AIR PICTURE OF CRAWFORD NOTCH
Showing State Forest Reservation

Courtesy of U. S. Air Service

State of New Hampshire

BIENNIAL REPORT

OF THE

Forestry Commission

For the Two Fiscal Years

ENDING

JUNE 30, 1922

CONCORD
November 1922

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REPORT

To His Excellency the Governor and the Honorable Council:

The Forestry Commission presents herewith its report for the two fiscal years ending June 30, 1922.

High valuations are causing timber lots to be thrown on the market faster than they can be absorbed and from ten to fifteen years or more before they should be cut. The need of some relief to owners of growing wood and timber is more apparent than ever before. In the judgment of the Forestry Commission there would be a real incentive to reforest land and to keep land in productive forest if the present unequal and confiscatory method of assessment could be remedied.

In the work of protection, improvement and extension of the forests, as defined by our forestry law, it has consistently been the purpose of the Commission, not only to administer the forest laws, but to create and build up an organization for the education of our citizens and future citizens along all lines of forestry, essential to the future welfare of the state and of benefit to all individuals. To this end the Forestry Department in its various lines of activity has endeavored to come into close contact with woodlot and timberland owners, lumber operators, wood using industries, business and recreational organizations, social clubs, public officials, railroads and other public service corporations, farm bureaus, and the public schools and institutions of the State. While education is made possible through legislation, it is not the end in view to punish offenders of the forest laws, but to bring them and others into agreement with the principles of forestry protection and improvement. While fire protection and blister rust control work are important administrative activities, they are also educational and have to do with protecting our present and future forest wealth. The growing and planting of forest trees

and the care and management of State forest reservations are also educational as well as directed to the task of building up new values for future use. A fine spirit of public service exists among those connected with the Department. The forest laws have been amended in ways to strengthen the work of forest fire protection and to bring the work of the Department into closer cooperation with land owners and lumber operators. There is much satisfaction in expressing the belief that this biennial period has been one of notable progress in the various activities carried on by the Forestry Department.

The people of New Hampshire have for many years appreciated the importance of a strong forest fire organization and this has, in the main, been accomplished by reasonable State appropriations and Federal aid and the carrying out of a consistent program of protection over a period of thirteen years. New Hampshire stands very high among all the states in its forest fire protective work. The forest fire organization is more efficient than ever before. Fire wardens and deputies have been prompt and efficient in handling fires and performing their other duties. There is close cooperation between lookout watchmen, fire wardens, railroad deputies, patrolmen and the general public. The past two years have had periods of the gravest fire danger since 1915 or 1911 and yet the areas burned over and the losses, while above the average, have been kept within fairly reasonable bounds. Improvements have been made in the location of lookout stations and telephone communication from them as a result of studying the telephone service obtainable from local exchanges and party lines. A new station near the Maine line is being maintained jointly by New Hampshire and Maine. There is close cooperation with Maine, Massachusetts and Vermont in reporting fires from all stations close to the lines. The patrol law is making it possible for the Department to work out additional means of protection among the larger land owners. The

records of fires during the past seven years since 1915 show that the average area burned over per year is but twelve one-hundredths of one percent. of the total forest area of the State.

Not until 1917 did the blister rust menace appear to be of sufficient importance to warrant legislative action. Since then the control of this disease has become, next to forest fire protection, the chief administrative work of the Forestry Department. It has taken five years to bring the people of our State to a partial realization that the future of our growing pine is at stake in this work. In order to control the disease currant and gooseberry bushes, both wild and cultivated, must be destroyed wherever white pine is found and on protective strips around them. There is no alternative and wherever this is not done, the growing of white pine will in time cease to be a commercial possibility. The cost should be paid largely by the towns, as at present, but the State should double its present annual appropriation of $12,000 in order to meet the town expenditures on a reasonable cooperative basis. Blister rust control is partly accomplished and the response from towns and private individuals is now so encouraging and the policy of eradicating currant and gooseberry bushes is so far shown to be correct that every assurance may be given of bringing the disease under control in towns where funds are made available. Work has already been done in 95 towns, 13 of which have been completed. The Federal Government withdrew its financial aid in eradicating bushes in 1921, but is now paying the salaries and expenses of blister rust agents, one in every county, who are employed by and work under the direction of the State Forester and with the County Farm Bureaus to take charge of all eradication crews and promote blister rust activities in their respective counties. These county blister rust agents are also working to advance all forestry interests in their counties by attending meetings with the agricultural agents, con-

ducting woodlot demonstrations, and meeting individual forest land owners on their property. The farm bureaus and the county agricultural agents are helping to make this work effective by their whole hearted cooperation.

During the past two years 5,366 acres have been added to the State forests and reservations, about 3,000 of which were donated to the State. This includes a magnificent gift of over 2,000 acres of hardwood growth, known as Cherry Valley, at the headwaters of the Ashuelot River in Washington and Goshen from Hon. Albert E. Pillsbury of Boston, a native of New Hampshire, and a splendid gift of 370 acres, largely in pine growth in the town of Hillsboro from Miss Caroline A. Fox of Arlington, Massachusetts. Steps are being taken to establish a bird refuge under the authority of the Fish and Game Department on the Fox Reservation. Purchases are now being made with more regard to enlarging the existing State Forests and acquiring in the name of the State the slopes and summits of important and well known mountains. It is the purpose to accommodate the public and develop the recreational uses of the larger State reservations wherever this may be done without extra expense to the State. Improvements in trails and facilities for camping have been provided on the Monadnock, Pillsbury, Cardigan and Crawford Notch Reservations. Joel H. Poole of Jaffrey, at his own expense, has constructed a roadway from the public highway to the Monadnock reservation, a distance of half a mile, and deeded the land to the State. He is now bearing the expense of extending the roadway across the lower part of the reservation. A small area including the site of the old Willey House on the Crawford Notch reservation has been leased, cabins built and other improvements carried out at a cost of nearly $5,000 without expense to the State but under the direction of the Forestry Commission for the accommodation of the public. Much of

the trail building has been done by members of boys' camps and outing clubs cooperating with the Forestry Department.

Reforestation work has been carried forward to the extent of funds available and as far as the facilities of the State nursery permit. Of the 520,000 trees taken from the nursery during the past two years, about 250,000 have been planted on the State forests and the balance sold to private parties at substantially the cost of growing them. Reforestation is a big problem for future development, requiring millions of trees to be grown and made available to individuals at a low enough cost to make planting attractive and a sound investment. The State nursery cannot begin to supply the demand for trees and applicants are forced to purchase from private nurseries at higher prices and even then cannot be sure of securing them. Several large land owners have been encouraged to start nurseries to supply their own needs and many others might do the same if they were willing to give the time and attention required in such work. With a plentiful supply of trees always on hand and encouragement given to landowners thousands of additional acres might become reforested every year in New Hampshire. The great obstacle at the present time is lack of trees of suitable kind and quality and at reasonable prices.

The survey of forest resources has been substantially completed and the results by counties are published with this report. Progress has been made in clearing up the titles to the Common Lands of Conway. A revised list of wood using industries has been compiled. The seed tree law became operative September 1, 1922 and is meeting with general approval. Over one hundred boy scout organizations within the State have been enlisted as cooperators along all lines of forestry. Examinations have been held and certificates of registered arborist granted to a number of persons who make a business of looking after shade and ornamental trees.

RECOMMENDATIONS

Forest Fire Protection

The law providing for the use of spark arresters on portable steam mills (Chapter 95, Laws of 1911, amended by Chapter 159, Laws of 1917) should be amended to provide that when any such mill is moved from one town or ctiy to another, or from one setting to another within the same town, said mill shall not be operated until the owner or operator thereof has notified the State Forester of the new location of said mill and the law should specify that approvals of spark arresters are in effect only for the calendar year when issued. The district chiefs should have authority to cancel approvals on inspection when immediate action is necessary.

In Section 13, Chapter 128, Laws of 1909, as amended, the term "in or near woodland" should be defined so as to make clear that no person shall kindle a fire or burn brush, except when the ground is covered with snow, in any woodland, pasture, sprout, brush, waste or cutover land, or where the fire may communicate with any such land, without the written permission of the forest fire warden, or the presence of the forest fire warden or person appointed to represent him. The law should furthermore provide that any person having permission from the forest fire warden to burn brush shall, if any expense is caused to the town and State on account of such burning, pay to the town the full amount of the expense bill, or else the State Forester should have specific authority to make regulations defining the terms and conditions under which permits may be granted and be in effect.

Section 5, Chapter 155, Laws of 1913, as amended, should provide that a violation continues in effect against the person, firm or corporation responsible until the slash has been properly removed or disposed of.

Chapter 59, Laws of 1909, and Section 10, Chapter 133, Laws of 1915, should be so amended as to give the Governor of the State authority through proclamation in time of grave fire danger to close the woods of any county or counties, or any section of any county to all fishing or hunting. It would be desirable to exclude all woods travellers except persons upon their own property and those engaged in legitimate work in the woods.

Section 15, Chapter 128, Laws of 1909, as amended, should include the district chiefs in the authority given the State Forester, forest fire wardens and deputy forest fire wardens to arrest without a warrant, any person or persons in the act of violating any of the laws for the protection of forest lands.

It is recommended that the appropriations for forest fire protection for each of the next two years be made the same as at present.

Blister Rust Control

Chapter 187, Laws of 1917, gives the State Forester sufficient authority for the present to continue the work of controlling the white pine blister rust disease. A large percentage of our white pine towns are raising money each year to be used with State funds to protect their towns and the work is progressing about as rapidly as men can be employed to conduct the work efficiently and economically. Further legislation will ultimately be necessary to require the raising of funds for control work in towns where there is great need but where no efforts have been made by the towns to bring the disease under control. In Maine the eradication of currant and gooseberry bushes is not only compulsory but the cost is chargeable against individual land owners. It is believed that the New Hampshire policy of eradication by towns with the expenses paid by the towns and the State, with such contributions as individuals wish to make for

work on their own land, and using local men as far as possible under experienced foremen, is less confusing and difficult to carry out and is giving more uniformly satisfactory results at a far less cost per acre.

The State appropriation for each of the next two years should be increased from $12,000 to $20,000.

Purchase and Care of State Lands

The appropriation for the purchase and care of State lands has been $5,000 per year for a number of years past. During the last two years about 88 percent. of this amount has been spent for actual purchase. Purchasing land for State forests does not interfere with the chances of acquiring reservations by gift. The policy of purchase and acceptance of gifts is building up a value in the name of the State which in the years to come will be worth many times the amount expended. It is recommended that the present appropriation of $5,000 per year be increased to at least $6,000 for each of the next two years.

Reforestation

The present State nursery appropriation is sufficient to maintain the State nursery and supply of trees for planting on State land with the surplus for sale at cost. In order to be of real service to those interested in tree planting and to stimulate further interest in planting waste and idle lands, the State should be able to supply a constantly increasing number of trees each year at cost to private individuals. This can be accomplished on the present nursery farm to the extent of about one million trees per year by clearing what additional land is available and establishing a water supply to take care of it. The State should ultimately be able to supply several million trees yearly but in order to do so a new nursery in a more desirable location would be necessary. The

cost of preparing new land on the present farm and a water supply, if carried out, must be met by a special appropriation for the purpose.

Respectfully submitted,

W. R. BROWN,
H. W. ANDERSON,
J. B. MURDOCK,
Forestry Commission.

JOHN H. FOSTER,
State Forester.

FOREST FIRE SERVICE

General

For purposes of fire protection the State is now divided into five districts instead of four, by creating a new district, called the central district, out of the southern district which formerly comprised most of the lower seven counties. This change was made possible by Chapter 129, Laws of 1921. Mr. Charles F. Young of Merrimack was appointed chief of the southern district in the early spring of 1922 in place of William M. Falconer, resigned. The newly created central district has headquarters at Concord under the direct supervision of the State Forester's office. Warren F. Hale, assistant State Forester, and Geo. F. Richardson, Jr. have attended to the district chief work temporarily until a permanent appointment is made. The north, east and west districts, respectively, have been maintained as heretofore by William H. Morrison of Gorham, Frank P. Allard of North Conway, and Elmer E. Woodbury of Woodstock.

It is believed that the town warden organization never functioned so smoothly and effectively as during the past two years. Fewer resignations have taken place and the wardens and deputies in all matters relating to handling fires, cooperating with other branches of the forest fire organization, making reports, submitting bills, and enforcing legal requirements have worked intelligently and often without due compensation for the best interests of the public. The district chiefs are entitled to much credit for the satisfactory condition of the forest fire service. Fire warden conferences have been held in ten places throughout the state, so that all wardens, deputies, selectmen and some of the lookout watchmen have had an opportunity to discuss matters personally with the State Forester. These meetings have been well attended. A joint meeting of fire wardens of towns

within the White Mountain National Forest area with Federal rangers and patrolmen was held during the past spring. The number of fire wardens and deputies at the close of the biennial period was 829. In addition there were 197 railroad section foremen and 268 state highway patrolmen holding deputy fire warden appointments. Some improvements have been brought about in making reports. Wardens now report each fire on a duplicate form, one copy of which goes to the district chief so that he may know of all fires which occur in his district and have a better grasp of the fire situation at all times. A new form has been issued for the use of wardens in reporting roadside slash violations to the State Forester. The brush burning permit form has been reprinted and improved. The standard cloth fire notices have been widely posted by the wardens and a new fibre notice in colors has been given as wide publicity as possible by the patrolmen along the principal highways. A new badge for the wardens, deputies and district chiefs has been designed and partially distributed. This is a small shield shaped badge in bronze appropriately lettered and has been made to satisfy the desire of most wardens for a lighter and less conspicuous badge which they may wear without discomfort and danger of losing. By another year it is expected that the new badge will be supplied to all regular town wardens and deputies.

Changes in the lookout stations and improvements in telephone service have helped to bring about quicker service from watchmen and closer cooperation between them and the wardens and others. Last spring the Forestry Department purchased two forest fire pumps, each with 1,000 feet of discharge hose for use in extinguishing fires where water is available, particularly fires under control but burning in the ground during very dry weather, where often it has been necessary to watch such fires with a considerable number of men for days or weeks to prevent them from breaking out again. Dur-

ing the summer of 1921 a pump of this type was loaned by the Massachusetts Forestry Department to extinguish a bad fire burning on the White Mountain National Forest in the town of Randolph and rendered excellent service. The two pumps now owned by New Hampshire will be available for use by any town warden. One is kept at the residence of District Chief Allard at North Conway and the other at the State Nursery at Gerrish and can be moved to a fire in any automobile and handled by two men. Standard fire fighting tools are still available for purchase by the towns at one half the cost to the State as the practice has been heretofore.

Cooperation between the State and the New Hampshire Timberland Owners' Association for patrol of wild forest lands has been strengthened by chapter 28, laws of 1921 which requires the patrol by their owners of any tracts of 1,000 acres or more of contiguous forest land at a cost not to exceed one cent per acre annually. The passage of this act tends to bring into the Association as members all land owners who have 1,000 acres or more in territory covered by Association patrolmen and who have not before been members. The Association controls over 800,000 acres and employs 20 to 30 or more patrolmen under the supervision of W. H. Morrison as secretary of the Association and who is also State district chief of the northern district. The Association's patrol work cost annually about $10,000, most of which is for actual pay of patrolmen.

A revision of the law bulletin, Circular 7, was published in 1921 and at the close of the biennial period, a revision of both the fire warden's manual and the personnel of the forest fire service was made under one cover and published. The last preceding issue was in 1918 in two separate bulletins. Those interested are referred to the new forest law bulletin and the Forest Fire Manual and Personnel for detailed information on all matters contained therein.

Federal Aid in Forest Fire Protection

New Hampshire continues to benefit from the appropriations made by Congress for cooperative forest fire protection. Prior to 1921 the allotments to the various states were based on the amount of appropriations made by the states themselves, for fire protection and were used exclusively for the payment of a certain number of lookout watchmen who were placed on the Federal payroll and received their pay direct from Washington. In 1921 the Government provided for making each State allotment a pecentage of the fire protective needs of the State. This was done in order to develop fire protective measures in states where their appropriations were inadequate and their needs were great. The result intended was to give greater assistance to states having relatively large forest areas in proportion to their total areas. Another important change was to pay the federal allotment to each state in one or more reimbursements upon receipt of vouchers showing that the State had spent its ratio of the total state forest fire appropriations and federal allotment combined. These federal reimbursements became available as soon as received for any forest fire protective work within the State. In 1921 the Federal allotment was increased from $5,800 to $6,300 with an additional special allotment for slash disposal work of $3,000, only $2,500 of which the State could take advantage of on a ratio basis.

For the year 1922, the cost of adequate protection for New Hampshire was determined by the Government to be $120,400 or two and eight tenths cents per acre per year. The Government then alloted seven per cent of this amount or $8,425 to New Hampshire out of the $400,000 appropriation by Congress and reimbursed it to the State on a basis of 17.7 per cent of the combined State appropriation and Federal allotment shown to have been spent for fire protection. In other words seventeen

and seven tenths cents on every dollar of State and Federal money available for protection this last year was returned to the State for further use. Chapter 37, Laws of 1921, made provision for the State Treasurer to receive funds allotted by the Federal Government in a continuous fund for purposes of forest fire protection. The changed method of federal cooperation does not greatly increase the amount of Federal funds to New Hampshire but it is a great benefit to have these funds available for any fire protective work. Except for this fund the Forestry Department would have been unable to reimburse the towns one-half their fire fighting costs for the year just closed.

Fire Seasons of 1921 and 1922

Each of the past two fire seasons as a whole contained periods of great fire danger although the seasons were not uniformly or continuously hazardous over the entire State. There were few fires during the fall period of 1920 but in the spring of 1921 the fires began early in March and dry conditions prevailed everywhere until midsummer and in the north country until October. The spring and summer of 1921 was undoubtedly the most serious fire period in a great many years, not excepting the years 1911 and 1915 when great fire losses occurred. Every effort was made by landowners to keep fishermen and campers out of the woods in the northern counties. Had there been any authority to do so by law, the Governor would have closed the fishing season. After the first of July the southern counties were favored with periodic rains but in the north the drought continued until fall. During this fiscal year ending June 30, 1921 there were 276 fires handled by town organizations and 7,172 acres of land burned over. Several of these fires exceeded 500 acres each. One in the Diamond section of Pittsburg started from the burning of camps stocked

with provisions, covered 800 acres of woodland and caused heavy losses including a dam and supplies. Other large fires occurred near the Beebe River operations in Sandwich and in Plaistow, Derry, Goffstown, Concord and Chesterfield. Several disastrous fires were averted by timely reports from lookouts and prompt response from wardens and men. One of these was in a remote section of Lincoln with no help nearer than ten miles. The watchman on Mount Carrigain saw the fire almost at the start and crews of men from the mills at Lincoln arrived in time to prevent the fire from sweeping over a vast territory.

The spring period of 1922 was exceedingly dry in the southern part of the State, beginning during the month of April, while the northern forests were still covered with snow. A total of 200 fires occurred in April and May in this section out of a total of 295 fires for the State during the entire fiscal year. The area burned over for the year, not including railroad fires, was 9,484 acres, the largest acreage burned since 1915, much of which was confined to brush and slash land around towns and cities in southern New Hampshire during the two months period of April and May. During the same spring period Massachusetts is reported to have burned over 40,000 acres and Maine suffered very heavy losses. The area burned during the last fiscal year was about one-fifth of one per cent of the forest area of the State as against one-tenth of one per cent which was the record for each of the years 1919 and 1920. The record for 1922 was much less favorable than 1921 as regards number of fires, area burned over and damages in spite of the fact that the fire danger was mostly confined to the southern counties in 1922, and was very general in 1921. Two of the fires in 1922 burned over 1,000 acres each within a short distance of Manchester and Concord while two other fires burned over 500 acres each. The average area burned per fire was over twice as large in both

1921 and 1922 as in 1919 and 1920 and the cost of fighting and damage increased nearly in the same proportion.

The following tables I to V are the official records of fires for the fiscal years 1921 and 1922 and are shown so that they may be compared with the records of preceding biennial periods.

Table I

NUMBER OF FIRES BY MONTHS

(Exclusive of Railroad Fires)

Fiscal Year Ending June 30, 1921			Fiscal Year Ending June 30, 1922		
September	1920	3	July	1921	15
October	1920	15	August	1921	10
November	1920	3	September	1921	28
			October	1921	32
January	1921	1			
March	1921	24	March	1922	6
April	1921	68	April	1922	103
May	1921	70	May	1922	96
June	1921	92	June	1922	5
		276			295

Table II

FIRE RECORD FOR FISCAL YEARS 1921 AND 1922

Fires Handled by Town Organizations

Name of County	Year	No. Fires	Total Acres Burned	Average Area Per Fire in Acres	Total Damage	Average Damage Per Fire	Total Cost for Fighting	Aver. Cost Fighting Per Fire
Belknap	1921	15	239	15.9	$4,610.50	$307.17	$796.99	$53.13
	1922	12	866	72.2	2,897.00	241.42	742.03	61.84
Carroll	1921	20	466	23.3	3,481.50	174.08	2,952.13	147.60
	1922	15	122	7.1	6,656.00	443.73	903.83	60.26
Cheshire	1921	28	404	16.6	5,940.50	258.28	1,285.68	55.90
	1922	27	1,679	62.2	19,527.00	723.22	1,773.84	65.68
Coos	1921	24	2,384	98.3	21,956.50	914.85	2,219.90	92.50
	1922	17	472	26.7	8,612.00	506.59	3,826.97	225.12
Grafton	1921	23	510	22.2	3,801.00	143.52	1,878.88	81.69
	1922	32	329	10.2	2,667.00	83.34	1,334.95	41.72
Hillsborough	1921	62	631	10.2	5,648.50	91.10	1,480.39	23.88
	1922	61	3,070	50.8	33,550.50	550.01	1,720.96	28.21
Merrimack	1921	38	777	20.4	1,321.00	34.76	819.57	21.57
	1922	32	1,812	56.6	5,669.00	177.15	1,150.93	35.95
Rockingham	1921	49	1,513	30.8	11,718.00	239.14	2,358.40	48.03
	1922	62	826	13.3	13,090.00	211.13	1,122.37	18.10
Strafford	1921	8	165	20.6	1,205.00	150.63	543.04	67.96
	1922	22	96	4.4	1,354.00	61.55	337.49	15.34
Sullivan	1921	14	88	5.9	321.00	22.93	608.16	43.44
	1922	15	212	14.1	894.50	59.63	447.28	29.82
Totals for State	1921	276	7,172	26.0	$59,503.50	$215.59	$14,938.74	$54.13
	1922	295	9,484	32.1	94,917.00	321.75	13,359.55	45.29

Table III

RAILROAD FIRE RECORD FOR FISCAL YEARS 1921 AND 1922

Year	Number Fires	Total Area Burned	Average Area Burned	Total Damage	Average Damage Per Fire
1921	264	403 A.	1.5 A.	$9,796.00	$37.10
1922	281	990 A.	3.5 A.	13,724.00	48.84

Table IV

CAUSES OF FOREST FIRES

Two Years Ending June 30, 1922

Causes	Percentage of Total Number of Fires
MECHANICAL CAUSES:	
Railroads	48.83
Portable Steam Mills	.72
HUMAN CAUSES:	
Burning Brush, Grass and Rubbish	10.66
Campers, Hunters, Fishermen, Flower and Berry Pickers, Automobilists and Careless Smokers.	17.03
Miscellaneous	3.31
Incendiary	.09
Burning Buildings	1.08
Lumbering	.63
Unknown	17.02
NATURAL CAUSES:	
Lightning	.63
	100.00

Table V

TOTAL FOREST FIRE DAMAGE, TWO FISCAL YEARS ENDING JUNE 30, 1922

Year	Railroad Fires	Other Causes	Total Damages
1921	$9,796.00	$59,503.50	$69,299.50
1922	13,724.00	94,917.00	108,641.00
Totals	$23,520.00	$154,420.50	$177,940.50

Railroad Forest Fire Protection

While the records show that the number of fires originating from the railroads was 264 in 1921 and 281, or over 48 per cent of the total number of fires in 1922, the total area burned was only 403 and 990 acres respectively each year. The average railroad fire burned 1.5 acres in 1921 and 3.5 acres in 1922. Recognizing that the railroads are the most serious cause of forest fires not only in New Hampshire but elsewhere, every precaution is intended to be taken by means of the laws as well as by the railroads for their own protection to prevent and extinguish forest fires. The laws provide for the use of spark arresters in locomotives and for the clearing of rights of way. The cost of extinguishing railroad fires is charged to the railroads. The railroads are protected as far as may be possible by requiring land owners and operators to dispose of slash within 60 feet of any railroad rights of way. The section foremen are appointed deputy forest fire wardens.

