

FIG. 1.—View in the new State Reservation at Jaffrey, N. H.; donated by Miss F. A. L. Haven. The mowing in the foreground of about  $1\frac{1}{2}$  acres, is the only open land on the Reservation.

STATE OF NEW HAMPSHIRE.

---

BIENNIAL REPORT

OF THE

FORESTRY COMMISSION

FOR THE YEARS 1907--1908.

---

NOVEMBER, 1908.

## MEMBERS OF THE COMMISSION.

---

HENRY O. KENT, Lancaster, *President.*

ROBERT E. FAULKNER, Keene, *Secretary,*

JASON E. TOLLES, Nashua,

ROBERT P. BASS, Peterborough,

*Forestry Commissioners.*

## TABLE OF CONTENTS.

---

<b>REPORT:</b>	<b>Page</b>
Introduction .....	5
The Pine Blight of 1907.....	7
The Pine Blight of 1908.....	14
Other Insect Pests of 1908.....	16
Fire Notes .....	18
List of Fire Wardens .....	24
A New State Reservation .....	32
Conservation Schedule .....	33
Timber Taxation Investigation.....	35
 <b>APPENDIX:</b>	
Conservation Schedule (P. W. Ayres).....	41
The Taxation of Forest Lands and the Efficiency of the Fire Laws in New Hampshire (J. H. Foster).....	49
Forest Measurements (C. A. Lyford).....	123
Statement of General Expenses of the Commission.....	186
Statement Showing Amounts Paid by the Forest Service and the Forestry Commission for Timber Taxation Investigation .....	187
Statement of R. P. Bass, Treasurer .....	189



## REPORT.

---

*To the Governor and Council:*

The Forestry Commission, in presenting its report for the biennial term of 1907-08, desires to make a few preliminary comments in reference to the subjects herein contained.

With regard to the investigations into the pine blights of 1907 and 1908 the commission regrets that no definite conclusion was reached as to the precise causes of the disease. It feels, however, that the work and time spent thereon will not be unproductive of good results, inasmuch as in both cases the progress and general characteristics of the disease have been noted and made a matter of record. The commission, moreover, has received assurances that the investigations will be continued in the near future.

Under the head of "Fire Notes," the commission renews its recommendation for a state forester; but as an additional protection for our forests from fire, it would suggest for the consideration of the next General Court a law empowering the governor to prohibit all fishing and hunting during the times of extraordinary drought. A law along these lines has recently been enacted by the Vermont legislature.

A reprint of Mr. Lyford's article, "Forest Measurements," from the report of 1905-06 was deemed advisable on account of the very many demands by foresters, lumbermen, and students for the report, to whom the tables and data therein contained are invaluable. The tables are also in use for reference and study in some of the forestry schools.

The illustrations accompanying the present report deal largely with conditions relating to the forestry management of the white pine. It is the expectation of the commission that the next report will represent pictorially like conditions

of that other most important and valuable tree in our state,—the spruce.

No mention is made in the report of the visit of the commission to Washington in February, 1908, to attend the hearing in behalf of the White Mountain reservation bill before the Committee on Agriculture. The result of that hearing, and the general status of the bill since, in which the drastic and arbitrary power of one individual were shown to be more influential than the combined interests of many states, are too well known for further comment.

HENRY O. KENT,  
R. E. FAULKNER,  
JASON E. TOLLES,  
ROBERT P. BASS,  
*Forestry Commissioners.*

## THE PINE BLIGHT OF 1907.

(Needle Blight.)

---

On the first of August, 1907, the commission received a letter from Plaistow, stating that the pines in that neighborhood were afflicted with a disease from which fully ten per cent were dying. This was followed in a few days by other reports of a like nature, some of them more alarming, and a visit was made by members of the commission to the Pen-nichuck Water Company of Nashua, where the blight was extensive. Trees of every age were found afflicted, from two-year-old seedlings up to seventy or eighty-year-old pines. An examination showed that the new needles were turned a yellowish brown at first, and as the disease progressed, and the other needles became infected, the tree had the appearance of having been dipped in a reddish dye. Local conditions of site, soil or exposure seemed to have no bearing on the matter and no insect parasite could be found to account for the trouble. Quite a number of young trees were dead or had a moribund appearance, and naturally the owners of these, as well as of other woodlands similarly affected, were considerably alarmed. The commission at once secured specimens of the blight and sent them to Mr. Perley Spaulding of the Bureau of Plant Industry at Washington for examination and suggestion as to overcoming the trouble. At the same time the co-operation of the Bureau of Forestry was solicited, and Mr. S. T. Dana was sent on to help in the investigation. The Bureau of Plant Industry reported that the diseased branches all contained specimens of the parasitic fungus *septoria*, but it was unable to state whether this

fungus was the cause of the blight or not. As it seemed desirable to form an idea as to the extent of the blight, a trip was made by members of the commission with Mr. Dana through Keene, Walpole, Charlestown, Claremont, Cornish, Lebanon, Canaan, Springfield, Newport, Sunapee, Goshen, Washington, Antrim and Peterborough, in all of which places traces of the disease were found. The eastern part of the state seemed most severely affected, the blight gradually diminishing as one approached the Connecticut. Wishing for further data and information on the subject, the commission sent out the following article to all the fire wardens in the counties of Grafton, Belknap, Strafford, and Carroll:

"A new disease of white pine trees has developed in this state and some other states which may become very serious. In trees so affected, the disease shows itself, first, in the tips of the needles, which turn a peculiar reddish brown. At first only the new growth seems to be affected, and the tree looks as if the ends of its needles had been dipped in a brownish dye. As the disease progresses, all the needles turn this color, and the result is the death of the tree. The exact cause is unknown.

"The New Hampshire Forestry Commission has co-operated with the Federal Forest Service and the Bureau of Plant Industry of Washington, to learn the cause of this disease, and, if possible, find a remedy. In order to facilitate and hasten this work, it is desirable to obtain as much information as possible of conditions in different localities. Your assistance is asked in this work, and if you will answer the following questions as definitely as possible, it will materially assist in the investigation:

1. Does it occur in your locality?
2. When did it first appear?
3. How plentiful is it?
4. Is it increasing; if so how rapidly?
5. Does it occur chiefly in wet or dry places?  
In open or in dense woods?  
In stands of mixed wood or in pure pine stands?



6. Does it affect young trees more than old?
7. Have the conditions of weather been such as might have helped to cause this disease?
8. Have you known trees thus affected to recover?
9. Have you ever heard of this disease in years past?
10. Will you keep the Forestry Commission posted as to any changes as to the progress of this in your locality?

“NEW HAMPSHIRE FORESTRY COMMISSION.”

The data furnished by replies to this article were duly recorded and sent on to Messrs. Spaulding and Dana at Washington, and as a further means of securing information on the subject, sample plots of affected trees were established at Peterborough. In these plots each tree was tagged and carefully described, and special characteristics noted, and from time to time the condition reported. About this time (September, 1907) Mr. Dana, in the course of his investigation, ran across Prof. George E. Stone of the Massachusetts Geological College, who advanced an entirely new theory as to the origin of the trouble. Professor Stone maintained that the blight was nothing but a “sun scorch” brought on by winter killing of the roots, that the fungus *septoria* was the result and not the cause of the blight; that the trouble was not new in any sense, but had been under his observation for the past twenty-five years, and that fully fifty per cent of blighted trees recovered. Professor Stone’s theory was very comforting and in some respects it has been borne out by results this year. For instance, on the sample plots at Peterborough, much more than fifty per cent of affected trees have recovered, and this is undoubtedly true of a large proportion of affected trees elsewhere. The forestry experts, however, do not believe that the trouble is climatic and have desired further proof. We give herewith Mr. Dana’s report, under date of September 30, 1907:

"Forest Service,

"Washington, D. C.

"Washington, September 30.—After a thorough investigation of the peculiar blight which has attacked the white pine of New England so generally this summer, government experts after two weeks' work say that the disease remains as much of a mystery as ever. The investigation is being made by the Forest Service and the Bureau of Plant Industry of the Department of Agriculture, and will continue until the real cause of the trouble is discovered. S. T. Dana, of the office of sylvics, who has charge of the investigation for the Forest Service, in a preliminary report to his chief, which has just been made, says:

"The disease is very widely spread throughout New England, and it occurs practically everywhere south of the White Mountains. By no means all of this territory is badly affected, however. In most places only a few scattered trees are attacked by the blight, although in a few localities as many as ten to twenty per cent of the trees are affected by the disease.

"Brunswick, Maine, appears to have suffered most severely, and it is feared that if the trouble should continue to increase, the beautiful and famous Bowdoin pines, of which Hawthorne and Longfellow wrote, will soon be a thing of the past. Another badly affected locality is Eliot, Maine. Here the noble grove of pines on the Greenacre conference grounds presents a very different appearance from usual to the hundreds of health seekers and others who visit the place every year.

"In New Hampshire the vicinity of Nashua seems to have suffered most, and brown, blighted trees mar the landscape wherever one turns. Massachusetts too has not escaped, and throughout the state the disease is found, but more particularly in the northern and central part. In Rhode Island and Connecticut white pine is not an abundant tree, but in both of these states the same trouble is found.

"It is evident then that the disease has suddenly made its



appearance in very widely separated localities all at once. Just how new the trouble is, is still an unsettled question. A few claim to have noticed the blight for the last twenty-five years, but most people agree that they never saw it until two years ago, in the summer of 1905. At that time it was reported from several localities, but the outbreak was not a severe one, and the trouble was not thought to be serious. In 1906 conditions remained about the same. Then this summer came the present outbreak, which without doubt exceeds in extent all previous ones, and has attracted very general attention throughout this section of the country.

"Unfortunately not enough definite information is available at present to enable the government experts to say precisely what is the cause of the trouble. In many respects the problem seems to be a complicated one, and one which will require considerable study to solve satisfactorily. The all important point to be determined is whether the disease is an infectious one and one which is likely to develop into a serious epidemic; or whether it is purely due to unfavorable conditions climatic in character and therefore not contagious.

"The evidence now at hand points both ways, and it is difficult to say which explanation is the correct one. Evidences of the parasitic fungus *septoria* have been found on all the specimens examined, but whether this is the cause of the blight, or the result of it, is not certain. In some respects the behaviour of the disease would seem to indicate that it is not caused by a fungus, but on the other hand the explanation that the trouble is a physiological one also has its weak points. If this latter explanation should prove to be the correct one, the trouble will probably disappear of its own accord next year, having done but little damage. If, however, it should prove to be a contagious disease of some sort, there are now so many centers from which it might spread that the result might be a serious epidemic.

"The present situation, therefore, is not one which calls for alarm but simply for further investigation. With this end in view the government has established several sample

plots at Peterborough, N. H., and at Brunswick, Maine, where a scientific study of the problem will be carried on. An examination of the roots of both healthy and blighted trees is also being made to determine whether winter-killing of the roots may not be the cause of the trouble. The state governments realize the importance of this investigation and stand ready to co-operate with the federal government as far as possible.

“New Hampshire and Maine have already rendered active assistance in collecting information regarding the occurrence and nature of the disease. Anyone who has any definite and accurate knowledge concerning the blight can greatly assist the government in its work by forwarding such information to the Forest Service at Washington. Any facts concerning the prevalence of the disease in a particular locality, how long it has been noticed there, whether affected trees often recover, and whether there have been any unusual climatic conditions of late that might have helped to cause the trouble, will be especially welcome.

“When the disease first appears in a place only scattering trees are usually affected, and these would not be likely to attract the attention of one who was not on the lookout for the trouble. Consequently it is probable that the disease occurs in many localities where it has not been noticed. It can always be readily recognized from the fact that the tips of the needles of this year's growth are turned a peculiar reddish-brown color, making the tree look as if it had been scorched, or as if most of the needles had been dipped into a reddish dye. When only a few, widely separated trees are affected in this way they are not conspicuous to the casual observer, but where the disease is prevalent it is very noticeable indeed, and the brown, blighted trees form an eye-sore in the landscape.’”

Since Mr. Dana's report the commission has been anxious to settle the matter definitely and has had considerable correspondence with Messrs. Dana and Spaulding; but the cause of the blight seems to be still as much of an enigma as when

it was first investigated. One thing of significance is to be noted, that not a single tree has been found this year (1908) to have the new leaves afflicted, which was not thus affected last year. This fact and also the fact that the blight is generally much less prevalent this year make it a matter of great satisfaction to those who have the best interests of our forests and woodlands at heart, and only a recurrence of the disease to any great extent can excite anxiety in the future.

## THE PINE BLIGHT OF 1908.

(Twig Blight.)

---

A new form of blight visited the pines during the season of 1908. In distinction to the blight of previous years, which attacked only the needles of the trees, this blight of 1908 is known as the twig blight. It first made its appearance very early in the spring. The ends of the twigs on the lateral branches of pine trees first drooped, then died and withered. Early in the year the Forestry Commission received many letters and inquiries concerning pine trees dead and dying from some unknown cause. In answer to these a trip was made through central New Hampshire to Pike, where Mr. Paul Hayhurst of the Bureau of Entomology was making an investigation under the direction of Dr. A. D. Hopkins. Here a conference was held between Dr. Hopkins, Mr. Hayhurst, a member of the Federal Forestry Service and a member of the New Hampshire Forestry Commission, to discuss conditions relative to this new blight, and to plan a thorough investigation of the trouble.

It was found through investigation in different sections of the state that this blight occurred sporadically in different localities, but that the trouble in general was less extensive than the blight of the preceding year, although certain localities were more severely affected. Mr. Hayhurst spent a portion of the summer in studying an insect which was found in the affected trees. This insect passed part of its existence in the pine and another portion in the spruce. Whether it was the primary cause of this blight is not as yet definitely known, but the fact that this affection was



much more prevalent in those sections where spruce is abundant would seem to be strong corroborative evidence in this direction, and investigation made by the commission in the extreme southeastern part of the state showed this blight to be very much less prevalent along the coast, where spruce is scarce.

In general, however, the last reports show a decided decrease in the amount of this twig blight and a corresponding decrease in the number of the above mentioned insects which are to be found this fall. It is to be hoped that this enemy of the pine will gradually disappear, and such is the indication at present. It seems, however, that these various enemies of one of our most valuable forest trees should be watched and studied to the end that everything may be done to prevent their assuming dangerous proportions before anything definite is known about them.

## OTHER INSECT PESTS OF 1908.

---

About August first considerable apprehension was caused in different parts of the state by attacks of caterpillars on deciduous trees. Specimens received by the commission were of two kinds, and they were forwarded to the Bureau of Entomology at Washington for identification. The "worms" were identified as the green-striped maple worm (*anisota rubiconda*) and the *heterocampa guttivitta*. The bureau also made suggestions as to fighting the pests, all of which information was duly forwarded to those seeking advice on the subject. The life history of the caterpillars, extent of damage done by them, with formulae and recommendations as to fighting them, is best summed up in Professor Sanderson's article No. 11 from the New Hampshire Agricultural Experiment Station, under date of August 10, 1908, a part of which is here quoted:

"For the past month serious injury to hardwood trees by caterpillars has been reported throughout the hill towns of the state south of the White Mountains. In Ossipee, Tamworth, and Sandwich, several thousand acres have been denuded so that the forests composed largely of maple and beech are as bare as in winter. Serious injury also occurs in Plymouth, Sanbornville, Laconia, Weare, Hancock, Sullivan, Newport, and elsewhere. No injury has been observed or reported north of Intervale, nor does any injury occur in the valleys or on isolated shade trees.

"This unprecedented injury is due to a green caterpillar, about one and one half inches long when full grown, of a bright green color and marked on the back with purplish-red of variable pattern, but usually consisting of an arrow-



head mark about the middle of the back, and minor markings toward the head and tail. The caterpillar is the larva of a native moth, *heterocampa gutivitta* Walk. As it has never attracted attention before, it has received no common name, but may well be termed the purple-marked forest caterpillar. The insect has always occurred here and throughout the eastern United States, but has never done any injury. The present outbreak is therefore most unprecedented.

"Almost all insects are prevented from increasing in abnormal numbers by their natural enemies, either parasitic insects, predaceous insects or diseases. In the present case some of these natural enemies have been destroyed, probably by weather conditions, and the insect has therefore increased in abnormal numbers. Just what the most important of its natural enemies are remains to be determined, and they are being studied. It is evident that it is entirely impossible to cope with the pest upon hundreds of acres of forest land in any artificial manner. Shade trees near infected forest may be protected by spraying with arsenate of lead, three to five pounds per barrel of water, or by tying strips of sticky fly paper or tanglefoot around the trunks, and thus preventing the ascent of the caterpillars. The injury by the pest seems to be about over for this year. When full grown the caterpillar descends to the base of the tree and there changes into a chrysalis or pupa about two inches under the surface of the leaf mould. Whether another brood of moths will emerge or not is not known, but it seems most probable that there is but one brood and that the moths will emerge next May and June. The moth is of an olive color, with a wing expanse of about one and one half inches."

No special mention will be made here of the gypsy or brown-tail moth question, inasmuch as this question was referred to the special commission created for that purpose by act of the last legislature. Interested parties were also referred to the excellent bulletin on this subject by Professor Sanderson, issued in February, 1908.

## FIRE NOTES.

---

### FIRE WARDEN REPORTS.

In section 3, chapter 97, Laws of 1905, fire wardens are required "To make reports of their doings to the Forestry Commission in such form and at such times as the commission may require." These reports are all in for the year 1907, and for 1908 up to September 25, and we give herewith a brief analysis of the same. For the year 1907 the fire wardens reported twenty-five fires: four in April, three in May, seven in June, two in July, six in August, one in September, and two no date given. They reported a total acreage burned over of 6,603 acres, but gave only \$3,420 as damages. This is accounted for by the fact that on two of the largest fires, one of over 5,000 acres at Lincoln and another of 800 acres at Windham, no estimate on the amount of property destroyed was given. With the exception of these two fires, the fire record was remarkably low, due no doubt largely to the uniform and plentiful rainfall of the year. For this year (1908) the record is very different. One hundred and one fires have been tabulated from the reports of fire wardens up to September 25, of which over 50 per cent were in July and September, in periods of extreme drought. These reports give an area of 8,076 acres burned over at an estimated loss of \$30,208. These figures again must be increased considerably, inasmuch as on a quarter of the total area burned over, or over 2,300 acres, little or no damage was reported. Since September 25, although the reports are incomplete, the drought having continued, many very large fires have occurred, so that the total damage to the state for the year will probably not fall short of \$100,000.

Other facts gleaned from the reports are as follows. In answer to the question as to how much of the land had been burned before, the wardens reported less than 25 per cent. In answer to the question as to what kinds of timber were destroyed they reported mostly pine, then spruce and hard woods. In general they did not report the destruction of much old timber. To the interrogatory as to what extent the fires were fought, answers were not always given in the reports. The sums expended for fighting fire ranged from \$7.50 to \$800, and the number of men engaged in the work of fighting fire from 6 to 300. As to the methods used in combating fires most wardens reported back-firing and trenching as the most efficient; in some cases chemicals and fire extinguishers were used with good success. It is unfortunate (and this will be rectified in the future) that in the fire blanks there is no column assigned expressly for reporting the causes of fires. Where the cause of the fire was given, it generally originated from the railroad or the carelessness of berrypickers or hunters.

## FIRE NOTICES.

### FIRE! FIRE!

#### Laws of New Hampshire Relating To Forest Fires.

If any person shall kindle a fire by the use of firearms, or by any other means, on land not his own, he shall be fined not exceeding ten dollars; and if such fire spreads and does any damage to the property of others, he shall be fined not exceeding one thousand dollars.—Chapter 277, section 4.

If any person, for a lawful purpose, shall kindle a fire upon his own land, or upon land which he occupies or upon which he is laboring, at an unsuitable time, or in a careless and imprudent manner, and shall thereby injure or destroy the property of others, he shall be fined not exceeding one thousand dollars.—Chapter 277, section 5.

Whoever shall inform the prosecuting officers of the state of evidence which secures the conviction of any person who willfully, maliciously or through criminal carelessness has caused any damage by fire in any forest, woodlot, pasture or field, shall receive from the state a reward of one hundred dollars. The state treasurer shall pay the same to the informer upon presentation of a certificate of the attorney-general or solicitor that he is entitled thereto.—Chapter 277, section 7.

Violations of these laws will be prosecuted to the full extent.

HENRY O. KENT,  
ROBERT E. FAULKNER,  
JASON E. TOLLES,  
ROBERT P. BASS,  
*Forestry Commissioners.*

It became evident to the commission early in the summer of 1907 that the above notice had not been very generally distributed throughout the state, and at a meeting of the commission in Concord the secretary was directed to take steps advertising the fact that the notice was available gratis to all woodlot owners upon application. Word to this effect was sent to several prominent newspapers in the state, and the following communication was sent out to all postmasters in the state represented by the fire warden list, two hundred and thirty-one in all, with the request that it be posted in conspicuous places:

### FIRES! FOREST FIRES!!

Owners of woodlots and timber lands in the state of New Hampshire are hereby notified that they can procure fire notices of the Forestry Commission by applying to the secretary, R. E. Faulkner, Keene, N. H. These posters give extracts from the laws relating to forest fires and are furnished gratis.

NEW HAMPSHIRE FORESTRY COMMISSION.



This information, coupled with the fact the fire wardens were repeatedly notified in correspondence upon other subjects, of the availability of the notices, has led to a gratifying increase of applications for them. For the year 1907 the secretary sent out on application seven hundred and seven notices. and for this year up to October 1, three thousand two hundred and seventeen. Judging from this increased demand and from correspondence with selectmen, wardens and wood lot owners, the fire notices are a real protection and serve as a check and warning to unscrupulous and careless persons while in the woods, and the distribution of the notices should be kept up and made more general until, as Mr. Foster says in his report, "they are in every postoffice, railway station, schoolhouse and town hall and in conspicuous places along streams, highways, and throughout the forested sections of the state."

#### PATROL.

A part of section 1, chapter 97, Laws of 1905, reads as follows: "In times of drought forest fire wardens themselves or by some agent or agents designated by them shall, when directed by the Forestry Commission, patrol the woods in their respective states or towns, warning persons who traverse the woods, campers, hunters, fishermen, and others about lighting and extinguishing fires." Believing that effective patrol is the true solution of the fire question, inasmuch as the prevention of large fires can be effected in this way, the commission has endeavored to secure proper patrol by calling the attention of the fire wardens to the law. This was done in the first place early in the year when the appointments of the fire wardens were made. Later, in July, their attention was again called to the law in the following notice:

#### STATE OF NEW HAMPSHIRE.

##### FORESTRY COMMISSION.

To the Fire Warden of.....New Hampshire:

DEAR SIR:—On account of the prolonged season of drought, your attention is again called to section 1, chapter 97, Laws

of 1905, and you are hereby directed to patrol, or have patrolled, such places as in your judgment seem likely to be exposed to fires through carelessness of campers, picnic parties, tourists, etc., or the negligence of the railroad. Please see also that the cloth notices recently sent you are all posted, and advise me at once if you require any more.

Very truly yours,

ROBERT E. FAULKNER.

KEENE, N. H., July 10, 1908.

Again in September, when the drought was once more serious, and extensive fires were reported in Maine and Massachusetts, a similar notice was sent out by the secretary as follows:

STATE OF NEW HAMPSHIRE.

FORESTRY COMMISSION.

To the Fire Warden of.....New Hampshire:

DEAR SIR:—Until rain falls and the drought is broken, you are hereby directed to patrol, or have patrolled, such places as in your judgment seem likely to be exposed to fires through carelessness of picnic parties, tourists, hunters, etc., or the negligence of the railroad. You are directed also to visit all steam mills operating within your jurisdiction and see that all precautions are taken by them to prevent fires. Please see, also, that the cloth notices recently sent you are posted, and advise me at once if you need any more.

KEENE, N. H., September 25, 1908.

How effective this patrol by the fire wardens has been the commission is unable definitely to say. From letters received it is evident that quite a number of the wardens have maintained a patrol at critical times over the woods, while others have no doubt given little or no thought to the matter. The whole question of patrol hinges on two considerations, without which we shall never obtain more than indifferent protection to our forests in times of drought. In the report of the efficiency of fire law made by Mr. Foster two recommendations stand out as of the utmost importance: (1) the



appointment of a state forester, who shall be chief fire warden and have charge of all the local fire wardens; (2) the need of a change in the existing statute so that the state shares equally with the towns the burden of fighting fires and patrol. By so assuming a part of the burden with the towns the latter will receive an inducement to patrol the woods in time of need, which at present does not exist; and under the direction and supervision of a state fire warden such patrol should be as effective and complete as it can be made. A state forester would be able personally to know the wardens, could co-operate with the selectmen in seeing that men physically fit were appointed to the office, and that they were accessible in time of need; he would also be able to advise with the wardens in their various other duties of estimating areas and damage done, of settling disputes between contiguous towns where the fire had crossed the line, etc., etc.

Aside from the problem of fire protection the appointment of a state forester would be a distinct step forward in the interests of forestry in our state. The commission at present is constantly receiving letters which call for data and information on such matters as planting, pruning, raising of seedlings, thinning, estimating standing timber and other kindred topics relating to forest management. All such letters have been referred either to the Bureau of Forestry at Washington or to some forestry expert. A state forester would make direct answer to all such inquiries, and save time now required of referring such answers to other sources. A state forester would likewise be able to carry on an educational propaganda in the interests of forestry such as is not possible under existing conditions by visiting farmers' institutes, grange meetings or lecturing before other social organizations in the state. He would also undoubtedly be of help to assessors and selectmen in matters of timber taxation. We repeat once more the urgent need of a state forester such as Massachusetts and Connecticut and other states have, and recommend the change of law relating to fire fighting and patrol expense, as indicated above.

## FIRE WARDENS.

---

### MERRIMACK COUNTY.

Allenstown,	Felix Connors.
Andover,	A. M. Loverin.
Boscawen,	Almon Harris (Geo. H. Gross, Agt.).
Bow,	C. S. Goodrich.
Bradford,	D. G. Peaslee.
Canterbury,	Lowell T. Mason.
Chichester,	C. A. Langmaid.
Concord,	W. C. Green.
Danbury,	Arthur R. Ford.
Dunbarton,	Natt. P. Hammond.
Epsom,	Joseph Lawrence, Gossville.
Franklin,	H. E. Colby (James Huntoon, Agt.).
Henniker,	E. E. Russell.
Hill,	J. E. Newton.
Hooksett,	John W. K. Rowell.
Hopkinton,	E. F. Dustin, Contoocook.
Loudon,	Daniel L. Moore.
Newbury,	Charles H. Muzzey.
New London,	W. A. Messer.
Northfield,	Jeremiah B. Smith (A. F. Cunningham, Tilton).
Pembroke,	William M. Smith.
Pittsfield,	David O. Sherburne.
Salisbury,	Edwin D. Little.
Sutton,	J. H. Keyser, North Sutton.
Warner,	O. A. Sawyer.
Webster,	M. J. Gilman, R. F. D., Contoocook.
Wilmot,	Sumner Woodward.

## HILLSBOROUGH COUNTY.

Amherst,	W. W. Sloan.
Antrim,	Oscar H. Robb.
Bennington,	H. W. Wilson, Agt.
Brookline,	Frank L. Willoby.
Deering,	Joseph F. Lock, East Deering.
Francestown,	F. A. Pettee.
Goffstown,	R. L. Shirley, R. F. D. No. 2, Manchester.
Greenfield,	W. M. Ford.
Greenville,	V. L. Parker.
Hancock,	William W. Hayward.
Hillsborough,	E. C. Newman.
Hollis,	George W. Hardy.
Hudson,	James E. Merrill.
Litchfield,	Charles B. Campbell.
Lyndeborough,	J. A. Woodward, South.
Manchester,	Thomas W. Lane (Vine St.).
Mason,	E. H. Russell, Greenville.
Merrimack,	H. G. Corning, Reed's Ferry.
Milford,	W. L. Winslow.
Mount Vernon,	C. H. Raymond.
Nashua,	Charles H. Whitney.
New Boston,	Henry E. Fox.
New Ipswich,	Arthur E. Chase.
Pelham,	George H. Currier.
Peterborough,	Timothy E. Driscoll.
Temple,	Charles E. Rockwood.
Weare,	G. H. Eastman, South.
Wilton,	M. J. Herlily.
Windsor,	J. R. Nelson, Hillsborough Upper Village.

## CHESHIRE COUNTY.

Alstead,	M. E. Knight.
Chesterfield,	A. H. Post.

Dublin,	Almon A. Baldwin.
Fitzwilliam,	Winfield M. Chaplin.
Gilsum,	Leon M. Osborne.
Harrisville,	B. F. Bemis, Chesham.
Hinsdale,	Robert W. Weeks.
Jaffrey,	Alvin L. Parker.
Keene,	Louis Nims.
Marlborough,	Dow J. Hart.
Nelson,	Wm. S. Mansfield, Agt., Munsonville.
Richmond,	A. B. Conway, R. F. D. No. 3, Winchester.
Rindge,	Albert L. Hale, East Rindge.
Roxbury,	C. M. C. Phillips, P. O., East Sullivan.
Stoddard,	Henry Wilson, Munsonville.
Sullivan,	Marshall J. Barrett.
Surry,	F. E. Nesmith.
Swanzey,	Walter F. Oakman.
Troy,	Asa C. Dort.
Walpole,	W. D. Knowlton.
Westmoreland,	C. H. Cobleigh, Ware's Ferry.
Winchester,	Ed. C. Hildreth.

## SULLIVAN COUNTY.

Acworth,	Henry A. Clark.
Charlestown,	G. L. Richardson.
Claremont,	C. E. Sears.
Cornish,	James B. Chadbourne.
Croyden,	Fred W. Putnam.
Goshen,	George F. Crane.
Grantham,	D. D. Thornton.
Langdon,	Charles A. Jeffs, Drewsville.
Lempster,	Fred A. Barton.
Newport,	George E. Lewis.
Plainfield,	C. H. Peterson.

Springfield,	Charles McDaniel, R. F. D. No. 1, Enfield.
Sunapee,	Fred M. Sargent.
Unity,	Charles A. Newton, Newport.
Washington,	S. N. Ball.

## BELKNAP COUNTY.

Alton,	George W. Place.
Barnstead.	E. B. Drake.
Belmont,	C. O. Judkins.
Center Harbor,	O. P. Smith, Ashland.
Gilmanton,	C. L. Chase.
Gilford,	O. V. Rand, R. F. D. No. 1, Lake- port.
Laconia,	Arthur W. Spring.
Meredith,	Albert A. Kidder.
New Hampton,	Charles D. Thyng.
Sanbornton,	Robert M. Wright, P. O. Hill.
Tilton,	Jeremiah B. Smith.

## CARROLL COUNTY.

Albany,	Archie Nickerson.
Bartlett,	G. K. Howard.
Brookfield,	Charles Willey, Sanbornville.
Chatham,	Hazen Chandler.
Conway,	E. Whittemore, Intervale.
Eaton,	David M. Thurston, R. F. D., Free- dom.
Effingham,	J. W. S. Palmer, R. F. D., Center- ville.
Freedom,	Edgar J. Young.
Hart's Location,	Roland B. Chase, P. O. Bemis.
Jackson,	Oscar W. Hayes.
Madison,	I. W. Frost.
Moultonborough,	George H. Bragg.
Ossipee,	N. P. Sias.

Sandwich,	Herbert E. Moulton, Center.
Tamworth,	Harry O. Mason.
Tuftonborough,	George W. Copp, Melvin Village.
Wakefield,	Frank J. Leavitt, Sanbornville.
Wolfeboro,	Herbert E. Davis.

## ROCKINGHAM COUNTY.

Atkinson,	John H. Smith.
Auburn,	Fred H. Hall, Agt.
Brentwood,	G. R. Rowe.
Candia,	George L. Cass, R. F. D. No. 1, Manchester.
Chester,	George S. West.
Danville,	G. M. Anderson.
Deerfield,	A. B. Chase, R. F. D. No. 1, Ray- mond.
Derry,	F. M. Gilchrist.
East Kingston,	E. A. Currier.
Epping,	James H. Whittemore.
Exeter,	George Carter.
Fremont,	E. D. Sanborn.
Greenland,	J. H. Brackett.
Hampstead,	Charles F. Adams.
Hampton,	James B. Brown.
Hampton Falls,	L. N. Sanborn.
Kensington,	Roscoe Kimball, R. F. D., Exeter.
Kingston,	A. W. Nason, R. F. D. No. 1, New- ton.
Londonderry,	Clarence Goodwin.
Newcastle,	William I. Haywood.
Newfields,	Jesse S. Gray, Agt.
Newington,	C. M. de Rochemont, R. F. D. No. 1, Portsmouth.
Newmarket,	H. B. Knowlton.
Newton,	E. H. Nichols.
North Hampton,	Otis S. Brown.





FIG. 2.—Snow under hardwoods. The picture was taken about the middle of April and shows excellently how the forest cover stores the waters for our springs and streams.





FIG. 3.—Excellent stand of hardwoods.





FIG. 4.—Mixed stand of hardwoods and pine.



FIG. 5.—Cross-section of old growth tamarack ; the tape across shows a diameter of only 9 inches. The section counts 250 rings. In the heart wood area it shows a growth radially of only one inch, and counts there 150 rings. The remarkable fact about this tree is its wonderful recuperation after suppression of 150 years, as indicated by the outer rings.



Northwood,	J. G. Towle, Ridge.
Nottingham,	P. B. Batchelder.
Plaistow,	F. P. Hill.
Portsmouth,	David E. Jenkins.
Raymond,	O. W. Fellows.
Rye,	Charles D. Locke.
Salem,	G. E. Whitford, Center.
Sandown,	J. F. Sargent, Chester, Route No. 3.
Seabrook,	Charles Gove.
South Hampton,	F. O. Towle, P. O., Amesbury, Mass.
Stratham,	W. Leslie Dining.
Windham,	W. L. Emerson.

## STRAFFORD COUNTY.

Barrington,	John F. Seavey.
Dover,	George E. Varney.
Durham,	David H. Fogg (Mark E. Willey, Agt.).
Farmington,	Ulysses S. Knox.
Lee,	Benjamin F. Davis, South Lee.
Madbury,	W. H. Knox, R. F. D. No. 5, Dover.
Middleton,	E. S. Moore.
Milton,	Fred Howard.
New Durham,	Dana P. Jones.
Rochester,	H. C. Hanson.
Rollinsford,	Charles E. Lord, Salmon Falls.
Somersworth,	D. J. Buckley.
Strafford,	Woodbury W. Durgin, West Bar- rington.

## GRAFTON COUNTY.

Ashland,	E. P. Harrington.
Bath,	B. W. Clark, R. F. D. No. 2, Lis- bon.
Benton,	L. H. Parker.
Bethlehem,	Walter H. Clarke.



Bridgewater,	D. B. Clement, R. F. D. No. 2, Plymouth.
Bristol,	Elbridge S. Bickford.
Campton,	George E. Pulsifer, R. F. D., Ply- mouth.
Canaan,	John Currier, R. F. D. No. 1.
Dorchester,	G. W. Rowen, Cheever.
Easton,	C. A. Young.
Ellsworth,	Burley O. Avery.
Enfield,	Ralph Nichols.
Franconia,	E. B. Parker.
Grafton,	Augustus F. Hoyt.
Groton,	W. H. Hunkins.
Hanover,	A. D. Storrs.
Haverhill,	H. W. Keyes, North Haverhill.
Hebron,	A. E. Moore.
Holderness,	J. W. Pulsifer, Plymouth.
Landaff,	C. M. Gale, Lisbon.
Lebanon,	H. M. Tucker.
Lisbon,	C. W. Pike.
Littleton,	E. C. Young.
Livermore,	John M. Garland.
Lyman,	Al F. Parker, R. F. D. No. 1, Lis- bon.
Lyme,	George A. Pushec, Lyme Center.
Monroe,	A. H. Nelson
Orange,	Charles H. Ford.
Orford,	A. M. Stevens.
Piermont,	J. P. Metcalf.
Plymouth,	George R. Foster.
Rumney,	G. D. Kidder, Depot.
Thornton,	W. P. Van Housen, West.
Warren,	H. L. Cotton.
Waterville,	Joseph L. Tuttle.
Wentworth,	W. S. Libbey.
Woodstock,	F. S. Merrill.

## COOS COUNTY.

Berlin,	William Beach.
Carroll,	John Paige, Bretton Woods.
Clarksville,	Alman Young.
Colebrook,	Lyman Lombard.
Columbia,	Frank Lang.
Dalton,	Foster Harriman, R. F. D. No. 1, Littleton.
Dummer,	Fred U. Woodward, P. O. Milan.
Errol,	William D. Thurston.
Gorham,	H. J. Fancy.
Jefferson,	W. D. Perkins.
Lancaster,	Allen Moyle.
Milan,	S. A. Collins.
Northumberland,	William Hayes.
Pittsburg,	George W. Baldwin.
Randolph,	Francis C. Wood.
Shelburne,	James Simpson.
Stark,	W. T. Pike.
Stewartstown,	Charles A. Heath.
Stratford,	F. S. Whitney.
Wentworth's Location,	J. R. Turner.
Whitefield,	William Byrne.

## A NEW STATE RESERVATION.

---

The commission takes pleasure in announcing the acquisition by the state of a new reservation,—the gift of Miss Frances A. L. Haven of New York City. The reservation is located in Jaffrey, on the Jaffrey road leading to Dublin, and is bounded on another side by the old abandoned highway leading to Peterborough. Of the fifty or sixty acres which comprise the lot fully 85 per cent is covered with pine of excellent height and quality, the remainder being a mixture of spruce and small clumps of hardwoods. The reservation is admirably adapted to serve as a park or recreation ground; and one side, an open field of about one and one third acres (as shown in the frontispiece), could, if not incompatible with the reservation idea, be devoted to a nursery and the raising of young pines, being completely sheltered and protected from the winds on all sides by the pine. A keeper will be put in charge of the reservation and paths laid out to make the many pretty nooks and retreats more accessible.

The citizens of our state are under great obligations to Miss Haven for this unsolicited gift, and at a meeting of the Forestry Commission in Concord on October 15 the following vote was passed: "That the New Hampshire Forestry Commission, in behalf of the state, extends its most sincere thanks to Miss F. A. L. Haven for her patriotic and generous action in presenting her timber tract to the state, and that a copy of this vote be sent to her." Miss Haven was accordingly notified of the action of the commission.

## CONSERVATION SCHEDULE.

---

Nearly every one is familiar with the origin and scope of the work undertaken at the memorable gathering of governors of the different states last May in Washington. The meeting, called together by the President, was in many respects the most notable and impressive convention ever held in this country, signifying as it did the first concrete step toward the consideration of that most vital and far-reaching problem, which underlies the whole fabric of our civilization,—the conservation of our natural resources. At that meeting the governors recommended among other things the appointment of a State Conservation Commission to act with the National Conservation Commission, in response to which suggestion the President organized the National Conservation Commission into four sections, making separate commissions on waters, forests, lands and minerals, and asked them to co-operate with the state commissions in securing data and information as to our natural resources on which to base his recommendations for legislation to the next Federal Congress.

In August last, inasmuch as no State Conservation Commission had been appointed, the National Conservation Commission on forests forwarded to the New Hampshire Forestry Commission the conservation schedule as herein printed, calling for data in our state, under the heads of land and timber classification, large timber holdings, woodlands, forest planting, forest fires, state lands. The Forestry Commission was fortunate in securing the services of Mr. P. W. Ayres, forester to the Society for the Protection to New Hampshire Forests, to carry out and complete this work. The data and

figures given in the schedule represent not only the first step in our state in the general conservation movement, but they are most interesting and valuable information for our own use, never before, we believe, brought together in this shape.



