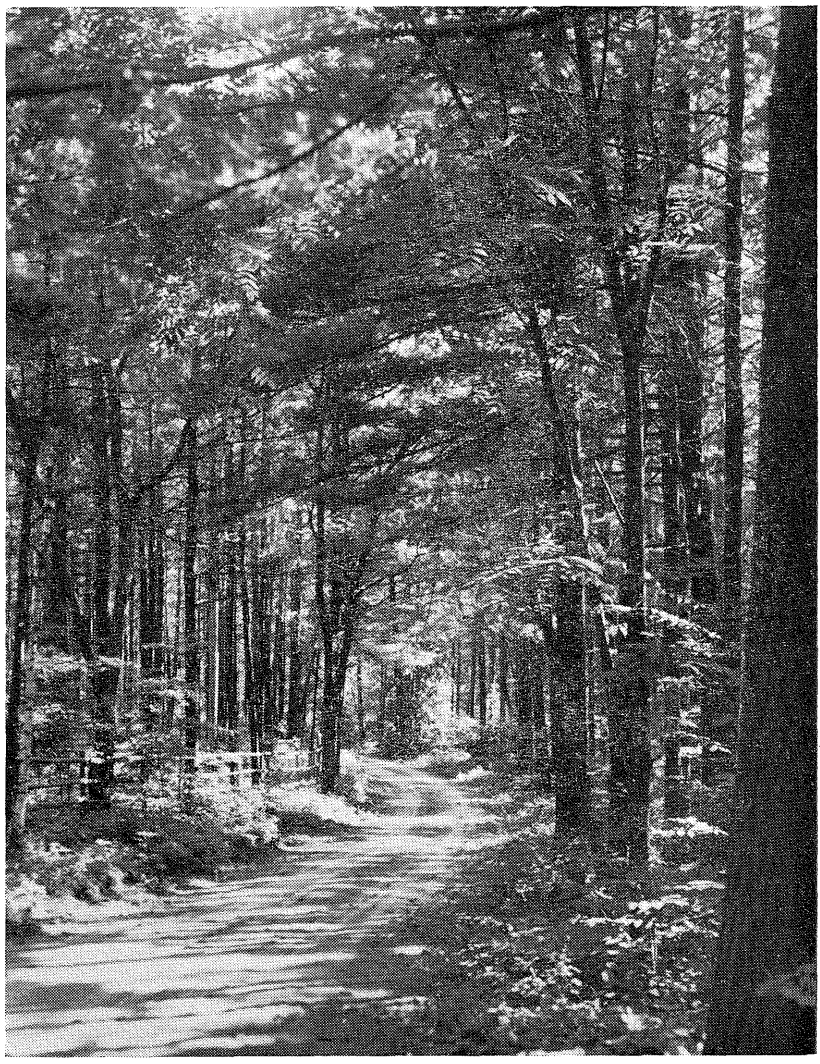


White pine is the predominating tree on Minnesota's Tree Farm No. 1, located in Isanti County. The area has been protected against white pine blister rust since 1931.

Division of Forestry

CLARENCE PROUT, *Director*

SUMMARY

The following summary statement covering the principal matters affecting the forest resources of the state discussed more in detail in the main body of this report are emphasized at the outset.

1. Forest Fire Prevention and Suppression

Greater strides have been made in perfecting an organization to prevent and suppress forest fires during the past seven years than in any similar period in the state's history. Increased appropriations by the legislature have made available more modern and effective equipment and an educated, aroused public has lent its support to the department's policies.

Notwithstanding this encouraging progress the needs of the state for additional protection against destructive fires, the worst enemy of the forest, are far from being met. A survey made under the Clarke-McNary Act found that for adequate forest fire protection Minnesota should spend not less than 12.4 cents per acre. The present state appropriation and federal allotment for forest fire prevention and suppression provide for 4 cents per acre. Michigan expends from the same sources 8 cents and Wisconsin 7. More significant, however, is the fact that state appropriations by Minnesota average 2.2 cents per acre while appropriations by Michigan and Wisconsin average 5.2 cents and 4.6 cents per acre respectively. In consequence forest fire losses in those states are relatively far less than in Minnesota.

2. Timber Administration and Forest Management

The State of Minnesota owns 4,100,000 acres of forest land of which 3,500,000 acres are classified as productive forests. The Division of Forestry is charged with the management of this land and the sales of the timber growing thereon. The average annual income from the sale of state timber is approximately $600,000.

The legislature of 1949 recognized the value of the timber resources owned by the state and for the first time appropriated moneys to be used for scientific management. A real start has been made in placing the state timber under management. Approximately 1,141,375 acres of the state forest land have been inventoried and placed under management to date.

There still remains approximately 2,300,000 acres of productive state forest land to be inventoried and planned for efficient management of its forests. This inventory and planning project should be completed without delay. When this has been accomplished competent foresters can be assigned to administer the forest management program according to plans. If the future income to the trust funds is to increase or even be sustained at its present yield inventorying present and potential timber sources is a "must" and funds provided for the purpose will be an inventment and not an outlay.

3. Nurseries and Planting

Great strides have been made in building up the two state forest nurseries since World War II. The legislature of 1947 by the enactment of a new nursery law has made it possible for the state to sell forest planting stock to private interests. The favorable reception of this law by the public was immediate. The demand for trees at once exceeded the capacity of the state nurseries to fill. This demand for trees has increased to a point where the division has been able to fill only a very small fraction of the orders.

A goal of 24,000,000 trees ready for distribution has been set for 1952. Formidable as this progress in increased output by the nurseries may seem, it is only a very small beginning of a tree planting program commensurate with needs. It is estimated that there are 4,117,000 acres of forest lands on farms in Minnesota in need of reforestation. With the annual output of state nurseries stepped up to 50,000,000 trees, 82 years will be required to complete this job.

4. Buildings and Administrative Sites

The Division of Forestry has some 600 buildings under its jurisdiction for use in administering state forests and the fire protection organization. Many of them were constructed years ago and are not large enough to meet present expanded needs nor are they properly located to meet present day requirements especially as headquarters for the division's fire protection organization. Some buildings have been enlarged and moved to better sites. Many more need to be adjusted and new buildings should be added.

The division owns and operates over 1,200 miles of telephone lines and approximately 1,200 miles of truck trails. The maintenance of these essential facilities is a constant problem. The gradual replacement of telephone lines by radio is strongly recommended. The forest road system must be maintained for fire control and forest management and requires mechanized road equipment of the kind not now owned by the division.

5. Private Forest Management Service

The area of forest lands on farms in Minnesota is approximately 4,117,000 acres. Very little of this land is managed for timber production. Farmers generally are interested in placing their forest lands under good forest practices as evidenced by the requests received by the division for advice and assistance.

The division has five foresters at present engaged in farm forestry work covering the entire state. The requests for assistance from small woodland owners have become so numerous that the foresters cannot begin to examine forest lands and assist all owners who ask for help. The organization of the Tree Farm program in Minnesota has given added impetus to farm forests and woodlot management. Thus far over 600 individual farmers, owning an aggregate of 26,930 acres of forest land have been assisted under this project.

This progress in good forest management on the farm woodlots, excellent as it has progressed, falls far short of what should be done to improve

this important source of timber along with the attendant benefits to soil, water and wildlife.

6. Forest Insects and Diseases

Forest insects and diseases annually take a bigger toll of the forests than fires and are a constant threat to state timber. The spring of 1950 saw an epidemic outbreak of the forest tentless caterpillar and may spread over a wider area in 1951. The larch sawfly is threatening our remaining stands of larch (tamarack). Other insects are a constant menace.

The division has been cooperating with the state division of entomology in the study of means to reduce losses from insects, but neither the division of forestry nor the division of entomology or both of these agencies are financed adequately to combat these insect epidemics.

A number of private concerns are now equipped to do spraying for insect control. Resort and other land owners should be encouraged to engage these operators to spray and do insect control work on their property. Furthermore, authority and funds should be provided the division to engage private spraying operators to check at the outset incipient epidemics before they have reached destructive proportions. Such use of already existing privately owned facilities will encourage operators to stay in the business and will obviate the need of the state investing in equipment of its own.

6. Auxiliary Forests and Memorial Forests

Thirty-eight auxiliary forests embracing a total of 160,868 acres have been established to date. Of these, fifteen contracts involving 28,116 acres were approved during the biennium. Cutting of mature timber on the forests has also increased. The Division of Forestry has the responsibility of inspecting and protecting these forests in order that each owner complies with the terms of the contract. With the increased number of auxiliary forests and the large acreage placed under this law, it will soon be necessary to detail a forester in charge of this program. This will bring uniformity of administration both in the case of the contract holder and the county boards which collect the yield tax and administer certain parts of the law.

DIVISION OF FORESTRY

CLARENCE PROUT, *Director*

INTRODUCTION

Fire Control

The first year of the biennium 1949-1950 was characterized by a very serious outbreak of fires during the early spring. Practically all of the fires in 1949 occurred in April and May. After that, due to considerable precipitation and a return to normal weather conditions, fire problems in the forested area could be rated as normal.

Because of a more liberal appropriation by the legislature of 1949 for the support of the division's activities it has been possible to add considerably to the division's mechanized fire fighting equipment and the starting of a two-way F-M radio network which it is planned will be enlarged until all the primary towers and ranger districts are thus equipped.

A greatly accelerated educational program was carried on through newspapers, radio and lectures, with the assistance of the Keep Minnesota Green organization. Cooperation from private individuals and large companies was excellent. It is planned by the Keep Minnesota Green committee to organize six more counties which will add considerably to the 5,000 children now enrolled in the KMG ranger clubs.

During the biennium all of the rangers in the Ranger I and Ranger II classes were given intensive training at training schools on various phases of fire prevention and suppression. This project will be greatly accelerated during the coming biennium.

We are still a long way from having the necessary amount of equipment and the proper type of equipment to do an efficient job of fire suppression, and it is planned that as rapidly as appropriations are made available this equipment will be secured.

Timber Administration and Forest Management

Due to the large inventories of timber the market was unusually dull during the fiscal year 1950. However, these inventories have been greatly reduced and at present there is a good demand for various types of forest products. The following table shows the amount of timber cut on state lands during the biennium:

	1949	1950
Auction Sales	$482,021.75	$252,835.13
Private Sales	140,041.07	164,687.81
Trespass	6,936.33	6,035.96
	$628,999.15	$423,558.90

Research is being continued in methods of cutting various types of state timber and utilization standards are finding more uses for timber products. It has been found that mills are capable of processing defective wood to a

greater extent than was heretofore thought possible. As a consequence markets will be found for some of our more defective timber.

Research is being carried on in the management of swamp species in cooperation with the Lake States Forest Experiment Station, the division having set aside 1,000 acres of state swamp land for this study.

Of the 4,100,000 acres of state owned forest land, approximately 3,250,000 acres are classified as productive. At the present time nine management blocks have been inventoried. This means that only 28 per cent of the state timber lands have been covered by a forest survey to date.

Probably one of the most outstanding projects, a forest survey of the Beltrami Island state forest, embracing a total of 476,953 acres of which the state owns 311,700 acres, is now nearing completion. This block will be the first one in which combined game management and forest management would be put into effect.

It is planned to add more foresters to the timber management and sales projects in order to better manage the state timber and to better utilize the various species occurring on state land.

Tree Nurseries

Since the passage of the new nursery act in 1947 allowing the division to sell trees to private land owners at cost it has been impossible to meet the demand for trees. Experience has proven that the appropriation for the forest tree nurseries and for planting made by the legislature of 1949 was entirely inadequate. The legislature of 1951 will be asked for increased funds to properly finance this activity.

The short supply of tree seed remains a bottleneck. Every effort is being made to secure enough seed for planting in our nurseries wherever available in order that there shall be a supply of seedlings constantly growing to meet the demand for trees from farmers, land owners, timber companies, and for the large acreage of state land that must be planted.

Furthermore, considerable additional new equipment will be needed for the two nurseries if they are to supply the trees demanded by private and public agencies and if satisfactory progress is to be made in the reforestation of state owned lands.

Lands and Recreation

During the CCC relief program of the '30's a large number of campsites, roads, telephone lines and trails were developed. Due to lack of maintenance funds many of these facilities are now in very poor condition.

A large portion of the platted summer homesites under the jurisdiction of the Division of Forestry has been leased. If the division is to meet the demands of the people for this type of lease it will be necessary in the next biennium to plat more homesites and develop new areas.

During 1949 $10,000 was realized by the State of Minnesota from all types of leases, and approximately the same amount will be yielded from

these sources during 1950. There is an increase in the demand from the public for summer homesites.

One of the big problems confronting the division is the maintenance of the Kabetogama moorage basin. This basin was constructed by CCC and has now deteriorated to a point where either it will have to be abandoned or funds provided by the legislature for its repair and rehabilitation. Much of the piling and the timber sheathing in the basin has rotted away, the banks have commenced to wash into the basin and unless steps are taken to make early repairs, it can no longer be used by boats seeking a sheltered moorage place.

Truck Trails

The repair and maintenance of truck trails with their culverts and bridges has reached the point where it is impossible for the present force with the limited equipment at its disposal to properly maintain and keep these facilities in repair. Money will be requested in our biennial budget to the legislature of 1951 for additional equipment and labor to repair the roads and bridges as well as culverts and the purchase of necessary material to do the job in a businesslike manner in order that these facilities may be made available to the public and for fire prevention and other forest management purposes.

Buildings

Many of the buildings that were constructed by CCC are not now adequate in size to house the present-day fire suppression equipment. The division is therefore faced with the need for enlarging quite a number of its warehouses and building new ones in order to have the proper storage facilities for this equipment.

Farm Forestry

At the present time the division has five farm foresters engaged in giving assistance to small woodland owners, advising them as to the proper management of their lands and timber and putting them in contact with markets for their products. The demands made upon these men have grown so that they are no longer able to take care of anywhere near the calls they get for assistance.

During 1950 the state joined the national Tree Farm movement. This new activity has accelerated the requests for assistance from the farm foresters. The number of men engaged in this activity will have to be doubled in the next few years if requests for this kind of assistance are to be met.

The farm forestry project is partly financed by federal funds made available through the Norris-Doxey Act but because of the fact that the legislature limited the amount of federal aid the division could claim from this source the state will not receive any aid during the fiscal year 1951. This limitation in the legislative appropriation act of 1949 should be stricken by the next legislature.

Forest Insects and Diseases

Forest insects and diseases are a constant threat to state timber. In fact, insects and diseases annually take a bigger toll of the forests than fires. The spring of 1950 saw an epidemic outbreak of the forest tentless caterpillar. This insect may appear over a wider area in 1951. The larch sawfly is threatening our remaining stands of larch, and there is a constant threat to our forests from other insects.

The division has been cooperating with the state division of entomology, but neither division is financed adequately to combat these insect epidemics.

There are a number of private concerns which are now equipped to do spraying for insect control, and resort and other land owners should be encouraged to engage these concerns to spray and do insect control work on their property. Similarly it is thought advisable that the state provide a fund from which these same private concerns could be engaged whenever epidemics appear imminent and thus utilize machinery and material now available to check any incipient epidemics on state lands before they become destructive. In other words, if a fund of $50,000 is provided for spraying against insect infestations on state owned lands the hiring of private operators to do the spraying is believed to be more economical than for the state to invest in its own equipment.

FOREST FIRE CONTROL

A. E. PIMLEY, *In Charge*

General Fire Conditions

There were several periods during the past two years when the fire hazard reached extremely dangerous proportions. These conditions, however, were of comparatively short duration and did not cover all portions of the state at the same time.

Conditions during the early spring of 1948 were quite favorable but beginning the last week in April until well into June with the driest May in many years, the situation became more serious. Approximately 40 per cent of all fires for the entire season burned during May. Midsummer saw somewhat more favorable conditions but in September dry conditions again returned and continued the fire hazard until the first week of November. As a result, fire conditions during the fall months of 1948 became sufficiently acute to justify the application of the most drastic emergency fire prevention measures taken in the state for many years.

On October 28 a forest fire emergency order was issued by the Executive Council prohibiting all hunting north of Trunk Highway No. 12 between Hudson and Vincent, and north of Trunk Highway No. 9 between Benson and Breckenridge. Even before the hunting restrictions were put into effect, all major roads and trails leading into the state forests and game reserves located in the high hazard areas were closed by the department to all except emergency travel. These restrictions postponed the bow and arrow hunting

on the Beltrami Island State Forest until the emergency restrictions were lifted on November 12.

Reports from the guards posted at the entrances to the restricted areas showed that an exceptionally fine spirit of sportsmanship was displayed by the hunters and that no major complaints were registered.

A comparison of the number of fires set on weekends prior to the period when the restrictions were in effect with those of the closed period proved the action taken materially reduced the number of fires.

The 1949 season started with a deficiency in precipitation in portions of the forest region and was further aggravated by a continued shortage of moisture during the spring months. Low rainfall in April, coupled with exceptionally high winds during the month of May, created a situation in several areas which at times threatened to reach conflagration proportions. Complements of heavy equipment and supervisory man-power were concentrated in the potential danger zones, fire warnings broadcast through radio and press and all emergency burning regulations put into effect.