Of the three railroad companies operating in New Hampshire, the Boston and Maine Railroad has most of the mileage. In 1912 a department of this company was organized to look after fire protection and prevention, since which time fires have been reduced 75 per cent. Each of the 1200 locomotives is equipped with a steel plate spark arrester with openings only three-sixteenths of an inch. These spark arresters and the appliances around them are regularly examined once each week and once each month the fires are drawn and careful inspections made. If a fire occurs and a locomotive is reported as passing the spot, a special examination is immediately made to ascertain whether or not any defects exist in the spark arrester or ash pan. During the fire season fifteen patrol cars are maintained which are equipped with fire fighting tools and used to follow trains over sections of unusual fire hazard.

The matter of cutting and burning grass along rights of way is given careful attention. The practice was formerly to cut the grass in summer which gave an opportunity for the grass to grow again before fall so that by another spring, plenty of dry material was available to start fires. From studies of the situation the policy has changed to burning the grass as late in the fall as possible. Section foremen keep in touch with owners of property contiguous to the rights of way, requesting them to remove inflammable material or to give them permission to do the same. In this way conditions outside the rights of way are made as satisfactory as possible. The section foremen cooperate with the town fire wardens in the matter of adjacent slash as well as in fighting railroad fires. Under the law the railroads may enter private property after hearing and with the consent of the Public Service Commission to dispose of inflammable material. Although slash can not be left within 60 feet of the right of way, it is often desirable for the railroads to burn dry grass and undergrowth outside their rights of way at dangerous points and there should be some more prompt and workable means than at present for the railroads to have this done. Most forest fires along the railroads start from sparks thrown outside the right of way.

Mountain Lookout Stations

Owing to the dry conditions during 1921 there were 29 lookout stations maintained for the whole or greater part of the fire season. This included the Crotchet station in Francestown and the new station on Dix's Peak near Dixville Notch, both of which are emergency stations. In 1922 five of the 29 stations were either temporarily or permanently discontinued because it was believed that the service from them did not justify the expense of their maintenance, except in emergency. The fire stations not operated were Dix's Peak, Pine Moun-

tain in Gorham, Mount Shaw in Moultonboro, Smart's Mountain in Lyme and Crotchet Mountain. Mount Israel was operated only part of the season. Under a cooperative agreement with the Maine Forestry Commission a 47 foot steel tower on Cedar Mountain in Maine was moved to Green Mountain in Effingham during the past summer and will be maintained jointly by Maine and New Hampshire. The new Green Mountain station commands a large territory in both states and has been greatly needed as a means of increased protection to surrounding towns in New Hampshire where many fires occur.

The lookout stations in operation during 1922 are in better condition as regards equipment and telephone lines than ever before. Nearly all the telephone line to the Monadnock station had to be rebuilt in 1922 owing to the severe ice storm of the preceding winter. Much damage was caused to other station lines in southern New Hampshire by this storm. A telephone line from Winchester has been extended to the fire station on Mount Grace in Massachusetts, which has brought seven towns in New Hampshire within the same telephone exchange with the watchman on Mount Grace, saving fully twenty minutes of time and expense of toll charges.

A metallic line to Mount Rosebrook was completed and connection made at the switch board at the Mount Washington Hotel. The cabin was enlarged by adding a cook room. The Mount Carrigain telephone line has been connected with the main line at Sawyers River by means of a new line from Livermore to the main line. The service to Mount Chocorua was improved by changing the line from the Liberty trail to the Bee Line trail.

A new wooden tower and cabin on Black Mountain in Cambridge and a new cabin on Magalloway with a telephone extension to the tower are the principal improvements in the northern district. All towers and

cabins are kept in repair and painted by the watchmen during the fire season.

During the past year a careful study has been made of the lookout stations in relation to the local telephone exchanges and local party lines. It is not enough that stations should overlook wide stretches of country and be so distributed that the entire state is under observation. The efficiency of a station depends on the watchman being able to telephone through one or more exchanges and reach the wardens and others on party lines in a reasonably short time. This investigation has been made possible by the generous cooperation of the New England Telephone officials and those of subsidiary companies. Much information has been brought to light. Stations which were considered satisfactory have been found to be poorly located for telephoning promptly in various directions. The remedy is either to build lines to connect with other exchanges, or to abandon stations entirely. During the past year several improvements have been brought about by extending the State lines and others are contemplated for another year. Several stations in or near the White Mountain National Forest will have their service improved by the Government within another year by connecting the stations with federal ranger headquarters which are in telephone communication with some exchange other than the one now used by the station. In this manner it is expected to connect Chocorua with the line to Passaconaway and Osceola with North Woodstock. Other important improvements would be to connect Mount Carrigain with Lincoln and Mount Magalloway with supply camps in the Diamond territory

Table VI shows the number of fires reported by the lookout watchmen during each of the past two years. By means of the weekly reports of the watchmen and the reports of fires by fire wardens and deputies, the district

chiefs and state forester are able to tell if any fires have been handled by wardens and not reported by the lookout watchman and, if so, to look for the reason. Information about burning brush without permit often comes to the wardens from the watchmen and the watchmen also report the location of portable mills when they change to a new setting.

Table VI

FIRES REPORTED BY THE LOOKOUTS

Year	North District	East District	West District	Central District	South District	Totals
1921	60	30	67	98	217	472
1922	53	52	88	90	206	489

Portable Steam Mills

Most portable steam sawmill owners and operators are showing a marked disposition to comply with the spark arrester law which states that no person, except when the ground is covered with snow, shall operate any portable steam mill unless the same is provided with a suitable spark arrester, approved by the State Forester, and unless the slash caused by wood and timber cutting shall have been removed for a distance not less than 100 feet from said mill, when required to do so by the State Forester, or his authorized agent. The law further requires that such approval shall be in writing signed by the State Forester, and may be revoked by him in the same manner. When any such mill is moved from one town or city to another, said mill must not be operated until the owner or operator thereof has notified the Forestry Commission or the district chief or the town forest fire warden of the new location of said mill.

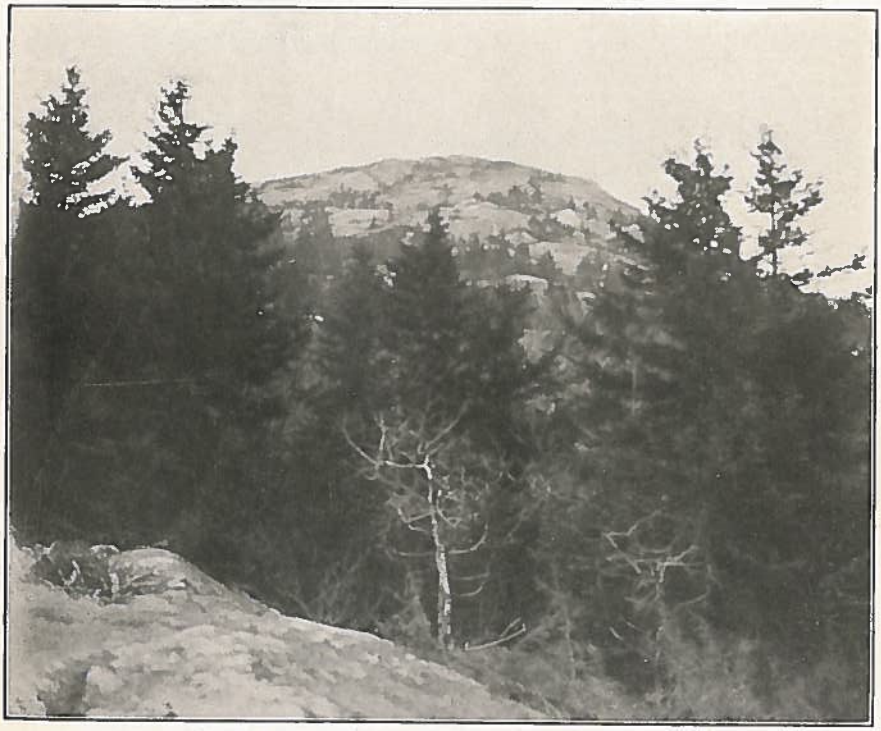
The desire of the Forestry Commission has been to have the permits renewed on January first of each year, whether the mills have changed location or not, in order

to keep the record of the locations of the mills up to date and not lose track of mills from one year to another. The administration of the law as it now stands is difficult because an operator under the law may notify the Forestry Commission, district chief or town fire warden of his change of location. It is impossible for the State Forester to know all of the changes in location unless the notifications of changes come direct to his office in Concord. The law should be amended in this regard and also clearly provide for the termination and renewal of permits at the close of each calendar year in the same manner as for motor vehicles, etc. In some states an annual registration fee is required for portable steam mills. In Maine the fee is $25.00 per year. While it is believed that this amount is unreasonably high, there are distinct advantages to be secured if a nominal fee of say $2.00 per year were charged for each mill and a registration number issued with the permit to be attached to the mill. Changes in location should in any event be filed with the State Forester in Concord and the permits should be renewed each year.

Forest fires are occasionally set by stationary steam mills, not necessarily saw mills, and the Forestry Commission has no jurisdiction over them. All stationary steam mills located within 100 feet of woodland and using forced draft or direct draft should be required to have a spark arrester the same as for portable steam mills. Gasoline mills are coming into more popular use but the danger of their setting fires depends mostly upon the employees handling the gasoline and working about the mills.

A number of violations of the spark arrester law during the past two years have been taken to court and the parties fined. It is very difficult to locate mills in remote places and the Forestry Department has been lenient in prosecuting parties, who have neglected to secure a permit, but whose spark arresters were found to be in

NEW LOOKOUT FIRE STATION
On Green Mountain, Effingham



CARDIGAN MOUNTAIN STATE FOREST
Showing summit and protective growth

satisfactory condition. Such parties have been given an opportunity to secure the proper permit. Where spark arresters are found to be in bad condition legal action is promptly taken. It occasionally happens that a forest fire results from a defective spark arrester and the situation comes to light and legal action follows as a result. Under the present law portable mill permits can be revoked only by the State Forester in writing. Inasmuch as the district chiefs make the inspections and find unsatisfactory conditions if they exist, it should be possible for them to revoke a permit if emergency requires.

Following is a list of the names and permanent addresses of 139 portable mill owners or operators whose mills have been approved by the State Forester during the biennial period of 1921 and 1922. Any mills being operated by persons whose names do not appear on this list are doing so in violation of law unless the mills have remained on the same setting for at least two years and approvals were secured at the time.

NAME	P. O. ADDRESS
Allard, C. F.,	Madison
Allen, Frank,	South Acworth
Anderson, John,	West Lebanon
Archibald, J.,	Contoocook
Ayers, B. K.,	Concord
Bailey, Charles,	Hampstead
Bailey Lumber Co.,	Suncook
Bean, V. A.,	Keene
Bosse, Paul,	Conway
Bourdon, Walter J.,	Northwood Narrows
Boynton, W. E.,	Henniker
Britton, A. H.,	Plainfield
Brock, Albert C.,	Dover
Brown, John,	East Barrington
Brown, W. J.,	Salem Depot
Brownell, G. R.,	Ossipee
Burnham, A. L.,	Goffstown
Burt, Alden S.,	West Rumney

Buswell, Guy A.,	Henniker
Buswell, Guy H.,	Windsor, Vt., R. F. D.
Cady, G. L. & Son,	Hill
Cardinal, John,	Farmington
Caron, Albert,	Lebanon
Carpenter, J. N.,	Newmarket
Champney, F. & L.,	Penacook, R. F. D.
Chick, Sumner,	Woodman
Churchill, F. A.,	North Dorchester
Clark Bros.,	New Boston
Clow, S. W.,	Wolfeboro
Colbert, J. W.,	Pequaket
Concord Lumber Co.,	Concord
Dennis, Lot, Jr.,	Melvin Village
Dennison, A. D.,	Conway Center
Dennison, A. L.,	Conway Center
Dodge, John G. S.,	Epping
Doolin, Ira F.,	South Lyndeboro
Dow, Everett A.,	Pittsfield
Dow, John A.,	Pittsfield
Drown, W. A.,	Glen
Ellison, Lewis H.,	Durham
Ellison, W. A.,	Rochester, R. F. D.
Ellsworth, E. S.,	Penacook
Fellows & Son,	Manchester
Fernald, T. E.,	Nottingham
Flanders, F. W.,	Hopkinton
Fleming, J. A.,	Antrim
Fortin, Peter,	Suncook
Foss, C. A.,	Northwood Center
French, L. E. & Son,	Center Barnstead
Fuller, H. K.,	Peterboro
Gibson, Spaulding & Hamlin,	Plymouth
Glazier, Don E.,	North Leverett, Mass.
Glidden, E. B.,	Granite
Glines, Leroy A.,	Canterbury
Graves, Ross M.,	Moultonboro
Hall, Walter F.,	Barnstead

Hancock, H. W.,	Belmont
Hart, D. J. Box Co.,	Marlboro
Hartford, P. N.,	Belmont
Hatch, H. A.,	Bellows Falls, Vt.
Heath, C. H.,	Greenville
Hill Lumber Co.,	Hill
Hills, Burley F.,	Raymond
Hobbs, F. P.,	Wolfeboro
Holmes, Brothers,	Gerrish
Hood, H. A. & B. A.,	Troy
Hopkins, Frank C.,	Keene
Howe, Geo. S., & Son,	Henniker
Howe, Richard,	Chesham
Howe Lumber Co.,	Greenville
Hoyt, Chas. E.,	Merrimack, Mass.
Jaquith, B. J.,	Tilton
Jenness, P. A.,	South Effingham
Jipson, A. A.,	Warner
Jones, Geo. H.,	New Durham
Kelley, A. B.,	Union
Kenrick, H. B.,	Hudson
Kimball & Noyes,	Manchester
Kimball, F. G.,	Manchester
Ladd, L. P.,	Epping
Leroux, D. W.,	Contoocook
Locke, C. B.,	Rochester
Marquette, Louis,	Peterboro
Martin, Frederick,	Peterboro
Mason, H. J.,	Lempster
McDuffee, Horace,	Manchester
McNamara, W. A.,	Manchester
Meredith Grain Co.,	Meredith
Merrill, George W.,	Francestown
Mills, A. E.,	West Hampstead
Morgan, Wm. R.,	Dunstable, Mass.
Muldoon Bros.,	Pelham
Nelson, Ernest,	Eaton
Paige, A. B.,	Henniker

Parker, Perham,	Reed's Ferry
Patenaude, W. C.,	Henniker
Patenaude, Wm. E.,	Hopkinton
Pettingill & Rogers,	Suncook
Pherson, Charles,	Amherst
Pitman, John M.,	Bristol
Potwin, R. F.,	Lempster
Prescott, C. W.,	Winchester
Quimby & Humphrey,	Northwood
Rand, O. H.,	Derry
Randall, Isaac,	Hampstead
Randall, Maurice I.,	Hampstead
Renfrew, J. S.,	Plymouth
Roberts, Shirley,	Grasmere
Rust, Horace,	Wolfeboro
Skofield, F. T.,	South Lyndeboro
Sleeper, Wm. L.,	Bristol, R. F. D.
Smart, C. E. & H. P.,	Mountainview
Smith, H. M.,	Goffstown
Snell, N. R.	Dover
Stevens, Fay O.,	East Pepperell, Mass.
St. John, Joseph P.,	Conway
Stone, D. S.,	Woodsville
Swain Lumber Co.,	Plymouth
Thayer, Fred I.,	Farmington
Thomas, J. O.,	Derry Village
Thompson, Freeman, & Son,	Dover
Todd, Perley A.,	New Boston
Towle, B. W.,	Gossville
Twombley, W. M.,	Center Conway
Vadney Bros.,	Francestown
Walker, John,	Newmarket
Walker, Lewis A.,	Newmarket
Weare, E. W.,	Meredith Center
Welch, James,	West Ossipee
Wheeler, Frank A.,	Concord
Whitehouse & Taylor,	South Effingham

Whitney, F. Ralph,	Winchester
Whittier, H. F.,	Greenville
Willey, Geo. F.,	Fremont
Willey, J. F.,	West Andover
Willey, W. Howard,	Wolfeboro Falls
Wilson, A. T.,	Peterboro
Wood, Perry,	North Sutton
Wyman, F. D.,	Keene
Yeaton, Wm. H.,	New Boston
Yeaton Bros.,	Hopkinton

Disposal of Lumber Slash

The law requires the removal or disposal of lumber slash 25 feet from any public highway and trolley right of way, and 60 feet from the right of way of any steam railroad. It also provides that in cutting on adjoining property lines, the trees shall be felled away from such lines. By an amendment to the law in 1921, the Forestry Commission may require the removal of inflammable material for a distance of 100 feet from camps.

In the enforcement of these provisions the Forestry Commission looks to the purchaser of stumpage as the party responsible for operating and consequently for disposing of slash and not the party who may actually be doing the cutting. Stumpage owners should contract in writing with parties who do the cutting if they expect to hold them responsible for failure to carry out the State requirements. The land owner will be held responsible where for any reason it is impossible to secure compliance from the party primarily responsible. Land owners should realize their responsibility when they sell stumpage along highways and railroads and provide in their deeds that the purchaser shall comply with the State law in this regard. Wherever complaints are received that slash has been left on adjoining property lines contrary to law the State Forester will take such steps as may be necessary to have it removed. Town fire wardens are

instructed to call the attention of operators to the legal requirements while operations are in progress along highways, trolley lines and railroads, although the law does not require such notification to be given. When the 60 day time limit has elapsed and the slash has not been removed, the case automatically becomes a violation and the warden is expected to report the violation on a blank provided for the purpose. The district chief examines the area and appears as complainant against the party responsible.

During the past two fiscal years no less than 68 violations of the slash law were taken up with the several county solicitors or the Attorney General. In all these cases, except one, the parties held responsible for operating cleared up the slash. In the one case the operator paid a fine of $50.00 and the land owner cleared the brush. Practically all old cases on record have been disposed of. The parties responsible for operating are more careful that their contractors or employees dispose of the slash within the legal time limit of 60 days.

Because of the number of non-resident operators who work back and forth across the New Hampshire line, it is sometimes difficult to reach these parties if they have slash in violation of the law. This might be overcome by requiring operators from outside the State to make a deposit of $100 with the State Treasurer before cutting any wood or timber, the money so deposited to be returned upon completion of the operation and an inspection has shown the slash properly disposed of as the law requires. The slash law should also make clear that every violation continues as such until the slash is removed or disposed of. It would be desirable if all persons or corporations responsible for the cutting of wood or lumber along brooks and streams were required to fell the trees so that the slash does not remain on the ground nearer than ten feet of the edge of the water.

Brush Burning Permits

About 10 per cent of the forest fires are caused by burning brush. The law requires that no person shall kindle a fire or burn brush in or near woodlands, except when the ground is covered with snow, without the written permit of the forest fire warden, or the presence of the warden or other person to represent him. The term "near woodlands" is interpreted to mean where the fire may communicate with woodlands by burning through an intervening space covered with dry grass or litter. The law is generally observed and the various town wardens are called upon to grant hundreds of written permits each season. The intent of the law and the spirit in which it is administered are not to prevent legitimate burning, but to restrict the use of fire when burning is dangerous and to see that fires are at all times confined to the area in question or at least to the property of the party doing the burning. Since no person has a right under the law to build fires on land not his own without the permission first of the land owner and also the town forest fire warden, the wardens do not, as a rule, grant permits except to owners of land themselves. The precautions necessary are that land owners asking for permits shall not burn without sufficient help or when fires are liable to go beyond their control, as in extremely dry and windy weather. The wardens alone have power to grant or deny permits and they often write into the permits such precautions as seem desirable. Permits should not be granted for more than a few days in advance except to railroad deputies, highway patrolmen and other responsible parties. The wardens are entirely within their rights to deny permits when in their judgment burning is unsafe. To create a great fire menace and endanger adjoining property because a land owner desires to burn his brush or clear land is intolerable and the wardens should not allow it, even though a permit from

the warden gives a party no immunity from responsibility for damage to his neighbor. Payment of money damage does not often compensate a land owner for losses from fire. Furthermore, the expense of fighting forest fires is a charge against the town and State and there is no justifiable reason why a party burning brush should be in a position to saddle a heavy fire fighting expense upon the public.

The brush burning permit law is at present very weak because a party holding a written permit from the warden and not exercising due precaution as regards weather conditions or not having sufficient help may cause a fire fighting expense of hundreds of dollars to the town and State without having violated the law or becoming personally responsible except for damage to adjoining property. Because of this situation, wardens are placed in a most embarrassing position in granting or denying permits. Many fires result from burning with permits and the towns and State must pay for the fire fighting. If a party burns without a permit he may be prosecuted and is subject to a fine of $200 or imprisonment for 60 days. The Forestry Department during the past two years has saved about $4,000 to the towns and State in fire fighting expenses where parties responsible for fires were willing to reimburse the towns for these expenses. There should be an amendment to the law that persons holding brush burning permits shall, if any expense is caused to the town or city and the State make reimbursement to the town for the whole amount of the bill.

Roadside Brush

The Forestry Department is charged with the enforcement of the laws requiring the removal or disposal of roadside brush as well as of lumber slash. These laws were enacted chiefly to prevent forest fires from originating along the highways and to prevent fires from cros-

sing the highways. Most of the roadside brush, not lumber slash, is the result of cutting bushes and young growth by the town road agents although a considerable amount is cut by telephone, light and power companies and by abutting land owners. The towns cut many miles of bushes along the highways every season, usually in the late summer and fall, and in a short time this brush becomes a dangerous fire menace. The law specifically states that if any cut brush has been left within the limits of the highways for a longer period than 30 days the State Forester is authorized to complete the removal or disposal and assess the cost against the person, firm, corporation or town authorizing or causing such brush.

Many towns keep the roadsides clean of brush. Some throw it back against adjacent uncut growth and only clear the ditches. Others leave the brush where it is cut. The brush cut by towns should be thrown in piles and burned at the proper time or else moved away to unobjectionable places at the time of cutting. There is a reasonable distinction between small bushes and brakes which almost disappear over winter and heavy brush which will not decay for several years. It is the heavy and larger brush, particularly adjoining woodlands rather than open areas, which must be disposed of because of the particular fire hazard and as a matter of justice to lumber operators who are required to dispose of their slash. The towns have a difficult and expensive problem on their hands to keep many miles of roadsides free from bushes. Selectmen and road agents can save the towns much expense in the long run if they will trim up desirable young trees to shade the sides of the roads and prevent the growth of low bushes. If shade trees can be properly distributed, even if it is necessary to plant additional trees, the necessity for cutting bushes can eventually be greatly lessened. The arbitrary cutting of roadside trees by telephone, light and power companies

is inexcusable and often most deplorable. If land owners understood their rights and took advantage of them, such wanton practices would not take place, particularly within village limits.

Conclusions

The State and town expenditures for forest fire protection during the last fiscal year were $36,739.13 and $7,500 respectively. With the Federal aid amounting to $8,787 and the amount raised for patrol by the Timberland Owners' Association of $9,700 the cost of protection amounted to $62,726.13 or one and one-half cents per acre of forest land in the State, which is a very reasonable amount. This does not include the expenditures made by the railroads or by the Federal Government for protection of the White Mountain National Forest. The annual cost of protection is not over one-sixteenth of one per cent of the value of our forests.

The area of forest lands burned over in 1922 amounted to one-fifth of one per cent of the forest area. The average area burned over per year during the seven years since 1915 is 5,594 acres or about twelve one-hundredths of one per cent of the forest area. The following tabulation shows the percentage of the total forest area of each county burned over in 1921 and 1922.