## TIMBER TAXATION INVESTIGATION.

---

The peculiar economic conditions prevailing in New Hampshire render forestry of especial importance in this state. New Hampshire has no coal, oil or gas within its boundaries to create the motive power for any of its industries. Coal must be transported a long distance before it can be used in the boilers of our factories; this adds largely to its cost and puts us to a disadvantage in this respect as compared with those communities where coal is mined near at hand.

We have, however, in our many rivers and streams a constant source of power, which is now being used, and can be further developed for manufacturing purposes. It behooves us as a state to both husband and develop this great resource. Conservative lumbering and proper reforestation are two important principles in the conservation of a uniform flow of water in our streams.

In comparison with many parts of this great country our soil lacks fertility, and owing to the rugged contour of the land it is difficult for our farmers to successfully compete in many agricultural pursuits with other sections of the country. But our soil, our climate and even our rocky hills are admirably adapted to the raising of trees, and in growing timber we can compete with the rest of the country. The ideal economic conditions for our state would seem to be a development of our forest resources to their greatest limit, in such a way as to preserve and develop the greatest water power in our streams, and with this the development of wood-working industries throughout the state, to manufacture here this timber product.

The ideal forest condition is that in which each acre of land is growing the largest amount of the most valuable

timber which that land will produce. Probably less than 10 per cent of the forested area of the state is at present doing this. Consequently there is here a great opportunity to increase the wealth and productiveness of the state. In order to attain the desired results, conditions should be made as favorable as possible to the growing of the best timber. Much educational work is necessary to teach the people throughout the state as to the best and most modern methods of cutting and reforestation to bring about the desired result. This educational work can best be done by a state forester and fire warden such as many states now employ.

The system under which forest property is taxed will without doubt exercise a great and continually increasing influence on the age at which, and method in which, timber is cut. Also on whether the land is so left after cutting that it will at once produce another crop of valuable trees.

In view of the great importance of this question to the present and future welfare of New Hampshire, the Forestry Commission invited the Federal Forest Service to co-operate with it in an extensive investigation of the conditions relative to the taxation of timber lands in New Hampshire. After consultation with Mr. Gifford Pinchot, chief forester of the Federal Service, the work was begun early last spring and continued throughout the summer. It was the purpose of the commission, through this investigation, first, to familiarize itself with present conditions relative to taxation of forest lands, and, secondly, to make such recommendations as might lead to the betterment of those conditions; not to the end that forest growth should escape paying its just proportion of the state's taxes, but rather that its taxes might be so levied as to make them as light a burden upon the timber grower as possible. The commission realizes that this is a problem of great importance to the state and one whose proper solution is sure to largely increase the prosperity and wealth of the state in generations to come.

Inasmuch as the State Tax Commission is investigating the general question of state taxes, with a view to recom-

mending certain changes, this seemed a particularly opportune time to carry out a thorough investigation in regard to the taxation of timber lands. The Forestry Commission has had two hearings before the State Tax Commission and has discussed their conclusions at length with that commission.

Throughout the investigation carried on by Mr. Foster, the Forestry Commission has actively co-operated with him and has conferred with him often as to the progress of the work. The suggestions attached to the end of this report for a bill concerning the taxation of growing timber was worked out by Mr. Philip P. Wells, of the Federal Forest Service, and the New Hampshire Forestry Commission, with certain suggestions on the part of the State Tax Commission. It contains the best solution of certain difficulties in regard to forest taxation which now exist and which are sure to increase, which the Forestry Commission has been able to formulate.

In this work the Federal Forest Service has borne one half of the expense and the New Hampshire Forestry Commission the other half. The investigation was made possible through the generosity of Mr. Robert E. Faulkner, secretary of the Forestry Commission, who has turned over to that commission his annual salary of one thousand dollars as secretary, to be used by the commission for the advancement of forestry in New Hampshire.

HENRY O. KENT.

ROBERT E. FAULKNER.

JASON E. TOLLES.

ROBERT P. BASS.

## APPENDIX.

## CONSERVATION SCHEDULE.

### LAND AND TIMBER CLASSIFICATION.\*

(State of New Hampshire.)

1. What is the total land area of your state?  
5,647,200 acres.  
Total area, 5,762,200; less estimated water area, 115,000.
2. What is the area cleared and in farms and pastures in your state?  
1,373,942 acres.  
Estimate derived from reports of Messrs. Chittenden and Lyford of U. S. Forest Service. Census (12th) figure is 1,076,879.
3. What is the area of naturally treeless land, including marshes, sand dunes, prairie, open range, etc.?  
43,485 acres.  
This includes 30,000 acres in the mountains made barren by cutting and fire.
4. What is the area of forest containing
  - a. Merchantable timber? 2,463,066 acres.
  - b. Nonmerchantable timber? 1,351,515 acres.Estimate derived from figures of Messrs. Chittenden and Lyford. Total forested area, 3,813,581 acres, or 67.5%.
5. What is the area of cut-over land which is fully restocking with forest? Estimated, 2,953,208 acres.
6. What is the area of cut-over land which is not fully restocking (a) with forest and which has not been put into farms? Due to fire, estimated, 350,000 acres.
7. What is the approximate stand of merchantable timber in your state? 31,250 million board feet.

\* Figures and data by P. W. Ayres.



8. What was the area of timberland cut over during the calendar year 1907? Estimated, 80,000 acres.  
The total cut in 1906 was 539,259,000 feet.
9. Of the timberland which is annually cut over in your state,
  - a. What per cent is put into farms? None.
  - b. What per cent is fully restocking with forest? 88%
  - c. What per cent, excluding farm land, is not fully restocking with forest? 12%

In very dry years, when fires are bad in the mountain region, the percentage fully restocking is smaller.

(a) As fully restocking is understood, cut-over land on which young growth or reproduction, or both, provide a satisfactory basis for a second crop.

### LARGE TIMBER HOLDINGS.

(State of New Hampshire.)

1. What is the area of merchantable timberland in your state owned or held under stumpage contracts by companies, corporations, and large private owners?  
Estimated, 525,000 acres.  
The cut-over, nonmerchantable areas held by the large companies are much larger.
2. What is the total amount of merchantable timber on these holdings? 5,250 million board feet.
3. Name the principal kinds of timber on these holdings in the order of their importance.  
Spruce, fir, pine, maple, birch, popple, oak.
4. How does the quality of the timber on these large holdings compare with that in the hands of the state of other owners?  
They contain the best timber in the state.
5. What proportion of the large timber owners are actively logging their holdings?  
All are logging their holdings actively; but the owners are few and the areas are very large. Some buy extensively in Canada to protect their holdings.

## WOODLOTS.

## Woodland Owned by Farmers.

(State of New Hampshire.)

1. Approximate area in woodlots in the state,  
Estimated, 2,700,000 acres.
2. Percentage of woodlot area containing saw timber, 60%
3. Average amount of saw timber per acre, 10 M feet.
4. Average amount of cordwood per acre, exclusive of saw  
timber, 15 cords.
5. Quality of merchantable timber (excellent, good or poor),  
Pine and spruce, excellent; hardwood, good.
6. Percentage of woodlot area containing timber just below  
merchantable size, 20%
7. Percentage of woodlot area practically brush land, 20%
8. Percentage of different species contained in average  
woodlot, either in the whole state or by definite sec-  
tions:

## SOUTH OF WHITE MOUNTAINS.

Pine .....	60
Maple, birch and beech.....	30
Chestnut and oak.....	10
	<hr/>
	100%

## IN THE MOUNTAINS AND NORTHWARD.

Spruce .....	50
Birch, beech, maple.....	40
Pine .....	10
	<hr/>
	100%

9. Percentage of woodlot area held mainly as source of  
timber or fuel supply for owners, 80%

## FOREST PLANTING.

(State of New Hampshire.)

1. Total of forest plantations in state,  
     Planted by private owners, 865 acres.  
     (Figure from Mr. Rogers of U. S. Forest Service.)  
     Planted by the state, None.
2. Principal species which have been planted,  
     White pine and a very little chestnut.
3. Chief purpose for which planting has been done (shelter-  
     belts, production of posts, firewood, timber, etc.),  
     Timber.
4. Upon what per cent of the area planted has forest plant-  
     ing been successful? 95%  
     What are the principal causes of failure, if any?  
         (1) Broadcast sowing of seed.  
         (2) Spaced wrongly.
5. Is the practice of planting waning or on the increase, and  
     to what extent?  
     Increasing four or five new plantations each year.
6. Area of land in the state best adapted for timber growing,  
     which is not restocking naturally and requires planting  
     to make it productive,  
         a. In possession of private owners, 150,000 acres.  
         b. In the possession of the state, None.
7. What steps do you consider necessary to promote, con-  
     sidered separately, forest planting by private owners and  
     by the state?  
     By the state, acquisition of state forests, with a state  
     forester; by private owner, a state nursery for the dis-  
     tribution of seedling trees at cost. More educational  
     work.
8. Chief purposes for which future planting will be done  
     in your state (production of timber, shelter belts, water-  
     shed protection, etc.),  
     Production of timber.



FIG. 6.— Virgin hemlock and hardwoods in mixture—Southern New Hampshire.



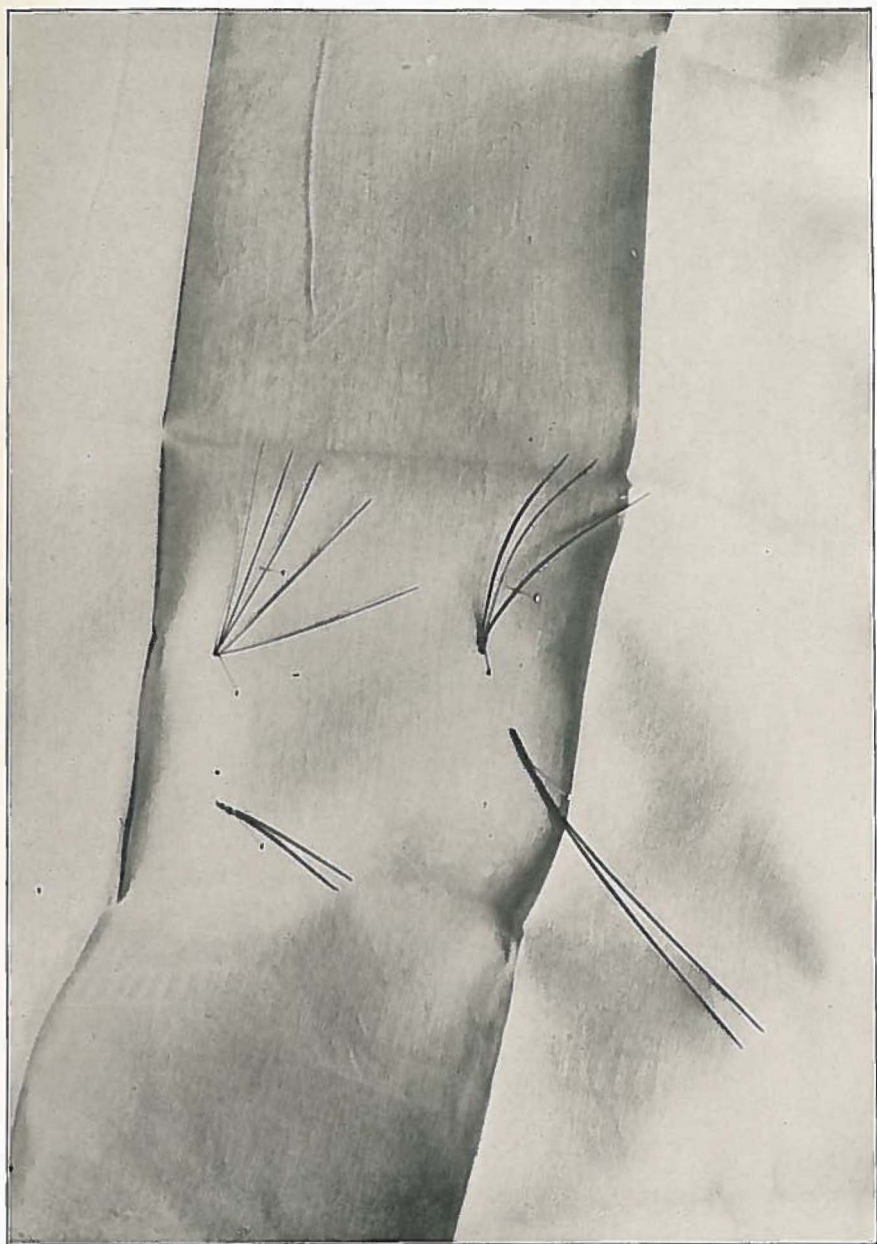


FIG. 7.— Pine needles showing the four kinds of pine native to New Hampshire. Upper left hand corner the white pine, five needles in a whirl; upper right hand corner, pitch pine, three needles in a whirl; lower right hand corner, red pine or Norway pine, two long needles in a whirl; lower left hand corner, Jack pine, two short needles in a whirl.





FIG. 8.— Old growth pine overtopping a stand of mixed hardwoods and hemlock. The tree measures by hypsometer 145 feet and is probably one of the tallest trees in the southern part of the state.

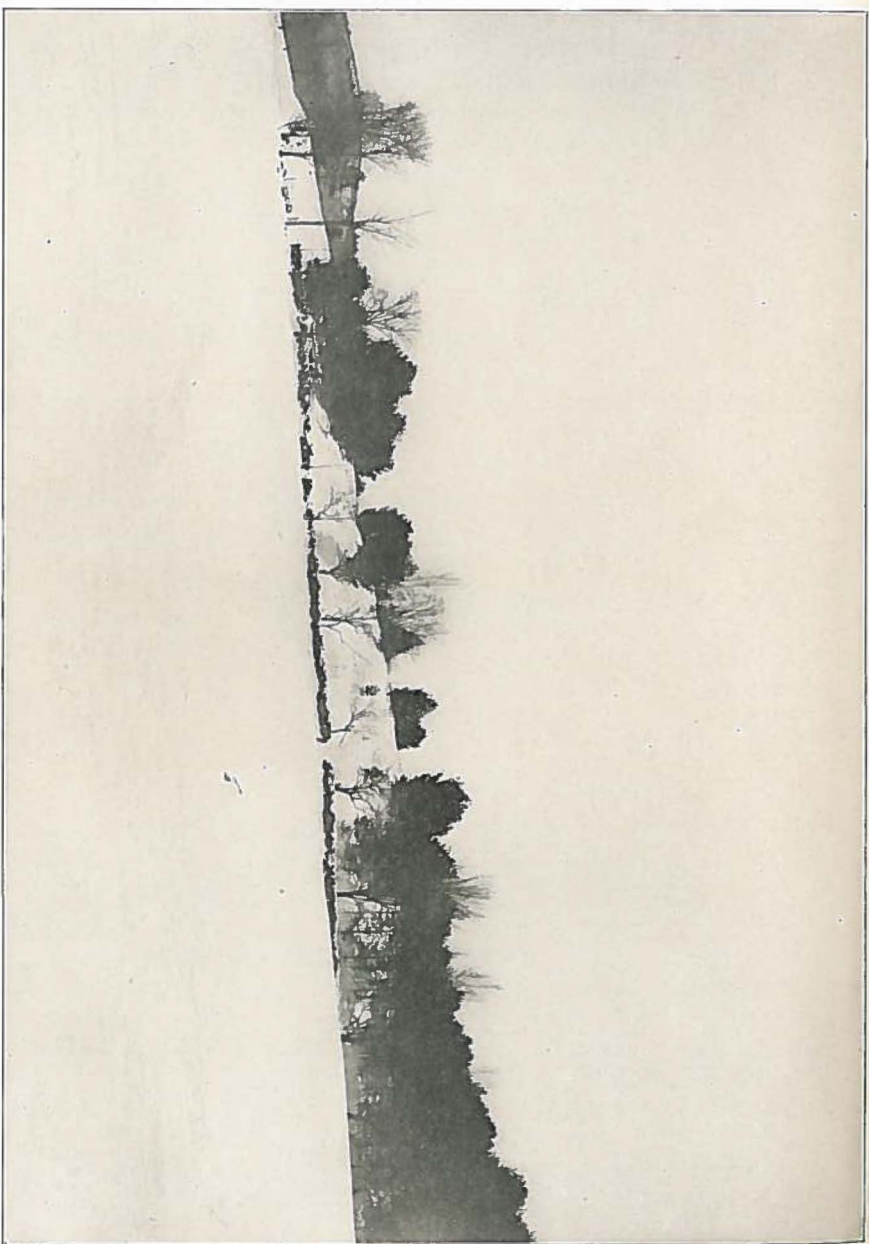


FIG. 9.—The advance of the pine. This picture shows a characteristic way of taking possession of abandoned pastures. To the right is seen the main body of the pine, which has completely covered the land. To the left the spaces left between the seed trees are rapidly being filled up. Much of our pine forests are created this way, but a large percentage of the timber is of inferior quality on account of the varying ages of the trees that make up the stand and the prominence of many limby trees.

9. Species best adapted to the region and which promise highest returns,  
White pine and chestnut.

### FOREST FIRES.

(State of New Hampshire.)

1. Approximate area of all forest land in state burned over during calendar year 1907, 10,000 acres.  
Figures based upon reports to State Forestry Commission.

2. Value of timber and other property destroyed by forest fires during calendar year 1907, \$5,000

3. What are the most common causes of forest fires, arranged in the order of their importance?

1. Railway engines.
2. Careless burning of brush.
3. Campers, hunters, fishermen.
4. Lightning.

4. What steps are being taken to prevent damage by forest fires through action by
  - a. The state and county?

The State Forestry Commission may direct local town fire wardens to patrol the woods in dry seasons, at the expense of the towns.

- b. Corporations?

Send their own men at their own expense to patrol.

- c. Private owners?

Send out a few to patrol their woods in dry seasons.

- d. Co-operation between any of the above?

None.

5. To what extent is damage by forest fires being lessened by the above measures?

The patrol by corporations and private owners is effective.

6. What additional measures do you consider necessary to further reduce damage by forest fires?

The appointment of a state forester, who shall direct the local town fire wardens.

## STATE LANDS.

## STATE OF NEW HAMPSHIRE.

Amount of standing timber and its quality, by species, owned by the state, as follows:

Species	State Forest Reserves, Acres	School Lands, Acres	Tax Lands, Acres	Swamp Lands, Acres	Other State Lands, Acres	Total State Lands, Acres
	1000 Ft., B.M. Quality	1000 Ft., B.M. Quality	1000 Ft. B. M., Quality	1000 Ft. B. M., Quality	1000 Ft. B. M., Quality	1000 Ft. B. M., Quality
Yellow Pine.						
White Pine...	400 M, exc't					400 M
West'n Pine...						
Sugar Pine...						
Douglas Fir...						
Hemlock.....						
Spruce.....	2000 M, good					2000 M
Cypress.....						
Cedar.....						
Oak.....						
Maple.....						
Yellow Poplar						
Other soft						
woods.....						
Other hard						
woods.....						
Total.....						2,400,000

SEPTEMBER 30, 1908.



THE TAXATION OF FOREST LANDS  
AND  
THE EFFICIENCY OF THE FIRE LAWS IN  
NEW HAMPSHIRE

---

By  
J. H. FOSTER  
Forest Assistant, Forest Service  
SEPTEMBER, 1908

# THE TAXATION OF FOREST LANDS AND THE EFFICIENCY OF THE FIRE LAWS IN NEW HAMPSHIRE.

---

BY J. H. FOSTER, FOREST ASSISTANT, FOREST SERVICE.

---

## INTRODUCTION.

One of the duties of the State Forestry Commission is to inquire into the forest conditions of the state and to conduct such investigations from time to time as may seem desirable in the interests of forestry within the state.

Forest taxation and fire protection are the chief problems to be considered in the future, and, while both have been discussed in previous reports of the Forestry Commission, and fire protection has been carefully investigated, no special study has been made of the tax conditions within the state.

The rapid destruction of American forests, threatening not only the practical exhaustion of the timber supply within twenty-five years, but also the alternate floods and droughts which result from the denudation of important mountain watersheds, has of late drawn general attention to the necessity of forest conservation. Though the national forests in the Sierras and Rocky Mountains are of great extent, and though considerable areas have been acquired for state forests in New York, Pennsylvania, Wisconsin, and other states, nevertheless, with respect to the total forest resources of the country, the area in public forests is relatively small and the timber relatively poor in quality. Four-fifths of the standing timber in the United States is in private ownership, and any effective plan for forest conservation must encourage private owners to so manage their woodlands as to secure a con-

tinuous supply of timber from them. For this purpose state legislation can be especially helpful in two directions, namely, adequate protection against fire, and equitable taxation. Accordingly, the subject of forest taxation is beginning to receive serious attention by forest experts and students of taxation problems, as is shown by the fact that it was discussed at the two last annual meetings of the National Tax Reform Association in Toledo, 1907, and Toronto, 1908, and is the subject of a special investigation now in progress for the National Conservation Commission appointed by President Roosevelt.

Under the laws of practically all the states, forest lands and growing timber thereon are considered real estate, to be annually appraised at their actual market value and taxed at the uniform rate imposed on other property. Many states (New Hampshire among the number) have passed tax exemption, rebate or bounty laws to encourage forest plantations under certain prescribed conditions, but such laws have not generally been taken advantage of, and in legal theory the taxation of forest lands and standing timber is fixed by the general property tax laws as above indicated. If the theory were carried out (i. e., the taxation of the land and standing timber annually in proportion to its actual market value each year), the owner of timberlands would be obliged to pay annually a tax on standing timber for all preceding years of its growth as well as for the last year, with no hope of a cash return until the timber is cut, whereas the owner of farm lands, growing yearly crops, or of improved real estate yielding rents, has an annual return, is not taxed for the product of preceding years, and, because of the time of year at which the taxes are collected, pays no tax even on the crop or income for the current year. This would mean that the timberland owner would be forced to cut the timber as soon as he could get a return for the operation, and that conservative cutting and the leaving of seed trees to reforest the land would be discouraged, since the annual taxes upon the land would steadily increase and would, especially when

the interest compounded on preceding taxes is considered, consume the entire value of the annual growth. This premature cutting and destruction of seed trees would mean that the towns would lose the taxes in future, which could have been collected had the trees been allowed to mature, or had proper care for reforestation been taken, in addition to the evils resulting from the exhaustion of the timber supply and the denudation of watersheds.

Theory, however, is one thing and practice another, a fact nowhere more apparent than in matters affecting taxation.

Therefore in the spring of 1908 an agreement for co-operation was entered into between the State Forestry Commission and the Forest Service at Washington for a study of the actual working effect of the present system of taxing timberlands in this state, the expense of the investigation to be shared equally by both parties. It was also agreed that the efficiency of the fire laws should be incidentally investigated at the same time, but inasmuch as the fire problem has been reported upon before, the greater part of the work was to be devoted to the problem of taxation.

As a result of five months of field study the Forest Service has submitted the following report to the State Forestry Commission. The woodlot conditions in the agricultural portions of the state differ so materially from the wildland conditions that both the tax study and the fire problem fall naturally into two subdivisions. The report considers these subdivisions separately.

The general conclusions which may be drawn from this investigation are:

(a) The actual tax burdens imposed on forest lands of the same value are not equal or "proportionate" as the state constitution requires, either as between the different towns or different taxpayers in the same town.

(b) In general the law has not been strictly enforced in the past, as is shown by the fact that little or no land reverts to the towns because of unpaid taxes. Sometimes an owner believes that the tax is more than the land can stand,



but in such cases a purchaser has always been found. This is due to the fact that growing timber has usually been assessed much below its actual market value, and the burden of taxation thus has been lightened so that the land can carry it.

(c) In the search for revenue to meet the financial necessities of the towns a strong tendency has recently developed to enforce the law more rigidly, and valuations have in many cases been increased with startling rapidity. This rapid increase in valuation cannot be long continued and applied to cut over land after the owner has been forced to cut, without causing abandonment. Such has been the result of the policy in California, and in Michigan, where the state has acquired and owns a million and a quarter acres of abandoned tax lands, and to a less extent in other Lake states.

(d) As between the farmer and the millman to whom he sells his woodlot, taxes have in the past been very low to the farmer while the timber was in his hands and some attempt has been made to appraise it more nearly at its actual value (or rather to approximate the selling price, which is often unduly low) when it is bought for lumbering. Usually, however, it is cut at once and the town collects taxes at the new appraisal but one year if at all. The consequence is that the timber escapes its fair charge of the public burdens.

(e) The present law, granting a percentage exemption to owners who have planted their land to timber, is not taken advantage of to any extent and is wholly inadequate. Most of the land upon which there is growing timber is seeded naturally, and therefore does not come within the law. The exemption ceases wholly in thirty years, at the time when it is to the advantage of the towns as well as of the owner, to allow the timber to mature further. Moreover tax exemptions are of questionable expediency and excite hostility to those taking advantage of them.

## TAXATION OF WOODLOTS IN SOUTHERN NEW HAMPSHIRE.

Fifty years ago, and even twenty years ago, woodlands were not considered to have any particular value aside from the farms of which they formed a part. Wooded tracts, distinct from woodlots, were located in the hills and the more inaccessible places more or less distant from the towns. The owners of these tracts were mostly lumbermen who held the land for its possible future value, or else individuals inherited such tracts from their forefathers and continued to keep them because of personal reasons or because there was no sale for the property.

The woodlots proper were invariably the uncleared portions of the farms. All such property was scarcely considered in the assessed valuations of the towns.

Farming was followed diligently by the people and a person's real estate was taxed according to the amount and condition of his cleared and cultivated land and his buildings. There was vastly more land under cultivation and in pasture in those days than at present. Every farmer owned many cattle and sheep and a large amount of pasture land was necessary for their maintenance. Young trees were cut from the pasture and the land cleared as fast as they started to grow. A man was considered shiftless who would allow any piece of land once cleared to return to tree growth.

With the development of agriculture and cattle raising in the West, farming in the East received a severe setback. Fewer cattle and sheep were raised, and the large amount of pasturage was not needed. Less land was cultivated each year on the hill farms, and little by little the fields and pastures were abandoned to tree growth.

The prices of lumber increased, the more accessible mature forests were cut, and the introduction of the portable saw-mills soon made the local pine lots of much more value. Far-sighted persons began to buy valuable stands of mature pine.

The abandoned fields and pastures continued to grow up to pine. During these years the valuations for the most part remained the same or were reduced on farms that were abandoned or partially uncultivated.

Within the last ten years people have gradually awakened to the fact that conditions have changed. They have come to realize that the timber and not the farm forms the real value of the land. Furthermore, they have learned that young growth, especially pine, gave the land more value than much of their former cultivated land and pastures.

Lumbermen and others have been quietly gathering up woodlots and partially grown-up pastures. From one to a dozen portable mills were located in almost every town. Farmers no longer cut the young pines from their pastures. Any farmer could sell his lot at any time when he needed the money to pay up a mortgage or repair his buildings. This was especially true near towns and cities. Often farmers who had little income from their farms sold enough wood each year to pay the taxes.

The price of lumber steadily increased. The pastures continued to grow up to forests, but during these later years much of the mature timber has been cut. Gold mines in the shape of lumber have been taken from the farmers' timberlands, but seldom by the farmers themselves. They have sold for moderate prices and the speculators and lumbermen have reaped the rewards.

But what about the taxes? For the most part they have remained as they were ten or twenty or even fifty years ago. Not until within ten years have the towns awakened and discovered that their mature timber is disappearing and that vast sums of money are being made from it and carried away by outside interests, which give but little in return to the towns. In other words, millions of dollars in the form of timber have never been taxed. The increase in the assessment of timberlands has not kept pace with the increase in the value of the land.

In many cases farmers are still paying taxes on worthless hill farms, from which they can scarcely make a living.

They have sold their timber to shrewd speculators and lumbermen for little or nothing compared with its real value. These men have turned the timber into money and carried it away before it could be taxed. The only charity, perhaps, is in the fact that the farmers have not realized what fabulous fortunes have been made.

Little by little a realization of facts and conditions is dawning on the people. This is shown by a general tendency to increase the valuation of timberlands by the various towns of the state. The towns have learned to look upon the lumbermen and speculators in timberland as self interested and selfish exploiters of their lands. Indignation frequently runs high and any proposed measures which might in a way favor such nonresident exploiters meets with immediate condemnation. They are earnest in their desire to improve the timber conditions and assist the local citizens to grow timber, but the outsider must not be favored. They argue that if lumbermen can afford to buy up young growth and hold it for ten years or more, as they are doing, they can afford to be taxed for all their property is worth.

Some towns are far more energetic than others in their policy of increasing the valuation of timberlands. There are instances where the recent assessed values are so high that the owners will not hold them and pay the taxes. There are actual cases where assessments are higher than the timber would bring at fair sales.

In general, however, careful investigations can only result in further increase in the valuation of many timberlands. Opinions differ widely in regard to premature cutting as a result of overvaluation. Certain persons say they know of no cases where such has been the result. Others will tell of many cases where cutting has resulted directly from increased valuations. Many of these cases, however, when investigated, show that the timber was ready to cut or would have been cut had taxation not entered into the problem. In order to be just to many small farms many timberlands should be assessed at a higher valuation.



Some people consider the taxation problem of so little importance that they think it need not be considered at the present time. It is true, however, that lumber companies owning lots in adjacent towns will cut the timber last in towns where the assessors are most lenient in their appraisals. In spite of this, many persons have affirmed that if there were no taxes at all, the cutting would have gone on precisely the same almost everywhere in the state. Increase in the price of stumpage has made speculation in timberlands profitable in the past. On the growth alone at the present value of land and with increasing taxes, there remains far less profit in future investments.

When the timber is mature, the owner will generally sell as soon as he can get a suitable price. A good offer would not induce the owner to keep such property if there were no taxes at all.

The men who want to buy timber often encourage the owners to sell by telling them that prices will soon be lower and that they may not get another offer. Without realizing the true value, the uninformed owner sells his timber at a price which seems to satisfy him.

It is common to find people owning various woodlots who are overtaxed on one or two of them. The reason why many of these people do not complain of their taxes is that the bulk of the lots are ridiculously undervalued and the total is in their favor.

Up to the present time timberlands in general over the southern part of the state are assessed for about one fourth to one third of their actual values. Little harm has yet been done by the present system of taxation. Owners often think the taxes are eating up their profits, but this is because they do not realize how fast the timber is growing.

If all timber lots were valued similarly and not assessed for over one third to one half of their actual values, there would be more revenue to the towns than there is today, and the taxation problem need not be considered further in connection with timberlands. If forest property is assessed for

near its actual value, the demand for a change in the system of taxing forests will be quickly shown everywhere.

Some towns are decidedly more lenient than others in their appraisal of forest lands. They believe it is better to get a fair assessment for a number of years than to get a higher one for a year or two and see the property removed.

Some towns believe in assessing for a certain per cent of the full value of timber lots and thereby have more uniform assessments; as 50 and 66 2-3 per cent of the full value.

Most towns use no system whatever, but assess one lot very high and another equally valuable lot very low, through ignorance of conditions, desire to discriminate against nonresidents, or because of lack of time and interest. The majority of towns assess forest property far below the actual value purely because of their ignorance of existing values and the amount of timber on the land. Most assessors never examine their forest lands, or if they do, it is only superficially. The majority of them are not qualified to examine and place values upon woodlands. They may be merchants or manufacturers who have never had any experience in appraising such property.

Farmers and lumbermen are best qualified to do such work. However, farmers are usually anxious to tax lumbermen high, while lumbermen in turn are usually trying to be lenient toward the owners of forest lands. Merchants on the other hand aim to favor the town people and make the lumbermen and farmers bear the burden of the taxes. All classes of assessors, however, tend to be lenient in the appraisal of young growth. This fact is quite noticeable and very commendable.

Many assessors are afraid to do their duty toward assessing property in general. They are often anxious to win the favor of their constituents, and oftentimes are afraid of incurring the enmity of their fellow citizens. Some are afraid of big corporations and wealthy people, thinking that by some means these people may lead to their undoing.

One assessor was said to have a personal interest in a certain piece of timberland and succeeded in compelling the owner to sell so that he might buy the property himself.

Assessors are in many cases owners of forest land. One assessor owned a large lot of timber which was never placed upon the tax book while he lived. When he died, this untaxed lot was found to be worth many thousands of dollars. A personal interest will be found occasionally as long as assessors themselves are timber owners. While they would not generally favor themselves alone, their sympathy is bound to be with those who own similar property.

Some assessors are undoubtedly the corrupt bosses of their towns, and are permitted to be the guides in all town matters. In matters of assessment, one assessor was said to regulate the property valuations according to the tribute which he received from the owners. In other words, he received bribes for placing low valuations on property.

There is a tendency for towns to keep the valuation on property low in order to decrease their state and county taxes, which are levied according to the valuation of the different towns. To prevent this it has been suggested that the state and county taxes should be obtained, not from the town valuations but from poll taxes. Statements have been made that many towns would raise their valuations fifty per cent but for increasing the state tax. The amount of consideration given to this attitude by the towns is doubtless exaggerated. The examinations made by the boards of county commissioners in various towns of the counties and by the State Board of Equalization in the various counties are more or less superficial. These boards seldom obtain any definite information as to how the towns assess their property.

The boards of assessors of the various towns make their annual inventory of property on the first of April. Inventory blanks are supposed to be in the hands of every owner of property, to be filled out by him, sworn to, and returned to the assessors. These blanks are never used systematically and are but little regarded. Many owners do not like to turn them in and most assessors will not use the figures when they are submitted. Even under oath these inventory blanks have come to be regarded as premiums on perjury. As a

remedy it has been suggested that owners indicate only the amount and condition of their taxable property and not the value of it.

The inventory made by the assessors has to be completed, the tax rate determined, and a report made to the state on the first of May. This gives only a month in which to complete the work. However, many towns are not able to complete the work in this time. The shortness of the time given for this work makes it impossible for any board to examine the timberlands of the town. At this season of the year many roads are almost impassable and the woods are often full of snow. The assessors are never properly paid for their work. It is a great temptation for assessors to use most of the figures from the books of the previous year and avoid personal investigation themselves. Mistakes and omissions, therefore, are often carried on year after year.

Valuations of timberlands remain the same almost invariably until the lots are sold or in one way or another the board learns what is contained on them. Occasionally complaints are made that owners of certain lots are not paying their just burden of taxes. This often gives the assessors a motive for making an investigation. When lots are overtaxed they soon learn about it from the owner. When they are under-taxed they will seldom learn of it except from outsiders or their own observation. Most people are honest except in the matter of appraising their own property for taxation.

So in a hundred ways the assessor is handicapped in the performance of his duty. He is the object of criticism constantly by his fellow citizens. The amount of labor he performs is seldom appreciated. The pay is no encouragement to careful work.

The law of 1880, soon after repealed, required the assessors to make a careful inventory of property every four years during September and October. This gave them sufficient time at a suitable season of the year and encouraged careful examinations of all property.

The laws exempting manufacturing plants for ten years



and old soldiers worth less than three thousand dollars have a bearing on forest taxation. In one town five manufacturing plants are paying no taxes. The town is badly in debt and its only hope of recovery is by valuing its timberlands for greatly increased amounts. There are few lots of much value and the burden must be necessarily great. Farms are already taxed for all they are worth.

The old soldiers' exemption deprived one small town of \$40,000 valuation. Two thirds of this amount had to be raised by increasing the valuation of young pine and sprout land. There was little merchantable timber in town. Cases have been reported by assessors where old soldiers have violated their oaths in order to benefit from such exemptions.

When all is known about assessors and the duties which they have to perform, it should be said to their credit that they are generally honest and faithful men, who try to do their duty as they see it. The law requires that assessors shall appraise all taxable property at its full and true value in money as they would appraise the same in payment of a just debt due from a solvent debtor. That this provision is seldom carried out is obvious after a little investigation. It is not within the possibility of the assessors to carry out the letter of the law. No two persons agree on the valuation of any piece of property. The physical difficulties that handicap the assessors in the performance of their work make it impossible for them to be familiar with existing conditions. Should the law be carried out, many hardships would result to timber owners.

In one town containing much timberland, the assessors went to the owners and said that the valuation of the town must be increased one hundred thousand dollars for certain improvements. The timber owners voluntarily submitted their valuations sufficiently high to make this addition possible. The assessors were thoroughly satisfied.

A true knowledge of conditions and values of property should be among the records of the assessors of every town. The buildings and live stock of a taxpayer are open for annual

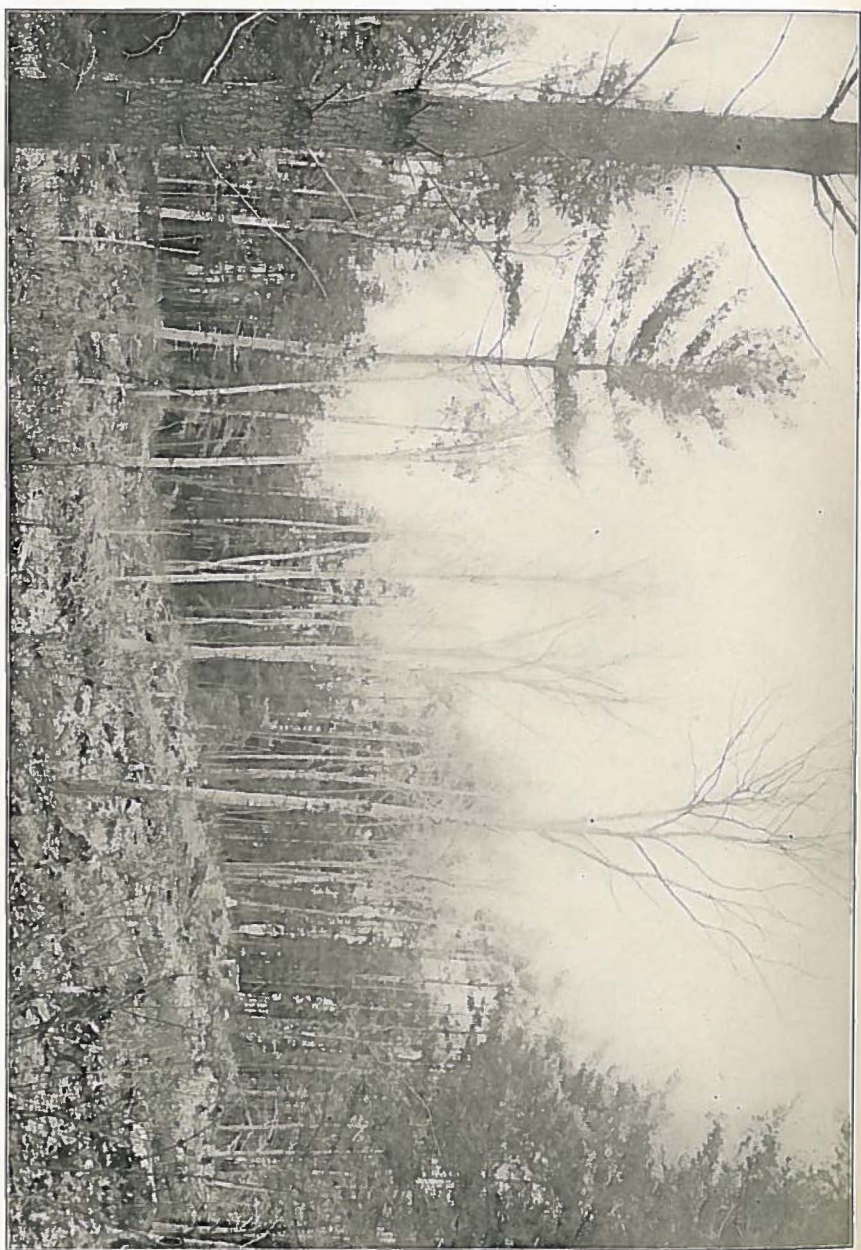


FIG. 10.— Removal of hardwoods from a lot to favor white pine and red oak.