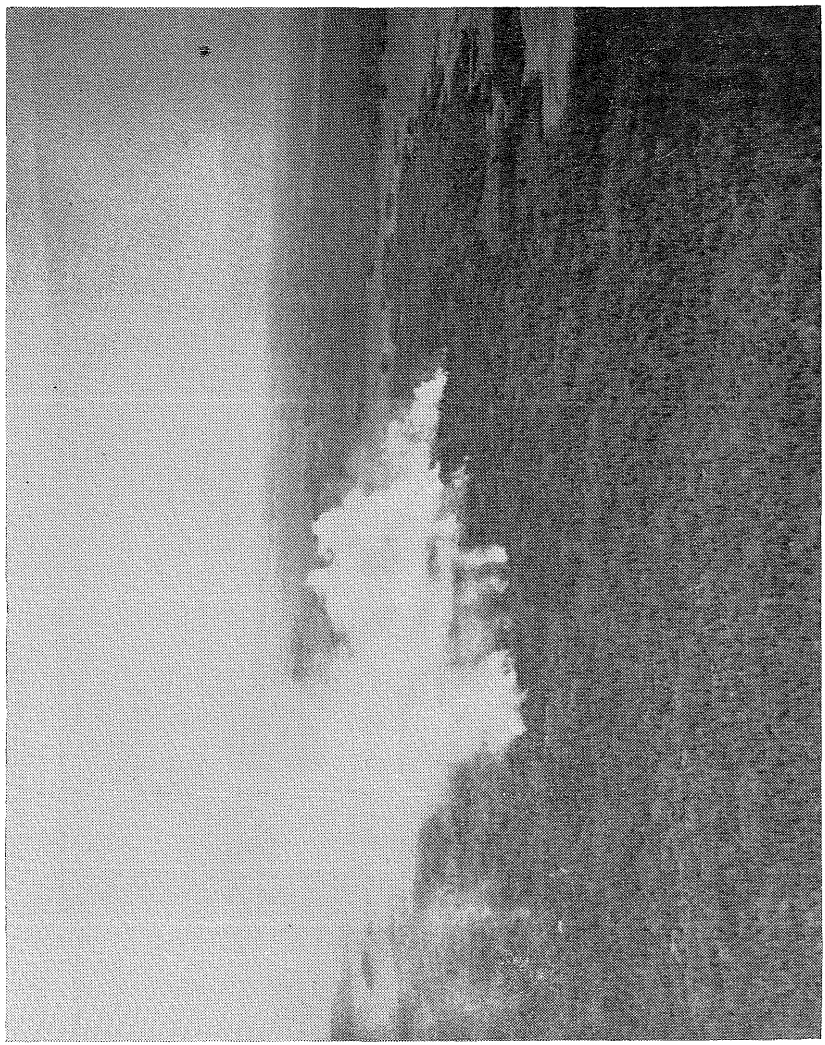
During the months of April and May, 80.8 per cent of all fires for the year occurred and burned over 97.6 per cent of the total area. Fortunately, extreme hazard conditions did not prevail in all portions of the protection area at the same time, making it possible to safely transfer experienced personnel and needed equipment from one administrative area to another.

The advantage and effectiveness of maintaining a working cooperative relationship with the federal and bordering states' forestry organizations was demonstrated during the year. Because of the extensive use and versatility of the hand pump tank at all stages of suppression and particularly for initial attack on small fires, this type of equipment should as far as possible be permitted to remain at strategic points and be available at all times. The division does not have enough of this equipment to put such an arrangement into effect. To meet the situation and to avoid the danger of depriving hazard areas of this type of versatile equipment the U. S. Forest Service supply depot in the Upper Peninsula of Michigan loaned the division an emergency supply of hand pump tanks. Division trucks were immediately dispatched and the equipment transported to the fire zone where it was held in reserve until the danger was past. This kind of cooperation between federal and state services can prove of great value in emergencies and is gratefully acknowledged.

The drought of the latter part of 1948 and the spring of 1949 extended the high hazard areas to the large peat bogs normally too wet to burn. The open nature of these swamps coupled with the exceptionally high winds spread the fires with great rapidity, leaving thousands of smoldering ground fires which made the job of suppression unusually difficult and costly.

Of the area burned over in 1949, over 50 per cent was peat land without much valuable tree growth, making timber losses negligible. Many of the peat fires which occur in the state are set for the purpose of burning off the top layer of peat in preparation for agricultural uses. This can be most easily accomplished when the bogs are exceedingly dry. Consequently

during every drouth period numerous fires are started regardless of consequences to adjoining areas. The only justification for spending money for controlling fires of this nature is to prevent them from spreading to settlements and highland or timbered lands. Also to eliminate the grave danger of numerous widely scattered smouldering small fires developing into one or more large uncontrolled fires in event of unfavorable weather conditions. The Hinckley, Baudette-Spooner, Moose Lake-Cloquet disasters directly originated from this source.



Black Bay Fire on Rainy Lake.

Forest Fire Control Organization

The area of the state to which intensive fire control is extended lies north of the Twin Cities and east of the prairie counties. This area is divided into two regions, each under a regional coordinator, each region in turn divided into eight supervisory areas or a total of 16 for the state, administered by area supervisors, district rangers and forest guards. The size of the areas and districts is determined by the normal work load in each, the extent of fire hazard and risk, farm developments, population, timber operation, and various other elements which affect efficient administration.

Actual experience and training in fire fighting is required of these men. They must be able to develop, administer, and keep up to date a complete fire plan of the assigned territory, conduct a continuous fire prevention campaign, and assist in other phases of forest administration. It is also necessary for them to keep currently informed of all lumbering operations, inspect and administer the disposal of slash, enforce all forest and fire laws and assist in the maintenance and repair of buildings and other property and facilities for which the division is responsible.

The Peat Fire Problem

During the biennium covered by this report, approximately 164,000 acres of open peat land, or 55 per cent of the total for the period, burned over. The control of peat fires has been and still is a major problem in Minnesota and even though much time and effort has been exerted to find ways and means of reducing it, very little, if any, progress appears to have been made.

Several years ago, an experimental area was selected in which no burning restrictions were to be imposed and no fire suppression work done by the state except in emergencies or when called upon to do so. This has proved quite satisfactory in normal hazard periods but only fairly so at other times. The experiment should be expanded to include the major portion of both the developed and potential farm regions within the larger peat areas. This would necessitate the zoning of definite tracts and the strict application of fire control measures by residents of the area. Such community cooperation would tend to discourage the common practice of unauthorized and sneak burning.

In cases where costly fire guards and breaks were constructed and the running fire checked, it was found that numerous new ones were set outside the control line to continue the burning. If the danger to human life, homes, timber, and other improvements were not so great, there would be little justification for spending the money to protect the areas where such conditions exist.

A perplexing factor in dealing with the problem is created by the fact that there is unquestionably some merit to the burning over of certain areas as a means of developing lands for agriculture. The question is how can it be done without endangering life and property and without burning over areas which will produce a crop of timber, or where nothing but harm will result.

After the running fire has been checked, mechanical pumpers are used to extinguish all smoldering logs, stumps, roots and duff along the fire line.

In some localities burning is necessary if farm development is to advance. The principal problem is one of confining clearing by burning to lands which will prove economically productive. It is also important that careful consideration be given to the time between the burning over of the land and its probable development. Experiments which have been carried on for years in the peat regions show that in some instances crops can be successfully grown, while in others the soil is unsuited to any type of farming. In still others it was found that fair crops could be raised only for a few years before the soil again became unproductive.

As a part of the zoning plan, a detailed survey should be made by soil, agricultural and forestry experts in conjunction with the county, township and local people, and all the pertinent factors carefully studied before establishing the boundaries and drafting the provisions under which the plan would operate. The final proposals should be agreed to by the land owners, municipal officials, and the Director of Forestry. Except for the construction and maintenance of permanent firebreaks, or during periods of fire emergencies, the responsibility for confining the fire to the area, the issuing of burning permits, and the cost of fire fighting would rest with the local people.

Public Relations

The success or failure of any fire control organization depends upon the cooperation and interest of the public. The task of establishing and maintaining favorable public relations is therefore of major importance and necessitates the carrying on of a continuous and vigorous campaign. A special effort has been made to promote fire prevention education in schools, among various organized groups, industrial concerns and individuals. The regular personnel of the control organization cannot carry on the job alone. At best, they can serve only as a promotional force.

In 1949 the Bureau of Information of the department presented a series of weekly radio programs devoted largely to fire prevention, maintained a 56-film loan library, provided speakers and moving pictures for 90 meetings, released 50 statewide weekly and 85 special news releases, and carried fire prevention articles in a number of the issues of the bureau's bi-monthly publication.

The Keep Minnesota Green committee, sponsored by a group of 60 Minnesota business concerns and individuals, is now in its sixth year and is making a fine contribution to the fire prevention program. During the past biennium the organization has been in contact with over 2,000 school teachers, delivered lectures to some 20,000 students below senior high school age, showed moving pictures featuring fire prevention to over 365,000 persons, had 60 speaking engagements, submitted 235 fire warnings for radio broadcasts, provided 29,000 newspaper column inches, prepared and distributed six feature stories on fire prevention, and distributed 108,000 pieces of literature.

A reflectorized license plate attachment for automobiles with the slogan KEEP MINNESOTA GREEN — PREVENT FOREST FIRES, was designed, financed, and distributed. More than 18,000 of these attachments are now in use in the state.

One of the projects designed to reach the organized youth groups in the state was the forming of forest fire ranger clubs among the Future Farmers of America, 4-H Clubs, Boy and Girl Scouts, and individual school groups. There are now 260 active clubs with a membership of nearly 6,000 boys and girls.

A "No Burning" contest, aimed at curtailing the promiscuous burning of grass and forest lands, was put into effect through the circulation of a pledge for the signature of land owners. Five hundred seventy-five children participated in this contest, which resulted in the signing of 17,500 pledges. This project not only reduced the number of fires which normally result from this type of burning, but it brought the general need of forest fire prevention to the attention of those who signed it and to numerous others as well.

At present there are five counties in the state which have county Keep Minnesota Green committees consisting of from 30 to 45 members actively engaged in the promotion of prevention and control of fires within the counties, with very effective results.

Protection Area

Some of the more highly developed farm areas require little or no protection from forest or brush fires. A large portion of these lands, however, would be greatly benefited if given some degree of consideration during certain times. The extent of protection would be based on the values involved, hazard, risk, and the general need.

The areas requiring major consideration are classed as being in need of **intensive** control and require the maximum of man-power and equipment within the limitations of available funds. In areas of lesser importance, **extensive** protection is given and the facilities reduced in proportion to the actual need.

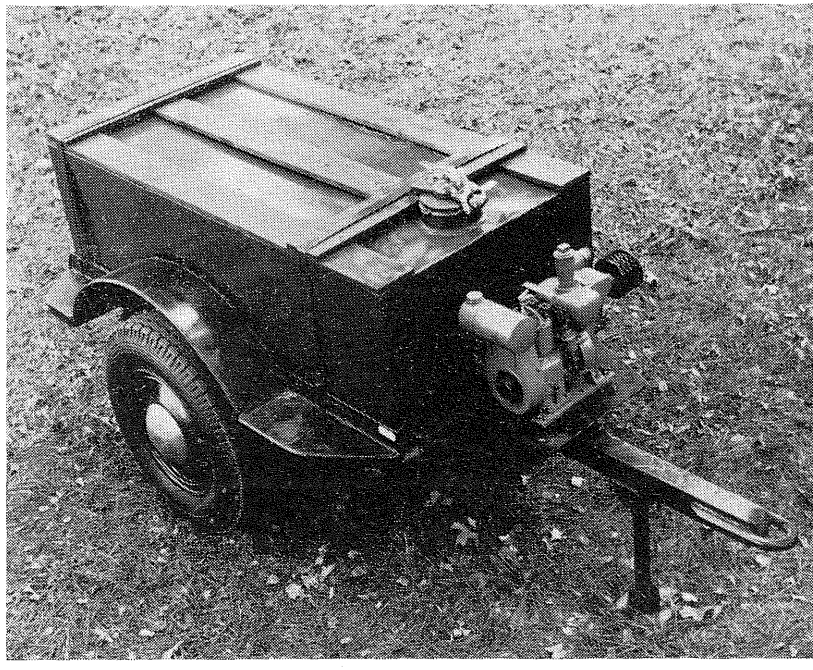
Thirty per cent of the state's 51,206,000 acres of land are in the intensively protected zone. This includes the largest timber producing area, the greater part of the summer resort and recreational playgrounds, and is perhaps the only part of the state where a conflagration of such proportions as to endanger human life would be possible. Since the present appropriations for forest fire control do not provide adequately for even the intensively protected area, the remainder of the state can be given little consideration except during emergencies.

When fire emergencies exist within the extensively protected areas the control organization responds to all requests for assistance. Trained technicians are dispatched from the intensive zone to help organize and supervise combat activities, and a limited complement of fire fighting equipment is supplied temporarily, as well as some financial aid. The only other manner in which further assistance can be rendered is in organizing cooperative groups and individuals into volunteer fire fighting units. By conducting a general fire prevention campaign, progress has been made in this respect in recent years by the farm foresters, game wardens, and a few public-spirited citizens living within the areas. Maximum results cannot be expected from these voluntary efforts until they become organized and their work supervised by full-time paid employees within the division.

Justification for providing adequate funds for this activity is indicated by the recent change in public opinion regarding the common practice of promiscuous and uncontrolled burning of the marginal non-agricultural areas. The general public is becoming more and more interested in preserving the remaining timber and woodlands, the farmers in the development of farm forests, woodlots, and windbreaks, and the sportsmen and nature lovers in protecting the rapidly diminishing game cover and nesting places of upland game and song birds. An increased interest is also being shown in the conservation and control of the water supply, which has resulted in a marked reduction in the number of fires which occur annually on wild pasture land and in the hilly areas where cultivation is impractical.

The land owners within organized soil conservation districts in southeastern Minnesota have recently organized the Winona County Forest Fire Fighters Association in cooperation with the Soil Conservation Service and the State Division of Forestry, with the financial backing of the county. This group has done a splendid job. Some administrative help has been

supplied by the two services. The state has issued a small complement of fire fighting equipment, which is housed in the Winona armory and is available for use at any place in the region. The cost of providing reasonable protection for the greater portion of this area is estimated at about one-half cent per acre, which is negligible compared with the values involved and the potential benefits to be derived.



Initial Attack Trailer Tanker with Portable Pumper.

Fire Control Technique

Many changes have been made in recent years in the types of equipment used and the methods employed in forest fire control. Today the use of some type of mechanical equipment is considered indispensable on most fires.

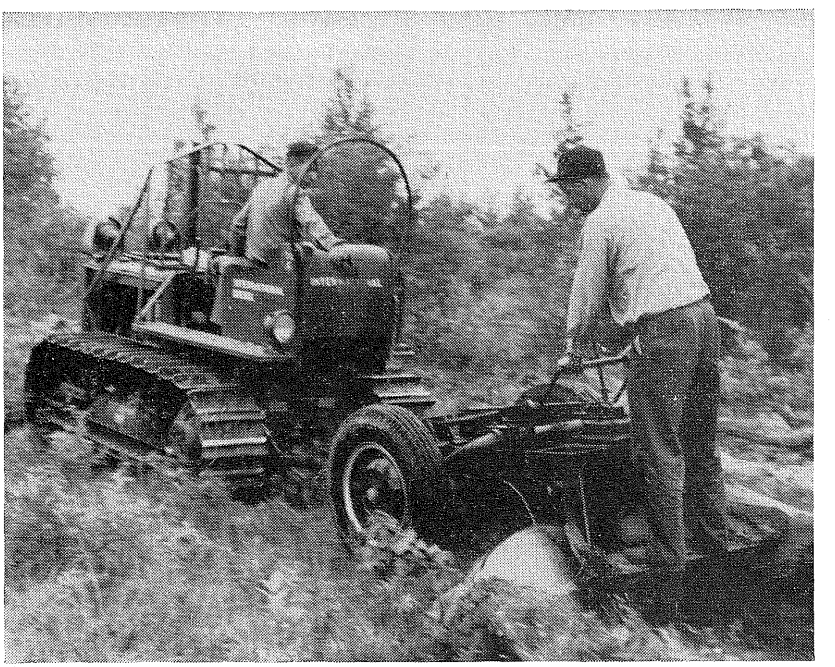
Better roads and the development of new hauling facilities have made it possible to transport power equipment to localities which heretofore could be reached only on foot. New designs in pumping machinery and water hauling receptacles, together with road improvement, have made the use of water possible on practically all fires. Where surface water is not available by either direct or relay pumping, subterranean sources can, in some cases, be utilized by driving or jetting well points into the ground.

Fire fighting trucks which formerly were used only for transporting men, supplies, and hand tools are now equipped with water tanks, permanent pumping units operated by the truck motor through a power take-off,

built-in containers, pump tanks, hand tools and miscellaneous implements, pressure back-firing torches, special electric lighting units, and in many cases a portable or auxiliary pump which can be carried by men to points inaccessible by truck.

Because of transportation difficulties, the use of heavy fire line equipment, such as bulldozers, tractors, and plows, has in the past, been quite limited. This has been largely overcome by the development of special trailers of the tilt-bed type which can be rapidly hauled as near as possible to the fire by truck, and from there run on their own power.

All available scientific and factual data is being put into use to eliminate as far as possible the guess-work in fire administration procedure, such as determining the number of men, amount and types of equipment required, and the most adaptable strategy to employ to control the fire as rapidly and cheaply as possible. These determinations are based largely on the nature of the terrain, type and extent of combustible ground cover which indicates the resistance to control, natural barriers, travel conditions, water supply, the distance from the nearest labor and equipment source, and the prevailing weather conditions.



The Minnesota Forest Fire Plow.

Bad roads and rough, rocky terrain may immediately rule out bulldozers, power plows and heavy units. Lack of a water supply will eliminate the need for pumping equipment. Rivers, lakes and wet swamps may serve

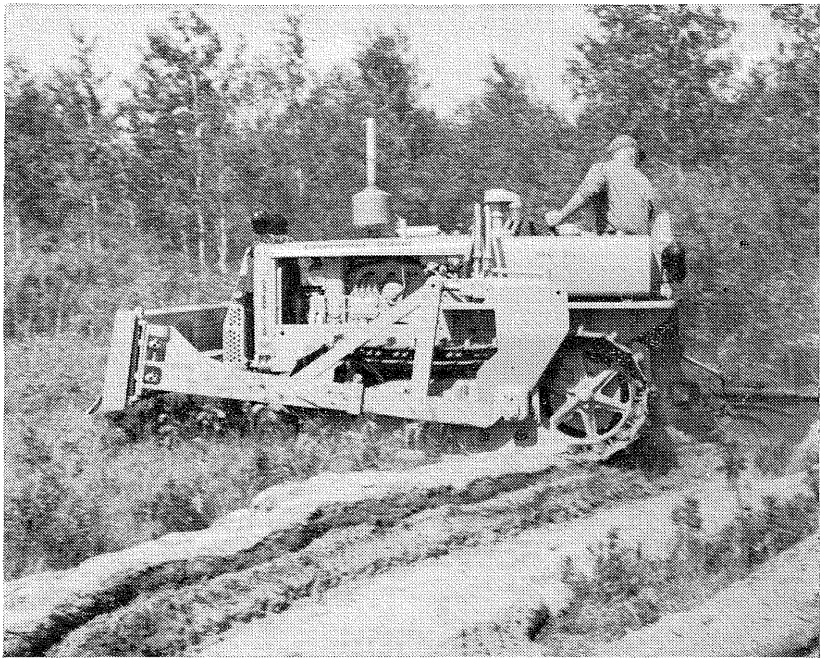
as barriers and make fire line construction unnecessary. By reviewing these facts, the forest officer is in position to intelligently select the amount and kind of equipment needed for the specific job.