County	Year	Per cent
Belknap	1921	.11
	1922	.40
Carroll	1921	.08
	1922	.02
Cheshire	1921	.11
	1922	.47
Coos	1921	.22
	1922	.04
Grafton	1921	.05
	1922	.03

County	Year	Per cent
Hillsboro	1921	.14
	1922	.70
Merrimack	1921	.16
	1922	.39
Rockingham	1921	.48
	1922	.26
Strafford	1921	.09
	1922	.05
Sullivan	1921	.03
	1922	.08

It can be seen by the above table and the records of fires from year to year more or less clearly show that the greatest number of fires and the largest areas burned over are cutover and waste lands in the more densely populated sections of the State. The vicinity of large manufacturing centers and the surroundings of our cities and larger towns have the greatest fire risk. Grafton County has consistently maintained a record of low forest fire losses, not equalled by other counties in New Hampshire. Sullivan County also usually has a low fire loss. With extra hazardous localities not considered, the forest fire risk for any given timber lot in New Hampshire is not large under our existing forest fire organization, even allowing for occasional years when the forests are exceedingly dry for long periods at a time. The Government in the protection of the National Forests throughout the country has recognized an objective of one-tenth of one per cent of the forest area as a reasonable average maximum of fire losses toward which to work at the present time. Few, if any, of the states have reduced their annually burned areas to this percentage. New Hampshire has probably come as near to it over a period of seven years as any. Unfortunately the percentage is still very high in many states. An average of one-tenth of one per cent maintained continuously

means that the forest risk is only one to one thousand and that a given acre is likely to be burned over but once in a thousand years. With our 1922 record the chance of loss is one to five hundred. In order to maintain even this record the forest fire organization must work efficiently and intelligently year after year and during emergency periods there must be no sparing of efforts or expense to take such precautionary measures as may be necessary to keep the fires down. A State having as much at stake in its forests as does New Hampshire should not hesitate to spend in emergency an average of two cents per acre of forest land for fire protection which would be two and one-half times the present State appropriation. The Federal Government recognizes our needs as two and eight-tenths cents per acre annually.

The Governor should have the power through proclamation to close the woods of any county or counties, or any section of any county to all fishing and hunting and to any woods travelling except by those engaged in legitimate woods business. The present laws authorize the closing of the hunting season throughout the State by proclamation but this is defective and unsatisfactory as it has been repeatedly shown that our periods of greatest fire danger come in the spring and often for a part and not the whole of the State. The present laws are based upon the fallacy that fire arms are the cause of fires when it is the careless persons in the woods, and not the fire arms they may be carrying, who cause the fires. There are periods when the woods are so dry that smoking and the use of fire should be stopped by common consent and almost without reservation. Whether or not such precautionary measures could be brought about by legislation is extremely doubtful. The least to be done is to make possible the closing of the woods or any part of them at any season when emergency might require. The Pennsylvania law (P. L. 530, Act of May 14, 1915) is the best in this regard.

The fire hazards caused by dry brush and slash remaining on the ground near places frequented by persons is a matter for consideration and discussion. This applies to roadways and trails, the banks of brooks and streams, and the borders of cutting operations. The cost of general slash disposal is prohibitive at present, even if it were effective, and the danger of starting forest fires from the burning of slash piles is so great that further consideration seems unreasonable as well as futile. The results of an experiment in brush burning carried out on a large scale during the past year by W. R. Brown, chairman of the Forestry Commission, in cooperation with the Federal Forest Service, is contained elsewhere in this report and should be read by all parties interested in the subject. The disposal of brush in extra hazardous areas together with increased patrol in dangerous sections are means of reducing the fire risk which appear to be reasonable and more urgent. Our laws at present provide for felling trees away from adjoining property lines so as to make a clearance strip along such lines and if generally practiced would be of considerable fire protective value. It is effective in protecting adjoining land owners who want their fences and walls kept clear and are sufficiently interested to complain of violations.

General education is necessary along all lines. It has already done much to keep our forests free from fire. When one realizes that our woods are the pleasure ground of many thousands of people from all parts of the country and the workshop for thousands more, it is surprising that fires are not more frequent and disastrous than they are. The point of view of both pleasure seekers and woodsmen has changed materially in ten years as a result of education. By continued efforts the results will be still more apparent in another ten years.

CONTROL OF THE WHITE PINE BLISTER RUST

Introduction

The appearance of the white pine blister rust in New Hampshire during 1915, and its subsequent wide distribution has produced one of the most serious problems which has yet confronted the woodlot owner. Evidence, carefully collected from year to year, has proved beyond all question that this disease, unless controlled, will ultimately cause great loss to timber owners and the State, and in many localities will wholly wipe out a valuable crop. The foregoing is a statement of fact, not one based on theory.

Blister rust is a bark disease of our native white pine. It originated in Europe and found its way into the United States several years ago. In the case of the chestnut blight—also a European pest—there is ample evidence of the tremendous loss which a bark disease is capable of bringing about. The day is not far distant when chestnut will cease to exist as a commercial timber crop. Will the public permit a far more valuable timber crop to come to a similar end? There are not any known methods which will successfully combat the chestnut blight, for it lives only on the chestnut and spreads directly from tree to tree.

White pine blister rust is different. It does not live wholly on the pine. It cannot spread directly from pine to pine. There must be currant and gooseberry bushes present ~~in order~~ that it may develop and spread among the pines. Therefore, the control of this disease can be effected by the removal of these bushes throughout white pine growth and for a proper distance around. How far control measures have proceeded to date in New Hampshire, and what is still necessary, will appear in the following pages.

Present Known Distribution of Blister Rust in New Hampshire

Areas of infected white pines have been found in 179 towns and cities in New Hampshire. In many places the damage resulting from the rust has already reached a serious stage. Careful examinations of conditions indicate that at least 25 per cent of the white pines are infected by blister rust in the towns of Littleton, Lisbon, Landaff, Lyman, Bethlehem, Monroe, Haverhill, Piermont, Orford, Benton, Bath, Warren, Wentworth, Lyme, Grafton, and Gilmanton. Certain outbreaks in two or three of these towns are cited to illustrate what blister rust has already brought about, and to indicate what will elsewhere result, unless currant and gooseberry bushes are speedily destroyed.

In September, 1921, several strip lines were run in various sections of the town of Littleton for the purpose of determining the general distribution and effect of the rust. At frequent intervals quarter-acre plots were laid off and the pines carefully examined, and a tally made of both infected and healthy trees. On one strip, five miles in length, the results of such an investigation disclosed the fact that from 62 to 93 per cent of the pines were seriously infected by blister rust. Another strip, two and one-half miles long, indicated 60 to 94 per cent infection. Pines once infected by blister rust do not recover.

During the same year there was discovered in Lisbon, a ten acre lot where blister rust appeared to be widespread. This lot was well stocked with pines, averaging about 20 years of age. Judging from its past growth, which has been very rapid, ten to fifteen years more would have produced a crop suitable for box boards. The result of a careful inspection indicated that 91 per cent of the pines were infected, and that 51 per cent were either dead or dying. Damage studies, conducted throughout

New England and New York have brought about the conviction that pines 20 years of age and under, once infected by blister rust, will not live to reach box board size. The conditions existing today in this ten acre tract in Lisbon prove that the foregoing statement is no exaggeration.

During February, 1921, scouting in Deerfield was instrumental in locating one of the most badly infected areas yet known in central or southern New Hampshire. Several contiguous pine areas, aggregating nearly 150 acres, were found to be 10 to 100 per cent infected. On many acres pines 30 to 40 years of age are dead or dying; thus proving conclusively that blister rust is capable of killing nearly mature trees in a relatively short time. Investigations conducted on these areas disclosed two significant facts regarding the spread of the rust. They are herewith given in the order of their importance.

First, conclusive proof was secured that the removal of currant and gooseberry bushes will stop the spread of blister rust. When this outbreak was first discovered, a search was made to locate the bushes responsible for the infection. Inquiries disclosed the fact that more than 100 black and red currant bushes, growing in an adjacent garden, had been destroyed six or seven years previous to 1921. This statement was substantiated by a further examination of the pines a short time after, and which showed that all young pines, that is, those under seven years of age, were not infected. The removal of the currant bushes, while made too late to prevent the then existing pines from becoming diseased, had been instrumental in saving from blister rust the growth which came up later.

The second fact, brought out by studies of this area, was that under certain conditions currant bushes may seriously infect white pines for a distance of several thousand feet. This conclusion was arrived at after more than 1,200 acres of woodland had been carefully stripped by a crew, working in close formation. So few

wild currant or gooseberry bushes were found by this experienced crew, that it was quite apparent that the cultivated currants, formerly growing in the garden, were the source of the infection. Such wild bushes as were found, were growing in heavy brush and in depressions not easy for the wind to catch the spores, developing on the leaves of these plants, and carry them any considerable distance. Measurements indicated that the cultivated currants had caused infection to pines 3,000 feet distant. The cultivated bushes were formerly located in an open plot on a hill about 200 feet high and east of the infected area.

The following summary by counties gives some conception of the present known distribution of blister rust on white pines. It should be remembered there is little doubt but this serious disease exists in every town.

County	Number of towns	Towns having Infected Pines
Belknap	11	11
Carroll	18	15
Cheshire	23	20
Coos	21	*4
Grafton	39	32
Hillsboro	31	21
Merrimack	27	22
Rockingham	37	28
Strafford	13	13
Sullivan	14	13
	234	179

* Coos County only partially examined as it has but a small area of white pine.

Infection on Currant and Gooseberry Bushes More Abundant

In the last report of the Forestry Commission, the fact was brought out that during the years of 1919-1920, both wild and cultivated currant and gooseberry bushes were found to be more heavily infected by the rust than ever before. The reason for increased infection on bushes each year will be clear when it is understood how blister rust extends its territory. Let it be supposed, for example, that only a single infected pine is present in the State. In the months of April, May and early June the rust breaks forth through the infected bark of the pine in the form of minute orange colored seeds or spores. These are blown about by the wind and infect some, if not all, of the wild or cultivated currant and gooseberry bushes near at hand. These spores cannot, however, infect other white pines. In addition to this, investigations have proven that the spores developing on the pine may be carried by the wind at least 10 to 15 miles, and still have the vitality necessary to infect such currant or gooseberry bushes as they may fall upon. Thus it will be seen that a single pine may start not only numerous local infections on these bushes, but also other outbreaks miles away.

In a few weeks after the currant or gooseberry bushes at a distance as well as those near by, have been exposed to spores coming from the pine, careful examinations show orange colored growths on the under surface of the leaves. Such outbreaks are known as the "Currant Stage" of the blister rust. From these infected leaves there develops another spore or seed that can only infect white pines. This one, like that produced on the pine, is distributed by the wind and falling on the needles of other pines causes another center of pine infection. This second lot of diseased pines, perhaps several miles distant from the first will infect other currant and goose-

berry bushes. Thus, the march of blister rust goes on, doing little harm to the bushes on which it halts for a time, but leaving in its wake ample testimony of its destructive power in the form of dead or dying pines. Only where currant and gooseberry bushes have been removed is the blister rust powerless to destroy the pines.

Comparisons of the amount of pine infection taking place each year and the records of the Weather Bureau for the same periods, indicate that climatic conditions are strong factors in the development and spread of blister rust. The late spring and early summer months of 1922 have been most favorable for the spread of the rust from currant and gooseberry bushes to pines. Unusually abundant rains, accompanied by winds of more than normal velocity, conspired to produce what will undoubtedly prove to be one of the heaviest infection years yet known in the annals of this disease.

White pine is one of New Hampshire's chief assets. All the currant and gooseberry bushes in the State dwindle into insignificance when compared to the value of the white pines. Expenditure of money is necessary to destroy these bushes, but the cost of such control work, when measured by the value of the crop thus saved, will be small indeed.

Progress of Control Measures

In 1917, the destruction of wild and cultivated currant and gooseberry bushes was commenced by the Forestry Department in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture. The work of that year was paid for wholly from State and Federal funds.

To give greater needed publicity to blister rust control, and in order that preventive measures might be speeded up and become more extensive, the situation was made known in 1918 to towns and cities, and appropriations were urged, financial assistance being promised

from State and Federal sources. Beginning with that year, many New Hampshire towns and cities have voted funds for inaugurating control measures. All such appropriations have been met on a dollar for dollar basis by the State, and the Federal Bureau of Plant Industry has covered, with an equal amount, both State and town funds. Federal aid has thus been received up to the fiscal year ending June 30th, 1921.

From 1918 to 1920 inclusive, a total of 79 towns and cities had cooperated financially with the State and Government in blister rust work. During this period control measures have been carried on in all of these towns, with the result that ten towns were completed. A total of 434,798 acres was examined and 4,732,130 currant and gooseberry bushes destroyed at an average cost of 25 cents per acre.

At the 1921 town meetings, 32 towns and cities appropriated the sum of $4,450 for control work, seven of which appropriated for the first time. During the 1921 eradication season, three more towns were completed, thus bringing the total number of towns completed to thirteen.

Table VII

PROGRESS OF CONTROL WORK 1917 TO 1922

Year	Number of towns Worked	Acres Covered	Average Cost Per Acre	Wild Bushes Destroyed	Cultivated Bushes Destroyed
1917	4	23,043	$0.42	462,500	500
1918	30	66,292	.39	959,312	8,427
1919	49	164,413	.19	1,659,936	21,171
1920	49	204,093	.175	2,061,996	21,288
1921	42	137,827	.159	1,654,443	9,713
1922	56	172,274	.146	1,774,198	10,036

Previous reports of the Commission show that appropriations were made by 43 towns and cities in 1918; by 52 towns in 1919, and by 51 towns in 1920. There

was a decided falling off in the number of appropriating towns for the year 1921, when only 32 towns voted funds for blister rust work. This was undoubtedly due to an announcement of the Forestry Department prior to town meeting, in which it was stated that there was little likelihood of continued Federal aid to towns after June 30th. The reason for this change in Federal policy was that since control methods had been devised which proved that currant and gooseberry bushes could be removed economically and with reasonable completeness, the responsibility rested with the State, towns and individuals to protect their pines.

Realizing the necessity of extending control work over a greater territory in order to stay the spread of the rust, and that the present State appropriations alone were insufficient to meet town appropriations on the dollar for dollar basis, the Forestry Department was forced to announce to the towns a change in the State policy formerly governing financial cooperation. It was certain that control work could not be carried on effectively, economically and over any considerable area of a town with less than $400 a year. Therefore, in indicating the necessity of continued work, the Forestry Department advised an appropriation by each white pine town of at least $400, offering to increase town funds 25 per cent. In view of the ever-increasing demands made on towns, and the strong public cry for more economy in towns, State and National Government, the action taken by towns at their annual meeting of 1922 clearly indicated the sentiment which prevailed over blister rust and proved conclusively that there was a strong realization of the value of the white pine crop. The returns from town meeting showed that a total of forty-six towns had appropriated the sum of $16,560. Twenty-four of these towns re-appropriated, while twenty-two towns and cities voted funds for the first time. The sums voted by New Hampshire towns ranged from $50 to $1,000. Sev-

eral towns voted $100 or less, in order that an examination might be made to determine the status of the disease and how much work was essential to successfully check its spread. While it will be necessary for such towns ultimately to appropriate larger sums, still, in providing for an inspection of the pine areas, considerable credit is due them for thus indicating a desire to learn the status of blister rust in their towns. The majority of towns voted $400, the town of Andover making the largest appropriation yet voted, namely, $1,000.

Individual Cooperation

During no year since the inception of blister rust control has there been such an evidence of widespread interest on the part of pine owners as in 1922. A total of 145 individuals, various manufacturing enterprises and lumbermen contributed the sum of $9,398.09 for the purpose of having their pine lands examined and the currant and gooseberry bushes removed therefrom. In addition to such active cooperation, several hundred requests have been made to the Department for an inspection of pine woodlots so that the situation could be determined and necessary steps taken to protect the pines.

Special action by two towns assisted materially in arousing pine owners; the appropriation of one being for the purpose of offering to pay 25 per cent of the cost of the control work upon the lands of local cooperators, while the other town voted to cooperate on a fifty-fifty basis. The Forestry Department, in order to encourage individual control work, offered to furnish any pine owner the services of an experienced crew foreman, and also to bear all cost of supervision. The total area covered through individual cooperation in 1922 amounted to 21,640 acres.

County Blister Rust Organization

Mention has been made elsewhere in this report of the termination of Federal aid on the dollar for dollar basis in the removal of currant and gooseberry bushes. While the present Administration maintained that the Government could no longer continue to spend its funds in the destruction of these bushes, as the control of blister rust had become a local problem, nevertheless, it believed that educational and demonstrative activities were entirely within the province of the Federal Government, and there appeared no sound argument why it should not extend to the States aid of this sort. A new plan was, therefore, drawn up as a basis for carrying on educational work among white pine owners. Briefly, the plan was as follows:

It is generally conceded today that with a carefully chosen personnel, a decentralized organization is capable of more intensive and efficient work than one centrally located and whose members conduct their affairs from the same central point. Recognizing the advantages that might be secured, it was proposed to place in each white pine county, a blister rust agent whose duties would be to inspect pine woodlots so as to determine the presence or absence of the rust, acquaint pine owners with the appearance of the disease, and to instruct them in the proper methods of control. It was planned to have these men come under the direct supervision of the State Forester. Rather than create a wholly new organization, it was proposed to have these men affiliated with the County Farm Bureaus. Before the plan was put into effect, the State Director of Extension, the various presidents of county farm bureaus, county agricultural agents and others were approached and the plan outlined to them. The reception accorded this plan was very gratifying, for the opinion was strongly in favor of the idea.

During the late spring of 1922 Federal funds were appropriated for this purpose and the sum of $30,000 was allotted to New Hampshire. The agreement between all states cooperating with the Government in this educational work stipulates that Federal expenditures shall be on the dollar for dollar basis. Inasmuch as the Federal Government has defined as State expenditures all sums spent by towns, cities and individuals in blister rust control, there is a very good possibility of securing additional Federal funds, since the combined expenditures in New Hampshire for this work will exceed the present allotment.

As fast as competent men could be secured, they were placed in the several counties as blister rust agents and the plan as previously outlined was immediately put into effect. It should be mentioned that great care has been taken in the selection of men destined to act as county blister rust agents, and aside from their blister rust experience and training these men have been carefully coached in all phases pertaining to their work. All men thus appointed are placed on a period of probation and if, at the end of that time, their work has been entirely satisfactory to the State Forester, the Federal Government then extends their appointment.

Benefits Secured to Date

While the county blister rust organization has been in effect but a short time, the results secured by these men proves conclusively that the idea is a sound one and has great possibilities. All of the 145 cooperators who contributed funds this past season for work on their lands were induced to take up blister rust control as a result of the activities of the county blister rust organization. To indicate the possibilities which this plan may bring forth after the organization is entirely perfected, attention should be called to the fact that it was not until early fall that all of the counties had an agent assigned. The

bulk of the cooperation received during the season of 1922 was secured by five agents. It seems quite reasonable to predict that the work of all agents during the coming winter months is likely to show a much larger volume of private cooperation as well as town appropriations another season than has ever yet been received since blister rust control work was started.

During the course of the field season meetings have been held in the field by the blister rust agents, the State Forestry Department and the County Farm Bureau cooperating. At one of these meetings, held on the South Deerfield infection area, nearly 200 pine owners were present. Such a gathering permits each person present to judge for himself as to the seriousness of blister rust and what will be the ultimate outcome to the white pine crop unless control measures are speedily put into effect. In addition to the large meetings, a great many smaller demonstrations have been given, so as to allow town officials and other interested persons a chance to observe the methods actually employed in control work, and to permit them to judge for themselves as to the effectiveness of the methods used, and whether or not the town and private expenditures are being made wisely. As pointed out elsewhere in this report, infection on white pine has been found in 179 towns in New Hampshire. In many of these communities only a small portion of the pine areas have been examined, but judging from the result of intensive inspections in other towns there is a strong probability that the situation is more acute than is now known to be the case. There are thousands of large and small infection centers throughout the entire white pine area, and, as the years go by, not only will these centers expand in size, but they will be the means of creating new centers so long as the currant and gooseberry bushes are allowed to remain in the white pine growth. If it were possible for every white pine owner

in this State to observe the damage already wrought by blister rust at such points as South Deerfield, Temple, Newbury, Littleton, Lisbon, and scores of other points, there would be no further need for the Forestry Commission or the Federal Government to continually sound a note of warning. There is an immediate need for concerted action by the State, towns and individual owners if the white pine crop of this State is to be saved from a fate similar to that which has overtaken the chestnut. The destruction of wild and cultivated currant and gooseberry bushes will absolutely stop the spread of this serious disease, and the work of the past five years has thoroughly demonstrated that present methods are effective and can be carried on at a reasonable cost.

PUBLIC FORESTS

Summary of Public Forests in New Hampshire

White Mountain National Forest.....	404,345 acres
State Forests, received by gift or purchase	17,905 "
State Tracts received under the Reforestation Act	272 "
Municipal or Town Forests.....	6,841 "
Total	429,363 acres

Owned by Forest Societies and Institutions

Society for Protection of New Hampshire Forests	2,440 acres
Appalachian Mountain Club.....	667 "
Yale Forest School.....	900 "
New Hampshire State College.....	150 "
Dartmouth College—Dartmouth Grant..	25,000 "
" " —Town of Orford...	300 "
Total	29,467 acres

National Forest

By J. J. FRITZ, Forest Supervisor

Extent:

A total of 447,927 acres have been approved for purchase in the White Mountain National Forest, of which 436,510 acres have passed title, 404,345 acres being in Coos, Carroll and Grafton Counties, N. H., and 32,165 acres in Oxford County, Me. Purchase of lands well located with reference to lands already acquired are being made as rapidly as satisfactory negotiations can be consummated with the funds available.

Administration:

The Forest Supervisor's office is at Gorham, N. H. Ranger headquarters are located at Gorham, Bartlett village, the east side of the Pemigewasset River in Woodstock, and on Gale River near Pierce Bridge in Bethlehem. Permits to build fires while camping temporarily within the Forest, and information concerning the purchase of timber, uses of land for grazing and other miscellaneous purposes, may be obtained upon application to any of the Rangers, Guards, or the Forest Supervisor at Gorham. Maps and booklets of the White Mountain Area showing the location of the Forest and other features are generally available through application to the Forest Supervisor at Gorham.

Improvements:

Although there is no point within the purchased areas more remote by air line than six miles from a telephone or a road accessible to automobiles, there are vast areas which are more remote by practical routes of travel than the air line distances would indicate. Many of the telephone lines in areas of sparse population are not dependable for use in cases of emergency when a serious fire situation exists. Wherever it is practicable, cooperation with the local commercial company or private parties is planned for a general strengthening of the communicative systems. It is planned to cooperate with the State Forestry Department to extend and improve within the fiscal years 1923 and 1924 telephone service to the Mount Chocorua and Mount Osceola lookout stations.

A new trail on a much improved location, constructed in 1922 to the top of Carter Dome, has opened the way for the construction of a new telephone line and observation quarters on this mountain which promise to give dependable day and night service during dry periods when the situation may require continuous vigilance.

The Federal Highway Act has made available two classes of funds for work on roads and trails. The Forest Highway Fund is for Forest roads of primary importance to the State, counties or communities within, adjoining or adjacent to the National Forests. The $35,294 available for use in New Hampshire for the fiscal years 1922 and 1923 under this fund will be spent on the Pinkham Notch road under the supervision of the Bureau of Public Roads in cooperation with the New Hampshire Highway Department.

The Forest Development Fund according to the Act is provided for the construction and maintenance of roads and trails of primary importance for the protection, administration and utilization of the National Forest, or when necessary for the use and development of the resources upon which communities within or adjacent to the National Forests are dependent. The $29,030 made available for the fiscal years 1922 and 1923 is being expended under the supervision of the Forest Service largely on existing roads in the towns of Chatham, Albany, Bartlett, Thornton, Benton, Easton, Carroll, Woodstock, Milan, and Berlin, New Hampshire, and in the towns of Gilead and Stoneham, Maine.

During the fiscal year 1922 a ranger station, the first permanent administrative building constructed on the Forest was built at Bartlett on a site well adapted for the purpose on land acquired a few years ago. Similar permanent quarters are greatly needed at the other ranger headquarters where increase in business makes a permanently equipped organization essential.

Recreation:

In general, the Forest Service recognizes the need of accommodating a number of diversified recreational interests of which from the standpoint of number the most important are as follows: Hotel guests, trampers, auto campers, fishermen, hunters, and summer residents.

The needs of these various recreational interests are being met by protection of the forests from fire, cooperation in the improvement of communication and transportation facilities, extension and improvement of trails and shelter facilities by cooperation with the various mountain clubs, construction and maintenance of public camp grounds, annually stocking several hundred miles of fishing waters in cooperation with the New Hampshire Department of Fish and Game and the U. S. Bureau of Fisheries, and by extension of shelters for the convenience of hunters and fishermen. In the management of the economic resources of the Forest, the present and future intensive recreational value of certain areas are recognized and taken into consideration.

