

FIRST ANNUAL REPORT
OF THE
NEW HAMPSHIRE
FORESTRY COMMISSION.

1893.

VOLUME I. . . . PART I.

CONCORD:
EDWARD N. PEARSON, PUBLIC PRINTER.
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PRINTED BY
REPUBLICAN PRESS ASSOCIATION,
CONCORD, N. H.

STATE OF NEW HAMPSHIRE.

REPORT OF FORESTRY COMMISSION.

To His Excellency the Governor and the Honorable Council:—

The Forestry Commission appointed in accordance with the provisions of an act of the legislature, approved March 29, 1893, submits the following report for 1893 :

The members of the Commission met in Concord on June 7, 1893, and organized by choosing Hon. George B. Chandler to be its president and Mr. George H. Moses to be its secretary.

The Commission at once began its work, and has pursued it uninterruptedly during the intervening six months, but the nature of the work makes impossible, at the end of so brief a period, any extended narrative of accomplishment.

A wide-spread misapprehension appears to prevail, both in and out of the state, regarding the duties and powers of this Commission. These are not general and broad, but specific and narrow. Examination of the statute authorizing the appointment of this Commission shows that the principal immediate objects that the legislature sought to accomplish by it were two : First, to obtain accurate information regarding the forests of the state, the rate and method of their removal, and the resulting effects, economic, social, and climatic ; second, to secure public discussion of forestry interests.

Under that statute it was made "the duty of the Forestry Commission to investigate the extent and character of the original and secondary forests of the state, together with the amounts and varieties of the wood and timber growing therein ; to ascertain, as near as the means at their command will allow,

the annual removals of wood and timber therefrom, and the disposition made of the same by home consumption and manufacture, as well as by exportation in the log; the different methods of lumbering pursued, and the effects thereof upon the timber-supply, water-power, scenery, and climate of the state; the approximate amount of revenue annually derived from the forests of the state; the damage done to them from time to time by forest fires; and any other important facts relating to forest interests which may come to their knowledge." These investigations were instituted, and are now in progress.

In some cases it appeared that these investigations could be made at less expense, and perhaps with more success, by some other state agency, and in these cases such agencies, whenever practicable, have been employed. For instance, the specific investigation which this Commission was empowered to make, with regard to "the extent and character of the original and secondary forests of the state, together with the amounts and varieties of the wood and timber growing therein," had already been undertaken by another state agency—the commissioners appointed to appraise the timberland of the state for purposes of taxation. That board was already at work when the Forestry Commission was organized, and it was deemed unwise to subject the state to the expense of doing the same work twice, as the commissioners of appraisal were taking data, from personal investigation, from which this board could easily learn the necessary facts. These data the commissioners of appraisal have placed at our disposal, and when this work is completed our tabulations will be made. The work of the commissioners of appraisal has been most carefully and accurately done, and their kindness has greatly reduced the expense of the Forestry Commission.

Such other investigation as the statute required has been taken up, and will be carried on until some measure of completeness is attained, before the results are published.

In addition to these enumerated duties of investigation, the Forestry Commission was also enjoined to "hold meetings from time to time in different parts of the state for the discussion of forestry subjects." This is practically the only feature of the

Commission's work in which it is at liberty to exercise any discretion. This branch of forestry work is not new in our state, and had been carried on, to some extent, by our predecessors, the temporary Forestry Commission authorized by the legislature of 1889. This, one of the most effective means by which any propaganda may be spread, has had hitherto only one drawback, so far as it relates to the forestry movement in New Hampshire. Audiences have been found with difficulty. For us this difficulty has been removed by the enthusiastic co-operation of an organization which has kindly furnished audiences. The Patrons of Husbandry have generously thrown open their programmes, for Pomona and subordinate grange meetings, for the introduction of forestry topics. In addition, the board of agriculture readily acceded to our request for a place on the programme of their annual field meeting at Boar's Head, and Mr. Bryant, of our board, made excellent use of this excellent opportunity. Besides this, the Forestry Commission co-operated with the board of agriculture in a general agricultural convention, which assembled at Keene, December 26, for a three days session, and at which three addresses on forestry topics were delivered.

Under this branch of their work the Commission sought the co-operation of the authorities of the New Hampshire College of Agriculture and the Mechanic Arts, and as a result a series of lectures on forestry has been incorporated into the "Institute course," planned for a feature of the work of the winter term at the college. These lectures, four in number for this season, are to be delivered by members of the Commission or by speakers appearing under the auspices of this board.

The legislature, by the same act by which it established this Commission, sought to provide adequate protection to the forests of the state against what many persons deem their worst enemy, fire. Selectmen of towns are made fire wardens, and it is their duty, under the law, to proceed at once, on learning of a forest fire, to the scene of the conflagration and to take suitable measures for its suppression. In localities where no town organizations exist, the county commissioners are authorized to appoint fire wardens; and the expense of extinguishing forest

fires falls upon towns in which the fires occur, or upon the county in case the fire occurs in a community where no town organization exists.

At the first meeting of the board the secretary was instructed to call the attention of selectmen and county commissioners to these provisions of the forestry law, and the county commissioners were asked to make their appointment of fire wardens for unincorporated places, and to notify the Forestry Commission of their action. To this request no answer was returned, and later another communication was forwarded, which met a similar silence.

Under these circumstances, the Commission did not deem its duty done until, after consultation with the Governor and Council, it had caused the different provisions of the Public Statutes, prescribing heavy penalties for the setting of forest fires, to be printed on cloth and to be posted in forest districts. The expense of this work was greatly reduced by the co-operation of lumbermen in different parts of the state, to whom these placards were sent, and who assumed the labor of posting them.

The importance of an effective system for the prevention of forest fires in the state cannot be overestimated. The match of a careless smoker, the burning wad of a hunter, or the camp-coals of a shiftless hunting-party, may be the cause of greater injury to a timber-tract than the axes of a thousand choppers working no matter how carelessly and cutting no matter how closely. The condition of the forests of New Hampshire renders them more exposed to this danger. The original forests are filled with the debris of windfalls and with underbrush, and the scene of a lumberman's operations is always littered with the refuse of his cuttings; chips, branches, and tree-tops, excellent fuel for a forest fire, lie ready for a stray spark, and beneath all our forests, original and secondary, are the vast beds of "duff," light, porous, and inflammable, a spongy reservoir holding the spring rains, but in the last days of summer, or in the autumn, when the hunter is astir, a bed of tinder for a spark's lodgment.

So far as our towns are concerned the forests are assured for the most part of reasonable protection against fire, as the selectmen have been measurably prompt in discharging their duties

as fire wardens when once they have learned them. But in the communities where no town organizations exist the forests are no better off under the new law than they were without it, for the county commissioners have neglected to make the appointments authorized, and the most extensive and most heavily timbered of all our forest tracts are left without official protection against their deadly enemy, fire. This portion of the law is clearly ineffective, and its deficiencies will be brought to the notice of the next legislature in the hope of securing some adequate remedy.

The selectmen throughout the state have been asked to make return to the Forestry Commission of such forest fires as might occur in their respective towns, together with the amount of damage done, the extent of territory burned over, the character of the growth destroyed, the probable origin of the fire, and the cost of extinguishing it.

Another provision of the forestry law of 1893 was that the state might exercise its right of eminent domain in the taking of forest land for park purposes whenever the money to pay the appraised price of the condemned tract should be furnished from any other source than the state treasury. No one has yet taken advantage of this opportunity to benefit all our people. On the contrary, persons who are looking for investments in forest lands continue to seek first their own advantage. In one instance which has come under our observation, an extortionate price was paid for certain rights in a small tract of mountain land where, had the forestry law been invoked, greater rights might have been obtained for less money. And in another instance an association was willing, and even anxious, to have the state exercise its powers of eminent domain in behalf of the purchasers, but had no desire to vest the title thus acquired in the state.

In view of these facts attention may be directed properly at this time to another method of securing practically the same end, the preservation of forest-areas, through what is called the co-operative plan.

There are vast areas of land in New Hampshire which may be had for a song. Much of it is covered with some sort of

timber-growth, some valuable, some worthless, and all of it capable, with little attention, of producing a valuable timber-crop. Such tracts are good investments, and many of them are in such a condition that a yearly revenue sufficient to pay a reasonable interest on the cost may be taken off from the first. Others may require a longer time to be realized upon, but there is no doubt of their value. The co-operative plan of forest preservation takes advantage of these facts, and combines the small contributions of many persons who form associations with sufficient capital to purchase mountain and timber-tracts of reasonable size. The co-operative plan in its farthest development comprehends the erection of cottages and club-houses, hotels perhaps, and designs to give two returns to the investor, the first being health and pleasure; the second will be a money-dividend which will accrue from a rational application of forestry principles to the timber-crop which the tract is qualified to produce.

This plan was first outlined by Mr. George B. James, of Boston, president of the New Hampshire Land Company, in an address before the Gridiron Club, of Boston, an organization which has since, by the generosity of the originator of the plan, acquired an estate in Waterville, so that the practical aspects of the co-operative plan for the preservation of the forests will be given ample demonstration.

Besides this, another tract, 2,500 acres in extent, situated in Andover, and comprising some portion of Ragged Mountain, has been secured by another association made up of citizens of our own state and Massachusetts. This reservation will be maintained on the co-operative plan, and will be used for recreation purposes. The standing timber on the tract will be treated in accordance with correct forestry principles, and the present season will witness the harvesting of a crop of matured timber to an amount sufficient to pay for the tract. In this co-operative investment there is to be an immediate return and the proprietors of the tract will enter into their possession free of cost, and find it in better condition than when they took the deed, because of the removal of the matured timber which would, if left standing, deteriorate faster than it grew.

The Ragged Mountain reservation meets the conditions of the co-operative plan more fully than does that of the Gridiron Club. The latter was the gift of one man, and he the originator of the plan; the former was purchased by the individual investment of the members of an association, and they, we may add, are well satisfied with their original investment, and are seeking now to add 2,000 contiguous acres to their first reservation.

With the lumbermen of the state the board has cultivated friendly relations. Many of them already perceive that their interests and the forester's interests are identical, and we are not without hope that the others will soon come to realize that it pays best in the long run to so treat our timbered areas that they shall produce successive crops of value in the least possible time, and that then all the lumbermen will co-operate to establish and maintain a wise system of forestry in New Hampshire. Substantial basis for this hope is found in a study of the conditions of ownership which govern the wooded areas of the state. Apparently we have reached such a point in the distribution of titles to forest areas that we are not likely to see many more large transfers of timber land. This means that lumber operators must henceforth confine their cuttings to the holdings of land which they now possess. Therefore, it behooves them to treat their possessions so as to insure their perpetual use with profit. This can be done only through the application of forestry principles. There are not wanting instances in which such a course is already followed, and it is believed there will be more in the future.

GEORGE B. CHANDLER,
NAPOLEON B. BRYANT,
JAMES F. COLBY,
GEORGE H. MOSES,

Forestry Commissioners.

NEW HAMPSHIRE FORESTRY LAW.

(SESSION OF 1893.)

Be it enacted by the Senate and House of Representatives in General Court convened :

SECTION 1. There is hereby established a forestry commission, to consist of the governor, *ex-officio*, and four other members, two Republicans and two Democrats, who shall be appointed by the governor, with the advice of the council, for their special fitness for service on this commission, and be classified in such manner that the office of one shall become vacant each year. One of said commissioners shall be elected by his associates secretary of the commission, and receive a salary of one thousand dollars per annum. The other members shall receive no compensation for their services, but shall be paid their necessary expenses incurred in the discharge of their duties, as audited and allowed by the governor and council.

SECT. 2. It shall be the duty of the forestry commission to investigate the extent and character of the original and secondary forests of the state, together with the amounts and varieties of the wood and timber growing therein; to ascertain, as near as the means at their command will allow, the annual removals of wood and timber therefrom, and the disposition made of the same by home consumption and manufacture, as well as by exportation in the log; the different methods of lumbering pursued, and the effects thereof upon the timber-supply, water-power, scenery, and climate of the state; the approximate amount of revenue annually derived from the forests of the state; the damages done to them from time to time by forest fires; and any other important facts relating to forest interests which may come to their knowledge. They shall also hold meetings from time to time in different parts of the state for the discussion of forestry subjects, and make an annual report to the governor and council, embracing such

suggestions as to the commission seem important, fifteen hundred copies of which shall be printed by the state.

SECT. 3. The selectmen of towns in this state are hereby constituted fire wardens of their several towns, whose duty it shall be to watch the forests, and whenever a fire is observed therein to immediately summon such assistance as they may deem necessary, go at once to the scene of it, and, if possible, extinguish it. In regions where no town organizations exist, the county commissioners are empowered to appoint such fire wardens. Fire wardens and such persons as they may employ shall be paid for their services by the towns in which such fires occur, and in the absence of town organizations, by the county.

SECT. 4. Whenever any person or persons shall supply the necessary funds therefor, so that no cost or expense shall accrue to the state, the forestry commission is hereby authorized to buy any tract of land and devote the same to the purposes of a public park. If they cannot agree with the owners thereof as to the price, they may condemn the same under the powers of eminent domain, and the value shall be determined as in the case of lands taken for highways, with the same rights of appeal and jury trial. On the payment of the value as finally determined, the land so taken shall be vested in the state, and forever held for the purposes of a public park. The persons furnishing the money to buy such land shall be at liberty to lay out such roads and paths on the land, and otherwise improve the same under the direction of the forestry commission, and the tract shall at all times be open to the use of the public.

SECT. 5. This act shall take effect upon its passage.

[Approved March 29, 1893.]

PROVISIONS OF THE PUBLIC STATUTES 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 wilfully, 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.

SECOND ANNUAL REPORT
OF THE
NEW HAMPSHIRE
FORESTRY COMMISSION.

1894.

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REPORT.

To his Excellency the Governor and the Honorable Council:

In compliance with the law, the New Hampshire Forestry Commission respectfully submits the following report for the year 1894:

Further experience confirms the impression expressed in our last report, that a widespread misapprehension in respect to the powers and duties of this commission exists both within and without the state. This makes it necessary again to call attention to the fact that the legislature which framed the forestry law of 1893, sought only facts upon which to base a proper forestry policy for New Hampshire, and so authorized the appointment of a forestry commission, with power only to investigate forest conditions and to report.

The work which the legislature laid upon the commission embraced the whole subject of forestry, except as it relates to the practical application of scientific facts to existing conditions.

AREA OF OUR FORESTS.

Our first duty was "to investigate the extent and character of the original and secondary forests of the state, together with the amounts and varieties of the wood and timber growing therein." The area of the forests of New Hampshire comprises practically sixty per cent. of the entire surface of the state, and has not greatly changed since the publication of the excellent report of the first temporary forestry commission in 1885. The 5,763,200 acres

of territory comprised within the limits of the state of New Hampshire were then divided into

1. Tillage land about 800,000 acres.
2. Pasture land about 1,508,112 acres.
3. Unimproved land, mostly forests, 3,455,088 acres.

More in detail the division of area may be shown as follows :

Counties.	Areas of each.	Improved land.	Unimproved land.	Per cent. of unimproved land.
Belknap	256,000	167,167	88,833	35 per cent.
Carroll	499,200	180,575	318,626	64 "
Cheshire	499,200	233,845	265,355	53 "
Coös	1,267,200	139,089	1,128,171	90 "
Grafton	976,000	425,783	550,217	56 "
Hillsborough	627,200	301,752	325,448	51 "
Merrimack	588,800	305,282	283,518	48 "
Rockingham	473,600	223,544	250,056	53 "
Strafford	204,800	125,087	79,713	39 "
Sullivan	371,200	205,988	165,212	44 "
Totals	5,763,200	2,308,112	3,455,140	

From the above table it will be seen that the amount of unimproved area of the state which may be classified chiefly as forest, varies from 35 per cent. in Belknap county, to 90 per cent. in Coös, and that the cleared and wooded surfaces in Hillsborough, Rockingham, Cheshire, and Merrimack counties are very nearly equal, being in area about 50 per cent. of their total area. It should also be borne in mind that considerable portions of Belknap and Carroll counties are covered with water, a fact which must not be forgotten when considering the unimproved areas of those counties.

Speaking broadly, the area of land in New Hampshire under forest cover is apparently increasing, despite the enlarged operations of the lumbermen. This statement, however, is assumed by many persons to imply that all forest is timber, and upon that assumption is based the fallacious argument of those who decry the agitation of forestry in New England. Their bald and unqualified assertion is

misleading, and should always be accompanied by the supplementary statement that tree growth is not necessarily timber, though so far as some of its economic, scenic, and climatic advantages are concerned, almost any kind of tree growth passes for forest. The increased forest area of New Hampshire consists largely of abandoned farms and pasture lands, which are rapidly growing up to trees. The character of the growth, however, is of such a nature as to render the wood thus produced entirely unfit under present conditions for commercial use, and therefore these tracts can for the present be dismissed from the consideration of the forester.

The forest in our state, and practically the only forest with which economic or sentimental forestry will have to do for many years to come, is that magnificent growth which clothes the slopes of the White Mountains, and extends northward to the highlands of the St. Lawrence. To this most important forest this commission has given its almost undivided attention, leaving for subsequent investigation the forest of secondary growth, which of late years has been springing up so rapidly in our southern counties. This already has become an object of commercial value, and soon will demand scientific treatment to insure continuing profit to its owners and permanent benefit to the state.

CHARACTER OF THE FOREST COVER.