The location of the fire and detailed road conditions will show the approximate time required to reach the fire from the nearest ranger station. The weather and type of cover will indicate the rate of spread. From these factors an estimate can be rapidly made of the approximate size or perimeter of the fire at the time the initial attack crew reaches it. Prepared work schedules show the average amount of fire line which can be satisfactorily handled by one man under specific conditions. The experienced dispatcher will be able to quite accurately determine the size of the crew required in each case.

Forest Fire Fighting Equipment

The greatest advancement in the field of fire protection has been made in mechanical equipment, mainly in the redesigning of available standard implements and of finding new ways to use them, rather than in the development of entirely new types.

Most mechanical units require comparatively few men to operate and will on the average fire line do a faster and more satisfactory job than a large crew of men working with hand tools. In areas where labor is scarce or widely scattered considerable delay ensues in organizing crews and



Bulldozer with Hydraulic Fire Plow.

transporting them to the fire. If standby mechanical equipment is available for immediate dispatching, this handicap is largely overcome, and quick action and excellent results are obtained. There are many localities in the state where there is an urgent need of this kind of protection, but it cannot be provided with the present funds and facilities.

The extent to which the limited supply of mechanical equipment was used during the past two years is illustrated by the fact that in the control of 500 fires, 692 miles of fire line were constructed by the use of power units, as compared to 28 miles of hand constructed trench involving 228 fires.

There are many other details affecting either directly or indirectly the technique of modern fire control, and the advancement of new ideas from time to time necessitates continuous changes in administration and operating procedures. The progress now being made in educational facilities, aircraft, radio, meteorology and various mechanical devices give at least some assurance that the forest fire control problem will be largely solved in the not too distant future, providing that adequate sound financial backing is forthcoming.

TABLE 1

Major Units in Present Fire Fighting Equipment Inventory and Estimated Additional Units of Each Type Needed for Reasonable Forest Protection

Item	Total in Service	Estimated Requirements
Jeeps	3	30
Trucks, ¼ T. - 1 T.	107	130
Trucks, 1½ T. - 3 T.	56	75
Administrative automobiles	10	10
Trailers, 5-15 T.	22	100
Trailers, utility	60	80
Fire plows, heavy duty	59	100
Fire plows, medium	32	40
Mechanical pump units	280	395
Power takeoff pump assembly	59	175
Firebreak graders	20	20
Firebreak road patrol	....	4
Tractors and bulldozers	47	160
Tractors, wheel type	5	20
Fire hose, all types	140,000 ft.	250,000 ft.
Pump tanks, back pack	4,084	8,000
Fire axes	5,000	6,000
Fire shovels	7,000	10,000
Pulaski fire tools	200	500
Radio units	15	310
Fire patrol launches	1	5
Fire patrol power boats	20	30
Fire patrol outboard motors	28	45
Portable water tanks, 50-100 gal.	206	210
Portable water tanks, 200-300 gal.	77	120
Aircraft	....	2

Fire Protection Cooperation

All railroad companies and most of the lumber, mining and other companies operating in northern Minnesota are assisting in one way or another in the prevention and control of forest fires. The timber operators, in particular, have made remarkable progress in this respect during the past several years. Many of them are contributing to the fire prevention program, and a few of the larger ones have set up protection forces within their own organizations. They not only provide the necessary men and equipment but have also employed trained foresters to administer the work and instruct the personnel. These groups keep in close touch with the state and federal rangers, and in some cases the leaders are participating in the training programs carried on by these two agencies.

Fires which originate within timber operation areas are handled almost entirely by these men, and it is not uncommon for them to volunteer their services on fires in areas completely outside of the company holdings.

One company during the 1949 season carried on a continuous fire prevention campaign within its operating territory by providing lecturers, moving pictures, displays and news articles for the local papers. It also assumed leadership in the organizing of the Junior Rangers and the 4-H Club "No Burning" campaign, supplied material for local radio programs, and distributed fire protection pamphlets and posters. Several of the personnel attended the state fire training schools, and their own foresters prepared and conducted a training course for the company men. Special fire fighting equipment has been acquired and assigned to fire duty. The company has its trucks and some of its tractors equipped with two-way radio and maintains a standby reserve for use on the fire lines.

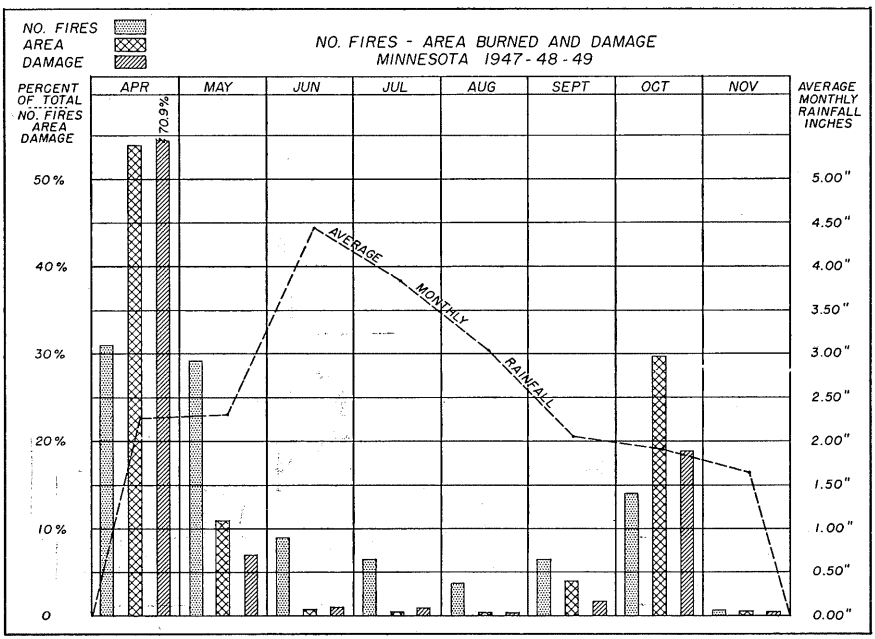
The railroad companies have continued to cooperate with the fire control organization in the prevention and suppression of forest and brush fires. As a prevention measure, the rights-of-way within the intensively protected areas of the state are cleared of all combustible material each year by cutting and burning during safe periods. The employees are directed to take every precaution to prevent fires from starting and also to take immediate action on those that start. During dry weather all trains are closely followed by fire patrolmen or section crews whose duty it is to extinguish any fire which may be set by the locomotives. In cases where control cannot immediately be accomplished by the patrolmen, section crews or special work crews are dispatched from the nearest point. As a result of this procedure, nearly all fires caused by locomotives are quickly extinguished without state or outside help and in most instances are held to small areas.

As shown in charts 10, 11 and 12, which include a complete six-year record, of the 1,654 railroad fires reported, 62.6 per cent were under ¼ acre in size, and 92.3 per cent were under 10 acres in size. This remarkable record is the result of quick action in both discovery and suppression. The effectiveness of this method is demonstrated by the fact that 72 per cent of all fires were discovered and acted upon by company employees.

Many fires of other than railroad origin occurring near the rights-of-way are extinguished by the railroad crews. In such case, the company is

reimbursed by the state for its services. On the other hand, the railroads compensate the state for labor costs contracted on company fires by the state organization.

Figure 1



Number Fires, Area Burned and Damage — Minnesota 1947-48-49.

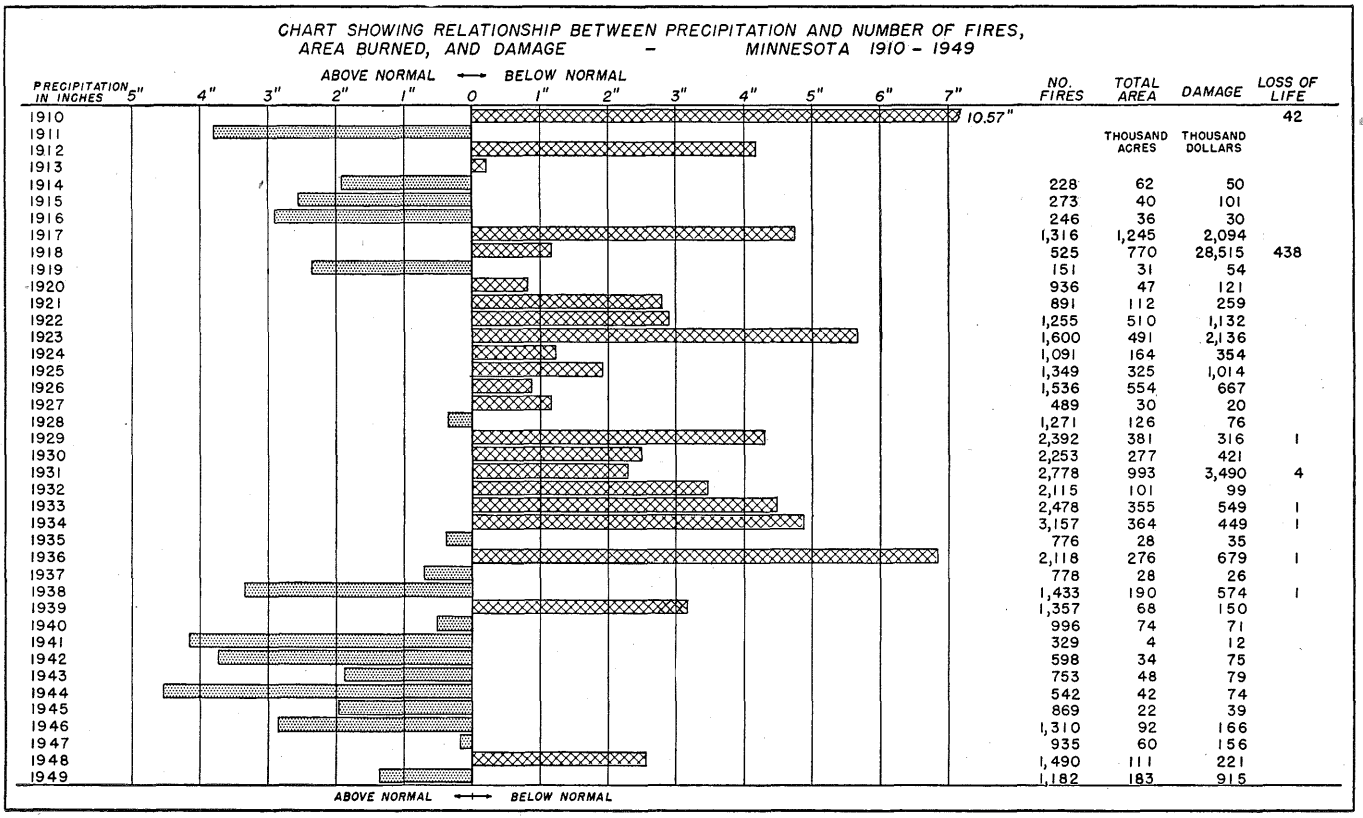


Figure 2

Showing Relationship Between Precipitation and Number of Fires, Area Burned and Damage — Minnesota 1910-1949.

TABLE 2

Number of Fires Per Year by Causes and Percentage of Each Period 1944-1949

Cause	1944	1945	1946	1947	1948	1949	Per Cent
Lightning	1	1	4	13	12	11	.6
Railroads	68	397	212	232	462	171	24.5
Campfires	12	22	44	30	57	29	3.1
Smokers	109	141	388	273	305	198	22.3
Land clearing	63	76	146	93	228	179	12.4
Incendiary	34	19	36	16	28	84	3.4
Lumbering	8	6	21	12	13	7	1.0
Meadow burning	192	141	315	149	245	367	22.3
Miscellaneous	55	66	144	117	140	136	10.4
Total	542	869	1310	935	1490	1182	

TABLE 3

Number of Fires Per Year by Responsibility Class Period 1944-1949

Class	1944	1945	1946	1947	1948	1949
Farmers	238	202	465	262	464	521
Hunters	52	39	80	83	133	81
Fishermen	10	30	86	56	86	51
Berry pickers	8	3	25	36	2	2
Work crews	16	14	52	35	42	49
Travelers	46	87	197	126	137	102
Miscellaneous	110	106	204	129	185	216
Locomotives	62	388	201	208	441	160
Total	542	869	1310	935	1490	1182

TABLE 4

Number of Railroad Fires by Size Class — Period 1944-1949

	Under ¼ A.	¼ A. to 10 A.	11 A. to 100 A.	101 A. to 1000 A.	Over 1000 A.
1944	28	24	16	2	....
1945	306	117	21	1	....
1946	114	87	20	1	....
1947	149	77	17	4	....
1948	340	133	15	5	1
1949	97	53	24	2	....
Per cent of total	62.6%	29.7%	6.8%	0.9%	0.0%

TABLE 5

Area Burned Over by Causes — Period 1944-1949

	1944 Acres	1945 Acres	1946 Acres	1947 Acres	1948 Acres	1949 Acres	Total Acres
Lightning	.....	.....	1	25	439	118	583
Railroads	1,002	1,503	1,408	2,780	4,504	2,235	13,432
Campers	126	474	1,059	1,575	204	2,033	5,471
Smokers	4,678	2,463	16,599	7,614	20,173	18,807	70,334
Land clearing	6,187	3,897	20,404	11,161	51,858	33,099	126,606
Incendiary	2,036	2,656	2,602	2,734	735	14,055	24,818
Lumbering	132	86	346	217	772	88	1,641
Meadow burning	22,541	9,303	44,412	28,480	30,347	92,980	228,063
Miscellaneous	4,910	1,891	5,235	5,428	2,479	19,881	39,824
Total	41,612	22,273	92,066	60,014	111,511	183,296	510,772

TABLE 6

Forest Fire Damage by Causes — Period 1944-1949

	1944	1945	1946	1947	1948	1949	Total
Lightning	$ 150	.....	$ 1	$ 412	$ 9,224	$ 1,587	$ 11,374
Railroads	2,133	$ 3,494	3,268	5,244	10,630	9,485	34,254
Campers	679	3,620	2,114	3,364	1,570	4,932	16,279
Smokers	9,681	3,522	32,956	22,516	72,164	122,008	262,847
Land clearing	12,144	5,498	19,294	31,970	64,196	117,969	251,071
Incendiary	6,287	1,243	7,282	4,783	1,283	81,389	102,267
Lumbering	315	147	1,388	1,150	7,421	2,502	12,923
Meadow burning	33,712	11,801	70,656	68,386	37,539	494,036	716,130
Miscellaneous	8,644	9,776	28,667	18,481	17,218	81,461	164,247
Total	$73,745	$39,101	$165,626	$156,306	$221,245	$915,369	$1,571,392

TABLE 7

Forest Fire Damage by Classes — Period 1944-1949

Year	Merchantable Timber	Timber Reproduction	Soil and Watershed	Wild Life and Recreation	Miscellaneous Damage	Total Damage
1944	$ 1,646	$ 25,924	$ 12,918	$ 24,339	$ 8,918	$ 73,745
1945	226	9,583	6,210	13,970	9,112	39,101
1946	4,637	66,983	17,649	44,501	31,856	165,626
1947	11,393	80,659	12,177	39,337	12,740	156,306
1948	13,713	92,482	22,655	49,811	42,584	221,245
1949	68,952	595,972	44,879	130,668	74,898	915,369
Total	$100,567	$871,603	$116,488	$302,626	$180,108	$1,571,392
Percent total	6.4%	55.5%	7.4%	19.2%	11.5%	

TABLE 8

Percentage of Fires by Causes, Burned and Damage Period 1944-1949

Cause	Percentage of Total Fires	Percentage of Total Burned Over	Percentage of Total Damage
Lightning	0.6%	0.1%	0.7%
Railroads	24.5	2.6	2.2
Campers	3.1	1.1	1.1
Smokers	22.3	13.8	16.8
Land clearing	12.4	24.8	15.9
Incendiary	3.4	4.8	6.5
Lumbering	1.0	0.3	0.8
Meadow burning	22.3	44.7	45.6
Miscellaneous	10.4	7.8	10.4

TABLE 9

Area Burned Over by Types Period 1944-1949

Year	Merchantable Timber Land Acres	Area of Reproduction Acres	Denuded Forest Land Acres	Non-forest Land Acres	Total Area Acres
1944	282	10,551	13,029	17,750	41,612
1945	176	4,445	6,271	11,381	22,273
1946	1,660	24,030	17,519	48,857	92,066
1947	1,817	24,624	12,148	21,425	60,014
1948	1,691	22,250	22,525	65,045	111,511
1949	4,983	77,235	44,664	56,414	183,296
Total	10,609	163,135	116,156	220,872	510,772
Per Cent Total	2.1%	31.9%	22.8%	43.2%	

TABLE 10

Area Burned Over by Classes

Period 1944-1949

	Forest Land Acres	Non-forest Land Acres	High Land Acres	Peat Land Acres
1944	23,862	17,750	31,680	9,932
1945	10,892	11,381	11,702	10,571
1946	43,209	48,857	60,218	31,848
1947	38,589	21,425	39,847	20,167
1948	46,466	65,045	40,213	71,298
1949	126,882	56,414	90,791	92,505
Percentage Total	55.8%	44.2%	53.7%	46.3%

TABLE 11

Fires by Size Class

Period 1944-1949

	Under ¼ A.	¼ A. to 10 A.	11 A. to 100 A.	101 A. to 1000 A.	Over 1000 A.
1944	58	177	207	99	1
1945	314	305	197	52	1
1946	201	513	429	156	11
1947	235	382	252	58	8
1948	525	532	295	120	18
1949	238	395	323	200	26
Per cent of total	24.8%	36.4%	26.9%	10.8%	1.1%

TABLE 12

Origin of Railroad Fires

Period 1944-1949

	Locomotives		Debris Burning		Miscellaneous		Totals	
	No.	Area	No.	Area	No.	Area	No.	Area
1944	64	1033	4	9	2	2	70	1044
1945	436	1179	6	329	3	1	445	1509
1946	209	1327	11	82	2	1	222	1410
1947	223	2350	17	133	7	13	247	2496
1948	469	3828	2	620	23	64	494	4512
1949	169	1572	7	623	....	....	176	2195
Per cent of total	94.9%	85.7%	2.8%	13.6%	2.3%	0.7%		

TABLE 13

Railroad Fires and by Whom Detected

Period 1944-1949

	Railroad Patrol	Other Railroad Men	Forestry Employees	Public
1944	14	29	11	16
1945	238	140	33	34
1946	74	72	43	33
1947	62	102	42	41
1948	191	148	108	47
1949	45	86	21	24
Per cent of total	37.7%	34.8%	15.7%	11.8%

TIMBER ADMINISTRATION

J. C. GANNAWAY, *In Charge*

The State of Minnesota is by far the largest single owner of merchantable timber within the state, and probably the largest owner of timber of any of the states. The administration of this valuable resource is "big business," the success of which should be of major concern to the public. It involves not only the responsibility of insuring a sustained maximum income for the state trust funds, but a continuous source of income and employment to large portions of the population in the timbered areas which depends on the timber resources of the state for its livelihood. Many manufacturing plants in the state are wholly dependent upon state-owned timber for their continued existence. To assure a prosperous future for those areas, it is essential that every acre of land capable of producing timber be placed under sound, practical forest management.