Public camping grounds accessible to automobile roads have been provided for at the Dolly Copp spring on the Glen Road, Gale River bridge on the Profile Road, Zealand bridge on the Bretton Woods Road, Wild River Ranger Station in Wild River valley, and Glen Ellis Falls on the Glen Road. The early development of sites in the Swift River valley, in the Pemigewasset valley, at the Brickett Place in the Cold River valley, and at Darby Field on the Glen Road is planned.

In addition to a great number of open shelters that have been provided by mountain clubs for trampers, hunters and fishermen, the Forest Service has provided shelters at Hermit Lake, Wild River Ranger Station, Mountain Pond in Chatham, Camp 19 in the Upper Ammonoosuc valley, and Russell Pond in Woodstock. Additional areas frequented by trampers, hunters and fishermen will be provided with shelters when opportunity and funds permit.

One of the most popular camp grounds was visited in 1922 by people from forty-one of the United States, and from territories and foreign countries as follows: Alaska, Canada, Cuba, England, Finland, France, Hawaii,

Holland, Ireland, Java, Philippines, Russia, and South America.

The demand for more areas for the rapidly increasing number of people who desire to use the most desirable sites for recreation for short periods has made it necessary to avoid the leasing of sites for long periods for the development of private summer residences and camps.

Forest Management:

Estimate figures show that there are about one billion feet board measure of merchantable timber on the Forest, 30 per cent of which is softwood and 70 per cent hardwood. The Forest for purposes of management has been divided into 12 working circles, each of which will provide a sustained yield of timber to at least one wood-working industry with a capacity of from 500,000 to 1,500,000 feet board measure per annum. Plans have been completed for six of these areas for which the allowable cut for the next five-year period is approximately as follows:

Name of Working Circle:	Allowable cut for next five-year period.
Wild River	10,000,000 ft. B. M.
Peabody River	3,500,000 "
Ammonoosuc River	15,000,000 "
Lower Pemigewasset	10,000,000 "
Swift River	12,500,000 "
Baker River	1,500,000 " *

On the basis of these six areas, it appears that the Forest could supply 18,000,000 to 20,000,000 feet board measure annually, of which 80 per cent would be hardwood and 20 per cent softwood. About 20 per cent of this possible cut is being marketed at present. Only

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* Cut approved only for a two year period.

such softwood timber is being sold at present as comes mixed in stands of hardwood which are ready for cutting.

All timber to be removed is marked or designated by a Forest officer. Softwood brush is burned. Spruce and fur are utilized to a four inch top diameter, and in log lengths down to four feet. A height of 30 to 35 feet is used in marking softwood for cutting instead of a diameter limit in order to provide against windfall. Such portions of hardwood tops as are not utilized for cordwood must be limbed out so that they will lie close to the ground to insure their rapid decomposition. The cubic foot rule is used in scaling National Forest lumber, 161 cubic feet equalling 1,000 board feet Blodgett or New Hampshire rule, which is the standard log rule in the White Mountain region.

Under the terms of the Weeks Act, 25 per cent of the gross revenue from the National Forest is paid to the State Treasurer to be distributed to the towns in which the National Forest is located.

State Forests and Reservations

The total acreage of state forests and reservations as published in the last biennial report was 12,163 acres. A gift of rights in the Conway Common land amounting to 374 acres was inadvertently omitted and the Walker Tract should have been shown to contain 47 acres instead of 45 acres, making a total of 12,539 acres prior to the present biennial period. During the past two years this was increased by 5,366 acres of which 3,003 acres were donated and 2,363 acres acquired by purchase at an average cost of $3.64 per acre. The present total area of 17,905 acres consists of 5,158 acres donated and 12,747 acres purchased.

Table VIII gives the name, date of transfer, location, acreage, condition, purchase cost and cost per acre of each tract acquired during the past two years. The same information for tracts previously acquired was published in the last biennial report.

AIR PICTURE OF FRANCONIA NOTCH Courtesy of U. S. Air Service

Table VIII

STATE FORESTS AND RESERVATIONS ACQUIRED IN 1921 AND 1922

NAME	Date of Transfer	Location	Area	Condition of Tract	Purchase Cost	Purchase Cost per Acre
Taylor	Oct. 1920	Concord	7	Open, with scattering pines	Gift	
Pillsbury	Nov. 1920	Goshen and Washington	2,395	Young hard wood growth, scattering spruce	Gift	
Cardigan Mt. addition	June 1921	Orange	1,150	Top and slope of Mt. Cardigan	$3,000	$2.60
Beech Hill	July 1921	Keene	21	Mixed pine and hardwoods	Court decree	
Honey Brook addition	July 1921	Marlow	180	Cut over, with young spruce growth	$990	$5.50
Marshall	Dec. 1921	New Ipswich	20	Scattering pine and hardwoods	Gift	
Conway Common Lands	1921 - 1922	Conway	318	Cut over, with young hardwoods	$1,412	$4.02
Annett	Mar. 1922	Sharon	190	Cut over	Gift	
Annett	May 1922	Rindge	100	Water		
			600	Cut over young pine	$3,000	$4.28
Fox	Mar. 1922	Hillsboro	250	Mature pine and hardwoods	Gift	
Fox	Aug. 1922	Hillsboro	120	Mature pine and hardwoods	Gift	
Green Mt.	June 1922	Effingham	15	Top of Green Mt.	$200	$13.33
Total			5,366			$3.64

Description of Tracts Acquired in 1921 and 1922

Taylor Tract:

Mr. Stephen A. Taylor of Concord, N. H., deeded to the State on October 8, 1920, a tract of seven acres to be used for forestry purposes. This lot lies adjacent to the Concord-Loudon highway and on the Soucook river. A furnished cabin on the property was reserved by the donor for his use during his lifetime; but will afterwards revert to the State. Most of the land is open, but small groves of birch, oak and pine lie along the southern boundary. All the open land has been planted with 3,700 white pines, which are growing and in good condition.

Pillsbury Reservation:

This reservation of 2,400 acres lying in the towns of Washington and Goshen was given to the State in November, 1920, by the Hon. Albert H. Pillsbury, formerly Attorney-General of Massachusetts. Mr. Pillsbury has long been interested in forestry and hoped to manage this tract according to forestry principles. He found distant management not feasible and decided to deed to the State this large area which includes five good sized ponds forming the headwaters of the Ashuelot river. This tract was extensively logged for spruce and some hardwoods over twenty years ago at which time there was a thriving settlement and a saw mill. The present growth is mixed hardwoods on the slopes and ridges with considerable young spruce and fir bordering the ponds. Most of the buildings are gone, but the old boarding house and former residence of the manager remain and now after certain improvements make suitable quarters for campers and a ranger station for the ranger and his wife. An additional 138 acres were deeded to the State as equivalent value for spruce stumpage cut on the reservation. Mr. John C. Butterfield of Newport whose father built the old water

PILLSBURY STATE FOREST IN WASHINGTON
Showing North Pond, the source of Ashuelot River

GLIMPSE OF HONEY BROOK STATE FOREST IN MARLOW

mill now standing on the main road gave to the State a small pasture of seven acres adjoining the reservation. A complete survey and map have been prepared by a class of forestry students from the State College at Durham. Due to past lumbering operations the road to Cherry Valley, so-called, from Washington village is in very bad condition and is not conducive to a large number of visitors. The Goshen entrance is far better at the present time, but both roads will probably be improved. A ranger or patrolman is employed during the fire season and has already accomplished much in the way of clearing trails, repairing cabin and roads, telephone construction and looking after visitors and camping parties. This reservation is visited by many fishing, hunting and camping parties and the public are always welcome. It is hoped that a proposed through trail from Dublin to Lake Sunapee will pass through this reservation.

Cardigan Mountain Addition:

During the year 1918 the State purchased about 700 acres on the slopes of Mount Cardigan in Orange. An additional purchase of 1,000 acres of partly cut over land was made during 1921. This land includes the top of the mountain and the slopes to the south on the Orange side. Some merchantable spruce in certain ravines was reserved to the grantor, but the young protective growth on the steep slopes is included in the purchase and should never be cut. This reservation now extends from the old Colony road, so-called, running from Orange to Groton to the lower southern slopes of the mountain and includes practically all of the unallotted lands. A cabin has been erected at the head of the trail leading from Canaan which is now open to parties seeking shelter from storms, but later this may be used as a lookout watchman's cabin. A boys' camp on Newfound Lake at Hebron called "The Mowglis"

has been interested in Mount Cardigan for many years and recently has undertaken to keep open the Mowglis trail from Hebron to the top of the mountain. This past year a shelter was built by the camp on this trail near its summit to be used by the public. Two lots of about 150 acres located near the base of the mountain on the Grafton-Orange road were included in this purchase. This reservation of over 2,000 acres now ranks third in size and contains almost an entire mountain range from whose summit one of the finest views within the state can be obtained.

Beech Hill:

A small tract of 21 acres located within three miles of Keene on the old Gilsum road was left to the State during the past year. This woodlot of young growing pine, hemlock and hardwoods was listed as property belonging to Miss Ellen Lang of Keene when she died in 1920. As she left no will and no heirs this department requested the Governor and Council to allow the tract to be withdrawn from any possible sale and asked for its control and management which was subsequently granted. The corners have been located and marked.

Honey Brook Addition:

A tract of 180 acres of cut over land was added in 1921 to the Honey Brook reservation which is located in Marlow and Acworth. This lot lies in part along the Marlow-Newport and Marlow-Bellows Falls highways and is adjacent to the Marlow Junction. This addition contains some valuable spruce and hardwoods with scattering open land suitable for planting. The total acreage of this tract is now close to 500 acres and practically all of it is accessible.

Marshall Tract:

Mr. Edward O. Marshall of New Ipswich gave to the State in 1921 a lot of 20 acres which consists of several acres of open land and the balance in young

growing pine and hardwoods. This tract lies just south of Bank Village and should make a valuable and interesting demonstration area. Some hardwood cutting has been started to release the pine and improve the stand. Planting of pine on open areas will probably be undertaken within a short time.

Annett Reservation:

Mr. Albert Annett as president of the Annett Manufacturing Company of Jaffrey recently gave to the State about 200 acres of forest land located in the town of Sharon. This gift was in memory of his father, Mr. Thomas Annett, a noted lumberman of that section and long interested in forestry. Adjacent to this lot, but in the town of Rindge, about 600 acres of cut over land were purchased from Mr. Annett which includes a good portion of the shores and surface of Hubbard Pond, the headwaters of the Contoocook River. These lots, though cut over, are real pine lands and extensive areas have already reproduced to pine. Certain clumps of pine too small to cut when these lots were operated still remain untouched. This reservation has many possibilities as it is situated about five miles from Jaffrey village and is interspersed with good roads. Hubbard Pond should attract fishermen and hunters and its shores should appeal to the camper.

Caroline A. Fox Reservation:

Miss Caroline A. Fox of Hillsboro deeded all her forest land of 250 acres to the State during the past year. This land adjoins her summer estate situated about two miles from Hillsboro station and lying on both sides of the main road to Hillsboro Center. Recently Miss Fox purchased an additional woodlot of 120 acres and transferred this to the State to prevent the pine timber from being cut and making a dangerous fire menace adjoining. This tract of 370

acres now makes one of the most valuable reservations in this section on account of its location and the amount of mature timber. There are large areas of mature pine and hardwoods, both pure and mixed. Near the southwest corner a fine stand of mature red oak has completely over topped and suppressed a stand of pine. There are many acres of young growing pine with a scattering stand of birch and maple which will soon receive improvement thinnings. Miss Fox petitioned the Fish and Game Commissioner to make a Bird Sanctuary of these lands which recently has been granted. This reservation is the first to include a Bird Sanctuary which is entirely under state control, and it is expected that hunters will conform to all regulations. It is planned to make improvement cuttings and to plant part of the open land near the road.

Green Mountain:

The State recently purchased 15 acres on the top of Green Mountain in Effingham for the purpose of erecting a fire lookout station to be maintained jointly with the State of Maine. This station is located within a short distance of the New Hampshire-Maine line and offers exceptional facilities for fire prevention work in both states. The land is covered with a mixed growth with clumps of mature spruce on the west slope. An area around the summit has been cleared and offers distant views in all directions.

Conway Common Lands:

By a joint resolution of the Legislature approved April 7, 1915 (Chapter 207, Laws of 1915) the New Hampshire Forestry Commission was authorized and instructed, with the assistance of the Attorney-General to investigate the forest conditions, titles, boundaries, possibilities of reforestation, etc., of the common lands, so-called, in the town of Conway, and to acquire, with the approval of the Governor and Council, such common

rights in said land as in the judgment of the Commission could be secured upon terms favorable to the proper management of said tract as a State forest.

Following the passage of this resolution a number of common rights in Conway were acquired by Mr. W. R. Brown of Berlin, N. H., during the years 1917 to 1919, and by him donated to the State. Additional rights were also purchased by the State during the years 1920-1921 so that the total acreage in rights at the present time is 692 acres.

The question then arose as to the status of the owner of rights in common lands with reference to the legal title to the property. The Assistant Attorney-General to whom the matter was submitted expressed the opinion that the legal title was in the proprietors in a corporate capacity and that the relation of the owners of the individual undivided rights to the corporate title, was similar to that of the stock holders of a corporation to the property owned by the corporation and in this view he appeared to be supported by opinions rendered by the Supreme Court in several of the earlier cases. In this situation it appeared to be doubtful whether as the owners of undivided rights the State would be in a position to protect the property against trespassers. It was accordingly thought advisable to make an effort to acquire title in severalty to the rights already purchased and such as might afterward be acquired.

There appeared to be two lines of procedure by which such title could be obtained: First, by calling a meeting of the proprietors and action at such meeting alloting the land in severalty to the owners of the common rights. Second, by a petition to the Court for partition.

It was decided to try the first plan and a meeting of the proprietors was called at the instance of the Society for the Propagation of the Gospel in Foreign

Parts, a corporation which was one of the original proprietors and which is still in existence. Such a meeting was called and officers were elected. But at the meeting it developed that there was much uncertainty as to the ownership of rights by persons who appeared at the meeting and claimed the right to vote. It also appeared that some sixty-one rights, being a majority of the whole number, were claimed by the Maine and New Hampshire Granite Company, a Maine corporation. The local superintendent of that corporation was present at the meeting, but stated that he was not authorized to take part, and under these circumstances the meeting was adjourned after the election of officers, without transacting any further business.

The meeting has been kept alive by successive adjournments from time to time, and still stands on adjournment to a definite future date. After the first adjournment a conference was arranged between representatives of the State and the Granite company and Mr. W. F. Hale, representing the Forestry Department and the Assistant Attorney-General met the officers of the corporation at Portland, Maine, on June 16, 1922. As a result of this conference it is expected that the Granite company will cooperate with the State in an effort to perfect title to the property and secure an equitable adjustment of their several rights therein. Whether or not a further effort will be made to accomplish this purpose through the meeting of the proprietors or whether a petition to the Court for partition will be filed is not yet determined, but is under consideration by counsel for the Granite company and the Attorney-General's office. It is expected that a definite course of procedure will be determined upon in the immediate future, and it is believed that if no other course is open, the title to the property can be assured as above suggested, by means of a petition for partition.

Reforestation Tracts

Only two tracts were deeded to the State during the past two years for reforestation purposes under the provisions of Chapter 163, laws of 1915. The planting of tracts previously acquired has been carried on each spring and fall and on several the work has been completed. Mrs. Flora Ames of Henniker deeded to the State in December, 1920, about 15 acres of cut over land for reforestation. To date 10,000 pines have been planted. Mrs. Alice H. Robie of Cambridge, Massachusetts, deeded a seven-acre pasture which is located in North Hampton. This small plot lies at the junction of the Lafayette Highway and a cross road and is admirably situated for demonstration purposes. This tract has been planted with 5,000 pines.

Improvement Work and Planting on State Tracts During 1921 and 1922

Improvement cutting has been done on twelve or more of the State forests and reservations. Most of this has been cordwood cutting to release growing pine. A total of 410 cords of hardwood and 5,470 board feet of pine have been sold at a profit of $1,330. Profitable cuttings have been made on the Mascoma, Alton Bay, Everett, Sugar Hill, Carroll, Kearsarge and Livermore Falls tracts. On several plantations and naturally seeded pine areas hardwoods too small to sell have been cut back to free the pine.

The bulk of improvement work has been in planting open areas. Table IX shows the number and species of trees planted on the State forests and reservations during the past two fiscal years.

Table IX

PLANTING ON STATE TRACTS

Name	Species	Fall 1920	Spring 1921	Fall 1921	Spring 1922
Contoocook	White pine	5,000	1,500		
	Red pine		4,000		
Litchfield	Red pine	3,000			
Ponemah	Red pine	5,000			
	White pine	5,000	10,000		10,000
Salmon Falls	Scotch pine	10,000	5,000		5,000
Taylor	White pine	1,000	2,700		
Bear Brook	White pine		10,000		
	Red pine		10,000		
Craney Hill	White pine		3,000		
	Red pine		1,250		
Dodge Brook	White pine		2,000		
	White ash			4,000	
Everett	Red pine		13,000		
Honey Brook	White pine		7,000		
	Red pine		5,000		
	Scotch pine				10,000
The Ledges	White pine		2,000		
Sugar Hill	White pine		1,000		
Huckins	Scotch pine			5,000	15,000
Mascoma	Scotch pine			5,000	
Mast Yard	Scotch pine			3,000	34,000
Kearsarge	Norway spruce.				7,000
Scribner Fellows	Red pine				6,800
	White pine				2,400
Nursery	European larch.				3,000
Under Reforestation Act					
Carroll	White pine				2,500
	Norway spruce.				3,000
Hodgman	White pine	3,000			
Allen	White pine	5,000			
	Red pine	5,000			
Ames	White pine		10,000		
Palmer	White pine			1,000	
Robie	White pine		5,000		
Totals		42,000	92,450	18,000	98,700
Grand total					251,150

The New Willey House Cabins

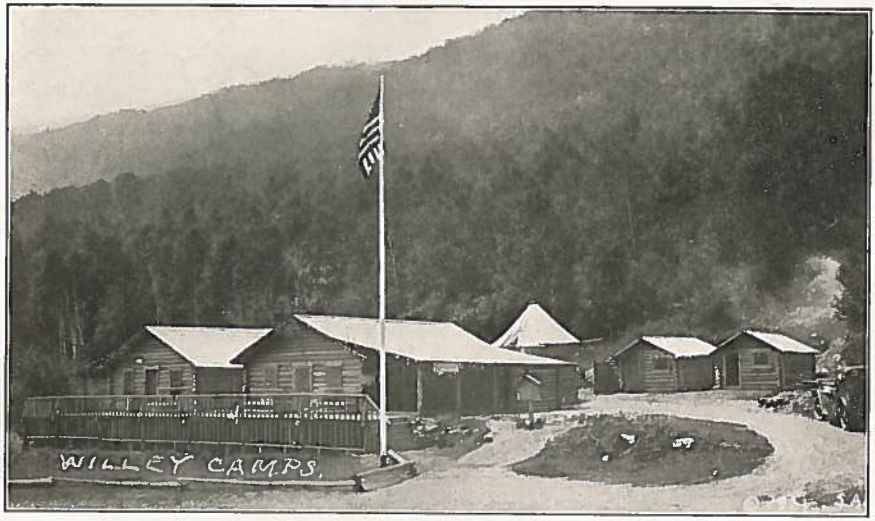
The Crawford Notch, one of the most famous gateways in the White Mountains, was named for Ethan Allen Crawford, one of the first settlers in the region. It is a source of gratification to know that a tract of 6,000 acres, extending southward from the gateway for a distance of about six miles, belongs to the people of New Hampshire and is known as the Crawford Notch State Forest Reservation. This reservation occupies the northerly half of the township known as Hart's Location. On either side the boundary extends to the summits of the mountains bordering the Saco river. The purchase of this reservation was made possible by a special act of the Legislature of 1911.

To the east and west of the State Reservation lies the White Mountain National Forest which makes of the region altogether a splendid stretch of forested mountains, valleys and slopes now in public ownership. A short distance below the gateway are the Silver Cascades, well worth a stop on the part of motorists passing through the Notch, but unfortunately frequently overlooked. Mounts Avalon, Willard, Willey and Frankenstein comprise the border range on the west, while the magnificent slopes of Mt. Webster occupy much of the easterly border of the valley. The southern border of the reservation is near the crossing of Bemis Brook, where a vista has been cut through to the river and a magnificent view may be obtained of the summit of Mt. Washington.

Within the Crawford Notch reservation and some three miles below the gate of the Notch, is the site of the original Willey House, famous the country over on account of the great slide which on August 28, 1826, came down the slope of Mt. Willey and killed the entire Willey family, who had rushed from their home upon the approach of the avalanche. It is well known that

the house itself remained untouched. This house was afterwards enlarged by the addition of another building and used as a hotel. The original house was finally destroyed by fire and the hotel buildings eventually disappeared. For many years now the only suggestion of previous habitation at this famous spot has been the clearing in the otherwise unbroken forest, the remains of the cellar walls of the original Willey House and the walls of other buildings. Gravel from the great slide has been used for many years in constructing and maintaining the state highway, known as the Theodore Roosevelt Highway, which passes the spot.

One-half mile below the Willey House site is the headquarters of the State ranger or patrolman employed by the Forestry Commission as caretaker of the reservation. The ranger cabin is known as the Allen Spring Camp, where there is located one of the finest springs in the mountains, close by the highway and near the State cabin. Through the fire season the State ranger watches for fire, patrols north and south along the state highway and the railroad above, allots camping space to forest travellers and motor tourists and gives permits for building fires. He is at the service of the public and is always glad to accommodate passers-by, point out places of interest and render every service possible free of charge. The open spaces between the Allen Spring Camp and the Willey House site are used for the accommodation of the public for camping purposes. Two permanent camps away from the highway and on a roadway leading to the Willey House Station on the Maine Central railroad a half mile below the Allen Spring Camp have been built by private parties under leases from the State. The station on the Maine Central railroad, known as the Willey Station, makes the Notch country accessible to parties wishing to visit the place either from the north or south by railroad.



WILLEY HOUSE CABINS
Crawford Notch State Forest

STATE BLISTER RUST CREW
Eradicating currant and gooseberry bushes

Thousands of persons each year stop at the Willey House site to see the historical spot and enjoy the unsurpassed view of the mountains afforded by the clearings made years ago. To accommodate the public and increase the recreational advantages, the Forestry Commission has this present season undertaken by lease to J. F. Donahue of Bartlett to erect two peeled spruce cabins close by the site of the old Willey House. Plans for the construction have been worked out by Arthur A. Shurtleff, landscape architect of Boston, who has freely given his services in the interest of this mountain country. One of the cabins is for a public rest room, with fireplace and toilets. The other cabin is a store and lunch room, where food and supplies as well as souvenirs, both for the tramper and automobile party, may be purchased at reasonable prices and under regulation by the State Forestry Commission. Smaller cabins, also of peeled spruce are placed artistically in the rear, both for service quarters and for use of overnight parties to a limited extent.

The Appalachian Mountain Club has accepted the Willey House cabins as one of the links in its system of camps east and west across the mountains. The possibilities for future development and service are very great. It is believed that this establishment may be able to render great public service and become a headquarters for camping parties and outfitters for those who wish to spend subsequent days in the woods. There is no purpose or intent to furnish hotel accommodations. Those who stop at the Willey House over night must either camp out on the public camping grounds, for which there is no charge, or pay a nominal price for the use of one of the cabins where they may have cot beds, but no luxuries.

The recreational use of forests has developed to a marked degree during the past few years. While our mountain roads and trails have long been used by

trampers, the auto camping party has come into his own quite recently. It appears that camping by the roadside has been longer in vogue in the western states and has come to us from that direction. The possibility for recreation throughout our mountain region is very great. The National Government is bending its efforts to establish public camping places, and private parties are beginning to take advantage of the opportunity to accommodate the public in this way. It is believed that the Willey House site is proper and suitable for development in this direction, always remembering that the public must be served freely with all that Nature has provided and that the traveler may pay for food supplies and comforts at reasonable prices. Already it is no uncommon thing to have forty automobile parties pass the night on the Willey House grounds.

Municipal or Town Forests

Municipal or town forests are owned by practically every city and town in many of the countries in Europe. Towns in Switzerland and Germany have maintained and managed their own forests for many years at a profit. The people of many of the small villages which own forests had no taxes to pay. The city of Zurich, Switzerland, has a very famous forest which has been under management for about 1,000 years. All the old established forests are on a sustained yield basis so that it is known just how much timber they can cut yearly for an indefinite period. Forestry is practiced on these town forests and they are made to pay for their maintenance besides returning a money profit. The forester is usually appointed by the State, paid by the town and is usually one of the leading citizens. Thus the town forest is one of the most popular local institutions in Europe.