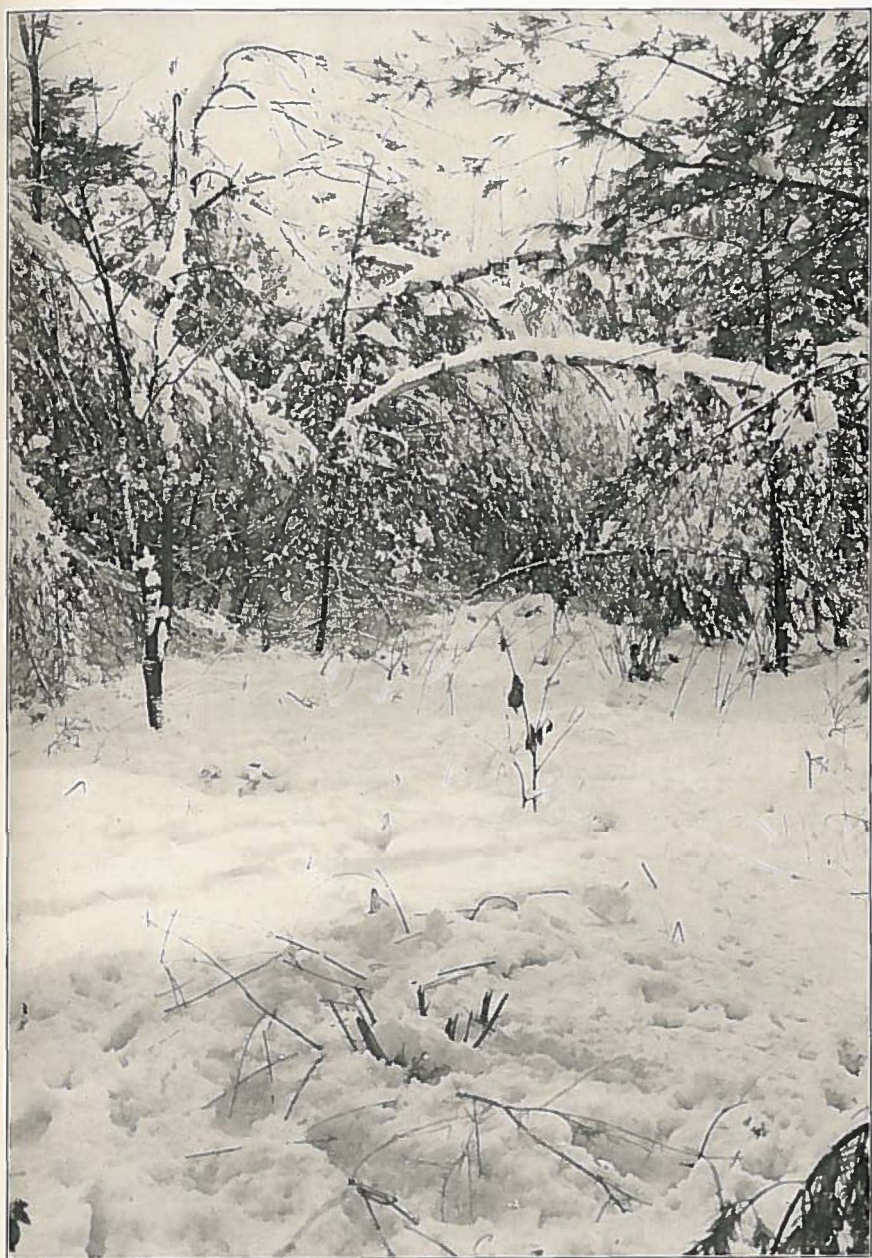


FIG. 11.— Young pine overcome by grey birch, weighted down with ice and snow.



FIG. 12.— White pine branch showing the old cones which have just discharged their seeds, and the new cones half-grown. It requires two years for the cones to mature.



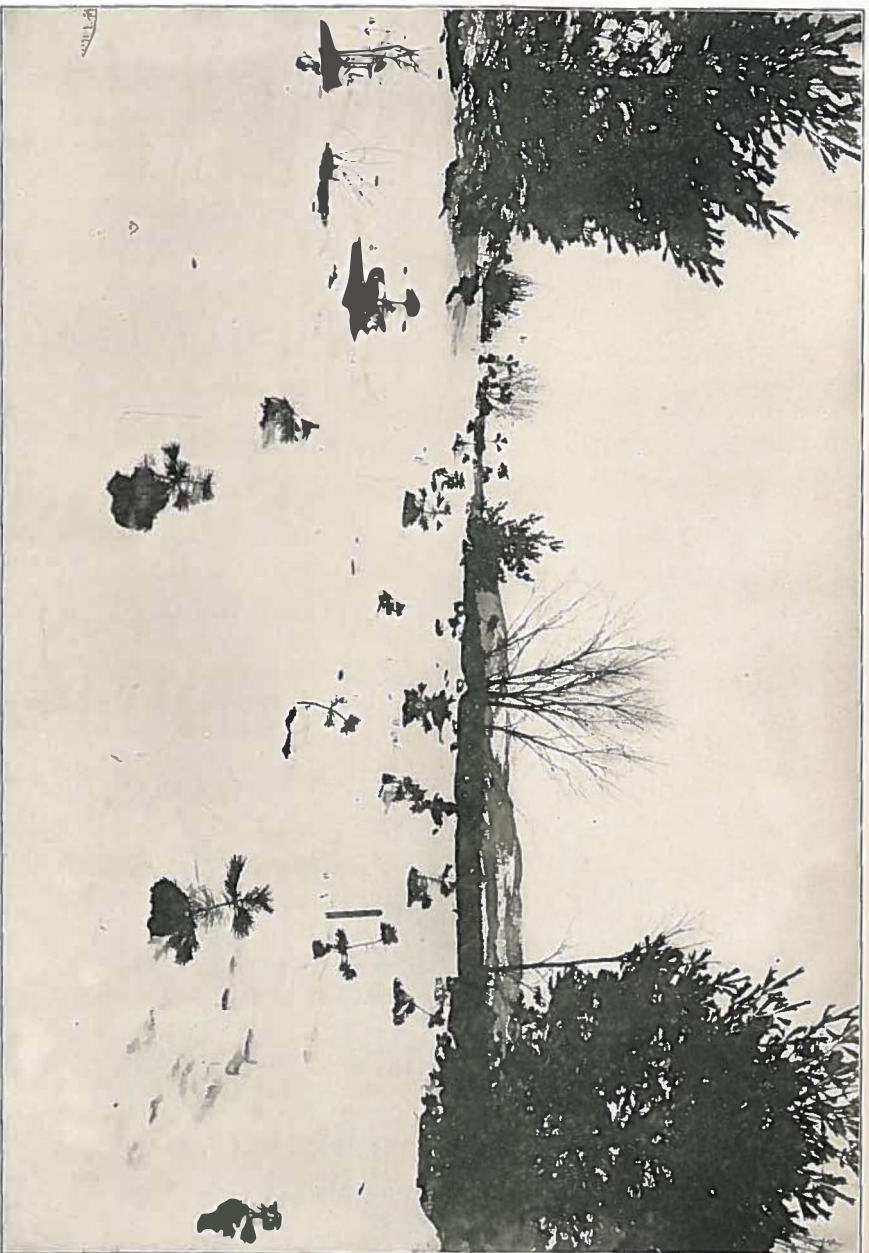


FIG. 13.—Plantation of pine 4 to 6 years old of which over 95% lived. The trees were natural seedlings.

inspection and cannot be concealed. A poor farmer with a few acres of cultivated land and a cow and horse is taxed for all he is worth. A value is placed upon this property annually. Some neglected timberland away from the public road may be overlooked entirely or taxed as it was years ago, when the growth had little value. Without warning the timber is suddenly sold and cut and the money is placed where it cannot be taxed. Such inequalities are, of course, due to the lack of a proper system of appraising property.

At the present time most timberlands are assessed as they were originally, together with the farms and for a lump sum. Only when individual lots are sold outright have the assessments become separate. In most cases the acreage is known only indefinitely or not at all. It is often impossible for an owner to find out for what amount a particular lot is assessed. The assessors cannot explain how they obtain their figures when information is sought by the owners.

Between 1905 and 1907 the value of pine boards has increased from nine dollars to eighteen dollars per thousand. The increase in stumpage corresponded. Where primitive methods of appraisal and former valuations were sufficient a few years ago, they are not sufficient today. It is a serious question, however, how much taxes a woodlot can stand when the values in the future are not known. Farmers often have not the money to pay for higher taxes, even though they may realize the increasing value of their lands. A company, on the other hand, with a large capital can afford to pay high taxes and hold the property for future use. Several lumbermen who are buying young growth have stated that they do not consider any woodlot in their purchase which cannot be lumbered in ten years. Beyond that time, they do not attempt to calculate. If the taxes become a burden in the meanwhile, they will sell the land.

The question of taxing the timberlands of the state is receiving considerable thought by the people of the state. Many persons realize the viciousness of the present tax laws, but have no solutions to offer. Assessors have not hesitated

to say that they do not believe they violate their oaths of office when they fail to assess forest lands for their full value. They believe they are doing their duty to their towns by this failure. The practice of the law is far less disastrous than the law itself.

Many suggestions have been received from assessors, lumbermen, and woodlot owners. There is considerable favor expressed toward the suggestion to exempt young growth for a period of fifteen or twenty years on land which the owner will agree to devote exclusively to forests. Some believe that there should then be a scale of valuations for different types of forests of different ages.

It has been suggested in all lumbering of pine lots that the law should require that seed trees be left on the land. One lumberman, who has been cutting pine lots for thirty years, acknowledged his lack of foresight in not leaving seed trees. He said that if he had left such trees on all the lots he has purchased, the value of the young growth today would be worth more than all the timber he has cut off in his lifetime.

It is generally agreed that the valuation should never be doubled in a single year, but should be increased slowly as timber increases in value.

Some believe there should be special assessors qualified to pass on the value of timberlands. Appraisals should, they claim, always be made by authorized officials of the town, but with a definite system. There is a feeling antagonistic to any outside interference in assessing property.

Lumbermen as well as assessors admit that it would be only fair if all timberlands should be carefully appraised every two to four years and assessed for a definite proportion of the full value, not to exceed two thirds. To this end a good forest map of each town should be in the hands of the assessors. This map should show all the timber lots in the town and the condition and value of each. It should be corrected from time to time. There should be a definite and uniform basis of assessment for all towns, liberal enough to encourage owners to hold growing timber until it is mature.



At least five towns in southern New Hampshire this year have either appointed special assessors to assist the board of assessors in making their inventory of property, or timber estimators have been employed by the assessors themselves. This latter action has caused considerable alarm among big timber owners, lumber and paper companies.

Following are a few typical examples from the large number of woodlots examined to compare the assessed value with the actual value. The information was obtained from assessors' books, lumbermen, and woodlot owners and from personal examinations of the woodlots. It was often impossible to get the acreage of the lots and to determine the values separately from adjoining farms and buildings. The examples are typical of the south half of the state.

#### EXAMPLES OF WOODLOTS EXAMINED.

1. A woodlot of about one hundred acres, including old deserted buildings and an abandoned farm, was assessed for \$3,500 in 1906. For several years before this the farm was assessed for \$2,000. In 1907 the assessors, realizing the value of the growing pine, and because of certain offers for sale which the owner had received, raised the valuation to \$7,000. The timber was sold for \$12,000 and cut the following winter. The valuation is now \$300. Before the last offer of sale the owner declared he would not pay another tax at the valuation of \$7,000. The tax rate is \$1.70 on \$100.

2. An interesting case was noted where an owner of timberland offered his property for sale at \$10,000. The valuation was promptly raised to \$5,500 by the assessors. Several lumbermen looked over the property but refused to give the owner a satisfactory offer. It is probable that at present the property will not bring much more than the assessed value. The assessment would have remained at a low figure if the owner had not advertised the place for a high price. The assessors did not examine the land, but decided that \$5,500 was a moderate assessment on property which the owner valued at \$10,000.



3. A farmer owning a small timber lot adjacent to his farm and buildings was valued \$700 for the whole. The pine on the timber lot was bought by the owner of a box factory for \$700, equal to the entire assessment. The assessors never knew what the timber was sold for, but when they learned of the sale to the mill man the assessment on the timber alone was raised to \$1,500. The lot contains about twenty acres of pine, which is too young to cut, but which is growing beautifully. The present owner is not ready to cut and is apparently willing to allow the timber to grow for a number of years yet. The assessed value is probably very close to the actual value of the timber.

4. A woodlot contains one hundred acres of sapling pine, hardwoods and old-growth pine. There are about twenty-eight acres of mature pine of great value and many scattered old-growth trees. The tract is located about five miles from the railroad but the haul is not difficult. The entire lot was bought a number of years ago for a few thousand dollars. In 1907 it was sold for \$14,500. The owner has refused \$20,000. The assessment since about 1906 has been \$9,500. The tax rate is \$1.45.

5. A fine young pine lot, pure and nearly 75 per cent stocked, contains one hundred and thirty acres. The trees are about thirty years old. The owner bought this a year ago for \$2,000. He estimates one million board feet could be cut at the present time. He has had a number of offers of \$5,000 for the property. It is probably worth nearer \$10,000. The assessed valuation is \$1,800.

6. Two lots were examined which were very nearly the same size and covered with the same character of growth. Neither was particularly valuable, being largely hardwoods and scattered pines with some open pasture. The lots were about equally distant from town and after a careful examination one would say they were of about equal value. In the town tax book in the assessors' office each was recorded as containing twenty-five acres. One was assessed for \$800 and the other for \$1,500. The assessors had never examined these lands and the owners were nonresidents.

7. A wealthy summer resident owns an estate which is assessed at \$18,000. This contains much valuable pine timber, some of which is old growth. The owner has been offered \$25,000 for the mature pine, but will not sell at any price. Recently a forester was engaged to remove some over-mature pine. The owner complains that the assessment is too high in spite of the fact that the \$18,000 includes fine buildings and agricultural lands. The actual value is probably \$50,000. The tax rate is \$1.98.

8. A large estate near a city and consisting of buildings, farm, and timberlands has been assessed repeatedly at \$5,500. Because of the ready market small amounts of cordwood and lumber have been sold from time to time. The owner stated that during the last thirty years the estate has furnished more than \$50,000 worth of wood in one form or another. The tax rate is now \$1.56.

9. A lumber company bought a tract of woodland for \$40,000. The company's timber man estimates there are seven million board feet of timber, nearly all pine, ready to cut at the present time. Besides, there are many acres of young growing pine. The property is valued at \$4,000 in one town and \$6,000 in another town. The acreage is not known. The company is doing some lumbering and expects that the supply will be sufficient to run a box factory for several years. It is actually worth \$70,000.

10. A cooperage industry owns timberlands in one town which has cost them \$10,000. The taxes have been increased year by year until now the land is assessed for \$14,000. Doubtless the timber is worth about \$20,000, but the management considers the taxes excessive as they say that \$10,000 is all the timber is worth to them. This particular town is badly in debt and is very seriously considering raising the valuations on all timberlands. The cooperage company intends to cut all its timber in the town and reserve for future use the lots in other towns where the taxes are nominal. The tax rate is \$2.35.

11. A timber lot of one hundred acres is assessed for

\$2,000. It is all wooded and about one half is covered with fair pine. The owner recently told the assessors he would hold the timber for many years if they do not increase the valuation; otherwise the timber will be cut at once. The assessors know the lot is worth much more than \$2,000, but believe it is for the interest of the town to keep the valuation down. The timber is probably worth twice the present assessed value. The tax rate is \$1.44.

12. A lot of ninety acres was pasture and apple orchards fifty years ago. A few of the old apple trees are still standing. About half of the area has seeded into pine, many of which are two and three-log trees. The other half is composed of open land and hardwoods. A lumber company recently bought this lot for \$2,000, intending to hold it for a number of years. A rough estimate of the value today would be \$3,000, although it is probable that at a forced sale no more than \$2,000 could be obtained. The assessed value was \$1,000 six years ago, but has been raised to \$1,600.

13. A lot of fifty acres consists of young pine about twenty years old. Some trees have grown fairly in the open and are limby, but the most of the land is well covered with pine. The lot was bought by the same lumber company for \$1,000 with a view of holding it. It was formerly a part of a large farm and when sold was assessed at the purchase price, \$1,000. The farm is worth more than \$2,000 today. Another lot of seventy-five acres, almost identical in character to the fifty-acre lot, is assessed for \$700. This valuation is \$300 less and the lot is worth \$1,000 more than the first lot. The assessors knew nothing about either lot. The tax rate was \$1.70 in 1907.

14. A lot of thirty acres of pine land is owned by a widow. Just before her husband died ten years ago he made her promise to keep the pine lot fifteen years before selling it. He realized that the lot would be very valuable some day. Until 1905 the lot was valued at \$400. The valuation was then raised to \$700, where it remains. The owner thinks the assessors are raising the taxes in order to force her to sell.

One of the assessors is said to want the lot. The woman has been offered \$1,000 by a lumberman. No doubt she can well afford to hold the lot and pay the taxes for the next five years. The pine is growing too fast to be cut now.

15. In one town a farmer, whom no one considers well off, owns lots all over town which are worth roughly \$40,000. Outside of the farm on which he lives he is assessed for only \$1,200. The lots are scattered and now grown to pine, and the assessors know very little about them. The tax rate was \$1.40 in 1907.

16. A tract of two hundred and nine acres contains at least one million feet of mature pine, hemlock, and spruce. There is considerable poplar of good size and much fine reproduction of pine. The property has been assessed for \$2,000, but was increased last year to \$2,100. It was bought last year for \$2,600, and is worth at least \$7,000 for the mature timber alone. The tax rate is \$1.71.

17. A woodlot of one hundred and fifty-five acres, cut over about twenty-five years ago, has been assessed at \$1,200. In 1900 the assessment was raised to \$1,400, and in 1905 again raised to \$1,800. About twenty acres are covered with splendid second-growth pine, while the remainder is composed of mixed hardwoods, pine, and gray birch. The timber should not be cut for ten or fifteen years at least. Much of it will then be worth double its present value. Probably this lot would not bring over the assessed value if sold at auction today. The owner declares that he is overtaxed. The lot is far from the railroad. The tax rate is \$1.50.

18. A fine estate in the Connecticut valley is assessed for \$16,000. There are about two hundred and fifty acres of land, half of which is covered with pine. About ten acres are virgin pine, and the tallest and finest seen in the state. It is difficult to place a value on this land. The buildings and improvements are worth more than the assessed value of the entire property. A rough estimate of the value of the timber would be \$20,000. There is also much valuable young pine. The land without the new buildings was once valued at \$800. The tax rate is \$1.67.



19. One large tract of timberland has been increased in valuation from \$2,000 to \$10,000 within the last ten years. It is a mixed spruce, pine, and hardwoods tract and is being lumbered now. The total final cut will probably be worth \$20,000. Another tract of twelve hundred acres in the same town was valued until 1905 at \$2,500. The valuation was then raised to \$7,500. The owner refused to pay this tax but once and cut off the pine on four hundred and sixty acres. About one million feet were obtained, valued at about \$10,000. The remainder of the tract is covered with spruce and hardwoods. The valuation has been reduced to \$4,000. The present actual value is probably \$6,000 to \$8,000. The tax rate was \$1.85 in 1907.

20. A large tract of farm and timberland, about nine hundred acres, has been valued at \$2,000 for many years. Formerly much of this land was cultivated or in pasture. Little by little the land has been abandoned and has grown up to timber. The timber has been sold for \$13,000 and will be cut off in five years. The owner thinks \$20,000 a fair estimate of the value of the timber. The tax rate was \$1.85 in 1907.

21. One city within the true white pine belt of New Hampshire is assessing its timberlands according to the results of careful examinations by a competent board of assessors. This city contains seventy valuable woodlots. Years ago these lands were assessed at very low figures. Fifteen years ago the assessors—one of whom is still on the board—made a careful appraisal of all property in town and recorded the various taxable items of each owner in a book for the purpose. In this way the number of acres of each kind of land was recorded separately, together with an estimate of the amount of timber on each lot.

Each year following, corrections were made in the book according to the improvements made, timber cut off, transfers of property, etc. There were also diagrams of farms showing different kinds of lots to be taxed.

In 1907 the board made another very careful appraisal

and again estimated the timber on all the lots separately, corresponding to the examinations made fifteen years ago. The assessors are familiar with woodlot conditions and they go over the lots together, often chaining distances to get the acreage. Each man estimates the timber separately and the results are averaged together. Young growth is valued according to its size and in the same proportion as mature timber. Inasmuch as lots will not be reassessed for a number of years, the board believes in placing a fair value on young pine lots.

Sprout lots or pastures are assessed for about \$5 per acre, and pine under ten years old for about \$10 per acre. A definite value with the estimate for each lot is placed on the books and then assessed for about 60 to 70 per cent of the actual value.

The assessors know of only two cases where any complaints have been made by the owners on account of the valuations. The owners know the values of the various lots are equitable and they have no grounds for complaint.

Provisions for this systematic method of taxation were made in the charter incorporating the city.

The system works well, the woodlots are not being cut faster than in other places, and the assessors know of no reason why every town in the state should not make a similar valuation of timberlands. They believe that such a system in general use would be a credit to the state, and would give general satisfaction.

The following are a number of examples of assessment copied from the books of this city:

- (a) Lot contains:
  - 150 M. pine of good quality.
  - 600 cds. wood (small growth). Valuation \$1,800.
  - Assessment raised from \$700 to \$1,400.
- (b) Lot contains:
  - 300 M. mixed—some extra good pines.
  - 400 cds. wood. Valuation \$4,000.
  - Tax \$2,900; formerly \$1,000.

(c) Lot contains:

500 M. extra good pine.

2,000 cds. wood.

300 M. mixed pine and hardwoods.

100 M. medium pine.

300 M. pine only fair.

Valuation about \$17,000.

Taxed for \$12,800; formerly \$2,200.

The owner has taken this case to court. He believes that he is assessed proportionately more than his neighbors. The assessors can show that this is not so.

(d) Lot of 100 acres:

400 M. of pine—ordinary.

500 cds. of wood.

Value \$3,300.

Tax \$2,460; formerly \$1,000.

22. One lumber company has bought nearly all the pine lots available in four adjoining towns. Many of these lots will not be numbered for ten years. It was the intention of the company in acquiring these lands to purchase only those which could be held in reserve for some years to come. Most of the lots were bought very cheaply about ten years ago.

23. An interesting example of the manner in which valuation of pine lots is increased from year to year was mentioned in a report made to the State Forestry Commission in 1906. A lot of one hundred acres has about eighty acres covered with good pine. It was purchased in 1897 for \$1,000, and taxed for the same amount. In 1899 the valuation was increased to \$1,300; in 1900 to \$1,600; in 1901 to \$2,000; in 1902 to \$2,300; in 1904 to \$3,250; in 1905 to \$4,500, and in 1906 to \$5,000. This year, 1908, the lot is assessed for \$7,000.

The owner feels that the taxes are greater than the annual growth, in which case the property is slowly being confiscated by the town. This probably is not so, however. At the present high valuation, probably the annual tax per acre is not over one half of the annual growth. The owner values

the property at about \$10,000. This is an interesting case, as it shows a tendency toward overvaluation.

### TAXATION OF WOODLOTS IN NORTHERN NEW HAMPSHIRE.

In the agricultural towns of northern and central New Hampshire, woodlot conditions prevail which are almost identical with those of the southern part of the state. In such towns as have little or no wild lands or extensive areas owned by individuals and corporations, the farms are usually small and are separated, as in the South, by woodlots and abandoned fields and pastures. The upper Connecticut valley towns, the region throughout the lower Ammonoosuc, the Pemigewasset, the lower Saco watershed, and the Lake Winnepesaukee section are largely of this nature.

Pine lots are the most important consideration, although many old pastures back from the valleys grow up to spruce. Pasture spruce grows exceedingly fast and in the North almost rivals the pine as an economic species. There is always a ready market for mature and half mature spruce for pulpwood.

There is a general neglect in the work done by assessors. They seldom make careful examinations and values are placed upon lots largely from hearsay. The values are very unequal. Some lots are much undervalued and others are proportionately high, even though they may not be high compared with the actual values.

The rates in many river towns are kept very high because of the expense of maintaining wooden-covered bridges. Two dollars and fifty cents on \$100 is a common rate in many of these towns. Where a town has many miles of road to keep in repair the rate is also apt to be high.

Fifty years or more ago most towns knew the bounds and acreages of the various lots. Transfers and sales of lots from farms have not been closely followed up and now many towns have no idea of the acreages, and in many cases of the lines separating the various lots.



The following are examples of the valuation and character of these lots, typical of the northern woodlot regions:

24. A number of lots consisting of about six hundred acres, have been valued in a lump as follows: 1906, at \$10,000; 1907, at \$13,000, and 1908, at \$15,000. This includes three farms, one of which has been abandoned. In 1907 one woodlot was sold for \$600, but on the remaining land the valuation was increased \$2,000. The timberland is extremely valuable. There are many acres of splendid mature pine, hemlock, and hardwoods. Small areas are covered with excellent young pine. There are small bunches of spruce on the higher slopes and all the timber has a ready market close at hand. There are estimated to be at least three million feet of merchantable timber worth \$20,000 to \$25,000. The farm buildings and cleared lands cover one third to one half the area and are very valuable. The owner does not consider the town valuation excessive, but he is alarmed by the steady and rapid increase each year. His purpose is to cut timber enough at least to keep the valuation where it is now. It is probable that the value of the annual growth of the timber is about three times the value of the annual tax on the entire property.

25. In the same town there is a lot of fifty acres of very fine mature pine, and a small lot of pine about forty years old. The valuation of this property was \$2,500 in 1906; \$3,000 in 1907, \$4,000 in 1908. Probably there are at least one million feet of merchantable pine worth double the assessed valuation of the property, and the amount may be very much greater.

As a general thing the assessors believe in valuing timberland high which they know will be cut off soon.

Woodlots in the vicinity of popular summer resorts are often valued very low. Pine lots near such towns add greatly to the attractiveness, but the owners, while they desire to help and improve their towns, can not always afford to leave such valuable property standing, especially when the timber has become mature. Some lots of this character, by the vote

of the towns in which they are located, are practically exempted from taxation. However, when a lumberman buys a lot for the purpose of cutting it off, the assessors generally increase the valuation to at least two thirds of the amount paid by the owner for the lot.

26. The towns east of the lake section of the state have in general increased their valuations during the last few years until they are now as high or higher than in most other towns in the state. Many of the valuations have been placed without accurate information. The result has been that most of the woodlots in the towns have been cut off. Near one town six million feet of piled lumber have been taxed the present year. All this has been cut during the past year when most lumbermen were doing much less business than usual. The selectmen know that the present valuations are stripping the timber from the towns, but they say that they are compelled to carry out the letter of the law. The State Board of Equalization recently doomed some of these towns severely.

Sprout lands and cut-over lands are often assessed for \$10 and \$15 per acre. The local sawmills are scattered so that millmen have practically a monopoly, and pay about what they desire for stumpage. Six dollars per thousand was all that could be obtained for first quality pine stumpage in many towns during the past year. Assessors, however, are usually more lenient with lots so small that it would not pay to locate a portable sawmill. Increasing the valuation of the timberlands has caused considerable disturbance among the owners in the lake country.

One assessor says that automobiles are ruining small towns by demanding good roads and then spoiling them. The town spent four thousand dollars last year on one mile of road for automobiles. Towns are compelled to appropriate each year for highways according to the valuation. Owners of automobiles, he claims, are getting poor country towns in debt and are contributing nothing toward the town's expenses. Valuations have been increasing at a tremendous rate during the

past few years. This assessor questions how poor towns are going to meet their expenses in the future.

27. One town has lost fifty million feet of timber in the last ten years. This was due first to the advance in value of timber, but now to the high valuations placed on timberlands. Here both the valuations and rate are high.

28. A farm of three hundred and fifty acres contains seventy-five acres of good pine forty to fifty years old, but rather uneven and more or less in mixture with hardwoods. One hundred and fifty acres are of forest and pasture growth. The entire farm was valued together in 1904 at \$7,000, and in 1908 at \$10,000.

The following estimate of the actual value was made:

750,000 feet of pine.....	\$4,500
Hardwood growth .....	600
Farm land and buildings.....	6,000

Total, not including stump land.. \$11,100

29. A lot of one hundred and fifty acres of good oak growth was valued in 1906 at \$2,300 and in 1908 at \$4,500. The lot is some distance from a village or the railroad, and a portable mill will be necessary if the lot is to be lumbered. Probably the lot would not realize over \$4,000 to \$4,500 if carefully lumbered.

30. A deserted farm of about thirty-six acres, with no tillage, was valued in 1904 at \$324 and in 1908 at \$1,400. There is a very nice young growth of pine but none that should be cut for some years. The present valuation is about \$39 per acre. With a tax rate of 2 per cent, the annual tax would be seventy-eight cents per acre. With an average annual growth of one cord per acre at \$5 per cord, the annual tax is approximately 15 per cent of the annual growth, which is a fair valuation.

31. A lot of two hundred and fifty acres was bought at auction for \$1,400. The property was valued very low up to that time, but was soon after increased to \$1,800. The timber was then partly cut and sold for \$2,800. The valuation was



further increased to \$2,100. It is doubtful if the property is worth this amount at the present time.

32. In one town extensive lumbering has been going on for the past ten years with portable mills. The timber is considered to be mostly cut off, and no lumbering to speak of has been done for two years. Most of the lumbering was done before the valuations were raised. Two years ago valuations were raised on all property, especially woodlots, and, with the exception of very young growth, the remaining woodlots are now assessed at nearly their full value.

33. An example of the undervaluation of timberlands was found in the Mount Y——— region, where a lot of one hundred acres of virgin spruce and balsam and sixty acres of mixed growth are valued at five hundred dollars. The assessors of the town apparently know nothing about the value of this property. This is about 10 per cent of the actual value.

34. In the P——— Valley pine lots are valued fairly high. The wild lands have been cleared, mostly twenty to thirty years ago. Lots are now valued at about \$5 per acre where there is valuable young growth. Poor mountain lots without valuable timber are valued at \$1 per acre. One or two fair spruce lots are valued at \$10 per acre.

### TAXATION OF WILD LANDS IN ORGANIZED TOWNS.

In the northern portion of New Hampshire much of the country is mountainous and the settlements are more widely separated than in the southern portion of the state. The majority of the towns have organized governments and assessors, but outside of the valley farms under cultivation, most of the land in these towns has never been cleared. Extensive tracts of timberland are found unbroken by roads or farms. Tracts of this nature are called wildlands to distinguish them from woodlots of small area. Spruce and balsam are the most important timber trees of these northern towns.



35. One town has been lumbered more or less for the past fifty years and there is no land which has not been cut over at least once for softwoods. Along the railroad hardwoods were formerly cut to supply fuel for the locomotives. Practically all of the softwoods have been removed, except on a few upper slopes. Over much of the eastern part of the township there is some scattered pulpwood. In 1903 nearly half of the town burned over and this land is almost all in a worthless condition. Spruce stumpage averages \$6 per thousand. The tax rate is \$2.15.

(a) One hundred and forty-two thousand acres belonging to one company and including nearly the whole of the burned area have been valued by the town at \$35,000, or \$0.24 per acre. The figures were the same in 1906 and 1907. Two million feet were removed in 1907.

(b) Another company owns fifty lots of 100 acres each, which were valued in 1906 at \$12,500. Including parts of other lots, the total for the year was 5,500 acres at \$17,800. Of this amount the 5,000 acres have been more or less severely cut over for softwoods and burned. The 500 acres in parts of lots, taxed for \$10 per acre, were culled many years ago and now contain over 5,000 feet per acre of softwoods. The average value per acre was \$3.24, and the annual tax per acre about seven cents.

(c) In 1907 the 5,500 acres were valued at \$21,550 or \$3.91 per acre. The owners attempted to get this valuation reduced but without success.

All of these lands are given considerable value locally and anyone owning such property is holding it for future increase in value of the hardwoods. It is doubtful if any of this land could be bought for \$10 per acre. A hardwood growth predominates where fires have not been too destructive.

36. All the land in another town was logged for softwoods many years ago and the accessible slopes near the railroads have been extensively cut over for hardwood fuel in the past. Two mills operating in this town for hardwoods have taken out most of the timber valuable for sawlogs.



FIG. 14.— Pine plantation thirty-two years old. Wild seedlings used as in Fig. 13.





FIG. 15.—Cut-over land on hillside, from which the pine was removed about ten years ago. The cutting was clean and there is absolutely no reproduction of anything excepting a very small quantity of grey birch here and there. The land is not used for pasturage purposes, and is producing nothing for the owner, who is, however, meanwhile obliged to pay taxes thereon.

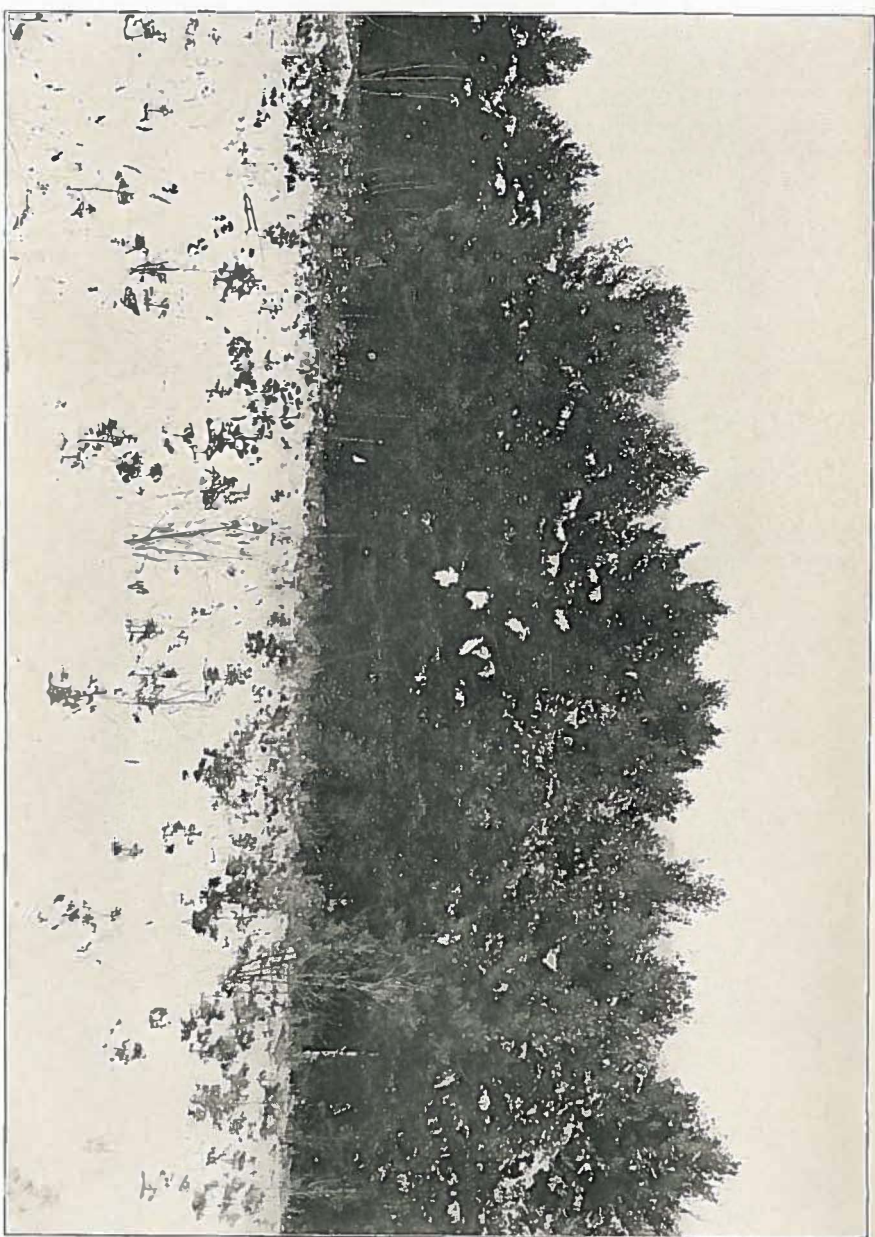
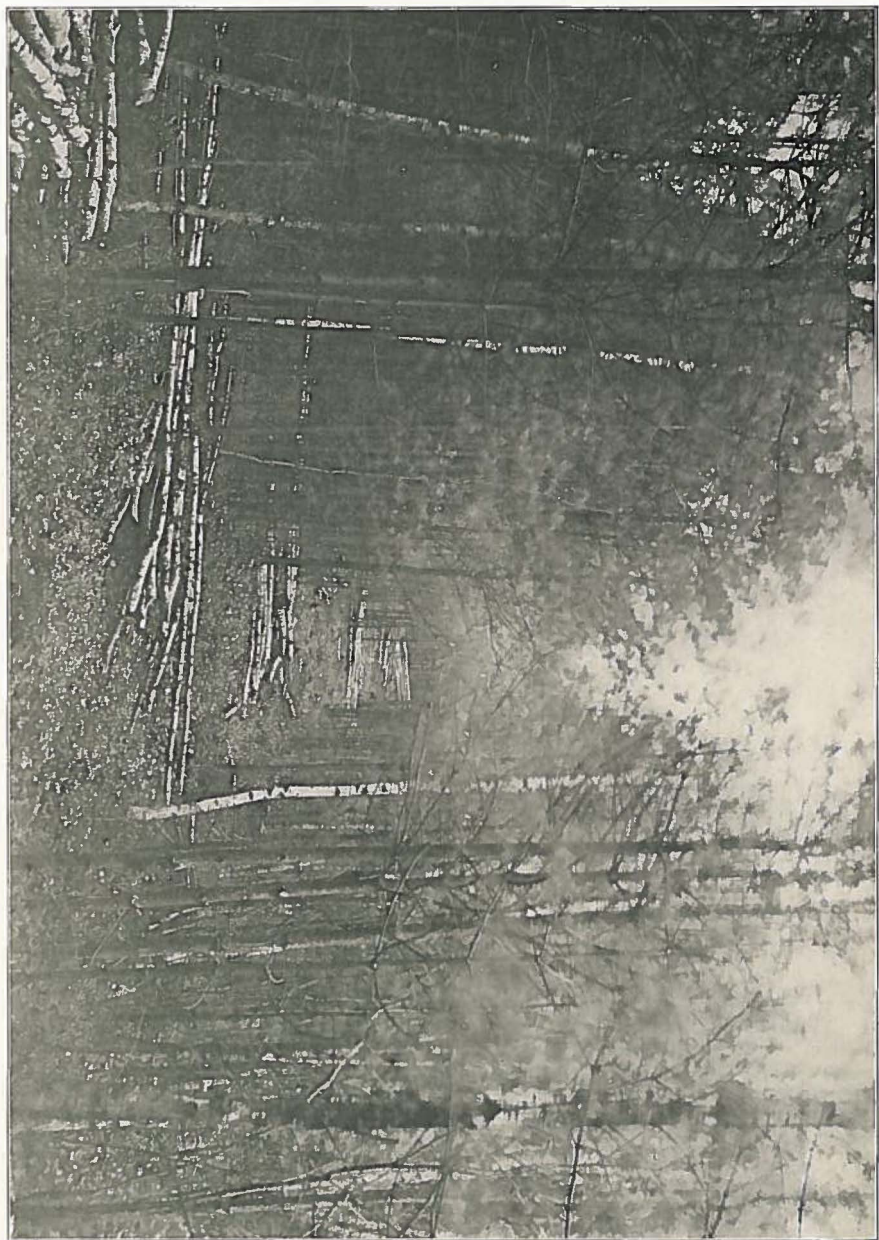


FIG. 16.—Excellent pine reproduction from the side.