During the war years and for several years thereafter, there was a large demand for all species of timber, and greatly inflated prices were paid for finished timber products. During this period, paper mills especially built up the largest inventories of pulpwood in many years. Early in 1949 a slump in the paper markets caused the mills to curtail their purchases of pulp timber by operating on accumulated inventories, with the result that the demand for pulpwood was lower in that year than during any period in the last ten years and prices on pulpwood dropped accordingly. Depletion of inventories and continued high demand for paper products has appreciably corrected the situation with every indication now pointing to a return to normal markets.

Because of the depressed timber market of 1949 and the large number of timber permits on which cutting operations had not been undertaken or completed, no auction sales were held in 1949. Private sales, authorized under the provisions of Laws of 1939, Chapter 352, however, averaged about the same as in former years. Due to some wind storms during the months of July and October, 1949, large stands of timber in state forests were severely damaged, making it necessary to assign all of the timber personnel to locate, appraise and sell this blow-down timber. Most of it in the larger blocks has been sold, but the state will stand to suffer a considerable loss because of the fact that the smaller scattered blow-down tracts are too small and isolated to attract loggers. Unless this timber is salvaged before July or August of 1951, it will be of little or no value because of insect damage.

Encouraging progress has been made by the timber management division during the biennium in advancing the inventory of state owned timber and large blocks of the state's best timber are now embraced in the division's management plans. There is still much work to be done to complete this inventory and if the rate of progress is to be accelerated appreciably more funds must be provided.

Sound forest management requires the removal of over-mature and defective trees, and the trees should be cut in such manner as to encourage reproduction and assure increased growth of the younger trees. The state owns too much mature and over-mature timber and on a great many acres of

land this type of timber is so widely scattered that it cannot be economically logged. To salvage this class of timber the state should construct logging roads into those areas to make it possible for the small operators to conduct logging operations profitably. Otherwise, the state will not be able to dispose of this timber and large volumes of good quality timber will be wasted.

Another serious problem in the application of management plans is the short term of timber permits fixed by our present statutes. Under the present laws the operator is given a two-year contract and for good and sufficient reason the executive council may grant four one-year extensions. There are many areas in the state where neither sales nor management can be conducted profitably under such short time permits including the extensions that may be made by the executive council. It is recommended that the statutes be amended so as to authorize the division to grant permits based on the best management requirements in each case, not to exceed ten years. Such long-time permits are now granted by other public timber management agencies, such as the U. S. Forest Service, the U. S. Indian Service and by the Canadian government.

The state and the U. S. Forest Service in cooperation with private industry have many research projects in operation with the aim of securing information that will aid in improving cutting regulations and utilization by the different industries of a greater portion of the raw material. Experiments to provide additional information on the regeneration of our black spruce stands, our most desirable and valuable timber, under different cutting regulations are also being conducted. There is need for a greatly expanded program of research in a field where much depends on a technical knowledge of the factors and elements that enter into supplying greater and greater intensified demands for our timber, and how our forest lands can be best utilized for the growing of such timber.

Income from timber sold from state-owned lands has added millions of dollars to the state trust funds. An average of more than a half million dollars has been contributed annually from this source during the last few years. Only by the application of intensified forest management practices will it be possible to sustain this income to the state trust funds into the future.

The timber sales division has fourteen full-time timber appraisers, whose duties are largely governed by statute. It is their duty to cruise the timber to be offered for sale and to enforce and supervise cutting regulations and supervise the utilization of all timber products cut, covered by an average of 1,200 permits each year. These men must also check the timber scales made by the Surveyor General of Logs and Lumber before the timber may be removed from the land on which it has been cut. They constantly patrol two million acres or more of state-owned lands against timber trespass. Without the assistance of other division personnel normally assigned to timber management and by forest rangers during low fire hazard periods, it would be impossible for the appraisers to perform the work expected of them. There is need for the appointment of a Ranger V to supervise and coordinate the timber sales work of the appraisers, rangers and timber management

men on a state-wide basis. Furthermore, present funds for supplies and expenses are inadequate for the most efficient administration of state timber sales and cutting activities.

Tables 14, 15 and 16 are statements showing the extent of timber cut under auction sale permits, private sale permits and in trespass.

Table 14

TIMBER CUT UNDER AUCTION SALE TIMBER PERMITS
FISCAL YEARS 1949 AND 1950

SPECIES	FEET		CORDS		TIES		POLES		POSTS		TREES		VALUE	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Pine, White and Norway	2,157,480	1,563,811											$ 27,678.21	$ 22,758.74
Jack Pine	1,144,820	1,014,624	27,612	10,761									49,738.84	30,626.43
Spruce	1,159,578	775,178	62,148	35,238									242,639.30	120,869.95
Tamarack	151,980	260,890	692	302	17,402	11,206							4,285.80	3,346.46
Tamarack Mining Timber		*113,555												397.34
Poplar	1,761,315	1,229,510	9,887	2,836									17,086.92	7,850.53
Balsam	72,730	59,780	18,472	5,555									33,350.13	11,505.88
Birch	57,130	41,720			14,251	3,778							3,099.88	847.49
Basswood	12,900	6,810											61.40	38.21
Cedar					18,465	9,555	68,222	25,944	154,260	56,077			41,234.00	9,450.79
Oak	2,730	4,600											19.01	35.54
Mixed Timber	228,820	30,710			965	7,679							1,351.58	911.86
Cedar Lagging			305	52									186.45	76.52
Mixed Bolts			7,147	1,515									13,911.15	2,412.50
Fuelwood			1,006	527									400.89	187.07
Christmas Trees											830,254	1,110,015	17,651.07	22,318.54
Totals	6,749,483	4,987,633	127,269	56,786	51,083	32,218	68,222	25,944	154,260	56,077	830,254	1,110,015	$452,694.63	$233,633.85
													Extension Interest	29,050.09	18,844.82
													Penalty Interest	277.07	356.46
														$482,021.79	$252,835.13

*Lineal Feet.

	Year 1948-49		Year 1949-50	
Log Timber		6,749,483 bd ft.		4,987,633 bd ft.
Pulpwood	118,811 cds	59,405,500 bd ft.	54,692 cds	27,346,000 bd ft.
Bolts	7,147 cds	3,573,500 bd ft.	1,515 cds	757,500 bd ft.
Cedar Lagging	305 cds	152,500 bd ft.	52 cds	26,000 bd ft.
Fuelwood	1,006 cds	503,000 bd ft.	527 cds	263,500 bd ft.
Ties, Std.	40,512 cds	1,012,800 bd ft.	25,108 cds	627,700 bd ft.
Ties, small	10,571 cds	158,565 bd ft.	7,110 cds	106,650 bd ft.
Cedar Poles	68,222 cds	2,728,880 bd ft.	25,944 cds	1,037,760 bd ft.
Cedar Posts	154,260 cds	514,200 bd ft.	56,077 cds	186,923 bd ft.
		74,798,428 bd ft.		35,339,666 bd ft.
				113,555 Lineal feet
		830,254 Christmas Trees		1,110,015 Christmas Trees

Table 15

TIMBER SOLD AT PRIVATE SALE
LAWS 1939, CHAPTER 352
FISCAL YEARS 1949 AND 1950

SPECIES	FEET		CORDS		TIES		POLES		POSTS		TREES		VALUE	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Pine, White and Norway	1,111,924	1,579,153											$ 12,591.65	$ 14,912.32
Jack Pine	1,149,430	1,415,246	2,550	5,883									14,986.33	20,969.10
Spruce	331,853	495,998	11,949	19,187									44,246.90	61,552.73
Tamarack	278,460	327,200	477	293	2,415	519			2,743	17,001			2,793.06	2,646.33
Tamarack Mining Timber	*287,577	*493,387											920.90	2,819.63
Poplar	1,679,267	2,825,287	6,671	6,976									13,531.08	15,573.01
Balsam	188,211	288,768	6,377	9,672									16,888.11	21,043.55
Birch	51,440	111,870			5,347	6,724							942.15	1,437.18
Basswood	124,408	207,080											821.04	1,169.77
Cedar					4,615	6,551	9,675	22,299	54,809	86,085			5,478.53	7,342.57
Oak	9,760	17,640											86.07	136.90
Mixed Timber	225,189	280,695	14	73	801	1,211							850.96	1,323.55
Jack Pine and Cedar Lagging			281	335									163.14	213.28
Mixed Bolts			9,306	2,402									16,984.63	4,764.45
Fuelwood			5,552	5,389									2,780.63	2,433.44
Christmas Trees											229,290	315,682	5,995.80	6,350.00
Totals	5,149,942	7,548,937	43,177	50,210	13,178	15,005	9,675	22,299	57,552	103,086	229,290	315,682	$140,041.07	$164,687.81

*Lineal Feet *287,577 *493,387

	Year 1948-49		Year 1949-50	
Log Timber		5,149,942 bd ft.		7,548,937 bd ft.
Pulpwood	28,038 cds	14,019,000 bd ft.	42,084 cds	21,042,000 bd ft.
Bolts	9,306 cds	4,653,000 bd ft.	2,402 cds	1,201,000 bd ft.
Cedar Lagging	281 cds	140,500 bd ft.	335 cds	167,500 bd ft.
Fuelwood	5,552 cds	2,776,000 bd ft.	5,389 cds	2,694,500 bd ft.
Ties, Std.	9,310 cds	232,750 bd ft.	11,774 cds	294,350 bd ft.
Ties, small	3,868 cds	58,020 bd ft.	3,231 cds	48,465 bd ft.
Cedar Poles	9,675 cds	387,000 bd ft.	22,299 cds	891,960 bd ft.
Cedar and Tamarack Posts	57,552 cds	161,840 bd ft.	103,086 cds	343,620 bd ft.
		27,608,052 bd ft		34,232,332 bd ft.
		287,577 Lineal Feet		493,387 Lineal Feet
		229,290 Christmas Trees		315,682 Christmas Trees

Table 16

TIMBER CUT IN TRESPASS ON STATE LANDS
FISCAL YEARS 1949 AND 1950

SPECIES	FEET		CORDS		TIES		POLES		POSTS		TREES		VALUE	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
Pine, White and Norway	14 545	42,942											$ 268.92	$ 652.92
Jack Pine	21,327	17,979	87	180									931.64	610.24
Spruce	8,340	5,440	166	256									1,070.53	1,278.62
Tamarack	7,130	300	5	94	44	94			95				204.65	209.00
Mining Timber		*7,706												38.53
Poplar	5,790	23,605	99	148									417.89	337.28
Balsam		100	145	152									1,151.35	414.63
Birch					4	348							.93	47.78
Basswood	3,410	200											63.66	1.40
Cedar					2	45	233	1,145	2,395	10,170			267.36	439.62
Mixed Timber	8,750	1,930	3	5	66	47							101.74	35.63
Mixed Bolts			5	16									22.90	70.43
Fuelwood			289	667									317.37	530.82
Christmas Trees											677	9,432	69.30	760.79
Reproduction														110.37
Totals	69,292	92,496	799	1,518	116	534	233	1,145	2,490	10,170	677	9,432	$4,888.24	$5,538.06
												Penalty	2,048.09	497.90
													$6,936.33	$6,035.96

*Lineal Feet. *7,706

	Year 1948-49		Year 1949-50	
Log Timber		69,292 bd ft.		92,496 bd ft.
Pulpwood	505 cds	252,500 bd ft.	835 cds	417,500 bd ft.
Bolts	5 cds	2,500 bd ft.	16 cds	8,000 bd ft.
Ties, Std.	50 cds	1,250 bd ft.	418 cds	10,450 bd ft.
Ties, small	66 cds	990 bd ft.	116 cds	1,740 bd ft.
Tamarack and Cedar Poles	233 cds	9,320 bd ft.	1,145 cds	45,800 bd ft.
Tamarack and Cedar Posts	2,490 cds	8,300 bd ft.	10,170 cds	33,900 bd ft.
Fuelwood	289 cds	144,500 bd ft.	667 cds	333,500 bd ft.
		488,652 bd ft.		943,386 bd ft.
				7,706 Lineal Feet
		677 Christmas Trees		9,432 Christmas Trees

FOREST MANAGEMENT

E. L. LAWSON, *In Charge*

Forest management is of vital importance to Minnesotans. Every citizen should be aware of the potential wealth to be obtained through protection of the resource and application of sound management practices. Such practices are essential to insure continuous and increased productivity of our forest lands so as to provide, without interruption, raw materials for industry, employment, income and community support.

The state owns over 4,100,000 acres of forest lands of which 3¼ million acres are classified as productive forest land. These state forest lands contribute significant and important values to our economy. They are of primary importance in supplying the demand for forest products by wood-using industries and are being drawn on heavily. They are a basic source of employment and income to woods workers. The average annual income to the state, principally to the trust funds, from sale of timber stumpage is about $600,000. However, the continuation and expansion of this income for the future will depend on the manner in which the forests are managed. To fully realize the present productivity of our forest resource and increase its yield so that succeeding generations of Minnesotans will benefit in far greater measure than we do today, it is necessary for us to protect the forest lands from fire, and build up the growing stock through planting, natural regeneration, and careful harvesting practices. With good management the forest lands can maintain permanent wood-using industries.

Progress of the Survey and Management Plans

For a number of years the division of forestry has had a small staff seasonally engaged in forest survey work. Forest inventories are being conducted in areas where state forest land ownership is large and on which there is still a considerable volume of commercial timber growing. All intermingled lands regardless of the status of ownership are being inventoried in conjunction with the state lands. Considerable progress has been made. To date forest surveys have been completed on nine separate management blocks, having a total area of 2,352,175 acres, of which 1,142,076 acres, or 48 per cent, are state owned lands.

Field surveys were completed on the Fond du Lac state forest during the early part of the biennium.

A resurvey of the Craigville management block was begun during the summer of 1949 by the initiation of a continuous inventory system. A new inventory of the management unit was needed because of heavy cutting during and immediately following the war. The volume, growth, and allowable cut data were formerly based on surveys conducted in 1936 and revised in 1945. In conducting this survey, the division of forestry was assisted by C. B. Stott, division of state and private forestry, U. S. Forest Service, Milwaukee, and by forest management personnel of the Minnesota and Ontario Paper Company.

A forest survey is now under way on the Beltrami Island state forest. This unit, located in Beltrami, Lake of the Woods and Roseau counties, has

a total area of 476,953 acres, of which 311,700 acres are state owned lands. In addition to the state lands there are 71,482 acres of Land Utilization Project lands owned by the United States which were acquired under the Bankhead-Jones Farm Tenant Act scattered throughout the unit. Title to these lands is vested in the Department of the Interior, but since 1940 these lands have been under lease to the state of Minnesota for a period of 50 years for the purpose of protecting and managing wildlife and forest and water resources. New aerial photographs of this area, flown in 1949, have been furnished by the Iron Range Resources and Rehabilitation commission.

On the completion of forest inventories on each unit, a policy statement is prepared on which to formulate forest management plans, based on data disclosed by the survey. The purpose of such basic plans is to provide the means of recording a summary of essential information on volume by ownership, rate of forest growth, periodic allowable cuts, and to prescribe general regulations for the administration of the forest resource within the management block.

With the completion of surveys and management plans for each unit, a forest manager is assigned to the management block, with responsibilities for the actual carrying out of the plan.

Application of Management Plans

The immediate goal is to bring the actual cut and allowable cut within each management block into reasonable balance. To achieve this, it is important to control not only the quantity but also the location of the annual cut of merchantable timber. Examination of merchantable timber stands within each unit has been given first priority. The loss of volume through failures to salvage over-mature and decadent timber stands should not be tolerated.

Field examination of timber stands has been materially aided by aerial photography. By examining the aerial photographs it is possible to appraise the over-all condition of the timber and select those stands which appear in need of cutting. These observations are later verified by field examination. Eventually all merchantable stands in each management unit will be examined and appraised, and the information in cutting priority, age, and growth rates will be used in making cutting plans for each management block.

Sufficient detailed knowledge of timber conditions has already been obtained on most of the present operating management blocks to formulate plans for systematic harvesting, according to predetermined priority of cutting. Operating areas are set up so as to include sufficient volume to make logging operations economically possible, and bring about the orderly harvest of forest stands.

As far as practicable, cutting operations during the next few years should be directed toward removal of mature and over-mature stands. The need of early harvest may also be indicated for stands in need of thinning, or partial and improvement cutting. Thinnings which produce valuable

products and substantial income, if made at the right time and in the right way, will actually improve the productiveness of the forest and increase the quality and quantity of the final harvest cut.

Studies Related to Cutting Practices

In order to secure more detailed information on the end results of cutting practices, intensive cutting experiments are being conducted in selected areas.

The Thistledew jack pine thinnings in the George Washington state forest and the partial cutting experiments in black spruce stands in the

Partially Cut Black Spruce Stand in the Craigville Management Block in Koochiching County.

Big Falls area are examples of such studies. Permanent sample plots have been established in the experimental areas for the purpose of making careful measurements and to observe and record periodically the results

of such cutting practices. Management plans and forecasts for the future can be placed on a more secure footing from studies and records built up from these experiments. Valuable and definite information is being obtained on growth, mortality, yield and reproduction.

Studies to date have given information which supports the application of the selective cutting method on about 50 per cent of the black spruce stands in the Big Falls area, and numerous stands of this highly valuable pulpwood species are now being selectively cut to increase the yields. The jack pine experiments show that such thinning procedures have greatly increased quality and commercial volume. Another great gain is the salvage of trees lost through normal mortality. Intermediate cuts will increase the yield from this stand by 25 per cent. Results to date indicate the desirability of this type of cutting practice in comparable jack pine stands, in preference to clear-cutting, a common practice in the past.