In this country conditions are different because of different standards of labor and of living. Progress

has been made however and in New England there are many cities and towns which own forests and are improving them by planting and proper methods of cutting. The General Court of New Hampshire in 1913 passed a law authorizing towns to purchase land and devote it to the practice of forestry under the supervision of the State Forester, the net revenue from the sale of wood and timber to be turned into the town treasury. At the present time 16 towns and cities in the State own a total of 6,841 acres. The list published in the last biennial report needs correction in the case of Hanover and Dartmouth College which are joint owners of about 1,275 acres. On several of the town forests considerable cutting has been done in a way to improve the growing conditions and increase the future value without any present loss and in one or two cases with substantial money returns. Unfortunately the records of work done have not been well kept in all the towns.

The Hollis town forest has continued to furnish cordwood from mixed pine stands for public purposes as well as some chestnut and over 12,000 feet of pine for sale during the past two years. Since 1918 over $1,000 of revenue from the 200 acres have been put into improving the growth and planting open areas.

The Keene forest, managed by the Water Works Department, from recent logging operations has returned over $14,000 in lumber sold, all growth under six inches being reserved. This forest contains 1,800 acres.

The Warner Town Forest of 800 acres was given to the town in 1919 by Admiral Lloyd H. Chandler in memory of his father, Senator William E. Chandler. It includes the northern part of the Mink Hills and consists of mixed growth with some pasture. The pine timber on the north end of the tract which was reserved by the donor has since been cut. The State Forestry Department cooperates in the general management of the forest with the chairman of the selectmen who also

does the scaling and looks after the sales. Large scattered and mature ash, oak and hemlock were selected for cutting during the fall of 1920. A sawmill operator contracted to cut and deliver oak logs to a local woodworking plant for $10 per M, the ash and hemlock to be sawed and stuck for the town use for $17.50 per M. As the town had been paying $30.00 per M. for hemlock bridge planking, the saving on the hemlock alone was $12.50 per M. The 15 M feet of ash gave a profit of $20.00 per M. Revenue to the town from this logging operation netted about $600. The ash and oak tops were cut for fuel and 23 cords were measured. The logging operation was well handled, the slash scattered and all young growth protected. During the logging two choppers were employed to cut cordwood in a nearby stand of pine and hardwoods, which needed thinning. About 100 cords of wood were cut from among the pine at a cost of $2.00 per cord for chopping and $1.50 per cord for teaming to town or a total of $3.50 per cord, not including supervision. This wood sold for $7.00 per cord, making a profit to the town of about $330. The total profits amounted to $930.

The town at its last meeting appropriated $125 for blister rust scouting on the forest which was recently completed showing infection on pines scattered over the whole area. Plans are under way to completely eradicate all currant and gooseberry bushes within the forest. During the fall of 1922 the town is planning to cut about 125 cords of wood to supply the schools, library and town hall.

Dartmouth College Forests

The Precinct of Hanover, New Hampshire, and Dartmouth College are joint owners of two small forest reservations.

One of 75 acres situated on the bank of the Connecticut River just north of the Village is known as

Pine Park. This area is practically all covered with pine, the timber varying all the way from young growth 12 or 15 feet in height to some very mature trees. Some thinning has been done under the advice of an expert forester and much more should be done in the near future. The tract came into the possession of the above named owners by gift, in part from the estate of Mrs. Hiram Hitchcock and in part from a group of citizens of the town who had purchased a portion of it lying directly on the river bank in order to prevent the sale to a lumber company that would have resulted in the entire cutting of the tract. At the present time there are probably several million feet of merchantable timber on this area. The tract is under the care of park commissioners appointed by the College and Precinct and it is their purpose to improve it by means of paths and driveways and to hold and maintain it permanently as an outing and pleasure ground for the citizens of the Village.

The second tract is the Water Company lot, which includes practically the entire watershed of the reservoir that supplies the Village with water. This is in form of a stock company, the shares however being practically all held by the College and Precinct. The area represents about 1,200 acres, about half of which is covered with forest and half consisting of old fields and pastures. On the field land the hay has been cut for many years without cultivation and is now of little value. The Company has therefore entered upon the policy of reforesting this open area and is now setting out about 10,000 white pine trees annually. The portions already in forest represent all the common varieties of hardwood together with pine and hemlock, some of the pine in clear stands and some mixed with hardwood.

In addition to these joint holdings of the College and Precinct, the College owns the entire township known as the Dartmouth College Grant in the northern

part of the State. The area is something over 25,000 acres, all of which is in forest. Spruce and fir are the prevailing marketable timber although there is a large amount of hardwood, but this at the present time is unmarketable due to its long distance from the railroad. Sales of softwood have been made from time to time and at present the Brown Company is making a rather extensive pulpwood cutting on this tract.

In addition to this larger tract, the College owns several other scattered tracts of woodland which have come into its possession in various ways. These include between two and three hundred acres in the town of Orford and a very beautiful wooded hill in Hanover just east of the Athletic Field.

New Hampshire College Forest

The College Forest at Durham contains 150 acres, about 50 acres of which consists of old growth white pine and hemlock, while the balance is in scattered parcels of second growth pine having an important æsthetic and protective value to the college buildings and grounds. The area of old growth is one of the largest in New England where white pine trees of such size and quality are growing in a close stand. The trees are being preserved as far as possible in their original condition but decadent trees are salvaged to prevent loss. The College Forest as a whole is managed on a conservative selective system, securing natural reproduction in openings and planting the waste areas. Once in about two to three years a moderate logging operation is carried on. The students are given instruction in mapping, estimating and management of the various types represented. Investigative work started in and around the College Forest in 1913 to determine the relative merits of different species of trees for planting purposes, as well as experiments in thinning and improvement cuttings have begun to show results.

Outside the College Forest and teaching work at the College, the Department of Forestry at the College carries on extension work, makes examinations of farm woodlots, particularly in Rockingham and Strafford counties, addresses meetings of organizations and prepares material for county and State fairs.

Yale University Forests

The experimental and demonstration forests owned by Yale University in the vicinity of Keene are in two tracts, the larger of approximately 700 acres on the Winchester Road, near Keene, and the smaller of approximately 200 acres in Westmoreland some 12 or 14 miles from the city and rather inaccessible. The larger tract on the Winchester State Highway is within about two miles of Keene. This tract is broken into two areas with irregular boundaries by interior holdings not owned by the University. Taking this tract as a whole, it has a moderately rolling surface and is situated between the flat land of the valley and the high rocky hills south and west of Keene. The forest is of excellent quality for the growth of pine, and it is practically all now covered with white and red pine in stands of various ages up to 50 years. The larger portion of the tract, however, is covered with the younger classes up to 25 years.

The policy of the University has been to gradually increase the area of this forest through purchase, as adjacent land comes into the market. The policy is to manage this forest under a sustained yield and gradually build up fully stocked stands of red and white pine in the various age classes essential for continuous forest production.

Heretofore, silvicultural operations have been confined: first, to planting open areas and under-planting stands of grey birch where pine was absent; second, to cutting out hardwoods (chiefly grey birch) and hem-

lock where large enough for timber or fuel wood and where standing over, and interfering with the growth of pine; third, to cleanings in natural and artificial stands of pine, in some cases even where the returns from the materials removed will not pay the cost of removal; fourth, mapping the property, dividing it into age classes and estimating the growing stock.

Nearly all the necessary planting on the area now owned, has been completed. Furthermore, nearly all of the hardwoods, large enough to be profitably removed for timber or fuel-wood, have been cut. Considerable areas of both naturally and artificially regenerated pine are badly in need of cleanings. In the main, the object of the silvicultural work, heretofore accomplished and now under way, has been the establishment of stands of pine and the improvement of existing stands. The aim is to make it a model forest and a research station for the study of problems in pine production. Studies are in progress to show the effect of various densities of over-wood of different species on the growth of pine growing beneath; to show the effect of root competition of competing hardwoods with the growth of pine; to show the results of various operations in plantations on quality and yield at various ages of the stand; to show the effect of under-planting with white and red pine on the cost and quality of the final stand; to show the advantages or disadvantages in burning slash or brush cover prior to planting; and to study the duration and intensity of the various site factors in their relation to forest production.

Research on this forest is, however, only at its beginning. It is the aim of the University to rapidly expand the research work on this property. It is confidently expected that at a reasonably early date every silvicultural system suitable for use in white and red pine production will be in operation; that all methods and

degrees of thinnings will be represented; that different methods of regeneration will be in practice.

The Westmoreland tract, due to its inaccessibility, has not as yet been used for silvicultural operations or for research. The larger part of it is covered with pine stands of various ages. There are here, however, a few stands of hardwoods and some open land.

Forest Reservations of the Society for Protection of New Hampshire Forests

Mount Sunapee, Sunapee	656	acres
Lost River, Woodstock	148	"
Roadside Pines, Tamworth	12	"
Masonian Reservation, Dublin and Jaffrey	650	"
Primeval Pine Trees, Sutton	5	"
Derby Woods, Dublin	125	"
Royal Arch, Springfield	35	"
Cathedral Woods, Conway	10	"
Beaver Meadows, Woodstock	152	"
Frank West Rollins Memorial, Warner	521	"
Richard M. Colgate Memorial, Sunapee	75	"
Hillside adjoining Royal Arch, Springfield	40	"
City Hill, Nelson	11	"
Total	2,440	acres

Reservations, Camps, and Trails of the Appalachian Mountain Club

By ALLEN CHAMBERLAIN

The Appalachian Mountain Club was organized forty-six years ago primarily to advance public interest in the White Mountains. At that time there were few trails through what was then almost an unbroken wilderness. To make the mountain summits and the remote sylvan beauties readily accessible to the public the Club began cutting trails, following a consistent program year by year until the walking routes main-

tained by the Club at present, ramifying throughout the mountain section, cover nearly three hundred miles. Many more miles of trail have been built under Club auspices in past years, but recently the Federal Forest Service and certain local clubs and associations have assumed responsibilty for some of the routes formerly laid out and cared for by the Appalachian Club. Prior to the passage of the act enabling the State Forestry Commission to acquire forest lands for public purposes the Appalachian Club secured charter powers permitting it to hold reservations of this nature as public trusts. In Massachusetts it holds three such properties, in Maine two, and in New Hampshire, which has ever been its most active field of endeavor, there are ten reservations maintained at the expense of the Club purely in the public interest. These reservations are as follows:

Lead Mine Bridge, Shelburne	37 acres
Snyder Brook, Randolph	36 "
Joseph Story Fay, Woodstock	150 "
Farrar, Pack Monadnock, Temple	4 "
South Baldface, Chatham	10 "
Kearsarge (Pequawket), Chatham	10 "
Rhododendron, Fitzwilliam	300 "
Sky Pond, New Hampton	100 "
Walter R. Davis Memorial, Jackson	30 "
Total	677 acres

Four of these are sightly mountain tops, the remaining five are of public value because of the beauty of their woods, and being near to places of considerable population which are resorted to by large numbers of summer visitors, they afford picnicking and recreational facilities freely accessible to all.

One other reservation, a small plot of one acre situated at tree line on Mount Madison in the Presidential Range, is the site of the first stone cabin built

by the Club for the convenience and shelter of persons tramping over the mountain trails. The first cabin was built there thirty-five years ago. Subsequently, as the public demand for additional accommodation of this nature increased, a second was built, and a third was erected during the summer of 1922. As the Club's trail system developed, many people, not summer visitors alone but many permanent residents of the State, began to appreciate the superior advantages of New Hampshire's highlands as a place for a holiday afoot. In addition to the stone cabin on Mount Madison the Club also has built nine lean-to log shelters at various sightly spots along the trails, all of which are freely open for the use of any who fare that way. Foot travel through the mountains has been steadily on the increase in recent years and a demand arose in consequence for simple shelter with bedding and meals at a moderate cost. To this the Club at once responded by equipping the stone cabin on Mount Madison and putting a man in charge. Other cabins have since been built, a stone structure by the lakelet in the picturesque Carter Notch, another at the Lakes of the Clouds close under the southerly side of the cone of Mount Washington, and two log cabins beside the State road at the height of land in the Pinkham Notch where a number of much used trails center. At all of these bed and board are furnished to all comers on a cost basis, and it is the intention of the Club to build yet others of like nature in other parts of the mountains, especially in the Franconia region, if funds can be secured for the purpose.

These various facilities for the benefit of people who enjoy walking in the mountains, and there are thousands of both sexes and of all ages who tramp there every year, represent an outlay running into many thousands of dollars. To build and equip a two room cabin at a point far back in the mountains, where every pound of building material has to be packed in on the backs

of men, and where inclement weather often retards the progress of construction for days at a time, calls for an expenditure of several thousand dollars. The mere maintaining of the Club trails over and through the mountains, keeping them reasonably clear of blow-downs and marked with blazes and sign boards, requires the employment of labor and costs not far from $2,000 a season. None of these activities yield the Club any revenue, nor do they afford any advantages to its members that are not enjoyed as fully by non-members. Such charges as are made for bed and board at the cabins are only sufficient to cover the costs of the service and the upkeep.

Bringing people thus into close association with the mountain forests is not alone physically beneficial and mentally inspiring to them, it also tends to promote a more intelligent appreciation of the public value of those forests, not merely as pleasant places in which to ramble on a holiday, but as producers of a raw material that is absolutely essential to the continued prosperity and happiness of the State and all its people. Because of its interest in the development of better forests and of an intelligent public sentiment for the protection of the forests the Appalachian Mountain Club has made these contributions toward the more general enjoyment of the hill country and their deep woods as a public service.

REFORESTATION

The State Forest nursery was established at Gerrish in April, 1911, in accordance with section 23, chapter 128 of the Forestry laws of 1909. One and one-half acres of land with a house and barn were leased for a ten year period. In 1912, 62,000 trees were distributed from seedlings purchased the year before and transplanted in the new nursery. This amount was increased from year to year until 1916 when the maximum of 443,000 trees were grown and distributed. By 1914 the nursery work had become so well established that the State purchased a farm of 142 acres with buildings adjoining the leased area at Gerrish, but little use was made of the land as a nursery until it became impossible to release the one and one-half acres in 1921. During the war nursery work was more or less suspended and not until the spring of 1920 had anything like normal conditions returned. The Forestry Department has for a number of years been improving and building up the farm purchased in 1914 for nursery purposes and is now striving to regain the loss suffered by the failure to renew the lease of the original nursery site. Many years are required to put run down and inferior land into suitable condition to grow forest seedlings. Out of 24 acres of tillable soil on the present nursery farm only 16 acres are fit to grow trees under any conditions because of undrained or uneven soil. Scarcely more than eight acres on the present farm are reasonably well adapted to nursery purposes. This area is now being utilized and the output has been increased from about 426,000 for the biennial years 1919-1920 to 520,000 during the last two fiscal years. In order to further increase the nursery capacity on the present farm, it will be necessary to clear new land on an upper level back from the present nursery site and where no water is

available. The cost of putting this area in shape for nursery purposes is considerable and several years will be required with an expenditure of funds for a water supply, including a storage reservoir. The present nursery farm can be made to yield upwards of a million trees per year in time.

The price of growing trees has been affected by general high cost of labor during the past few years. Trees which were sold for $3.00 and $4.00 per M. ten years ago are now costing $8.00 to grow in the nursery. While this price has not been changed in sales to private parties since 1920, it will probably be necessary to increase the price within another year or two. White pine continues to be the standard tree grown in the nursery although considerable Scotch pine is grown and distributed as well as planted on state land where soil conditions are exceedingly poor. Unfortunately it is impossible to secure any amount of Norway or red pine seed. The Department purchases all the Norway seed possible from collectors in this part of the country and employs men to collect seed from a few places in New Hampshire where seed is available during favorable years. The whole amount of Norway seed which the Department has been able to secure, however, is so small that trees of this species can not be supplied to the extent desirable in view of their adaptability and value for planting in New Hampshire. If an abundance of Norway pine seed could be collected or purchased each year the Forestry Department would plant Norway pine much more extensively on state land and recommend it to private parties.

During the last 12 years the Department has planted about 1,000 acres of state land with trees grown in the State nursery and distributed to private parties trees for the planting of about 1,700 acres more. Orders for trees received by the Forestry Department and turned over to private nurseries have made possible

the planting of 1,200 acres, making a total of 3,900 acres planted in New Hampshire either with trees from the State nursery or purchased through the Department. A great many plantations are made with trees purchased direct from private nurseries or with wild stock and the Department has no records of the extent of such planting. It is believed that at least 5,000 to 10,000 acres represent the total extent of planting at the present time. This is not a large area when compared to the amount of land available for planting and not productive for any purpose. The State should be able to supply trees in greatly increased quantities. Private nurseries, if they could have enough trees always available at reasonable prices and made special efforts to interest land owners in planting, could undoubtedly supply hundreds of thousands of trees a year. The average cost of State planting including the cost of trees and transportation is about $15.00 per acre. The question of planting today is not so much a question of cost as it is ability to secure the trees. This is a most discouraging aspect of the reforestation problem, but one which can be remedied if the State can maintain an adequate nursery or private nurseries can be induced to go more extensively into the business of raising trees for forest planting. Commercial nurseries can not afford or do not try to grow more trees than they are sure of selling. While small orders can generally be filled, it becomes impossible to furnish the trees for large orders. During the past two years the State and commercial nurseries together have not been able to supply more than 50 per cent of the demand for planting stock and the desirability of planting has never been fully advertised. As a means of obviating this difficulty where large supplies are likely to be needed, the Forestry Department has urged private landowners to establish and maintain small nurseries of their own. One such nursery has already been established

near Rochester to grow 150,000 trees and others are being considered by large corporations and city departments. Where a land owner can see his way to plant 25,000 to 50,000 or more trees per year, it is believed to be entirely feasible for such owner to grow the trees himself if there are facilities and the trees may be given suitable care. Almost any landowner can grow a few thousand trees in his home garden. Until at least a million trees can be planted each year on waste and cut over land, it is apparent that great progress in reforestation work in New Hampshire is not being made. As a matter of fact several million trees per year would not be a large program for the people of this State.

Table X shows the planting record of the State nursery for the two years ending June 30, 1922.

Table X

PLANTING RECORD 1921 AND 1922

Period	Trees Planted on State Forests	Trees Planted on Ten Year Tracts	Trees Sold for Private Planting	Totals
Fall, 1920	29,000	13,000	20,062	62,062
Spring, 1921 ...	77,450	15,000	113,774	206,224
Fall, 1921	17,000	1,000	31,506	49,506
Spring, 1922 ...	93,200	5,500	103,613	202,313
Totals ..	216,650	34,500	268,955	520,105

Directions for Growing Trees in Home Nurseries

Any person interested in forest planting and who has a home garden may grow his own trees and thus save the expense and difficulty of purchasing them. It is now impossible for the State to supply trees to many who apply for them. The following brief instructions have been worked out for the benefit of those desiring to start a home nursery.

Seed may be secured from cones in late August or early September before they are opened by early frosts. A bushel of cones will yield about three-quarters of a pound of seed, sufficient to grow at least 3,000 seedlings in a home garden. The cones may be opened by spreading them on a cloth in the sun for a few days and then thrashing out the seed. After cleaning, the seed should be placed in a cool dry cellar over winter where the mice can not get at them. Seed may also be purchased from a number of commercial seed dealers.

Select a garden spot early in the spring where the soil is mellow and well drained and free from weeds and weed seed. Lay out the beds, preferably 4 x 12 feet with paths between. The beds should be carefully worked and smoothed with the center of each an inch or two higher than the edges, and thoroughly watered the day before sowing the seed or else plan the sowing after a soaking rain. One ounce of white pine seed is sufficient for three square feet of surface or a pound to a 4 x 12 foot bed. Use half as much of spruce or two-thirds as much of either red or Scotch pine. Sow the seed evenly over the bed and cover them with a layer of soil equal to the thickness of the seed or more if the soil is very light. An ash sifter or box with a screened bottom can be used for sifting the soil over the beds. The beds must be protected from birds and from drying out by making sides and tops. Stakes driven at the corners, about a foot in height and connected by strips of wood make suitable supports. The sides may be covered with building paper held in place at the bottom with soil, or boards may be used if they are available. Lath frames are best to cover the tops of the beds. These frames should be made with openings between the laths the same width as the laths, giving half open spaces. Until germination takes place building paper or burlap should also cover the lath frames. About 21 days are required for germination of

white pine and about 14 days for other pines and spruce.

After an even stand has germinated and the seed caps still cling to the seedlings the paper shade over the lath frames should be removed. The partial shade of the lath frames is necessary more or less until late in August, and particularly at the first of the season. During rainy weather the frames should be removed entirely but replaced when the sun is shining. Great care must be given the beds during the first three or four weeks after germination. If the beds become dry, sprinkle them slightly. If they are wet and heavy as during and after rains a damping-off fungus may destroy many of the seedlings soon after germination. This may be checked to some extent by airing the soil around diseased spots with a pointed stick. In very hot, dry weather the lath frames may not furnish sufficient shade, in which case the openings between the laths should be filled with additional laths. After a month from the time of germination, weeding will be necessary and this should be continued as required until late in August when all shade should be removed so that air and light may pass freely through the beds. The little seedlings need the full light in order to harden and become resistant to freezing temperatures. They will need weeding but no shade during the second season and watering will not be necessary unless the soil becomes unusually dry.

When the seedlings are two years old they should be transplanted to other beds in order to develop stocky root systems to enable the trees to compete with vegetation when permanently planted. This is done by carefully spading up the beds with a fork, shaking the seedlings free from soil and placing them in bundles with the roots in a pail or pan of water ready for transplanting. Use great care not to expose the roots to the sun or wind for more than a few minutes at a time. The seedlings may be transplanted a row at a time into

beds 4 to 6 feet wide, with about one inch between the seedlings and with the rows about 6 inches apart. The Forestry Department and most commercial nurseries use a transplanting board with notches for holding seedlings and a hinged cover which keeps them in place while they are being planted. The board is strung with seedlings, a trench made the length of the board and about six inches deep and the board held over the trench while the soil is packed about the roots of the seedlings and then removed. By this method much time is saved in transplanting work.

Very little attention is needed except weeding while the trees are in the transplant beds. After one year the trees are known as three year old transplants and are then suitable for planting, or they may be kept in the transplant beds an additional year to good advantage. It is well to have trees of different ages growing in the home nursery so that a few thousand, or as many as desired, may become available in succeeding years. It is well to remember that in taking up the seedlings preparatory to planting them permanently, great care must be used to keep the roots from drying. They should be carried from one place to another in pails with the roots in water or wet moss. They may be dug, packed in bundles and heeled in for a considerable number of days by digging a trench and laying the bundles in the trench with the roots well covered with soil. If transported any distance, the bundles of trees should be packed with wet moss in baskets or crates and then heeled in near the planting site until needed.

SURVEY OF FOREST RESOURCES

The survey of forest resources begun in the summer of 1919 was completed with the present fiscal year, excepting the cities of the State where, on account of the difficulty of separating rural from city property in the local records the classification of lands was found to be impossible. The areas within cities comprise less than five per cent of the State and will be covered during the following year by making type maps of the rural portions. The final results check very closely with the estimates published in the last biennial report after 130 towns or 58 per cent of the State were surveyed. The land area of each town has been divided into four classes, namely, merchantable timber; young, valuable growth; waste land and inferior growth; and improved farm land and pastures. A further division of merchantable timber into principal species and of valuable young growth into softwoods, hardwoods and mixed growth is shown with the results grouped by counties, in Table XI.

The total area of the State as determined from the best available maps is 5,830,860 acres. Of this, the area of merchantable timber as determined by the survey is 1,020,750 acres or 17.5 per cent; young valuable growth 1,713,874 acres or 29.3 per cent; waste land and inferior growth 1,950,052 acres or 33.5 per cent; improved land and good pasture 1,020,570 acres or 17.5 per cent; and water surface 125,614 acres or 2.2 per cent. The area of merchantable timber is practically the same as that of improved land and good pasture while the area of young, valuable growth is somewhat less than that of waste land and inferior growth.

The area of merchantable timber contains about 7.4 billion board feet, of which 27 per cent is pine, 31.2

Errata: In place of second paragraph, Page 96:

The total land area of the State as determined from the best available maps is 5,705,246 acres. Of this, the area of merchantable timber as determined by the survey is 1,020,750 acres or 18 per cent; young valuable growth 1,713,874 acres or 30 per cent; waste land and inferior growth 1,950,052 acres or 34 per cent; improved land and good pasture 1,020.570 acres or 18 per cent. The area of merchantable timber is practically the same as that of improved land and good pasture while the area of young, valuable growth is somewhat less than that of waste land and inferior growth.

per cent spruce, 5 per cent hemlock, and 36.7 per cent hardwoods. Poplar is included with hardwoods as it was found impossible to separate them.