FIG. 17.—Removal of grey birch from pine stand twenty years old, which it was beginning to whip and injure.



There is generally a heavy growth of hardwoods, worth \$1 per M stumpage near the railroad. Fifty years ago the spruce was not worth 50 cents per M. The same figures are used generally year after year. The lumber industry has almost entirely passed in this town.

(a) In 1898 one lumber company was valued at \$4,200 on 2,500 acres, or \$1.45 per acre. This was raised the following year to \$9,550, and in 1906 to \$14,100. In 1907 the valuation was \$14,200, or \$5.07 per acre.

(b) Lots aggregating 1,300 acres were valued at \$2,000 in 1898; \$2,525 in 1904, and \$2,600 at the present time, an average increase from \$1.60 to \$2 per acre.

(c) A tract of 900 acres has been valued by the town at \$3,000 for fifteen years. This is \$3.33 per acre.

All of the land is the same in character and differs in value chiefly according to the distance from the valley. None of this land could be bought for less than \$10 to \$15 per acre. There is a prevailing idea that this land will be very valuable some day. All portions of the town are within easy reach of the railroad. The tax rate is \$2.60.

37. Another town was formerly covered with a dense growth of mixed spruce, balsam, and hardwoods. The slopes are moderate and the timber was easily driven down the Androscoggin river, which flows through the center of the township. Considerable excellent farming land is found along the river.

Logging began many years ago in a small way and a good part of the town has been culled lightly for softwoods. Hardwoods have scarcely been touched.

The bulk of the timberlands is owned by private individuals and it has been their policy to sell stumpage in comparatively small amounts to the lumber companies, cutting such portions first which were more mature and always preserving the younger growth. No disastrous cuttings have been made by these land owners on any of their holdings. The rapid increase in valuation, however, has caused considerable alarm and the owners say that they cannot afford to hold their val-

uable timberlands and lumber them so conservatively in the future. They own in this town 141 lots of 150 acres each or 21,150 acres valued at \$172,800 in 1907 and \$245,600 in 1908. This is an increase from \$8.17 per acre to \$11.61 per acre. The change was due to the efforts of the State Board of Equalization. The town tax rate is \$1.40, making the annual tax per acre about sixteen cents. This timber is the finest large body in the town and the best stands vary from 10,000 to 16,000 feet per acre of softwoods. The average is about 8,000 feet per acre.

The total nonresident valuations (timberlands) have increased as follows:

1892 .....	\$37,018
1902 .....	43,980
1904 .....	88,572
1905 .....	112,368
1908 .....	267,500

One lot of 150 acres was sold at auction ten years ago for \$4,200. The timber cut amounted in value to \$12,000. There was in the vicinity of 16,000 feet per acre on the lot.

Stumpage values have increased rapidly during the last ten years. At present they are about as follows in this section under average conditions:

Spruce .....	\$6.50 per M.
Pine .....	7.50 per M.
Balsam .....	4.50 per M.
Hardwoods, first quality.....	6.50 per M.
Hardwood, cordwood .....	1.00 per cord.

In general timberlands are valued at one third to one half of their actual values. It is affirmed by all the large owners that they cannot stand a high valuation and in addition pay a two thirds tax on all the logs when cut, as they are doing now.

38. One township was once heavily covered with spruce and mixed hardwoods. The southern portion of the town contains considerable agricultural land and many prosperous farms. The northern half has been culled for softwoods,



but still is covered with a magnificent growth of hardwoods with a good proportion of young spruce.

For several years the town has contemplated having a special examination made of the timberlands. In 1908 the selectmen employed a timber estimator to value all the timberlands of the town. This estimator considered only softwoods large enough for pulp or sawlogs. Reproduction was not considered. The values, of course, varied according to the distance from the river and the topography. He purposely allowed one third less than the stands would actually cut. Finally the assessors discounted all figures 20 per cent for their final valuation. The values of these lots are regulated entirely by the amount of softwood timber on them.

The following are a few of the figures for 1908 obtained from the special estimator. The lots in this town consist of 100 acres each.

Lot.	Estimate.	Valuation in 1908.
1 .....	510 M.	\$1,500
2 .....	185 "	370
3 .....	100 "	300
4 .....	545 "	1,900
5 .....	337 "	1,100
6 .....	225 "	675
7 .....	200 "	600
8 .....	125 "	375
9 .....	360 "	1,500
10 .....	150 "	525
11 .....	300 "	1,050
12 .....	150 "	560

The tax rate in 1907 was \$2.35.

39. There is comparatively little softwood timber in the town of X———. Lumbering has been carried on for many years and there is much pasture and cultivated land. There have been extensive burns and a great amount of land is in so-called "skeleton lots," which were badly culled and are of little value now. Because of two large valleys passing through the town, this section is consequently within easy reach of markets and the value of land has been rather high.



(a) In 1906 lots amounting to 1,300 acres were valued at \$11,500, or \$8.84 per acre. Since then, 1,000,000 feet of pulpwood has been cut and the value is now placed at \$6,950, or \$5.34 per acre. These lands are mostly "skinned" for pulp, but probably 3,000,000 feet could be cut now besides the hardwood, which is not considered.

(b) In the hills a tract of 3,500 acres had practically no value. The lots were valued at \$7,100 in 1906, or about \$2 per acre on an average. Many millions of feet of pulp have been cut within the past few years, so that in 1908 the valuation of the 3,500 acres has been reduced to \$5,400, or \$1.54 per acre. Many of these lots contain 200 acres, although they are only supposed to contain 100 acres. The badly burned lots are assessed for about \$100 or less, making the value per acre oftentimes less than fifty cents. Several of the lots were said to have cut 6,000,000 feet per lot for pulpwood. Considering the overrun in size of most of the lots, the values of these lands are probably not now over one fourth to one third of their actual salable values. Two or three cords of pulpwood per acre could be cut on an average.

(c) Another tract of 2,600 acres was valued in 1906 at \$13,400, or \$5.15 per acre. In 1907 4,000 cords of pulpwood were removed, worth nearly double the entire assessed value. Since then the valuation has increased \$500, and is now \$13,900 for the 2,600 acres, or \$5.34 per acre. While many of the lots are comparatively skinned and some are burned, several cords of pulpwood could be removed per acre averaged over the whole tract. Pulpwood is worth \$5 per cord.

This town averages an annual cut of about 10,000,000 feet of timber and pulpwood. A cut of 3,000,000 feet could be kept up many years, but at the present rate there will be no cutting at all in a few years. The valuation is decreasing rapidly and like many other towns in the north, where the valuable timber is gone, the bulk of the taxable property is removed. The tax rate in 1907 was \$2.25.

40. A certain town has an organized government, although there are only a few residents and isolated farms. Most of this township is owned by two or three individuals. Years ago the best sawlogs were culled but comparatively little has been removed lately, and the lots are well covered with excellent spruce, balsam and hardwoods. Some fine hardwood sawlogs are being cut at \$6 per M. stumpage and sawed in a small local mill. The spruce and balsam average 6,000 feet per acre. Some especially good stands run 15,000 feet or more per acre.

In 1896 10,000 acres were valued at \$9,000. The valuation was soon after raised to \$40,000, where it remained until 1907. The valuation is now \$75,000. Taken together, this is an increase from 1896 to 1908 of from \$9,000 to \$75,000, or an average increase per acre of from eighty-four cents to \$7.07. Some timber has been cut in the meantime, but not any great amount. The tax rate in 1907 was \$1.25.

41. Another town contains a great deal of uncut timber. The western and central portions have been heavily lumbered and contain a large amount of agricultural land. The bulk of the timber is along the eastern and northern borders of the township. Much of these areas have never been lumbered at all. It is estimated at the present rate of cutting it will require thirty years to log the township. One lumberman puts the estimate of softwoods at one billion feet. The lumbered areas have been cut conservatively for the most part and almost every acre contains good growing softwoods in addition to valuable hardwoods. Some portions were culled so many years ago that the logging could be repeated with as good a yield as before.

All this great region of timber has been practically untaxed until within the last few years. In 1906 the State Board of Equalization doomed the town \$200,000. This resulted in a general increase in valuation in the spring of 1907.

(a) One grant of about 23,000 acres contains one of the finest large bodies of timberland in New Hampshire. It averages probably 10,000 feet of softwoods per acre or

about 230,000,000 feet, not counting hardwoods. No lumbering has ever been done. In 1906 this grant was valued at \$138,672, or \$6 per acre. In 1908 the valuation was increased to \$199,396, or \$8.62 per acre. This is about 10 per cent of its actual value.

(b) Another tract of 15,340 acres is immensely valuable. This is entirely unlogged and easily averages 6,000 to 7,000 feet per acre, making 110,000,000 feet to 128,000,000 feet of spruce and balsam. In 1906 the valuation was \$73,360, or \$6.00 per acre. In 1908 the valuation was increased to \$127,240, or \$6.93 per acre.

(c) A grant of 9,800 acres was logged twenty-five years ago, but only for sawlogs, and the growth of softwoods is in excellent condition. Doubtless the average stand of softwood today is 4,000 feet per acre, or 40,000,000 feet for the tract. The valuation in 1906 was \$9,600, or \$2 per acre. In 1908 this was increased to \$29,600, or about \$3 per acre. The comparison with the actual value is about 10 to 15 per cent. This tract is much more accessible owing to its location near the railroad and in easier reach of the market.

(d) One company owning a large amount of timberland pays an annual tax somewhat over \$10,000. The owners are perfectly satisfied with the present valuation, but they would not like to see them go any higher. They believe in a log tax, together with a small annual land tax. As it is now, they say they are taxed for the timber twice, when standing and in logs on the banks of the streams. The scale reports made by some lumbermen to the assessors on April first are said to be only about one half the amount which is actually cut.

The town expenses are comparatively small, as in other thinly-settled communities. Much of the money raised for the town is used on the roads, and these are in excellent shape. The rate in 1907 was only ninety-eight cents. This year it is \$1.30, because of the added expense of a new town house and extra road repair. No extensive lumbering has been done since 1906. Stumpage prices vary up to \$8 per



thousand for softwoods, and, delivered on the banks of the streams, \$12 is the average price obtained per thousand. Tremendous sources of revenue are available in such timberlands, when the town needs extra money. The rate would be exceedingly low if anything like the true value were placed on the timberlands.

42. A certain town is divided into blocks or tracts of 10,000 acres each and each tract is supposed to contain fifty lots of 200 acres, although, as a matter of fact, these lots vary widely.

(a) One tract has never been logged and is very valuable. Ten thousand feet per acre of softwoods would be a low average. Some men in the town believed the tract would run 15,000 feet per acre. Logging is easy, as drivable streams run directly into the Connecticut river.

It is the policy of all big lumbermen to buy stumpage from every available small owner and preserve their own holdings until the others are exhausted. It is usually this policy which accounts for large and valuable stands of softwoods being found within fairly easy reach.

This tract of 10,000 acres was valued in 1890 at \$6,000; 1895, at \$10,000; 1900, at \$20,000; 1905, at \$30,000, and 1908, at \$60,000. This is an increase in eighteen years of from sixty cents per acre to \$6 per acre. At present the valuation is less than 8 per cent of the actual value.

(b) Another tract contains forty-nine lots, or about 9,800 acres. It was logged twenty years ago for sawlogs and is very valuable. Such a tract before the days of pulpwood logging would stand as much per acre after twenty years as before being logged. It would be safe to figure on 8,000 feet per acre at the present time. In 1895 the valuation was \$14,000 and was reduced to \$12,000 in 1900 after the culling. In 1905 the valuation was \$20,000, and in 1908 it was increased to \$29,000. This is an increase from \$1.42 per acre in 1895 to \$2.95 in 1908. The increase in actual value of this tract has been very much greater since the lumbering than in one which had never been logged. The increase in



assessed value has only been about doubled in the thirteen years.

(c) A number of lots consisting of 700 acres, mostly old cuttings and pasture spruce land, is valued at \$2,800, or \$4 per acre. This valuation has been the same for a number of years.

Land of this nature has a high value for the pulpwood, which runs easily ten cords per acre over large areas. This land is more in the class with farm woodlots and is within reach of roads.

Along the banks of the Connecticut river are some valuable timberlands. Some of this has scarcely ever been lumbered and is covered with a uniform growth of spruce, balsam, and scattered hardwoods, which run 10,000 feet per acre. Most of this timber can be cut and put into the Connecticut river with scarcely any haul.

(d) Three hundred acres were valued at \$1,500 in 1905, \$2,100 in 1907, and \$2,400 in 1908. Farther back from the river 180 acres were valued at \$630 in 1905 and \$720 in 1908.

The best land valued here at \$8 per acre could not be purchased for \$60 per acre.

There are many other small areas more or less well timbered. One of 400 acres is valued at \$1,150, or \$2.87 per acre. Another of 100 acres is valued at \$1,000. This lot has the highest valuation in the township and contains 1,000,000 feet of spruce and balsam according to an estimate. The lot is very accessible, but there are many large tracts equally as valuable which are only valued for half this amount. As a general observation, the larger holdings are valued less in proportion to the number of acres than the small lots.

The tax rate is \$1.30. The assessors only increase their valuation as they are compelled to do so by the State Board of Equalization or for the necessities of the town. They are right in believing that their timberlands are a very valuable asset which they cannot afford to lose.

43. The only extensive timberlands in one township

in the extreme eastern part, are owned by two or three concerns and were practically all lumbered many years ago. The present growth of softwoods is excellent and is said to average 5,000 to 8,000 feet per acre for pulp.

(a) One company owns about 3,400 acres of this character of land, which were valued in 1905 at \$15,000, or \$4.40 per acre. In 1908 the valuation was increased to \$16,000, or \$4.70 per acre.

(b) An estate consisting of 250 acres was valued in 1906 and 1908 at \$3,000, or \$12 per acre. There are also 364 acres valued at \$5,000 in 1906 and \$5,500 in 1908, or \$13.75 and \$15.10 per acre, respectively. These lots are very valuable and may run 10,000 feet per acre.

(c) A small tract of 450 acres was valued in 1906 at \$1,200 and 1908 at \$1,500, or \$2.66 and \$3.33 per acre. This property is well timbered with growing softwoods from which at least five cords of pulpwood could be cut per acre. The growth is rapid, and, if held for many years, the investment would be a good one.

The increase in valuations was made two years ago, following the examinations made by the State Board of Equalization. The tax rate in 1907 was \$2.24.

The township is largely in a farming section. Considerable pulpwood is cut during the winter by the farmers and sold at the railroad for about \$10 per cord.

44. In another town the lumber industry has come and gone. Thirty years ago there were six mills in the town doing a large business; now there are none. The timberlands are mostly owned by large lumber concerns, who are holding the land partly in hopes of another cut of spruce, balsam or poplar, and partly because there is no opportunity to dispose of them. They are far too valuable to forfeit for taxes. On some of the lands there are splendid young growths of pulpwood, which will be very valuable in a few years. On the upper slopes there are still dense stands of stunted spruce and balsam, which will be cut for pulp in the future. More than half of the township has been burned

over since logging ceased and much of this land is not very valuable.

The lots are supposed to contain 100 acres each, but most of them vary upwards to 120 acres. Valuations here are largely on cut-over and burned lands.

(a) One concern owns 146 lots, which are all valued at a flat sum of \$200 per lot. Lumbering began here thirty years ago and was mostly completed fifteen years ago. Some of the lots cut over 20,000 feet per acre and cost the owners less than eight cents per thousand stumpage.

The valuation of the township fifteen years ago was \$700,000. Today it is \$892,000 with all its timber gone. This is because there are many hotels in the town now and the valuation of the timberlands has not changed materially. Before the timber was cut there was no more value placed upon it than there is today on the cut-over lands. Many persons believe the customary valuation of \$2 per acre today on cut-over lands is too high. No lot in this town has ever been valued over \$400, or about \$4 per acre.

Farm land is valued very low in this town. The tax rate in 1907 was \$2.15.

45. Practically all of the timber in a neighboring town has been cut except that which is owned by hotel companies or in small holdings. There have been some disastrous fires, and one last fall burned 5,000 acres in the southeast part of the town. All the fires have occurred in old slashings.

(a) There is one small mill operating principally among the pine woodlots in the western part of the town. The lots in this town were surveyed 160 acres each.

In 1905 one company owned 4,960 acres valued as follows:

11 cut-over lots at \$1 per acre.

9½ partly culled lots at \$5 per acre.

10½ lots of virgin timber at \$10 per acre.

The land valued at \$10 per acre included several lots that cut 20,000 feet per acre. In 1908 the total acreage of the company in this township is 9,440 acres valued at \$13,510, or \$1.43 per acre. Since 1905 there has been an addition of



about 4,400 acres of so-called unlotted land which the company has purchased and stripped. The company has practically completed its logging in this town and its entire holdings are cut over. It was in this recent cutting that the previously mentioned fire of 1907 occurred.

(b) Another company owns 1,520 acres valued at \$5,060 in 1906 and \$5,600 in 1908, or an increase per acre from \$3.32 to \$3.68. The land was cut over some years ago and now contains considerable valuable growth.

A large body of uncut timberland belongs to a hotel company and is assessed together with hotel property and improvements. There is some complaint that the large holdings are not taxed in equal proportion with the small ones. Pulpwood stumpage is \$5 per cord. The tax rate in 1907 was \$1.80.

46. Most of the timberlands in a certain township have been lumbered more or less extensively. Many lots were culled years ago and a majority of them now contain 3,000 to 5,000 feet of pulpwood per acre.

There are about 670 acres of farm and forest land which the owners would not sell for \$100,000. About 600 acres of this are well timbered with spruce, balsam, and hardwoods and are of great value in the summer business. This land probably contains 8,000 to 10,000 feet per acre of softwoods. These lands together are valued by the town at \$10,200, or \$15.22 per acre.

(a) One company owns 700 acres of cut-over land valued at \$1,500, or \$2.14 per acre. In addition there is one lot of 148 acres valued at \$1,000. This is covered with an excellent stand of spruce and balsam.

(b) A lumber company owns 2,500 acres in this town. The property has been badly cut over and has been considered almost worthless and the poorest of the mountain lands. Yet this company or almost any other owner would not sell for three times the present assessed value. The lots are now constantly improving in value with softwoods and poplar, although there are many acres that are still worthless.



The increase in valuation per acre since 1902 has been from fifty cents to \$2.50.

It is generally true in this section that taxes on timberland are no burden to the owners. Two prominent timber owners admitted that if it were necessary they could afford to pay many times their present assessment. The towns do not require large revenues and the need for a high valuation is not felt. The large hotels help to bear the principal burden, although even these are assessed comparatively low. Many wild lands are growing up to poplar, which the owners are regarding as very valuable. The tax rate is \$1.50.

47. The southern half of one town is almost entirely cut-over and is practically worthless as far as its timber is concerned. The western half contains some scattered bunches of timber. The northeastern portion is heavily timbered with magnificent spruce and balsam.

There are but few property owners in the town and most of the valuable timber is owned by one company.

(a) A small concern owns 3,125 acres of all kinds of growth, almost entirely cut over, but still containing some good softwoods. The company cuts a small amount of its own timber and buys some stumpage each year. The valuation in 1907 was \$5,708, an average of \$1.82 per acre. In 1908 the valuation is \$1.50. The maximum valuation on one or two lots is \$4 to \$5 per acre.

(b) One company owns some very valuable timberlands. These have been culled more or less, but there is some fine softwoods mixed with the hardwood growth. In 1907 there were 700 acres valued at \$125 per lot of 100 acres or \$1.25 per acre, and 900 acres at \$200 per lot or \$2 per acre. The present year the lots at \$2 per acre were increased to \$2.50.

There is also a considerable area of recently cut-over land, nearly worthless, valued at \$1 per acre in 1907 and increased to \$1.50 in 1908.

In 1907 there were 4,000 acres of worthless cut-over and burned land valued at fifty cents per acre and 2,100 acres of old growth valued at \$4 per acre. Some land was assessed at \$1.25 per acre.

In 1908 the worthless cut-over land was increased to \$1 per acre; the old growth to \$5, and the land at \$1.25 increased to \$2 per acre.

The old growth consists of portion not previously cut because it was more inaccessible. They contain thousands of cords of pulp, which will be cut in the future.

Another extensive tract was recently heavily timbered. In 1907 19,000 acres had been cut over for sawlogs and pulpwood, and the land was then valued at \$9,500, or fifty cents per acre. The remainder, 13,000 acres, was uncut and of equal value with any timber in the state. This was valued at \$52,000, or \$4 per acre.

In 1908 1,500 acres more were stripped, making 20,500 acres of cut-over land and 11,500 acres of virgin softwoods. The cut-over land is now valued at \$20,500, or \$1 per acre, and the uncut land at \$92,000, or \$8 per acre. All of this growth will average from 10,000 to 15,000 feet, or more per acre of spruce and balsam. An actual value of \$60 per acre would be moderate for a good proportion of the area. Logging is difficult, but once a railroad is constructed the cost of haul per thousand feet is not high.

The tax rate in the township has increased from \$1 in 1907 to \$1.70 in 1908.

48. Another town contains a very extensive body of timberlands. Practically no land has ever been cleared and lumbering has only been carried on in the lower valleys and the most accessible slopes. Roughly, about one half of the township has been cut over, much of it very lightly. The finest of virgin spruce and balsam remain about the slopes of the mountains.

There are no towns or settlements, save one hotel settlement, and only one road.

The bulk of the land is owned by three companies. The logging for the most part has been very conservative. Some slopes of the mountains were cut by contract and stripped. Most other cuttings were made by the owners and young

growth has been well preserved. There has been but little cutting for the last three years.

(a) There are supposed to be 14,468 acres of one company's holdings in the township, valued in 1906 at \$46,390 or \$3.20 per acre and in 1908 at \$103,086, or \$7.12 per acre. The best lands were valued at \$3 to \$4 per acre in 1900. Now they are valued at about \$8.50 and the cut-over lands at about \$3 per acre. There are about 100,000,000 feet in this tract.

Not over one fourth of the holdings have been lumbered. The virgin growth averages about 8,000 feet per acre of softwoods. Some slopes will exceed 20,000 feet.

(b) There are 8,600 acres valued in 1906 at \$30,990, or \$3.36 per acre and in 1908 at \$60,873, or \$7.07 per acre. Very little lumbering has been done on this tract.

In the township there are about 30,426 acres of timberland, which have an average valuation of \$5.66 per acre at the present time. Since 1906 the tax rate has dropped from \$1.82 to \$1.40. The town valuation was unchanged from 1900 until 1908, when it was increased \$73,328.

(c) The following holdings of one lumber company are located in various organized towns in northern New Hampshire. They are almost entirely spruce and balsam lands, and for the most part they have been lumbered, although fairly conservative. It is the policy of the company to save young growth and always leave their tracts in such good condition that another cut may be obtained in from fifteen to twenty years. Lumbering may be carried on in one town for a winter and then the operations are transferred. As a rule no large areas in any one town are lumbered in a single year. This company, as well as other large concerns, buys stumpage wherever possible, and saves its own timber for the future.

Lots of wild land in most of the northern towns overrun about 10 per cent; that is, a lot of 100 acres on the town tax book is very apt to contain 110 acres when accurately surveyed.

In general this company's lots have not been overvalued.



They say there is much more timber than they even realize themselves. They do not believe, however, that they can afford to be valued over \$3 per acre on the land that has been culled or cut over and then hold the land twenty years for another cut. The company frankly admits that all timberlands must pay more taxes than formerly, although they dislike to see their valuations jumped annually from 100 per cent to 1,000 per cent or more. They feel that they do not know just where they stand financially.

Many assessors argue that large lumber companies contribute nothing toward the welfare of the town, that they purchase their supplies at a distance, import their own crews and teams, destroy the roads and then demand that these be repaired. The town's only hold on such corporations is obtained through their power to tax. This company does not deny these accusations, but says, however, that they spend thousands of dollars on roads which they often leave in better condition than they ever were before.

These figures are from the tax files of the company:

Acres	Assessed		Tax	Conditions.	Actual value per acre.
	Assessed value 1907.	value per acre 1907.			
2,000	\$4,090	\$2.04	\$0.04	Cut over and partly burned.	\$5.00
4,600	9,000	1.95	0.03	Cut over partly. Some farm land.	6.00
350	1,100	3.14	0.05	Fair spruce.	15.00
8,198	49,990	6.09	0.08	Valuable mixed spruce.	15.00
200	1,000	5.00	0.06	Pasture spruce.	20.00
1,100	3,300	3.00	0.06	" "	20.00
300	1,200	4.00	0.08	Mostly pure spruce.	18.00
14,500	95,166	6.56	0.09	Uncut spruce.	30.00
8,800	19,400	5.10	0.08	Uncut spruce.	40.00
161	500	3.10	0.07	Pasture spruce.	20.00
1,616	4,000	2.47	0.03	Partly culled.	10.00
2,142	6,750	2.46	0.04	Old cutting. Valuable.	8.00
4,255	20,000	4.67	0.03	Mixed. Valuable.	15.00
600	960	1.60	0.01	Cut over and burned.	3.00
1,789	1,310	0.73	0.01	Cut over and burned.	8.00
150	425	2.83	0.09	Cut over.	6.00
300	1,600	5.33	0.10	Uncut spruce.	40.00
560	1,500	2.67	0.04	Partly culled.	8.00
15,000	35,000	2.33	0.04	" "	10.00
150	500	3.33	0.06	Pasture spruce.	15.00
3,000	11,992	3.99	0.11	Young spruce.	10.00
4,270	9,000	2.10	0.05	Culled heavily.	6.00
400	364	0.91	0.02	Good young spruce.	12.00
4,100	23,070	5.53	0.15	Mostly pure spruce.	25.00



There is one town in which the company considers itself outrageously overtaxed. In this town the principal timberlands are owned by two concerns. The tracts are back from the valley and on the rough slopes of the mountains.

The present year the town appointed three expert timber estimators to value the timberlands and report to the assessors. The estimators stated that they valued only timber, which is at present merchantable, and disregarded all hardwoods and young softwoods under six inches in diameter. The stumpage prices used in the valuation were \$4 per thousand for spruce and balsam. It costs from \$3 to \$4 per thousand to haul logs to the river. The estimates were made and the assessors discounted the results for the final assessed values. The assessors claim that they gave the owners the benefit of any doubt in all cases.

The total town valuation was increased \$90,000. The increase was entirely on timberlands. The assessors admitted that this investigation would cause considerable cutting, but believe they were justified in the work. They consider the valuations raised to about three fourths of their actual values. They are confident that no owner would sell his land for the present assessed values.

This company owns 1,628 acres in the town, mostly fair spruce land, but which has been lumbered extensively at different times and now is valuable chiefly for pulpwood.

In 1906 the valuation was \$3,330, or about \$2 per acre. In 1907 the valuation was \$5,560, or \$3.42 per acre. The company was also taxed on 10,300,000 feet of logs and 5,600 cords of pulpwood on the river bank. In 1908 the valuation was increased to \$50,000 or an average of \$30.32 per acre.

The company has had the timberlands examined by its own estimators and as a result has petitioned for an abatement. It is said that they will sell the timberlands for \$10,000. If no adjustment can be reached, the company will immediately strip the land of every piece of timber and pulpwood.

The other company owning timberland in the same town



FIG. 18.—Pine tree pruned thirty-two years ago. Note that the wounds have not entirely healed over.





FIG. 19.— Sometimes pine seeds, instead of being dissipated by the winds, fall to the ground still in the cone, from which they are spilled in a mass. This results in the generation of a compact body of seedlings. The illustration shows ninety-two plants in such a body, transplanted at the age of two years to the vase.

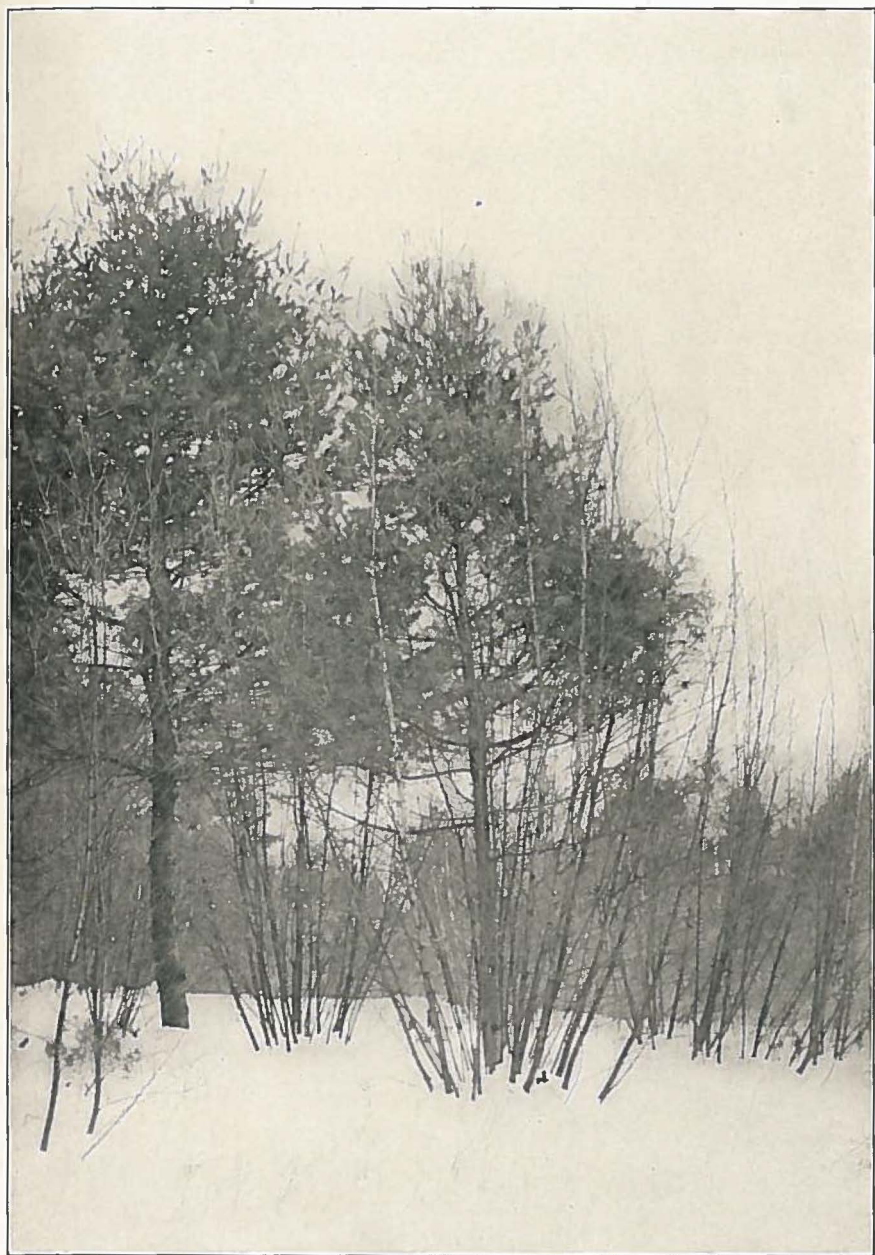


FIG. 20.—Grey birch sprout growth showing a height of 20 feet or more, after cutting six years ago.



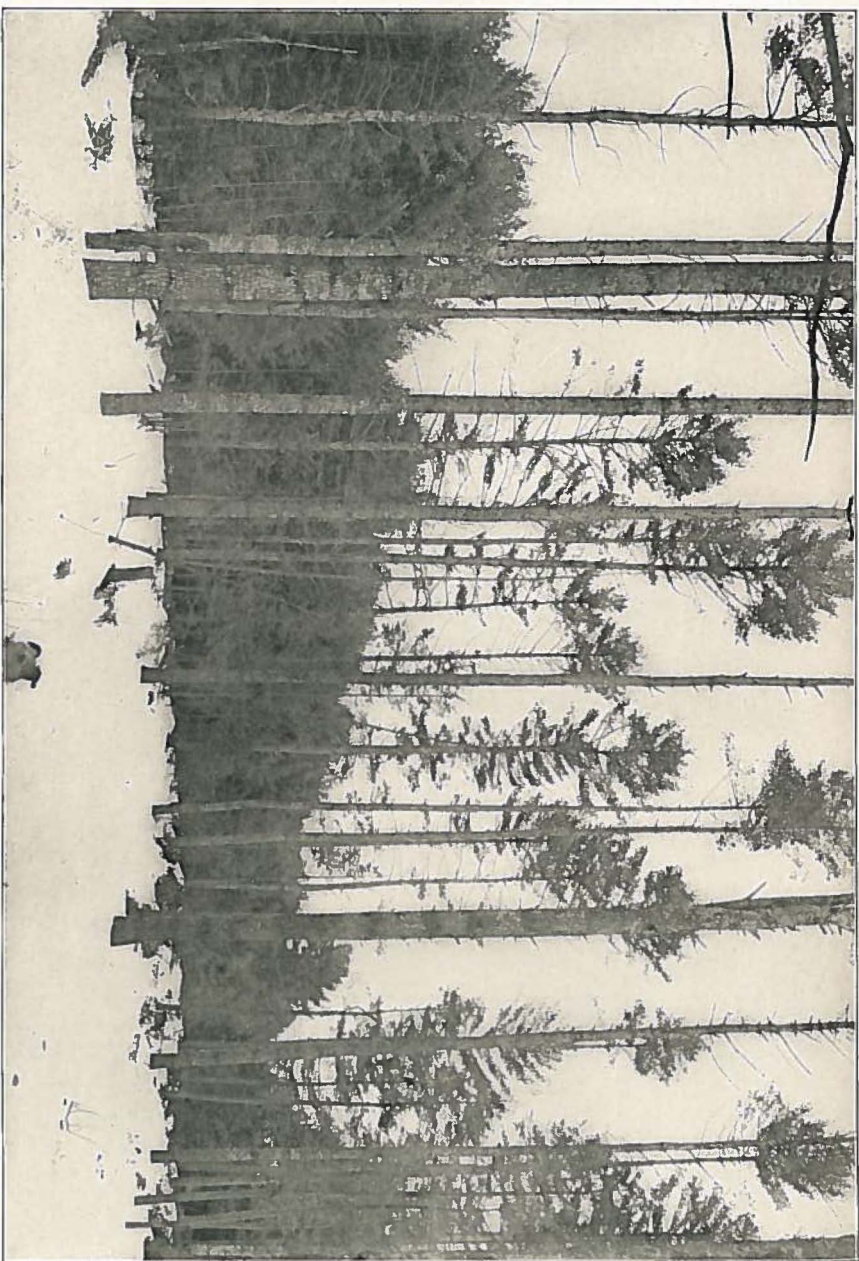


FIG. 21.—Thinning of pine stand eighty years old. This was a very intense thinning, amounting almost to the leaving of a plentiful supply of seed trees. There is excellent reproduction under the trees not shown, however, on account of the snow.

is similarly situated. There are about fifteen different lots of irregular size and the acreage is not known. Of the lots examined, the increase has been from \$6,550 to \$22,650 during the present year. Most of these valuations were exceedingly low before and they are not as a whole excessive at present. Some of these, however, seem to be unreasonable.

Some idea of the situation may be obtained from the following quotation, which is from a letter received from the owner of the land:

"I had an interview with the selectmen of the town some weeks ago and learned that they had two timber estimators, supposed to be experienced men, go over these wild lands and submit an estimate of the lumber on the lands. I am convinced that their estimate was in excess of the actual stumpage, and they have also set the stumpage altogether too high on many lands which are located in mountainous places and which are very expensive to operate.

"They have increased the valuation on my wild lands from 300 per cent to 4,500 per cent. It is only fair to say, however, that in the most extreme cases, that is, 4,500 per cent (\$100 to \$4,500), that their previous valuation was very low. The lot which they had been taxing at \$100 was probably worth \$1,000. I would sum up the result of their action by saying that they have on an average taxed our lands at from two to three times what I should consider a fair value at the present time."

A very interesting situation has been found to exist where one town is largely controlled by a single industry. A large increase in the town's valuation was declared by the Board of Equalization two years ago. The town books show that instead of an increase in the total valuation of the town it is even lower in 1908 than in 1906. The tax rate, however, has been nearly doubled. The state and county taxes have been paid on a basis of the increased valuation, but the increased expense to the town has been met by increasing the rate rather than the valuation.

All poll taxes in New Hampshire are levied according to

the tax rates of the various towns on a valuation of \$100. This particular town has many polls and by increasing the tax rate instead of the valuation of the town, the increase in the state and county taxes is in large part met by the revenue from the polls. If the valuation had been increased and the rate had remained the same this revenue would have been derived chiefly from the large timberland owners of the town.

### TAXATION OF WILD LANDS IN UNORGANIZED TOWNS.

Unorganized townships are those in which there are no organized town governments. They are usually owned by individual lumber companies and the valuations are fixed by the State Board of Equalization every four years with the assistance and advice of the county commissioners.

The unorganized townships are in Coos county.

49. A tract of 13,000 acres is owned by one company. Lumbering has been going on for several years and is practically completed. One camp will continue another winter. Cutting has been very severe and in other places more difficult to reach; quite large patches of timber have been left. There is a good stand of hardwoods in mixture and the ground cover is well preserved after lumbering.

There was formerly a heavy stand of spruce and hardwoods, averaging 10,000 feet of softwoods alone. At present there are about four cords of pulpwood per acre over the whole area. The present valuation made in 1906 is \$210,000 or \$15.14 per acre, which is almost equal to the present actual value of the land. This valuation is very high in proportion to other property.

50. A tract of 23,040 acres has been badly treated in past years when the owner allowed unlimited cutting. At the present time the lands are being well cared for and 1,000,000 feet or more of softwoods are cut annually. In general the forest is in fine growing condition, except at the west, where cutting has been most severe.



There are said to be 50,000,000 feet of merchantable softwoods in the tract at present. In addition there is a large amount of young softwoods, which are growing rapidly. The value should increase very rapidly in the next ten years. The tract has been entirely lumbered.

The present valuation is \$250,000, or \$10.85 per acre, which is higher than the value of heavily timbered land in some of the organized towns. The valuation was only half as much in 1902.

51. A tract of 13,105 acres has been lumbered for thirty-five years until three years ago. The owners began by cutting 2,000,000 feet per year and ended with 10,000,000 feet. The average cut was about 4,000,000 annually for the whole time of cutting. Originally this was about the best timbered township in the north country. The land is pretty well cleaned of all its softwoods, but there is a good foundation for another growth if the property can be protected from fire and misuse for the next ten years. The 13,105 acres are valued at \$75,000 or about \$5.72 per acre. The increase over 1902 was \$5,000.