The maps prepared to accompany this report will show more graphically than the above statistics can the extent and character of our forest cover. The map embracing the entire state shows the limits of the distribution of forest in New Hampshire, and makes plain the wide expanse of forest areas which the state contains. The larger maps of the three heavily wooded counties, Coös, Grafton, and Carroll, with their appropriate tints indicate original and secondary forest and arable land. Though the extent and character of the forest cover of northern New Hampshire is believed

to be fairly outlined by the different tints upon these maps, no claim is made for absolute correctness in the shadings. The work of preparing these maps was carried on under great difficulty. To have completed it as the work deserved would have required a full and accurate survey of all the forested areas of northern New Hampshire, a task which, from the rugged contour of the greater part of the north country, is rendered very difficult as an engineering feat, and extremely expensive as an administrative work. In view of these facts we have been obliged to rely upon such expert testimony as could be gathered from surveyors and cruisers of long experience, from owners and operators in timber lands, from the lumbermen themselves, from county commissioners and from selectmen of towns.

So far as these maps relate to the area and location of the original forests in the state we believe them to be as accurate as they can be made without an expensive survey. The same statement applies also to these maps so far as they relate to the greater areas of secondary forest growth, although several towns which are represented upon the map as being completely covered with a secondary forest, boast a few tenantable and profitable farms, but upon the whole their predominant character is that indicated upon our maps. The arable land in northern New Hampshire is very much scattered, and is interspersed with a great deal of timber, chiefly in the form of woodlots upon farms, and aggregates only a few acres in one lot. To indicate upon these maps the location and proportionate size of such woodlots was manifestly impossible with the means at our command, and so, wherever the farm land greatly predominates over the secondary or original growth, the entire township has been shaded to indicate its agricultural nature. Thus, of the towns in Coös county bordering on the Connecticut it may be said that there is in each a considerable area of forested tracts, yet they are so scattered and so small as to render it impossible to class these towns

other than as purely agricultural. This statement applies with equal force to many towns in Grafton and Carroll counties.

THE FOREST PRODUCT.

Another duty laid upon the commission was to ascertain the amount of wood and timber growing within the forests of the state. This commission, as was stated in its first report, in order to avoid unnecessary expense, sought to ascertain these facts through another state agency—the commission for the appraisal of lands in unorganized districts. The expiration of the term of this latter commission before its work was completed, has made it impossible for us to present any definite report upon this subject at the present time, without incurring an expense so large as to seem to us unwarranted without a specific appropriation. Pending the authorization of such an expenditure, we have sought to obtain the testimony upon this subject of numerous experts. These concur in the judgment that the estimate made by Mr. George T. Crawford may be accepted as an approximately accurate statement of the amount of marketable timber now standing in the White Mountain forests. That estimate is as follows:

BOSTON, DECEMBER 24, 1894.

George H. Moses, Esq., Sec. N. H. Forestry Commission:

DEAR SIR: In accordance with your request I herein submit some facts relating to the areas of the primeval forest growth of spruce in New Hampshire, also an approximate estimate of the amount cut for lumber and wood pulp each year.

ACREAGE.

Connecticut river waters in Coös county.....	150,000	acres.
" " Grafton " 	50,000	"
Androscoggin " Coös " 	150,000	"
Pemigewasset " Grafton " 	150,000	"
Saco " Carroll and Grafton county	25,000	"
Total in the state.....	525,000	"
About 300,000 acres of which is in the White Mountain district.		

PRODUCT.

The annual product from this acreage is for lumber about 240,000,000 feet board measure, and for pulp, about 40,000,000 feet board measure. A total of about 280,000,000 feet. The amount used for pulp is increasing about 15 per cent. per year. The lumbermen, as a rule, continue to cut their lands "clean" or down to six inches in diameter, at the stump, thereby destroying all opportunity for a reproduction of spruce by growth of small trees.

The large pulp mills, which own large tracts of virgin forest, have adopted the system of cutting no spruce trees less than 12 inches in diameter at the stump, and are already reaping the benefits of such a course.

From the economic view, the system pursued by the lumbermen is doing an incalculable damage to the state and its resources, while from the scenic standpoint the damage is great for the present, but nature will quickly reproduce a growth of some kind to cover the nakedness of a denuded forest, but that growth will be of little material or commercial value for ages to come. It is a difficult matter to remedy this evil by legislation in the line of the ideas of certain enthusiasts,—yet, if your commission can succeed in educating the lumbermen into a system of cutting mature trees only, it will confer a favor, looking directly, not only to the interest of the lumberman himself, but to the best interests of the entire state, and will alone be worth all its costs.

Yours very truly,

GEO. T. CRAWFORD.

In this connection the commission was further directed to ascertain the varieties of wood and timber growing in the forests of the state.

The great variety of surface and soil and elevation in the state makes it the habitat of nearly every species of shrub and tree found in northern New England; over one hundred and eighty different species of woody plants grow within our borders. More than one half of these are either large shrubs or trees, and of these latter over sixty are trees of commercial value.

A complete list of the "Trees and Shrubs composing the N. H. Forests" was prepared by William F. Flint, B. S., an experienced woodsman and a member of the Forestry Commission of 1885, after a personal observation of all parts of the state, and it was published in the report of that commission for 1885. This list has since been revised by Prof. Henry G. Jesup, of Dartmouth college, another

member of that commission, and will be found in Appendix A.

The commission was also directed to ascertain, as nearly as the means at its command would allow, the annual removals of wood and timber in the state, and the disposition made of it by home consumption and manufacture, as well as by exportation in the log. A systematic attempt of this commission to obtain this information soon proved that the results of its labor would be meagre, inaccurate, and unsatisfactory, because nearly all of the manufacturers and operators to whom our inquiries were directed evidently considered them either impertinent or unnecessary, and neglected or refused to make answer. Under these circumstances the only means left at our command for ascertaining the annual removals of timber from our forests was through the consensus of opinion of those engaged in the work of timber removal. According to such expert opinion it appears that the annual removal of wood and timber approximates three hundred million feet.

THE LUMBER INDUSTRY.

These figures apply only to the removals of spruce timber, and as the law gives us no power to compel answers to our inquiries, we have not been able to find any means of estimating the annual removals of other varieties of timber and of wood, nor of the disposition made of the same by home consumption and manufacture, as well as by exportation in the log, except such as are furnished by the tables showing the values of the entire manufacture and product of the state.¹ These important statistics were collected by the census bureau of the United States in 1890, and under ordinary circumstances would not have been ready for publication for several months to come, and now are made available for this report only through the courtesy of Hon. Carroll D. Wright, commissioner of labor in charge of the Census Bureau. In this way it is

¹ See Appendix B.

now possible to present herein the entire results of the United States census of 1890, so far as they relate to the lumber industry of New Hampshire, and thus accurately inform the state regarding the extent and magnitude of the manufacturing interests dependent upon the maintenance of our forest cover.

It is doubtful if many citizens of New Hampshire have had any adequate idea of the magnitude of our lumber and saw-mill industry, and it is probable that when the complete returns for the eleventh census are tabulated in such form as to render comparison easy, it will be found that that industry is second to none in the state, and that the return upon the capital invested probably exceeds that of any other manufacturing enterprise. By reason of the minuteness with which the Census Bureau conducted its investigations and the care with which it prepared the results for publication, the tables which appear in our appendix present accurately the capital invested in logging, milling, handling, and manufacturing the timber product, the number and classes of operatives employed, the total capital used, the amount of wages paid, and the value of the product.

Another disposition of the forest product of which these figures from the Census Bureau make no mention will be found in the subjoined tables which deal with the pulp and paper industry, and which have been kindly furnished us by Mr. George T. Crawford, of Boston, Mass. The larger table, taken from the *American Paper Trade Journal*, of the date of July 12, 1894, shows in gross the relative position of the different states with regard to their production of paper and pulp. The smaller table presents in detail the statistics of this industry for New Hampshire, and indicates the daily production in towns of every pulp mill in the state, together with the superficial area of spruce timber consumed in the manufacture of the pulp, and the source of supply of wood material for each mill.

STATISTICS OF DAILY PRODUCTS OF WOOD PULP IN
NEW HAMPSHIRE, 1893.

Name of Location.	Kind of Pulp.	Quantity.	Superficial feet spruce used annually.	Where Cut.
Berlin Mills Co., Berlin Falls.	Ground.	15 tons.	2,768,000	1,000,000 in N. H.; balance in Me.
Burgess Sulphite Fibre Co., Ber- lin Falls.	Sulphite.	20 "	8,000,000	2,000,000 in N. H.; balance in Me.
Forest Fibre Co., Berlin Falls.	Chemical.	(Runs part of time.)		1,000,000 in N. H.
Glen M'fg Co., Berlin Falls.	G. and Sul- phite.	100 tons.	22,000,000	20,000,000 in N. H.
Mason & Perkins Paper Co., Bris- tol.	Ground.	11½ "	2,225,000	2,225,000 in N. H.
Train, Smith & Co., Bristol.	"	6 "	1,100,000	1,100,000 in N. H.
Garvin's Falls Pulp Co., Con- cord.	"	5 "	1,000,000	1,000,000 in N. H.
P. C. Cheney Co., East Tilton.	"	10 "	2,000,000	Canada.
Winnipiseogee Paper Co., Franklin.	"	34 "	6,400,000	6,000,000 in N. H.
Excelsior Fibre Co., Goffstown.	Sulphite.	5 "	1,800,000	Canada.
P. C. Cheney, Co., Manchester.	Ground.	10 "	2,000,000	2,000,000 in N. H.
United Indurated Fibre Co., Peterborough.	"	5 "	1,800,000	1,000,000 in N. H.
Emerson Paper Co., Sunapee.	"	5 "	1,800,000	1,800,000 in N. H.
Total,		226½ "	53,893,000	39,925,000
Cut in New Hampshire and used in mills out of the state, about.....				10,000,000
Total cut in New Hampshire for pulp.....				49,925,000 feet.

TABLE SHOWING THE DAILY CAPACITY IN POUNDS OF THE
 NING, AS REPORTED BY MANUFACTURERS FOR IN
 DIRECTORY OF THE

Submitted by Howard Lockwood & Co. in advance of the Seven-
 tion, to be held on July 25,

STATES.	Binders' board.	Blotting.	Book and news. (b)	Building, roofing, and sheathing.
Alabama.....				
California.....	2,000		89,000	
Colorado.....			58,000	
Connecticut.....	47,000	4,000	96,000	22,000
Delaware.....			86,000	
Georgia.....		500	5,500	
Illinois.....				45,000
Indiana.....			124,000	85,000
Iowa.....				
Kansas.....				
Kentucky.....			20,000	
Maine.....			543,000	
Maryland.....	3,000		125,000	5,500
Massachusetts.....	6,000	14,000	571,000	70,000
Michigan.....	4,000	12,000	161,000	12,500
Minnesota.....			10,000	25,000
Missouri.....				10,000
Nebraska.....				
New Hampshire.....			299,000	
New Jersey.....	60,800		16,000	52,000
New York.....	18,000		1,179,000	78,000
North Carolina.....			4,000	
Ohio.....	86,000	7,000	206,000	44,000
Oregon.....			40,000	
Pennsylvania.....	51,500		434,900	181,000
South Carolina.....				
Tennessee.....			6,000	
Texas.....				
Vermont.....			188,000	
Virginia.....		26,000	11,000	
Washington.....			14,000	
West Virginia.....			25,000	
Wisconsin.....			687,000	10,000
Totals.....	223,800	63,500	4,928,400	640,000
" for 1893-94.....	214,800	63,500	4,922,400	590,500
	9,000		1,000	49,500
Per cent. of gain.....	4 1-5		1-49	8 2-5
" of loss.....				
Totals for 1881.....	124,120	11,500	1,390,050	153,800
" 1883.....	165,820	15,000	1,682,650	272,800
" 1884.....	158,600	16,800	1,998,050	814,250
" 1885.....	184,050	15,800	2,029,350	818,750
" 1886-87.....	200,650	22,600	2,142,900	256,750
" 1887-88.....	187,150	22,600	2,279,400	887,000
" 1888-89.....	209,650	25,100	2,661,550	877,000
" 1889-90.....	217,200	24,100	2,837,850	444,500
" 1890-91.....	239,800	81,600	3,081,850	525,500
" 1891-92.....	212,800	43,600	8,785,150	498,000
" 1892-93.....	208,800	58,000	4,238,150	514,500
Per cent. of gain since 1881.....	79 11-12	452 1-6	254 1-5	816 1-8
" of loss since 1881.....				

(a) This table shows the daily CAPACITY, not the actual production of all the mills. The basis of the table is the statement and claims of manufacturers. In some instances figures have been altered when manufacturers have reported a producing capacity which was evidently incorrect, when compared with the size and number of engines, the power and other details in our possession, and which in themselves determine very closely what a mill can produce. About 7½ per cent. of the mills were idle at last reports, the capacity of which does

PAPER AND PULP MILLS OF THE UNITED STATES NOW RUN-
 SERTION IN THE TWENTIETH EDITION OF LOCKWOOD'S
 PAPER TRADE, 1894-95 (a).

*teenth Annual Meeting of the American Manufacturers' Associa-
 at Saratoga, N. Y.*

Card.	Chemical Fibre. (c)	Collar.	Color'd. (d)	Cotton Hull fibre.	Hanging and curtain.	Leather board.
	16,000					
22,000	12,000		89,000		8,000	14,500
	50,000		5,000			
	70,000					
	682,000					19,500
82,000	65,000		22,500		10,000	
4,000	110,000		17,000		16,000	28,500
12,000	190,000		4,000			16,000
	12,000					1,000
49,000	500,000		23,000		180,500	4,000
	90,000		28,000			
	20,000					
6,000	319,000		28,000		16,000	8,500
	10,000					
				12,000		
20,000	30,000				9,000	
	40,000					
	5,000					
	90,000					
	235,000		9,000			
195,000	2,526,000		171,500	12,000	284,500	87,000
178,000	2,210,000		178,000		270,500	95,000
17,000	316,000		6,500	12,000	36,000	8,000
9 9-16	14 8-10					
			8 2-3		13 2-7	8 4-9
41,000	259,500	14,000	111,900		112,200	94,800
82,600	466,000	9,000	95,760		154,300	77,100
84,500	576,000	5,500	104,900		159,800	129,100
89,500	587,000	5,500	108,650		191,400	101,500
108,500	537,000	4,500	100,150		191,400	92,250
103,750	602,000	1,000	110,400		185,100	85,750
106,250	617,000		121,600		210,100	71,500
133,750	866,500		113,800		228,600	87,500
147,850	1,111,500		181,850		224,400	92,800
149,850	1,543,500		140,600		249,200	86,500
183,250	1,786,000		176,500		265,000	87,000
875 5-8	878 2-5		58 1-4		109	
		100				7 7-9

not appear in this table. Total number of mills as last reported, 1,231; idle, 95.

(b) Every kind of book and newspaper from all classes of stock is embraced in this column.

(c) These totals include the product of mills making chemical fibre solely, and a considerable quantity of fibre made by mills for their own use. The totals do not, therefore, represent the *entire* production of chemical fibre.

TABLE SHOWING THE DAILY CAPACITY IN POUNDS OF THE
 NING AS REPORTED BY MANUFACTURERS FOR IN
 DIRECTORY OF THE

Submitted by Howard Lockwood & Co., in advance of the Seven-
 tion to be held on July 25,

STATES.	Manilla.	Palm fibre.	Press board.	Straw board. (e)	Straw fibre. (f)	Straw wrap- ping.
Alabama.....						
California.....	8,000			2,000		27,000
Colorado.....	8,500					8,500
Connecticut.....	71,000		25,800	53,000		
Delaware.....	16,000					
Georgia.....	9,000					
Illinois.....	42,000			286,500		246,700
Indiana.....	51,500			341,000		203,000
Iowa.....				16,000	20,000	88,000
Kansas.....	12,000					23,000
Kentucky.....						
Maine.....	188,000					
Maryland.....	45,000			28,000		26,700
Massachusetts.....	249,000		2,000	8,500		
Michigan.....	20,000			52,500		92,000
Minnesota.....	10,000					
Missouri.....				8,200		17,000
Nebraska.....						20,000
New Hampshire.....	47,000			10,000		
New Jersey.....	188,000			40,000		
New York.....	517,000			148,500		219,000
North Carolina.....	2,000					
Ohio.....	190,000			476,000		278,000
Oregon.....	6,000					10,500
Pennsylvania.....	170,000			14,000		20,800
South Carolina.....	8,000					
Tennessee.....	2,000					
Texas.....	4,000					6,000
Vermont.....	86,000			5,000		
Virginia.....	16,000			20,000		
Washington.....	9,000					4,000
West Virginia.....				30,000		13,000
Wisconsin.....	152,000			45,000		45,000
Totals.....	2,007,600		27,800	1,574,200	20,000	1,198,200
“ for 1893-94.....	1,908,100		27,800	1,671,580		1,068,650
	99,500			97,880	20,000	129,550
Per cent. of gain.....	5 1-5					12 1-12
“ of loss.....				5 2-3		
Totals for 1881.....	648,900		7,600	505,000	25,000	502,400
“ 1888.....	879,100		8,600	743,800	23,000	645,700
“ 1884.....	809,700	8,000	9,600	786,800	23,000	718,500
“ 1885.....	949,250	8,000	12,000	828,800	17,000	780,500
“ 1886-87.....	943,250	3,000	9,800	881,050	12,000	797,900
“ 1887-89.....	1,039,200	8,000	11,800	941,250	6,000	759,500
“ 1888-89.....	1,092,400		10,800	988,500	6,000	885,200
“ 1889-90.....	1,228,600		15,800	1,117,500	6,000	925,400
“ 1890-91.....	1,357,400		18,800	1,344,000	6,000	923,000
“ 1891-92.....	1,531,400		23,800	1,488,500	46,000	958,900
“ 1892-93.....	1,720,900		23,800	1,545,500		960,000
Per cent. of gain since 1881.....	209 1-3		265 3-4	211 7-10		137 1-2
“ of loss since 1881.....					20	

(d) All kinds of colored paper, except ordinary tinted book and writing, are included under this heading.