The area of young, valuable growth is divided into softwoods, pine, spruce and fir, 35.1 per cent, mixed softwoods and hardwoods 22.8 per cent, and hardwoods 42.1 per cent. All of this will make merchantable timber in time as distinguished from the area of waste land and inferior growth, most of which will not produce timber of more than cordwood value. This area of waste land and inferior growth is intended to represent unproductive land, resulting from clean cutting on poor soils, burns, abandoned pastures not reseeding to valuable growth but also includes highways and areas within village limits. This area in general can supply large quantities of fuel wood but estimates of the amount have not been considered. Much of this class of land is in the more densely populated sections on poor sandy or rocky soils and where market conditions would be the best. It is unfortunate that so much of our waste and unproductive land should be so situated, disfiguring the main avenues of travel and the landscape near cities and towns and returning little of value to their owners. Reforested and under management they would eventually double our yield of timber and become an asset of unbelievable value to the people of the State.

Table XI

FOREST SURVEY OF NEW HAMPSHIRE

COUNTY	Total Land Acres	Total Forest Land Acres	MERCHANTABLE TIMBER					
			Total Acres	M. Board Feet				
				Total	Per Cent. Pine	Per Cent. Spruce	Per Cent. Hemlock	Per Cent. Hard-woods
Belknap	283,043	213,401	16,074	229,705	64.3	5.7	8.3	21.8
Carroll	606,994	530,148	149,795	759,187	44.1	20.9	7.8	27.2
Cheshire	447,739	355,328	52,788	490,477	54.0	12.9	10.9	22.0
Coos	1,153,300	1,067,564	405,511	2,649,780	.3	43.5	1.1	55.2
Grafton	1,078,623	873,226	243,630	1,688,451	18.3	43.9	3.8	34.0
Hillsboro	554,225	436,156	36,759	324,683	66.3	4.4	9.3	19.9
Merrimack	579,828	462,563	51,811	542,053	56.9	11.8	7.8	23.5
Rockingham	430,333	308,954	21,872	256,286	80.6	.2	7.7	11.4
Strafford	243,556	174,146	10,965	136,108	71.0	1.6	14.7	12.7
Sullivan	327,605	263,190	31,545	314,350	29.5	30.4	10.4	29.7
Totals for State	5,705,246	4,084,676	1,020,750	7,390,380	27.0	31.2	5.0	36.7

Table XI—(Continued)

FOREST SURVEY OF NEW HAMPSHIRE

UNTY	YOUNG VALUABLE GROWTH				Waste Land and Inferior Growth	Improved Farm Land and Good Pasture
	Total Acres	Per Cent Soft woods	Per cent Mixed	Per Cent Hard woods	Total Acres	Total Acres
Belknap.	57,002	32.3	24.2	43.5	139,425	69,624
Carroll....	180,965	29.0	22.8	48.2	199,388	76,846
Cheshire.....	126,635	34.5	17.5	48.0	175,905	92,411
Coos.....	480,837				181,216	85,736
Grafton.....	264,657	39.8	26.1	34.1	364,939	205,397
Hillsboro.....	178,754	37.3	19.5	43.3	220,643	118,069
Merrimack.....	173,570	34.1	22.2	43.8	237,182	117,265
Rockingham.....	102,878	35.9	27.0	37.1	184,204	121,979
Strafford.....	46,726	45.7	20.1	34.2	116,455	69,410
Sullivan.....	100,050	28.2	23.8	47.9	130,695	64,415
Totals for State...	1,713,874	35.1	22.8	42.1	1,950,052	1,020,570

BRUSH BURNING IN NORTHERN NEW HAMPSHIRE

By W. R. BROWN

In cooperation with the United States Forest Service, the Brown Company of Berlin, New Hampshire, conducted an experimental camp for brush burning in Northern New Hampshire during the winter logging season of 1921-22. The place for an experiment was selected by employees of the Forest Service from the Maine and New Hampshire lands of the Brown Company, in order to secure what they considered to be the average conditions in the New England region. The place chosen was Hell Gate camp on the Dead Diamond river in Northern New Hampshire. This camp served the purpose of a general storehouse for the Brown Company, and was surrounded by a considerable number of camps. In the summer it was 43 miles from the railroad, partly over a good State road, and in the winter 25 miles over a snow road, so that men and provisions were obtainable at reasonable figures. The men and horses used in the work were lodged in the Hell Gate camps with a nominal charge for overhead. They were boarded at cost and their labor was charged at the going rate for men and horses for the winter.

The work was laid out to accomplish the following:

Operation I. To ascertain the extra cost of piling and burning brush in crews operating for long logs over the usual cost where brush piling and burning was not done.

Operation II. To ascertain the extra cost of piling and burning brush in crews operating for four foot

pulpwood over the usual cost where brush piling and burning was not done.

The comparison undertaken in Operations I and II was conducted in the same approximate area, but each operation was divided into two methods of piling and burning:

Spring Burning, A. Where the brush was piled in the summer and fall before the snow came and when it was unsafe to burn, and burned either on the first snow in the fall or in the spring, and

Winter Burning, B. Where the brush was burned as fast as piled in the winter on snow.

The area chosen for Operation I, A. and B., and II A., carried a stand of medium tall, scattering, average topped spruce and fir balsam with which a considerable amount of hardwood was mixed with an average amount of underbrush. The bottom was rough and broken but reasonably free from windfall.

The area chosen in Operation II B. was divided into two locations, the first location carrying a fair stand of spruce and fir timber equal to the stand in area cut in Operation I, A. and B., the second location carrying a splendid stand of mature old growth spruce and fir, large and heavy topped, which had never been cut into, with little or no hardwoods or underbrush, a fairly smooth bottom and reasonably free from windfall.

Area in Operation I, A. and B., and the first area in Operation II, B., were one mile from the camp on the side hill close to a drivable brook. The second area in Operation II, B., was situated two miles from the camp on a flat, and a mile from a drivable brook.

The mutual agreement between the Forest Service and the Brown Company specified in advance the wages chargeable for men and horses; the cost of provisions; overhead charges for camp use and depreciation of equipment; that an agent of both was to be in constant

attendance on the job; that weekly and monthly reports were to be rendered; that figures obtained were to be kept confidential until agreed upon at the close of the season; that the result obtained from one year's work was not to be considered determinative for all time.

The operation was commenced on October 16, 1921, and finished on March 8, 1922. Snow coming early on November 5th interfered with the burning of brush which had already been piled out during dry ground logging, and these piles had to be abandoned to be burned in the spring. Little or no rain fell in the fall or winter to ice the brush piles and interfere with burning. While the early snows were somewhat heavy, later snows were light and weather logging conditions in general were the most favorable for years.

In Operation I, A. and B., Long Logs, Spring Burning and Winter Burning, five crews of five men each were set to cut long logs, each crew consisting of a teamster, a head chopper, second chopper, swamper and sled tender. Alternating each week two of these crews acted as control crews and did the usual straight logging. The other three crews in addition to their straight logging piled their brush in the fall and burned it during the winter. In the fall the swamper and sled tender piled their own brush, but when the snow became about two feet deep a brush burner became necessary and was added to the crew. The personnel of the crews remained the same as far as possible, subject only to the usual replacement of men leaving. An attempt was made by a capable boss to secure the best talent possible from the many men passing through the Hell Gate storehouse.

In Operation II, B.,—Pulpwood—first location, two crews consisting of three men each, a first and second chopper and swamper, were set to cutting and piling four foot pulpwood. They alternated weekly during the season, one crew piling and burning brush and

the other acting as control crew without burning brush.

In Operation II, B.,—Pulpwood—second location, in the old growth, four crews of three men each were set to cutting and piling four foot pulpwood, two burning brush alternating with two not burning brush.

Careful scale and accounts were kept by representatives of the Forest Service and the Brown Company working together, who were in substantial agreement as to amounts and costs. The system of scaling and accounting was that used by the Brown Company in its many operation and covered practically every detail. At the close of the operation in March unburned piles left when the snow fell in the fall were burned in the spring by special crews between April 25th and May 3d without endangering the forest.

In the crews where brush burning was being done, the branches as fast as they were lopped were dragged into piles and burned, fire being carried from one pile to another. It was necessary to start from four to ten fires daily in each crew. The branches burned readily when freshly cut, but if piles were left and became covered with snow, the snow acted as a wet blanket and made a fire extremely difficult to start and maintain. It was found better practice in order to burn piles that had been covered by snow to start a fire and move the branches piece by piece to the new fire, rather than to try to burn them where they lay. It was necessary to haul branches lopped from long logs farther in distance than where lopped from the trees felled to be cut into four foot pulpwood, because the boles of the trees from which long logs were being made had to be felled alongside and lengthwise of a drag road, while trees destined for pulpwood could be felled in any direction and the resulting brush was more readily gotten together. Piles burned holes in the ground of an average diameter of ten feet, but the ratio of the sum of these areas to the whole area of the forest

was of little moment. No attempt was made to burn blow down or natural forest litter, of which there was a considerable amount on the ground, or such hardwood trees as were felled in the making of roads. The men were somewhat bothered from the sparks igniting their clothes and a few left on account of the expense of keeping in clothes. No trouble was experienced from men loafing in front of the fire and no burning accidents were experienced.

The final figures as agreed upon for this test showed a total average expense from all operations on all areas of $1.05 per cord for brush burning over the usual logging costs. This was divided among the various experiments as follows:

The average extra cost for Operation I—Long Logs —Spring Burning, for burning brush piled in the fall and burned in the spring, was $1.82 per cord, or an addition of about 20 per cent to the cost of cutting and hauling, but one dollar of this amount was due to the necessity of spring burning. As a practical matter brush piling called for an addition of one extra man in each crew for the purpose, as it took all the time of one man to collect and pile the brush for two choppers, a swamper and sled tender, these men favoring the brush burner as much as possible.

When as in Operation I, B.,—Long Logs—Winter Burning, the piling and burning was all done in the winter months,, this extra cost was reduced to $1.01 per cord or an addition of 16 per cent to straight logging. While costs for cutting were larger than in Operation I, A., the costs for hauling were less, and this job escaped the extra cost of spring burning.

In Operation II, A.,—Pulpwood—Spring Burning, so little four foot pulpwood was cut in the fall, an amount of only 55 cords in all, and the brush piled for burning in the spring, that it was considered not enough to make a comparison and the figures are not given.

Also an attempt to burn in the fall the brush from 64 cords of long logs in Operation I, A., long logs proved to be so expensive and unsatisfactory that the cost was not used in arriving at the figures above.

In Operation II, B.,—Pulpwood—Winter Burning, there was a difference of 42c per cord in the cost between a crew cutting and piling four foot pulpwood and burning the brush and one not burning the brush, or an addition of eight per cent to the cost of burning and piling.

Many interesting lessons were learned from this experiment which have a bearing on the desirability of the introduction of this kind of work in northern New Hampshire. It is probable that there will be less cost per cord in brush burning while cutting four foot pulpwood during the winter months than when cutting long logs, for the following reasons: That the men are close to their work; that the bole of the tree is run further into the top; that less right-of-way for road has to be made; and that the tops have to be dragged a less distance. The cost of brush burning will remain reasonably steady during the year, being a trifle higher in the early months and reduced a little as the year progresses, provided deep snow is not encountered, due to the experience of the men and the stimulus given them by the management. The cost of brush burning in the heavy growth will be somewhat less than in the light growth, and the difference between burning and not burning in the heavy growth will be less than in the light growth. It would seem to the writer however, that the outstanding lesson learned was the greatly increased difficulties and costs of spring burning over winter burning and the dangers attendant thereon. More and more the long log cut is being displaced by a straight four foot pulpwood cut. Much of this wood is peeled in the early summer before being cut up and

much of the pulpwood timber is scattering and must be picked up in the fall on bare ground before the arrival of deep snow. Since therefore the greatest proportion of four foot pulpwood is cut in New England during the summer and fall, during the season when it is unsafe to burn brush this brush must be piled and left for burning later. In only two seasons of the year can this be safely done. The first is late in the fall when heavy rains have set in or on the first fall of snow; the second, a short interval in the early spring. As the snow comes quickly in New England, the interval afforded for this work in the fall might be less than one week and in an average year at best would afford only two or three weeks for work. During this short period if large operations had been made over a whole state in the summer and fall, (Maine and New Hampshire for instance would probably cut better than two million cords of four foot pulpwood before the snow came) it can easily be seen that a great army of men would be required to cover all the brush burning, a practical impossibility to secure on account of distance, distribution and uncertainty. This condition would exist in the spring in a more acute degree, the time of burning being even shorter, and the moisture hanging in and around the piles longer than in the open. In the spring after the men have left the woods for good, (summer logging not starting until much later,) it would be a costly matter to bring them back and run camps solely for this purpose, for such a short time for such a large number of men. Again burning brush in the fall and spring, to say nothing of the occasional pulpwood pile that experience has shown is destroyed by some careless burner, would necessarily have to be left to the judgment of the logger, as conditions and seasonal changes vary in different localities. It is impractical to supervise such work by any possible fire warden system over an

immense area, and a tremendous fire risk would be existent if the burning was left to general judgment.

It also must be borne in mind that New England conditions as to brush burning parallel but slightly Western, Southern or European conditions in the matter of soil, seasons, forest floor, stand per acre, species, climatic change, rainfall and many other variants, and little comparison can be had. While it is true that burning clears the immediate vicinity of fallen trees or brush or slash, there still remains a larger area adjacent to and between roads, in areas where from the scarcity of trees or other reasons no cutting is done, along the banks of brooks, in old roads and landings and in a thousand places, which still remain covered with a considerable amount of forest litter, blowdown, bushes, leaves, dry grass, bare sticks and other inflammable matter which it would be an impossible task to rid the forest of, and this is at all times equally ignitable by lightning, careless campers and the usual fire risks. Such litter is constantly accumulating, especially from wind throw, following thinnings, from bug work, rot, etc., and the areas it covers would not be cut over by operators in many years. If brush burning in New England was made compulsory for every operation, the fire risk of the State would be little helped for generations. In other words, the burning of brush in operations alone is not at all a complete riddance of inflammable material existing in the woods and only in small restricted areas offers a partial solution of the fire risk. It is also well known that once a fire is well started in dry weather and high winds it will run in the crowns of trees alone.

For the reasons stated above, therefore, it is the writer's opinion that the advantage gained for New England in fire protection, by spring or fall brush burning, would not be at all commensurate with the attendant cost and danger to the State.

While it is understood that the results obtained

above were for a single year and carried on by inexperienced labor, which necessarily would be subject to some improvements were tests continued, it is believed that experienced labor and technique could not greatly reduce the costs, as the nature of brush burning is neither intricate nor difficult of comprehension.

If there are something like 600,000 cords of wood cut yearly in a small state like New Hampshire and some millions in New England as a whole, the addition of anything like a dollar a cord yearly to the cost of operating this amount, or from $600,000 to some millions of dollars annually, for the sake of fire protection would not from a financial point seem to be sound business for the public, when during the last ten years the average annual fire loss in the State of New Hampshire by forest fires is not in excess of $50,000. It is the writer's opinion that, purely as a fire protective measure, judging from unfavorable climatic conditions, the inadequacy of results obtained and the excessive cost, the burning of brush in logging operations in New England is not good forestry practice. A much smaller tax upon the community spent in fire protection as applied to education, report, patrol, accessibility, equipment and enforcement would yield and is yielding far greater results. From a forestry angle, the burning or leaving of brush and slash offers an interesting field at the present time in New England for further investigation to ascertain what effect it has, if any, on the harboring and spread of devastating beetles, what effect it has if left evenly scattered about in furnishing shade for seedlings and in retaining moisture in the spring. What would be the loss in reproduction if seed cones were all burnt up; what is the length of time that seed can remain fertile in the forest floor and germinate and in what kind of forest floor it lives longest; how long lopped limbs take to rot naturally; and some other brush disposal matters are problems about which the writer is uncertain.

THE SEED TREE LAW OF 1921

Although the seed tree law of 1921 did not become effective until September 1, 1922, a great deal of publicity was given to the law during the past season and many operators began leaving pine seed trees in anticipation of the law becoming effective. This law was passed in order to encourage the reproduction of pine on cutover pine lands and in addition requires the party responsible for cutting to file with the State Forester a statement of intention to operate before cutting begins, as is also required by recent legislation in Massachusetts. The New Hampshire law has met with general approval. Very few have shown any disposition to question the justice of the law or any unwillingness to conform to its reasonable requirements. Chapter 22, Laws of 1921, is as follows:

> "Section 1. Every person, firm or corporation responsible for the operation of lumbering or cutting timber on pine woodlands shall leave standing upon every acre where pine trees represent 75 per cent or more of the total number of trees of merchantable size upon said acre, at least one pine tree ten inches or over in diameter on the stump and of sufficient spread of crown to be wind firm and capable of producing an abundance of seed cones during the bearing years. Such pine trees left for seed shall be the property of the land owner, but they shall not be cut until at least fifteen years have elapsed after the operation of lumbering on said land, except where such seed trees interfere with the clearing and improvement of land for agricultural or other purposes.

"Section 2. Such person, firm or corporation shall before lumbering begins on any pine woodland as defined in section 1, file with the state forester a statement of intention giving the name, location and approximate size of the lot to be operated, upon penalty of a fine not to exceed $100 for failure to file a report upon complaint of the state forester. It shall be the duty of the state forester, under the direction of the forestry commission, to examine all pine woodlands during or immediately following lumbering operations to determine whether or not the provisions of section 1 have been adequately and reasonably complied with.

"Section 3. Every person, firm or corporation failing to carry out the provisions of section 1 shall be fined an amount equivalent to $5 for each and every acre upon which a seed pine has not been left standing as provided in section 1. The amount of such fine shall be credited to the forestry fund in the state treasury and used by the state forester in supplying trees from the state nursery and labor of setting them out on the particular area cut over contrary to law, to the extent of the amount of fine and in the most practical manner.

"Section 4. This act shall take effect September 1, 1922, and the forestry commission is hereby charged with its enforcement."

The above act applies to the cutting of pine lots where 75 per cent or more of the trees of merchantable size are pine. Thinning or removal of a few scattered trees will not be considered an operation of lumbering as defined in the act. The Forestry Commission will

look for and expect a reasonable compliance with its provisions. Failure to file a statement with the State Forester before cutting begins on pine lots, giving the name, location and size of the lot, will be prosecuted. There is a penalty of not to exceed $100 for failure to file such statement.

Any large area cut over with no pine seed trees left standing or without young pine growth under way will be considered a violation of the provisions of this act. Pine trees of suitable size left along the borders of lots and around interior openings and elsewhere so that an apparent effort has been made to leave a tree for every acre from among the more limby and scrubby trees will be considered to fulfill the requirements. Trees which are very tall and slim are not windfirm and will not make satisfactory seed trees. There is no disposition to force the leaving of trees of high timber value or those which are unsuitable or not likely to stand the wind. Every party responsible for operating should see that at least an average of one tree for every acre reasonably well distributed is marked before operating begins and he should be sure that the choppers do not cut these trees.

Seed trees left are the property of the land owner and are to be allowed to stand for fifteen years after the lot is operated unless the land is afterwards cleared and improved. There is a fine of $5 for each and every acre where a required seed tree has not been left standing, to be collected by the State Forester and applied to the planting of trees on the land where seed trees are absent. The State Forester will cause all lots to be examined during or following cutting, to see that the provisions of the act are carried out in a reasonable manner. Examination can not be made before cutting begins, although the Forestry Department will endeavor to cooperate with and advise parties beforehand as far

MEMORIAL ROADWAY LEADING TO THE MONADNOCK STATE FOREST
Constructed and given to the state by Joel H. Poole of Jaffrey

as it is able to do so. The filing of intent to operate is fundamental and must be lived up to.

A great many interesting and important facts have already been brought out. Not a few land owners have for years been leaving seed trees as well as young pine growth. Most land owners when they understand the importance of it are anxious to have trees left for seed. When they sell standing growth, they should select trees which they desire to have left. Purchasers of stumpage are willing to have these reservations made when it is understood that the seed trees belong to the land owner and are not to be sold. One concern uses small wooden posters marked "Seed Tree. Do Not Cut." Others mark the trees with paint spots, but mostly the trees are blazed with an axe as a guide to the choppers.

The purpose of the seed tree law is not arbitrary interference with private operations, but to improve the conditions of cut-over pine lands from this time on, which is a matter of great economic importance to the general public, and to the landowners and the white pine lumber industry. It merits the cooperation of every citizen interested in the perpetuation of white pine.

FORESTRY WORK ON PRIVATE LANDS

The Forestry Department has been able to retain the services of many of the foremen of blister rust crews during the last four years because of work which they have done for towns, institutions and individuals during the winter periods without any expense to the State. The demand for men to prune shade and ornamental trees, prepare surveys and maps of private lands, make thinnings and improvement cuttings in woodland, paint gypsy moth egg clusters, and carry on a diversity of outside work closely related to forestry and landscape gardening has been both surprising and gratifying. Over seventy projects were carried out under the direction of J. M. Corliss, who is field supervisor for the Forestry Department during the blister rust season from spring to fall, but no part of the work was performed by men while in the employ of the State. The value to the State at present is in being able to keep the men needed on State work from one season to another without expense during the winter.

One of the projects undertaken during parts of the last two winters near Nashua as suggestive of what might be done on many similar tracts, was a thinning of pine and a general improvement of an entire tract by cutting hardwoods and planting open areas with pine. About 210,000 board feet of pine and 75 cords of hardwood were removed in the form of a thinning, greatly to the benefit of the whole stand and at a profit of $3,308. Out of this profit $1,577.50 (or $7.50 per acre) were spent in cutting brush and hardwood sprouts from an area of 205 acres where natural pine seedlings were being suppressed and killed; $565.50 were spent in planting about 30 acres; and $50 was the cost of burning brush and slash in and around the tract. There

was a net profit of $1,115.83 and the entire tract was brought into valuable growing condition, where before there was only a stand of pine occupying part of the area which was too dense to grow at its best. The thinning of the pine stand not only increased the rate of growth and shortened the time necessary to mature the stand, but paid for putting 235 acres additional into growing pine with a balance of $1,115.83.

In time it may be possible to handle many important operations and by so doing, help to encourage private forestry practice by those who are anxious to do so, but are unable to personally look after the work. The State Forester is authorized by law to cooperate with counties, towns, corporations and individuals in the protection, management and replacement of trees, woodlots and timber tracts where the expenses are paid by the parties receiving assistance. There seems to be a real opportunity to help land owners in estimating and marketing and advising in the management of their lands. These are matters not overlooked in planning for the future.

BOY SCOUT FORESTRY PROGRAM

The Forestry Department has recently undertaken to carry out a program of instruction in forestry with the Boy Scout organizations of New Hampshire, which consist of 100 scout masters and 2,000 boy scouts. The opportunity to enlist in some degree the interests and activities of boy scouts in general forestry, but particularly in forest protection, reforestation and woodland management, has long been recognized. In fact such knowledge is really a part of and only an advanced step in the logical training of the boy scouts. Executives and scout masters have shown much interest in the project. A means of carrying it out has been made possible through the county blister rust agents employed by the Federal government under the direction of the State Forester. These agents will meet with the various scout troops as frequently as possible and accompany them on trips of instruction. The following program has been worked out for the coming winter and spring.

Identification of Trees.
- Through means of leaf, bud, twigs and characteristic form and color.
- Life habits of trees, such as light, soil and moisture requirements.
- Competition of trees growing together.
- Commercial uses of trees.

Forest Protection.
- Fire prevention and control.
- Forest tree diseases and insects.

Reforestation and Planting.
- Visit State or such commercial tree nurseries as may be nearby.
- Collect seeds.

Preparation of seed-beds and care of them.
Planting trees.
Forest and Woodlot Management.
Brief discussion and demonstration.
How to reproduce valuable woods after cutting.
How to improve the value of young forests.
Care and Treatment of Shade and Ornamental Trees.