52. A tract of 31,683 acres is owned mostly by one company. Cutting has been very light on this entire tract. The general average per acre over most of the tract is 5,000 board feet per acre of softwoods. Most of the logging has been on the east slope and the more accessible timber has been culled. Lumbering in the future will require longer and harder drives and much timber must come from upper slopes. The valuation of the 31,683 acres was \$200,000 in 1902 and \$325,000 in 1905, an increase from \$6.31 to \$10.25 per acre. In 1890 the valuation was \$25,000.

53. A small tract of 2,300 acres is well timbered with spruce and balsam averaging over 5,000 feet per acre. Logging is difficult and the tract has less value on that account. It is not near any roads or good drivable streams. Probably this land is worth \$25 per acre.

The valuation in 1906 was \$40,000, or \$17.39 per acre, and in 1902 it was \$30,000, or \$13 per acre. This is out of all



proportion to the valuation of many other timberlands in the state. In 1890 the valuation was \$5,000, or \$2.17 per acre.

54. An unorganized township still has some good timberlands, but considerable trouble has been found in getting out the logs. It is probable that this tract will average 8,000 feet of softwoods per acre, worth \$30 to \$50 per acre. Considerable lumbering has been done at times. There are some small lots and some good agricultural land in the valley.

The township is now valued at \$350,000, or \$15.08 per acre. In 1902 the valuation was \$250,000, or \$10.77 per acre. In 1890 the valuation was \$40,000.

55. Another unorganized township has been severely lumbered and burned. The land is mostly covered with hardwoods with occasional patches of mature softwoods and some good growing pulpwood. There are 29,000 acres valued since 1902 for \$125,000, or \$4.31. This would not be excessive if all cut-over lands were valued similarly.

56. A third township has been lumbered for many years and the growth is almost entirely hardwoods.

The valuation for 30,472 acres was \$60,000 in 1902 and 1906, or \$1.96 per acre. This is reasonable for cut-over land. It is probably worth much more..

57. A tract of 25,000 acres contains at least 5,000 acres of the finest virgin spruce and balsam.

The valuation of the 25,000 acres together was \$200,000 in 1906, or \$8 per acre, and in 1902 was \$165,000, or \$6.50 per acre. This timber will all be removed in the next two or three years. It will average 10,000 feet per acre.

58. A tract consists of 10,000 acres. With the exception of about 200 acres of virgin spruce the whole tract has been lumbered and about 2,000 acres burned. Most of the lumbering was done many years ago, and there is an excellent growth of young softwoods with the hardwoods. Probably 6,000 acres contain several cords of pulpwood per acre, besides the 200 acres of virgin growth, which runs 12,000 to 15,000 board feet per acre. The tract is very valuable to preserve the beauty about the grounds of the various hotels.

The 10,000 acres were valued in 1902 and 1906 at \$25,000, or \$2.50 per acre. In 1890 the valuation was \$30,000, or \$3 per acre. The actual value of the land averages at least \$15 to \$25 per acre.

#### SUMMARY OF ASSESSED VALUES COMPARED WITH ACTUAL VALUES.

The following figures are given to show the comparative assessed and actual values of the timberlands in different sections of New Hampshire. Examples are taken from lots whose values are most accurately known. It is interesting to note how the valuations of the wild lands compare with those of the woodlot sections. The real values shown are average figures and as accurate as it was possible to obtain them.

Examples of overvaluation are rare. Many lots which appear at first to be overvalued prove upon examination to be valued far below what they are actually worth. The inequality of the assessments between lots in the same towns and between similar lots in different towns, is the most noticeable feature, and is common everywhere in the state.

The figures also show that wild lands in unorganized towns are valued somewhat higher in proportion to their actual values than similar lots in organized towns.

Region.	Type and condition.	Assessed value per acre, 1908.	Approximate actual value per acre.	Per cent of assessed value to actual value.	Remarks.
Central woodlot	Mixed pine.....	\$6.50	\$30.00	21.6	A large area well tim- bered with pine and hemlock principally.
"	Pure pine, 50 years old	53.00	104.00	41.3	Lot of 30 acres close to village.
"	Fair pine, 40 years old	10.00	50.00	20.0	
"	Pine, 50 years old....	50.00	64.00	78.1	
"	Valuable oak growth..	3.00	30.00	10.0	A mill necessary to lum- ber properly.
"	Pine, 30 years old....	39.00	60.00	65.0	Very fine growth.
"	Pine and hardwoods..	8.50	22.00	38.6	250-acres tract, mixed growth.
"	Spruce and hardwoods	3.00	50.00	6.0	Isolated old growth stand.
"	Pine, about 50 years..	37.50	70.00	53.5	Very valuable lot near town.
Southern woodlot	Fair pine lot.....	50.00	80.00	62.5	
"	Pine and pasture....	13.00	23.00	65.5	Young growth too small to cut.
"	Young pine.....	40.00	100.00	40.0	
"	Pasture pine.....	16.00	40.00	40.0	
"	Hemlock & hardwoods	35.50	150.00	23.6	Old growth. Very fine quality.
"	Pine and hardwoods..	18.00	52.00	34.6	
"	Mixed pine .....	95.00	150.00	63.3	Virgin pine and young growth.
"	Pine, 30 years old....	13.50	34.00	39.7	
"	Young pine land.....	11.50	36.00	31.9	1,400 acres of valuable pine.
"	Old pasture.....	2.30	10.00	23.0	240 acres. Some good pine.
"	Young pine and hard- woods .....	30.00	50.00	60.0	
"	Good pine lot.....	20.00	75.00	26.6	
"	Pine and hemlock....	54.00	90.00	60.00	
"	Good pine lot.....	66.00	100.00	66.6	
"	Excellent pine.....	57.00	128.00	44.5	
"	Old growth pine.....	90.00	325.00	27.6	22 acres of this growth.
"	Pine and hardwoods..	50.00	60.00	83.3	This lot being cut off to avoid taxes.
"	Pine pasture.....	23.00	30.00	76.6	
South	Wild spruce land.....	5.00	40.00	12.5	A large tract sold for \$40 per acre.
"	Sprout lot.....	5.00	30.00	16.6	Growing up to poplar.
"	Half grown pine.....	23.00	66.00	34.8	Owner holding for high- er price.

Region.	Type and condition.	Assessed value per acre, 1908.	Approximate actual value per acre.	Per cent of assessed value to actual value.	Remarks.
South	Mature pine.....	70.00	150.00	46.6	Value probably above \$150 per A.
North	Wild spruce land....	30.32	35.00	86.6	Wild land in organized town.
"	Wild spruce land.....	4.70	35.00	13.4	Wild land in organized town.
"	Virgin spruce.....	5.00	40.00	12.5	Wild land in organized town.
"	Cut over and burned..	0.24			Wild land in organized town.
"	Spruce and hardwoods	11.61	50.00	23.2	Wild land in organized town.
"	" " "	15.00	30.00	50.00	Wild land in organized town.
"	" " "	7.00	35.00	20.0	Wild land in organized town.
"	" " "	8.60	60.00	14.3	Wild land in organized town.
"	" " "	7.00	40.00	17.5	Wild land in organized town.
"	" " "	6.00	35.00	17.1	Wild land in organized town.
"	" " "	6.00	60.00	10.0	Wild land in organized town.
"	" " "	4.70	35.00	13.4	Wild land in organized town.
"	" " "	15.00	60.00	25.0	Wild land in organized town.
"	Cut over.....	2.00	..	..	Wild land in organized town.
"	Cut over.....	1.43	..	..	Wild land in organized town.
"	Cut over.....	2.50	..	..	Wild land in organized town.
"	Cut over.....	1.00	..	..	Wild land in organized town.
"	Virgin spruce.....	8.00	75.00	10.6	Wild land in organized town.
"	Culled spruce.....	4.00	20.00	20.0	Wild land in organized town.
"	Spruce and hardwoods	8.50	50.00	17.0	Wild land in organized town.
"	Culled spruce.....	3.00	10.00	30.00	Wild land in organized town.
"	Culled spruce.....	15.14	20.00	75.7	Wild lands in unorgan- ized town.



Region.	Type and condition.	Assessed value per acre, 1908.	Approximate actual value per acre.	Per cent of assessed value to actual value.	Remarks.
North	Culled spruce.....	10.85	25.00	43.4	Wild lands in unorgan- ized town.
"	Culled spruce.....	5.73	20.00	28.6	Wild lands in unorgan- ized town.
"	Partly culled.....	10.25	25.00	41.0	Wild lands in unorgan- ized town.
"	Well timbered.....	19.43	30.00	64.7	Wild lands in unorgan- ized town.
"	Well timbered.....	2.50	30.00	8.3	Wild lands in unorgan- ized town.
"	Some virgin.....	8.00	25.00	32.0	Wild lands in unorgan- ized town.
"	Cut over.....	2.31	..	..	Wild lands in unorgan- ized town.
"	Cut over.....	2.31	..	..	Wild lands in unorgan- ized town.
"	Partly virgin.....	17.39	25.00	69.5	Wild lands in unorgan- ized town.
"	Partly culled.....	15.08	30.00	50.2	Wild lands in unorgan- ized town.

Considerable criticism is expressed in regard to the process of equalizing property over the state. It is a common belief that State Boards of Equalization and County Commissioners do not have sufficient information and that they do not understand the local conditions which govern assessors in the performance of their duty.

### TAX LANDS.

Throughout the state few examples were observed where land was sold for taxes and not redeemed by the owner before the two-year limit had expired. Failure to pay taxes is largely due to neglect by nonresidents. Often such lands are sold by the towns, but the purchasers buy these lands fully expecting them to be redeemed sooner or later.

Land is seldom wilfully abandoned to avoid the payment of taxes. Apparently no lands are so barren or unproductive as to cause the owner to abandon them. Some times

lots are sold by the owners where they think the taxes are more than they can stand, but always some purchaser is found who is willing to take the burden of the taxes.

The condition is quite different from this in many states, and indicates that serious damage by overtaxation of timberlands is not found yet in New Hampshire. The rapid increase in valuation of the past few years cannot be continued long, however, without causing considerable distress among many owners.

### HOW FOREST PROPERTY IN NEW HAMPSHIRE SHOULD BE TAXED.

The fact that until recently the tax burden upon timberlands has been exceedingly low has given rise to a belief that in the future, timberlands should be assessed for their full, present value and taxed each year at the same rate as other property. The great advance in prices and the desire to retaliate for past losses to the state and towns often outweigh a consideration of what tax burden the future timberlands can stand. This attitude is shown particularly against lumbermen and large nonresident owners. Assessors argue that such owners of timberland have no local interest, being influenced only by the desire to exploit the lands and then leave them cut over and valueless.

The purpose of all taxation is to obtain revenue for the maintenance of government. This revenue must be sufficiently regular to meet the needs of the state, counties, and towns, yet it should be admitted that the taxes upon forest property can best be paid when the property is able to offer returns to the owner.

If a land tax is to be equal as between different landowners, it must take one of three forms: (1) a uniform percentage of the actual sale value of the property as it stands; (2) a uniform percentage of the actual income from the property; (3) a uniform percentage of the estimated power of the soil to yield, or potential income.

In this country the first form is the one in use, although,

in the case of agricultural lands, the actual sale value is generally based unconsciously upon the fertility of the soil or its potential yield. The assessment of forest lands is based upon their supposed actual sale value, but the land itself is not considered. It is the value of the growth upon the land which indicates the sale value. Agricultural crops, being harvested annually, escape taxation entirely. Forest lands, therefore, are not taxed under the same form as agricultural lands, although there is no provision in the law for such distinction.

Under the second and third forms taxes are levied with a real approach to equity. These forms are extensively used in Europe, and this fact accounts for the general esteem in which forest legislation is held there.

In this country the system of assessing property at its actual sale value and taxing it a uniform percentage of that value works well enough when applied to agricultural land, but when applied to growing forests it is both unjust and unwise. It is unjust because it ignores the facts that growing timber before it is large enough for market has only a prospective value and the income or returns can only be obtained at long intervals. It is unwise because the system often forces the owner to cut the timber before it is mature.

There are various reasons why the subject of taxation as applied to timberlands should receive serious consideration at the present time. Until recently such consideration was not necessary. Forest land had little value, and the haphazard methods of taxation were adequate. The forests of the present and the future must come more and more to be considered as crop forests, in which the elements of labor and expense are associated. The cost of establishing new forests and of improving and maintaining them afterwards, until they are large enough to harvest, has a serious relation to the future taxation of these lands. As economic management of forest lands is necessary in the future, so should there be systematic and judicious methods of taxation at present.



Careful business men hesitate to engage in transactions in which they cannot figure approximately the probable gains and losses of the business. The management of woodlands in the past has not necessitated careful figuring, because there was no such narrow margin between profit and loss as there will be in the future. With the necessity for more conservative management of forest lands, the owners should be enabled to judge more accurately what the tax burden on their lands will be. At present they cannot tell whether their assessments will be increased 100 per cent or 1,000 per cent from one year to another. There is no inducement to the owner to plant his waste and cut-over land or improve his present forest growth as an investment, when there is a possibility of his tax becoming so great that he must cut his timber before it is mature or run the risk of a final loss.

Forests are necessary to the public welfare. They are a valuable asset to any community. Thousands of people go to every portion of the state during the summer, and forests are necessary to the continuance of this summer business. Forests also regulate the flow of streams. They should be able to supply the constant local demand for lumber in every community.

There is an increasing desire among lumbermen to own the land upon which they are operating and to protect their cut-over lands from fire, with the view of future lumbering on the same ground. Lumbermen, in general, are coming to consider their forests as permanent investments. Large lumber companies are already cutting much more conservatively than formerly, and many small operators within the woodlot area are investing in young growth and are anxious to cut their mature pine lots so as to get a reproduction of the same species. While originally the investments in forest lands were made largely for speculation, there will be far less of this done in the future. Formerly the taxes were never considered, but in the future the policy which lumbermen will pursue must depend largely upon the tax burden which their timberlands are forced to carry.



The destruction of the original forests has been due to the increase in value of wood products and the resulting large profits to the lumberman, together with his belief that the forest resources of the country were inexhaustible. That belief has passed, but the destruction of young forests now growing is likely to be encouraged rather than checked in the future by the present system of taxation. Under the present system assessments which approximate the actual sale values are becoming more and more frequent.

The constant menace of destruction by fire is a risk peculiar to forest investments. The towns do not pretend to offer the same protection to woodlands that they do to other property. Yet the owner is paying a constantly increasing tax upon his woodlands.

The efficiency of the fire service should increase in proportion to the increase in taxation. No insurance company at present would think of insuring forest property from fire at anything short of prohibitive rates. In Europe it is a common practice to insure forest property. The danger from fire, as well as from other destructive agents, like wind and predatory insects, should give the owner of forest land a more equitable consideration in the matter of taxation.

The present law, that all property shall be assessed at its full value, is so pernicious when applied to growing timberlands that, should the law be enforced, there would be a tremendous slaughter of half-grown timber throughout the state. Doubtless much land would revert to the towns for nonpayment of taxes, as has happened in California and Michigan. The injustice becomes more and more apparent as the valuations are increased from year to year. Although the law is not fully enforced, except in isolated cases, the provisions for its enforcement are there, and assessors are often being charged with neglect of duty by state and county officials. Any law which is capable of so much injury as partly to prevent its enforcement should not be permitted to remain upon the statute books.

Forest growth differs from other property because it pro-

duces no income to the owner except at long intervals. No other business is compelled to wait such long times for its returns. The value of the growth increases annually, it is true, but this growth must be stored in the trunks of the trees until the forest has reached a merchantable size. Yet the owner pays an annual tax upon that growing timber, which, at the time, is producing him nothing. To pay the annual tax, the owner must literally borrow money from some other investment which is producing him an annual income.

It is well known that annual crops are not taxed at all because they are harvested and disposed of before the annual appraisal of property is made in April. Forests should not be entirely exempt, however, and further taxation of farm property should be discouraged. The small farmers of the state already bear as much of the burden of taxes as they can afford, and often more than their just share.

There is a fundamental difference between levying an annual tax on property producing an annual income and levying an excessive annual tax on property producing an income only at long intervals. This difference is purely one of mathematics and can be shown by comparing two lots of land at present without any crops whatever. It may be assumed, for example, that in the next sixty years each lot is capable of producing an annual income of \$10 per year. These lots would then appear to be of equal productive capacity, but, according to common usage, two lots of land of equal productive capacity should mean lots capable of producing an equal amount of revenue in the long run. These lots would most certainly not do that.

\*One lot is planted to field crops, and the \$10 are obtained annually for sixty years. The other lot is planted to trees, and \$600 are obtained when the timber is cut at the end of sixty years. For the purpose of illustration money may be considered to be worth 5 per cent interest, compounded annually. Then at the end of sixty years, while the value of the timber crop is \$600, the value of the farm crops with

\* This example, somewhat differently expressed, is from an article in the Canadian Forestry Journal for October, 1905, by Dr J. F. Clark

the accumulated interest is \$3,535.80, or nearly six times the yield of the forest during the same length of time.

If the two lots in question are assumed to be physically the same and are so taxed, then no sensible man would devote one of them to forestry, which would yield only \$600 after sixty years, but which, if farmed, would yield \$3,535.80 in the same length of time. The fact simply is, that the productibility of the forest land is only 17 per cent of that of the farm, and should, therefore, be taxed in that proportion.

Looking at it in another way, the value of the taxes and interest on each lot amounts to \$358.58 at the end of sixty years. This amount, then, is only 10 per cent of the total returns from the field crops, while it is 59 per cent of the yield of the forest crop. In order to be equitable, the tax on the forest crop should be 10 per cent of its final yield of \$600, or \$60. Discounting to one year and considering the true productivity of each lot, the one planted to farm crops should pay an annual tax of \$1.00, while the lot planted to forest trees should pay an annual tax of seventeen cents.

With a longer rotation and a higher rate of interest, the forest property might be confiscated entirely in paying the annual taxes at the full assessed value. These figures are intended to show that growing timber cannot be assessed for anywhere near its actual value without the taxes eating up the profits of the investment.

Conditions of forest growth are variable over the state. There are still many acres of old growth in the north. In the southern parts the forests are mostly young and growing, and there the tendency to overvalue is greatest. It is in the South also that the forests partake more of the nature of European forests. Yet any tax system must apply equally to the whole state. There are many thousands of acres of idle forest lands which have long ago been lumbered and whose owners have had no encouragement to care for new valuable growth. The state needs to have every acre of true forest land growing up to valuable timber. No land should be idle,



and when not needed for agriculture or pasturage it should be made to grow valuable forest trees.

It seems probable that encouragement through a proper system of taxing timberlands would go a long way toward improving the present conditions.

### SUGGESTIONS IN TAXING TIMBERLANDS.

In the preceding pages it has been shown just what the tax conditions are in all sections of New Hampshire, and what the effect would be if the present law were fully enforced. Suggestions tending to correct entirely the possible ill effects of the present system call for a radical change in the tax laws of the state and possibly an amendment to the Constitution.

It is evident that the old method of taxing forest property, as well as other property, at its supposedly full value will, as the value of timber increases and is recognized, put a premium on premature and reckless cutting, and will hinder any effort to reforest cut-over lands. No business man will engage in an undertaking where the returns are so long deferred and the risks are uninsurable unless he can estimate the probable expenses and a probably large profit. That the forests themselves, irrespective of their ability to stand taxation, are of great value to the communities in which they are located and to the state at large for water protection, lumber supply, and scenery in resort regions is undoubted.

The problem is, not how to relieve timberland from taxation and place the burden upon other property, but how to place upon such land its rightful proportion in such a way as to encourage careful management of new and old growth and insure reforestation of cut-over land.

The fundamental difficulty is that the tax should be in proportion to yield or income and not in proportion to market value. Economists are substantially agreed that this principle is applicable to the taxation of all kinds of property with certain exceptions. Where there is a reasonably certain annual yield or income the market value is



theoretically dependent upon it. Therefore a general tax assessed yearly at a uniform rate upon the appraised value of all property conforms somewhat closely to the theoretically correct principle, and if honestly and efficiently enforced works no very great injustice or hardship. A woodlot or forest, however, usually in this country, has no annual yield. Its crop matures once in fifty, sixty or eighty years. It is unjust to require the owner to carry the full annual burden of taxes, risk and protection in every year for the chance of a yield once in fifty years, and it is impossible for the owner to do it, for the taxes with compound interest would confiscate his entire capital. This is fully recognized in continental Europe, where a tax on the yield is the fundamental principle of forest taxation, but European methods of applying this principle are of little value in this country because of radical differences in local government, tax machinery and forest management. What is needed in this state is a method of taxing forest lands, which can be administered by the towns in conformity with the established functions and procedure of our local governments, which insures an annual revenue while the timber is immature commensurate with that formerly derived from the low appraisals of immature timber held by farmers and others, which imposes a fair burden on the timber crop when it is cut and collects it from the person who cuts and sells the timber. This burden will be a tax on the yield or income and not on the land or capital. It should, therefore, be relatively high. To prevent the speculative holding, without taxes, of land chiefly valuable for residence, manufacturing or farming purposes, the law should be restricted to land found by the selectmen and assessors to be chiefly valuable for the production of wood and timber. Timber cut from lands so classified should be taxed when it is severed from the land and should not be removed until a tax of fifteen per cent of the value of such timber has been assessed and collected by the selectmen or proper security shall have been given to them. Willful removal contrary to the provisions of the law should be subject to a

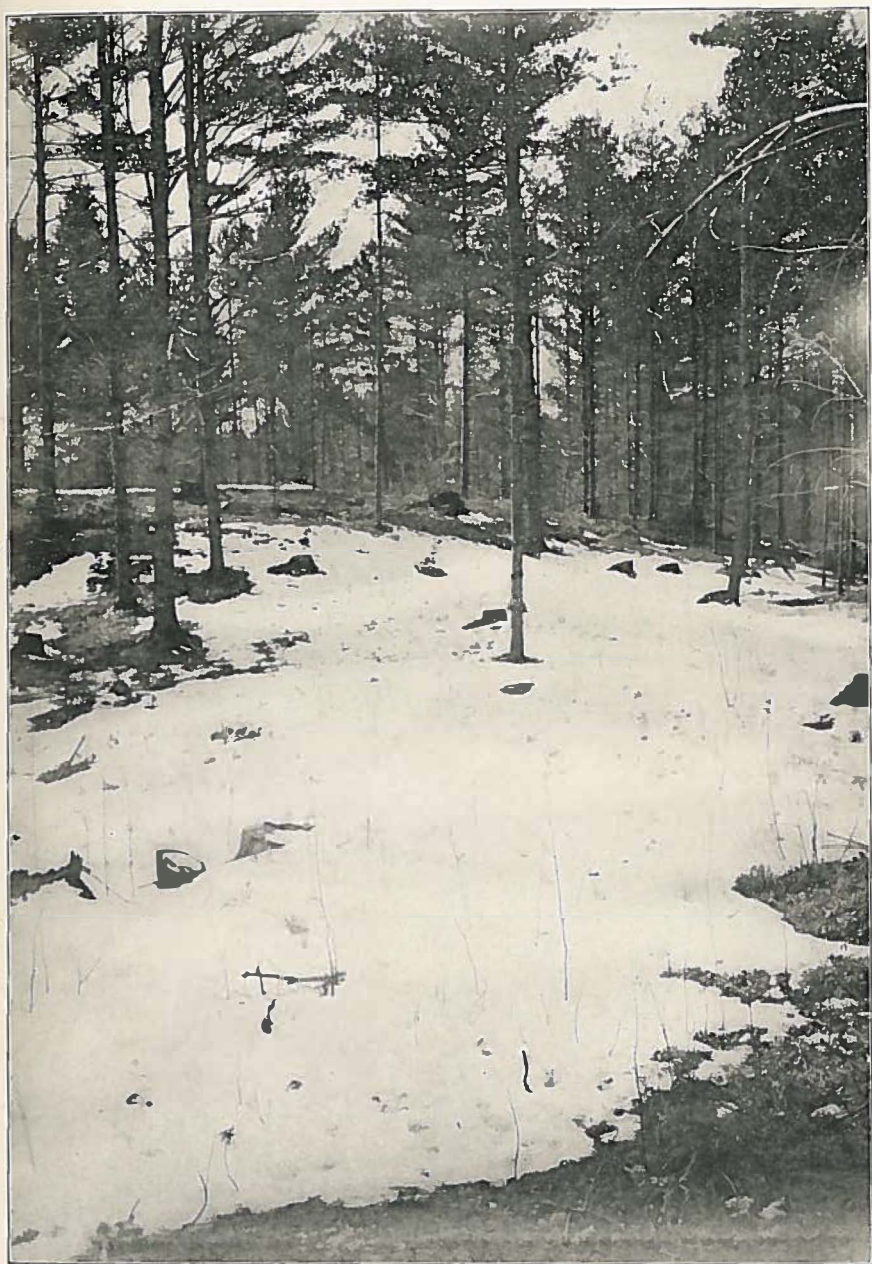


FIG. 22 — A reproduction cutting. Notice in the foreground the stumps of trees which have been cut to let in the light on the young seedlings, which are coming up in great numbers through the snow.





FIG. 23. — Young pines intermixed with grey birch generally means whipping of the pine by the birch. See Fig. 24.



FIG. 24.—These are grey birch and pine tops taken from the stand as shown in Fig. 23, struck in the snow, and occupying relatively the same position to each other as they did in the original stand. Both pines have been ruined by the constant whipping of the birch.



FIG. 25.—A typical grey birch stand.



proper penalty, but owners or tenants of farms should be allowed to cut and remove wood up to a certain value each year for domestic use free of all taxes.

Finally, since timber now half grown or mature has presumably been taxed in accordance with the present law, and since it is desirable to introduce the new system gradually, the new method of taxation should be applied only to tracts upon which forest growth has recently started and then only at the option of the land owner.

The following statute is suggested for this purpose:

Be it Enacted, etc.

SECTION 1. Any land in this state chiefly valuable for the production of wood or timber and occupied by a natural or planted growth of trees, approximately three fourths of which do not exceed the age of ten years, may be separately classified for taxation; and when so classified such lands and the wood and timber thereon shall be taxed as is in this act provided, in lieu of all other taxation.

SECT. 2. The blank inventories now required by law shall hereafter be so arranged and formulated as to permit a description of each tract of land which the owner may desire to have classified under this act, and also each tract which has theretofore been so classified, with the year of such prior classification, separate and apart from other real estate, and a statement of the variety, gross amount and value on the stump of the wood and timber taxable under this act, which shall have been cut or removed from each such tract during the current year, ending on the first day of April.

SECT. 3. Any person or corporation to whom is taxable any contiguous tract of land suitable for classification as above provided may separately list the same as forest land to be classified in the year then current, and in that case shall, under oath, show that the tract is of the kind, situation, and value specified by, and that the growth thereon is within the age limited by section one of this act, and also the area of the tract, its value per acre, exclusive of the growth thereon, and the variety and age of such growth.

SECT. 4. The selectmen and assessors shall thereupon, after such further inquiry, view or hearing (if any) as they may deem necessary, decide whether, in their opinion, the tract is of the kind, situation, and value specified by, and the growth thereon is within the age limited by section one of this act. If their decision is in the negative, they shall not classify such tract under this act.

SECT. 5. If their decision is in the affirmative, such tract shall be deemed to be classified under this act and shall remain so classified so long as, in the opinion of the selectmen and assessors, it continues to be chiefly used for the production of wood or timber, and they shall thereupon and annually thereafter determine the average value per acre, exclusive of the growth thereon, of all tracts so classified, which are annually returned as required by section 6 of this act, and shall assess the same for taxation at such value; but if the return required by section 6 is omitted for any year the selectmen and assessors shall for that year assess the land with respect to which such omission occurs for taxation at the value of the land plus the value of the growth upon it, but the land shall continue to be classified under this act. If any part or the whole of such tract is at any time after such classification chiefly used for other purposes, such part or the whole, as the case may be, shall thereupon cease to be classified under this act. The selectmen and assessors shall in every year designate upon their invoice all tracts classified under this act, with the year of such classification; they shall also specify the kind, quantity and value of all wood and timber, taxable under this act, which shall have been cut or removed from each tract during the preceding year.

SECT. 6. Any person or corporation to whom is taxable any tract of forest land classified under this act shall separately list the same in his inventory in each and every year after such classification and shall show under oath as to each such tract the year such classification was made, the description and area of the tract, and the variety and average age of the growth thereon; also the description and value of any



part of the tract which, during the year ending the first day of April, has been chiefly used for other purposes than the production of wood and timber; also the name and residence or location of every other person or corporation which has during said year cut or removed from the tract any wood or timber.

SECT. 7. From any one or more such tracts appurtenant to any farm, there may be cut and removed in any one year, for the household or farm use of the owner or tenant of such farm, wood and timber not exceeding for any one farm twenty-five dollars in stumpage value, and the wood or timber so cut or removed shall be exempt from taxation under this act. Any wood or timber cut or removed from any tract classified under this act during any year ending April first other than or in excess of the quantity in this section above exempted shall be taxed in the town where the tract lies and to the person or corporation cutting or removing the same, who shall list the same in his or its inventory and show under oath the description and area of the tract, the year of its classification, the name and residence or location of the person or corporation to whom the tract is taxable (if other than the one so cutting or removing), and the variety, quantity, and value of the material so cut or removed. No wood or timber cut upon any such classified tract, except for farm and household uses as above exempted, shall be removed therefrom until the tax thereon shall have been assessed and paid or security for such payment, satisfactory to the selectmen and assessors, shall have been furnished by or on behalf of the owner of such wood or timber. Every person or corporation which removes any such wood or timber in violation of this section shall be liable to the town in an action of debt for an amount equal to the full stumpage value thereof; and the taxes assessed under this act upon the wood or timber so wrongfully removed shall be a prior lien upon such wood or timber in the possession of any and all persons or corporations whatsoever and shall be satisfied before any and all other claims. The town may seize such wood or timber



wherever found, and after notice may sell so much thereof as may be necessary to pay the taxes assessed or to be assessed thereon under this act plus the expense of seizure and sale. If the person or corporation cutting or removing wood or timber in violation of this section shall neglect or refuse to pay the taxes assessed thereon until the first day of June in the year for which such assessment was made, the owner of the tract from which such wood or timber was cut or removed shall be liable for said taxes, and the tract itself shall be holden for said taxes in like manner as if they had been assessed against said owner.

SECT. 8. The selectmen and assessors shall annually appraise at its true value on the stump the timber and wood taxable under this act cut or removed from each and every tract, and thereupon shall assess upon the same for the year following the first day of April after such cutting or removal, and in lieu of all other taxes up to and including such year, proportionate taxes at the uniform and equal rate of fifteen per cent of such appraised value; *provided*, that they may make such appraisal and assessment at the time of such cutting or thereafter, but not later than the making of their invoice for the year for which such wood or timber is taxable.

SECT. 9. With respect to unincorporated places, the State Board of Equalization shall perform the duties imposed upon selectmen and assessors in towns under the provisions of this act.

SECT. 10. If any owner of land or of wood and timber, the taxation of which is or may be provided for by this act, shall consider himself aggrieved by any decision of the selectmen and assessors or Board of Equalization in applying the provisions of this act, he may within nine months after notice of such decision, and not afterwards, apply by petition to the superior court in the county where the land lies, who shall make such order thereon as justice requires.

## THE EFFICIENCY OF THE FIRE LAWS IN NEW HAMPSHIRE.

The fire problem, like other forest problems in New Hampshire, applies to two classes of property: (1) woodlots and (2) wild lands. The danger from fire and the difficulty of protection vary greatly, depending upon whether the timberlands are separated by cleared and pasture lands in settled communities or are in large, compact bodies in isolated regions.

### WOODLOT CONDITIONS.

The danger of disastrous fires in the woodlot section of New Hampshire is not a serious one. No very extensive tracts of woodland are found, which are not intersected by numerous roads. Fires start for the most part along railroads due to sparks from the locomotives, or in dry slash and undergrowth set carelessly by boys or irresponsible hunters and fishermen. A few fires occur in the majority of towns each spring, but most people are thoroughly alive to the damage that fires cause and are prompt to extinguish them. As very little clearing of land is done nowadays, this serious cause of fires may be disregarded.

Railroads, which are responsible for most of the fires, are prompt to settle with the owner of any property destroyed. One man is known to have been compensated for three fires in three years on the same piece of land.

Towns having organized fire departments respond to brush fires the same as to other fires, and a fire seldom does serious damage before it is extinguished. Many towns and all cities have a special brush fire alarm. Some places have a still alarm for brush fires, to which only a few men respond unless more are needed.

Even towns without organized fire departments are generally prompt in fighting fires. The telephone has proved a very effective means of precaution, because, when a fire is discovered, only a short time is required to get people together, who will often work without expense to the town.

Neighbors always assist each other in the protection of their woodlands.

Towns usually pay about twenty-five cents per hour where help is hired. The fire warden of a town submits a bill to the town for each fire and is reimbursed by the town. Incorporated cities pay regular salaries to their fire-fighting force, except for the extra help which may be required.

Some towns complain of difficulty in getting any compensation for services rendered in adjoining towns. A brush fire in one town may be much nearer a fire department in another town than that of its own town. Usually town lines form no barrier to the fire-fighting force, but a number of instances were noted where towns have refused or neglected to compensate assisting towns. This attitude is causing considerable bad feeling between towns. One town having been unpaid for services rendered in another town, later refused assistance when a large hotel was burning.

One case was reported where fires were set in order to furnish work during the dull season. The selectmen finally became suspicious and threatened several with arrest if any more fires occurred. This had the desired result.

In many towns the efficiency of the present fire system dates from the passage of the law appointing fire wardens in the towns (1905). The present system, however, is not well organized in every town, and some towns have no wardens as yet, but there is a wholesome desire everywhere to protect forest property from fire. General discussions and correspondence with townspeople on the fire question, the posting of notices and educational measures are most desirable to bring the people to a thorough understanding of the serious damage from forest fires.

#### WILDLAND CONDITIONS.

In 1903 over 84,000 acres of New Hampshire forest lands were burned over. Since that time, however, extensive fires in the north country have been rare. Several thousand acres around Milan were burned over two years ago. Every effort



was made to check this fire, the lumber companies furnishing the men and the town of Milan paying for their food and supplies.

The most disastrous fire recently in the north country burned over 5,000 acres of cut-over land in Franconia in the fall of 1907. The fire was thought to be caused by lightning, and considerable headway was gained before any systematic fire fighting was begun. For a time the property of the Profile and Flume Houses was threatened, but the fire was unable to make any great headway in green timber and was checked.

In towns where there is an organized fire department the chiefs always respond to brush-fire calls, but the same interest is not shown as for fires within village limits. A few men are usually sent to the fires unless it is a severe one, when a larger number of men are collected. Practically no patrol work is ever done during dry seasons by town fire departments. Many towns are so large that it is very difficult to get a party of men to the scene of the fire in any reasonably short time.

Where there are no organized fire departments, there is little or no system in handling forest fires. Selectmen are slow to respond, and many of them do not appear to know which of them are the appointed wardens. It is often easier to collect a party spontaneously from among the village people and adjoining owners without regard to the call of an authorized warden. Most small fires are put out in this manner.

Hotel companies make every effort to protect the timberlands surrounding their property and often spend large sums of money without assistance from the towns.

Most fires are caused by railroads and fishermen. The railroads are earnest in their desire to prevent fires, and some lines over steep grades in wooded country send out section-men and trackmen to extinguish any fires that may have started after heavy trains have passed.

Careless fishermen are best reached by fire notices, which

should be freely distributed, particularly in the north country.

There is a general interest shown in the fire problem and a general belief that the state should bear part of the expense of patrol and fire fighting.

In unorganized towns private owners have failed to take advantage of the law of 1905, providing for the appointment of special fire wardens at the expense of the owners and counties jointly. In these unorganized townships fires are exceedingly rare. Large lumber companies own practically all of the timber, and they instruct their woodsmen and river drivers to be on the lookout for fires. In the dry season employees of the companies are detailed as fire guards, and arrangements are made so that walking bosses and others can use any crews when an alarm of fire is given.

For the most part the work of fire patrol by lumber companies is not systematic, and it is not carried on in all the unorganized towns, but nevertheless considerable attention is given to protection from fires. The owners prefer to carry on this work at their own expense and as they see fit, rather than bother about getting aid from the state and county.

In general, there should be more systematic fire service, and it is only just to timberland owners that as their assessments are increased from year to year, there should be better service and more assistance from the state, county, and town toward the protection of their woodlands from fire. Among other things, wardens should give more time to patrol during dry seasons and not wait for fires to get under headway.

### RECOMMENDATIONS.

The fire laws of the state, in so far as they impose fines and penalties for malicious and careless destruction of forest property by individuals and railroads, are adequate for the present.

The Laws of 1905, establishing a fire-warden system, fixing the duties of wardens, and providing for the general protection of forests from fires, are a most decided step in the

right direction. The chief defect in this present system is the difficulty in carrying out the provisions of the law. That these difficulties are fundamental has been pointed out repeatedly and the present recommendations can only be along the lines of those already made in previous reports to the State Forestry Commission.

(1) The warden system should have at its head one whose duty it is to have general supervision of all the forest fire wardens in the state. Such authority should be in the hands of a state forest fire warden, who should also be the state forester. His whole energy should be devoted to the work of protecting the forests of the state from fires and promoting the forest interests within the state.

No official or state commission composed of men engaged in private business will give sufficient time to the work of the state. Therefore, any system which has for its head an unpaid or poorly paid commission, however earnest its members may be in their desire to serve the state, must fail to be effective.

A commission, if it exists at all, should be simply advisory to the official who is responsible for the actual work.

(2) Perhaps the most serious defect in the present fire warden system is that the state does not share with the towns the burden of expense in forest protection. Great efficiency in system can not be expected where the state compels the appointment of fire wardens, specifies their duties, and then does not aid in the payment of the town's expenses.

The value of growing timber throughout the state is as great to the state at large as it is to the towns within which it is located. The state receives its constantly increasing tax in part from the value of the timberlands, and in justice the state should bear its proportion of the expense of fire protection.

In order to bring about the best results it is desirable that the towns should pay the entire cost of fighting fires and of patrol during the dry season, and then be reimbursed for half the amount by the state.



(3) In towns having organized fire departments the chief engineer should be appointed forest fire warden, as provided for under the present law.

In towns where there are no organized fire departments the appointment of wardens should not necessarily be from among the selectmen of the respective towns, as provided in the law. The fire warden of the town should be one particularly fitted for the position and interested in the work. Selectmen are not always qualified or interested, and sometimes much more desirable men are kept from the positions by the present limitations of the law.

The fire wardens and assistants employed by them should receive definite compensation by the hour or day for time actually spent in the performance of their duty. Payment for services rendered should be prompt. Failure to pay men promptly is a discouragement, leads to inefficient work, and prevents systematic results.

(4) The system of fire patrol should be improved. Greater safety from forest fires lies in preventing fires than in extinguishing them after headway has been gained.

In organized towns there is little attempt to patrol timberlands, because towns are not willing to stand the expense, and because the wardens are not thoroughly alive to the necessity. Educational work by the state fire warden would greatly improve the present existing conditions.

For the unorganized towns there should be a more effective system of patrol. Co-operation between the big timberland owners and the state should be encouraged. Wardens should be appointed in each unorganized township. They should be residents of the townships, and they should be selected for their ability and integrity. They should give their whole time during dry seasons to patrol duty, and they should be authorized to employ assistants when needed. The state should share equally with the owners the expense of patrol and fighting fires. Since only in unorganized townships the law provides for the county sharing the expense of patrol and fire fighting equally with the private owner, and since all the

unorganized townships are in one county, it is unjust for the county to pay half the expense. The failure of the present system of patrol for unorganized towns is due largely to the fact that there is no satisfactory medium for co-operation between the timberland owners and the state.