(e) This column includes many small “air-dried” mills, whose product for the season aggregates only a comparatively small amount.

(f) This does not include pulp made from straw at regular print mills, but only at such mills as sell to paper-makers.

PAPER AND PULP MILLS OF THE UNITED STATES NOW RUN-
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 PAPER TRADE, 1894-95

*teenth Annual Meeting of the American Paper Manufacturers' Associa-
 at Saratoga, N. Y.*

Tissue. (g)	Tissue manilla.	Wood pulp. (h)	Wood pulp board.	Wrap- ping. (i)	Writing. (j)	Miscel- laneous.	Total capacity of states.
.....	.....	4,000	.....	.....	.....	.....	4,000
1,000	.....	20,000	.....	8,000	.....	.....	97,000
.....	.....	24,000	.....	8,000	14,000	.....	122,000
13,000	2,700	.....	8,000	63,500	38,500	.....	535,000
.....	180	.....	.....	1,000	2,000	.....	160,180
.....	.....	9,500	.....	8,000	.....	.....	27,500
.....	.....	20,000	.....	111,500	.....	15,000	766,700
4,000	4,000	161,000	80,000	28,500	.....	.....	1,147,000
.....	.....	.....	.....	47,000	.....	.....	121,000
.....	.....	.....	.....	22,000	.....	.....	57,000
.....	.....	.....	.....	.....	.....	.....	20,000
.....	.....	763,000	61,000	10,000	5,000	.....	2,196,500
.....	.....	20,000	.....	1,500	.....	.....	264,700
8,600	800	82,000	.....	56,500	530,500	16,500	1,824,200
6,000	.....	68,000	24,000	30,000	24,000	.....	687,000
.....	.....	20,000	.....	15,000	.....	.....	80,000
.....	.....	.....	.....	10,000	.....	.....	40,200
.....	.....	.....	.....	.....	.....	.....	20,000
2,000	13,800	429,000	.....	8,000	9,000	.....	1,039,600
29,100	4,400	.....	62,400	40,400	4,000	5,000	459,700
19,700	31,000	1,892,400	112,000	140,000	41,000	2,000	5,149,100
.....	.....	5,000	.....	1,000	.....	.....	12,000
.....	.....	20,000	.....	107,500	24,000	19,000	1,428,500
2,000	.....	61,000	.....	8,000	.....	.....	147,500
5,800	10,200	84,000	7,000	89,000	67,500	6,000	1,512,300
.....	.....	.....	.....	.....	.....	.....	18,000
.....	.....	12,000	.....	4,000	.....	.....	36,000
.....	.....	.....	.....	4,000	.....	.....	14,000
5,500	13,000	320,000	39,000	.....	.....	.....	690,500
.....	.....	12,000	.....	10,000	11,000	.....	146,000
.....	.....	12,000	.....	12,000	2,000	.....	58,000
.....	.....	90,000	.....	.....	15,000	.....	268,000
8,000	.....	577,000	.....	32,000	99,000	7,000	1,897,000
.....
104,200	79,680	4,705,900	893,000	856,400	877,500	70,500	20,986,180
111,700	96,180	4,285,400	372,000	755,700	868,900	80,500	19,968,710
.....
7,500	16,500	420,500	21,000	100,700	18,800	10,000	1,027,470
.....
.....	.....	9 3-4	5 2-3	13 1-8	1 4-7	.....	5 1-7
6 8-11	17 1-7	.....	.....	.....	.....	12 8-8	.....
.....
14,300	40,180	484,300	39,000	428,400	305,700	2,250	5,815,400
24,850	45,180	633,450	43,000	489,400	354,900	38,800	6,949,800
23,850	40,630	795,550	46,000	517,000	409,000	35,900	7,367,830
24,700	50,180	835,830	58,000	523,750	407,700	42,900	8,147,060
24,250	58,960	960,600	65,000	486,550	407,000	41,400	8,854,480
30,550	64,760	1,085,900	61,000	480,600	456,200	58,900	8,957,830
36,250	50,880	1,536,500	83,000	477,250	474,700	49,900	10,091,180
33,850	46,580	2,607,600	95,500	583,750	567,100	58,500	12,224,480
36,450	58,030	2,900,700	129,500	595,750	560,000	60,000	13,561,180
77,500	59,730	2,953,700	186,000	685,750	589,600	64,500	15,219,580
88,500	103,480	3,400,800	187,000	708,700	706,000	74,500	16,970,380
.....
628 5-7	98 8-10	871 2-8	907 2-8	99 6-7	187	3,083 1-3	294 4-5

(g) Includes all kinds of white and colored tissue.

(h) Some ground wood pulp made and used at the paper mill is not included in these aggregates.

(i) Includes all grades of wrapping and bogus, except straw wrapping.

(j) Includes all grades of paper of bank note, ledger, flat, and folded, tub, and engine sized, and envelope paper.

The forestry law further prescribes that the commission shall investigate the different methods of lumbering pursued and the effects thereof upon the timber supply, water power, scenery, and climate of the state.

METHODS OF LUMBERING.

Two centuries ago practically the whole of New Hampshire was covered with forest, and the earliest lumbering operations in the state were undertaken to obtain land for agricultural uses. The methods employed were adapted to remove the forest cover in the shortest possible time, and may be described as a wholesale attack upon the forests with ax and with fire. The object sought by this method of forest removal—sufficient tillage and pasture land for the population—was attained about seventy-five years ago. Since that time there has been no reasonable excuse for using such indiscriminate methods, and it does not appear that any large areas have been wrested from forest control and turned over to agriculture during the past seventy-five years. Indeed the movement within the last fifty years has been in the other direction, and some of the land which was cleared a quarter of a century earlier has been turned over again to the care of nature.

After sufficient tillage and pasture land had been secured the remaining forest areas were regarded by their owners as a source of individual profit, and have been utilized steadily to secure such wood material as the needs of an increasing population have demanded. These needs in the early days of the state comprised timber for houses, for fences, and for ship building, and wood for fuel. To these requirements there must now be added an increasing demand for those manifold commodities which man's ingenuity has enabled him to furnish from the forest product, and which has thus given value to almost every variety of wood which our forests contain. The original demand for wood material just described was satisfied by

only the largest trees, and by only a few varieties of these. The pine alone gave our forests their first value. Timber, spars, fuel, fence rails, and naval stores (pitch and turpentine) were all supplied by the removal of that one variety of tree, while the hemlock was rapidly cut to secure its bark, and the oak was sought for pilings and ship timbers. Thus these species early disappeared, so that the forests of New Hampshire fifty years ago were made up almost wholly of spruce, fir, and a little cedar among the evergreens, and of birch, poplar, and maple among the hard woods. These trees then had only commercial value, and were first brought upon the market by the increasing demands of the lumber trade, which is yet fastidious, and finds no use for New Hampshire hard woods in appreciable quantities.

These conditions compelled the introduction of methods of lumbering which by cutting the forests tended to exterminate the desirable species of growth and to leave the ground to be covered by the less desirable species. For fifty years, at least, the New Hampshire lumberman has culled the forests more or less systematically with the result that the end of our spruce is in sight, and that, too, with but little chance for its reproduction. Nevertheless, the culling system of lumbering is really crude forestry, for under that system the lumberman commonly aims to remove only the mature trees. The crude character of this system arises from the careless manner in which it is applied, the heedlessness or ignorance of the woodsmen in felling the tree, in nearly every instance, producing more damage to the young growth than the profit on what is felled would repair. Yet there is much to commend this method of lumbering; it needs only to be applied with due care for the tree which is spared the direct application of the ax to convert it into genuine forestry, though not of the most prudent or scientific type.

Twenty-five years ago this method of lumbering was in general use throughout the state, and promised to develop

into a prudent if not a scientific scheme of forest management. This development was thwarted by man's genius in utilizing wood-fibre for the manufacture of paper, which radically changed the methods of lumbering, and set a new task for the forester.

LUMBERING *v.* FORESTRY.

A comparison of the pulp industry with the lumber business must be invidious to those controlling the former. No student of forestry can avoid the knowledge that with scarcely an exception the owners of pulp mills conduct their business with utter recklessness so far as the future of the forest is concerned. Competition in the lumber business has made it desirable and profitable for the mill-owner to manufacture only from large sized logs, while competition in the pulp business has led to a diametrically opposite result, and calls for trees of the most diminutive size while it rejects as waste products of the forest which might be easily and profitably utilized. Speaking broadly, it may be safely asserted with reference to the economic management of our forested areas that it is not what is used but what is wasted that causes the greater loss. It is this fact that emphasizes the difference between German forestry and American lumbering. The German forester rarely markets less than eighty per cent. of his tree product. The American lumberman rarely markets more than twenty per cent. of his tree product. To be sure, the social conditions in Germany and America are utterly unlike, and the scarcity of fuel which in Germany tends to make ready market for every limb, twig, and even root of the spruce tree, has never existed here. American conditions have thus far prompted the operator to seize only that kind of timber which was most advantageous and profitable for him to work, and have led him to treat as worthless that which might have swelled his profits to a considerable degree.

It is worth noting, however, that these conditions al-

ready have been greatly modified if they have not wholly ceased to exist. The world is admittedly approaching the exhaustion of its timber supply, and of the 3,500,000 acres of forest land which now remain in New Hampshire, a consensus of experts sets the original forest cover at only about 500,000 acres. None of this is free from the danger of immediate assault by operators who, impelled by their own wasteful methods, are driven to seek more promising fields of labor. The realization of the hardships that these conditions must soon impose is leading the more provident owners of timber lands to place restrictions upon their operations, and it is now by no means rare to find lumbermen who are beginning to apply some of the principles of forestry, and mill owners who are seeking to turn to account every forest by-product.

Such application of the principles of forestry was commented upon in our previous report, in which the opinion was expressed that more examples of this kind would soon be found among our lumber operators. That expectation, we are happy to state, is being fulfilled. In this increasing number of owners of timber-land who feel compelled to take measures for the protection of their forest, sometimes against themselves, is found the greatest fruit of the forestry agitation in New Hampshire.

While the number of lumbermen and mill owners who are trying to utilize every forest by-product must increase under the spur of competition, the great majority of them still conduct their business with prodigal wastefulness.

This wastefulness in lumber operations in New Hampshire not only entails loss upon the present owners, but is also a permanent injury to the forest itself. Those methods of lumbering which permit and even encourage the littering of the ground with a large amount of debris of tops and limbs are most reprehensible, and deprive the operator himself of a large per cent. of the profit which his tree might yield. The pulp mill to-day is demanding smaller trees for

its grinders, and the lumberman furnishes them, while neglecting the large tops which would serve the same purpose at less expense and with less detriment to the forest. The injury to the forest which this method of lumbering entails is increased by the danger from fire which grows out of the enlarged amount of refuse left upon the ground. The debris of an original forest is always great; the debris of a lumbered forest, as it too frequently presents itself, suggests nothing short of criminal carelessness in view of the risks of fire, for each dried and decaying top furnishes additional fuel for any chance flame, and diminishes the security of all adjoining proprietors if once a fire secures a foothold.

THE LESSON OF FORESTRY.

True forestry will teach the lumberman how best to utilize that which he now wastes. It will induce the managers of pulp mills to make use of tree tops instead of small trees. It will lead the operator to set up his charcoal kiln for the use of limbs only, and to every charcoal plant it will add an apparatus for securing the acid by-products of the kiln. It is gratifying to note that many of these things are now being done in our New Hampshire forests. The charcoal kiln is clearing many an acre of ground after the lumberman has passed over it, and experiments of chemists are convincing pulp makers that the tree top furnishes them their cheapest raw material. The by-products of the pulp mill, too, are receiving attention, and the latest problem which the forester has laid before the mill owner is how to save the half ton of starch which now goes down stream with the making of each ton of pulp, but which is twice as valuable as the pulp itself.

This commission in entering upon its work realized that one of the objects of the forestry movement in America is to harmonize the interests of the lumberman and the forester, and to provide due protection for the lumber industry, without needless sacrifice of the forest.

Accordingly it has been our constant aim to direct the attention of practical operators to such methods for utilizing present waste as are indicated above, and to induce the discussion of all new methods calculated to promote a more rational use of the forests. By the agitation of such subjects among those having the most immediate and largest pecuniary interest in the forest product it is hoped that much will be accomplished.

Meantime the effect of the removal of our forest cover as now carried on in New Hampshire is felt, if the fundamental theories of orthodox forestry are correct, throughout the whole range of the state's activities, and is more or less marked upon our timber supply which is vanishing, upon our water-power which is rendered variable and uncertain, upon our scenery which is defaced, and upon our climate which is made less inviting. Such in general are the results of forest removal in New Hampshire. But the magnitude of the private interests involved, the still greater importance to the state of their wise administration, and the consequent care which should mark any official statement, precludes any detailed report upon these subjects at this time. Investigations already begun upon these subjects, though convincing us of the truth of the general proposition above expressed, make proper a suspended judgment upon special points until such time as we shall be able to present a larger body of facts upon which to base our conclusions. We therefore postpone all publication of the results of this research until it shall cover substantially the entire field affected.

A CHANGE IS NECESSARY.

Enough evidence, however, has been collected already to warrant us in affirming that unless the owners of pulp mills and those operating for them shall make an early, radical, and complete change in their present methods of cutting, the state must soon face the question how it will stay the ruthless waste of its wealth and protect the interests of

future generations. By the exercise of the power of eminent domain for the creation of a series of public forest reserves, it could effectually secure these objects and make the White Mountain range a source of constant income, unfailing water supply, and perpetual scenic pleasure.

If public spirited citizens should, at any time, provide funds to establish such a series of public parks in accordance with the provisions of section 4, of the Forestry Act of 1893, of which no instances have yet occurred, substantially the same beneficial results would be realized.

But the power of eminent domain is not the only power available by the state for the protection of our forested areas. The police power is elastic and coextensive with all the interests of the state: its applications change and increase with the changing needs of an advancing society. In the opinion of many competent persons this power may be constitutionally applied to prevent the owners of forests, as well as of any other kind of private property, from so using their own as to injure others and especially the whole people. But without resort to any novel exercise of the police power, something, undoubtedly, can be done by the state to lessen the waste wrought by the indiscriminating axeman and so to promote the weal of subsequent generations. One method that has been suggested for securing these ends consists in the exemption of timber lands from taxation, upon condition that their owners will enter into agreement with the state to refrain from removing all except the matured timber thereon standing. The state of New York, by an act of its legislature, approved April 7, 1893, is now making trial of this means of preventing the waste of the forests in the Adirondack region. Another method open to fewer practical, and perhaps constitutional, objections for securing the same ends is state regulation of all incorporated lumber companies operating in New Hampshire, some of which at present are guilty of the most indiscriminate cutting. Fortunately, this

state, when granting charters to such companies, has reserved the right to amend or repeal, and hence unquestionably it is now competent to prescribe their methods of lumbering, and to limit them, under penalty of forfeiture of their franchises, to the removal of matured timber only, and to enforce its regulations by state inspectors.

While now only enumerating some proposed remedies for the evils which have been described, no one of them should be adopted without the fullest consideration. The enlightened self-interest of all operators who now cut indiscriminately and their increasing recognition of the just interests of the state, which creates and protects all their titles to private property, may indefinitely postpone such consideration. Otherwise, the adoption by the state of some legal remedy cannot be long delayed.

FOREST FIRES.

The first efforts of this board, which were directed toward securing adequate protection of our forest areas against fire, have not been relaxed during the present year, and these continued efforts have served to increase our conviction expressed a year ago, that the fire law of 1893 must prove ineffective. How ineffective it is we are fortunately unable to state fully, for during the past year our forests, unlike those in many other states, providentially have been free from any extensive ravages by fires, yet the damages, which have been so incurred, are sufficient to emphasize the necessity of an immediate and far-reaching amendment of section 3 of the Forestry Act.

There is little fault to be found with the manner in which the selectmen of towns have discharged their duties as fire wardens, and that part of the law which clothes those officials with the power to protect the forests of their towns against fire, appears to require only slight modification. That part of the law, however, which relates to the protection of the great forested areas, which are found in

the unincorporated townships of the northern counties of the state, should, in the opinion of this board, be amended. The provision by which county commissioners were empowered to appoint fire wardens for places where no town organizations exist has been wholly inoperative, and despite the frequently renewed and often vigorous and personal protests of this board, not a single fire warden for such places has been appointed under the provisions of that act.