Brush Reduction Studies

As a part of the forest management program, there is need for further studies of stimulating reproduction by reducing brush competition. In the summer of 1949, the division began such studies on the Craigville management unit, by disking to reduce brush and to encourage reproduction by exposing the mineral soil. Disking was done on jack pine slash and under a partial cut stand of white pine. Additional disking projects are planned for the summer of 1951. On a limited scale experimental work on brush competition reduction through the use of herbicides was also tried on the Craigville block. This project was initiated by the white pine blister rust control organization with the assistance of forest management personnel. Sample mil-acre quadrats were established to check the results of this work.

Long Range Plans

Plans for organizing and placing additional acreage of state owned forest lands into operative forest management blocks are included in the division's long-range program, and will be put into effect as soon as the division's resources permit. The assignment of present trained personnel to forest survey projects and to the management of forest units has so depleted the limited management staff that there is little opportunity for further extending the program of intensive forest management to additional forest units. A much needed expansion of the effective management of our forest requires a greater force of trained employees than can be made available by the division at present.

An analysis of land ownership in areas as yet not covered by forest survey shows that some of the state forests have a considerable acreage of timber lands owned by the state. There are also some concentrations of state timber lands outside of the present forest boundaries for which some form of management should be developed. Much of this land was cut over many years ago and now supports reproduction and advanced second growth timber. It does not necessarily follow that intensive management should be extended to all the state lands available for timber use.

In view of the widely different forest conditions and scattered state holdings, consideration should be given primarily to units in which state land ownership is concentrated in workable forest management blocks. Lands which will not qualify for intensive management because of unfavorable situations or other factors will be given extensive management, embracing protection from fire and trespass and enforcement of good logging practices.

Over 2½ million acres of state owned forest lands remain to be inventoried. To insure proper handling of the timber resource the aim should be for completing the detailed inventory needed for the management of such lands as quickly as possible. As an objective, such forest surveys and management plans should be completed within the next five years.

RECREATIONAL AND HOMESITE DEVELOPMENTS IN STATE FORESTS

HAROLD OSTERGAARD, *In Charge*

Minnesota's forests with their thousands of lakes attract visitors from every state in the Union. Some of these people spend their vacations at established resorts, while others bring trailers or camping equipment and set up their camps wherever they find a satisfactory place.

Special Use Permits and Leases

In order to lessen the fire hazard caused by the extensive recreational use of the forests, simple campgrounds have been prepared by the division of forestry in many locations. Some of them have fireplaces and tables, and whenever available, a sanitary water supply. All of them have had most of the duff and leaf mold removed so that the danger of fires starting and spreading has been reduced considerably.

The division has subdivided and platted stated owned lakeshore. This platted property is leased for private summer cottages. Currently there is a great demand for these sites especially within a comfortable driving radius of the Twin Cities. In order to be accessible under all conditions, the sites must have a road to each. State lakeshore which can now be reached by car is practically all platted and occupied. If more sites are to be made available, it will be necessary to construct short roads to connect them with main highways. Unless more lakes on which state lands are located are made accessible by the construction of such roads, additional sites cannot be platted and leased. Leasing for resorts on state lakeshore is not a common practice and is done only where the needs and conveniences of the public can best be served by such developments.

Woodenfrog Campground on Lake Kabetogama.

TABLE 17
SPECIAL USE PERMITS IN FORCE AND REVENUE COLLECTED

	No.	1947	No.	1948	No.	1949	No.	1950
Homesites	409	$4,240.00	426	$ 4,370.00	469	$ 4,800.00	559	$ 5,743.00
Hay and Farm	179	1,473.14	220	1,767.64	187	1,498.14	170	1,215.19
Commercial	57	1,543.00	53	1,220.00	52	1,500.00	48	1,207.00
Rights-of-Way	31	159.80	36	370.80	69	523.82	75	596.70
Gravel	6	354.18	9	3,459.64	5	1,081.86	5	1,282.45
Miscellaneous	.....	.....	.....	.....	2	601.00	2	54.00
Total	682	$7,770.12	744	$11,188.08	784	$10,004.82	859	$10,098.34

In addition to lakeshore permits, other permits and leases are made on state forest land as the need arises. Table 17 shows use permits in force for the years 1947-1950 inclusive, and revenues yielded by each class.

BUILDINGS AND ADMINISTRATIVE SITES

HAROLD OSTERGAARD, *In Charge*

The division has more than 600 buildings of various sizes and types under its care, yet there is need for more and the remodeling of existing ones. Buildings constructed years ago have become too small to meet present day needs. Some of them can still be used by remodeling. Buildings in some instances were constructed on high hills near lookout towers for the use of towermen during the summer months only. With the present prevailing housing shortage, forest rangers cannot find houses to rent and are forced to live all the year around in their cabins where roads are seldom kept open or at best at great expense, and in houses which were never designed for winter use. In some instances the better cabins have been moved to more accessible locations. This improves the housing situation somewhat but leaves the tower sites without a cabin for the towermen. Experience has proved that generally it will be more practical and economical to leave the old small tower site cabins where they are and build new ones, more suited to present day residential needs, and in more accessible locations.

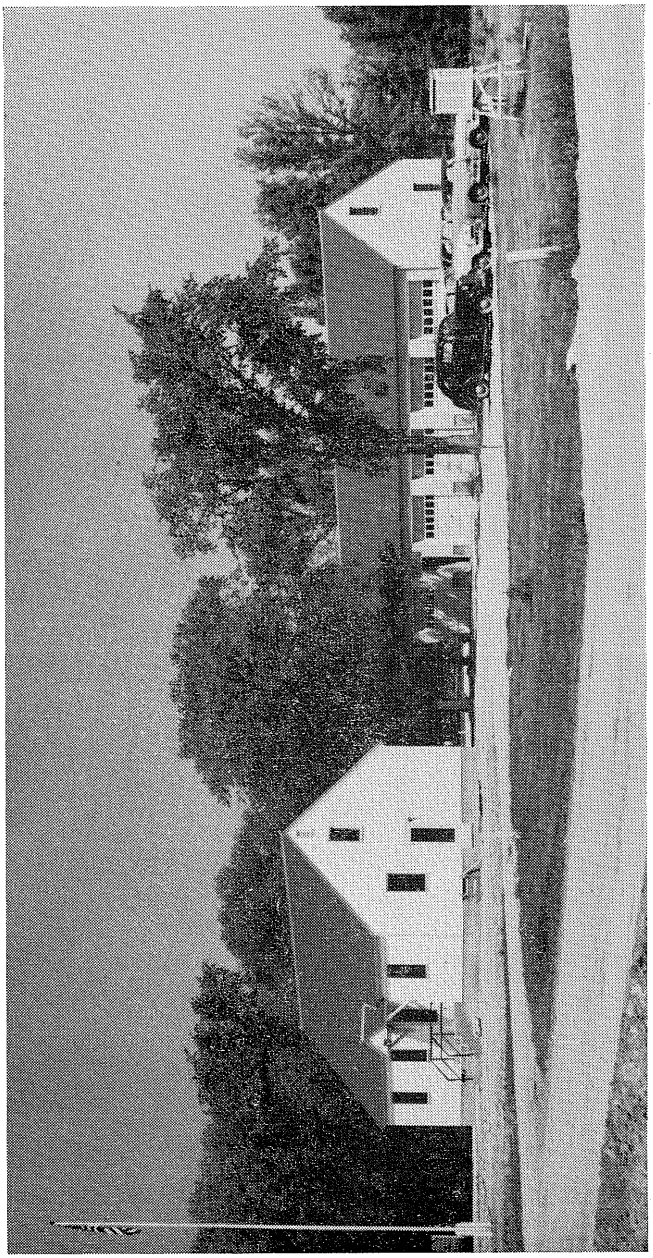
TABLE 18

Buildings Constructed During Biennium Ending June 30, 1950

Location	Description	Size
Pillager	Warehouse — Office	30′ x 64′
Guthrie (Schoolcraft)	Warehouse — Office	30′ x 64′
Guthrie	Cabin, Moved and Remodeled	24′ x 38′
Warroad	Office	26′ x 36′
Spooner	Office	26′ x 36′
Eveleth	Warehouse — Office	26′ x 36′
Washburn Lake	Cabin — Repair	24′ x 32′

Buildings Moved

Description	Location
Cabin	Deer Lake to Effie
Cabin	Stony Ridge to Effie
Cabin	Thistledew Tower to Thistledew Station
Cabin	Beauty Lake to Side Lake
Cabin	Rock Cut to Dentaybow
Warehouse	Rock Cut to Dentaybow
Ice House	Rock Cut to Dentaybow
Storage	Willow River to Hill City
Storage	Willow River to Sandy Lake



Warroad Area Headquarters.

The cost of suitable administrative building sites has increased during the last few years to a point where the annual appropriation of $500 for this purpose by the legislature is sufficient to purchase one site only, with whatever money is left reverting back to the general revenue fund.

Only three additional building sites were acquired during the biennium, 1.1 acres at Nimrod, .5 acre at Birchdale, and .8 acre at Garrison.

Some of the state ranger stations are located in the wilderness, remote from commercial electricity and where REA services will probably never become available. Few people live in such locations and as a rule there are no schools, stores, or even neighbors. In order to provide rangers and their families stationed at such locations with a semblance of normal comforts, it is the practice of the division to install home electric plants in order to provide running water, lights and refrigeration. One such plant with an electric water pressure pump was purchased and installed during the biennium.

Similarly, at most of the ranger stations, other than the supervisors' headquarters, there are neither public water nor sewage disposal facilities. In such places, wells are being provided and residences are gradually being modernized. This modernization should be accelerated for the comfort of a class of employees who at the best live in isolated locations and are usually deprived of many of the social contacts and conveniences enjoyed in normal environments.

Truck Trails and Telephone Lines

One of the most serious problems confronting the Division of Forestry at this time is the very poor condition of many of its forest access roads, truck trails and telephone lines and the desperate need for their repair. There are 1,180 miles of access roads and truck trails, and 1,219 miles of telephone lines in the division's forest management plant. Most of these facilities were provided through CCC and WPA during the period 1933-1940 with only a nominal cost to the state. The repair and rehabilitation is the responsibility of the division and has developed into a very urgent need.

Telephone lines and truck trails are indispensable units of service in forest management. Without dependable telephone communication, fires cannot be reported to headquarters and without passable truck trails fire fighting equipment cannot be brought to the places where it is needed. To illustrate, there is an area between Big Falls and Waskish, known locally as Pine Island, 25 miles by road from either village. The division has a ranger station and lookout tower on Pine Island occupied the year around. One single trail connects the area with Waskish and another with an outlet to Big Falls. In case of fire these are the only roads over which to bring in equipment. They are in very bad state of repair.

One state telephone line runs westerly from the lookout tower on Pine Island to another lookout and continues on to the ranger station at Waskish. Another state line runs north and connects with an Indian Service lookout near Fairland. To the east, the telephone line runs to the Big Falls ranger

station and lookout tower. If a complete failure of either one or both of these facilities should occur during a fire on Pine Island, such failure might well completely isolate the area and result in a fire sweeping over large areas of young forest growth. This one instance is cited to illustrate the danger of the failure of roads and telephone lines. There are others equally critical.

The division has neither the equipment nor the manpower to maintain adequately these critical service facilities. The trails are used not only for forest management but as soon as a trail or road is made passable, it at once becomes of convenient use to the general public. Loggers, hunters, tourists, fishermen and even resort and cabin owners find these trails convenient, and use them regardless of weather or road conditions. Gates or other barriers placed by the division across the roads during the time of the year when the roads are too soft for use cannot long be maintained under present laws except by constant policing as locks are broken and gates destroyed. This use of forest roads which are not public thoroughfares without a contribution by the users for maintenance and repairs throws a disproportionate burden on the division to keep its protection roads passable.

The division needs additional mechanical equipment for rebuilding roads and bridges and for the cutting away of brush and branches which interfere with telephone service. The budget that will be presented to the Department of Administration for operating funds for the next biennium contains requests for this increase in equipment and manpower.

Kabetogama Moorage Basin

During the last year of CCC camps, a large moorage basin was constructed fronting and adjoining the Division of Forestry's ranger station near Gappa's Landing on Lake Kabetogama in St. Louis County. The division needed this basin in order to provide protection for its boats which prior to that time had to be anchored out on the lake proper where they were exposed to heavy wave action and strong winds especially from the northeast, occasionally driving them ashore during the night and causing them to break up on the rocky shores.

The moorage basin has afforded a very good shelter not only for state boats but for a good many privately owned boats operating on Lake Kabetogama and adjoining lakes that seek this shelter. The sides of the moorage basin were cribbed up with cedar poles and tamarack planking. Floating gang planks and walks were constructed all around the basin and between the various berths.

This moorage basin is endangered by the rotting away of many of the planks and walks. The severe flood of the spring of 1950 speeded deterioration and added materially to the damage. It is a question of only a short time when the basin will be unsuited for use unless a complete job of rehabilitation and repair is undertaken and without delay.

This is an undertaking of considerable magnitude for which the Division of Forestry has neither the funds nor personnel. Adjoining the basin, and

in reality a part of it, is a long dock which not only serves as such but also as a breakwater which prevents the filling with sand and debris of the channel running into the moorage basin. Ice and wind and decay have completely wrecked this dock.

There are two possible solutions to the problem which appear to be reasonably satisfactory. One is to construct a breakwater across a part of the small bay for a large number of boats. The other solution is to rebuild the dock and the walls of the present moorage basin with concrete. Either project is expensive, and probably will cost not less than $75,000.

There is no other good moorage basin or sheltered boat harbor on Lake Kabetogama which can be reached by automobile by the general public. The need for the upkeep of a moorage basin at this point therefore is great, not only for state boats but perhaps more so for the increasingly large number of large boats now being operated on the lake.

Since the time in which this moorage basin may no longer be used is fast approaching, reconstruction and repair must be undertaken without delay. An appropriation of $75,000 is accordingly recommended to be included in the budget to be submitted to the Department of Administration for the biennium ending June 30, 1953.

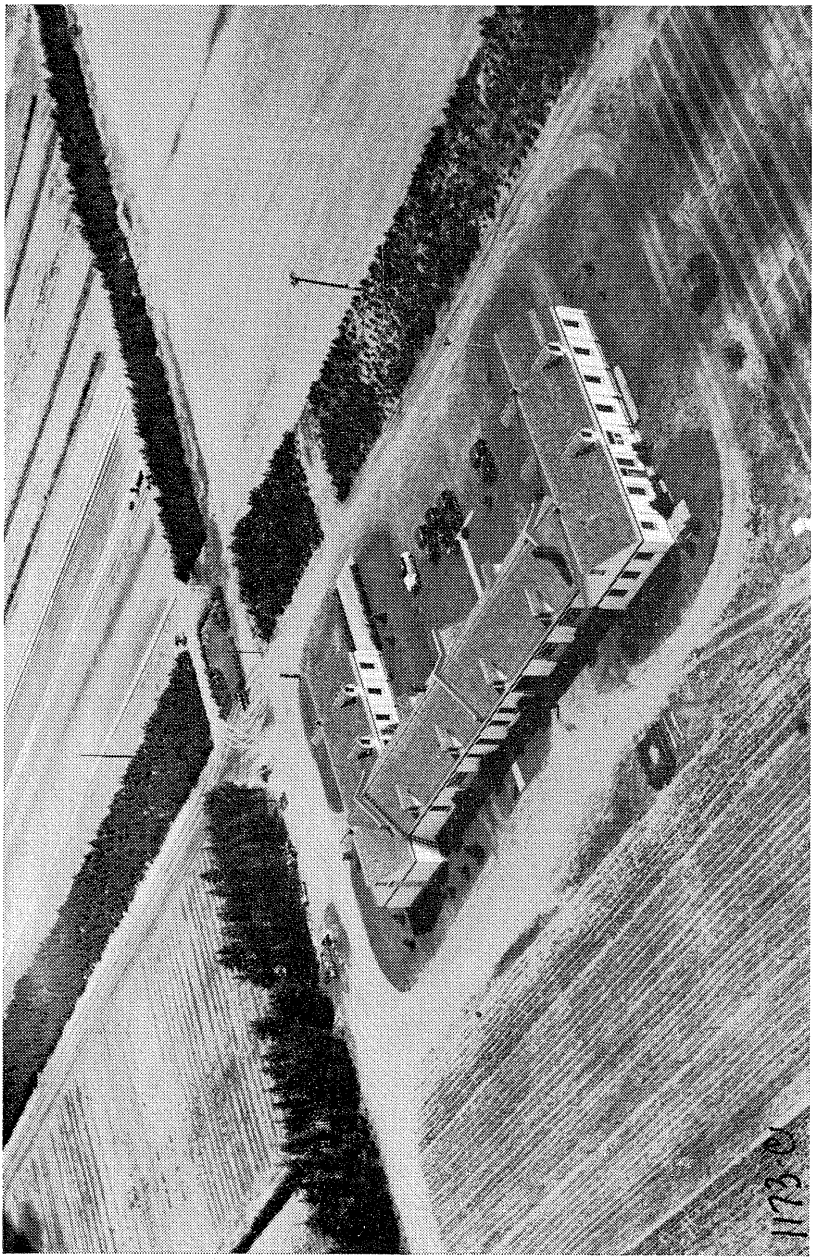
FOREST TREE NURSERIES

R. CLEMENT, *In Charge*

Forestry ranks among the state's four largest industries. It is estimated that the combined value of forest products harvested in Minnesota in 1948 totaled $136,024,720, and in 1949 $129,575,195, representing a combined total of over a quarter of a billion dollars of income to the people of Minnesota in a two-year period. For the administration of this vast source of wealth the state expended for all forestry activities for the same biennium about .6 of 1 per cent of this income.

The production and distribution for planting of adequate planting stock is a prime necessity in any forward looking reforestation movement. The present facilities of the state nurseries organization to supply, distribute and plant trees on state forest lands, and raise and process trees for planting by public and private interests is the "bottleneck" which limits the progress of tree planting, and public and private demands cannot be supplied for the appropriations thus far made for the operation and maintenance of the nursery organization. In this connection it should be borne in mind that the seeding and transplanting of the seedlings at the nurseries is not the only nor indeed the greatest source of expense. The digging, baling and preparing the output for distribution to private agencies and the digging, baling, distribution and planting on state-owned lands are the most costly phases of the work.