HISTORY AND CONTROL OF THE SPRUCE BUDWORM

H. B. PEIRSON, Maine State Forest Entomologist

The general public has little knowledge of the tremendous damage which has been done to the spruce and fir forests of the Northeast during the last ten years following a widespread outbreak of the spruce budworm. The losses in some localities are beyond all belief, and if it were not for actual cruising reports covering large areas of forest land, statements made might well be open to doubt. In Maine reports on township after township show all the merchantable fir, and fifty or more per cent of the spruce to be dead, and in many cases the trees are still dying. In the provinces of New Brunswick and Quebec the loss is also stupendous. In New Hampshire no definite figures have been obtained for the spruce region of the State, but the damage is variously estimated at from ten to twenty per cent. The presence of large amounts of hardwoods has had considerable to do with keeping the damage low.

Outbreaks of the budworm have occurred in the Northeast periodically in about forty year cycles which investigation has shown is the time required for a crop of spruce to work its way up through the transition type of hardwoods or softwoods. The earliest records are those relative to an outbreak in Maine in 1818. Mr. Austin Cary in "The Forester" for March, 1900, page 52, mentions lumbermen telling of great destruction of spruce timber in northern New Hampshire and Vermont occurring thirty years' previous. The drives on the Connecticut are said to have been made up largely of dead timber. Packard in 1880 mentions seeing a good many dead spruce and firs while traveling between

Gorham and the half-way house on Mt. Washington. The last outbreak started about 1912 and in some localities is still underway. In each case the budworm outbreak has been followed by bark-beetle epidemics and fungi which attack the weakened trees.

The spruce budworm is a defoliating insect which starts feeding within the new buds of the fir or spruce, hollowing them out, and later feeds on the foliage itself, stripping the trees. This defoliating of the trees so weakens them that they are made easily subject to such agencies as winterkilling, drying out, barkbeetles, or fungi. In conifers there is very little storage place for food, the trees depending upon the food taken in from day to day. This means that if the source of food supply is cut off for even a short time, such as takes place when the tree is defoliated, the tree dies because there is practically no reserve food present. The budworm is present in small numbers at all times in the spruce and fir stands. When conditions become favorable, which means the maturing of a considerable amount of fir, the budworm again finds an abundance of food in the sunlight and the moths lay eggs on the needles during July.

An insect outbreak is very much like a fire in that if found in its early stages it is easily stamped out, but if allowed to run and assume great proportions the chances of stopping it under present forest conditions are very slight. The control of the budworm must take the form of prevention rather than control. Knowing the habits and life history of the insect, which are so fixed that interference at any point will upset their development, it is possible to direct the control measures against the weakest point. In the case of the budworm this point seems to be the habit of passing the winter as first stage caterpillars that have just hatched from the eggs and that are so weak that unless suitable food is present when they emerge in the spring

the caterpillars will soon die. Knowing that budworm outbreaks start in isolated spots in the forest, and that it takes several seasons to gain headway enough to be a real menace to the forest, the most logical control is for the timberland owner to send a small jobber into a newly infected area and clean cut the infected stand during the late fall or winter. In the spring the young caterpillars coming out will find nothing but dry tops and will consequently be unable to survive, their food supply having been cut off. Under ordinary circumstances this method of prevention or control, which is at present being tried out with success in Maine, would not only be feasible, but should pay for itself many fold. In the first place the infestation being located during its early stages would probably allow two seasons during which to cut the area. The operation should, if properly planned, practically pay for itself. The protection to the surrounding timber would more than offset any financial loss due to the operation.

Such a method of control depends upon a fairly thorough patrol of the forest regions and in Maine the services of the State forest fire patrol and foresters in general have been called upon. A general forest type map of the spruce region, which is now being made, will be of great service in locating outbreaks, and showing the pure bodies of spruce and fir which are the danger spots to be carefully watched. It is in such stands that outbreaks have started in the past.

A NECESSARY STEP FORWARD IN FORESTRY

By PHILIP W. AYERS, Forester of the Society for Protection of New Hampshire Forests

We have nearly two million acres of idle forest land in New Hampshire that is producing very little. We have nearly two million other acres in forests, that are producing large revenues, running our saw mills and employing thousands of people. The profits from our forests could easily be doubled. We might secure an annual gross revenue of thirty million dollars a year instead of fifteen million, as at present. New Hampshire cannot afford longer to delay a beginning in this matter of reforestation of idle forest land. To aid this movement two other things are necessary:—

1st. We must stop the creation of additional waste land. From fifty to seventy-five thousand acres are cut over annually in New Hampshire, only half of which returns to valuable forest. This is a matter for serious consideration by the Legislature. It concerns every inhabitant of the State.

2d. Our system of taxing forests often takes more annually in the tax than the annual growth on the land, which is confiscatory. In some towns where the law is enforced it is no longer profitable to hold timber in order to get the larger prices that mature timber brings. Until this is changed, it is hopeless to expect private owners to retain growing woodland, except over short periods for speculative purposes. With a growing scarcity of timber throughout the country at large, New Hampshire should be growing valuable timber, not useless bushes.

Throughout the Northeastern States, we are beginning to import timber from the Pacific Coast, through

the Panama Canal, at high freight rates, and at the same time we have vast areas of idle land at our doors. A start in the right direction should be made by the Legislature this winter. Trees grow slowly, and it will be too late to start when the pinch comes.

FOREST MANAGEMENT BY THE NEW ENGLAND BOX CO.

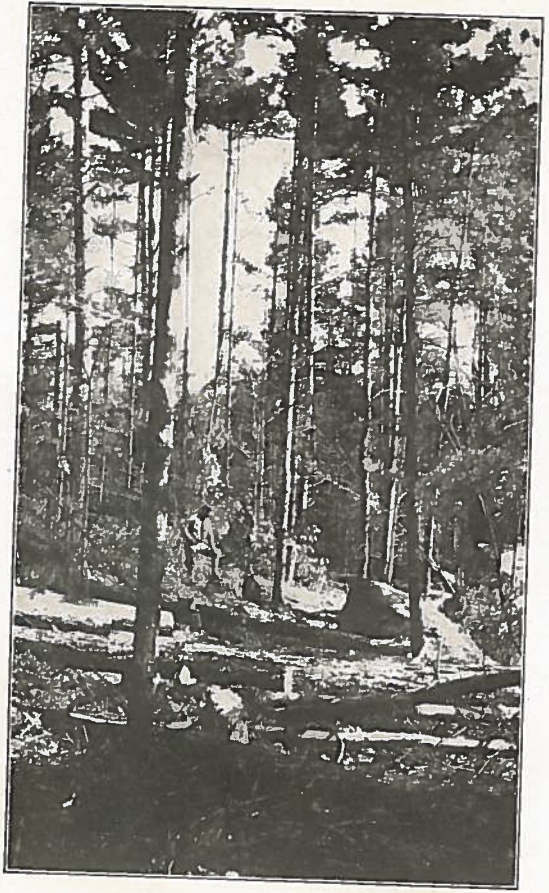
By G. C. HAWKINS, Forester, New England Box Co.

The annual conference of the Society for the Protection of New Hampshire Forests was held this year at Keene, N. H., and from the attendance and discussion it was quite evident that the problem of conserving our timber supply is becoming of great interest and concern to the people of the State. Resolutions passed and action taken point to the fact that it is considered purely a business proposition upon the solution of which depends the future of the State's lumber industry. This industry, one of our most important, is responsible for the distribution and circulation of a great amount of money, is paying a big freight bill to the railroads and is furnishing employment to thousands of men. Yet, at the present rate of cutting, the end of the timber is in sight and this tremendous lumber business, so vital to the prosperity of our citizens, is doomed to exhaustion within a comparatively few years. New Hampshire has been rich in lumber but can maintain this natural wealth only through the development of new plans for management and taxation of her forests. The lumbermen are naturally taking a keen interest in such developments and are themselves devising new methods of operating and planning ways and means to maintain a continual supply of lumber for the wood working industries.

The New England Box Company manufactures lock cornered boxes, shooks and pails, and operates throughout central New England. It has been building up for some twenty years a reserve of timber and forest land and has now underway a systematic plan of

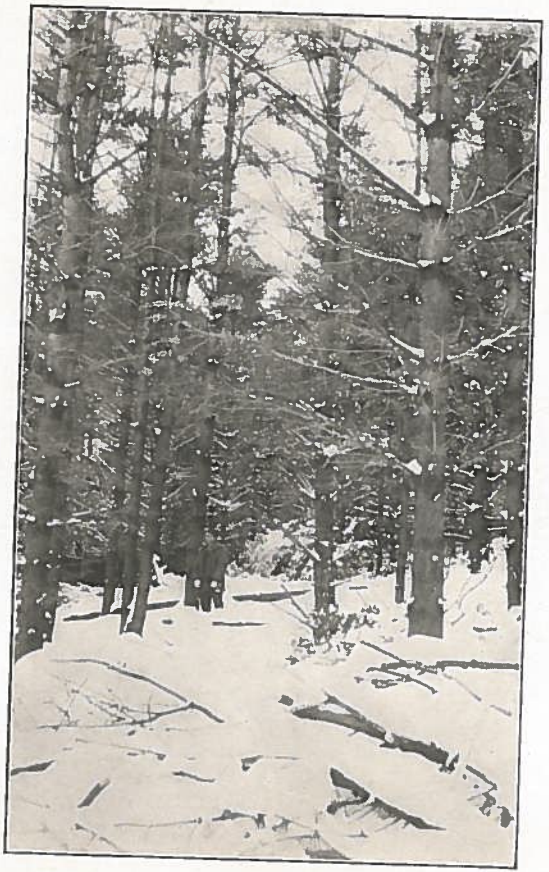
management which should go far toward supplying her factories with the necessary amount of lumber. This Company made a small beginning in its forestry program when in 1911 and 1912 a few thousand trees were set out on cut over and waste land. In 1913 the writer of this article, a technically trained forester, was hired which, however, in no way means that a great change was made in the management of its forest lands at that time. A policy was adopted, however, involving the setting out of 100,000 white pine trees annually on cut over and waste land. This plan has been interfered with during the past three years owing to the war but will be resumed next year, especially in Massachusetts where a new tax feature has been enacted recently into the Forestry laws. This law in its operation separates the crop from the land, taxes the land annually and the timber when cut. The planting season lasts but three or four weeks in the spring leaving the new forester without any specific work in his field for the other eleven months of the year. During the first two years he obtained a few practical points in book-keeping at the main office as well as considerable physical agility in driving logs on the river, scaling logs, building woodroads and any other tasks which might be considered within his ability.

The Directors then decided that their knowledge of the Company's land holdings was limited and upon the Forestry Department, then a one man department, devolved the task of surveying all of the Company lots. At the present time four transitmen with surveying crews are working under the direction of the forester, surveying, cruising, estimating and mapping these lots consisting of some 30,000 acres scattered over New Hampshire, Vermont and Massachusetts and representing 330 purchases ranging from 10 to 1,000 acres each. The titles of these lots sometimes have to be examined back as far as Revolutionary days in



White Pine 40 years old, after cutting out Hard Pine and Chestnut. Stand now has good chance to grow

N. E. Box Co.



White Pine 45 years old, after cutting out 10,000 board feet per acre

N. E. Box Co., Winchester

order to determine the present boundary lines. These lines are run by the stadia transit method while interior timber lines of different classification are determined by box compass and pacing back and forth across the lots. In this manner an inventory of land and timber of the Company will be completed in the near future. Lot lines are blazed and corners marked by one inch solid iron pins. Additional purchases are treated similarly as fast as acquired and placed on record so that it may be easily calculated how much timber is at the disposal of any of the Company factories for any period of time a number of years in advance. Thus information obtained and correlated by the Forestry Department may be used to determine the extent and location of clean cutting, thinning and planting operations for each year.

On average soil at fifty years of age a white pine stand should have produced a good yield of merchantable box boards at a minimum expense and should be ripe for the axe. It is upon this maxim that the forester of the New England Box Company has based all calculations. A stand which has to grow seventy years, for instance, would become a source of considerable loss as the original investment carried with compound interest, together with the taxes at compound interest, would amount to much more than the value of the timber for box boards. Therefore anything which may be done to hasten the growth of the trees, provided it does not involve an expense greater than the benefit derived, is a profitable and desirable operation to carry on.

White pine is now less apt to grow in pure stands but is usually intermixed with grey birch, maple and hardwood trees of less value. These trees—well called weed trees—often crowd and whip the pine into crooked trunks and poor shapes, making inferior lumber and

in many places succeed in killing the pine altogether, Here is a great opportunity for the forester.

Where the Company acquires a lot on which there is a growth of young pine and weed trees, it is just as profitable, if not more so, to weed this lot as it is to set out pine on waste land. Weeding has been resorted to on several hundred acres by the Company and at present during the summer months a foreman and crew of four men go to the lots in need of weeding and cut such hardwood, the removal of which will hasten the growth of the remaining pine trees. It may be of interest to note here that on one acre of such growth where 1,000 weed trees (with diameters up to seven inches) were cut out for the benefit of 360 pines and 25 red oaks, the labor of one man for ten hours was required. Expense of automobile, labor, overhead, etc., would not total five dollars an acre and had this acre been left alone hardly any of the young pine would have survived. In this way a young pine stand fifteen years old was saved and is now carried on the records as an acre which will be ready to cut about 1955.

During the winter this woods foreman is busy with his crew thinning dense stands of pine where thinning of the trees will give the remaining trees more light and space in which to grow. This operation should be carried on when the trees are about thirty-five years old. Small dead and dying trees together with the dominant or wolf trees are removed and the logs delivered to the sawmills, leaving an even stand of well formed trees with a good opportunity to grow. Here again the purpose of the operation is to produce timber in the shortest possible time by aiding nature at a minimum expense.

The investment in a pine lot from the time of its seeding is a long term investment, say for example fifty years. It is easy to figure that it will have to

double in value between the age of fifty and sixty years to take care of interest and taxes. If the lot has been well managed and is on average soil it should have produced at least 35,000 board feet at fifty years of age, worth at a nominal price of ten dollars per thousand, $350.00. The question is, will this lot cut 70,000 board feet per acre at sixty years of age? The answer is emphatically no, so the investment must be reduced by cutting at the age of fifty.

If this is true of a lot which has been well managed by man, it is equally true of some lots which have grown naturally and we come face to face with the fact that many natural stands are becoming sources of loss to the Company because the increase in growth is not enough to pay the interest on the investment together with the taxes. Neglecting to use the axe upon such a lot is a mistake in management and so we find the New England Box Company adopting a policy of cutting out trees either as individuals (by thinning) or as a group (by clear cutting in small areas) as soon as they have reached maturity. As a result the invested capital in timber is substantially reduced and a large saving made in interest charges. This method differs from clear cutting the entire lot, in that the smaller trees are left to grow and the inevitable increment growth is not lost.

The New England Box Company, it may be observed, is beginning to realize the great possibilities in the field of forestry, by planting its waste land and making it productive; by caring for its natural stands and raising the crop of timber in the shortest possible time, considering the cost; by a system of cruising and mapping its timber holdings so that they may be operated intelligently and economically and a continual rotation of crops kept in progress. All these policies the Company has adopted, after being convinced that in the long run they pay the largest dividends.

MANAGEMENT OF FARM WOODLOTS

The farm woodlots of New Hampshire should be handled with the idea of continuous production. Annual taxes on high valuation are partly responsible for this not being done. A fear is created that efforts to improve woodlots will bring still higher taxes. There is also the fact that farmers along in years are not concerned as much as they should be with the future of their land, and there is lack of understanding of the economic timber situation and how owners may keep valuable growing timber on their land. Timber growing like general agriculture is a matter of economics and the owner who handles his land systematically and on a plan of management, will profit by it. A woodlot owner today can not afford to ignore the matter of keeping his forest growing valuable trees.

Our woodlands are made up of two classes of growth—valuable and inferior. Valuable growth is primarily young pine or spruce, with some better hardwoods, such as ash, basswood, white and yellow birch and poplar on good soil. On poor soil in southern New Hampshire pine is the only tree to encourage. The State is covered with inferior growth such as gray birch, cherry, scrub oak, maple and beech for which there is no market. Whether or not hardwoods are worth encouraging depends largely on the soil. On heavier soils hardwoods tend to predominate and a higher grade is obtainable. On such soils where better hardwoods are seeding in and softwoods have less chance in competition, it is possible to secure hardwood timber of saw log size and of high quality in time, perhaps in mixture with softwoods. On the other hand light sandy soils throughout central and southern New Hampshire are best adapted to pine and when,

through lack of proper cutting and woodlot management, the pine is not reseeded, woodlots are forced into the class of unproductive lands. The hardwoods which occupy these sandy soils are inferior, never make sawlog timber and the land remains from one generation to another covered with a nearly worthless growth or producing only fuelwood of low value.

There is no conception of the need for softwoods or the future possibilities in growing it. With an inferior woodlot the owner is paying taxes on unproductive land and he has little to look forward to. Such land has no value to sell now or to hold. It is almost as easy to be growing valuable timber which has a sale value at any time or which promises handsome returns in years to come if the owner holds it for himself or children. Stumpage values of pine and spruce have nearly if not quite doubled in the last ten years. It is impossible to foresee what values will prevail in the years to come, but those who understand the timber situation in the country know that prices will continue upward. The person who owns a good lot of merchantable pine or spruce in 20 or 40 years from now will be independent.

Our productive woodlots are contributing an important part of the revenue from many farms. According to census reports the number of farms reporting forest products decreased from 16,938 to 1909 to 13,161 in 1919. Yet the value of forest products sold or cut and held for sale from these farms has increased from $2,677,746 in 1909 to $4,282,071 in 1919. In addition these farms cut for their own use one and one-fourth million dollars worth of forest products in 1919, an increase from $932,432 in 1909. In 1920 there were 8,011 farmers owning 427,115 acres of merchantable timber mostly sawlog size in New Hampshire.

It is obvious, therefore, that forest products on farms return a substantial profit to their owners and

the value of the farmers' uncut timber is very large. These farms could scarcely support their owners in many poor agricultural sections without the revenue from the woodlots. Woodlot management is urgently needed in order to prevent the falling off of present revenue and ultimately to cause living on the poor farms an unprofitable and impossible task.

A large part of 2,000,000 acres of forest land classed as unproductive in New Hampshire is in the southern part of the state and consists of inferior hardwood growth following clean cutting on poor sandy or rocky soil. If fires have run over such areas, the chance of the land again becoming productive is extremely remote. Owners are paying, if valued at say $5.00 per acre with a tax rate of two and one-half per cent, one fourth of a million dollars each year in taxes and getting nothing in return, except what firewood may be cut. A table given elsewhere in this report and carefully worked out shows that unproductive land (taxed at two and one-half per cent on a valuation of $5.00 per acre and money worth five per cent) held for 40 years without yielding any returns results in an average loss of $1.22 per acre for each of the 40 years because of taxes and interest on land value. If natural seeding of pine had taken place without cost to the owner the average net return after paying all taxes and interest charges would be $5.93 per acre for each of the 40 years. If the unproductive land had been planted at a cost of $15.00 per acre, the average net return would be $3.29 per acre each year after paying all taxes and the interest on land value and cost of planting. If the 2,000,000 acres of waste land were growing up to valuable timber, their owners might be accumulating value at the rate of $10,000,000 or more each year.

An ideal woodlot is composed of quick growing trees having a ready and constant market value, the

area all utilized, the trees properly spaced to insure maximum growth, and must have good roads. A step further in woodlot management is to have a division into blocks or types of definite ages so that definite blocks may come into market at different periods and thereby furnish the owner with a yield of timber periodically. If distribution of ages can be regular, the cutting may be at regular intervals and if blocks are of same size, then approximately the same amount may be cut at each period. The owner should have a map drawn to scale showing boundaries, the acreage of the whole tract and of definite blocks or types. Such a forest can be managed on the basis of sustained yield. To give a simple illustration, a woodlot of 50 acres could be developed into 50 distinct age classes by planting one acre each year for 50 years. With a rotation of 50 years and a yield per acre of 40,000 board feet at end of 50 years, then one acre of 40,000 feet may be cut each year after 50 years. If each acre is reforested after cutting, the yield of 40,000 may be available without end. Or 200,000 feet may be removed from five acres at end of every five years, taking the whole in ten regular cutting periods instead of 50 with the same results.

This is the basis of management in many European forests where periodical cuttings have been in progress for generations. Many natural woodlots are composed of irregular age classes, having re-seeded at different times, and under management may be continued without end. There are notable examples in New England when owners of comparatively small woodlots are able to cut timber every year or every few years and by reseeding the areas cut over, continue to keep all their land in valuable growing condition. In one or two cases this is being done by operating companies and in others by farmers who take advantage of the winter period to use their teams in hauling logs to the nearest

mill, but they must distribute their cuttings, protect young growth and provide for natural seeding, so that there is always new growth coming on. This in a primitive way is the meaning of forest management. Improving young growing areas by removal of over crowding hardwoods and thinning to let in light should be part of the plan for keeping each block or type in the best growing condition.

Most woodlots starting on cutover land need attention. After they are cutover in the usual manner of clean cutting, a variety of growth takes possession of the soil. Hardwoods grow rapidly, especially on better soils, and in a few years make a dense cover and the lot is commonly known as a sprout lot. Every owner should study the nature of such a sprout growth, bearing in mind a fixed purpose to improve its quality and value. He may be surprised to find a large number of pines underneath the hardwoods. If this is so, then he can well afford to give time and some money to seeing that the pine is not shaded and killed by the overtopping hardwoods. If the overtopping growth is gray birch, cherry and poplar on sandy soils, the shade is less dense and pine has a better chance to come through. If it has maple and beech in mixture the shade is heavier and pine has an almost impossible task to struggle upward to the light without help. Pine can stand shade for a few years after seeding; in fact, on dry sandy soils the cover of hardwoods is a great help in holding the surface moisture and thus helping pine to develop its roots and become established. Later on as hardwoods increase in height and power to shade the ground, the pine begins to find competition intolerable, becomes less vigorous and finally dies. It is not uncommon to see on a single acre hundreds of dead pines less than six feet in height shaded out by a vigorous growth of hardwoods having a dense mass of foliage such as maple, beech, and oak. On better

soils this condition is more prevalent while on light sandy soils the hardwoods run more to gray birch and thin foliaged trees, are less vigorous and pine has a better chance to struggle through to the light and ultimately predominate the entire stand. Different kinds of trees vary in their demands for light in which to live and grow. Hemlock, spruce and fir will tolerate the densest shade of other trees and live underneath until an opening above gives them the chance to grow more rapidly. Pine similarly situated dies before the increased light becomes available.

A study of the sprout growth conditions in the woodlot reveals the needs there may be for helping more desirable trees in their struggle for existence. Where the pine is likely to be crowded out, some of the overtopping hardwoods, if of little value, should be cut back to let the light in to the pines. It may be that the pine will survive the shade until the hardwoods are large enough to be dragged out and saved for fuel. Even if the weeding process brings no immediate return in fuel, the saving of the pine is well worth the land owner's time. A day is well spent in work which will give the owner an acre of growing pine, which would otherwise be lost.

The sprout lot which contains no pine or softwoods may be valuable or inferior according to the soil and kind of growth. In general on better soils, there should be an effort to save ash, basswood, straight oak, poplar, white and yellow birch for high grade stock and thin out inferior species and poor trees in fuel wood cuttings. Inferior hardwoods without any pine on light sandy soil can be improved only by underplanting where the growth is not too dense. There are land owners in the state who have cleared areas of poor hardwoods at considerable expense and planted pine. It is difficult to prescribe for conditions once they have been allowed to get bad. The point is to avoid the

waste and inferior conditions so that the expense of planting may not be necessary, except on relatively small areas or where fires have run. In open stands of gray birch and where there is no heavy undergrowth it is feasible to underplant with pine, removing the birch carefully when large enough for fuel. It is always desirable to remove or girdle large, sprawling hardwood trees which are undesirable and occupy considerable space, especially if they are overtopping young valuable growth.

Pine which seeds naturally on open land without hardwood competition, will generally take care of itself. When about 20 years old pure stands of pine are greatly benefited by a thinning or removal of those which are inferior in form or vigor and crowding the better trees. The final spacing should give room for the crowns of all trees without overlapping. Moderate and frequent thinnings are better than a single heavy one. From five to eight cords of wood per acre may be cut from white pine stands 20 years old with the certainty of improving the quality and hastening the time of maturity of the whole stand by at least ten years.

Pruning side branches of growing pines improves the quality of lumber in the first log if the branches are cut off clean without injuring the bark. If lower branches are carefully removed when the trees are not more than 20 years old, followed by another pruning higher up as the trees get older, the amount of clear boards in the first logs may be considerably increased. It is more important and altogether safer to remove dead branches than live ones because only dead branches make loose knots and there is less danger of injuring the trees. Pruning may very properly be carried on at the same time as thinning and confined to a few of the more vigorous trees. This would tend to increase the quality in those trees which will be largest when the lot is marketed.