Thus what appears to us to have been the plain intent of the framers of that act has been nullified by the neglect of the county commissioners to give effect to its only administrative feature. The only excuse given for this neglect, so far as we know, is that the cost of protecting these areas of forest ought not to be borne by the county, but that it is the duty of each man to protect his own forest. The legislature of 1893 seems to have judged this position to be untenable. The forest owners who have been denied the protection of the law then enacted, it must be assumed, have paid their assessed share of all taxes, and they therefor are entitled to all the benefits of the law. Nor is it any adequate answer to allege that they are not assessed proportionately, for if this is the fact, a remedy can be applied by the proper authority. At any rate the law contemplates the protection of our forests against fire as a public duty, and since, for the reasons above stated, it has proved inadequate to secure that result we shall suggest to the proper legislative committee, such changes in the present law as will, in our judgment, give the forests the protection they require, and which the state, in our opinion, intended to afford by the act of 1893.

CO-OPERATIVE FORESTRY.

The attempts at coöperative forestry which were referred to in our first annual report, and which were undertaken by

the Gridiron club in Waterville, and by the Ragged Mountain Park association in Andover, have not this year been productive of specific results. The Gridiron club has deemed it unwise during the prevalence of the hard times to undertake any large expenditure. It is likely, however, that during the next year some determined effort will be made to carry out the purpose for which that club acquired its landed property. The Ragged Mountain association applied forestry principles to its timber tract only so far as it was necessary to secure from this forest an amount of timber sufficient to provide the purchase-money for the tract. It then abandoned its efforts, and now, like the Gridiron club, awaits better times.

The educational work which is imposed upon this commission, and which for some time to come must be the most important feature of its work, has been carried on throughout the entire year. The course of lectures in forestry referred to in our last annual report, was delivered under the auspices of this commission before the students of the New Hampshire College of Agriculture and the Mechanic Arts, at Durham, and the various public meetings which the forestry law requires have been held as often as opportunity permitted. We are under repeated obligations to the Patrons of Husbandry for the interest which they have taken in this portion of our work, and for the numerous opportunities afforded us by their meetings. The board of agriculture has heartily coöperated with us during the past year, and at all of the farmers' institutes and at both of the field meetings of that board, forestry has had an important place upon the programme. The state board of trade likewise gave a place for this topic in the programme of its mid-summer meeting. Knowledge of forestry principles has thus been diligently spread, and arrangements are now being made by the commission for a series of independent forestry meetings. Legislative action can never be far in advance of public opinion, and we are firmly convinced that

public opinion on forestry in New Hampshire can best be awakened by its agitation in every accessible community.

AMERICAN FORESTRY ASSOCIATION.

Perhaps our most effective work in this direction during the past year was done through the special midsummer meeting of the American Forestry association, which was held in the White Mountains, August 24-29, by invitation of this board. This meeting was attended by nearly one hundred members of the association, whose homes are scattered from Alabama to Wisconsin, and the discussion of the White Mountain forestry problem was carried on within sight of the very conditions which the labors of this association attempt to remove or mitigate. Two of the most valuable papers presented at this meeting will be found annexed to this report, the first a comprehensive and graphic historical paper dealing with "The White Mountains," by Hon. Joseph B. Walker, of Concord, formerly president of the forestry commission, and the other a discussion of "Coöperation in Forest Preservation," by Mr. George B. James, of Boston, editor of the *American Cultivator*, who originated the idea of coöperative forestry.

But the effect of all such lectures and meetings must be far short of what may be accomplished by the public schools and other educational institutions in the state. In view of the rapidly increasing demands made upon the time of the public schools by the introduction of new topics, we are not now prepared to indicate the place in their curriculum which should be occupied by the study of forestry, and that question professional educators must determine. But we know no reason why the New Hampshire College of Agriculture and the Mechanic Arts should not make immediate provision for a thorough, systematic, and permanent course of instruction in forestry. In every civilized country, except the United States, the cultivating of trees is deemed as essential a part of agriculture as the raising

of wheat. The acreage of New Hampshire soil which may be devoted to the growth of wheat or any other cereal, is small as compared with the immense area which will bear, and can be made to bear, no other crop than trees. The proportional claims of the two crops upon the attention of its Agricultural college are thus made evident. Scattered as our forests are throughout the entire state, it is a remote contingency that they can all ever become public property. Numerous wood-lots must remain subject to the wise or foolish control of their individual owners, and collectively must make up a large part of our forest area. It therefore behooves the state to provide without delay for such educational instruction as has been suggested.

The most important facts relating to our forest interests, in addition to those already enumerated, that have come to our knowledge during the year are the result of a scientific, biological investigation of the growth and character of the White Mountain spruce, inaugurated by the division of forestry in the department of agriculture at Washington, upon a plan devised and developed by Prof. B. E. Fernow, the accomplished chief of the division. Professor Fernow's agent, who conducted the investigation in New Hampshire, was Mr. Austin Cary, of Bangor, Me., a scientist of repute and reliability, and through the kindness of Professor Fernow this commission is enabled to present the results of that investigation so far as they are now completed.¹

GEORGE BYRON CHANDLER,

NAPOLEON B. BRYANT,

JAMES F. COLBY,

GEORGE H. MOSES,

Forestry Commission.

¹ See Appendix.

APPENDIX A.

TREES COMPOSING THE NEW HAMPSHIRE FORESTS.

IN THE SUBJOINED LIST ONLY THOSE TREES APPEAR WHICH ARE OF COMMERCIAL VALUE, THE SHRUBS WHICH FORMED SO LARGE A PART OF MR. FLINT'S ORIGINAL LIST BEING ELIMINATED FOR THE PURPOSES OF THIS PUBLICATION.

THE TREES AND SHRUBS COMPOSING THE NEW HAMPSHIRE FORESTS.

THEIR DISTRIBUTION, RELATIVE ABUNDANCE, AND UTILITY.

BY WM. F. FLINT, B. S., WINCHESTER, N. H.

Originally a dense forest covered our state. There were no "parks" as in the Rocky Mountain region, or "oak openings" and grassy plains as in the valley of the Mississippi; but with the exception of a few sedgy swamps, the work of the beavers, and some favorable spots near the streams where the Indians had established their rude corn fields, together with those parts of the White mountains whose elevation above the sea gives them a climate too severe to allow the growth of arborescent vegetation, there were no other breaks in this wilderness,—a body of forest, which, when the white man's axe first began to destroy it, was equal in the variety and quality of its timber to any on the northern part of the Atlantic slope.

Two hundred years have so far changed this, that, instead of possessing a superabundance of the finest timber, the present generation must consider the best methods of conserving what now remains, and can never hope to see in the present young woodlands timber equal in quality to that of the primitive forest. The old growth remains only in parts of the White mountain district and a few localities elsewhere, which are not easily accessible.

That the evil is not far greater is due, probably, to the fact that the climate of our state is more favorable for the return of a new forest after the old one has been destroyed than that of most coun-

tries, and because the railways have rendered it easy to use mineral coal for fuel in the large towns and cities.

The chief of our recent geological survey, Prof. C. H. Hitchcock, in order to get information which might help to solve certain problems in geological science, caused researches to be made concerning the way in which the animals and plants of the state were distributed. As a result, it was found that both the fauna and flora could be separated into two well-marked divisions, which, in accordance with the usage of others who had made similar studies, it was thought best to term Canadian and Alleghanian. The dividing line between the two, however, was found to be much more sharply defined in case of the animals than of the plants, owing, perhaps, to the fact that the animals are able at will to keep within those limits which they find to be most congenial, while the plants spring up wherever the seed happens to fall, and must adapt themselves to the particular locality and conditions, or perish altogether. It is easy to adopt this classification for the distribution of our arborescent vegetation; and the primal cause which places the different species in one division or the other is found to be the altitudes above the sea level at which they appear or disappear.

Certain of our trees, which may be regarded as typical of the Alleghanian flora as it is shown in our state, are found at their northern limit growing at an altitude which is not far from six hundred feet above the ocean; and the six hundred feet contour may be taken, therefore, all things considered, as best defining the northern limit of this part of our flora. We find, also, on all those elevations in the southern part of the state that rise higher than one thousand feet, that the trees are mostly those species which compose the forests of the White Mountain district and northward, and therefore to be considered of the Canadian type; and the Alleghanian species so rarely reach that altitude that their presence in such localities may be considered exceptional.

As examples of this method of distribution, we may name the white oak and the pitch and red pines as characteristic Alleghanian trees, because at the six hundred feet contour they find their northern limit in the Connecticut valley on the west, and at about the same elevation south of the White mountains on the east side of the state, while near the Massachusetts line they are very

rarely seen growing in localities more than one thousand feet above the sea.

On the other hand, that strictly Canadian tree, the arbor-vitæ, is never found native at altitudes which are below six hundred feet above the sea, except at one place in the Connecticut valley where its southern limit is at the rapids which are not far north of the White river; also the most of the spruce which grows south of the White mountains along the Connecticut-Merrimack watershed, is found at altitudes not far from one thousand feet above the sea. It is also not uncommon to find, throughout the area which is mostly occupied by the southern types, tracts where the flora is largely Canadian, which tends to show that the latter is much the older, and has been slowly giving way to the encroachments of those trees which flourish best farther south.

At first thought it might seem that only those woody plants which grow tall enough to be of some value as fuel need be included in a description of our forest trees; but as it is difficult always to draw the line between a small tree or a large shrub, and as shrubs are always present in our fields and forests, and so many of them have a direct economic value because of their fruit, and as they must all be dealt with in any scheme of forest culture, either as weeds to be removed to make way for a better growth, or as nurses for the seedlings of the best kinds of timber trees, it is thought best to include them, noting those that are rarest, or of little importance, very briefly. In the following catalogue the species are designated by their scientific and some of their common names, together with brief descriptions and notes of some of their uses.

The authority followed is Gray's Manual of Botany, sixth edition (1890).

Tilia Americana, L.

American Linden, or better known as Basswood. A large tree, to be met with in all parts of the state, from the sea to altitudes two thousand feet above it. In the southern part of the state it is found most abundantly near the streams, and when found on high lands, prefers a moist, rich soil. It is commonest and best developed in the upper Connecticut valley, where specimens are often met with which are eighty to one hundred feet in height, with a diameter of from two to four feet. Bark very tough and strong,

owing to its very coarse fibres, and can therefore be used for making coarse matting. Wood very soft, light, and elastic; useful for lumber, a good material for carving, and remarkable for the facility with which it can be molded into various curved forms, and therefore much in demand for carriage-work. As bees derive an abundance of the best of honey from its flowers, it is recommended by apiarists, as a profitable investment, to plant it as a source of honey. It is of very rapid growth; its abundant foliage makes it very desirable as a shade tree. It matures in from fifty to one hundred years, but becomes of sufficient size for timber in twenty or thirty. Wood of little value for fuel, but the ashes very rich in potash.

Acer saccharinum, Wang.

Sugar or Rock Maple, the finest and most useful of the maple genus. In New Hampshire it is most abundant as a highland tree, and is characteristic of the Canadian division of our flora. It is least common in the southeastern part of the state, and when found indigenous to Hillsborough and Rockingham counties it is in moist, rocky places, where the conditions of the soil resemble the slopes of the highlands farther north and west. It is a common tree throughout Cheshire, Sullivan, Grafton, and Coös counties; a source of revenue because of its sugar, and the standard wood for fuel. It yields lumber which is very hard, heavy, susceptible of a fine polish, and is much used in chair-making and cabinet-work, but is only moderately durable when exposed to the weather. Isolated specimens occur which have the peculiar grain known as "bird's-eye maple," so much prized as an ornamental wood. There is a variety known to the farmers as "black sugar maple," which differs somewhat from the ordinary form in botanical characters. When at maturity in the forest, the rock maple attains a height of seventy or eighty feet, with a diameter of from two to four, but in the open land forms a many-branched, rounded or oblong head, with a short, stout trunk. Foliage brilliant yellow and orange in autumn. This maple is one of the most ornamental and popular of deciduous shade trees, matures in about one hundred years, but grows rapidly enough to be valuable for fuel, timber, and shade in twenty or thirty. Although this tree is entitled to a place in the first rank in economic forestry, it is too much neglected, and there

are few attempts to replace the old sugar camps preserved by the first settlers.

Acer rubrum, L.

Red or Scarlet Maple, but almost universally called "White Maple" by the farmers and lumbermen of New Hampshire. A good sized tree, so universally distributed over the state, from the sea to two thousand feet altitude, as to be at once recognized as the most common of our maples. Flourishes in all soils and situations from swamp to rocky hillside. Wood far more durable than that of other maples, lasting a long time unless driven into the ground as posts or stakes. Not as hard as that of the preceding species, but takes a good polish, and is used for the same purposes. "Curled maple," the variety with wavy grain, is derived from this species. It is of rapid growth, has a height of from forty to sixty feet, and, owing to the brilliant colors of the foliage in autumn, and the red flowers in spring, is the most notable deciduous tree in our forests.

Acer dasycarpum, Ehrh.

White, Soft, or River Maple. A tree sometimes sixty or seventy feet in height, and four or five feet in diameter, although usually not more than forty or fifty feet in height, with a diameter of twelve or eighteen inches. A graceful tree, with deeply cut leaves, ripening its fruit the earliest of any of the maples. With us it is closely confined to the banks of the larger streams, and therefore forms a small proportion of our forests. It has soft wood, is of very rapid growth, and is the maple so largely used to plant on the prairies west of the Mississippi.

Robinia Pseudacacia, L.

Common Locust. A valuable timber tree with us, naturalized from the South or West. It does best in moist, alluvial soils, but in this latitude it is so subject to the attacks of borers as to greatly injure its wood and make the tree so short-lived that it is not worth while to give it much attention as a forest tree, which is to be regretted, as the timber is hard, elastic, and exceedingly durable. It is with us a middle-sized tree, but in the South becomes sixty or eighty feet high, with a diameter of three feet.

Prunus serotina, Ehrh.

Black Cherry. A tree often sixty to eighty feet high, with a diameter of two or three feet, the hard, reddish-colored wood taking a high polish, and yearly becoming more valuable for the making of fine furniture, finishing the interior of houses, railroad cars, etc. It does not form extensive tracts of woodlands by itself, but may be frequently met with among all species of deciduous trees and in a great variety of soil in all parts of the state below two thousand feet above the sea. The cherry grown in New England is harder to work than that from the Mississippi valley, but it is darker colored, and takes a much higher polish. As cherry lumber brings readily from thirty to sixty dollars per one thousand feet, and is of very rapid growth, it cannot fail to prove an excellent species for planting, the only objection being that it is the host of the tent caterpillar, but the danger to fruit trees from this source is probably exaggerated.

Pyrus Americana, DC.

American Mountain Ash. A small tree with pinnate leaves, and a bushy habit. It bears a profusion of white flowers, followed by the bright-red fruit, and is well known as an ornamental tree. The common pear can be readily grafted upon it, and flourishes well for a while. It is a highland tree, common to the Connecticut-Merrimack watershed, and very abundant on the sides of the White mountains, where it sometimes becomes a foot in diameter, and thirty feet high.

Nyssa sylvatica, Marshall.

Hornbeam, Sour Gum, Pepperidge, or Tupelo. A tree sometimes sixty or seventy feet high, with a diameter of from eighteen inches to three feet, and stiff, angular branches. It usually grows in swamps, and in moist, low lands. It is most common in the Merrimack valley, and seldom seen north of the White mountains. Wood remarkable for its spiral grain, which renders it unwedgeable. It is seldom used in the arts, but if not too soft its non-splitting property would make it a good material for wagon-wheel

hubs. It has been thought equal to holly as a cabinet wood, by those who have experimented with it.

Fraxinus Americana, L.

White Ash. One of the most widely distributed and valuable of our forest trees, but nowhere occurring in large quantities. It grows in a great variety of soils, but attains its best development in a strong, rocky soil, along with the beech, birch, and maple. Although its wood is not so heavy as that of the European ash, it is superior to it in strength and elasticity, and endures exposure to the weather moderately well. It is so well known and adapted to so many different uses, such as carriage-making, the handles for agricultural implements, oars for boats, etc., that it is becoming scarce and more valuable each year. It is of such rapid growth that it is one of the best trees for planting, either for fuel or timber.

Fraxinus pubescens, Lam.

Red or Downy Ash. Alluvial soil in the Merrimack valley as far north as Boscawen. A smaller tree than the white ash, which it much resembles. Not abundant enough to be of much value.

Fraxinus sambucifolia, Lam.

Black or Brown Ash. A medium-sized tree, common to swamps and wet lands throughout the state, but most abundant south of the White mountains. The old growth yields lumber much used for interior finishing and cabinet-work. The easily separated layers of the young trees are very tough, and used for coarse baskets and hoops, bands for baling hay, etc. The wood is hard and considered good for fuel, but not very durable when exposed to the weather.

Platanus occidentalis, L.

Buttonwood, Sycamore, or Western Plane-tree. Occurs in the Merrimack valley towards the coast, and along the Connecticut as far as Westmoreland. Generally found very near the streams, and much more abundant formerly than now, as this species, although vigorous enough in the Mississippi valley, appears to be falling into decay and to be gradually disappearing from New

England. It is a large and handsome tree. The outer bark flakes off in large scales and shows the white inner bark, thus giving the surface a peculiar mottled appearance. The wood is moderately hard; said to be of value for cabinet-work, but does not bear exposure to the weather. It is easily cultivated, and bears the dust and smoke of cities, better than most trees.

Ulmus Americana, Willd.

White, Weeping, or American Elm. One of the largest and most imposing of our forest trees, never forming groves by itself, yet common from the sea to the base of the mountains. The finest specimens grow in the rich alluvium of the river valleys, and it has been more largely planted along the streets of the cities and villages than any other tree. The wood is light, strong, and tough, with the fibres interlaced; difficult to season without warping, yet it is much used for the naves of carriage-wheels, ox-yokes, etc. It is a very heavy feeder, and consequently of rapid growth, and its ashes are said to yield more potash than those of other trees.