Following the act of the legislature of 1947 authorizing the division to raise and sell trees to private interests as well as public agencies, the division at once set about preparing its nurseries for the greater demand to be expected. Because of the limited maintenance appropriations provided for nursery operation and maintenance in prior years, much of the funds



Administrative headquarters of the General C. C. Andrews state nursery.

made available by the legislature had to be spent on expanding the capacities of the nurseries and installing additional equipment and appliances to permit a greatly increased volume of output.

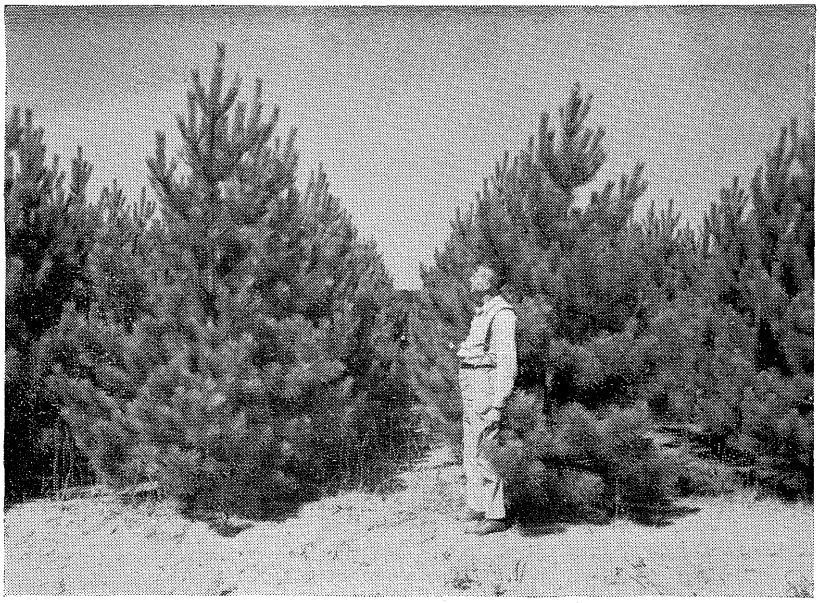
The goal of production for the state-owned nurseries for the biennium ending June 30, 1952, was set at 24,000,000 trees per year. Seeds already planted are expected to produce 18,000,000 trees for the year 1951. Experience will have to indicate how much further nursery production will have to be expanded to supply what may reasonably be expected to meet an increasing demand for the years to come. The rate at which demands for trees are coming in from public agencies, farmers, woodlot owners, lumber companies, and conservation groups of all classes points to a probable leveled-off sustained annual demand for trees of not less than 50,000,000 trees. If this number of trees is to be available annually it will mean that the state nurseries will have to carry a continuous inventory of not less than 150,000,000 growing trees.

On the assumption that a yearly output of 24,000,000 trees will be sufficient to meet public and private requirements, it is estimated that the distribution between the various agencies will be as follows:

For private use	15,000,000
For state forest lands	4,500,000
For county forest lands	2,000,000
For highway rights of way, state institution grounds, and supplies to the Divisions of Game and Fish and State Parks, etc.	1,700,000
For community forests	400,000
For school forests	200,000
For wildlife food and cover	200,000

White spruce plantation, eight years old, at the Badoura state nursery.

If the state fails to maintain a balance between nursery production and public and private needs, a condition may well develop that will tend to dampen public enthusiasm and support for reforestation built up through years of educational work and as a result the state's tree planting program may well suffer a serious setback. The state-wide tree planting plans stimulated through the efforts of conservation and civic leaders and groups already initiated are expanding at a rate which already has overtaxed the division's nurseries' capacities to meet demands. A substantial increase in funds for the support of the division's nursery organization is a prime necessity if the state's reforestation program is to go forward and produce the results that people expect from it.



Norway pine plantation, nine years old, at the Badoura state nursery.

STATE TREE PLANTING

R. CLEMENT, *In Charge*

During the fiscal years covered by this report the Division of Forestry has been swamped by an unprecedented demand for tree planting stock by public agencies. Considering the limited funds made available for carrying out a large planting program, good progress has been made in keeping up with the accelerated tempo in demand for trees and increased public interest.

Requests for tree planting stock for public lands still far exceed the immediate supply. This sustained increased public interest in the planting of trees on public land is indeed encouraging as indicating a state-wide support of a huge future planting program. If personnel and equipment

are to be able to direct this planting program in the best interests of good forestry now and for generations to come, more funds must be made available with which to finance the division's nursery and tree planting activities.

Counties are showing an increased interest in an expanded tree planting program. Some counties have already employed foresters and have purchased equipment to promote their planting projects. Records for the past biennium indicate that the counties have more than tripled their tree plantations as compared with the years 1947 and 1948. Indications are that the areas to be planted in 1950 will be more than double those of 1949.

Notwithstanding the low inventory of trees available on July 1, 1949, for planting on public lands the division's nurseries were able to supply enough trees to plant some 2,100 acres of deforested lands, an increase of

Nursery bed of three-year-old balsam fir.

15 per cent over that planted during the biennium 1947-1948. Approximately 31 per cent of the area planted was in state forests and on administrative sites, with the balance being distributed for planting by other state agencies, counties, municipalities, townships, and schools, usually with the aid and under the supervision of Division of Forestry personnel.

Some progress has been made in acquiring some of the heavy equipment needed in an enlarged program, an essential addition to the division's

tree planting establishment. Fourteen pieces of heavy equipment were purchased for expanded tree planting during the biennium, including three tractors, four planting machines, one pickup truck, and three heavy-duty brush disks, together with fuel and essential accessories required in their operation.

The perfecting of a mechanical tree planting machine has been a major factor in accelerating the forest development program within the state. There are many thousands of acres of denuded lands and open stands where these planting machines can be used advantageously. With this in mind, the division plans to further mechanize the work of tree planting to the extent that future appropriation of funds will allow.

The planting of the trees raised in the nurseries in their permanent place in the forests has always been the costliest operation in the tree planting program. Especially where fires have raged through a well-established stand of timber, the cost of renewing that stand can be extremely high. If we are going to derive the full benefits of forests in their relation to soil, streams and lakes, and wildlife restoration of denuded areas, planting must be accelerated at the greatest practicable rate. The cost of planting plays a critical part in the rate of progress of any tree planting program.

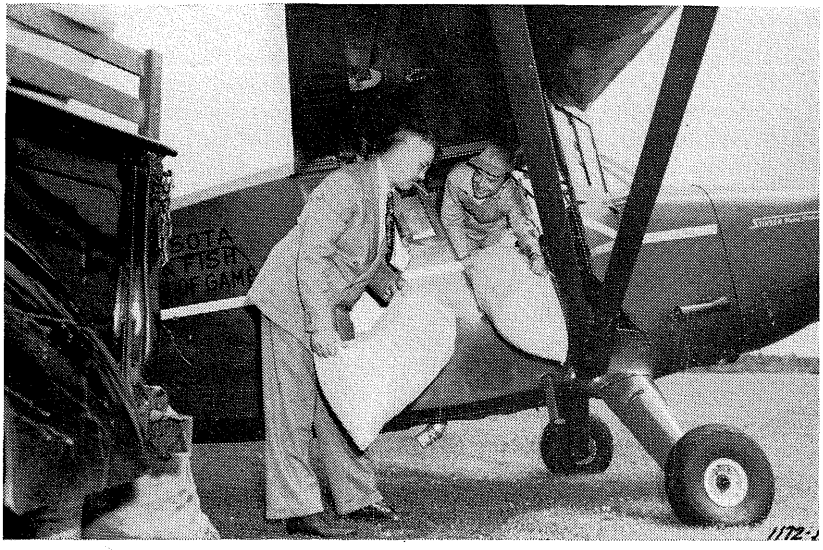
Depending upon the species and the site of the planting job, and exclusive of the cost of raising the stock in the nurseries and transportation, the actual cost of planting 1,000 trees by use of hand labor may vary from $10 to $20 and sometimes even higher. Planting the same number of trees by the use of a planting machine will run from $5 to $10. Planting machines, however, have their limitations and are not adapted for use in all areas. There are thousands of acres where the planting machines cannot be operated successfully and where hand labor is still the only method to be employed.

The Division of Forestry has been conducting a number of experiments in forest development research in an effort to discover how to speed up natural regeneration. Some progress has been made in the direct reseeding of certain species. Investigations to determine the influence of weather and methods of seed-bed preparation on forest tree seed germination are currently being conducted, and plans call for a continuation of this type of research. Many acres of land, some covered by mature seed trees, and others in open treeless areas, have been prepared by heavy brush disks to aid in germinating seed. In cases where there are no residual seed trees, seeds are broadcast. Primarily this experimental work is directed towards improving seed beds so as to encourage germination of seed that falls naturally as well as those broadcast artificially. The cost of operating heavy disking equipment in this type of work varies from $4 to $9 per acre.

In most cases the speeding up of forest regeneration has been quite successful and encouraging, and research of this nature should be continued to assist in the reestablishment of forest stands direct from seeds, thereby eliminating costly planting.

The use of airplanes in broadcasting seeds of forest trees over areas that have been very recently burned has speeded the work. Within the past two years approximately 3,500 acres of burned-over timber lands have thus

been seeded with some 2,500 pounds of seed. A considerable quantity of hardwood seed is on hand to be used in the event that areas suitable for these species are burned over.



Broadcast seeding by airplane on burned-over timber lands speeds forest regeneration.

As more and more trees are made available from the nurseries for public land planting, larger appropriations will be needed by the Division of Forestry for the prosecution of a successful tree planting program.

TABLE 19

Summary of Tree Sales by Counties — 1949

County	No. of Trees	No. of Applications	County	No. of Trees	No. of Applications
Aitkin	4,600	5	Cottonwood	10,187	12
Anoka	25,710	20	Crow Wing	97,056	9
Becker	15,240	18	Dakota	28,243	32
Beltrami	13,005	15	Dodge	6,941	12
Benton	43,483	23	Douglas	24,785	33
Big Stone	20,639	30	Faribault	4,000	4
Blue Earth	6,690	6	Fillmore	8,818	14
Brown	6,697	10	Freeborn	9,845	8
Carlton	254,062	5	Goodhue	42,329	33
Carver	11,463	14	Grant	20,188	23
Cass	269,277	8	Hennepin	52,145	28
Chippewa	5,435	7	Houston	2,000	1
Chisago	35,775	24	Hubbard	38,458	19
Clay	19,365	4	Isanti	42,319	37
Clearwater	7,694	7	Itasca	260,000	3
Cook	3,500	3	Jackson	700	1

County	No. of Trees	No. of Applications	County	No. of Trees	No. of Applications
Kanabec	1,522	3	Pope	23,020	23
Kandiyohi	6,141	8	Ramsey	34,475	29
Kittson	15,044	12	Red Lake	9,087	9
Koochiching	253,417	9	Redwood	.....	....
Lac qui Parle	3,485	6	Renville	6,066	8
Lake	4,000	2	Rice	13,484	19
Lake of the Woods	5,215	5	Rock	10,056	8
Le Sueur	533	1	Roseau	25,318	33
Lincoln	13,557	19	St. Louis	23,505	23
Lyon	6,008	7	Scott	9,056	8
McLeod	7,241	10	Sherburne	41,668	36
Mahnomen	9,979	9	Sibley	12,624	21
Marshall	12,503	16	Stearns	36,078	28
Martin	8,810	13	Steele	2,066	3
Meeker	9,456	15	Stevens	26,832	38
Mille Lacs	14,921	13	Swift	10,305	10
Morrison	12,145	12	Todd	19,638	19
Mower	9,725	12	Traverse	17,164	22
Murray	12,084	14	Wabasha	8,206	11
Nicollet	11,253	11	Wadena	3,179	6
Nobles	11,389	4	Waseca	4,231	6
Norman	43,089	54	Washington	47,922	56
Olmsted	5,026	7	Watonwan	600	1
Otter Tail	71,189	67	Wilkin	600	1
Pennington	17,046	19	Winona	4,672	6
Pine	21,914	14	Wright	7,257	9
Pipestone	25,010	31	Yellow Medicine	8,963	9
Polk	23,279	23	TOTALS	2,432,202	1326

STATE TREE PLANTING REVOLVING FUND

R. CLEMENT, *In Charge*

The enactment by the legislature of 1945 of Chapter 535 created a state tree planting revolving fund of $3,000 and appropriated $4,460 for each of the fiscal years of 1946 and 1947 to cover the cost of administering the act.

Under authority of the act contracts were awarded commercial nurseries for the production and delivery of 550,000 deciduous trees to be delivered for planting in the spring of 1948, and 450,000 coniferous trees to be delivered in the spring of 1951.

The act also provided that any unused funds remaining from each of the 1946 and 1947 appropriations of $4,460 should be reappropriated and transferred to the revolving fund.

The 550,000 deciduous trees were delivered in the spring of 1948 as provided by the contract. The proceeds from the sale of trees were credited to the revolving fund, and the commercial nursery was reimbursed for the trees delivered.

The same procedure will govern the delivery and sale of the coniferous trees in 1951.

Table 20 is an accounting to date of appropriations, receipts, and expenditures involved in the purchase and sale of contract trees under legislative authority.

TABLE 20

Revolving fund appropriation available 7/1/46		$3,000.00
Appropriation for administrative costs of revolving fund available 7/1/45	$4,460.00	
Less administrative costs for F. Y. 1945-46	2,351.49	2,108.51
Available funds 6/30/46		$5,108.51
Appropriation for administrative costs of revolving fund available 7/1/46	$4,460.00	
Less administrative costs for F. Y. 1946-47	1,180.34	3,279.66
Available funds 6/30/47		$8,388.17
Receipts from sales of deciduous trees for F. Y. 1947-48	$6,375.84	
Less contract payment to private nursery for trees delivered	5,937.53	438.31
Available funds 6/30/48		$8,826.48
Receipts from sales of deciduous trees during F.Y. 1948-49		27.50
Available funds 7/1/49 reappropriated to 7/1/50		$8,853.98

CHRISTMAS TREES

R. CLEMENT, *In Charge*

The Forest Industries Information Committee has estimated the cut of Christmas trees, including wreaths, etc., in Minnesota as aggregating 5,600,000 for the year 1948, and 5,900,000 trees for the year 1949. With the value of one dollar per tree this industry alone carried on a business of $11,500,000 for these two years with income from employment and investments accruing to the people of our state.

Natural and processed trees harvested in Minnesota were sold in nearly every state in the Union, with most of the trees and processed products going to eastern markets.

The old tree tagging law of 1935, in force from 1936 to 1948, had yielded more than $181,500 in revenue to the state from tree tags sold during that period. This income had been used entirely in policing the industry.

In 1949 a revised Christmas tree law was enacted, eliminating the tags and imposing license fees only on large dealers. The 1949 act yielded only $600 in license fees for that year. This meant a loss in revenue of about $17,600 as compared with the last previous year under the old tag law. However, results of enforcement of the new law were more satisfactory, on the whole, than under the old law.

Table 21 shows income from operations under the Evergreen Tree Tag law by areas for the biennium ending June 30, 1949. Table 22 is a summary by years for the period 1936-1947.

TABLE 21

Statement Showing Receipts from Operations Under the Evergreen Tree Tag Law for the Biennium Ending June 30, 1949

Area	No. of 2c Tags Sold	Amount
St. Paul	265,068	$ 5,301.36
Cambridge	3,960	79.20
Moose Lake	136,506	2,730.12
Cloquet	88,419	1,768.38
Brainerd	13,848	276.96
Hibbing	21,600	432.00
Hill City	135,103	2,702.06
Bemidji	37,715	754.30
Park Rapids	16,213	324.26
Arago	2,628	52.56
Warroad	38,328	766.56
Baudette	1,456	29.12
Blackduck	18,044	360.88
Littlefork	17,719	354.38
Orr	26,006	520.12
Duluth	39,279	785.58
Hovland	3,500	70.00
Total	865,392	$17,307.84

Statement Showing Receipts from Operations Under the Decorative Tree Law for the Year Ending June 30, 1950

No. of Permits Sold	Amount
3	$600.00
3	$600.00

TABLE 22

Revenue Yielded the State from Operations Under the Evergreen Tree Tag Law for the Period 1936 to 1948, Inclusive

Year	Amount
1936	$ 10,582.31
1937	13,169.03
1938	13,653.65
1939	13,822.41
1940	13,132.39
1941	14,124.83
1942	10,113.09
1943	19,457.73
1944	10,519.25
1945	13,986.79
1946	16,134.76
1947	14,620.52
1948	18,207.91
Total	$181,524.67

LAND EXCHANGE

E. L. LAWSON, *In Charge*

Land exchange proceedings are under the jurisdiction of the Land Exchange Commission consisting of the Governor, State Auditor and Attorney General. Because of the fact that the Commissioner of Conservation is by law directed to formulate and recommend land exchange proposals and make investigations of lands in connection therewith for action by the commission, a report of the activities of the department on land exchanges is made a part of the biennial report.

Operations under the land exchange amendment to the state constitution ratified in 1938 and legislative statutes to make the amendment operative have been carried on by the Land Exchange Commission to the full capacity of its funds and resources. Under the statutes the Commissioner of Conservation is to formulate land exchange proposals to be submitted to and receive final action by the commission. Proceedings for the exchange of state lands for federal or private lands, and exchange of tax-forfeited lands for private lands in land exchange proposals submitted by counties, are both designed to correct the diverse and intermingled pattern of land ownership by consolidation for better management, and as an aid in the acquisition, development and use of land for conservation purposes.

The Division of Forestry has been designated by the Land Exchange Commission as the administrative agency for processing exchange proposals involving state owned lands, and by order of the Conservation Commissioner to check and approve field appraisals on county land exchanges and on exchange proposals submitted by private land owners. For purposes of negotiation, all lands owned by the state and under the jurisdiction of the Conservation Commissioner are classified as Class A lands and tax-forfeited lands administered by the county authorities as Class B lands.

Exchanges Between State and Private Land Owners

The state may exchange state owned lands for privately owned lands where the latter are needed in connection with the development of conservation projects. Thus far, the Land Exchange Commission's policy has been to confine such exchanges to only those that effect consolidation of state owned lands within the boundaries of state forests, game refuges and conservation areas or where such lands are needed in connection with the development of other types of conservation projects.