Every woodlot owner should be able roughly to survey out his lot and estimate the amount of his merchantable and valuable growing timber. The value of a rough survey is to enable the woodlot owner to know the acreage of the whole lot and the principal types and show them on a map. The description and acreage may or may not be given in the deeds. In either event the owner should have his lot plotted on paper and know the area of the types making up the whole. If there is no detailed boundary description this may be obtained by means of a compass with sights to get the direction or bearing of the different lines and measuring the distances with a chain or tape. With a protractor and scale rule these bearings and distances may be plotted on paper to a convenient scale and the acreage determined by ruling the map into squares of equal and known size, counting the number of whole squares included within the boundary and estimating the fractions of squares included. Having the boundary of the lot plotted on paper, the inside divisions into types may be made by pacing or measuring with a chain the distances from known corners, taking their approximate bearings with the compass and plotting them on the map with the protractor. The areas of these sub-divisions can be obtained in the same way as the whole by counting the squares and fractional squares included. This procedure gives the owner a working map with approximate acreage and prepares him for making estimates of his merchantable timber and young growth by the type divisions. Having the few necessary instruments for this work and a book on rough map making and estimating are well worth while to any person who may have occasion to sell as well as buy any timber or land.

The work of estimating standing timber is made comparatively simple by the use of so-called volume

tables, provided the timber is more or less uniform and evenly distributed over the subdivisions or lots and the acreage is known. Volume tables give the contents of trees of different diameters and heights for different species growing under given conditions. A volume table in board feet for second growth white pine in New Hampshire is reprinted from the report of the Forestry Commission for 1905-6, and will be found on the following page.

In estimating timber it is necessary to measure the diameters and total heights of the different trees, and then to look up their contents in the volume table. Diameters to the nearest inch are always measured four and one-half feet above the ground, called breast height, wooden calipers being generally used for the purpose. Circumferences may be taken with a tape measure and changed to diameters by dividing by 3.1. Heights are measured to the nearest ten feet. There are instruments for measuring heights or one may approximate the height by placing a ten-foot pole beside the tree and from a convenient distance determine the number of times this pole will go in the total height of the tree.

If the lot is small the diameters of all the trees may be measured and tallied on paper ruled so as to have a space for trees of each inch diameter and ten-foot height class. The volume table is consulted and the total amount of standing timber in board feet on the lot determined.

On larger lots it is not practicable to measure every tree. The practice then is to measure and tally the trees on plots or in strips of known size selected so that conditions are representative of the entire lot. One may measure the trees in a circle having a radius of 60 feet, which is about one fourth of an acre, or 85 feet, which is one half an acre. A rapid but less accurate method is simply to count the total number

Table XII

VOLUME IN BOARD FEET OF SECOND GROWTH WHITE PINE IN NEW HAMPSHIRE*

Diameter, breast-high	Height of tree (feet)									
	30	40	50	60	70	80	90	100	110	120
	Volume (board feet)									
5	8	12	15							
6	13	20	23	27	29					
7	18	28	34	39	44					
8	24	36	45	53	62					
9	32	44	56	69	81	93				
10	41	53	70	85	102	119	138			
11		63	84	103	126	147	163			
12		73	100	125	151	177	200	228	245	
13		84	117	148	180	210	238	270	293	
14		95	137	173	210	243	277	312	348	
15		105	158	200	241	282	321	362	406	
16			181	230	277	323	370	415	470	
17			209	261	313	368	421	471	540	
18			238	297	352	411	475	531	610	688
19			270	336	393	460	530	598	682	768
20			302	379	436	506	583	660	750	840
21				425	480	553	634	720	820	918
22					522	597	681	779	887	990
23					566	639	727	834	958	1,065
24						674	769	889	1,030	1,135
25						706	809	942	1,105	1,205
26						737	846	994	1,180	1,275

* Table prepared by Louis Margolin, U. S. Forest Service, in cooperation with the N. H. Forestry Commission. Volumes given are actual saw cut with one-fourth inch kerf. Sixty per cent. was round edged, while 40 per cent. was squared. Seventy per cent. was cut into one-inch boards and the rest into two-and-one-eighth-inch plank.

of trees in the circle, determine the size of an average tree by the eye and multiply its contents found in the volume table by the total number of trees in the circle.

On large lots, it is better to measure and tally the trees in strips of known width and length. A surveyor's chain is 66 feet long and is made use of in estimating by measuring and tallying all the trees 33 feet on each side of the chain stretched on the ground. This area is 4,356 square feet, or one tenth of an acre and, by measuring in this way ten successive chain lengths, an acre of ground is covered. Strips of this character may be run at equal intervals across a lot so that the area measured in the strips will be from five to ten per cent of the total area, which is sufficient for a fair estimate.

Even aged forests of a given species like white pine growing under similar conditions or soil quality and fully stocked, that is, without open spaces and when unthinned, tend to have the same volume of timber per acre at a given age. Table XIII has been prepared for New Hampshire giving the yield in board feet per acre of even aged stands of white pine at different ages and growing in three different quality classes. It may be used as a check in estimating even aged white pine by determining the age and quality class of a stand and reading from the yield table the number of board feet for a stand of that particular age and quality. If the area is not fully stocked or contains open spaces, the yield should be decreased proportionately. A similar table prepared by the Massachusetts State Forester gives from 15 to 20 per cent higher results.

Table XIII

WHITE PINE YIELD PER ACRE, SOUTHERN NEW HAMPSHIRE*

Age	Volume			Age	Volume		
	Quality 1	Quality 2	Quality 3		Quality 1	Quality 2	Quality 3
Years	Bd.. Ft.	Bd. Ft.	Bd. Ft.	Years	Bd. Ft.	Bd. Ft.	Bd. Ft.
20	4,600	3,150	1,700	60.....	57,300	47,400	37,500
25..... ..	8,400	5,900	3,450	65.....	61,850	51,850	41,850
30..	15,100	10,800	6,550	70.....	65,900	55,800	45,700
35..... .	24,950	18,050	11,200	75.....	69,750	59,500	49,250
40.....	33,550	25,000	16,450	80.....	73,300	62,850	52,400
45.....	40,750	31,450	22,150	85.....	76,700	66,000	55,300
50.....	47,450	37,800	27,650	90.....	80,050	69,000	57,950
55.....	52,350	42,550	32,750				

* Data gathered by Louis Margolin for the U. S. Forest Service in co-operation with the N. H. Forestry Commission. First published in biennial report of the Commission for 1905-6.

The present method of clear cutting and stripping woodlots of every tree large and small has come largely with the introduction of portable mills. If white pine is to be maintained as a dominant and commercial product of our southern New Hampshire woodlots, present methods of clean cutting and windrowing the pine must give way to methods of partial cutting whereby a part of the pine is left standing long enough to seed up the cutover areas. Furthermore, the young pine on every lot too small for sawlogs must be zealously protected and not destroyed in operating as at present. The magnificent stands of second growth white pine cut during the past twenty years or more have grown on land once cleared as a result of seeding from old growth pines left in adjoining woodlands. Competition with hardwood trees did not take place

in the development of our second growth pine stands in the past, but this is a mighty obstacle to the perpetuation of pine in commercial quantities on land not previously cleared. We cannot continue to grow our commercial pine on the fields and pastures of abandoned farms but must meet the problem of growing successive crops of pine on cutover land. The welfare of the State demands a halt in the increase of devastated, cutover land, too worthless for any use except to grow pine and not permitted to do that. Pine is a crop which can be grown on the same land in successive rotations of from 35 to 45 years. Yet the practice prevails of turning merchantable stands of pure pine into nearly worthless sprout growth and permitting the land to be idle indefinitely, a loss to the owner and a detriment to the general public.

Cutting to secure a continuation of the pine type should be the goal of the woodlot owner. In practice this can be brought about by removing the merchantable trees in two or more operations long enough apart for the land to become reseeded to pine and of course saving the small pines. The best way to reseed a pine lot is by a series of cuttings which may be called thinnings, gradually opening up the forest to increased light and preserving the soil moisture so necessary in germinating the seed. The early settlers practiced this method of cutting unintentionally when they selected their trees here and there as they needed them. The method was still in use later when the market was confined to trees above 10 or 12 inches in diameter and smaller trees were not cut. Making the first cutting in the form of strips or patches, or even leaving irregular groups of pines and scattered trees are satisfactory modifications of the partial cutting plan as long as there is provision for abundant scattering of pine seed and there is some protection from the drying of the soil. No specific plan of cutting is necessary

so long as the owner understands that a pine lot cannot be stripped at one time with any chance of pine following pine unless the cutting is right after a good seed year and there is abundant seed on the ground at the time. In Europe a variety of cutting methods are practiced, including that of clear cutting followed by planting, the only unalterable provision being that renewal of the forest shall be assured.

The so-called seed tree law (Chapter 22, Laws of 1921) is a step in the direction of better management of white pine woodlots. It provides, in addition to notifying the State Forester of pine lots about to be operated, that one pine seed tree 10 inches in diameter or over shall be left on each acre where the lots contain 75 per cent or more of pine. The law has met with general favor and will do much to help seed up cutover areas and focus the attention of land owners and operators on the question of reseeding pine areas. The operation of the seed tree law is discussed elsewhere in the report.

Whether or not the woodlot owner sells his standing growth for a lump sum or by the thousand feet mill tally or operates the lot himself, he should make such reservations or conduct the operation in such manner that the area will be reseeded to pine. This applies to any owner whether he is a lumberman, farmer or summer resident. It is not enough to have one seed tree on each acre, as the law requires in pine operations. There is need to do away with clean cutting and windrowing the trees and return to the principle of selecting trees ripe for market and reserving the remainder for increased growth and reseeding the land. There is no satisfactory reason for an owner selling all his standing growth at one time. It is the part of wisdom and judgment to keep something coming on. There is a ready market for any pine timber which the owner offers for sale at stumpage prices of

$10 to $14 per thousand feet. The yearly growth is capable of exceeding one thousand feet per acre and the owner can make his pine lot produce a revenue periodically if he limits the cutting and properly distributes it each time.

If the owner operates his own lot and looks after the cutting himself, the work can be done under the most favorable circumstances. If he sells the stumpage outright or contracts for the cutting and is not in a position to personally supervise the work, he should make reservations and define the cutting areas in the deed of sale or contract so that there may be no mistake in having his purposes carried out. Spotted lines may be run on the ground to exclude areas of young growth to be saved. Selected trees may be marked for cutting when the bulk of the growth on an area is to be reserved. All trees below a given diameter on the stump might be generally reserved. There could be an agreement that only spotted trees were to be cut, according to the practice in selling stumpage on the National Forests. Wherever specific limitations are made on the ground by spotted trees or lines, the deed of sale or contract should make clear what the understanding is.

Competition among buyers is keen today and they are generally willing to buy stumpage with whatever reasonable restrictions are placed by the seller. The woodlot owner is foolish who sells his growth without restriction or reservation to any timber buyer and permits him to strip the land. The owner should study the situation and market, make known by advertising as widely as possible what he has for sale, secure bids from different operators, and deal with responsible parties even at some sacrifice in price. If there are local mills or woodusing industries, inquire what prices are paid for logs delivered at their mills. The woodlot owner with teams and equipment is in a position to

handle the logging himself, secure wages for his teams during dull periods and in the end obtain a higher price for his logs. He may of course hire the sawing done and market his lumber, but this involves an investment and other difficulties incident to selling the lumber which most owners not familiar with operating wish to avoid. Neighboring owners should be able to work together in operating small amounts of timber and have the County Farm Bureau agent hire the sawing and look after the marketing for them.

It is possible today to turn over the operation of a lot on a profit sharing basis to responsible foresters who are in the operating business by paying an agreed price per thousand feet for the amount cut plus a small per cent of the net profit. This enables an owner to cut as much or as little as he chooses, bear no expense in operating or marketing and receive a substantial return for the timber sold. Sales on a basis of estimates are thus avoided and the cutting may be carried out with due regard to keeping the woodlot in good growing condition.

The following suggestions for a stumpage deed are intended to show land owners how they may make any reservations and restrictions they desire in selling timber, to save areas of immature growth, and provide for leaving suitable trees to reseed, as well as to place the responsibility with the purchaser to conform to the legal requirements in operating and insure protection to themselves in this and other matters; such suggestions to be included in the body of any printed form of deed:

.....and by these presents do give, grant, bargain, sell, alien, enfeoff, convey and confirm unto the said.....heirs and assigns forever.

All the (insert here the kind of trees, as softwood, hardwood, pine, etc., sawable timber; or trees above ....inches in diameter at the point of cutting; or trees

spotted by the grantor; or sawable timber, except trees spotted by the grantor; or such other designations and reservations as may be desired) standing upon a certain tract of land situated in the town of....., county of ....., in said State of New Hampshire, bounded and described as follows: (insert here description of the premises by metes and bounds; or designate the portion of the premises to be cut as marked off by spotted lines or other monuments); together with the right to enter upon said premises to cut and remove said timber, to erect and operate a portable saw mill and to stick lumber on said premises, all said rights to be exercised within..... years from.....; and in such manner that no unnecessary damage shall be done to other growth; it being understood that only a single lumbering operation shall be carried on during said period.

This conveyance is made upon the express condition that the grantee and his heirs and assigns in operating said lot shall comply with all the laws of the State of New Hampshire applicable to such operations, including statutes regulating portable steam mills, requiring the removal or disposal of slash, and requiring notice of pine operations and the leaving of seed trees, and amendments thereto; and that any and all timber described in the deed which shall not be removed within the time herein limited is not included in this conveyance but shall revert to and become the property of the grantor and his heirs and assigns.

It is further understood that (insert here other terms and conditions)

To have and to hold.....

Financial Maturity of White Pine

During the past two years much has been said and written about forest taxation in New Hampshire. The situation is growing more serious every year as valuations on immature timber reach higher levels. Woodlots are being thrown on the market and cut off 10 to 15 years before they should be, in spite of unfavorable market conditions. The owners say they cannot continue to pay the taxes on the valuations assessed, either because they do not have the cash on hand or because they think the value of the yearly growth is less than the taxes and interest charges. When lots are thus prematurely cut, a considerable quantity of timber, which would be available later, is lost and virtually wasted. Whether or not the owner loses by cutting prematurely, the town is certan to lose because the lot must afterwards be assessed as cutover land.

In order to determine how many years a pine owner can hold his timber without financial loss under conditions existing at the present time, the Forestry Department has worked out table XIV, which shows the actual expenses and net profit per acre at five year periods up to 60 years for white pine stands resulting from both natural reproduction and from planting. The expenses consist of taxes on the land, taxes on the timber beginning with the fifteenth year, interest on the value of the land, and the cost of planting, all carried forward at five per cent compound interest. The value of bare land was placed at $5 per acre, the tax rate at two and one-half per cent and planting at $15 per acre. The value of the timber at each five year period was placed at $12 per thousand feet for the amount of timber given in our New Hampshire yield table for fully stocked stands of white pine growing under average conditions. The taxes are assessed on the full values indicated for periods of five years.

Table XIV

FINANCIAL ROTATION OF WHITE PINE

Money Value 5 per cent; Value of Land $5 per A; Cost of Planting $15 per A; Tax rate 2½ per cent.

Rotation Years	Stumpage Value at $12 per M.	Natural Reproduction					Net Profits	Plantations			Net Profits
		Expenses						Expenses			
		Taxes			Interest						
		Taxes on Timber		On Land							
		Annual for Five Year Periods	Accrued to end of Rotation	Accrued to end of Rotation	On Value of Land Accrued End of Rotation	Total Expenses		Taxes and Interest on Timber and Land Accrued to end of Rotation	Cost of Planting Carried to end of Rotation	Total Expenses	
15	$25.00	$ .625	....	$2.832	$5.604	$8.44	$16.56	$8.44	$31.183	$39.62	-$14.62
20	37.00	.925	$3.626	4.339	8.603	16.57	20.43	16.57	39.709	56.37	-19.37
25	71.00	1.775	9.994	6.264	12.431	28.69	42.31	28.69	50.795	79.48	-8.48
30	150.00	3.750	23.054	8.720	17.316	49.09	100.91	49.09	64 829	113.92	36.08
35	293.00	7.325	51.181	11.854	24.766	87.80	205.20	87.80	82.740	170.54	122.46
40	394.00	9.850	107.820	15.854	33.059	156.73	237.27	156.73	105.599	262.33	131.67
45	487.00	12.175	194.758	20.960	43.644	259.36	227.64	259.36	134.775	394.14	92.86
50	558.00	13.950	319.204	27.476	57.152	403.83	154.17	403.83	172.010	575.84	-17.84
55	607.00	15.175	488.332	35.793	74.393	598.52	8.48	598.52	219.534	818.05	-211.05
60	638.00	15.950	711.293	46.407	96.397	854.10	-216.10	854.10	280.187	1,134.29	-496.29

From Table XIV it may be seen that the highest net profit is obtained when the timber is cut at 40 years of age. If held beyond this period there is a rapid decrease in profit and if the owner should hold the timber 60 years, there would be a net loss of $216.10 per acre of natural reproduction and $496.29 per acre where the expense of planting was included. The table shows that 27 per cent of the total value is taken in taxes on the timber alone in 40 years; 57 per cent is taken in 50 years; 80 per cent in 55 years; and 111 per cent in 60 years.

On the other hand there is still a net profit of $5.93 per acre for each year up to 40 years in growing white pine where natural reproduction can be secured and $3.29 per acre where the land is planted. A lower tax rate or lower assessed valuation would extend the time of financial maturity beyond 40 years, which of course is extremely desirable in order to obtain the larger yield and higher quality of timber.

Enemies of White Pine

The question is often asked whether or not white pine is now a desirable tree to plant and encourage because of the blister rust disease, the injury caused by the weevil, and the more or less prevalence of the blight, gypsy moth, etc. The Forestry Department has not lost faith in the white pine. It is the standard commercial tree over much of New Hampshire and New England and the Northeastern States, is well adapted to our poor, sandy soils, and capable of renewal after cutting if it is but given the chance. The markets are adjusted to the use of white pine even of poor quality, a fact which is well known but often unappreciated. Visitors from distant parts of the country are amazed at the enormous amount of low grade white pine which finds a ready market in industrial New England. They are accustomed to seeing

similar grades wasted or left in the woods and only the higher grades used. Low grades from a distance are kept out of our eastern markets because of the high cost of transportation. It would indeed be a calamity both to industry and to our woodlot owners and lumber business to lose our low grade market through inability to produce the timber. Therefore the continuance of white pine in our woodlands is most urgent and worthy of our united and unceasing efforts. There is imminent danger of diminishing the supply through failure to restock our cutover areas and because of natural diseases and insect enemies to such a degree that the markets will be compelled to look elsewhere for substitutes and thus deprive us of an industry and a wealth which would make living conditions almost intolerable for many New Hampshire people.

As regards the blister rust disease war has been declared against currant and gooseberry bushes, both wild and cultivated. This war must be waged until all pine lands and protective strips around them are free from these bushes and kept free. There is no alternative for white pines and currants and gooseberry bushes cannot grow together. The cost of eradicating bushes is one which must be met and with as little delay as possible. Every year hundreds of thousands of additional pines are becoming infected, the results of which will reflect very seriously upon the question of our future supply of pine. White pine may be safely planted and encouraged to grow wherever currant and gooseberry bushes have been removed.

The white pine weevil causes widespread but not fatal injury to young trees usually under 12 feet in height. This beetle lays its eggs in the terminal shoots of the white pine in the early spring. The eggs hatch into small white grubs which immediately begin feeding just beneath the bark on the wood of the shoot. As the grubs increase in size they feed deeper into the

wood, all of the time working downwards. This is the time when the weevil's work is noticed, as the leader is soon girdled and immediately begins to wither and die. The grubs will continue feeding in the main stem until they have sometimes passed the first and even the second and third whorls of branches. The results of this destruction of the main shoots are three fold. In the first place it makes crooked, forked, or many branched trees. Secondly, it materially lengthens the time of maturity for the crop; and in the third place injured trees are very apt to have large knots and short internodes which lower the grade and value of the lumber. All of the damage cannot be eliminated but may be greatly reduced by watching young pine areas and removing and burning the infested leaders as they begin to wilt. Experiments have shown that the beetles do not fly high, but if once allowed to establish themselves will be found in greater numbers each year following. Infected trees may be assisted by removing all but one of the most vigorous side branches, thus allowing the remaining branch to become the leader without competing with the other branches. This work can usually be done at a moderate cost per acre if started when the first infections are noticed. Where the pines are growing in a close stand, the recovery from weevil injury is more rapid as the trees do not have the same opportunity to fork and branch out. Much of the very serious damage resulting from weevil injury in plantations may be due to faulty planting methods or very poor soil inasmuch as the sooner the young trees reach a height of 12 to 15 feet the less damage there will be.

The so-called white pine blight has caused some alarm among woodland owners for many years. Many have confused the blight with the blister rust disease. Very little is known as to the cause of the blight. It is probably due to some unfavorable climatic condition

inasmuch as there is no indication of insect or fungus attack. The effect is a browning of the needles or sometimes only the tips of the needles over the entire tree. A badly blighted tree looks as if a fire had scorched the whole of it. There is no evidence that a blighted tree affects others nearby, but large as well as small pines may be equally unhealthy. There have been more reports of trees in this condition from Rockingham County than from any other part of the State. Many badly browned trees are known to die but a larger percentage usually recover in time. While there are no suggestions to offer as to the cause or the remedy, owners are advised not to cut their trees under the apprehension that they will die anyway.

Trees infected with blister rust in the earlier stages of development will have one or more branches brown but not the entire tree until the main trunk has been girdled. In any event the bark where the disease is working will have a yellowish appearance and show evidence of constriction and usually bleeding.

Injury to white pines by the gypsy moth is confined to the southern counties where the pines are young and growing in mixture with oak and gray birch and where there is an abundance of caterpillars. Protection of the pine under such conditions is largely a matter of keeping the pine as free as possible from birch and oak. A pure stand of pine is practically immune to attack.

A small snout beetle, known as the Pales weevil, is attracted in large numbers to areas where freshly cut pine stumps, logs and slash occur. These beetles breed in the freshly cut pine wood and feed on the tender bark of pine seedlings from one to five years or more of age, growing in the vicinity and for a period of about three years. Injury to pine reproduction and plantations on freshly cutover pine land by the Pales weevil has been far more noticeable in parts

of Massachusetts than in New Hampshire. However, similar damage may occur in any recently cutover pine areas and it is not advisable to plant such areas until three years after operations have been completed.

Ants by stinging the bark will kill young pine trees which shade their ant hills. In one instance recently observed in the plantation of the Claremont Water Works, ants had killed 25 pines in a complete circle with the ant hill in the center.

FINANCIAL STATEMENT

SEPTEMBER 1, 1920 TO JUNE 30, 1921

	Appropriation	Expenditure
Salary of Forester	$3,000.00	$2,500.00
Field Assistance	2,000.00	1,784.90
Clerical Expense	3,000.00	2,307.50
Traveling Expense	1,200.00	700.08
Incidentals	1,600.00	983.15
Printing Blanks	900.00	506.67
Printing Report	600.00	600.00
District Chiefs	5,400.00	4,496.82
Lookout Stations	8,000.00	7,968.34
Conferences	1,000.00	427.59
Prevention	3,000.00	2,603.35
Nursery	4,365.71	4,365.71
Care and Acquisition of State Lands	5,000.00	5,000.00
Forest Fire Bills to Towns	7,500.00	7,036.59
Reforestation	2,500.00	2,499.30
White Pine Blister Rust	10,000.00	9,972.94
	$59,065.71	$53,752.86

YEAR ENDING JUNE 30, 1922

Salary of Forester	$3,000.00	$3,000.00
Field Assistance	2,200.00	2,199.16
Clerical Expense	4,000.00	3,965.08
Traveling Expense	1,500.00	1,489.82
Incidentals	1,800.00	1,799.05
Printing Blanks	1,200.00	1,198.78
District Chiefs	7,500.00	7,498.89
Lookout Stations	9,900.00	9,896.64
Conferences	1,200.00	1,200.00
Prevention	3,000.00	2,999.80
Nursery	5,500.00	5,494.52
Care and Acquisition of State Lands	5,000.00	4,988.71
Forest Fire Bills to Towns	7,500.00	7,499.94
Reforestation	3,000.00	2,999.84
White Pine Blister Rust	12,000.00	11,990.78
	$68,300.00	$68,221.01