Juglans cinerea, L.

Oilnut or Butternut. A very valuable tree, both for its timber and nuts. When grown in the forest, it is from two to three feet in diameter and sixty feet high, but in open land develops a short trunk, and heavy, wide-spreading top. It prefers the alluvial soil of the river valleys, or fertile, moist hillsides, and is common throughout the Connecticut valley and along the Merrimack and its tributaries to the base of the White mountains. It is one of our best trees for timber culture, but such a gross feeder that it should not be planted near cultivated fields.

Carya alba, Nutt.

Shagbark Hickory. The largest and most valuable of our hickories. In the eastern part of the state it ranges to Lake Winnepesaukee, and in the Connecticut valley to Windsor, Vt. Never found naturally very far from the alluvium of the streams, but will grow in almost any well-drained soil when planted. The nuts are readily sold at from two to four dollars per bushel, and bring

a considerable revenue to some of the farmers of the lower Merrimack. The wood is considered the standard fuel, and first class for carriage-work and tool handles of various kinds. It should be largely planted, and the work not left wholly for the squirrels to do, as is now the case.

Carya porcina, Nutt.

Pig Walnut or White Hickory. A much smaller tree than the preceding, seldom being more than eighteen or twenty inches in diameter, but in the forests it grows tall and slender. Wood very valuable for axe-handles, wagon-thills, spokes, hoops for cooperage, etc. Nuts sweet and edible, but not equal to those of the shag-bark. It is common in the lower Merrimack valley and towards the coast. In the Connecticut valley it is abundant on the hills near the river in the vicinity of the state line, but is not common above Bellows Falls.

Carya tomentosa, Nutt.

Called Mocker Nut or Black Hickory in the South and West. In New Hampshire it is found sparingly near the coast. The quality of the wood resembles that of *C. porcina*, but it becomes a larger tree.

Quercus alba, L.

White Oak. The most valuable of our oaks. Seldom seen at elevations much above six or seven hundred feet above the sea. It grows to a large size, and New Hampshire white oak in quality is unequalled by any grown in the United States. It is put to a greater variety of uses that require strength, hardness, and elasticity, than any wood we have. Very little of the old growth, formerly in demand for ship-building, is left. This species prefers a strong, well-drained soil, and grows from the acorns much faster than is generally supposed, and should be fostered as much as possible. It is most abundant in the eastern part of the state. In the Connecticut valley it is confined to the hills in the immediate vicinity of the river, extending up the tributary streams a short distance, and disappears entirely before reaching the mouth of the Passumpsic.

Quercus bicolor, Willd.

Swamp White Oak. A large sized, very rough-barked, valuable species, growing in low, moist ground throughout eastern Massachusetts; occurs in the Merrimack valley as far as the mouth of the Souhegan, and probably extends throughout Rockingham county.

Quercus Prinus, L.

Rock Chestnut Oak, Mountain Oak. A medium-sized tree. The wood strong and durable, and considered excellent for railroad sleepers. Occurs in belts or patches in the eastern part of the state, as at Amherst and Milford. In the Connecticut valley it barely reaches our limits on the hills of the southern part of Winchester and Hinsdale.

Quercus ilicifolia, Wang.

Barren or Scrub Oak. Has the same range as the last, and also appears along the lower Connecticut. A much branched and contorted shrub, six to fifteen feet high, forming dense thickets; very difficult to eradicate, and impeding the growth of better timber.

Quercus tinctoria, Bartram.

Black or Yellow Oak. A large species, common to the lower Merrimack valley and eastward; absent on the highlands, and only seen again within three or four miles of the Connecticut river, ceasing at North Charlestown. The wood is elastic, strong, free-splitting, and durable, the bark very rich in tannin, and gives a yellow dye. This species is not valued as its merits deserve, for it would serve equally as well as white oak for many purposes.

Quercus rubra, L.

Red Oak. The most widely distributed and largest of our oaks. Very common in all parts of the state up to 1,500 feet above the sea, and only disappears in Coös county, far north of the White mountains. The timber is not nearly so heavy as that of our other species, but, from the freedom with which it could

be split and worked, the old growth has been mostly cut and manufactured into staves for molasses hogsheads, an industry which flourished thirty or forty years ago, but has now disappeared from our state, owing to the scarcity of mature timber. Red oak grows much more rapidly than the other kinds, and attains a diameter of four or five feet, with a height of seventy or eighty. The younger growth is now much used for the bent work in chair manufacture.

Fagus ferruginea, Ait.

Beech. This is essentially a highland tree, and does not become common until an altitude of five hundred feet above the sea is reached. It is a common tree on the Connecticut-Merrimack watershed, and enters largely into the composition of the hardwood forests of Coös county. In the southern part of the state the best of it has been cut and used for chair-stock, bucket-hoops, etc. As it depends upon the seed alone for its propagation, it does not hold its own well in company with other trees, but is considered a valuable tree to grow. Wood dense and heavy; not very liable to warp, but easily perishable when exposed to the weather.

Castanea sativa, Mill. *Var. Americana*.

Chestnut. This well-known and very valuable tree has a rather limited range in this state. The largest area where it flourishes is in the Merrimack valley south of Concord, although it occurs sparingly considerably north of that. In the Connecticut valley the most of it grows in the towns of Hinsdale, Winchester, and Chesterfield, but it grows near the river as far north as Windsor, Vt. The large timber has long ago been cut, but it is of such rapid growth that it yields large quantities of railroad ties in short periods of time. The wood is very durable when exposed to the weather, and has been much employed in fencing. It is much used as a cabinet wood, and for interior work of houses, building-timber, etc., and its planting should be encouraged wherever it will grow. It flourishes best in strong, well-drained soil.

Ostrya Virginica, Willd.

Hop Hornbeam, Iron Wood, Lever-Wood. A slender tree, with light-colored bark, brown-tipped branches, and birch-like

eaves. Fruit enclosed in inflated sacs, which resemble those of the hop. Seldom more than forty feet high, with a diameter of a foot or eighteen inches. Wood white, very hard and stiff. Occurs in all parts of the state, but most abundantly along the high lands and northward.

Betula lenta, L.

Black Birch. A tree sometimes two to four feet in diameter, but usually not more than eighteen inches or two feet. Bark dark-colored, scaling from the trunk when old; heart-wood reddish, this species therefore sometimes called cherry or mahogany birch. The wood is heavier than that of the other birches, and takes the best polish, is much used in turning and cabinet-work, and makes a superior fuel. Its range is from the seacoast westward over the southern highlands, and in the Connecticut valley finds its northern limit a little beyond that of the chestnut.

Betula lutea, Micbx.

Yellow Birch. The largest of our birches, often three or four feet in diameter, and sixty or seventy feet high. The bark of the young trees is yellow, whence comes the common name. It grows in all parts of the state, but is most abundant in places which are more than five hundred feet above the sea level. The wood is nearly as valuable as that of the preceding species, which it much resembles in grain and density. It is much used in chair manufacture, and, like all species of birch, yields superior charcoal.

Betula papyrifera, Marshall.

White Birch, Canoe Birch. This species is found in all parts of the state, but may be called one of the types of the Canadian division of our flora, as it is the most common on highlands, and only ceases to exist when the alpine area of the White mountains is reached. It is conspicuous because of its very white bark, which was used by the Indians for making their canoes; and as it is easily separated into thin layers, it can be used for a variety of purposes, like the making of baskets, etc. This tree is sometimes two or three feet in diameter, and sixty or seventy feet high;

the wood moderately hard, yet capable of a good polish, and much used for spools, bobbins, chair-work, boxes, etc., and, when properly cured, makes a good fuel, but very easily decays on exposure to the weather. Being of very rapid growth, it is of value for quickly reforesting lands, and preparing for a growth of oak or other slow-growing trees.

Betula nigra, L.

River or Red Birch. A medium-sized tree found sparingly near streams in the southern part of the state. The leaves are acutish at both ends and downy underneath, as is also the fruit. The wood is light colored.

Betula populifolia, Ait.

Poplar-leaved, White or Gray Birch. A slender tree of small diameter, and dingy white bark, common to eastern New Hampshire, ranging as far north as Conway and around the base of Monadnock, and along the Connecticut to Westmoreland. Wood useful as fuel in the vicinity of the large villages, but back from such markets it is of more value as a material for making charcoal, for which it is excellent. The young shoots are much used for hoops, in the making of fish barrels, nail kegs, and other coarse cooperage. As it is easily grown from the seed, and succeeds well in the most sterile soils, it could probably be used for a nurse in the starting of pine and other trees, which will not grow in such places without some protection when first sown.

Alnus incana, Willd.

Common or Speckled Alder. A tall shrub, with stems one to four inches in diameter, having few branches. Well known as forming thickets along all of the smaller streams, and in swampy places. Wood soft, of some use for fuel, and the charcoal made of it sometimes used in the manufacture of gunpowder.

Salix nigra, Marsh.

Black Willow. The only one of our native species which rises to the dignity of a tree. This one is often forty feet high and a

foot in diameter. It confines itself very closely to the borders of the larger streams. The leaves are very long and narrow, taper-pointed.

Salix alba, L.

White Willow. This species, which often becomes a tree three or four feet in diameter, was introduced from Europe, and has become well naturalized throughout most parts of the state. The wood is light, strong, and durable, and useful for many purposes. This species is the one so extensively planted in the Western states for wind-breaks, fencing, and fuel. With us it is better than any other tree to plant along river banks where they are in danger of being undermined by freshets. There are numerous varieties.

Salix longifolia, Muhl.

Long-leaved Willow. A common Western species, which finds its eastern limit along the Connecticut river, occurring from Westmoreland to the Massachusetts line. The slender shoots are better than any other American species for basket-work.

Salix uva-ursi, Pursh,

Salix argyocarpa, Anderson and

Salix herbacea, L., are all dwarf alpine species, chiefly confined to the treeless area of Mount Washington.

Populus tremuloides, Michx.

American Aspen. Called Quaking Asp in the Rocky mountains. The most widely distributed of our poplars, being found in all parts of the state, up to 3,000 feet altitude, and in all varieties of soil except deep swamps. Usually a small tree ten to eighteen inches in diameter, and forty to sixty feet high. Springs up oftentimes in great abundance where woodlands have been entirely cleared. The wood, when seasoned under cover, makes excellent fuel, but it easily decays when exposed to the weather. This species, until recently, was considered nearly worthless, but has now become of considerable value for the manufacture of pulp for paper.

Populus grandidentata, Michx.

Large-toothed Aspen, or Black poplar. Ranges nearly with the last-mentioned species, but most abundant within the altitudes of

500 and 2,000 feet above the sea. A tree much larger than the Quaking Asp, being sixty to eighty feet high and two feet in diameter. Wood very white, of light weight, and strong,—good for furniture, interior work, and for paper-making.

Populus balsamifera, L.

Balsam Poplar; both it and the variety *candicans*, known as Balm of Gilead. A large species. With us it is native to the Connecticut valley, generally near the river, becoming more plentiful northward. The variety *candicans* is rarely found in a wild state, but is the form commonly planted, and botanically it seems to be a transition between this and the next species. This poplar is a very rapid grower, and makes large timber. The wood is very soft, tough-grained, and easily decays. It spreads so rapidly by shoots from the roots as to become a pest where the land is at all valuable, but it could often be employed in waste lands where a quick-growing tree is desirable for fuel.

Populus monilifera, Ait.

Necklace Poplar. This and the preceding species are known through the West as "Cottonwood." It barely comes within our limits, being confined to the immediate vicinity of the Connecticut river, and disappears near the northern part of Westmoreland. It is a large, handsome tree, and probably would be equal to the other poplars for paper-making.

Pinus Strobus, L.

White Pine. The largest, most useful, and having the greatest range of distribution of our conifers, being everywhere common, from the sea to 2,500 feet altitude. Originally two great belts occupied the valleys of the Merrimack and Connecticut, which contained some of the finest timber in New England; but this magnificent forest has long since disappeared, a few scattered remnants only remaining. Specimens have been known which were more than two hundred feet high and six or eight feet in diameter. The white pine seeds very freely, and the site of the ancient forest is indicated by tracts of vigorous saplings which in twenty or thirty years are good to cut for pail and fish-barrel staves, laths,

clapboards, box boards, etc., and in sixty years yield good timber and boards. Springing up as it does on so many worn-out and abandoned farms, it has made industry and wealth possible to many parts of the state which otherwise would have been wholly deserted. As it is our most useful evergreen, so it is the easiest to be made to grow, or it could not hold its own so well against the constant cutting to which it is subjected, and in any scheme of forest culture in our state it must hold the foremost place.

Pinus rigida, Miller.

Pitch Pine. This and the next species may be considered types of the Alleghanian division of our flora, because at their upper limit they approximate very closely to the contour line of six hundred feet. The pitch pine, when fully grown, is from fifty to seventy feet high, and two feet in diameter, with heavy, very resinous wood, which is well suited for flooring and building timber; but the old growth, which accords with this description, has nearly disappeared, and the second growth is short and scrubby, better adapted to fuel than anything else; the wood also makes good charcoal. It is most common from the Merrimack valley to the sea and to the base of the White mountains. It delights in dry, sterile soil, and forms large tracts of woodland on the broad sandy plains of the Merrimack valley and lake region. It is to be met with, where the soil is favorable, in the southern highlands up to 1,000 feet above the sea, and along the Connecticut to the mouth of the Passumpsic.

Pinus resinosa, Ait.

Red Pine, also commonly called Norway Pine, a name which is erroneous, as this tree is not a native of Europe. The botanical name also is a bad one, as the wood is not specially resinous. It is a very handsome species, growing from sixty to eighty feet high, holding well its diameter, and makes excellent building timber and floor boards. It ranges with the pitch pine, but is less common, being usually in groves of from a few acres to several hundred in extent. It will grow well in the sterile soil preferred by the pitch pine, and as it is so much more valuable as a tree, it is preferable for planting in such places. During the first twenty years of growth it attains a larger diameter than either the white or pitch pine.

Picea nigra, Link.

Black Spruce. Belongs to the Canadian division of our flora; the most abundant conifer of upper Coös, the White mountain region, and the higher parts of the Connecticut-Merrimack watershed; next to the white pine, the most important evergreen, and, with the balsam fir, the last to give way to the alpine White mountain area. It there becomes dwarfed, with a short trunk, two or three feet high, with dense branches, spreading twenty-five or thirty feet, making a mat strong enough to walk upon. Its timber composes the greater part of the drives of logs which are annually floated down the Connecticut, Merrimack, and Androscoggin. The wood is light, elastic, and strong, valuable for a great variety of uses, both for inside and outside work, paper pulp, etc. In the White mountain region and northward it grows very rapidly, but on the southern highlands, where the old growth has been mostly removed, the younger does not seem to start quickly, and the timber is coarse and knotty.

Picea alba, Link.

White Spruce. A Canadian species, abundant around the source of the Connecticut, disappearing at the Fifteen-mile falls on that river. It is a medium-sized tree, the wood similar to that of the black spruce, but the tree more symmetrical in outline, with light-colored bark and a bluish-green appearance to the leaves.

Abies balsamea, Miller.

Balsam Fir. Ranges with the black spruce, and equally common with it in the White mountains and Coös county. In the southern part of the state, around the sources of the Contoocook and Miller's rivers, are extensive swamps where this is the prevailing timber. It is the most symmetrical of the spruces; sometimes attains two feet in diameter; is short lived, and until recently considered worthless, but is now considered to be good for boards and shingles, which bear exposure to the weather as well as the hemlock. The trunk is covered with large blisters, which yield the Canada balsam employed in medicine and microscopy.

Tsuga Canadensis, Carriere.

Hemlock. The most widely distributed of our spruces, ranging from the sea to 2,000 feet altitude in the White mountains, and disappearing before reaching upper Coös county, but appears again in the valley of the St. Lawrence. A large tree, and when young the most graceful of our conifers; well adapted for ornamental planting. Its bark is so much sought after for tanning leather, and the wood for boards, shingles, and building timber, that the old growth is mostly gone. It does not seed so freely as the pines, but with a little care and protection can be easily grown, and a track of hemlock forest would probably yield a revenue next to that of one of white pine.

Larix Americana, Michx.

American Larch, Hackmatack, Tamarack. The only deciduous-leaved conifer found in the northeastern part of the United States. A tall, slender tree, preferring cold, highland swamps, but occasionally met with in eastern New Hampshire. In Cheshire county, south of Monadnock, on the watershed of the Contoocook and Miller's river, are great swamps where the tree is very abundant. Then in Dalton, Lisbon, Whitefield, and Bath in the Connecticut valley, and Milan, Millsfield, and Dummer on the Androscoggin, it appears in great quantity. The roots strike out at right angles from the trunk, generally three or four very large ones. The tree is dug up, and four or six feet of the trunk taken off with the roots, to be sawed up into the "knees" used in ship building. The timber is hard, very heavy, and moderately durable when exposed to the weather. Probably inferior to the European larch, but would be a good tree to grow upon lands that cannot be easily drained.

Thuja occidentalis, L.

Arbor Vitæ, or White Cedar. This may be considered the typical conifer of the Canadian division of our flora, being mostly confined to the upper part of Coös county, disappearing in the Connecticut valley at the White River narrows near Hanover, and only seen in a few isolated localities south of the White mountains.