(5) The distribution of fire notices should be more general throughout the state. Their value cannot be overestimated. Many thousands of dollars' worth of forest property has undoubtedly been saved by such notices already posted. These notices should be in every postoffice, railway station, schoolhouse, and town hall, and in conspicuous places along streams, highways, and throughout the forested regions of the state.

The subject of systematic fire protection has passed the experimental stage. Although expensive, the needs become more and more urgent each year. Time is required for any system to become thoroughly efficient, but an examination of the work already accomplished for the woodlots of Connecticut and for the wild lands of Maine must convince anyone of the advisability of improving the fire laws of New Hampshire in order to make them more effective.

# FOREST MEASUREMENTS

BY

C. A. LYFORD



## FOREST MEASUREMENTS.

---

Forest management is largely dependent on a knowledge of yield. By yield is meant the amount of wood which now is, or may be expected in the future, on a given area. The measurement of yield falls into two parts:

1. The determination of the volume and value of single trees and stands by means of mill tallies and volume studies.
2. The prediction of the yield from entire stands by means of yield tables based on sample plots.

To illustrate the practical use of the tables a third part has been added:

3. The determination of the proper time for cutting white pine stands.

*Mill Tallies.*—There is a great variation in the quality of wood that may be cut from even the same tree. In the lumber market these various qualities are separated into a number of corresponding “grades,” more or less uniform throughout the country. Except in special cases it does not concern the lumber manufacturer to what use a board will be put; if it answers a certain description it is placed in a certain grade, whether ultimately used for furniture, interior finish, or panelling.

This common system of grading lumber is not followed in southern New Hampshire. A very crude method is here in use, and almost every mill has its own special grades; some of these grades are recognized by most mills. There are several reasons why the various lumber association rules are not in use here. The bulk of the lumber, coming from comparatively young second-growth, is of inferior quality. In many cases the difference between the best and poorest boards is not enough to make two separate grades under the common rules of grading. In the second place, practically

all of the lumber cut is for local use in a few well-known industries, and the boards are separated at the mill according to the use to which they will be put. Hence, instead of calling boards No. 1 common, cull, or mill-cut, they are known as box-boards, furniture stuff, coffin and casket stock, etc. Two or more grades may be of the same value and yet have different names, as, for example, window sash planks and refrigerator stock. Again, many lumbering operations are so small that it would hardly be worth while to subdivide the product into several grades. The fact that a large proportion of the boards cut is not edged is still another reason why the common system of grading is not followed here, round-edged lumber rarely being recognized by those rules.

The four main factors which affect the quality of a board are its width, the proportion of sap to heartwood, its soundness, and the presence or absence of knots. In southern New Hampshire the second-growth timber was found to be quite sound. Sapwood is not considered a serious defect here. The width of the board and its clearness from knots are, therefore, the only factors which affect the value of lumber.

In general, the bigger the tree the better the lumber obtained from it. Hence, trees increase in value as they increase in size, not only because big trees have more lumber than small ones, but also because the lumber is of better grade. One tree may have only three times as much lumber as another, and yet have four or five times the value.

To determine as accurately as possible the rate of appreciation in value with increase in size, the graded yield and the money value of the more important commercial trees in southern New Hampshire were studied in several localities, under average conditions of manufacture. The results here given represent averages of a great many measurements, and can, therefore, be safely applied only to averages of entire stands. Their accuracy in application will also vary somewhat from mill to mill, according to the care exercised in logging and sawing the timber.

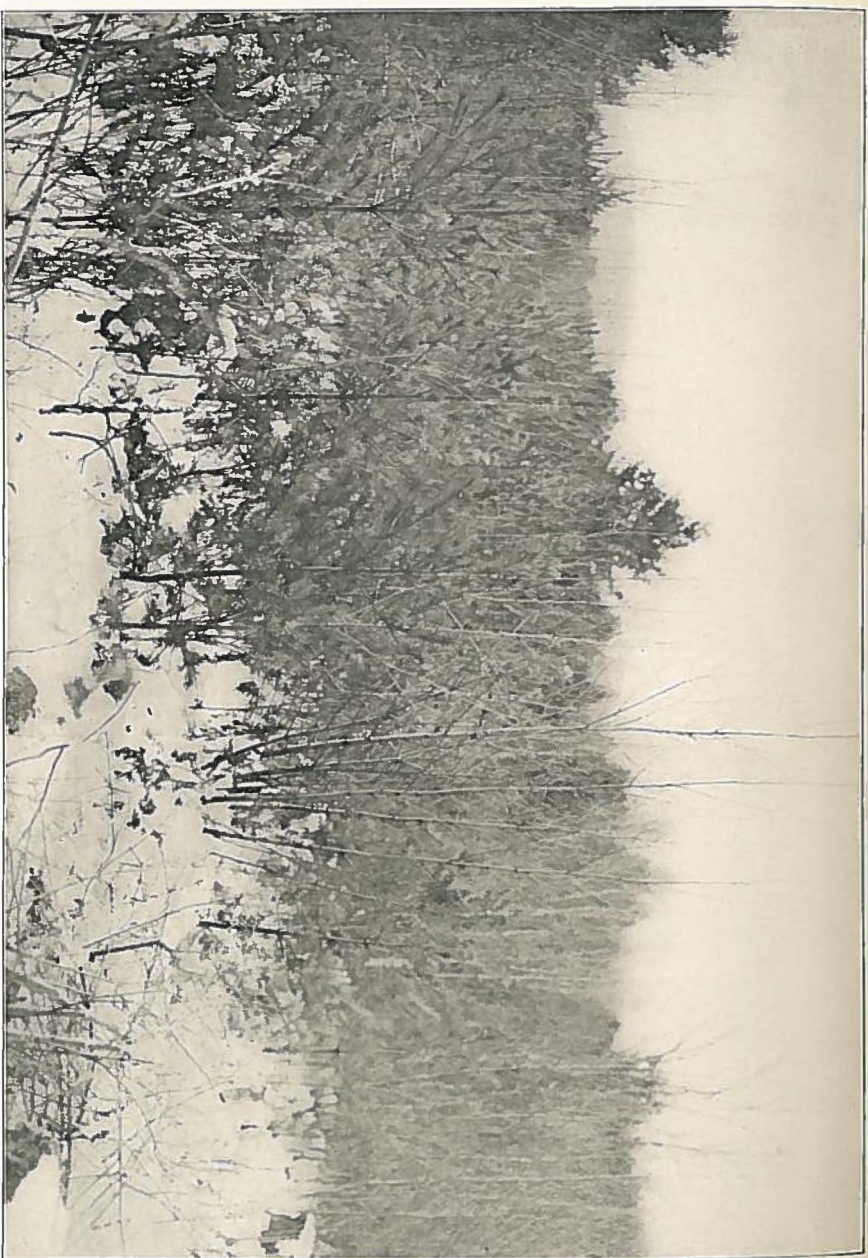


FIG. 26.—View taken from same spot as Fig. 25, seven years later. The grey birch has been removed and the land stocked with white pine, showing an average growth of six to eight feet. After the planting of the pine, which were five years old seedlings, it was necessary to cut back the grey birch sprouts three or four times on account of the danger of whipping and injuring the young pine.



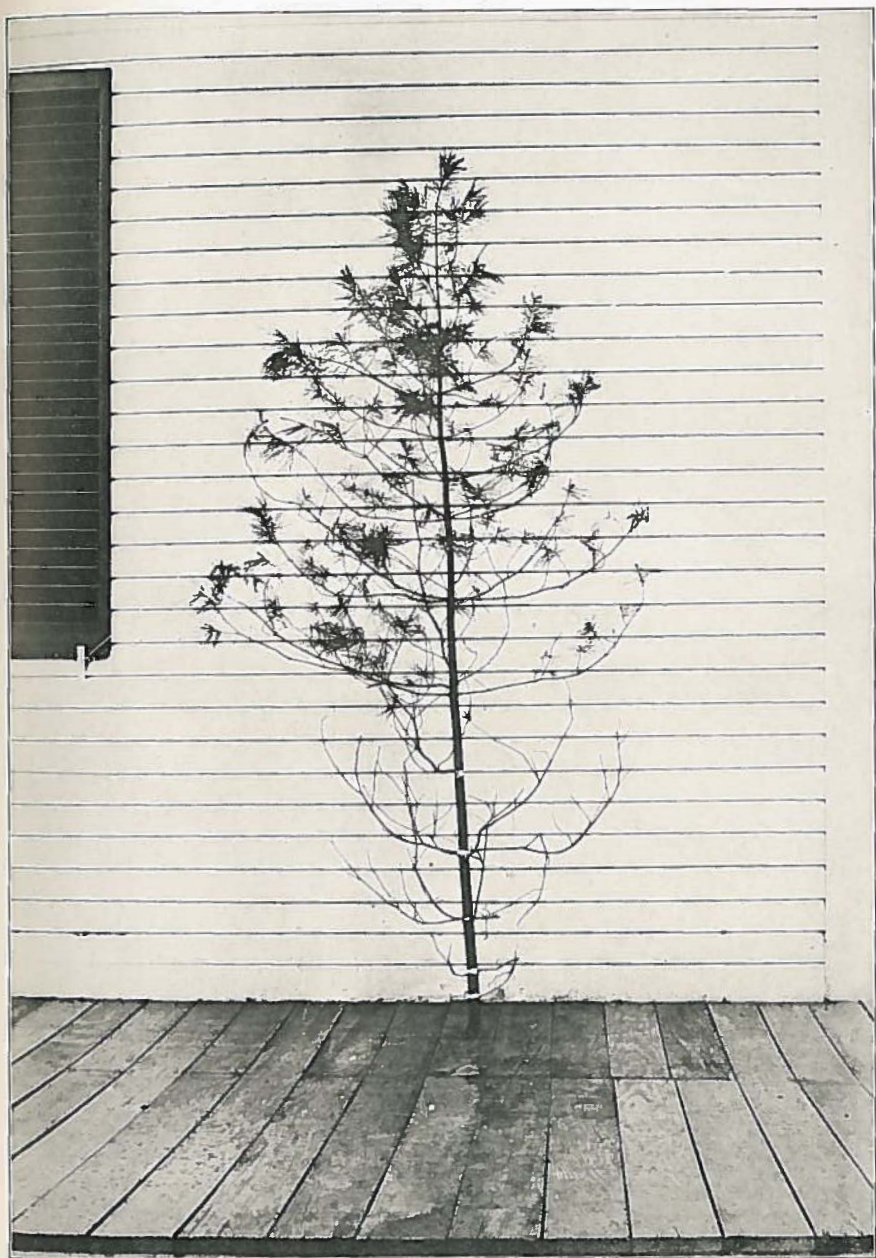


FIG. 27.— The way a pine should not grow. The tree is twenty-two years old, although less than nine feet high. To ascertain the age of a pine, count the whirls, and add two years for the seedling stage. The tree has long been suppressed and for want of light and nourishment will never make good timber.



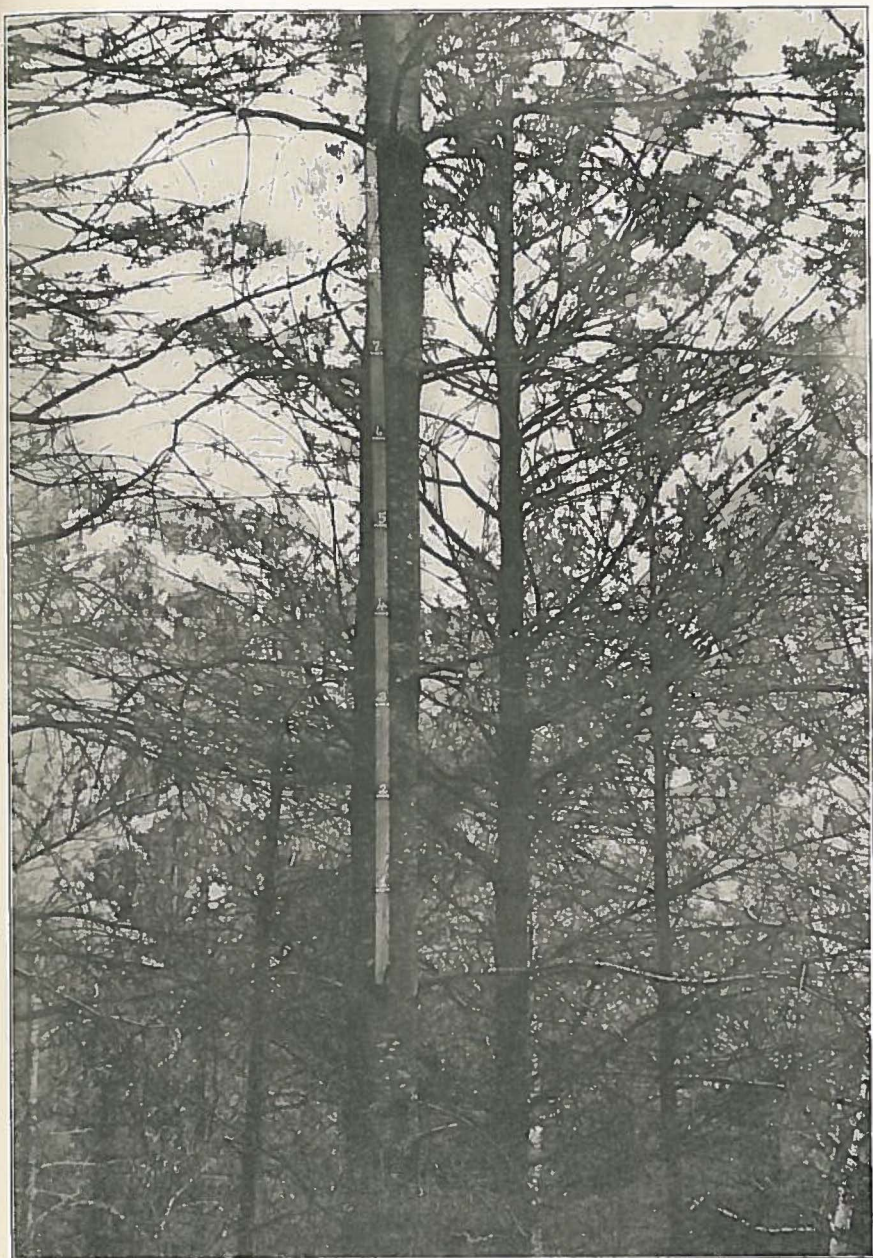


FIG. 28.—The way a pine should grow. This picture shows the pine under ideal conditions of light, air, and soil — conditions which are generally realizable only under forestry management. Note the measure on the tree, which is graduated into feet, showing an average growth of over three feet between the whirls, or over three feet per year. This tree grew more in three years than the one in Fig. 27 did in twenty-two years.

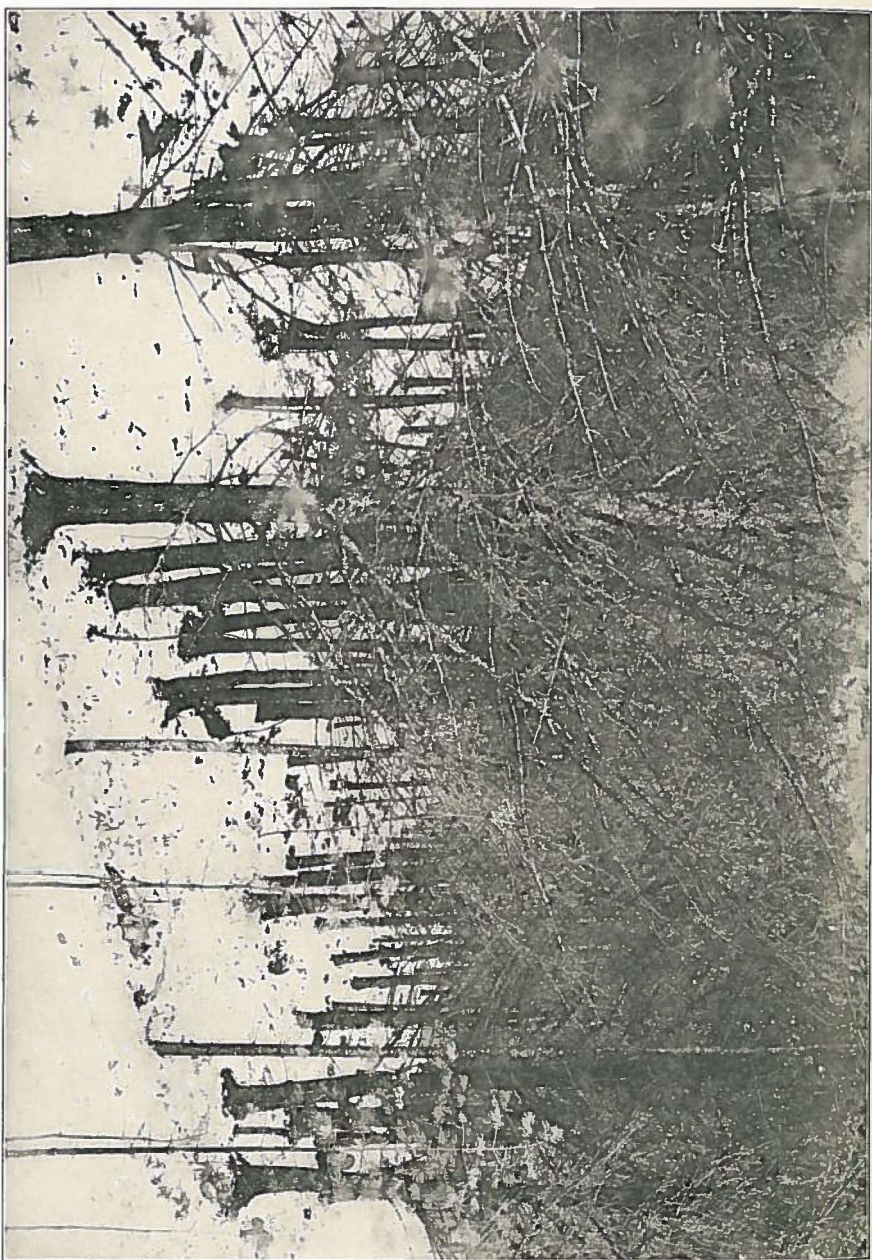


FIG. 29. — An thinned stand of pine fifty years old.



The method of carrying on these tallies was as follows: Each tree was measured as it was felled in the woods, the measurements were recorded, each log was marked with a number so that it might be identified at the mill, and the lumber sawed out from the identified logs was measured and inspected. The quantity and the grades of lumber from each log were recorded on a separate sheet, and by bringing together the sheets corresponding to the various logs of any given tree, the exact amount and quality of lumber obtained from that tree were ascertained.

Over 5,000 trees, or about 20,000 logs, were thus followed through in seven different mills situated in various parts of the state—one mill in the town of Warner, two mills in Sutton and one in Henniker in Merrimack County, two mills in Winchester, in Cheshire County, and one mill in Brookline, in Hillsborough County.

The manner of measuring lumber is uniform in all the mills studied. Theoretically, the scaler or "marker" is supposed to measure a board or plank at its average width, considering both the wide and the narrow faces of the board. In practice the board is always measured on its narrower face, at its average width. This method was followed in making the mill tallies. The boards from young timber, especially those coming from upper logs, are very irregular in shape; and, since most of the lumber is not edged or squared, it is very difficult in many cases to determine the average width of the board. The skill of the marker will influence the accuracy of measurement, though the error tends to rectify itself in the long run.

In considering the detailed discussion of the mill tallies and tables, the following points must be constantly borne in mind:

1. All lumber was measured "green." Lumber shrinks slightly in the process of seasoning or drying.
2. A large proportion of the lumber is cut "round-edged"; that is, the boards are not edged or squared. The volume tables cannot, therefore, be used in regions where all the lumber is squared.

3. Whenever the diameter of a tree is given the diameter outside the bark,  $4\frac{1}{2}$  feet above the ground, is meant, unless otherwise specified.

4. When the diameter of a log is given, the diameter *inside* the bark, at the smaller end of the log, is meant, unless otherwise specified.

5. The tables were constructed by the statistical method of plotting the data on cross-section paper, drawing curves, and reading the averages from these curves. For this reason some of the tables have certain values for which there was apparently no basis. These values were read directly from the curves.

6. In constructing the volume tables, no allowance was made for waste due to the carelessness of the sawyer, to unnecessarily heavy slabbing, or to miscut boards. In applying these figures for practical purposes, a slight reduction—never more than 5 per cent—should be made for these unavoidable losses.

7. It must be constantly remembered that the values given in these tables represent *averages* of many measurements, and cannot safely be used for single trees or logs.

*White Pine.*—About 2,500 pine trees, or more than 10,000 logs, were followed through six mills. Five of these mills were equipped with circular saws 48 inches in diameter and removing a kerf of about  $\frac{1}{4}$  of an inch. The one in Brookline was a portable band-mill, with a saw eight inches wide,  $34\frac{1}{2}$  feet long, and removing one inch of kerf with every eight cuts.

The system of grading the lumber was practically the same in all the five circular-saw mills. In general, the wide, clear stuff was cut into  $2\frac{1}{8}$ -inch, round-edged plank, for door and window sash stock. The small, knotty logs were cut into inch or  $2\frac{1}{8}$ -inch box-boards. Whenever possible, all logs squaring more than six or seven inches, but not clear enough for the best  $2\frac{1}{8}$ -inch grade, were cut into 1-inch square-edged box-boards, and two widths were recognized, commanding different prices; namely, boards less than ten inches wide, and boards ten inches or more in width.



*The Waterloo Mill.*—The trees cut at this mill came from a mixed pine and hardwood stand, which had come up on land lumbered fifty-five to sixty years ago. The trees in mixture, named in order of their abundance, were white pine, red oak, paper birch, hemlock, red pine, white ash, popple, white oak, and sugar maple. Over 50 per cent of all the trees were white pine, occurring, as a rule, in small, pure stands in the moister situations. The average age of the trees was about fifty years. Almost 70 per cent of the pines were seven to eleven inches in diameter, breast high, and from forty-five to sixty-five feet in height. There was very little waste in lumbering, low stumps and short tops being the rule. The stumps rarely exceeded eight inches in height, and the average length of top left in the woods was seventeen feet. The diameter of the small end of the last log, inside the bark, was five inches or less. Fifty-five per cent of all the pine lumber was cut into 1-inch stuff, while 45 per cent was 2½-inch plank. Seventy-five per cent was round-edged, and the remainder square-edged.

*The Henniker Mill.*—The trees cut at this mill, although slightly younger than those cut at Waterloo, and growing in a pure stand, were so nearly of the same size and general character as the trees described above, that the data collected at the two mills were thrown together and worked up as one stand.

*The South Sutton Mill.*—This was one of the best lots of second-growth white pine found anywhere in the state. It was a fairly even-aged, practically pure stand, about seventy-five years old. By actual survey and measurement it was found to run 99,137 board feet per acre in the best part of the stand, of which 97,024 feet were white pine. The average stand on an area of about four acres was 75,000 board feet per acre.

The pine was mixed with a very small per cent of hemlock, white oak, red maple, and several scattered trees of other species. The stand was situated at the foot of a moderately steep slope, on a rather shallow, sandy loam, abounding in

springs and water holes. The pine trees were tall, cylindrical, of good form, but not well cleaned, the dead limbs on many trees persisting almost to the ground. In the more open places the trees were forked, yielding large quantities of inferior box-boards. The trees varied from eight to twenty-five inches in diameter, and from 60 to 100 feet in height. The average height of stump cut was sixteen inches, the average length of the top left in the woods was about nineteen feet, and the average diameter at the small end of the last log was six inches inside the bark. Fifty-five per cent of all the pine cut was round-edged, while 45 per cent was squared; 76 per cent was cut into 1-inch boards, and the rest into  $2\frac{1}{2}$ -inch plank.

*The Brookline Mill.*—This woodlot consisted of several more or less even-aged stands of pine, mixed with varying proportions of chestnut, chestnut oak, popple, black oak, white oak, hemlock, paper birch, etc. The pine followed through the mill was about seventy years old, eight to twenty-two inches in diameter, and sixty to ninety feet tall. There was little waste in logging. The stumps were rarely more than ten inches high, while the tops left in the woods average about fifteen feet. The diameter at the small end of the log was between four and five inches inside the bark. The milling was done with a band saw, and the grades turned out were different from those made in the other mills described. The best logs were cut into  $1\frac{3}{4}$ -inch boards to be used in making refrigerators. Fairly clear lumber, not good enough for this best grade, was cut into  $1\frac{1}{2}$ -inch stuff, while the poorest logs went into  $1\frac{1}{4}$ -inch box-boards. Sidings obtained in squaring, and the square-edged boards obtained from the larger knotty logs, were put into 1-inch box-boards. Seventy-five per cent of all the lumber cut was round-edged, and the remainder squared; 39 per cent was one inch thick, and 61 per cent was thicker than one inch, 29 per cent being  $1\frac{3}{4}$  inches, 21 per cent  $1\frac{1}{4}$  inches, and 11 per cent  $1\frac{1}{2}$  inches thick.

In addition to the above, about 600 pine trees were fol-

lowed through two other mills, described in connection with the chestnut mill tallies.

Tables I, II, and III show the number of board feet cut at the mill, from different sized trees.\* It will be noticed by comparing these tables, that of two trees having the same diameter and height, the older one has the greater volume. This is due to the fact that a tree becomes more cylindrical with age.

TABLE I.—VOLUME TABLE FOR WHITE PINE.—WATERLOO AND HENNIKER, AGE 50 YEARS.

Diameter breasthigh.	Height—Feet.						Basis.
	30	40	50	60	70	80	
Inches.	Volume—Board feet.						Trees.
5	9	13	15	.....	.....	.....	18
6	12	18	23	27	.....	.....	66
7	17	26	33	38	.....	.....	98
8	24	38	44	51	.....	.....	130
9	32	46	58	69	80	92	146
10	41	56	70	85	100	116	135
11	.....	65	84	105	124	143	104
12	.....	72	99	126	150	170	74
13	.....	83	116	148	176	198	64
14	.....	.....	130	170	204	228	26
15	.....	.....	144	196	233	258	14
16	.....	.....	.....	221	264	291	21
17	.....	.....	.....	247	293	324	2
18	.....	.....	.....	.....	324	360	1
19	.....	.....	.....	.....	354	397	3
							Total ....902

\* The left-hand vertical column in each table shows the diameter of the tree at breast height (4½ feet above the ground). The uppermost horizontal line shows the total height of the tree from the ground to the top of the crown. To find the volume of a tree of any given diameter and height, as for example, 12 inches in diameter and 60 feet in height, in table I, look in the left-hand column for the diameter (12), and under the height (60), find the volume of the tree (126 board feet).



TABLE 11.—VOLUME TABLE FOR WHITE PINE.—SOUTH  
SUTTON, AGE 75 YEARS.

Diameter breasthigh.	Height—Feet.									Basis.
	40	50	60	70	80	90	100	110	120	
Inches.	Volume—Board feet.									Trees.
7	25	40	.....	.....	.....	.....	.....	.....	2	
8	35	50	65	80	.....	.....	.....	.....	18	
9	45	65	80	95	.....	.....	.....	.....	19	
10	55	75	95	115	130	150	170	.....	23	
11	70	90	115	140	160	185	205	.....	25	
12	85	105	135	165	190	220	245	.....	40	
13	95	125	155	190	225	255	285	.....	29	
14	.....	140	180	225	260	300	330	370	37	
15	.....	165	210	260	300	345	385	425	28	
16	.....	190	240	295	345	405	435	485	39	
17	.....	215	275	335	390	445	495	550	41	
18	.....	245	310	375	440	495	555	620	41	
19	.....	275	350	420	490	555	620	690	32	
20	.....	.....	395	465	540	615	685	760	31	
21	.....	.....	435	515	595	675	755	835	20	
22	.....	.....	.....	560	645	735	820	905	17	
23	.....	.....	.....	.....	700	795	885	980	12	
24	.....	.....	.....	.....	755	860	950	1,055	11	
25	.....	.....	.....	.....	805	925	1,020	1,130	7	
26	.....	.....	.....	.....	.....	985	1,090	1,200	5	
Total...477										

TABLE III.—VOLUME TABLE FOR WHITE PINE.—BAND-SAW.—  
BROOKLINE, AGE 70 YEARS.

Diameter breasthigh.	Height—Feet.						Basis.
	50	60	70	80	90	100	
Inches.	Volume—Board feet.						Trees.
7	40	50	60	.....	.....	.....	3
8	50	65	80	.....	.....	.....	10
9	65	80	100	120	.....	.....	16
10	80	100	120	150	180	.....	32
11	100	120	145	180	210	.....	32
12	120	145	170	210	245	.....	43
13	135	170	200	240	280	.....	32
14	.....	195	230	275	320	.....	33
15	.....	225	265	310	360	.....	36
16	.....	260	300	350	405	.....	33
17	.....	295	340	390	450	.....	31
18	.....	330	380	430	500	600	26
19	.....	365	420	475	550	650	28
20	.....	405	465	525	600	700	18
21	.....	.....	510	580	660	760	12
22	.....	.....	555	635	725	825	10
23	.....	.....	600	695	795	895	7
24	.....	.....	550	760	865	970	5
25	.....	.....	.....	830	940	1,050	2
26	.....	.....	.....	900	1,020	1,135	1
27	.....	.....	.....	975	1,100	1,225	.....
28	.....	.....	.....	.....	.....	1,320	1
							Total.... 411

Table IV shows the number of board feet that was obtained per cubic foot of the used volume of the trees.

TABLE IV.—RELATION BETWEEN VOLUME OF USED LENGTH, WITH BARK, IN CUBIC FEET AND ACTUAL MILL CUT, IN BOARD FEET.—WHITE PINE.

Diameter breasthigh.	Circular saw.		Band saw.
	Henniker and Waterloo, age 50 years.	South Sutton, age 75 years.	Brookline, age 70 years.
Inches.	Number of board feet per cubic foot		
5	4.7	5.5	.....
6	5.0	5.7	6.2
7	5.3	5.8	6.4
8	5.6	5.9	6.5
9	5.9	6.1	6.6
10	6.1	6.2	6.8
11	6.3	6.3	6.9
12	6.5	6.5	7.0
13	6.7	6.6	7.1
14	6.8	6.7	7.3
15	6.9	6.8	7.4
16	7.0	6.9	7.5
17	7.1	7.0	7.6
18	7.2	7.0	7.7
19	7.3	7.1	7.8
20	.....	7.1	7.8
21	.....	7.2	7.9
22	.....	7.2	8.0
23	.....	7.2	8.1
24	.....	7.3	8.1
25	.....	7.3	8.2
26	.....	7.3	8.3
27	.....	7.3	8.3
28	.....	7.3	.....
29	.....	7.3	.....
30	.....	7.4	.....
31	.....	7.4	.....
Average.....	6.3	7.0	7.4
Basis, trees.....	900	475	411

In general there is relatively less waste in sawing a large log than in sawing a smaller one. Furthermore, an older tree gives more board feet per cubic foot than a younger tree of the same diameter and height, because, as remarked above, the younger tree is less cylindrical; thus, while there were sawed out on an average 6.3 board feet per cubic foot in the 50-year-old pine, a cubic foot of timber in the 75-year-old



stand yielded 7.0 board feet. The 70-year-old stand, falling in age between the other two stands, if cut with a circular saw, should have yielded only about 6.8 board feet per cubic foot. Cut with a band saw it actually gave 7.4 board feet, indicating a gain of .6 of a board foot for every cubic foot. This represents a saving of almost 9 per cent, by using a band instead of a circular saw.

It is assumed here that the saving of 9 per cent was due mainly to the narrower kerf of the band saw; for, although the great bulk of lumber cut was round-edged, and therefore gave a higher yield than if squared, this was neutralized by the fact that the average thickness of boards cut here was less than at the other mills.

A careful study of the data showed that although lumber improves in quality with growth in diameter, it is not much affected by the height of the tree. Two trees of the same diameter but of different heights will bring the same value per thousand board feet of lumber, though the taller tree, having the greater volume, will also have a greater total value. In making the graded volume table, therefore, height was disregarded, and the trees were arranged in diameter classes only.

Table V shows the percentage of the different grades that may be cut from trees of different diameters.

TABLE V.—PERCENTAGE OF GRADES SAWED FROM SECOND-GROWTH WHITE PINE.

Diameter breast- high.	Round-edged.			Square-edged.		Basis.
	1 inch box boards.	2½ inches box boards	2½ inches clear plank.	Less than 10 inches wide.	10 inches wide or more.	
<i>Inches.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Trees.</i>
5	26	74	.....	.....	.....	18
6	27	68	5	.....	.....	66
7	21	67	6	6	.....	104
8	41	39	10	10	.....	149
9	42	24	16	18	.....	168
10	38	18	18	20	.....	159
11	36	14	28	27	.....	129
12	37	9	20	34	.....	115
13	83	7	24	34	2	94
14	34	4	26	34	2	64
15	81	3	24	32	10	48
16	27	4	33	25	11	60
17	27	1	81	23	18	45
18	28	.....	27	17	28	42
19	28	1	23	17	31	86
20	22	.....	83	15	80	81
21	26	.....	11	16	45	21
22	24	.....	20	13	43	18
23	24	.....	29	8	89	14
24	81	.....	17	10	42	8
25	22	.....	82	6	40	11
26	28	.....	25	13	34	6
						1,401

It will be noticed from this table that although no general law can be laid down as to the increase or decrease of any particular grade, yet as the trees grow in diameter there is a more or less steady decrease in the per cent of the poorer grades—the box boards—and a rather uniform increase in the proportion of better grades, especially the clear plank and the wide square-edged boards. Tables VI and VII show more satisfactorily how the improvement in the quality of the lumber with the growth of the tree takes place. In making these tables the following values per 1,000 board feet based on lumber f. o. b. Warner, N. H., were used:

1-inch box boards, round-edged,	\$12.00
2½-inch box boards, round-edged,	13.00
2½-inch clear plank, round-edged,	25.00
1-inch square-edged boards, less than 10 inches wide,	20.00
1-inch square-edged boards, 10 inches wide or more,	22.00

TABLE VI.—VALUE (F. O. B.) OF SECOND-GROWTH WHITE PINE.

Diameter breasthigh.	Value of lumber per thousand board feet.	Diameter breasthigh.	Value of lumber per thousand board feet.
<i>Inches.</i>		<i>Inches.</i>	
5	\$12.00	16	\$18.33
6	12.50	17	18.58
7	13.11	18	18.70
8	13.87	19	18.85
9	14.81	20	18.98
10	15.72	21	19.09
11	16.40	22	19.18
12	16.95	23	19.26
13	17.40	24	19.33
14	17.78	25	19.40
15	18.08	26	19.46

Starting with a 5-inch tree in table VI, where the lumber is fit only for 1-inch box boards, the value is \$12 per thousand board feet. From this point there is a comparatively rapid increase in value, as the better grades enter and increase in proportion, until the 13 or 14-inch diameter is reached, where, although the value per thousand feet is still increasing, the rate of increase falls off, because all the grades have now entered. The increase in value now depends only on the increase in the proportion of the good grades and a corresponding reduction in the proportion of the poorer grades. At 26 inches the value of the lumber is \$19.46 per thousand board feet.



TABLE VII.—RELATION BETWEEN INCREASE IN VOLUME AND INCREASE IN VALUE.—WHITE PINE.

Diameter breasthigh.	Volume of aver- age tree.	Value of aver- age tree.	Increase in di- ameter breast- high.	Increase in to- tal volume of tree.	Increase in to- tal value of tree.	Basis.
<i>Inches.</i>	<i>Board ft.</i>		<i>Inches.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Trees.</i>
5	12	\$ 0.14	From 5 to 6	66.7	78.5	18
6	20	.25	6 7	55.0	64.0	66
7	31	.41	7 8	45.1	53.6	104
8	45	.63	8 9	37.8	47.6	149
9	62	.93	9 10	33.9	41.9	168
10	83	1.83	10 11	32.5	37.1	159
11	110	1.81	11 12	30.0	33.7	129
12	143	2.42	12 13	28.0	31.0	115
13	183	3.18	13 14	26.8	29.6	94
14	232	4.12	14 15	23.3	25.5	64
15	286	5.17	15 16	20.6	22.2	43
16	346	6.32	16 17	18.6	19.9	60
17	409	7.58	17 18	16.9	17.9	45
18	478	8.94	18 19	14.9	15.8	42
19	549	10.35	19 20	13.3	13.9	36
20	622	11.79	20 21	12.1	12.9	31
21	697	13.31	21 22	10.9	11.4	21
22	773	14.83	22 23	9.4	9.8	18
23	846	16.29	23 24	8.3	8.7	14
24	916	17.71	24 25	7.3	7.7	8
25	983	19.07	25 26	6.8	7.1	11
26	1,050	20.43				6
						1,401

Table VII shows the relation between the increase in the total volume of the tree and the increase in its total value, expressed in percentages. This emphasizes the tendency shown by the former table. Up to 13 inches in diameter the rate of increase in value is comparatively much higher than the rate of increase in volume, but for the higher diameters, the difference between the two rates is so small as to be negligible.

It will be shown farther on when the subject of rotation is considered, that under the present system of grading, and with present prices, the increase in value per thousand feet of lumber with the increase in the diameter of the tree is enough to prolong the most profitable rotation for white pine, by ten years. Should a more careful system of grading white pine lumber be introduced into southern New England, the rotation will be still further lengthened.

*Chestnut.*—The bulk of the chestnut timber in the state, being of small size, is cut into railroad ties and fence posts. The larger logs are sawed either into switch ties, or into plank, used for furniture and coffin stock.

Practically all the ties are sold to the Boston & Maine Railroad, the only railroad in this part of the state. The sawed ties are piled along the railroad track, and, the purchasing agent being notified, an inspector is sent to inspect and grade the ties. The printed specifications of the company recognize two classes of ties:

All ties to be sound and free from shakes and rotten knots. To be 8 feet long, flattened on two sides, and to have 6 inches and over of face, and to be 6 inches in thickness. Ties to be sawed square ends. No. 2 ties will be taken on the basis of 10 per cent of the total number of No. 1 ties accepted, and must be not less than 5 inches face.

In practice these rules are seldom followed. The rigidity with which they are enforced depends on the demand for ties, on the number of ties delivered, and on the disposition of the inspector. Some inspectors are more lenient than others. In general, a big batch of ties is more favorably graded than a smaller lot.

After a careful consideration of the question, the following system of grading ties was used in making the mill scale tallies:

All sound ties, free from large rotten knots, measuring at least 5 inches face, were classed as No. 1.

Sound ties with less than 5 inches, but at least 4 inches face, were classed as No. 2.

Ties less than 4 inches face, and unsound ties, were classed as culls, and tallied as fence posts.

Switch ties were formerly accepted only when delivered in sets as follows:

7 ties 9 feet long	6 ties 13 feet long
11 ties 10 feet long	5 ties 14 feet long
9 ties 11 feet long	2 ties 15 feet long
7 ties 12 feet long	1 tie 16 feet long

At present the railroad company accepts switch ties not in sets, but they must be 9 to 16 feet long, 7 inches thick, with at least 7 inches face.

Switch ties are bought by the thousand feet, board measure, the contents being determined by multiplying the length of the tie in feet by the face and the thickness in inches, and dividing the product by twelve. Ordinary cross-ties are bought by the piece.