Intermingled with state lands are scattered tracts held by private owners who wish to exchange their land for other more desirable tracts. Numerous exchange proposals from such private owners have been received during the biennium but only a small portion have actually been consummated by the commission. Twenty-one of such proposals involve lands located in state forests, conservation areas or refuges and were recommended by the Department of Conservation for acquisition through exchange proceedings. Field examinations and appraisals of the lands offered and of the state lands selected for exchange purposes in connection with these private land exchange proposals have been authorized by the Land Exchange

Commission. A total of 7,243 acres were thus examined and appraised, of which 4,646 acres were privately owned and 2,597 acres state owned.

Nine of the twenty-one private land exchange proposals, involving a total of 1,315 acres of private lands and 918 acres of state lands, were rejected because of too great differences in values; that is, the value of the private land offered did not substantially equal that of the state lands sought in exchange. Five proposals involving 919 acres of private land and 800 acres of state land have been processed to the point where they are ready for public hearings. Three proposals involving 640 acres of private land and 400 acres of state land have been approved for exchange and require only clearance and transfer of title to be consummated. Four proposals involving 1,770 acres of private land and 479 acres of state land require further processing and a public hearing by the Land Exchange Commission.

The law provides that state land shall be exchanged only for private lands of at least equal value. In cases where state land other than trust fund land is involved, the proposed exchange may be consummated upon payment by the applicant of the difference between the value of the state land and the private land offered in exchange. Legally there is no limit in the difference in value which may be thus adjusted. As a matter of policy, however, the Department of Conservation does not recommend exchanges where the difference between the values of lands offered and sought is disproportionately great, as such exchanges could be made to defeat the object and purpose of the exchange program and would not be in the best public interest. Furthermore, exchange proceedings entail much work and considerable expense on the part of the state and should be evoked only in cases where the results will reflect substantial benefits to the public, and should not be permitted as a means to circumvent the requirements of the statutes which normally limit the acquiring of state trust lands to purchases at public sales.

State-Federal Land Exchange Projects

Ever since the approval of the land exchange amendment to the constitution, both state and federal forestry agencies have been cooperating in the developing of a land exchange program for the consolidation of lands owned by each for greater efficiency in planning and management. These programs have been largely directed toward consolidations within state and national forests.

One outstanding land exchange project in keeping with this program, on which all field work has been completed and on which the required public hearing has been held, is the so-called Pine Island - Chippewa - Superior National Forests exchange proposal. No objections to this project were raised at or subsequent to the public hearing at which this exchange was considered by the Commission. The proposal was initiated in 1942 through a formal offer by the Land Exchange Commission made to the U. S. Forest Service to exchange Class A lands located within the boundaries of the Chippewa National Forest for federal lands acquired under the Bankhead-Jones Farm Tenant Act. This exchange will include federal lands in Koochiching, Lake of the Woods, Beltrami and Carlton counties comprising 573

tracts, aggregating 21,127.45 acres. State lands aggregating 401 tracts are located within the Chippewa and Superior National Forests and total 15,899.32 acres. Of this, 11,070.10 acres are within the Chippewa National Forest and 4,829.22 acres within the Superior National Forest.

Most of the federal lands included in the Pine Island-Chippewa-Superior National Forest exchange proposal were purchased by the federal government in Koochiching County in a plan to remove and resettle isolated and distressed settlers within the Pine Island federal resettlement project. On the suspension of operations by the government within the area, the lands, in 1940, were leased to the State of Minnesota for a period of fifty years to be managed for the protection and preservation of wildlife, forest and water resources. Also included among the federal lands in this proposed exchange were 926.25 acres of resettlement lands situated in Lake of the Woods, Carlton and Beltrami counties located within the federal resettlement area.

When this exchange has been completed it will have made possible a much desired and needful consolidation of state land ownership within the Pine Island, Koochiching, Northwest Angle, Fond du Lac and Nemadji State Forests, as well as contribute toward consolidation of federal lands within the Chippewa and Superior National Forests. The larger portion of federal lands to be acquired are located within the Black River and Big Falls forest management blocks in Koochiching County. The state already owns 280,000 acres, or 76 per cent, of the land in the Big Falls block and 181,000 acres, or 48 per cent, of all the lands in the Black River block.

The state lands affected by the Pine Island-Chippewa-Superior National Forest proposal lie immediately adjacent to or through which U. S. Forest Service roads were constructed as a part of the unemployment relief program of the thirties by the CCC and on which the national forest service now holds road easements. These easements require processing and renewals once a year. The proposed exchange would eliminate largely these road easements, and would bring about a further consolidation of federal ownership within and adjacent to the federal Pike Bay and Cut Foot Sioux experimental forests. Furthermore, the management of the federally owned lands within the Pine Island resettlement area under the existing lease involves accounting and other time consuming details that will be eliminated when the proposed exchange becomes effective.

The Division of Forestry has been designated as the administrative agency of these leased federal lands and under the lease is responsible for their management, the keeping of records of sales of timber and other products and inventories of buildings and of equipment left by the government when the state took over management under the lease, subject to inspection by the U. S. Forest Service. On the completion of the pending exchange, administration of the area would be greatly simplified with savings in cost to both the state and federal government.

New State and Federal Exchange Projects Authorized

The Land Exchange Commission has recently received a proposal from the federal government and the commission has authorized the division to

proceed with field examination and appraisals of lands in connection with an exchange involving approximately 19,000 acres of lands now owned by the federal government within the Finland and the George Washington state forests, where the boundary of the Superior national forest overlaps these two forests, in order to consolidate state holdings within the latter. For the federal lands offered in exchange, state lands of corresponding value will be selected in the Superior national forest within townships situated immediately adjacent to those in which state lands were withdrawn for exchange in the previously consummated Nerstrand Woods exchange deal.

Adoption of Less Intensive Appraisal Methods in Exchanges Between State and Federal Agencies

Amendments in Laws 1949, Chapter 373, have materially reduced the expense of land appraisals in exchange proposals. Under authority of this act, the Land Exchange Commission has directed that examination and appraisals of lands be conducted under standard and generally accepted practices employed in forest surveys and inventories. The adoption of such procedures will effect material savings in time and funds.

Land Exchanges Affecting State Parks

Enabling acts passed by the legislatures of 1947 and 1949 authorize the Commissioner of Conservation to request the federal government to acquire for purposes of exchange with the state certain lands within state park areas proposed for Fillmore and Wright counties.

The proposed park area in Fillmore County is located on the south branch of the Root River near the old townsite of Forestville, known locally as "Meighan Woods." It is a dense hardwood forest largely preserved in its virgin state and covers the valley and surrounding bluffs. It is exceptionally well suited for park purposes. The land proposed to be acquired is limited by the act to 850 acres.

The proposed state park area in Wright County is located near Silver Creek Village, about ten miles west of Monticello. The tract is the remains of the extensive hardwoods which originally covered this portion of the state and is covered largely with second-growth hardwoods. A small spring-fed lake is located within the tract. Acquisition in this instance is limited by law to 1,000 acres under conditions similar to those under which the Nerstrand Woods exchange in Rice County was completed. Funds would be appropriated by Congress to enable the U. S. Forest Service to purchase the lands within the two proposed state park areas. Lands thus purchased would then be conveyed to the state in exchange for state owned lands located in one or the other of the two national forests in the state and wanted by the U. S. Forest Service.

Further developments on these two proposed park exchanges await action by Congress to provide funds and the U. S. Forest Service to acquire the lands needed for land exchanges affecting these parks.

AUXILIARY FORESTS AND MEMORIAL FORESTS

ELIZABETH BACHMANN, *Secretary to the Director*

Auxiliary Forests

Any tract of land in this state containing not less than 35 acres, generally suitable for the planting, culture, and growth of trees for the production of timber or forest products, may be made an auxiliary forest. A woodlot auxiliary forest may be established on lands not less than five acres nor more than 40 acres in area on which trees are growing or will be planted, and which are protected from fire, insects and disease by the owners or tenants living on or near them.

The auxiliary forest contract provides that at least 90 per cent of the lands within the area shall be capable of producing at least 400 well established and well distributed trees per acre of the species stipulated in the contract exclusive of timber considered merchantable at the time of the making of the contract.

Before a contract takes effect, the application for its establishment must be approved by the county board of the county in which the land is located and by the Commissioner of Conservation, and after these preliminaries have been completed, approved by the director of the University's school of forestry and lastly by the executive council.

Auxiliary forest land is taxed at the rate of six cents per acre annually during the life of the contract. Contracts shall run for a period of 50 years and by mutual agreement between the owner and the state may be renewed for an additional period not to exceed 50 years.

When timber estimated to be merchantable at the time of making the contract is cut, the owner must pay a yield tax of 40 per cent of its value if the cutting is done within one year after June 30 following the date of the contract. This yield tax is reduced by two per cent each year until it reaches 10 per cent, after which the rate remains constant. Timber which becomes merchantable during the life of the contract is taxed at the rate of 10 per cent of its value at the time it is cut.

Fifteen new auxiliary forests were established during the past biennium, covering 28,116 acres. They are located within the counties of Carlton, Clearwater, Hubbard, Itasca, Koochiching and St. Louis. These additional forests bring the total number of auxiliary forests that have been established up to July 1, 1950, to 38. They comprise an aggregate area of 160,868 acres of privately owned lands, the owners of which have entered into contracts with the state to administer them as forest lands under a definite conservation and land use plan.

Four additional applications have been received from owners of land for the establishment of auxiliary forests, one each in Carlton and Hubbard counties and two in Koochiching County. They have been approved by the respective county boards and will be consummated shortly, and thereby bringing more than 15,000 acres additional under contract.

During the biennium two applications were not approved by the county boards. One, in Itasca County, taking in 2,268 acres of land, was disapproved in its entirety. The other, in St. Louis County, for placing 7,858 acres under contract, was approved only as to half the area submitted.

For the first time since the passage of the auxiliary forest law in 1927, small amounts of timber have been cut from auxiliary forest lands and on which the counties have assessed the yield tax.

Tax receipts collected by the counties from such auxiliary forest lands for the biennium have yielded $17,586. Had the lands not been placed under the auxiliary forest law, it is quite probable that many of them would have been allowed to become tax-delinquent and forfeited and a burden on the rest of the county.

One tract of land of 190 acres was withdrawn from an auxiliary forest in Koochiching County on representation that the land was wanted for agricultural purposes by owners of adjoining farm land. Upon examination of the land these representations were confirmed and the application for its withdrawal was duly approved.

Table 23 shows auxiliary forests by counties and acreage of each.

TABLE 23

Auxiliary Forests Established

County	No. of Forests	Acreage
Carlton	2	1,597.50
Clearwater	1	160.00
Hubbard	3	4,742.43
Itasca	7	22,771.03
Koochiching	17	91,268.55
Stearns	2	90.95
St. Louis	6	40,238.21
Total	38	160,868.67

Memorial Forests

Under an enabling act passed by the legislature of 1945, any county may by resolution of the county board set aside tax-forfeited lands for forestry purposes and dedicate the lands as a memorial forest and manage them on forestry principles.

All moneys received as income from the land so dedicated may be expended for the development and maintenance of the dedicated forest.

During the past biennium six new memorial forests were dedicated, and additions were made to four previously established forests in Becker County. The new forests are in Becker, Cass, Crow Wing and Itasca counties. These new forests and additions embrace an area of nearly 200,000 acres. The total acreage of lands set aside as memorial forests and managed for forestry purposes and dedicated to honor the men and women who served their country during the last war aggregated 836,066 acres on July 1, 1950.

Table 24 indicates the acreages of the memorial forests in the various counties:

TABLE 24

Memorial Forests

County	No. of Forests	Acreage
Becker	8	68,143.90
Beltrami	2	480.00
Cass	2	117,864.41
Hubbard	1	10,825.46
Crow Wing	1	5,093.49
Mahnomen	1	240.00
St. Louis	6	494,259.00
Itasca	3	139,160.00
Total	24	836,066.26

PRIVATE FOREST MANAGEMENT SERVICE

EMIL G. KUKACHKA, *Project Forester*

In Minnesota there are few large ownerships of forest lands other than those publicly owned. For example, the state and federal government own 11,500,000 acres, while the large private holders own but half a million acres. Eleven per cent of the forest land in Minnesota is in small industrial and private holdings, and of these 27 per cent are in farm woods. Approximately 7,000,000 acres of the state is classified under farm woods and other private ownership. Of the total of 4,117,000 acres in farm woods 3,000,000 is pastured.

Industrial owners recognize the fact that the continuation of their business for any appreciable length of time into the future will depend on analyzing and taking inventory of their present holdings and making plans for sustaining and building up this inventory for the future. Farmers with forest plots and other small woodland owners are not organized so as to be able to manage their forest lands cooperatively, and individually cannot afford to engage trained foresters to aid them.

Analysis of timber production during the past ten years shows that contrary to popular opinion a very considerable amount of forest products comes from small private holdings. This fact was especially notable during the war years when the small holdings were producing the lion's share of the harvest. This tendency to lean on the small woodland owner was considered practical by both industry and the individual because of monetary values involved. At the time while the importance of the production of the small operator was stressed, no great amount of serious thought was given to the problem of managing these small holdings for sustained and increased production in the future.

During the last five years there has been an increasing recognition by timber owners and foresters of the need for good management of these small holdings. Owners who were well enough informed to know their

needs asked for help from the state division of forestry, the only agency available to render aid but which because of lack of personnel was hard pressed to respond to the requests. Experience in working with small woodland owners emphasizes the fact that there are literally thousands of owners who, while they sense a need for help, do not have sufficient information on the subject of forest management to recognize the possibilities of their land. An expanded educational program in this field would yield results much more than commensurate with the costs.

Prior to the legislative session of 1947, no state funds had been provided for private forest management service. The initial step for planned aid to small woodlot owners was taken in the spring of 1946 when the Minnesota Forest Industries donated $8,000 to the State of Minnesota to be administered by the state division of forestry in carrying out the program. Two project foresters were employed by the division of forestry to furnish private owners of small forest tracts competent forest management services in marking, measuring and marketing forest products. Their services were confined to the northeastern fourteen counties of the state.

Work under the gift of the Minnesota Forest Industries terminated June 30, 1947, when an appropriation of $10,000 made by the legislature of 1947 for the purpose became available, and has been continued since that time as a public service by the division of forestry. This act extends forest management services to the entire state but limits it to owners of 1,000 acres or less. The act further provides that a reasonable charge may be made by the commissioner of conservation for such services. Charges, however, are made only where owners request the actual cruising, estimating and marking of salable timber. In every such instance the land owner is given a report of the results of investigations and when requested is assisted in contacting buyers for his timber products. Those interested in having their timber cruised only are referred to private consulting foresters or timber cruisers.

In January, 1948, the state received assistance for the program from the U. S. Forest Service under the Norris-Doxey Act, making it possible to add another project forester and divide the state into three areas. In August, 1949, budget funds available permitted the employing of two additional project foresters. At present five project foresters are employed by the state division of forestry.

The state is now divided into five project areas. Area 1, with headquarters at Park Rapids, includes twenty counties in the northwestern corner of the state. Woodlot owners in this area who have received this service have been very favorably impressed. The Minnesota Tree Farm program has stimulated and increased requests for aid and service.

Area 2, with headquarters at Cambridge, covers the central counties lying north of the Twin Cities and west to the state line. There are nineteen counties included in this territory. By far the greatest number of requests for assistance have come from four of the counties nearest the forester's headquarters, making it quite apparent that the service is not too widely known throughout the area. About fifty per cent of the requests in this area

have come as a result of news releases and other informational material published by the local papers. In the early months of 1950 the requests for assistance for management more than doubled in this area. This increase has been due mainly to the Minnesota Tree Farm movement which came into being in February, 1950. Considerable help has been given to land owners in tree planting for windbreaks and shelterbelts, including a start to have some of the sugarbush groves placed under management.

Area 3, with headquarters at Faribault, comprises the southern counties of the state except those seven counties in the extreme southeastern portion which are in Area 4. Area 3 includes twenty-six counties. Requests for assistance have been received from fourteen counties. Again the largest number of requests have come from counties nearest headquarters, reflecting a lack of information in counties remote from headquarters. Here as in the other areas the Minnesota Tree Farm program was given statewide publicity, and stimulated considerable interest and responses from woodland owners increased. Persistent and uninterrupted publicity is necessary to keep the public informed of the service.

Area 4, with headquarters at Rushford, was created in August, 1949. This area comprises seven counties of the southeastern portion of the state. Assistance has been given in the form of windbreaks and shelterbelts, management of woodlots, together with estimating, marking and harvesting of forest products. Aid in marketing has been a major factor in bringing greater returns to the woodlot owner.

Area 5, with headquarters at the state ranger station at Brainerd was established September 1, 1949. It covers sixteen north central and northeast counties. The project forester in charge has the following to say about the area:

"From a knowledge of this area, the following facts are obvious. First, privately owned woodlots capable of providing good returns to the owner under management are plentiful. Secondly, there are still many owners who are not aware of the value of good timber management. Thirdly, owners who would appreciate this service are still unaware that it exists. The publicity which has been given to make the present service known has produced an increase in requests. However, much more is needed and should be of a constant nature rather than sporadic as in the past. Since the Tree Farm program came into effect early in February, 1950, many requests have been received. It can be stated that the persons contacted have been very satisfied with the program. In quite a few of the cases immediate and increased financial returns were obtained by the owners. In others, steps to increase future returns have been outlined."

Accomplishments

Thanks to the publicity given the program by the press and radio, aided by the stimulus given by the Minnesota Tree Farm program, requests for aid and advice on private forest management have been on the increase during the biennium. The 82 Tree Farms, comprising 4,600 acres of land,

which were established during the last six months of the biennium, were examined by the project foresters.

There is still considerable work to be done in the disseminating of information as it is still quite apparent that many small woodland owners do not understand what the service means, how to avail themselves of it, and what benefits can be gained. Of the projects worked it is evident that resident owners gain more real values than non-resident owners. Each case considered is one by itself and has its own problems.

The size of the present areas assigned to each forester is too large to enable him to make contacts with woodland owners for best results and should be reduced in order that a greater interest may be aroused and sustained among larger numbers of small owners. To make this possible more foresters are needed.

The accomplishments from June 30, 1948, to July 1, 1950, are shown in table 25.