This tree has light, soft, very durable wood, excellent for shingles, fencing, telegraph poles, etc. It sometimes attains a diameter of three feet, but not unusually more than eighteen or twenty inches, and a height of fifty or sixty feet. It is much used to plant for evergreen hedges, and in this form is common in all towns and villages.

Chamæcyparis sphæroidea, Spach.

White Cedar, Cypress. Until recently classed botanically as a true cypress. With us it is limited to Rockingham county near the coast, in deep swamps and marshes. A middle-sized tree, with wood similar to that of the arbor vitæ. Useful for boat boards, shingles, telegraph poles, and fencing.

Juniperus Virginiana, L.

Red Cedar. A small tree, growing in dry, sterile soil. It is most frequent in the southeastern part of the state. Appears in the Connecticut valley sparingly as far as Haverhill, and found also in Hart's Location. Wood very durable, and valuable for fuel and fencing, and the handsome, deep-red heart-wood for ornamental purposes. It has the slowest growth of any of our conifers.

APPENDIX B.

ELEVENTH CENSUS OF THE UNITED
STATES.

STATISTICS RELATING TO THE LUMBER
INDUSTRY OF NEW HAMPSHIRE.

STATISTICS OF

STATE OF NEW

Lumber, Planing-Mill Products,

CENSUS YEAR ENDING

Live Assets includes Raw Materials, Stock in Process and Finished Products on Hand, and Taxes (including Internal Revenue), Insurance, Repairs, ordinary, or buildings and sundries not elsewhere reported. Cost of Materials used includes Fuel, Rent of Power

COUNTIES.	Number of establishments re- porting.	CAPITAL.						Miscellaneous expenses.	AVERAGE	
		Aggregate.	Plant.				Live Assets.		Aggregates.	
			Total.	Land.	Buildings.	Machinery, tools, and implements.			Average number.	Total wages.
State total.....	32	\$493,598	\$259,657	\$66,400	\$86,270	\$106,987	\$233,941	\$34,829	709	\$347,477
Cheshire County.....	3	33,900	11,000	1,500	2,000	7,500	22,900	4,506	65	34,970
Cochs "	8	19,700	11,200	2,200	5,000	4,000	8,500	723	11	5,350
Grafton "	3	19,200	10,100	2,150	3,350	4,600	9,100	1,988	33	16,070
Hillsborough "	12	335,378	177,262	54,975	60,300	61,987	158,116	21,875	469	230,583
Merrimack "	5	43,270	23,720	2,500	6,720	14,500	19,550	2,685	47	18,117
All other counties (a)..	6	42,150	26,375	3,075	8,900	14,400	15,775	3,052	84	42,387

(a) Counties in which less than three establishments are reported are grouped in order to avoid disclosing the operations of individual establishments. These establishments are distributed as follows: Belknap county, 2; Carroll county, 2; Rockingham county, 1; Strafford county, 1.

MANUFACTURES.

HAMPSHIRE.

including Sash, Doors, and Blinds.

MAY 31, 1890.

Cash, Bills, and Accounts Receivable. Miscellaneous Expenses includes Rent for Tenancy, machinery, amount paid contractors, Interest paid on cash used in the business, and all and heat, and Mill Supplies.

NUMBER OF EMPLOYES AND TOTAL WAGES.														Cost of materials used.	Value of products, including receipts from custom work and repairing.		
Officers, firm members, and clerks.				Operatives, including skilled and unskilled.					Pieceworkers.								
Males above 16 years.		Females above 15 years.		Males above 16 years.		Females above 15 years.		Children.		Males above 16 years.		Females above 15 years.				Children.	
Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.			Number.	Wages.
41	\$33,226	3	\$1,360	601	\$289,882	1	\$800	22	\$3,920	33	\$16,014	6	\$2,550	2	\$225	\$511,051	\$986,893
4	2,970	.....	.....	61	82,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56,850	103,199
.....	.....	.....	.....	11	5,350	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,584	15,550
4	3,060	.....	.....	29	18,010	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,162	29,020
21	19,034	2	910	386	189,010	1	800	20	3,640	31	14,914	6	2,550	2	225	350,828	665,297
6	3,962	1	450	86	12,325	.....	.....	2	280	2	1,100	.....	.....	.....	.....	20,162	43,850
6	4,200	.....	.....	78	88,187	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65,485	180,477

STATISTICS OF MANUFACTURES.

LUMBER MILLS AND SAW MILLS—TOTALS FOR STATE OF NEW HAMPSHIRE.

Year ending May 31, 1890.

Number of establishments reporting	531
CAPITAL.	
Value of hired property	\$230,060
Direct investment:	
In timbered land tributary to mill	1,208,350
In logging operations:	
Tools, implements, and live stock	\$280,215
Logging railways and equipment	80,700
Canals and flumes or chutes	20,200
River improvements	4,250
Vessels employed in transportation	1,000
Forest products not delivered at mill	66,295
All other capital invested in logging	23,975
Total investment in logging	476,635
In mill plant—lumber and saw mill:	
Land	\$362,934
Buildings	787,859
Machinery, tools, and implements	1,062,466
In mill plant—planing mill:	
Land	23,655
Buildings	34,600
Machinery, tools, and implements	74,860
Dry kilns	20,625
Total mill plant	2,366,999

Live assets:	
Logs and bolts at mill	\$699,609
Lumber or other products on hand	747,226
Cash, bills, and accounts receivable, and sundries not elsewhere reported	723,561
	<hr/>
Total live assets	2,170,396
	<hr/>
Aggregate direct investment	\$6,222,380
Miscellaneous expenses:	
Rent paid for tenancy	\$18,813
Taxes	36,550
Insurance	30,942
Ordinary repairs of buildings and machinery	79,210
Interest paid on cash used in the business	42,187
All sundries not elsewhere reported	13,460
	<hr/>
Total	\$221,162

EMPLOYES AND WAGES—SUMMARY FOR ALL BRANCHES.

Aggregates:	
Average number	8,052
Total wages	\$1,965,797
Males above 16 years:	
Average number	7,891
Total wages	\$1,935,829
Females above 15 years:	
Average number	116
Total wages	\$24,129
Children:	
Average number	45
Total wages	\$5,839

LOGGING OPERATIONS.

Aggregates:	
Average number	3,401
Total wages	\$505,868

Employed in woods :	
Average number	2,138
Total wages	\$321,396
Employed in transportation of logs :	
Average number	852
Total wages	\$122,752
Employed by contractors :	
Estimated number	411
Total wages	\$61,720

MILL OPERATIONS.

Aggregates :	
Average number	4,651
Total wages	\$1,459,929

Firm Members, Officers and Clerks.

Males above 16 years :	
Average number	344
Total wages	\$140,774
Females above 15 years :	
Average number	4
Total wages	\$1,450

Operatives—Including Skilled and Unskilled.

Males above 16 years :	
Average number	3,965
Total wages	\$1,209,228
Females above 15 years :	
Average number	73
Total wages	\$17,875
Children :	
Average number	29
Total wages	\$3,564

Piece-workers.

Males above 16 years :	
Average number	181
Total wages	\$79,959
Females above 15 years :	
Average number	39
Total wages	\$4,804
Children :	
Average number	16
Total wages	\$2,275
Animals in use :	
Number	2,115
Cost of keep	\$140,081

MATERIALS USED.

Im Operation other than Planing Mill.

Obtained in woods :	
Standing timber,—	
Quantity (number of 1,000 feet scaled measure) .	176,737
Cost (stumpage value)	\$345,977
Logging supplies (cost)	21,915
Total cost	\$367,892
Purchased at mill :	
Logs,—	
Quantity (number of 1,000 feet board measure) .	130,242
Cost at mill	\$868,957
Bolts,—	
Cost at mill (27,934 cords)	149,200
Mill supplies (cost)	59,882
All other material (cost)	72,900
Total cost	\$1,150,939

Planing mill :	
Rough lumber,—	
Quantity (number of 1,000 feet board measure) .	28,183
Cost at mill	\$299,800
Mill supplies and all other materials (cost) .	7,258
	<hr/>
Total cost	\$307,058
Aggregate cost of all materials	\$1,825,889

PRODUCTS.

Saw logs :	
Number of 1,000 feet board measure	1,317
Value	\$9,580
Telegraph poles :	
Number	516
Value	\$612
Fence posts :	
Number	11,800
Value	\$1,142
Railway ties :	
Number	37,275
Value	\$11,566
Piling :	
Number of pieces	900
Value	\$3,700
Hewed timber :	
Number of 1,000 feet board measure	165
Value	\$2,375
All other forest products valued	\$4,675
Total value	\$33,650

Manufactured at Mill.

Agricultural implement stock :	
Quantity (1,000 feet)	95
Value	\$1,631

Bobbin and spool stock :	
Quantity (1,000 feet)	7,236
Value	\$86,708
Carriage and wagon stock :	
Quantity (1,000 feet)	519
Value	\$10,121
Furniture stock :	
Quantity (1,000 feet)	1,885
Value	\$40,824
Pickets :	
Quantity (1,000 feet)	438
Value	\$4,380
Sawed lumber :	
Quantity (1,000 feet)	266,890
Value	\$2,869,035
Shingles :	
Number of thousand	79,193
Value	\$131,614
Staves :	
Pieces	30,501,800
Value	\$136,207
Heading :	
Sets	2,794,000
Value	\$80,197
Lath :	
Number of thousand	55,834
Value	\$83,750
Tolls received for custom sawing	\$90,129
All other products, value	\$1,023,678
Total	\$4,558,274
Planing mill products and re-manufactures	425,138
Aggregate value of all products	<u>\$5,017,062</u>

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR ENDING MAY 31, 1880.

COUNTIES.	Number of establishments reporting.	CAPITAL.		Logging.								All other capital invested in logging.
		Value of hired property.	Aggregate.	Timbered land (tributary to mill).	Total.	Tools, implements, and live stock.	Logging railways and equipments.	Cana and humes, or shutes.	River improve-ments.	Vessels employed in transportation.	Forest products not delivered at mill.	
The state.....	531	\$230,080	\$6,222,380	\$1,208,380	\$478,685	\$280,215	\$80,700	\$20,200	\$4,250	\$1,000	\$68,295	\$23,975
Bellnap.....	17	18,500	277,071	24,525	5,000	2,000	2,500	.....	.....	.....	500	.....
Charoll.....	48	8,080	702,080	184,600	189,275	70,550	40,400	.....	.....	.....	20,250	2,075
Cheshire.....	88	81,700	702,270	87,555	40,205	23,950	.....	.....	.....	.....	15,545	.....
Cook.....	39	12,800	1,000,449	501,435	110,888	62,353	11,000	20,000	2,500	1,000	3,750	11,600
Crafton.....	106	10,600	1,010,132	186,885	24,650	40,330	26,600	.....	.....	.....	2,400	2,750
Hillsborough.....	89	10,600	465,323	64,060	24,625	20,925	200	.....	.....	.....	1,000	6,000
Merrimack.....	60	88,200	401,205	93,200	23,000	20,850	.....	.....	.....	.....	9,000	50
Rockingham.....	98	8,250	326,635	95,450	24,560	19,650	.....	.....	.....	.....	9,500	1,600
Stratford.....	16	5,000	291,747	117,950	23,232	10,652	.....	.....	.....	.....	12,250	.....
Sullivan.....	42	40,900	154,456	22,700	10,275	9,375	.....	.....	.....	.....	250	.....

NEW HAMPSHIRE.

DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS

CENSUS YEAR ENDING MAY 31, 1880.

CAPITAL.—Continued.

Direct investment.—Continued.

COUNTIES.	Mill plant.						Live assets.							
	Lumber and saw mills.			Planing mills operated by lumber manufacturers.			Total.	Dry kilns.	Total.	Logs and bolts at mill.	Lumber or other products.	Cash, bills, and accounts receivable and all other sundries not elsewhere reported.		
	Total.	Buildings.	Machinery, tools, and implements.	Total.	Land.	Buildings.							Machinery, tools, and implements.	
The state.....	\$2,366,999	\$2,213,259	\$362,934	\$787,859	\$1,052,466	\$133,115	\$23,655	\$34,600	\$74,860	\$20,625	\$2,170,396	\$699,609	\$747,226	\$723,561
Belknap.....	115,642	89,987	11,539	24,039	48,889	24,150	2,050	7,400	14,700	7,525	181,904	47,843	49,189	85,872
Carroll.....	249,545	235,195	27,270	70,025	187,900	12,750	600	4,000	8,150	1,600	184,660	68,630	69,375	46,655
Cheshire.....	817,855	817,305	47,960	107,845	161,500	800	.....	.....	800	250	258,865	46,907	100,488	111,465
Cochs.....	553,750	533,125	85,975	259,850	187,800	20,125	5,850	3,800	10,975	5,500	729,781	326,750	144,050	258,931
Grafton.....	886,607	878,457	50,025	120,325	203,107	9,150	1,900	8,000	4,650	4,000	894,940	117,900	143,812	133,723
Hillsborough.....	217,460	205,760	40,460	65,850	99,950	11,075	1,500	4,800	4,375	625	143,190	87,435	77,500	23,255
Merrimack.....	164,805	158,180	22,615	57,090	79,475	6,625	1,725	1,000	8,800	.....	144,800	26,790	67,410	50,600
Rockingham.....	176,080	141,980	25,380	87,450	79,150	33,280	8,080	6,700	13,500	800	90,575	13,725	42,100	29,750
Stafford.....	88,455	77,655	38,020	14,710	26,925	10,800	1,700	2,000	7,100	.....	62,080	2,635	43,905	15,500
Sullivan.....	91,820	86,635	15,690	31,675	89,270	4,860	750	1,800	2,810	825	29,641	6,444	9,892	13,805

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR ENDING MAY 31, 1880.

COUNTRIES	Miscellaneous expenses.										Statistics of employes and wages. Summary for all branches.			
	Total.	Rent paid for tenantry.	Taxes.	Insurance.	Ordinary repairs of buildings and machinery.	Amount paid for contracting.	Interest paid on cash used in the business.	All sundries not elsewhere reported.	Aggregates.		Males above 16 years.			
									Average number of employes.	Total wages.	Average number.	Total wages.		
The state.....	\$221,162	\$18,813	\$36,550	\$30,942	\$79,210	.....	\$62,187	\$13,460	8,052	\$1,965,797	7,891	\$1,935,829	
Belknap	9,193	1,063	1,131	1,946	1,242	.....	3,661	150	227	79,703	225	79,503	
Carroll	21,689	528	5,419	2,951	5,885	.....	5,833	1,025	948	246,981	907	238,532	
Cheshire	34,466	8,115	3,879	5,163	12,611	.....	2,633	2,065	926	278,907	870	271,350	
Cods	68,437	525	9,608	10,774	26,215	.....	16,605	4,710	2,780	631,974	2,744	625,882	
Grafton	32,432	900	4,045	4,711	14,087	.....	7,503	1,266	1,135	282,661	1,111	275,661	
Hillsborough	11,880	943	2,362	1,376	4,625	.....	2,592	182	556	109,303	564	108,053	
Merrimack	14,466	1,925	3,018	1,183	5,903	.....	1,212	1,225	554	126,863	551	126,653	
Rockingham	10,871	600	1,623	1,561	4,682	.....	870	1,355	214	102,060	504	102,060	
Strafford	9,566	500	1,816	564	1,895	.....	504	1,297	214	67,601	214	67,601	
Sullivan.....	8,292	3,716	649	723	2,205	.....	814	185	213	38,734	211	39,481	

NEW HAMPSHIRE.

DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.

CENSUS YEAR ENDING MAY 31, 1890.

Statistics of employes and wages.—Continued.

COUNTIES.	Summary for all branches.—Continued.				Logging operations.								Mill operations.—Aggregates.	
	Females above 15 years.		Children.		Aggregates.		Employed in woods.		Employed in transportation of logs.		Employed by contractors.		Average number.	Total wages.
	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Estimated number.	Total wages.		
The state.....	116	\$24,129	45	\$5,839	8,401	\$505,968	2,138	\$321,896	852	\$122,752	411	\$61,720	4,651	\$1,459,929
Bellnap.....	.....	.....	2	200	29	7,600	16	4,600	6	2,000	7	1,000	198	72,103
Carroll.....	.....	7,684	5	725	428	76,515	299	64,890	30	6,785	99	14,900	515	170,476
Cheshire.....	41	5,515	15	2,042	181	27,722	97	15,185	84	12,537	.....	.....	745	251,185
Cods.....	18	3,730	18	2,862	1,568	194,032	1,933	136,864	495	40,620	110	16,548	1,212	437,942
Grafton.....	24	7,000	.....	.....	899	65,988	158	22,686	53	14,995	188	28,312	736	216,768
Hillsborough.....	.....	.....	2	250	214	84,114	150	21,260	69	12,104	5	750	842	75,189
Merrimack.....	1	.....	50	160	225	45,534	141	81,820	33	18,564	1	150	829	81,829
Rockingham.....	.....	.....	.....	.....	189	25,883	143	17,644	46	8,239	.....	.....	815	76,177
Strafford.....	.....	.....	.....	.....	106	23,996	68	18,298	38	9,698	.....	.....	108	44,505
Sullivan.....	1	150	1	100	62	5,579	33	3,159	28	2,360	1	60	151	84,155

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR ENDING MAY 31, 1880.