About 1,200 chestnut trees, or some 6,000 logs, were followed through two mills. The two stands were three to four miles apart, of the same general character, growing in similar situations, and on practically the same exposure. The chestnut was mixed with a small proportion of hemlock, red oak, paper birch, popple, ash, and other hardwoods. White pine occurred scattered singly or in small groups throughout both areas. Over 95 per cent of the chestnut on both tracts were sprouts.

The chestnut on the Pisgah tract was 59 years, 7 years older than that on the Ashuelot tract, and was therefore somewhat larger and of better quality. In the older stand 97 per cent of all the trees ran from 9 to 18 inches in diameter breasthigh, and from 70 to 85 feet in height. Individual trees over 100 feet in height were not rare. The diameter of the last log averaged from 5.5 to 6.7 inches inside the bark. The length of the used portion of the tree varied from 25 to 57 feet.

In the younger stand, 52 years old, 96 per cent of all the trees were from 8 to 15 inches in diameter. The average length of the used part of the tree varied from 25 to 47 feet. The diameter at the top of the last log averaged 5 to 7 inches inside the bark.

The larger chestnut logs of the Pisgah tract were cut into 1½-inch round-edged plank, while similar logs on the Ashuelot lot were cut into switch ties. A certain quantity of plank was obtained at the latter mill from sidings of logs cut into ties.

One of the questions for this study to decide was whether



it pays better to put the larger logs into switch ties than cutting them into plank.

Table VIII was constructed to show the money value of chestnut trees of different sizes, assuming the following prices, based on lumber f. o. b. Winchester, and ties delivered at the track:

1½-inch plank (\$28 per thousand feet surface measure), \$18.67 per thousand board feet.

Switch ties, \$16.00 per thousand board feet.

No. 1 ties, 48 cents apiece.

No. 2 ties, 25 cents apiece.

Posts (including cull ties), 15 cents apiece.

TABLE VIII.—VOLUME AND VALUE OF CHESTNUT.

Diameter breasthigh.	Ashuelot—Trees cut into posts, ties, and switch ties.				Pisgah—Trees cut into posts, Ties and plank.			
	Volume of used portion of tree including bark.	Value of tree.	Value per cubic foot.	Basis.	Volume of used portion of tree including bark.	Value of tree.	Value per cubic foot.	Basis.
<i>Inches.</i>	<i>Cu. ft.</i>		<i>Cents.</i>	<i>Trees.</i>	<i>Cu. ft.</i>		<i>Cents.</i>	<i>Trees.</i>
7	5.0	\$0.41	8.2	7	.....			.....
8	6.9	.63	9.1	37	9.6	\$0.72	7.5	3
9	9.3	.91	9.8	100	12.3	1.03	8.4	15
10	12.2	1.25	10.2	109	15.4	1.42	9.2	52
11	15.6	1.63	10.4	95	19.0	1.90	10.0	87
12	19.5	2.06	10.6	61	23.2	2.42	10.4	104
13	23.7	2.53	10.7	43	27.6	3.01	10.9	117
14	28.2	3.04	10.8	27	32.4	3.64	11.2	108
15	33.0	3.61	10.9	13	37.4	4.30	11.5	74
16	38.0	4.23	11.1	12	42.9	4.98	11.6	52
17	43.0	4.87	11.3	7	48.7	5.68	11.7	31
18	47.8	5.53	11.5	4	54.7	6.39	11.7	23
19	52.9	6.15	11.0	2	60.0	7.11	11.7	11
20	57.4	6.74	11.7	.....	66.8	7.85	11.8	5
21	.....	.....	.....	.....	72.9	8.57	11.8	1
				517				678

To compare the relative values of two trees it is necessary to know their volumes. Since it is difficult and impracticable to determine the volume in board feet of trees cut into ties and posts, the volume of the used portions of the tree, expressed in cubic feet, was taken as a basis for comparison,

and the value per cubic foot of trees of different sizes was determined. Table VIII shows the volume of the used portion of the tree in cubic feet, the total value of the tree, and the value per cubic foot, of the chestnut from each tract.

It will be seen from this table that for the smaller sizes the Ashuelot chestnut has a greater value per cubic foot than the Pisgah lumber. This is because the trees cut at the former place were not so closely utilized as at the Pisgah mill. In other words, the Ashuelot mill left longer tops in the woods, using only the better portion of the tree. This, of course, had the tendency to raise the value per unit of volume, but to lower the total value of the tree. In the higher diameters the better quality of the Pisgah lumber was enough to overcome this difference, and we find that above twelve inches in diameter not only the total value of the Ashuelot trees, but also the value per cubic foot is lower. The difference in value between switch-tie lumber and round-edged plank was another factor which influenced the relative values of the trees. This is clearly shown in table IX, which compares the values of logs cut into switch ties and sidings, and the same sized logs cut into plank.

TABLE IX.—RELATIVE VALUES OF LOGS CUT INTO SWITCH TIES AND INTO PLANK.—CHESTNUT.

Diameter outside bark at middle of log.	Contents of log cut into switch ties and sidings.		Value of log cut into switch ties and sidings.	Contents of logs cut into plank.	Value of log cut into plank.
	Switch ties.	Sidings.			
<i>Inches.</i>	<i>Bd. ft.</i>	<i>Bd. ft.</i>		<i>Bd. ft.</i>	
12	64	13	\$1.28	59	\$1.10
13	68	18	1.43	71	1.38
14	70	29	1.65	82	1.53
15	70	42	1.80	85	1.77
16	70	57	2.19	108	2.02
17	84	60	2.47	122	2.28
18	88	67	2.65	136	2.52
19	105	59	2.78	150	2.80

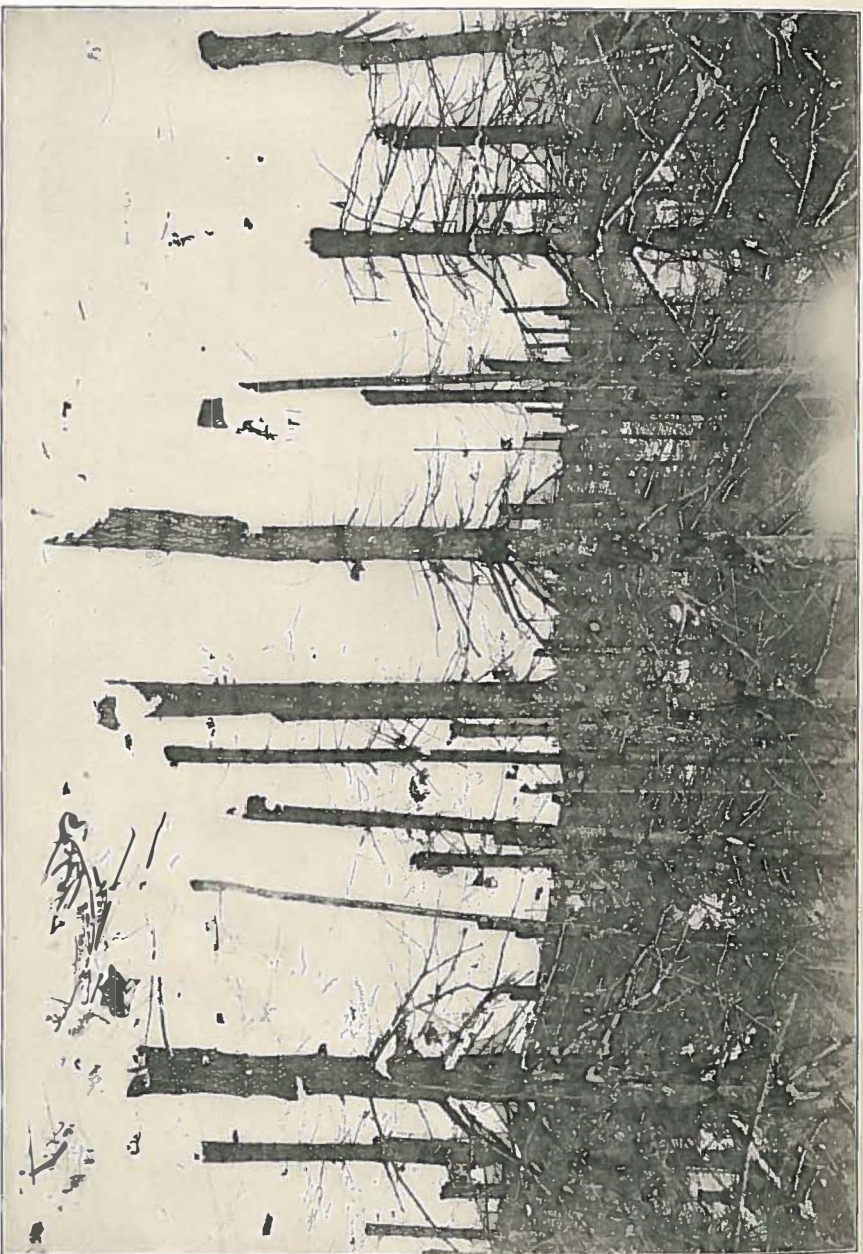


FIG. 30.—View from same position of same stand as Fig. 29, after thinning. Seventy-three hundred board feet per acre were removed in thinnings, or about 30% of total stand.





FIG. 31. Cross-section of an average tree from same stand as shown in Figs. 29 and 30. Note the excellent growth of the tree for the first thirty years, the marks indicating each a growth of ten years. At the end of the thirty years the tree put on very much less wood, due, doubtless, to competition with the other trees, and indicated by the very fine outside rings. The stand should have been thinned when thirty years old.

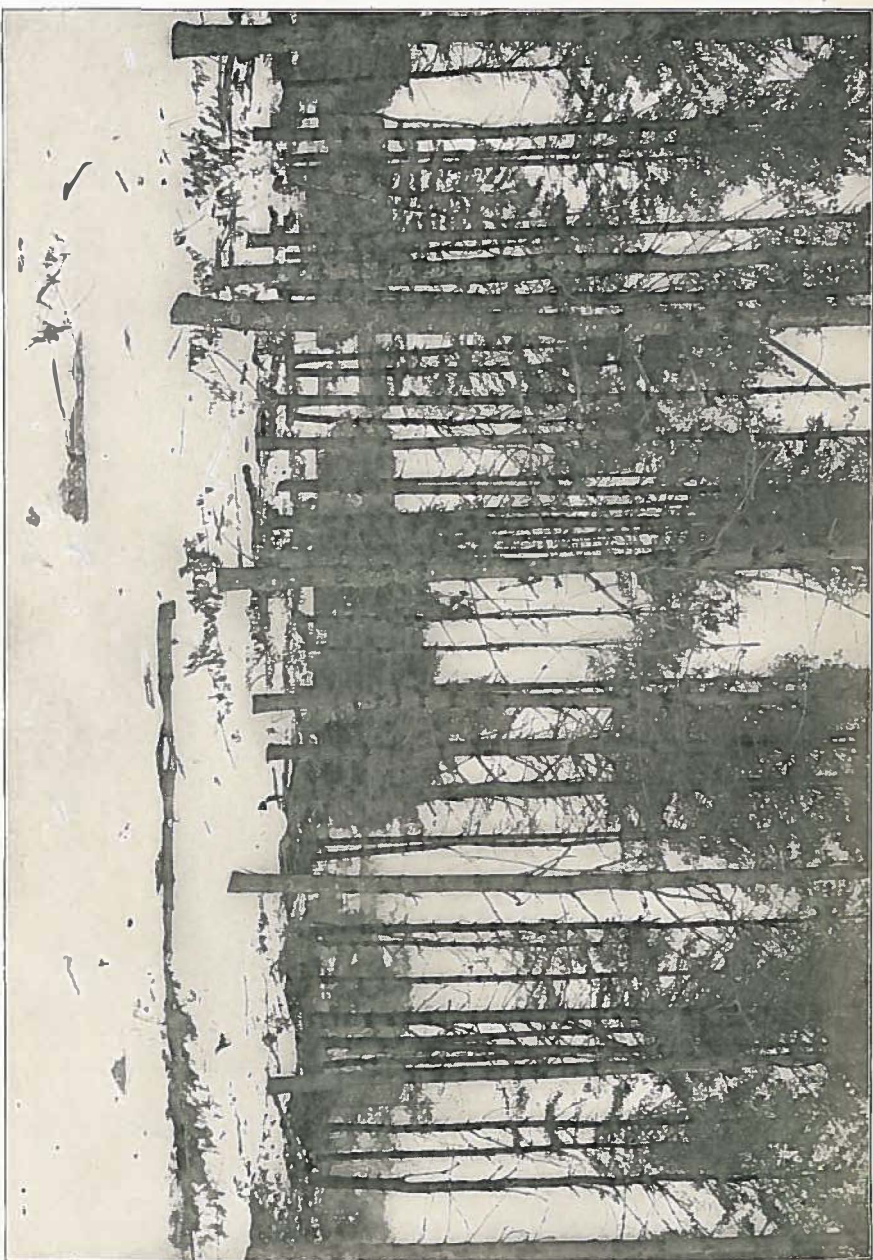


FIG. 32.—Another thinning of fifty years old pines, 9,000 feet per acre removed in thinnings.





FIG. 33.—Cross-section of a dominant and a suppressed tree from same stand as Fig. 32. The trees count exactly the same number of rings, but the dominant has twice the area of the suppressed tree. The marks on the sections indicate ten years' growth.



It will be seen from this table that there is some advantage in cutting logs less than nineteen inches in diameter outside the bark into switch ties rather than into lumber. The larger logs, however, can more advantageously be put into plank. This is because there is comparatively less waste due to saw-kern and slabs in cutting a larger log.

TABLE X.—RELATION BETWEEN INCREASE IN VOLUME AND INCREASE IN VALUE.—CHESTNUT.

Increase in diameter breasthigh.	Ashuelot.		Pisgah.	
	Increase in volume of used portion of tree.	Increase in value of tree.	Increase in volume of used portion of tree.	Increase in value of tree.
<i>Inches.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per Cent.</i>	<i>Per Cent.</i>
From 7 to 8	38.0	53.7	.....	.....
8 9	34.8	44.4	28.1	43.1
9 10	31.2	37.4	25.2	37.9
10 11	27.9	30.4	23.4	33.8
11 12	25.0	26.4	22.1	27.4
12 13	21.5	23.8	19.0	24.4
13 14	19.0	20.2	17.4	20.9
14 15	17.0	18.8	15.4	18.1
15 16	15.1	16.9	14.7	15.8
16 17	13.2	15.4	13.5	14.1
17 18	11.2	13.3	12.3	12.5
18 19	10.7	11.4	11.3	11.3
19 20	8.6	9.6	9.9	10.4
20 21	.....	.....	9.1	9.2

Table X shows the relation between the increase in the total volume of the tree and the increase in its total value, expressed in percentages. The fact is brought out here, as was the case with the white pine, that in the smaller diameters the rate of increase in value is comparatively much higher than the rate of increase in volume. Above 16 inches the difference in the two rates is small. This is especially true for the Pisgah lumber.

To summarize, the chestnut mill scales show that with present prices it pays better to cut logs less than 19 inches in diameter outside the bark into switch ties and larger logs into plank; and that in considering the proper rotation for chestnut coppice the increase in the value of trees more than

16 inches in diameter, due to the improvement in the quality of the lumber, may be left out of consideration, if prices remain as they are at present, and no new grades are introduced.

*Red Oak.*—The red oak on second-growth woodlots is usually less than 16 inches in diameter breasthigh, and yields inferior grades of lumber. The wood is quite sound but knotty, and, if graded according to the rules of the National Hardwood Lumber Association, the bulk of it would fall into "shipping culls." The lumber is used in making furniture, mostly chairs, and is rarely separated into grades.

About 700 trees were followed through several mills, mostly in Merrimack County. About 85 per cent of the lumber was cut into 1½-inch round-edged boards, the extra ½ inch being allowed for shrinkage in drying and dressing. The rest of the lumber was cut into 1½-inch round-edged plank.

The trees were from 50 to 80 years old, the age varying rather uniformly with the diameter. The used portion of the trees ranged from 15 to 50 feet in length, yielding from 1 to 4 12-foot logs. The hardwoods are not so closely utilized for lumber as the conifers, the cutting limit here being 5 to 9 inches inside the bark at the small end of the last log. The stumps, also, were quite high, varying from 1.1 to 1.6 feet.

The used length of the tree, rather than its total height, was chosen as a basis for the table, because of the difficulty in estimating the total height of a hardwood tree.

Table XI shows the volume in cubic feet of the used length of the tree, the amount of lumber sawed out at the mill, and the number of board feet obtained per cubic foot.

TABLE XI.—VOLUME TABLE FOR RED OAK.

[illegible]



Table XII shows the value of red oak trees of various sizes, with lumber at \$20 per thousand board feet.

TABLE XII.—VALUE OF TREES WITH LUMBER AT \$20 PER THOUSAND BOARD FEET.—RED OAK.

Diameter breasthigh.	Used length.—Feet.					Basis 683 trees.
	10	20	30	40	50'	
<i>Inches.</i>						
5	\$0.14					3
6	.18	\$0.30				19
7	.28	.44	\$0.59	\$0.68		73
8	.36	.60	.78	.86		128
9	.50	.80	.98	1.16		142
10	.62	1.00	1.20	1.46	\$1.99	129
11	.74	1.26	1.48	1.80	2.36	72
12	.88	1.56	1.78	2.20	2.86	44
13	1.08	1.86	2.14	2.64	3.48	32
14	1.30	2.18	2.52	3.20	4.16	14
15		2.48	2.98	3.80	4.86	10
16		2.86	3.46	4.60	5.76	8
17		3.26	4.02	5.24	6.00	7
18		3.62	4.64	6.16		1
19		4.04	5.30	7.12		1
20		4.46	6.00	8.10		

*Paper birch.*—More or less paper birch is found in almost all second-growth hardwood stands, but the tree is rarely more than 15 inches in diameter breasthigh. The lumber which is sound, but knotty, is used extensively for spool and bobbin stock, and more rarely for chairs.

Table XIII is based on the measurements of 427 trees, taken in various parts of the state. Practically all the lumber was cut into 1½-inch round-edged boards. The trees varied from 45 to 60 years in age, and from 6 to 15 inches in diameter. The used portion of the trees was from 10 to 37 feet, yielding 1 to 3 12-foot logs. The diameter at the small end of the last log ranged from 4 to 10 inches inside the bark.

In this table, as with the red oak, the used length of the tree, rather than its total height, was the basis chosen, because of the difficulty in determining the height of a hardwood tree.

TABLE XIII.—VOLUME TABLE FOR PAPER BIRCH.

Diameter breasthigh.	Used length.—Feet.					Number of bd. ft. per cu. ft.	Basis 427 trees.		
	Volume of used length.								
	10	20	30	40	50				
Inches.	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.			
6	2.2	9	4.1	17	5.2	21	16		
7	2.9	12	5.2	24	6.3	32	58		
8	3.6	15	6.6	31	7.3	40	73		
9	4.4	18	8.0	38	8.1	46	82		
10	5.2	21	9.3	43	9.0	51	93		
11	6.3	24	10.3	48	10.0	55	70		
12	7.8	27	11.6	55	12.1	63	87		
13	.....	30	13.7	67	14.0	71	36		
14	.....	33	15.9	81	17.9	87	13		
15	.....	36	18.2	95	20.9	100	10		
16	.....	39	21.0	111	24.1	124	6		
	.....	42	23.8	130	27.6	147	.....		
	.....	45	26.5	150	31.0	160	.....		
	.....	48	29.2	176	34.8	173	.....		
	.....	51	31.9	203	38.9	200	.....		
	.....	54	34.6	233	41.5	229	.....		
	.....	57	37.3	261	44.1	261	.....		
	.....	60	40.0	288	46.8	288	.....		
	.....	63	42.7	315	49.5	315	.....		
	.....	66	45.4	342	52.2	342	.....		
	.....	69	48.1	369	54.9	369	.....		
	.....	72	50.8	396	57.6	396	.....		
	.....	75	53.5	423	60.3	423	.....		
	.....	78	56.2	450	63.0	450	.....		
	.....	81	58.9	477	65.7	477	.....		
	.....	84	61.6	504	68.4	504	.....		
	.....	87	64.3	531	71.1	531	.....		
	.....	90	67.0	558	73.8	558	.....		
	.....	93	69.7	585	76.5	585	.....		
	.....	96	72.4	612	79.2	612	.....		
	.....	99	75.1	639	81.9	639	.....		
	.....	102	77.8	666	84.6	666	.....		
	.....	105	80.5	693	87.3	693	.....		
	.....	108	83.2	720	90.0	720	.....		
	.....	111	85.9	747	92.7	747	.....		
	.....	114	88.6	774	95.4	774	.....		
	.....	117	91.3	801	98.1	801	.....		
	.....	120	94.0	828	100.8	828	.....		
	.....	123	96.7	855	103.5	855	.....		
	.....	126	99.4	882	106.2	882	.....		
	.....	129	102.1	909	108.9	909	.....		
	.....	132	104.8	936	111.6	936	.....		
	.....	135	107.5	963	114.3	963	.....		
	.....	138	110.2	990	117.0	990	.....		
	.....	141	112.9	1017	119.7	1017	.....		
	.....	144	115.6	1044	122.4	1044	.....		
	.....	147	118.3	1071	125.1	1071	.....		
	.....	150	121.0	1098	127.8	1098	.....		
	.....	153	123.7	1125	130.5	1125	.....		
	.....	156	126.4	1152	133.2	1152	.....		
	.....	159	129.1	1179	135.9	1179	.....		
	.....	162	131.8	1206	138.6	1206	.....		
	.....	165	134.5	1233	141.3	1233	.....		
	.....	168	137.2	1260	144.0	1260	.....		
	.....	171	139.9	1287	146.7	1287	.....		
	.....	174	142.6	1314	149.4	1314	.....		
	.....	177	145.3	1341	152.1	1341	.....		
	.....	180	148.0	1368	154.8	1368	.....		
	.....	183	150.7	1395	157.5	1395	.....		
	.....	186	153.4	1422	160.2	1422	.....		
	.....	189	156.1	1449	162.9	1449	.....		
	.....	192	158.8	1476	165.6	1476	.....		
	.....	195	161.5	1503	168.3	1503	.....		
	.....	198	164.2	1530	171.0	1530	.....		
	.....	201	166.9	1557	173.7	1557	.....		
	.....	204	169.6	1584	176.4	1584	.....		
	.....	207	172.3	1611	179.1	1611	.....		
	.....	210	175.0	1638	181.8	1638	.....		
	.....	213	177.7	1665	184.5	1665	.....		
	.....	216	180.4	1692	187.2	1692	.....		
	.....	219	183.1	1719	189.9	1719	.....		
	.....	222	185.8	1746	192.6	1746	.....		
	.....	225	188.5	1773	195.3	1773	.....		
	.....	228	191.2	1800	198.0	1800	.....		
	.....	231	193.9	1827	200.7	1827	.....		
	.....	234	196.6	1854	203.4	1854	.....		
	.....	237	199.3	1881	206.1	1881	.....		
	.....	240	202.0	1908	208.8	1908	.....		
	.....	243	204.7	1935	211.5	1935	.....		
	.....	246	207.4	1962	214.2	1962	.....		
	.....	249	210.1	1989	216.9	1989	.....		
	.....	252	212.8	2016	219.6	2016	.....		
	.....	255	215.5	2043	222.3	2043	.....		
	.....	258	218.2	2070	225.0	2070	.....		
	.....	261	220.9	2097	227.7	2097	.....		
	.....	264	223.6	2124	230.4	2124	.....		
	.....	267	226.3	2151	233.1	2151	.....		
	.....	270	229.0	2178	235.8	2178	.....		
	.....	273	231.7	2205	238.5	2205	.....		
	.....	276	234.4	2232	241.2	2232	.....		
	.....	279	237.1	2259	243.9	2259	.....		
	.....	282	239.8	2286	246.6	2286	.....		
	.....	285	242.5	2313	249.3	2313	.....		
	.....	288	245.2	2340	252.0	2340	.....		
	.....	291	247.9	2367	254.7	2367	.....		
	.....	294	250.6	2394	257.4	2394	.....		
	.....	297	253.3	2421	260.1	2421	.....		
	.....	300	256.0	2448	262.8	2448	.....		
	.....	303	258.7	2475	265.5	2475	.....		
	.....	306	261.4	2502	268.2	2502	.....		
	.....	309	264.1	2529	270.9	2529	.....		
	.....	312	266.8	2556	273.6	2556	.....		
	.....	315	269.5	2583	276.3	2583	.....		
	.....	318	272.2	2610	279.0	2610	.....		
	.....	321	274.9	2637	281.7	2637	.....		
	.....	324	277.6	2664	284.4	2664	.....		
	.....	327	280.3	2691	287.1	2691	.....		
	.....	330	283.0	2718	289.8	2718	.....		
	.....	333	285.7	2745	292.5	2745	.....		
	.....	336	288.4	2772	295.2	2772	.....		
	.....	339	291.1	2799	297.9	2799	.....		
	.....	342	293.8	2826	300.6	2826	.....		
	.....	345	296.5	2853	303.3	2853	.....		
	.....	348	299.2	2880	306.0	2880	.....		
	.....	351	301.9	2907	308.7	2907	.....		
	.....	354	304.6	2934	311.4	2934	.....		
	.....	357	307.3	2961	314.1	2961	.....		
	.....	360	310.0	2988	316.8	2988	.....		
	.....	363	312.7	3015	319.5	3015	.....		
	.....	366	315.4	3042	322.2	3042	.....		
	.....	369	318.1	3069	324.9	3069	.....		
	.....	372	320.8	3096	327.6	3096	.....		
	.....	375	323.5	3123	330.3	3123	.....		
	.....	378	326.2	3150	333.0	3150	.....		
	.....	381	328.9	3177	335.7	3177	.....		
	.....	384	331.6	3204	338.4	3204	.....		
	.....	387	334.3	3231	341.1	3231	.....		
	.....	390	337.0	3258	343.8	3258	.....		
	.....	393	339.7	3285	346.5	3285	.....		
	.....	396	342.4	3312	349.2	3312	.....		
	.....	399	345.1	3339	351.9	3339	.....		
	.....	402	347.8	3366	354.6	3366	.....		
	.....	405	350.5	3393	357.3	3393	.....		
	.....	408	353.2	3420	360.0	3420	.....		
	.....	411	355.9	3447	362.7	3447	.....		
	.....	414	358.6	3474	365.4	3474	.....		
	.....	417	361.3	3501	368.1	3501	.....		
	.....	420	364.0	3528	370.8	3528	.....		
	.....	423	366.7	3555	373.5	3555	.....		
	.....	426	369.4	3582	376.2	3582	.....		
	.....	429	372.1	3609	378.9	3609	.....		
	.....	432	374.8	3636	381.6	3636	.....		
	.....	435	377.5	3663	384.3	3663	.....		
	.....	438	380.2	3690	387.0	3690	.....		
	.....	441	382.9	3717	389.7	3717	.....		
	.....	444	385.6	3744	392.4	3744	.....		
	.....	447	388.3	3771	395.1	3771	.....		
	.....	450	391.0	3798	397.8	3798	.....		
	.....	453	393.7	3825	400.5	3825	.....		
	.....	456	396.4	3852	403.2	3852	.....		
	.....	459	399.1	3879	405.9	3879	.....		
	.....	462	401.8	3906	408.6	3906	.....		
	.....	465	404.5	3933	411.3	3933	.....		
	.....	468	407.2	3960	414.0	3960	.....		
	.....	471	409.9	3987	416.7	3987	.....		
	.....	474	412.6	4014	419.4	4014	.....		
	.....	477	415.3	4041	422.1	4041	.....		
	.....	480	418.0	4068	424.8	4068	.....		
	.....	483	420.7	4095	427.5	4095	.....		
	.....	486	423.4	4122	430.2	4122	.....		
	.....	489	426.1	4149	432.9	4149	.....		
	.....	492	428.8	4176	435.6	4176	.....		
	.....	495	431.5	4203	438.3	4203	.....		
	.....	498	434.2	4230	441.0	4230	.....		
	.....	501	436.9	4257	443.7	4257	.....		
	.....	504	439.6	4284	446.4	4284	.....		
	.....	507	442.3	4311	449.1	4311	.....		
	.....	510	445.0	4338	451.8	4338	.....		
	.....	513	447.7	4365	454.5	4365	.....		
	.....	516	450.4	4392	457.2	4392	.....		
	.....	519	453.1	4419	459.9	4419	.....		
	.....	522	455.8	4446	462.6	4446	.....		
	.....	525	458.5	4473	465.3	4473	.....		
	.....	528	461.2	4500	468.0	4500	.....		
	.....	531	463.9	4527	470.7	4527	.....		
	.....	534	466.6	4554	473.4	4554	.....		
	.....	537	469.3	4581	476.1	4581	.....		
	.....	540	472.0	4608					

Table XIV shows the value of paper birch trees, with lumber at \$16 a thousand board feet.

TABLE XIV.—VALUE OF TREES WITH LUMBER AT \$16 PER THOUSAND FEET.—PAPER BIRCH.

Diameter breasthigh.	Used length.—Feet.					Basis 427 trees.
	10	20	30	40	50	
<i>Inches.</i>						
6	\$0.14	\$0.27	\$0.34	\$0.42	\$0.50	16
7	.22	.38	.51	.61	.74	58
8	.29	.54	.67	.82	.99	79
9	.38	.69	.90	1.04	1.31	82
10	.46	.85	1.14	1.33	1.62	70
11	.59	1.07	1.39	1.66	1.96	57
12	.74	1.30	1.70	1.98	2.35	36
13	.....	1.52	2.00	2.40	2.77	13
14	.....	1.78	2.35	2.82	3.20	10
15	.....	2.08	2.74	3.25	3.66	6
16	.....	.....	3.12	3.73	4.18	.....

*Hemlock.*—Hemlock occurs in greater or smaller quantities in almost every stand, and is cut together with the other species. It is usually put into building material, either as one-inch squared boards, as 2 by 4 and 3 by 4-inch studs, or as joists. When occurring sparingly in mixture with white pine, the hemlock is cut into box boards. The lumber, as a rule, is sound and fairly free from shake, and is rarely separated into grades.

Table XV is based on the measurements of 317 trees taken in various parts of the state in connection with the mill tallies of other species. About half of the lumber was put into studs, and the rest into inch boards. The trees were from 55 to 80 years old, ranged in height from 35 to 65 feet, and most of them were 7 to 15 inches in diameter breasthigh. The diameter at the small end of the last log varied from 4.4 to 6.5 inches inside the bark. The used portion of the trees was from 15 to 45 feet long. The table shows the volume in cubic feet of the used length of the trees, the amount of lumber sawed out at the mill, and the number of board feet which was obtained per cubic foot.





With hemlock at \$15 per thousand board feet, Table XVI shows the value of the various sized trees.

TABLE XVI.—MILL SCALES—SOUTHERN NEW HAMPSHIRE.—  
VALUE OF TREES WITH LUMBER AT \$15 PER THOUSAND  
BOARD FEET.—HEMLOCK.

Diameter breasthigh.	Total height—Feet.					Basis 317 trees.
	30	40	50	60	70	
<i>Inches.</i>						
6	\$0.07	.....	.....	.....	.....	4
7	.15	\$0.30	\$0.45	\$0.63	.....	17
8	.26	.42	.59	.75	.....	40
9	.39	.54	.73	.90	.....	57
10	.54	.69	.89	1.06	\$1.29	57
11	.70	.87	1.08	1.29	1.54	41
12	.90	1.09	1.29	1.55	1.84	42
13	.....	1.32	1.56	1.86	2.22	17
14	.....	1.60	1.88	2.20	2.60	14
15	.....	1.89	2.22	2.58	3.06	14
16	.....	2.22	2.56	3.00	3.60	6
17	.....	.....	2.96	3.50	4.22	8

#### VOLUME TABLES.

Certain kinds of wood are not cut into boards or plank, but are utilized in the form of bolts and billets. The lumber, in that case, is sold by the cord. This is especially true of spruce sold for pulp, and popple used either for pulp or excelsior.

To determine as accurately as possible the amount of lumber that may be obtained from trees of various sizes, measurements were made on 900 spruce and 300 popple. The diameter was measured at intervals of 4 feet along the stem, and the limit of cutting was fixed at 4 inches outside the bark. The thickness of bark was measured on 300 spruce trees, at intervals of eight feet along the stem, and its volume computed. It was found to be about 11 per cent of the total volume of the tree with the bark, varying only very slightly with the size of the tree.

All volume measurements were made on green logs.

*Spruce.*—Only second-growth spruce was measured. Six hundred trees were taken at Waterville, in Grafton County, and 300 trees more at Stoddard, in Cheshire County.

The Waterville spruce was an even-aged stand about 70 years old. The trees ranged in height from 48 to 64 feet, and in diameter from 5 to 14 inches. The used portion of the trees ran from 18 to 46 feet in length. The height of stump was usually less than a foot.

The Stoddard spruce was rather irregular in age, varying from fifty to ninety years. The heights ran from 40 to 80 feet, and the diameters from 4 to 19 inches. From 10 to 60 feet of the length of the trees were utilized. The stumps were from .2 to .3 of a foot higher than in the Waterville spruce.

In spite of the slight variation in size and age, the difference in volume between trees of the same diameter and height from the two stands was so small that the data collected in both places was worked up in one table.

Table XVII shows the volume of second-growth spruce of different diameters and heights. To obtain the volume of peeled spruce, deduct 11 per cent from these volumes.\*

TABLE XVII.—VOLUME TABLE FOR SECOND-GROWTH SPRUCE.

Diameter breasthigh.	Height—Feet.					Basis.
	40	50	60	70	80	
Inches.	Volume of used length including bark—Cubic feet.					Trees.
4	0.9	.....	.....	.....	.....	5
5	1.8	2.4	.....	.....	.....	33
6	3.5	4.2	5.3	6.6	.....	99
7	5.1	6.2	7.3	9.0	.....	127
8	7.0	8.3	9.7	11.3	.....	153
9	8.9	10.6	12.1	14.0	.....	155
10	10.9	13.4	15.2	17.1	.....	103
11	.....	16.2	18.4	20.7	.....	64
12	.....	19.3	21.9	24.4	.....	37
13	.....	22.7	25.6	29.0	33.7	22
14	.....	26.0	30.0	33.4	38.2	20
15	.....	.....	34.2	38.0	43.2	23
16	.....	.....	38.8	43.1	48.6	18
17	.....	.....	43.5	48.2	54.5	10
18	.....	.....	48.0	53.0	60.0	9
19	.....	.....	.....	58.8	66.0	6
						903

\*The volume tables are given in cubic feet. To reduce them to cords it is only necessary to divide them by the number of cubic feet allowed to the cord. It is common practice in many places to allow 100 cubic feet to the cord.



*Popple.*—Three hundred popple were measured, all of them taken at Plainfield, in Sullivan County. All measurements, except the breasthigh diameter, were made on peeled logs. The trees varied in age from 25 to 50 years. They were from 50 to 75 feet high, and from 5 to 13 inches in diameter. The used portion of the trees ran from 17 to 56 feet in length, and the height of stumps from .6 to 1.3 feet.

Table XVIII gives the volume of peeled popple.

TABLE XVIII.—VOLUME TABLE FOR POPPLE.

Diameter breasthigh.	Height—Feet.				Basis.
	50	60	70	80	
Inches.	Volume of used length peeled.—Cubic feet.				Trees.
5	2.0	2.2	.....	.....	19
6	3.1	3.6	4.5	.....	69
7	4.3	5.3	6.5	7.7	65
8	5.7	7.3	8.8	10.2	58
9	7.1	9.6	11.7	13.4	40
10	.....	12.2	14.9	17.2	15
11	.....	.....	18.3	21.3	13
12	.....	.....	22.3	.....	8
13	.....	.....	26.3	.....	2
					289

All the above tables can be directly applied in finding the contents and value of entire stands. For a full description of methods used for measuring the height and diameter of trees, and the use of volume tables, consult "The Woodsman's Handbook," Bulletin 36, Bureau of Forestry, U. S. Department of Agriculture, which may be had on application to the Forest Service, Washington, D. C.

*Yield Tables.*—A yield table is a statement in tabular form of the amount of lumber per acre that may be expected at different ages in a forest of a specified description. Its principal use is in foretelling future yield.

The yield of a forest depends on a number of factors, all of which must be known before the future production of lumber can be predicted.

1. The composition and character of the forest must be known. Pine will produce more lumber per acre in sixty years than red oak or chestnut. Again, the amount of lumber produced by chestnut will be different according to whether the forest is of seedling or sprout origin.

2. The region where the forest is found. Tables which apply to New Hampshire conditions may not apply to Minnesota.

3. Even in the same region the site quality will have a marked influence on the amount of lumber produced by a stand. Soil, moisture, exposure to light and wind, all have their influence on the growth of the trees and are finally reflected in the yield.

4. The method of managing the forest and the time when thinnings and cuttings are made will affect the production of lumber.

Furthermore, all the above factors may be identical for two stands, and their yield may still be quite different, because one of the stands is fully stocked while the other is only partially stocked. Since yield tables are generally used as standards of measurement or comparison, it is customary to base them on fully stocked stands.

The following yield tables are based on fully stocked, even-aged, unmanaged, pure white pine stands in southern New Hampshire, and apply only to stands that agree with this description.

One hundred and ninety-six sample plots of white pine were taken in fifteen different towns, well scattered over the southern portion of the state. Because of the difficulty in finding larger areas which would conform to all the requirements, most of the sample plots were only one quarter of an acre in extent. The data was then worked up in the office. The volume in board feet for each plot was obtained by the use of table XXXVI, the yield being expressed for whole acres. The results were plotted on cross-section paper, curves were drawn through the maximum and the minimum points, and the confined zone was divided into three equal

bands. In this way three site qualities were distinguished—quality I representing that most favorable to tree growth, quality III the most unfavorable, and quality II the average or intermediate quality of locality.

Table XIX shows the volume of lumber in board feet and the value per acre that may be expected at every fifth year, from twenty to ninety years, on the best, the average, and the poorest site qualities, of a fully stocked, pure, even-aged, unmanaged white pine stand.



TABLE XIX.—YIELD TABLE FOR WHITE PINE.

Age.	YIELD PER ACRE.								
	Quality I.—Value of lumber.			Quality II.—Value of lumber.			Quality III.—Value of lumber.		
	Volume.	f. o. b. value.	Stumpage value.	Volume.	f. o. b. value.	Stumpage value.	Volume.	f. o. b. value.	Stumpage value.
Years.	<i>Bd. ft.</i>	\$	\$	<i>Bd. ft.</i>	\$	\$	<i>Bd. ft.</i>	\$	\$
20	4,600	56.35	6.44	3,150	38.59	4.41	1,700	20.83	2.38
25	8,400	104.58	13.44	5,900	73.45	9.44	3,450	42.86	5.52
30	15,100	191.77	27.94	10,800	137.16	19.98	6,550	83.19	12.12
35	24,950	338.09	57.30	18,050	237.36	41.52	11,200	147.28	25.76
40	33,550	474.73	81.72	25,000	353.75	62.50	16,450	232.77	54.29
45	40,750	615.33	110.72	31,450	474.90	83.06	22,150	314.47	94.14
50	47,450	752.08	137.19	37,800	594.13	100.00	27,650	438.25	138.25
55	52,350	831.10	159.16	42,550	619.95	123.28	32,750	538.74	183.40
60	57,800	968.37	184.07	47,400	801.05	150.77	37,500	633.75	226.88
65	61,650	1,070.00	208.93	51,850	897.00	173.43	41,850	724.00	269.93
70	65,900	1,109.73	230.81	55,800	990.45	198.02	45,700	811.18	316.32
75	69,750	1,235.50	258.71	59,500	1,071.00	225.42	49,200	886.50	352.14
80	73,300	1,337.73	282.42	62,850	1,147.01	250.00	52,400	956.30	397.70
85	76,700	1,418.95	308.76	66,000	1,221.00	275.00	55,800	1,023.05	423.05
90	80,050	1,500.94	332.40	69,000	1,293.75	300.00	57,050	1,088.56	457.81

By the use of the sample plots, which showed the number of trees of different sizes on an acre, and table VI, which gives the value of the lumber from different sized trees, the f. o. b. value of the lumber per acre was obtained, and is given in the third column of table XIX. By dividing these total f. o. b. values by the total volume in board feet in the second column, the f. o. b. value per thousand board feet of lumber obtained from stands of different ages was determined, and is given in the second column of table XX.