TABLE 25
WOODLAND MANAGEMENT REPORT

	Acres	Bd. Ft.	Cords	Poles	Ties	Posts	Gals. Syrup	Units
1. Owners given woodland management assistance								622
a. Woodland involved	26,930							
b. Timber marked for cutting	922	517,000	216					
c. Timber inventoried for management plan	11,337	22,142,000	10,620					
2. Woodlands on which improved practices are being followed								381
a. Commercial timber cut	1,000							
b. Forest stand improvement	307							
c. Young timber saved from harvest	4,877							
d. Land planted	95							
e. Woodland placed under fire protection	9,599							
f. Woodland protected from grazing	8,946							
g. Improved sugarbush operations	698							14
3. Estimate of forest products harvested under improved cutting practices (both sale and home use):								
a. Sawlogs, lumber, veneer logs		1,459,000						
b. Pulpwood			457					
c. Poles, piling and drive posts				110				
d. Crossties					2,507			
e. Fuelwood			887					
f. Fenceposts						200		
g. Maple syrup							2,280	
4. Marketing assistance only		576,000						

Total forest products harvested ..... 2,916,000 Bd. Ft.
Approximate stumpage returns to woodland owners ..... $ 37,718.00
Approximate gross returns to woodland owners $110,481.00

FOREST INSECTS AND FOREST TREE DISEASES

ARTHUR F. OPPEL, *In Charge*

The forest insect and forest tree disease survey being conducted by the division of entomology and economic zoology of the University of Minnesota and the state entomologist in cooperation with the division of forestry was continued through the biennium.

The report compiled by Dr. A. C. Hodson, division of entomology and economic zoology, University of Minnesota, for 1948 and 1949, reflects the results of this cooperative project and is incorporated herewith.

MINNESOTA FOREST INSECT SURVEY REPORT FOR 1948-1949

By A. D. HODSON

Division of Entomology and Economic Zoology
in Cooperation with

Division of Forestry, Department of Conservation,
and the State Entomologist

General Conditions in 1948

In general, 1948 was slightly warmer and somewhat drier than average. Unusually low temperatures occurred on the 10th and 11th of March when low temperature records for the month were exceeded by several degrees. As the result of this cold wave there was serious winter injury to many species of conifers including forest trees and nursery plantings. Exotics such as Scotch pine were injured most severely. Phenologically the spring season was about average, but unusually dry weather during April and May retarded some plant growth.

Insects Reported in 1948

The larch sawfly continued to be the most abundant and important forest insect of 1948. Heavy defoliation was reported from many localities infested before, and new infestations became evident over most of the northern part of the state. Additional evidence was gathered to confirm the 1947 prediction of the development of a new outbreak of the forest tent caterpillar. Some complete defoliation was observed at Wind Bay in Basswood Lake and smaller populations were found near Walker, Grand Rapids, Whitefish Lake and Itasca Park. The variable oak caterpillar was also more abundant than usual, while the jack pine sawfly outbreak was beginning to show signs of termination. The red-headed pine sawfly, which had been confined mostly to roadside plantings, was found in a number of plantations for the first time. The shoot moth on jack pine was found over a large area and continued to cause heavy damage in plantations and in natural reproduction.

Jack Pine

The jack pine sawfly caused very heavy defoliation of old growth near Brainerd, Nimrod and Akeley. It was present in smaller numbers at Park Rapids, Side Lake, Pinewood and Bemidji.

The jack pine budworm was reported as light from only one area near Pencer.

The pine shoot moth was very abundant in young jack pine over much of the northern part of the state. It caused the greatest amount of damage in plantations and natural reproduction near Brainerd, Cass Lake, Grand Rapids, Cloquet and Willow River.

The pine pitch nodule-maker was much less abundant than in 1947.

The red-headed pine sawfly caused some spotty complete defoliation near Brainerd, north of Remer, at McGregor and in plantations in Sherburne County and at the Cloquet Forest Experiment Station.

Red Pine

The jack pine sawfly caused some defoliation of red pine in the vicinity of Lake Hubert, north of Brainerd. In all cases there were young red pine growing among infested jack pine trees.

The red-headed pine sawfly completely defoliated roadside planted trees and some marginal trees in a plantation between Remer and Cohasset.

White Pine

No important infestations were reported from white pine.

Spruce

No serious insect infestations were reported this season. The most important discovery was the collection of a single specimen of the European spruce sawfly in black spruce near Orr. This find indicates a considerable westward extension of the range of this insect in Minnesota.

Tamarack

The larch sawfly was found in nearly all areas where its host occurs. Heavy defoliation was reported from the following districts: Bemidji, Bagley, Pencer, Baudette, Side Lake, Cotton, Cass Lake, Beltrami Island State Forest, and Tower. Medium to light infestations were found at Hovland, Lake George, Itasca State Park, Pinewood, Cloquet, Ely, Zimmerman, Fond du Lac State Forest, and McGregor.

Miscellaneous Hardwoods

The spring cankerworm was most abundant in scattered parts of the Twin Cities and at Ivanhoe. The fall cankerworm was very abundant at Orr for the second year and also was reported from Park Rapids, Cotton

and Osage. The variable oak caterpillar was reported feeding on oak and basswood at Osage and Park Rapids. The eastern tent caterpillar was much more abundant than usual along roadsides and forest margins. The increase in numbers of this species is of interest because it often parallels the development of outbreaks of the forest tent caterpillar. The birch sawfly was very abundant on paper birch near Cook.

General Conditions in 1949

The weather was slightly warmer and considerably wetter than 1948. July had heavy rains, particularly in the extreme northwestern and north central counties. In many localities tamarack bogs were flooded at the time when large numbers of larch sawfly larvae were descending to form their cocoons. There was a long growing season which permitted insects such as the northern walking stick to complete oviposition before being killed by fall frost.

Insects Reported in 1949

Seven defoliating species were present in outbreak numbers during the summer. They were the larch sawfly, the forest tent caterpillar, the northern walking stick, the orange-striped oak worm, the jack pine sawfly, the red pine sawfly, and the spring cankerworm. Walking sticks were found very abundant locally in three new areas, and the red pine sawfly collection represents the first record of the occurrence of this species in Minnesota. Local, heavy (not complete) defoliation by the forest tent caterpillar was observed both south and north of Walker along highway 371.

Jack Pine

The jack pine sawfly caused some defoliation north of Brainerd but much less than in 1947 and 1948. Heavier defoliation was reported from Bemidji and in the vicinity of Itasca State Park.

The black-headed jack pine sawfly was found in small numbers at Gheen and also near Brainerd on both plantation trees and in natural stands.

The pine shoot moth was still very abundant over most of the area where stands of young jack pine are found. It was particularly important near Pinewood and at Cloquet.

Reports of the pine pitch nodule-maker were more numerous than in 1948.

Red Pine

The red pine sawfly was very abundant in several stands of planted trees from Copas to near Stillwater along the St. Croix River. It occurred also between Stillwater and White Bear Lake. The trees attacked varied in age from about seven to 20 years. Only the old needles were destroyed. This species has not been found in Minnesota before.

White Pine

The introduced pine sawfly caused defoliation in a plantation located at the St. Cloud Teachers College. It was present also in small numbers at Lake Vadnais near St. Paul. Abbott's pine sawfly caused complete defoliation of windbreak trees near Winnebago.

Spruce and Balsam Fir

No interesting or important reports of insects on these trees were received in 1949.

Tamarack

The larch sawfly continued to be present in outbreak numbers over the northern part of the state. Individual records provide little information not already reported in 1947 and 1948. At present there is little evidence of defoliation injury in stands attacked during the past few years. In a few cases the tops of some trees show evidence of dead branches but there has been no wholesale killing.

Miscellaneous Hardwoods

The northern walking stick caused heavy defoliation at Gull Lake, Pillager, Pequot Lakes, Becker County, Farmington, Oronoco, Spring Valley, Pencer, Princeton, and New Brighton. It was found for the first time in the last three localities named. Both the area covered and the amount of defoliation increased in all of the old infestations. Only at Gull Lake, where the first outbreak population was discovered in 1941, was there any sign that the outbreak might be less severe in 1951. In this area all of the oak and much of the hazel has been killed. Also there has been an increase in the percentage of egg parasitism. At Gull Lake the area of heavy infestation has shifted eastward from the original locality and probably will invade lakeshore property in 1951.

The orange-striped oak worm caused complete defoliation during August near Moose Lake, Spicer, Annandale and along the Mississippi River from Becker to St. Cloud. This is the first record of large populations of this species since the survey started in 1939. Oaks were the principal host.

The spring cankerworm was abundant enough locally in the Twin Cities area to make spraying necessary.

WHITE PINE BLISTER RUST CONTROL

L. B. RITTER, *In Charge*

White pine blister rust control is conducted by the division of forestry in cooperation with the bureau of entomology and plant quarantine, United States department of agriculture. The responsibilities of the federal personnel assigned to the activity also include the technical direction of the work on lands managed by the United States forest service and the United States Indian service. This includes the development of control procedure, the training of temporary personnel and the inspection of completed work.

White pine was the tree that gave character and distinction to the original forests of northern Minnesota. While occasionally occurring in pure stands, it usually grew in association with other upland tree species. On light sandy soils it grew in mixture with jack and red pine; on heavy soils with white spruce and balsam-fir. South of the coniferous forest, it grew in mixture with hardwoods.

Only fragments of the original white pine stands remain. White pine trees are found on about a million acres and in substantial numbers on about 250,000 acres. The State has passed its peak in acreage of the temporary forest types that followed the big forest fires. Now these temporary types, principally aspen and jack pine, are being slowly but gradually replaced by more permanent forest types including white pine.

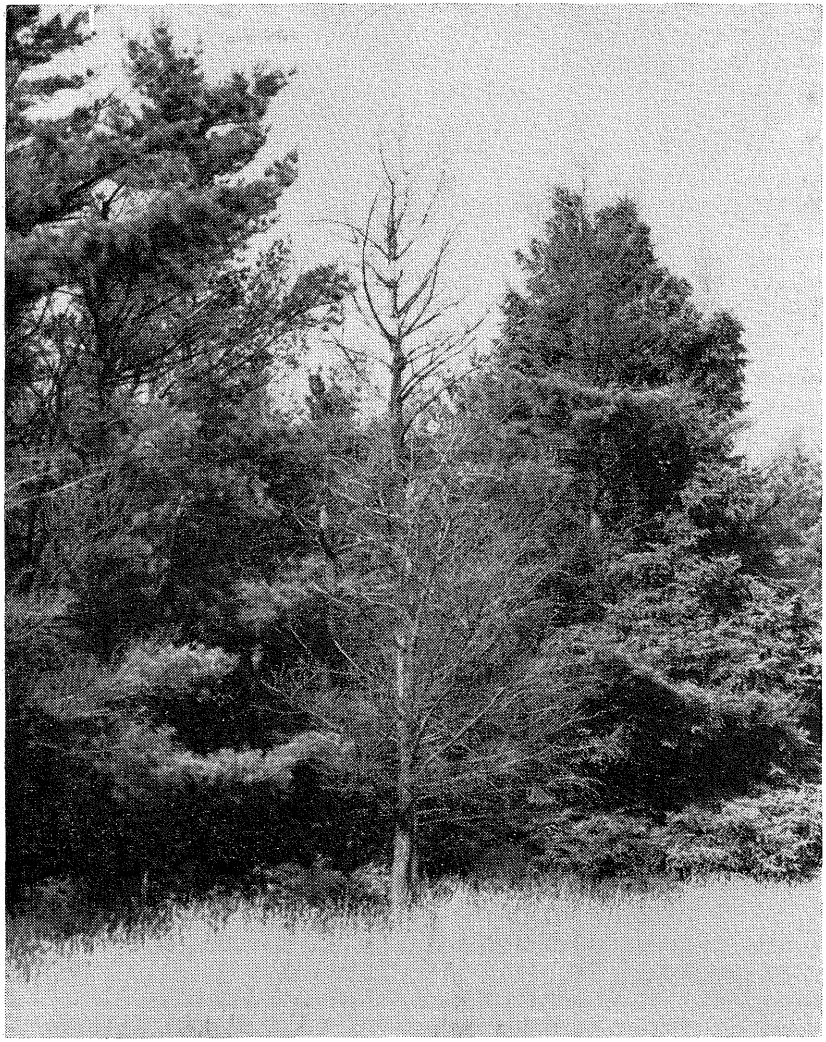
Lumber is still the most important forest product of the United States. In spite of the changes that are occurring in wood utilization there are no reasons for assuming that lumber will not continue to be the major forest product. A sound forest policy requires that Minnesota's pine stands be intensively managed for the production of saw and veneer logs. Considerable amounts of pulpwood and similar material will be a by-product of such intensive management.

A problem associated with the management of white pine is the protection of that tree from the European disease, blister rust. Blister rust affects two entirely different plants—white pine and the various wild and cultivated currants and gooseberries (which are collectively called ribes, their generic name). Fortunately, the disease cannot spread from one white pine tree to another and spreads only a short distance from ribes to white pine. Therefore, control of the disease can be secured by destroying the ribes growing in white pine stands and for distances up to 900 feet around those stands. Second and third workings at intervals of five to ten years are often necessary to keep ribes growth suppressed.

The first step in the application of blister rust control in the pre-eradication survey. Its purpose is locating, mapping and evaluating white pine stands and their control problems. The information secured is used in selecting white pine stands to be protected and planning the protection of those selected stands. Nearly 800,000 acres of white pine have been mapped and 237,234 acres of natural white pine and 12,676 acres of planted white pine scheduled for protection. Minnesota's pre-eradication survey was done during work relief days and is now obsolete. A complete re-appraisal of the preblem on the Superior national forest is under way. A

limited amount of re-survey and new survey is being done on the state forests. Surveys are made on private lands following requests for blister rust control assistance.

A number of methods are used in destroying the currants and gooseberries growing in and near white pine stands selected for protection.



White pine blister rust damage in a small unprotected white pine stand.

There is only one place for 2,4-D (2,4-Dichlorophenoxyacetic acid) in ribes eradication in Minnesota; that is in the foliage spraying of American

black currants when these bushes are found in large enough concentration to warrant special attention. The following year a large number of seedlings make their appearance. A second spraying is necessary to kill these seedlings and living parts of the original bushes. Where concentrations of American black currants are encountered considerable savings result from the use of 2,4-D. Experimental use of 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid) during the past two years indicates that it may have more value in blister rust control than 2,4-D.

Hand pulling still remains the best way of destroying currants and gooseberries. The one-man crew has during the past two years found a place in ribes eradication procedure along with three- and four-man crews and the combination survey-scout eradication crew.

Table 26 sets forth local control accomplishments for the past two years. The major portion of the work now being done is re-work to maintain suppression of currant and gooseberry growth.

During the biennium work was done on the Smoky Hills and Paul Bunyan state forests and the Whitewater game refuge and public hunting grounds. St. Louis County appropriated funds for work in the Island Lake memorial forest. Some work is done every year on private lands, the owners furnishing the labor and the state and federal cooperating agencies supervision and materials.

White pine nursery stock should be grown in blocks that are surrounded by a 1,500-foot ribes-free zone. Six nurseries, private, state and federal, that have been aided in establishing and maintaining such zones still possess active zones. In 1949, the Badoura state nursery zone was re-examined.

Pruning out of infected parts of white pines has little if any value as a control measure. However, it may be an advisable treatment of ornamental trees or, following ribes eradication in heavily infected young stands, for the purpose of salvaging timber-producing values. During the past two years the major portion of the canker pruning work done was on private lands. Canker pruning is still experimental. A large scale experiment is under way at the Superior-Quetico Wilderness Research Center on Basswood Lake. This project is beginning to answer some fundamental canker pruning questions.

Table 27 is a statement of the status of control by ownerships as of December 31, 1949. The figures that add up to the totals in this table are being constantly revised and as of December 31 of each year this "balance sheet" for blister rust control is compiled. In Minnesota, the 250,000 acres of white pine, which have been selected as valuable enough to warrant their protection against blister rust, constitute the control problem. Initial work has been done for 166,377 acres of pine. Control work is completed for all practical purposes for the 61,995 acres of white pine on maintenance.

Serious amounts of blister rust infection are present in both unprotected stands and in those stands whose re-working has been delayed too long. Stands are being removed from the control problem every year because of excessive blister rust damage. Unless blister rust control is

more vigorously applied serious losses of Minnesota white pine values will occur.

TABLE 26

White Pine Blister Rust Control

	Acres White Pine Protected	Acres Worked	Ribes Destroyed	Man-Days Expended
Initial Working				
1948	2,356	3,532	185,422	2,091
1949	2,242	3,265	219,489	2,161
Total for Biennium	4,598	6,797	404,911	4,252
Total to December 31, 1949	171,993	403,031	62,033,604	165,640
Rework				
1948	6,594	10,801	1,354,798	7,121
1949	5,075	7,607	525,680	5,394
Total for Biennium	11,669	18,408	1,880,478	12,515
Total to December 31, 1949	88,458	160,337	10,799,459	61,560

TABLE 27

STATUS OF BLISTER RUST CONTROL, BY OWNERSHIPS, DECEMBER 31, 1949

Ownership Class*	Total Control Problem, Acres**		Acres Initially Worked		Acres on Maintenance***	
	Acres White Pine	Acres To Work	Acres White Pine	Acres Worked	White Pine	Control Area
U. S. F. S.	87,704	143,465	39,765	60,760	16,638	27,549
U. S. I. S.	21,817	32,172	21,794	32,129	17,600	24,448
State Forests	45,863	88,080	30,975	56,017	11,737	20,913
State Parks	4,977	9,344	4,885	9,182	.....	.....
Other State	1,411	10,108	1,222	6,025	733	2,874
Municipal	1,796	4,742	1,523	3,860	320	483
Private	86,432	271,700	66,213	204,411	14,967	36,201
Totals	250,000	599,611	166,377	372,384	61,995	112,468

*Includes lands within gross boundaries of State, Federal and Indian Forests.
**The Total Control Problem includes only the better stands of white pine.
***A pine area is on maintenance when it requires little, if any, additional currant and gooseberry eradication to prevent commercial damage before it matures.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the personnel of the Division of Forestry for their cooperation and conscientious efforts in performing the work of the division, for their loyalty and their devotion to duty. Without their whole-hearted cooperation the work on which they have herein reported could not have been satisfactorily performed.

Grateful acknowledgment is also made of the assistance and helpful cooperation given the division by the many organizations, agencies and individuals who contributed their time and efforts in the furtherance of forestry in Minnesota. In particular we acknowledge the cooperation of the Keep Minnesota Green committee, the Forest Industries Information committee, the U. S. Forest Service, the Lake States Forest Experiment Station, and the University of Minnesota School of Forestry, to mention only a few.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