Statistics of employes and wages.—Continued.											
Mill operations.—Continued.											
Operatives, including skilled and unskilled.											
COUNTIES.	Males above 16 years.		Females above 15 years.		Males above 16 years.		Females above 15 years.		Children.		Total wages.
	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	
The state	344	\$140,774	4	\$1,450	8,965	\$1,209,228	73	\$17,875	29	\$3,564	
Belknap	7	6,691	1	800	189	66,212	2	7,315	2	200	
Carroll	23	14,450	1	800	448	146,915	29	7,315	3	675	
Cheshire	68	29,635	3	1,150	472	149,641	15	930	8	267	
Cochs	54	42,125	3	1,150	1,112	385,425	16	2,480	16	1,912	
Grafton	39	15,846	3	1,150	673	193,322	24	7,000	2	250	
Hillsborough	40	9,970	3	1,150	292	61,969	2	7,155	2	180	
Merrimack	37	9,964	3	1,150	289	71,155	2	7,155	2	180	
Rockingham	20	4,060	3	1,150	295	72,117	2	7,155	2	180	
Strafford	16	5,602	3	1,150	92	89,063	2	7,155	2	180	
Sullivan	40	8,431	3	1,150	108	24,389	1	150	1	100	

NEW HAMPSHIRE.
 DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
 CENSUS YEAR ENDING MAY 31, 1890.

COUNTIES.	Statistics of employes and wages.—Continued.										Animals in use.
	Mill operations.—Continued.										
	Piece workers.										
	Males above 16 years.		Females above 15 years.		Children.		Total wages.		Average number.	Number.	
Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.	Average number.	Total wages.				
The state	181	\$79,659	39	\$4,804	16	\$2,275	2,115	\$140,081			
Belknap							14	1,400			
Carroll	8	1,702	1	69	2	50	299	27,234			
Cheshire	149	70,852	36	4,585	12	1,775	100	9,289			
Cods	10	4,800	1	100	2	450	796	52,702			
Grafton							347	11,917			
Hillsborough							169	12,467			
Merrimack	8	3,000					117	9,189			
Rockingham			1	50			99	6,763			
Stafford							113	7,104			
Sullivan	6	605					61	2,126			

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR, ENDING MAY 31, 1890.

COUNTIES.	Materials used.									
	Obtained in woods.					In operations other than planing mill.				
	Standing timber.		Purchased at mill.			Obtained in woods.		In operations other than planing mill.		
Aggregate.	Quantity, No. of 1,000 feet (scaled measure).	Cost (stump-age value).	Total cost.	Quantity, No. of 1,000 feet (board measure).	Total cost.	Quantity, No. of 1,000 feet (board measure).	Total cost.	Logging supplies (cost).	Quantity, No. of 1,000 feet (board measure).	Total cost.
The state.....	\$1,825,889	176,787	\$345,977	\$21,915	\$1,150,939	130,242	\$888,957			
Belknap.....	98,621	4,400	13,200	.....	67,806	7,098	62,299			
Carroll.....	231,645	24,744	62,513	3,250	173,892	19,495	128,757			
Cheshire.....	213,244	10,490	19,980	20	192,244	9,825	55,735			
Coles.....	895,705	77,905	117,845	15,745	164,765	22,540	143,070			
Grafton.....	282,249	16,830	26,857	2,425	284,787	28,729	260,348			
Hillsborough.....	108,715	11,634	30,660	400	67,785	9,645	62,289			
Merrimack.....	167,656	11,890	39,488	100	98,777	12,755	85,644			
Rockingham.....	141,670	10,315	24,780	150	80,630	13,570	73,005			
Sherburne.....	81,423	7,363	15,050	100	30,440	3,275	20,860			
Sullivan.....	56,062	2,206	5,664	125	39,543	5,372	37,060			

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR, ENDING MAY 31, 1890.

COUNTRIES.	Materials used.									
	In operation other than planing mill.— <i>Continued.</i>					Planing mills.				
	Purchased at mill.— <i>Continued.</i>					Total cost.	Quantity, No. of 1,000 feet (board measure).	Rough lumber.	Cost at mill.	Mill supplies and all other materials (cost).
	Bolts.		All other materials (cost).							
Number of cords.	Cost at mill.	Mill supplies (cost).	All other materials (cost).							
The state.....	27,834	\$149,200	\$59,882	\$72,900	\$307,058	23,183	\$299,800	\$7,258		
Belknap			1,734	3,773	17,615	1,200	16,800	815		
Carroll	5,375	35,125	5,668	4,332	52,000	5,475	51,550	450		
Cheshire	14,750	76,567	8,953	62,989	62,989					
Cobs			15,750	5,945	97,850	10,400	95,800	1,650		
Grafton	4,845	21,945	10,281	2,193	18,500	1,200	18,000	500		
Hillsborough.....	450	1,350	2,861	1,285	9,930	990	9,680	250		
Merrimack.....	1,400	8,200	4,463	570	19,190	1,425	18,690	500		
Rockingham.....	200	250	5,900	1,475	48,210	3,503	44,910	1,300		
Strafford.....	814	5,333	4,149	103	55,533	3,010	34,000	1,333		
Sullivan.....	100	425	2,123	235	10,430	980	10,370	60		

NEW
DETAILED STATEMENT, TIMBER PRODUCTS, NOT
CENSUS YEAR, END

Number.	COUNTIES.	CAPITAL.										
		Number of establishments.	Value of hired property.	Direct investment.								
				Aggregate.	Timbered land or standing timber.	Plant.						
						Total.	Tools, implements, and live stock.	Logging, railways, and equipment.	Cans, furn's, cbnt's.	River improvements.	Vessels.	All other items of investment in plant.
	State totals.....	39	\$1,000	\$1,389,787	\$782,405	\$346,547	\$91,862	\$175,300	..	\$2,500	..	\$76,885
1	Carroll.....	3	.....	21,500	11,000	.....	.....	.....	.....	.....	.....	.....
2	Cods.....	6	.....	1,107,597	687,200	308,897	69,512	175,000	..	2,500	..	61,885
3	Grafton.....	6	.....	50,600	17,500	11,250	4,250	.....	.....	.....	.....	7,000
4	Hillsborough.....	6	.....	61,845	18,020	9,550	2,250	300	.....	.....	.....	7,000
5	Merrimack.....	8	1,000	57,450	19,125	9,300	8,300	.....	.....	.....	.....	1,000
6	Rockingham.....	3	.....	7,210	1,660	950	950	.....	.....	.....	.....	.....
7	Strafford.....	3	.....	46,000	21,800	3,300	3,300	.....	.....	.....	.....	.....
8	All other counties (a).....	4	.....	17,585	6,100	3,300	3,300	.....	.....	.....	.....	.....

Number.	COUNTIES.	Average number of employes											
		Aggregates.		Officers or firm members.		Foreman and mechanics.		Hewers.		Choppers.		Skidders.	
		Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
	State totals.....	1075	\$284,917	8	\$1,629	20	\$9,035	41	\$7,156	356	\$90,484	81	\$27,895
1	Carroll.....	48	10,150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	Cods.....	551	181,280	.....	.....	15	7,910	40	7,000	202	66,870	54	21,380
3	Grafton.....	149	18,260	.....	.....	3	980	.....	.....	50	5,986	6	650
4	Hillsborough.....	103	25,708	.....	.....	.....	.....	.....	.....	32	4,952	9	1,575
5	Merrimack.....	93	15,740	5	645	2	145	1	156	18	2,038	2	290
6	Rockingham.....	19	1,275	.....	.....	.....	.....	.....	.....	8	400	.....	.....
7	Strafford.....	88	23,210	2	360	.....	.....	.....	.....	40	8,500	10	4,000
8	All other counties.....	24	9,294	1	624	.....	.....	.....	.....	6	1,740	.....	.....

(a) Counties in which less than three establishments are reported are grouped in order to avoid disclosing the operations of individual establishments. These establishments are distributed as follows: Belknap county, 1; Cheshire county, 1; Sullivan county, 2.

HAMPSHIRE.

MANUFACTURED BY MILLING ESTABLISHMENTS.

ING MAY 31, 1890.

CAPITAL.—Continued.			Miscellaneous expenses.						
Direct investment.—Continued.			Total.	Rent (not including cost of stampage.)	Taxes.	Insurance.	Repairs, ordinary, of buildings and machinery.	Interest on cash used in the business.	All sundries not elsewhere reported.
Live assets.									
Total.	Value of production on hand.	All other capital not included in the foregoing items.							
\$240,885	\$130,270	\$110,565	\$39,045	\$56	\$5,313	\$3,611	\$2,250	\$3,386	\$24,474
10,500	7,200	3,300	68	.....	28	5	.....	80	.....
111,500	83,400	78,100	82,060	.....	8,574	3,000	1,650	1,312	22,024
21,860	19,400	2,460	1,021	.....	384	162	75	400	.....
34,275	27,500	6,775	1,188	.....	307	175	350	176	175
29,025	17,425	11,600	1,189	.....	56	705	123	75	100
4,600	4,450	160	111	.....	111	.....	.....	.....	.....
20,900	14,750	6,160	2,570	.....	92	100	.....	873	2,000
8,185	6,145	2,040	898	.....	117	41	100	440	200

and total wages.						Animals in use.		Materials used.				
Teamsters.		All other employes.		Piece-workers.		Total number.	Cost of keeping.	Cost of all materials used.	Timber.			Cost of all other materials.
Number.	Wages.	Number.	Wages.	Number.	Wages.				No. of cords.	Number of 1,000 feet scaled measure.	Cost (stumpage value).	
197	\$43,753	83	\$33,083	289	\$66,382	643	\$44,930	\$135,635	20	\$68,300	\$129,085	\$6,600
.....	.....	.....	.....	48	10,150	10	600	2,400	.....	1,450	2,400	.....
91	29,370	74	81,750	75	17,000	320	26,313	\$1,118	.....	83,470	55,313	5,800
43	4,544	1	100	46	6,000	141	6,025	9,980	.....	5,285	3,980	1,000
13	2,644	.....	.....	49	16,537	19	975	21,610	.....	5,954	21,310	800
11	1,065	8	1,283	46	10,170	74	2,502	9,432	.....	6,020	4,482	.....
8	150	.....	.....	8	725	6	75	1,737	.....	1,125	1,737	.....
80	9,000	.....	.....	6	1,350	72	7,400	26,243	.....	7,831	26,243	.....
6	1,980	.....	.....	11	4,950	6	540	3,065	20	3,165	3,065	.....

Number.	COUNTIES.	PRODUCTS.								
		Total value of all products.	Basket stock.		Cooper-age stock.		Excelsior stock.		Fence posts.	
			Cords.	Value.	Cords.	Value.	Cords.	Value.	Lumber.	Value.
	State totals.....	\$624,383	140	\$1,250	....	....	76	\$380	32,150	\$1,866
1	Carroll.....	17,990	.....	.....	.....	.....	.....	.....	.....	.....
2	Cods.....	387,107	.....	.....	.....	.....	.....	.....	.....	.....
3	Grafton.....	39,208	30	300	.....	.....	.....	.....	.....	.....
4	Hillsborough.....	55,791	40	400	.....	.....	.....	.....	2,100	210
5	Merrimack.....	38,447	.....	.....	.....	.....	76	380	28,050	1,466
6	Rockingham.....	4,850	.....	.....	.....	.....	.....	.....	.....	.....
7	Strafford.....	63,917	20	250	.....	.....	.....	.....	.....	.....
8	All other counties.....	17,073	50	300	.....	.....	.....	.....	2,000	200

Number.	COUNTIES.	PRODUCTS.—Continued.											
		Handle stock.		Hemlock bark.		Oak bark.		Piles.		Paving stock.		Pulp stock.	
		Cords.	Value.	Cords.	Value.	Cords.	Value.	Number.	Value.	Cords.	Value.	Cords.	Value.
	State totals.....	45	\$1,250	1,027	\$5,812	20	\$140	1,116	\$3,568	....	....	825	\$4,025
1	Carroll.....	.....	.....	.....	.....	20	140	.....	.....	.....	.....	200	1,000
2	Cods.....	.....	.....	150	900	.....	.....	.....	.....	.....	.....	.....	.....
3	Grafton.....	.....	.....	30	159	.....	.....	.....	.....	.....	.....	.....	.....
4	Hillsborough.....	.....	.....	259	1,465	.....	.....	356	718	.....	.....	125	625
5	Merrimack.....	25	1,000	348	1,555	.....	.....	360	750	.....	.....	500	2,500
6	Rockingham.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	Strafford.....	20	250	200	1,600	.....	.....	200	1,200	.....	.....	.....	.....
8	All other counties.....	.....	.....	40	133	.....	.....	200	800	.....	.....	.....	.....

STATISTICS OF MANUFACTURES.

TIMBER PRODUCTS NOT MANUFACTURED BY MILLING ESTABLISHMENTS—TOTALS FOR STATE OF NEW HAMPSHIRE.

Year ending May 31, 1890.

Number of establishments reporting 39

CAPITAL.

Value of hired property \$1,000

Direct investment:

Timbered land or standing timber 782,405

Plant:

Tools, implements, and live stock . . . \$91,862

Logging railways and equipment . . . 175,300

River improvements 2,500

All other items of investment in plant . . . 76,885

Total plant 346,547

Live assets:

Value of product on hand \$130,270

All other capital not included in the foregoing items 110,565

Total, live assets 240,835

Aggregate, direct investment \$1,369,787

Miscellaneous expenses:

Rent (not including cost of stumpage) . . . \$56

Taxes 5,318

Insurance 3,611

Ordinary repairs of buildings and machinery . . . 2,250

Interest on cash used in the business . . . 3,336

All sundries not elsewhere reported . . . 24,474

Total \$39,045

EMPLOYES AND WAGES.

Aggregates :	
Average number	1,075
Total wages	\$284,917
Officers or firm members :	
Number	8
Wages	\$1,629
Foremen and mechanics :	
Number	20
Wages	\$9,035
Hewers :	
Number	41
Wages	\$7,156
Choppers :	
Number	356
Wages	\$90,484
Skidders :	
Number	81
Wages	\$27,895
Teamsters :	
Number	197
Wages	\$48,753
All other employés :	
Number	83
Wages	\$33,083
Pieceworkers :	
Number	289
Wages	\$66,882

ANIMALS IN USE.

Total number	648
Cost of keep	\$44,930

MATERIALS USED.

Timber :	
Number of cords	20
No. of 1,000 ft., scaled measure	68,800
Cost (stumpage value)	\$129,035
All other materials (cost)	6,600
	<hr/>
Total cost of all materials	\$135,635

PRODUCTS.

Basket stock :	
Cords	140
Value	\$1,250
Excelsior stock :	
Cords	76
Value	\$380
Fence posts :	
Number	32,150
Value	\$1,866
Fence rails :	
Number	3,000
Value	\$300
Hoop poles and hoops :	
Number	80,000
Value	\$280
Hewed timber :	
No. of 1,000 ft., board measure	75
Value	\$250
Hardwood and other logs for export :	
No. of 1,000 ft., scaled measure	12,573
Value	\$95,886
All logs for domestic manufacture :	
No. of 1,000 ft., scaled measure	70,302
Value	\$463,155
Handle stock :	
Cords	45
Value	\$1,250

Hemlock bark :		
Cords	. . . . .	1,027
Value	. . . . .	\$5,812
Oak bark :		
Cords	. . . . .	20
Value	. . . . .	\$140
Piles :		
Number	. . . . .	1,116
Value	. . . . .	\$3,568
Pulp stock :		
Cords	. . . . .	825
Value	. . . . .	\$4,025
Railway ties :		
Number	. . . . .	37,563
Value	. . . . .	\$14,114
Rived or shaved shingles :		
No. of 1,000	. . . . .	440
Value	. . . . .	\$1,136
Masts and spars :		
Number	. . . . .	10
Value	. . . . .	\$600
Ship knees :		
Number	. . . . .	150
Value	. . . . .	\$1,000
Charcoal :		
Bushels	. . . . .	58,000
Value	. . . . .	\$5,650
Telegraph poles :		
Number	. . . . .	400
Value	. . . . .	\$850
Wheel stock :		
Cords	. . . . .	340
Value	. . . . .	\$3,750
Value of all other products	. . . . .	19,121
Total value of all products	. . . . .	<u> </u> \$624,383

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR, ENDING MAY 31, 1890.

COUNTIES.	PRODUCTS.									
	Manufactured in forest.									
Aggregate value of products.	Saw logs.		Telegraph poles.		Fence posts.		Railway ties.		Piling.	
	Quantity, No. of 1,000 feet (board measure).	Value.	Number.	Value.	Number.	Value.	Number.	Value.	No. of pieces.	Value.
The state	1,317	\$9,580	516	\$ 612	11,800	\$1,142	37,275	\$11,566	900	\$3,700
Belknap										
Carroll										
Cheshire	50	125			5,000	600	2,800	1,040		
Cook	1,030	8,000			4,000	240				
Grafton	2,275	1,380					6,000	915		
Hillsborough	5,757		516	612	1,700	185	8,850	3,685		
Merrimack	10,908				500	75	18,850	5,758	900	3,700
Rockingham	8,261						150	61		
Stratford					800	42				
Sullivan	344	95					825	207		
Total value.		\$33,650								

NEW HAMPSHIRE.
DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
CENSUS YEAR, ENDING MAY 31, 1890.