TABLE XX—VALUE OF WHITE PINE.

Age.—Years.	Value per thousand board feet, f. o. b.	Value per thou- sand board feet, stumpage.
20.....	\$12.25	\$1.40
25.....	12.45	1.60
30.....	12.70	1.85
35.....	13.15	2.30
40.....	14.15	3.30
45.....	15.10	4.25
50.....	15.85	5.00
55.....	16.45	5.60
60.....	16.90	6.05
65.....	17.80	6.45
70.....	17.75	6.90
75.....	18.00	7.15
80.....	18.25	7.40
85.....	18.50	7.65
90.....	18.75	7.90

To obtain the stumpage values, it was assumed that the lumber from the average 50-year-old stand is worth \$5 per thousand board feet standing, and that the total cost of manufacture, from the stump to the car, averaged \$7 a thousand. Both of these assumptions are fair averages, and rather conservative. Assuming, then, that \$12 a thousand represents the lumberman's total expenses, this sum was deducted from \$15.85, the f. o. b. value per thousand feet of 50-year-old lumber, which left \$3.85 as the lumberman's profit. Since there is no good reason why the lumberman should make a greater profit from a 60 or 70-year-old stand than from a 50-year-old stand, and assuming that the total cost of manufacture remain \$7 a thousand, \$10.85 was deducted in every

case from the f. o. b. values of the lumber, and the third column of table XX was obtained, showing the stumpage value per thousand board feet of lumber gotten from stands of different ages. These figures were then used in getting the stumpage value per acre in the yield table, the fourth column of table XIX. Where the total cost of manufacture is more than \$7 a thousand, the additional cost should be subtracted from the stumpage value, while in the more favorable localities where the cost of manufacture is less than \$7, the difference should be added.

#### FINANCIAL ROTATION FOR WHITE PINE.

The practical application of the yield tables is in determining the proper rotation for a forest, that is, the age at which the forest should be cut, by foretelling the yield to be expected from it at any time.

The standing trees in a forest may be considered as a capital, and the yearly growth in lumber as the interest on that capital. Considered from a purely financial point of view, whenever this interest falls below the rate which may be earned by the money into which the timber can be converted, the forest should be cut. This rate of current annual increase in value is given in the third column of table XXI.



TABLE XXI.—RATE OF CURRENT ANNUAL INCREASE IN VOLUME AND VALUE, PER ACRE.—WHITE PINE.

Increase in age.	Quality I.		Quality II.		Quality III.	
	Current annual increase in volume.	Current annual increase in stumpage value.	Current annual increase in volume.	Current annual increase in stumpage value.	Current annual increase in volume.	Current annual increase in stumpage value.
Years.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
From 20 to 25	11.7	14.1	12.3	14.5	13.6	15.9
25 30	11.4	14.0	11.7	14.3	12.4	15.0
30 35	9.8	13.8	10.0	14.0	10.6	14.4
35 40	5.9	12.7	6.4	13.2	7.6	14.3
40 45	3.9	8.8	4.6	9.5	5.9	10.8
45 50	3.0	6.2	3.7	6.9	4.4	7.6
50 55	2.0	4.2	2.4	4.6	3.4	5.6
55 60	1.8	3.8	2.2	3.7	2.7	4.2
60 65	1.5	2.8	1.8	3.1	2.2	3.6
65 70	1.3	2.6	1.5	2.8	1.8	3.1
70 75	1.1	1.8	1.3	2.0	1.6	2.2
75 80	1.0	1.7	1.1	1.8	1.2	1.9
80 85	.9	1.6	1.0	1.6	1.1	1.7
85 90	.85	1.5	.9	1.5	.9	1.6

This table shows that if money can be invested at 4 per cent compound interest it does not pay to hold a stand of timber on quality I after it is 50 to 55 years old; it may be kept two or three years longer if it grows on quality II; and it must be cut between the fifty-fifth and sixtieth year, if it is on quality III. In the same way the proper rotation can be determined, assuming any other rate of interest. Thus, if money is valued at 3 per cent, the forest should not be left longer than the sixtieth, the sixty-fifth or seventieth year, according to the site quality. The lower the rate per cent at which money is valued, the longer the timber may be left standing; and, on the other hand, the higher the rate per cent demanded the earlier the forest must be cut.

The rate of current annual increase in volume is given in the above table for the purpose of comparison with the corresponding increase in value. It shows the effect that the improvement in quality of lumber with age has on the length of rotation. If there were no improvement in quality, the

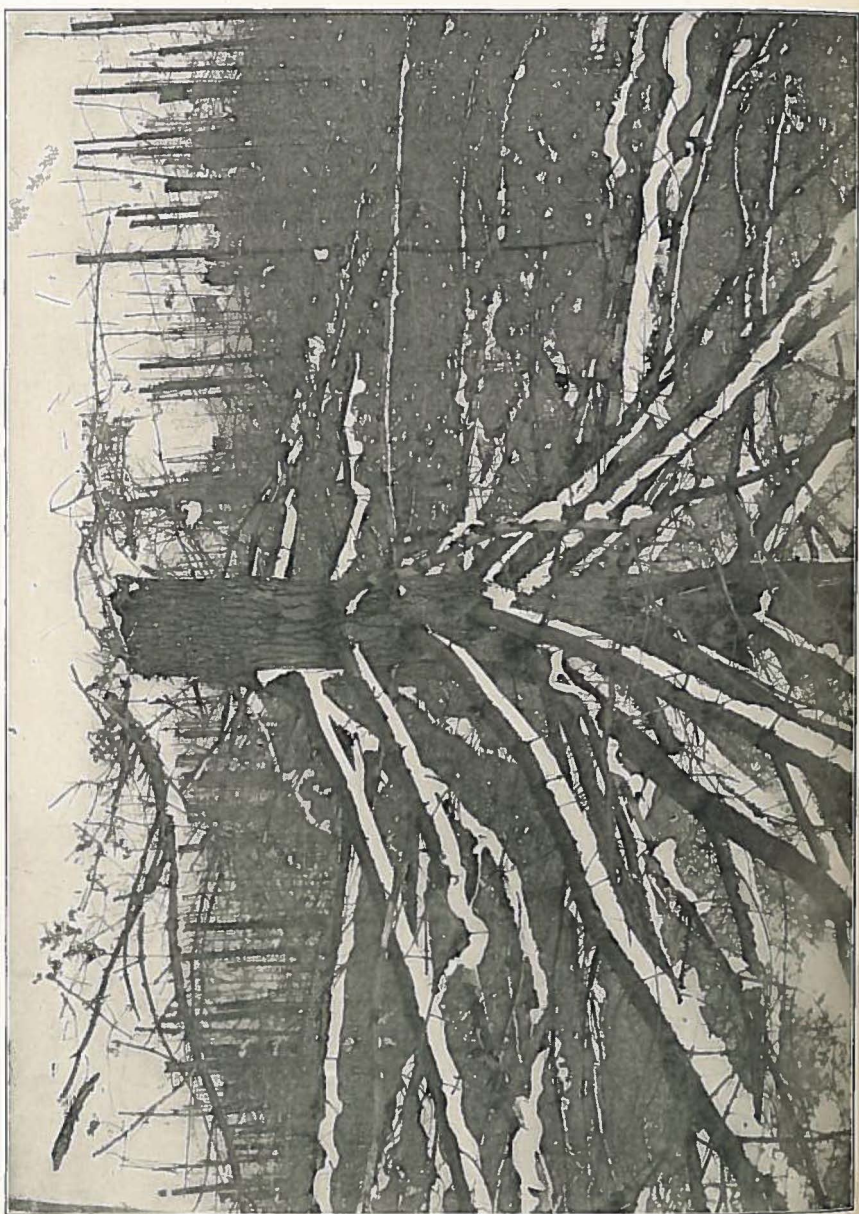


FIG. 34.—Type of limby pine, called "Cabbage," or "Wolf" pine. The lower branches measure 30 feet. A circle with a radius of 30 feet, has an area of 2,827 square feet, or about one-fifteenth of an acre. In an acre, then, composed of such trees, only fifteen could stand. By cutting the tree, its age was found to be sixty years. At the age of sixty, instead of 15 trees per acre there should be, under forestry management, 200 trees or more per acre.





FIG. 35.—Same tree as in FIG. 34, felled, showing branches piled into four feet wood, and logs in the foreground. The merchantable logs scaled only .52 of a cord, while the four feet wood, made up of limbs, and having no market value at all, measured  $1\frac{1}{4}$  cords. Under forestry methods an abnormal tree like this would be impossible.





FIG. 36.—A roadway in the new State Reservation at East Jaffrey.

current annual increase in value and in volume would be identical, and with money valued at 4 per cent the time to cut the forest would be hastened by ten years.

This table does not definitely determine when the forest should be cut. It simply indicates the age beyond which it is unprofitable to let the trees grow. To find the proper rotation it is necessary to know all the items entering into the cost of producing the crop, and the rate of interest that the owner demands on the money invested. To illustrate how such calculations are made several tables were constructed assuming different values of land, various costs of planting, a certain outlay in protection and taxes, and three different rates of interest. These tables show the practicability of planting white pine under certain conditions.

Tables XXII to XXV are based on quality II, which approximates the average conditions in the region studied.

TABLE XXII.—FINANCIAL ROTATION FOR WHITE PINE.

[Money valued at 4 per cent.—Value of land, \$5 per acre; cost of planting, \$7 per acre.]

Rotation.	Years.	Gross returns.	EXPENSES.										Net profit at end of rotation.		
			Stumpage value of lumber at end of rotation.		Taxes.		Cost of producing crop.				Total expenses at end of rotation.			Per Acre.	Per Acre.
					Taxes on timber.		Interest on value of land accrued to end of rotation.	Cost of planting carried to end of rotation.	Cost of protection accrued to end of rotation (10 cents per acre per year).						
					Annual for each 5-year period.	Accrued to end of rotation.									
			Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.	Per Acre.		
20	20	\$ 4.41	\$0.029	.....	\$ 0.28	\$ 5.96	\$ 15.24	\$ 2.08	\$ 24.56	—\$ 20.15					
25	25	0.44	.003	.16	.52	8.33	18.66	4.16	31.83	—22.39					
30	30	19.98	.266	.53	.81	11.22	22.70	5.61	40.87	—20.89					
35	35	41.52	.554	2.09	1.35	14.73	27.62	7.37	53.16	—11.64					
40	40	82.50	1.100	5.55	2.06	19.01	33.61	9.50	69.67	12.83					
45	45	133.66	1.782	12.71	2.80	24.21	40.89	12.10	92.71	40.95					
50	50	183.00	2.620	25.12	3.77	30.53	49.75	15.27	124.44	64.56					
55	55	238.28	3.177	44.20	4.94	38.23	60.52	19.13	167.02	71.26					
60	60	294.77	3.824	70.98	6.37	47.00	73.64	23.80	222.39	84.38					
65	65	334.43	4.459	106.80	8.12	58.89	86.59	26.50	253.00	41.43					
70	70	385.02	5.134	154.41	10.24	72.86	109.00	30.42	382.93	2.09					
75	75	425.42	5.672	215.66	12.81	89.73	132.62	34.86	496.68	—70.26					
80	80	465.09	6.201	293.08	15.96	110.25	191.35	56.12	636.75	—170.66					
85	85	504.90	6.732	390.15	19.77	135.22	196.31	67.60	809.05	—304.15					
90	90	545.10	7.208	511.13	24.41	165.60	238.84	82.81	1,022.79	—477.69					



There are four main headings in this table: the rotation, the gross return, the expenses, and the net profit.

1. The rotation is given in five-year periods.

2. The gross return is simply the stumpage value of the lumber at the end of the rotation. In managed stands there will be in addition a certain return from thinnings. This is discussed farther on. It is assumed in these calculations that the price of lumber will remain the same. Since lumber values tend to rise the results here given are conservative.

3. The expenses fall into two general classes: taxes and the cost of producing and protecting the crop. All expenses were carried forward with compound interest to the end of the rotation.

- (a) In considering the outlay in taxes it was assumed that the tax is uniformly at a rate of two cents on a dollar on a two thirds valuation, that the value of the land remains the same throughout the rotation, and that the growing timber is revalued at the end of every five years, as the law requires. Further, since the table applies to planted stands, a deduction was made for the abatement in taxes allowed by the law of 1903.

The third column in the table shows what the yearly tax on the timber would be during each five-year period, while the next column shows what the taxes would amount to at the end of each rotation, accrued with compound interest. The fifth column gives the taxes on land accrued to the end of each rotation.

- (b) The items under the cost of producing the crop are the interest on the value of the land, compounded annually, the cost of planting carried forward to the end of the rotation, and the cost of protecting the crop, for which 10 cents per acre per year was allowed. This last item is purely arbitrary, but was accepted as a fair average.

4. The total expenses are obtained by adding the various items in columns four to eight, inclusive, for any rotation, and this deducted from the gross returns for that rotation gives the net profit (or loss, indicated by a minus sign).

The point at which the net profit is highest represents the age at which it pays best to cut the timber, the financial rotation of the crop. In table XXII this point falls at the fifty-fifth year.

Tables XXIII and XXIV were constructed in the same way as table XXII, but different rates of interest were taken.

TABLE XXIII.—FINANCIAL ROTATION FOR WHITE PINE.

[Money valued at 3 per cent.—Value of land, \$5 per acre; cost of planting, \$7 per acre.]

EXPENSES.													
Rotation.	Years.	Gross returns.	Stumpage value of lumber at end of rotation.	Taxes.			Cost of producing crop.				Total expenses at end of rotation.		Net profit at end of rotation.
				Taxes on timber.		Taxes on land accrued to end of rotation.	Interest on value of land accrued to end of rotation.	Cost of planting carried to end of rotation.	Cost of protection (10 cents per acre per year).	Per Acre.	Per Acre.		
				Annual for each 5-year period.	Accrued to end of rotation.								
												Per Acre.	
20		\$ 4.41	\$ 0.029	.....	\$ 0.26	\$ 4.03	\$ 12.64	\$ 2.60	\$ 10.02	\$ 15.21			
25		9.44	.063	.....	.47	5.47	14.05	3.65	24.40	14.96			
30		19.98	.086	.....	.73	7.14	16.99	4.70	30.13	10.15			
35		41.52	.154	.....	1.20	9.07	18.70	6.05	38.03	8.49			
40		82.50	.254	.....	1.74	11.81	22.53	7.54	48.69	33.81			
45		123.06	.383	.....	2.37	15.91	26.47	9.27	63.97	69.60			
50		169.00	.531	.....	3.10	16.92	30.69	11.28	85.30	103.70			
55		238.28	.717	.....	3.85	20.41	35.58	13.00	113.94	124.34			
60		286.77	3.824	.....	4.53	24.46	41.24	16.30	150.64	136.13			
65		334.43	4.459	.....	5.07	29.16	47.81	18.43	196.62	137.81			
70		385.02	5.134	.....	5.39	34.59	56.43	23.06	253.30	131.72			
75		426.43	5.672	.....	5.82	40.90	64.25	27.26	322.66	102.80			
80		465.09	6.201	.....	10.70	48.21	74.49	32.13	405.78	69.36			
85		504.90	6.732	.....	12.76	56.68	86.35	37.79	504.94	— .04			
90		545.10	7.268	.....	15.16	65.50	100.10	44.83	637.34	— 92.24			





The three tables given above all assume the value of land to be \$5.00, and the cost of planting \$7.00 an acre. Table XXV was made to show where the financial rotation would fall with different values of land and different costs of planting, but with all other factors as in the above tables.

TABLE XXV.—FINANCIAL ROTATION FOR WHITE PINE.

Money valued at.	Value of land, \$3.00 per acre.						Value of land, \$5.00 per acre.						Value of land, \$10.00 per acre.					
	Cost of planting per acre.						Cost of planting per acre.						Cost of planting per acre.					
	\$5.00		\$7.00		\$10.00		\$5.00		\$7.00		\$10.00		\$5.00		\$7.00		\$10.00	
	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.	Financial rotation.	Net profit.
3%	Yrs. 65	\$103.56	Yrs. 65	\$155.90	Yrs. 65	\$135.41	Yrs. 65	\$151.47	Yrs. 65	\$137.81	Yrs. 60	\$118.45	Yrs. 60	\$108.51	Yrs. 60	\$100.73	Yrs. 60	\$89.03
4%	60	111.01	55	92.52	55	66.68	55	88.55	55	71.26	55	45.32	55	35.37	50	30.26	50	8.94
5%	50	53.40	50	30.47	No rotation.		50	26.61	50	3.68	.....			No profitable rotation.				



It must be remembered that in all of the above tables of rotation the net profit represents the amount earned in addition to the demanded rate of interest on the investment. Furthermore, the above figures are very conservative for planted and managed forests, which would give a higher yield than the unmanaged stands on which the yield tables are based. In addition there will be certain returns derived from thinnings, if the forest be properly managed.

In taking the sample plots for the yield tables, the trees that should be removed in thinnings were recorded separately, and the results from the plots falling within the average quality of locality were worked up into table XXVI. Since trees less than five inches in diameter are not cut into boards, their volume is given in cubic feet. The total volume to be removed in thinning is also given in cubic feet.

TABLE XXVI.—YIELD FROM THINNING FULLY-STOCKED,  
UNMANAGED WHITE PINE STANDS.

Age.	YIELD PER ACRE.		
	Trees 5 inches or more in diameter.	Trees less than 5 inches in diameter.	Total.
<i>Years.</i>	<i>Bd. ft.</i>	<i>Cu. ft.</i>	<i>Cu. ft.</i>
25	750	750	900
30	3,300	600	1,300
35	5,800	450	1,880
40	7,500	300	1,900
45	8,900	150	2,040
50	9,900	.....	2,100

In applying the above table it should be remembered that the yield from thinnings is strictly additional, the ultimate yield being actually greater because of the accelerated growth of the trees left for the final crop.

## APPENDIX.

## APPENDIX.

## APPENDIX.

---

### PRINCIPAL USES OF THE COMMERCIALY IMPORTANT TREES.

*White Pine*.—Box boards, pail and fish barrel stock, match blocks, sash and blind stock, boat boards, refrigerator stock, common lumber, shingles.

*Chestnut*.—Ties, posts, poles, piles, furniture, coffin stock, interior finish.

*Red Oak*.—Furniture, interior finish.

*Spruce*.—Pulp, dimension lumber, piano boards.

*White Ash*.—Car and wagon stock, agricultural implements, furniture, interior finish, tool handles.

*Sugar Maple*.—Chair stock, flooring, bobbin stock, dowels, staves, veneer, crutches, dimension lumber, maple sugar.

*Paper Birch*.—Bobbin and spool stock, shoe pegs, dowels.

*Yellow and Black Birch*.—Chair stock, bobbin and spool stock, dowels, staves, veneer, crutches, dimension lumber.

*Popple*.—Pulp, excelsior, box boards.

*Hemlock*.—Dimension and common lumber, box boards, tanbark.

*Beech*.—Chair stock, staves, bobbin stock, dowels, cordwood.

*Red Maple*.—Chair stock, cordwood.

*White Oak*.—Ties, posts, wagon stock.

*Hickory*.—Wagon stock, agricultural implements, tool handles.

*Basswood*.—Boxes, excelsior.

*Red Pine*.—Box boards, dimension lumber.

*Pitch Pine*.—Rough box boards, cordwood.

*Balsam Fir*.—Pulp, box boards, excelsior.

*Tamarack*.—Ties, posts, poles.



## A. MILL TABLES AND VOLUME TABLES.\*

## WHITE PINE.

TABLE XXVII.—VOLUME TABLE FOR WHITE PINE.—WATER-  
LOO AND HENNIKER, AGE 50 YEARS.

Diameter breasthigh.	Height—Feet.						Basis.
	30	40	50	60	70	80	
Inches.	Volume of used length with bark.—Cubic ft.						Trees.
5	1.6	2.4	3.1	.....	.....	.....	15
6	2.3	3.5	4.3	5.1	.....	.....	61
7	3.4	4.8	5.8	7.0	8.3	.....	96
8	4.6	6.2	7.5	.....	10.8	.....	138
9	5.9	7.7	9.5	11.8	13.5	15.5	152
10	.....	9.2	11.7	14.0	16.7	19.0	131
11	.....	10.8	14.0	16.8	20.0	22.7	101
12	.....	12.6	16.3	19.8	23.8	26.5	72
13	.....	14.5	18.5	23.0	26.8	30.2	63
14	.....	.....	21.0	26.0	30.5	34.2	25
15	.....	.....	.....	29.3	34.7	38.3	12
16	.....	.....	.....	32.4	38.8	42.5	18
17	.....	.....	.....	.....	43.0	47.0	.....
Total ..							884

\* The volume tables in cubic feet of the used length of the tree may be readily reduced to cords by dividing the volume of the tree by the number of cubic feet allowed to the cord. It is common practice to allow 100 cubic feet to the cord.







TABLE XXXI.—VOLUME TABLE FOR WHITE PINE—AGE, LESS THAN 60 YEARS.—VOLUME OF USED LENGTH.

Diameter breasthigh.	Height—Feet.							Basis.
	30	40	50	60	70	80	90	
Inches.	Cubic feet.							Tree.
5	2.0	2.3	2.7	.....	.....	.....	.....	7
6	2.9	3.7	4.4	5.3	.....	.....	.....	40
7	4.0	5.0	6.0	7.5	.....	.....	.....	71
8	5.0	6.5	8.0	9.7	.....	.....	.....	102
9	6.2	8.0	10.0	12.1	14.3	.....	.....	176
10	7.2	9.6	12.1	14.7	17.4	20.2	.....	162
11	.....	11.1	14.2	17.4	20.8	24.3	.....	130
12	.....	12.6	16.3	20.3	24.2	28.3	.....	96
13	.....	14.0	18.5	23.5	28.0	32.5	37.0	102
14	.....	.....	21.0	26.5	31.5	37.0	42.0	38
15	.....	.....	23.0	29.5	35.5	41.5	47.0	22
16	.....	.....	25.5	33.0	39.5	46.0	52.5	34
17	.....	.....	.....	36.0	43.5	51.0	57.5	14
18	.....	.....	.....	.....	47.5	55.5	63.5	8
19	.....	.....	.....	.....	52.0	60.0	69.0	6
20	.....	.....	.....	.....	.....	64.5	75.0	1

TABLE XXXII.—VOLUME TABLE FOR WHITE PINE.—AGE, LESS THAN 60 YEARS.—TOTAL VOLUME, INCLUDING BARK, STUMP AND TOP.

Diameter breasthigh.	Height—Feet.							Basis.
	30	40	50	60	70	80	90	
Inches.	Cubic Feet.							Trees.
5	2.4	3.0	3.4					7
6	3.4	4.3	5.0	6.0				40
7	4.0	5.7	6.7	8.0				71
8	5.8	7.3	8.8	10.6				102
9	7.2	9.0	10.9	13.0	15.0			176
10	8.5	10.7	13.0	15.7	18.8	21.9		152
11		12.5	15.3	18.5	22.2	25.7		130
12		14.5	17.7	21.6	25.8	29.7		90
13		16.5	20.5	25.0	29.5	34.0	38.0	102
14			23.5	28.5	33.5	38.5	43.0	38
15			26.5	32.5	38.0	43.5	49.0	22
16			30.0	36.0	43.0	49.0	54.5	34
17				40.0	48.0	54.5	61.0	14
18					53.0	60.5	68.0	8
19					58.5	66.0	75.0	6
20						72.0	82.5	1











[illegible]

TABLE XXXVIII.—VOLUME TABLE FOR SECOND-GROWTH WHITE PINE, ALL AGES COMBINED.

Diameter breasthigh.	Total volume, including bark, stump and top.										Basis.
	30	40	50	60	70	80	90	100	110	120	
Inches.	Cubic feet.										Trees.
5	2.3	3.0	3.6	.....	.....	.....	.....	.....	.....	.....	7
6	3.0	4.3	5.1	6.0	6.5	.....	.....	.....	.....	.....	41
7	4.1	5.7	6.9	8.2	9.2	.....	.....	.....	.....	.....	75
8	5.4	7.1	8.8	10.5	12.2	13.9	15.8	.....	.....	.....	128
9	6.9	8.8	10.9	13.0	15.4	17.8	20.3	.....	.....	.....	166
10	8.6	10.5	13.1	15.9	18.9	21.9	25.0	.....	.....	.....	177
11	.....	12.3	15.5	18.7	22.5	26.1	29.9	.....	.....	.....	164
12	.....	14.3	18.0	22.0	26.4	30.8	35.0	40.1	45.9	.....	146
13	.....	16.3	20.7	25.3	30.4	35.4	40.1	45.8	52.0	.....	137
14	.....	.....	23.7	29.1	34.8	40.2	45.8	51.7	58.8	.....	91
15	.....	.....	27.0	33.1	39.2	45.3	51.9	58.0	65.8	.....	61
16	.....	.....	30.7	37.5	44.3	51.0	58.1	65.1	73.7	.....	88
17	.....	.....	35.0	42.3	49.9	57.0	65.1	73.1	82.5	.....	70
18	.....	.....	40.0	47.6	55.5	63.9	72.2	82.0	92.1	104.2	68
19	.....	.....	.....	53.0	60.2	70.9	80.0	91.0	102.1	114.8	44
20	.....	.....	.....	.....	67.1	78.1	88.1	100.2	112.2	125.6	35
21	.....	.....	.....	.....	73.1	85.7	98.7	108.2	122.1	136.3	23
22	.....	.....	.....	.....	79.1	93.1	105.3	118.1	131.7	146.7	16
23	.....	.....	.....	.....	.....	101.0	113.6	127.0	140.5	156.1	19
24	.....	.....	.....	.....	.....	108.6	121.8	135.8	149.8	165.5	9
25	.....	.....	.....	.....	.....	115.8	129.8	144.2	159.0	174.6	12
26	.....	.....	.....	.....	.....	122.7	137.8	153.1	168.5	183.2	11
											1,578

## CHESTNUT.

TABLE XXXIX.—VOLUME TABLE FOR SPROUT CHESTNUT.—ASHUELOT.

Diameter breasthigh.	Height—Feet.					Basis.
	50	60	70	80	90	
Inches.	Volume of used length, including bark—Cubic feet.					Trees.
7	5.4	7.4	.....	.....	.....	7
8	6.3	8.3	9.1	.....	.....	37
9	7.1	9.6	11.9	13.7	.....	100
10	8.1	11.0	14.0	16.3	18.8	109
11	9.1	12.6	16.0	19.1	22.6	95
12	.....	14.9	18.2	22.0	26.5	61
13	.....	17.2	20.5	25.2	30.7	43
14	.....	.....	22.9	28.8	35.1	27
15	.....	.....	25.4	32.6	40.0	13
16	.....	.....	28.0	36.8	45.0	12
17	.....	.....	30.8	41.0	50.9	7
18	.....	.....	33.8	45.7	57.0	4
19	.....	.....	.....	50.3	.....	2
20	.....	.....	.....	55.1	.....	.....
						517



TABLE XL.—VOLUME TABLE FOR SPROUT CHESTNUT.—  
PISGAH.

Diameter breasthigh.	Height—Feet.					Basis.
	60	70	80	90	100	
Inches.	Volume of used length, including bark—Cubic feet.					Trees.
8	7.7	8.5	9.7	.....	.....	3
9	10.0	11.1	13.0	14.4	.....	15
10	12.4	14.1	16.4	18.0	.....	52
11	15.0	17.3	20.0	22.0	25.4	67
12	18.0	20.9	24.0	26.5	30.2	104
13	21.1	24.7	28.0	31.0	35.1	117
14	24.4	28.3	32.0	35.7	40.0	103
15	28.0	32.7	36.5	40.6	45.1	74
16	32.0	36.8	41.0	45.6	50.3	52
17	36.0	40.8	45.9	50.8	56.1	31
18	39.9	45.0	51.0	56.1	62.0	23
19	43.7	49.5	56.4	62.0	68.3	11
20	.....	54.0	62.0	68.0	74.8	5
21	.....	.....	68.1	74.4	81.3	1
						678

*B. Log Rules.*—In making the mill scales, the tally of lumber cut from each log was kept on a separate sheet. It was thus possible to construct a series of log rules based on actual mill cut. Such log rules are here given. In using them it must be remembered that they are reliable only for a run of logs including butt, top, and intermediate logs.

*White Pine.*—Sixty per cent of the lumber cut from the logs on which these rules are based was round-edged stuff, and the remaining 40 per cent was squared. Seventy per cent of the lumber went into 1-inch boards, while the rest was cut into  $2\frac{1}{8}$ -inch plank.

TABLE XLI.—LOG RULE FOR SECOND-GROWTH WHITE PINE.—  
SOUTHERN NEW HAMPSHIRE.[Cut into both square and round-edged boards; circular saw,  $\frac{1}{4}$ -inch kerf.]

Diameter inside bark at small end of log.	Length of log—Feet.			Total basis, 5,177 logs.
	10	12	14	
	Basis, 613 logs.	Basis, 1,915 logs.	Basis, 2,649 logs.	
Inches.	Contents—Board feet.			
3	5	7	9	167
4	8	10	12	429
5	13	15	17	530
6	18	21	24	606
7	24	28	33	613
8	30	36	42	542
9	38	46	52	456
10	47	56	65	395
11	56	68	80	290
12	66	81	97	248
13	77	96	115	202
14	89	112	134	168
15	102	130	155	144
16	.....	149	176	104
17	.....	169	198	97
18	.....	189	222	64
19	.....	211	247	40
20	.....	235	275	41
21	.....	260	304	17
22	.....	284	333	11
23	.....	.....	364	9
24	.....	.....	398	4

TABLE XLII.—LOG RULE FOR SECOND-GROWTH WHITE PINE.—  
SOUTHERN NEW HAMPSHIRE.[Cut into both square and round-edged boards; circular saw,  $\frac{1}{4}$ -inch kerf.]

Diameter outside bark at middle of log.	Length of log—Feet.		
	10	12	14
Inches.	Contents—Board feet.		
5	7	8	10
6	10	13	16
7	15	19	23
8	22	27	31
9	28	34	40
10	35	43	50
11	44	53	63
12	53	64	77
13	61	76	91
14	70	88	106
15	82	104	125
16	95	119	144
17	109	136	163
18	.....	155	184
19	.....	173	204
20	.....	203	226
21	.....	211	247
22	.....	235	273
23	.....	256	298
24	.....	281	328
25	.....	304	355
26	.....	.....	384

TABLE XLIII.—RELATION BETWEEN DIAMETER INSIDE BARK AT SMALL END AND DIAMETER OUTSIDE BARK AT MIDDLE OF 14-FOOT LOG.—WHITE PINE.

Diameter inside bark at small end of log.	Diameter outside bark at middle of log.	Diameter outside bark at middle of log.	Diameter inside bark at small end of log.
<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
		5	3.2
		6	4.4
3	4.8	7	5.5
4	5.7	8	6.7
5	6.5	9	7.7
6	7.4	10	8.7
7	8.3	11	9.7
8	9.3	12	10.7
9	10.3	13	11.6
10	11.3	14	12.5
11	12.4	15	13.5
12	13.4	16	14.4
13	14.5	17	15.3
14	15.6	18	16.3
15	16.6	19	17.2
16	17.7	20	18.1
17	18.8	21	19.0
18	19.9	22	19.9
19	21.0	23	20.8
20	22.1	24	21.8
21	23.2	25	22.7
22	24.3	26	23.6
23	25.4		
24	26.4		

## HARDWOODS.

Practically all of the lumber cut from the logs on which the hardwood rules are based was  $1\frac{1}{2}$ -inch round-edged boards. The log rule for the 12-foot length is based on actual mill tally, while the rules for the 10- and 14-foot lengths were constructed by subtracting and adding  $\frac{1}{8}$  of that scale, respectively.



TABLE XLIV.—LOG RULE FOR SECOND-GROWTH HARDWOODS.  
SOUTHERN NEW HAMPSHIRE.

[Cut into 1½-inch, round-edged boards; circular saw, ¼-inch kerf.]

Diameter inside bark at small end of log.	Length of log—feet.		
	10	12	14
Inches.	Contents—Board feet.		
4	6	8	10
5	9	11	13
6	13	16	19
7	18	22	26
8	25	30	35
9	32	39	46
10	42	51	60
11	54	65	76
12	68	82	96
13	83	100	117
14	100	120	140
15	117	141	165
16	137	165	193
17	160	192	224
18	185	222	259

Based on 1,831 12-foot logs.

TABLE XLV.—LOG RULE FOR SECOND-GROWTH HARDWOODS.—  
SOUTHERN NEW HAMPSHIRE.

[Cut into 1½-inch, round-edged boards; circular saw, ¼-inch kerf.]

Diameter outside bark at middle of log.	Length of log—Feet.		
	10	12	14
Inches.	Contents—Board feet.		
6	9	11	13
7	13	15	17
8	18	21	24
9	25	29	33
10	32	37	42
11	42	49	56
12	52	61	70
13	64	75	86
14	78	91	104
15	92	107	122
16	108	126	144
17	123	143	163
18	141	165	189
19	160	187	214
20	180	210	240

Based on 1,831 12-foot logs.

TABLE XLVI.—RELATION BETWEEN DIAMETER INSIDE BARK AT SMALL END AND DIAMETER OUTSIDE BARK AT MIDDLE OF 12-FOOT LOG. SECOND GROWTH HARDWOODS.

Diameter inside bark at small end of log.	Diameter outside bark at middle of log.	Diameter outside bark at middle of log.	Diameter inside bark at small end of log.
<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
4	5.1	6	4.9
5	6.1	7	5.9
6	7.1	8	6.9
7	8.1	9	7.9
8	9.1	10	8.8
9	10.2	11	9.8
10	11.2	12	10.7
11	12.3	13	11.6
12	13.4	14	12.5
13	14.6	15	13.4
14	15.7	16	14.3
15	16.9	17	15.1
16	18.0	18	16.0
17	19.2	19	16.8
18	20.4	20	17.6

TABLE XLVII.—LOG RULE FOR SPROUT CHESTNUT, SOUTHERN NEW HAMPSHIRE.— CUT INTO 1½-INCH ROUND-EDGED PLANK.

Diameter outside bark at middle of log.	Length of log, 12 feet.	Basis.
<i>Inches.</i>	Contents—Board feet.	Logs.
8	21	4
9	33	5
10	43	97
11	50	197
12	59	229
13	71	162
14	82	117
15	96	60
16	108	32
17	122	14
18	136	9
19	150	1
20	165	...
21	185	1
22	209	1
		929

## FINANCIAL STATEMENT.

---

Statement of the expenses of the Forestry Commission from June 1, 1906, to August 31, 1908, from the report of the state treasurer:

	15 months to August 31, 1907.	1 year to Au- gust 31, 1908.
Salaries .....	\$1,250.00	\$1,000.00
Incidentals .....	1.65	
Printing report .....	823.38	350.00*
Printing blanks .....	13.93	68.79
Expense .....	128.53	23.43
	<hr/>	<hr/>
Totals .....	\$2,217.49	\$1,442.22

\*This item was a charge for illustrations in the last report of the Forestry Commission, which item was held up and was not paid until November 7, 1907, too late to appear in the year's business, where it belonged.

STATEMENT SHOWING THE AMOUNTS PAID BY THE  
FOREST SERVICE AND THE NEW HAMPSHIRE  
FORESTRY COMMISSION ON ACCOUNT OF  
THE PROJECT, "FOREST TAXATION  
IN NEW HAMPSHIRE."

PAID BY THE FOREST SERVICE.

Salary, J. H. Foster:	
July 1-31, 1908 .....	\$100.00
Aug. 1-31, 1908 .....	100.00
Sept. 1-30, 1908 (part) .....	60.00
Expenses, J. H. Foster:	
June 1-30, 1908 .....	71.39.
July 1-31, 1908 .....	54.74
Aug. 3-27, 1908 .....	32.13
Transportation, J. H. Foster:	
Request No. 23141, Boston to Washington, D. C., August 26, 1908.....	11.05
Request No. 75302, Washington, D. C., to New Haven, Conn., March 6, 1908.....	7.15
Salary, P. P. Wells:	
Six days, July, 1908.....	50.00
October 22 to 27, inclusive, 1908.....	50.00
November 3 to 5, inclusive, 1908.....	25.00
Expenses, P. P. Wells:	
July 1-27, 1908 .....	49.51
Typewriting .....	10.00
Total .....	<hr/> \$620.97



## PAID BY THE NEW HAMPSHIRE FORESTRY COMMISSION.

## Salary, J. H. Foster:

Mar. 1-31, 1908 .....	\$83.34
April 1-30, 1908 .....	83.33
May 1-31, 1908 .....	83.33
June 1-30, 1908 .....	83.34

## Expenses, J. H. Foster:

Mar. 6-31, 1908 .....	60.80
April 1-30, 1908 .....	70.16
May 1-31, 1908 .....	42.04

## Expenses, P. P. Wells:

Oct. 22-27, inclusive, 1908 .....	43.42
Nov. 3- 5, inclusive, 1908 .....	46.00

Total .....	\$595.76
Deposited by the New Hampshire Forestry Com- mission .....	\$1,000.00
Expended .....	595.76
Balance .....	\$404.24

*ERRATA.*

Page 131, Table III, column 4. Volume of a 24-inch, 70-foot tree is 650 board feet instead of 550.

Page 162, Table XXIV, column 5. Taxes on land accrued at 45 years should be \$3.34 instead of \$2.34.

Page 172, Table XXX, top of column 6. The volume of a tree 9 inches in diameter and 70 feet high is 85 board feet instead of 65.

## ACCOUNT OF ROBERT P. BASS, TREASURER N. H. FORESTRY COMMISSION.

Amounts received from Robert E. Faulkner, being his salary as secretary of the commission:

1907.

April	1.	By check .....	\$250.00
July	1.	By check .....	250.00
Oct.	1.	By check .....	250.00
Jan.	1.	By check .....	250.00

1908.

April	1.	By check .....	250.00
July	1.	By check .....	250.00
Oct.	1.	By check .....	250.00

Total receipts .....	\$1,750.00
----------------------	------------

### DISBURSEMENTS.

1908.

March	7.	To check to treasurer Federal Forest Service for investigation of taxation in New Hampshire. (See detailed account.) .....	\$1,000.00
June	12.	To check to Charles A. Lyford, in payment of traveling expenses incurred in coming to New Hampshire to consult with Commission of Taxation, report .....	73.14
June	29.	To check to Charles A. Lyford, traveling expenses for second conference .....	21.95
Nov.	17.	To check to P. W. Ayres for services in making report to National Conservation Commission .....	300.00

Total disbursements .....	\$1,395.09
Balance on hand .....	354.91
	\$1,750.00