COUNTIES.	Manufactured in forest.— <i>Continued.</i>		Products.— <i>Continued.</i>										
	Hewed timber.		Manufactured at mill.					Number of 1,000 feet, board measure.					
	Quantity, No. of 1,000 feet (board measure).	Value.	Total.	Total quantity.	Total value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
The state	165	\$2,375	\$4,558,274	277,063	\$3,012,699	95	\$1,631	7,236	\$86,708	519	\$10,121		
Bellnap			179,102	9,840	106,095								
Carroll			631,993	41,176	424,627			602	9,435	110	1,400		
Cheshire	50	700	656,039	14,208	160,781	1	15	16	250	10	200		
Cooks	40	400	1,176,470	92,695	961,460			2,615	41,400				
Grafton			731,934	42,209	483,628	94	1,616	3,645	31,058	53	1,040		
Hillsborough			804,713	13,619	147,225			100	1,000	70	1,400		
Merrimack	75	1,275	397,143	24,442	282,753			116	1,455	251	6,481		
Rockingham			230,249	22,006	233,986								
Strafford			134,585	10,800	110,000								
Sullivan			116,096	6,268	82,137			143	2,080				

NEW HAMPSHIRE.
 DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
 CENSUS YEAR, ENDING MAY 31, 1880.

Products.—Continued.

Manufactured at mill.

Number of 1,000 feet, board measure.

COUNTIES.

	Furniture stock.		Pickets.		Sawed lumber.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
The state.....	1,885	\$40,824	438	\$4,380	286,890	\$2,869,035
Belknap.....	.....	.....	.....	.....	.....	.....
Carroll.....	.....	.....	.....	.....	.....	.....
Cheshire.....	152	2,224	100	1,200	9,340	106,095
Cods.....	188	3,995	12	165	40,212	410,368
Grafton.....	.....	.....	.....	.....	.....	.....
Hillsborough.....	1,110	23,625	.....	.....	13,981	166,156
Merrimack.....	.....	.....	.....	.....	89,070	887,460
Rockingham.....	80	1,400	.....	.....	37,397	426,087
Strafford.....	.....	.....	1	25	13,338	142,625
Sullivan.....	.....	.....	6	132	23,990	274,255
.....	.....	.....	6	150	21,975	233,245
.....	245	7,205	3	108	10,800	110,000
.....	.....	.....	.....	.....	5,877	72,744

NEW HAMPSHIRE.
 DETAILED STATEMENT.—LUMBER MILLS AND SAW-MILLS.
 CENSUS YEAR, ENDING MAY 31, 1880.

COUNTIES.	Products—Continued.						Planing mill products and re-manufactures.
	Shingles.		Staves.		Heading.		
	Number of 1,000.	Value.	Pieces.	Value.	Value.	Value.	
The state.....	79,193	\$131,614	30,501,800	\$136,207	\$80,197	\$1,197,557	\$425,133
Belknap	1,844	2,882	1,021,800	11,570	34,000	70,125	41,618
Carroll	9,185	13,870	5,870,000	15,363	8,645	147,978	75,650
Cheshire	2,246	4,411	7,640,000	34,240	1,880	466,839	116,000
Coles	36,125	52,405	1,800,000	4,000	5,750	109,485	24,000
Grafton	8,070	15,978	1,800,000	5,600	24,910	222,580	94,000
Hillsborough	7,608	12,969	12,615,000	55,600	24,910	73,989	14,725
Merrimack	7,265	15,400	2,105,000	15,315	5,000	48,990	25,100
Rockingham	2,269	4,789	2,105,000	15,315	5,000	21,130	62,800
Strafford	1,750	1,500	50,000	169	12	23,085	58,729
Sullivan	10,386	17,380	50,000	169	12	16,398	2,025

STATISTICS OF MANUFACTURES.

LUMBER AND PLANING MILL PRODUCTS, INCLUDING SASH, DOORS, AND BLINDS—TOTALS FOR STATE OF NEW HAMPSHIRE.

Year ending May 31, 1890.

Number of establishments reporting 32

CAPITAL.

Aggregate		\$493,598
Land	\$66,400	
Buildings	86,270	
Machinery, tools, and implements	106,987	
Total plant		259,657
Live assets		\$233,941
Miscellaneous expenses		\$34,829

EMPLOYES AND WAGES.

Aggregates:

Average number		709
Total wages		\$347,477

Officers, Firm Members, and Clerks.

Males above 16 years:

Number		41
Wages		\$33,226

Females above 15 years:

Number		3
Wages		\$1,360

Operatives—Including Skilled and Unskilled.

Males above 16 years :	
Number	601
Wages	\$289,882

Females above 15 years :	
Number	1
Wages	\$300

Children :	
Number	22
Wages	\$3,920

Piece-workers.

Males above 16 years :	
Number	33
Wages	\$16,014

Females above 15 years :	
Number	6
Wages	\$2,550

Children :	
Number	2
Wages	\$225

Cost of materials used	\$511,051
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Value of products, including receipts from custom work and repairing	\$986,893
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RECAPITULATION.

Totals of the Lumber and Saw-Mill Industry of New Hampshire Compared with the Totals of Maine.

ITEMS.	NEW HAMPSHIRE.	MAINE.
Number of establishments reporting.....	831	531
Capital:		
Hired property.....	\$448,146	\$330,060
Direct investment.....	11,883,447	6,222,380
Miscellaneous expenses.....	546,396	221,162
Average number employés (aggregate).....	8,932	4,651
Total wages.....	2,519,609	1,459,929
Firm members, officers and clerks.....	626	348
Firm members, officers and clerks, wages.....	238,688	142,224
Operatives, skilled and unskilled.....	8,046	4,067
Operatives, skilled and unskilled, wages.....	2,175,773	1,230,667
Piece-workers.....	360	236
Piece-workers, wages.....	105,148	87,038
Cost of materials used.....	4,883,591	1,825,889
Value of products (aggregate).....	10,907,438	5,017,062
forest products.....	146,562	33,050
saw logs.....	119,855	9,580
telegraph poles.....	2,375	612
fence posts.....	830	1,142
railway ties.....	2,566	11,566
piling.....	6,736	3,700
hewed timber.....	2,500	2,375
all other forest products.....	11,710	4,675
mill products.....	9,920,132	4,558,274
agricultural implement stock.....	2,517	1,631
bobbins and spool stock.....	394,394	86,706
carriage and wagon stock.....	6,377	10,121
furniture stock.....	22,362	40,824
pickets.....	65,737	4,380
sawed lumber.....	6,516,541	2,089,035
shingles.....	932,679	131,614
staves.....	391,039	136,207
heading.....	211,828	80,197
all other products, including receipts from custom sawing.....	1,376,658	1,197,557
planing-mill products and re-manufactures by saw-mills.....	840,744	425,138

APPENDIX C.

THE WHITE MOUNTAIN REGION.

BY JOSEPH B. WALKER.

AN ADDRESS

DELIVERED BEFORE THE AMERICAN FORESTRY
ASSOCIATION, AT PLYMOUTH, N. H.,
AUGUST 24, 1894.

[The bird's-eye map of The White Mountain Region, found annexed to this report, will be of great value in perusing this paper. This map is furnished through the generous courtesy of Mr. F. E. Brown, General Passenger Agent of the Concord and Montreal Railroad.]

THE WHITE MOUNTAIN REGION.

BY JOSEPH B. WALKER.

Some time ago, at a moment not very fortunate for you, I fear, I promised the secretary of the New Hampshire Forestry Commission to present, on this occasion, some account of our White Mountain region. When, however, I came to think of the brevity of the time assigned me, and the high character of the audience I was to meet, I realized the rashness of my promise, and that, although Puck might "put a girdle round the earth in forty minutes," I was not smart enough to conduct you through the defiles and over the summits of these mountains in thirty.

THE WHITE MOUNTAIN REGION.

The White Mountain region extends in an easterly and westerly direction across New Hampshire, and occupies the lower part of the northern portion of it. But for the various passes which here and there cleave its general elevation, it would form an impassable barrier between the upper and lower sections of the state.

The area of this region depends upon the limits arbitrarily assigned to it. Sweetser's Guide Book reports it as 1,270 square miles; about one seventh of that of the entire state. On his map, Mr. George T. Crawford has greatly extended these limits, and increased its surface to 2,250 square miles. One may enlarge or contract either of these areas according to his idea of its proper boundaries; for the region is surrounded by mountains on all sides, and where it properly begins or ends is a matter of individual opinion.

The number of mountains in this region is also a matter of uncertainty. One may easily count 105 on Sweetser's map, and on Crawford's, 169. It would be vain, however, to attempt a correct enumeration until the circuit of the region is definitely established, and the exact constituents of an individual mountain are distinctively defined.

The most important and deepest of the passes just alluded to, pursue a northerly and southerly direction. The Franconia, the Crawford, the Pinkham, and the Carter notches, as they are termed, run very nearly north and south. The courses of the Saco, the Swift, the Baker, and most other river valleys are substantially easterly and westerly. The number of these passes is undetermined. Hardly any two persons would enumerate them alike.

The Indians knew many of them, and made trails through the most important ones. That up the Merrimack river bifurcated at Franklin into two. One went up the Winnepesaukee river and on by the lake through the Ossipee country to Fryeburg. Thence, following the Saco, up through the Crawford Notch, it led on to the Upper Coös and to Canada.

The other followed the Pemigewasset to Lincoln, and thence ran onward, through the Franconia Notch, to the Connecticut valley. A third, leaving the Pemigewasset at Plymouth, and following the Baker's and Oliverian streams, struck that valley at a point lower down. It was on this that John Stark was captured by the Indians, in 1752, and carried thence to Canada; to there run the gauntlet to the entire satisfaction of both himself and his captors, and to show, at that early age, a pluck which, twenty odd years later, made him famous at Bunker Hill and the hero of Bennington.

It is a fact worthy of note that the Indian was so good an engineer that the white man who succeeded him has made his main highways by simply broadening these trails, and that, in the improvement of transportation, railway officials have found no better lines for their tracks of steel.

The study of mountain locomotion shows that thus far each kind of highway has answered the requirements of those who used it; and that even the simple forest path conveyed the soft moccasined foot of the Indian maiden, lightly clad and unencumbered, while under our later civilization broader highways are necessary, and

"Miss Flora McFlimsey, of Washington Square,
With a hundred fine dresses and nothing to wear,"

with her poodles and Saratoga trunks, requires a track upon which steam locomotion is possible and palace cars can run.

HISTORY OF THE WHITE MOUNTAIN REGION.

Very little was known of the White mountains previous to the settlement of Capt. John Mason's colonists at Portsmouth and Dover, in 1623. Before this, mariners sailing along the New England coast had observed the lofty inland elevations, eventually designated the White mountains, and made mention of them; but they had no more than this remote acquaintance with them.

The Indians learned more of them by hunting in their forests, and by threading their dark mazes, as they journeyed back and forth from Canada to the sea. There was also an Indian village in their vicinity, but a superstitious dread of malign spirits, supposed to reside upon their summits, kept them from mounting to these elevations.

Darby Field, however, a wide-mouthed Irishman "about Pasquatquack,"¹ had no such fears, and made the first ascent, so far as known, ever made to the summit of Mount Washington.

Governor Winthrop, in his history of New England, says that, "His relation at his return was, that it was about 100 miles from Saco, that after forty miles he did for the most part ascend, and within twelve miles of the top was neither tree, nor grass, but low savins, which they went upon the top of sometimes, but a continual ascent upon rocks, on a ridge between two valleys filled with snow, out of which came two branches of Saco river, which met at the foot of the hill, where was an Indian town of some 200 people. Some of these accompanied him within eight miles of the top, but durst go no further, telling him that no Indian ever dared to go higher, and that he would die if he went."²

For a century after this, the White Mountain region was rarely visited by white men. Population from the coast moved inward but slowly. Not until 1730 did it reach Concord and the adjoining towns, where it rested for a generation; until life had been made secure in the regions beyond by the treaty of Paris, in 1763, and all hope of French supremacy on this continent had been abandoned forever by the worthless king of France. From this time onward, central New Hampshire was settled with great rapidity.

¹ Bell's History of Exeter, p. 25.

² Winthrop's History of New England, Vol. 2, pp. 80 and 81, Savage's edition, 1853.

Between 1760 and 1770 more than half of all the towns of Grafton county received their acts of incorporation.¹

Except to the Indians, the Crawford Notch was unknown until 1771, when it was discovered by Timothy Nash, a hunter, who was subsequently rewarded for his discovery by a gift from the state of an important tract of land, afterwards known as Nash & Sawyer's location. This led in time to the opening of a highway for travel from the upper Coös to Conway.

In 1792 Eleazer Rosebrook moved his family into a log house in the primeval woods upon this highway. It stood near the site now occupied by Fabyan's. He subsequently cleared up a farm in the vicinity, and built a new house, barns, and mills. Here he dispensed a rude hospitality to such as claimed it, to the time of his death in 1817.

President Dwight, of Yale College, was his guest in 1797. He says, "For the usual inconveniences of a log house we were prepared; but we found comfortable beds, good food, excellent fare for our horses, all furnished with as much good-will as if we had been friends of the family."²

President Dwight was one of the earliest of White Mountain tourists. The attractions of the region became known by degrees, and others followed him.

As the last century approached its close, the people of the Coös country felt the necessity of a better road for the transportation of their products to the market towns on the coast, and in 1803 the Tenth New Hampshire Turnpike was chartered, to run through the Crawford Notch. It was twenty miles long, and built at a cost of forty thousand dollars, or two thousand dollars per mile, a very large expense for the construction of a common highway. The next year, to connect this with Lancaster, the Jefferson turnpike was chartered, and subsequently built at an expense of eighteen thousand and four hundred dollars.³

¹ Bath, Campton, and Canaan, 1761; Coventry and Dorchester, 1764; Enfield, 1761; Franconia, 1764; Hanover, 1761; Haverhill, 1763; Holderness, 1761; Landaff, 1764; Lebanon and Lyme, 1761; Lincoln, 1764; Lisbon, 1768; Lyman, 1761; Orford, 1761; Peeling, 1763; Piermont, 1764; Plymouth, 1763; Rumney, 1761; Warren, 1763; Wentworth, 1763.

² Dwight's Travels, Vol. 2, p. 131, London Ed., 1823.

³ The first half of the present century was quite prolific in turnpike roads. No less than sixty-one were chartered between 1800 and 1850. "The Tenth Turnpike Road in New Hampshire" extended from the upper line, in Bartlett, through the Notch in the White Hills, twenty miles. "The Jefferson Turnpike Incorporation" extended from the northern extremity of the Tenth Turnpike Road through Bretton Woods, Jefferson and Lancaster, to Lancaster Meeting-House.

These two turnpike roads made practicable the passage of teams of all kinds from the Upper Coös country to the east side of the mountains. New hotels of a primitive character appeared from time to time along the way, and the number of mountain visitors increased slowly from year to year. Professor Sanborn says, in his "History of New Hampshire," that "during the first quarter of this century the number of visitors averaged about twelve each year."¹

Your speaker first saw the White mountains in 1838. At that time the only hotels in the region were a single one in the Franconia Notch, still standing as an humble adjunct to the Profile House; that of Abel Crawford, in the Saco valley; that of Thomas J. Crawford, at the north entrance to Crawford Notch; and that of the celebrated Ethan Allan Crawford, the grandson and successor of Mr. Rosebrook.

A stay of several days at the latter impressed its appointments pretty strongly upon your speaker's memory. Possibly the impress may have been deepened somewhat by the society of the landlord's two daughters, and also a little more by the abundant supply of mountain brook trout served upon his table, which were then as plenty there, apparently, as were the salmon at Amoskeag Falls an hundred years before. At all events, a boy who could successfully digest three square meals each day, and a luncheon before and after dinner, was liable to be thus impressed.

This hotel, so pleasantly remembered, would then accommodate from thirty to forty guests, according to the number of beds set up in each room, and the number of sleepers put in each bed. Since then the number and capacities of the White Mountain hotels have increased astonishingly. Some fifteen years ago, Mr. John Lindsey, a hotel proprietor who had been long conversant with the mountain business, remarked that he well remembered when the aggregate receipts of all the mountain houses did not exceed \$12,000 a year, but that from this sum they had gradually risen to \$1,200,000. These facts are of value mainly as showing the increase in the number of visitors to our mountains during the last two generations.

¹ Sanborn's History of New Hampshire, p. 310.

IMPORTANCE OF WHITE MOUNTAINS REGION.

This mountain region, formerly remote and little known as already stated, has latterly become of much importance, not only to the people of New Hampshire, but to the unnumbered thousands without her limits, who visit it from time to time.

RIVERS.

Within its limits are the sources of two of New Hampshire's largest rivers, the Merrimack and the Saco. Those of the former may be found on the sides of Franconia Notch, and of the Willey mountain; those of the latter upon the slopes about the Crawford House. To these two should also be added the Ammonoosuc, a large affluent of the Connecticut, which starts upon its wild career from the Lakes of the Clouds, near the base of the cone of Mount Washington, five thousand feet above the level of the sea, and falls two thousand feet in the first three miles of its course.

FORESTS.

A large proportion of the primeval forests still standing in New Hampshire are to be found within the limits of the White Mountain region. Here emphatically is the home of the black spruce (*Abies Nigra*), which climbs the mountains to a higher altitude than all other trees, except the balsam fir, diminishing in size, as it ascends, until it dwindles to a tangled shrub and disappears altogether at the edge of the Alpine area, some four thousand feet above the ocean level.

FOREST DESTRUCTION.

Some twenty years ago, more or less, the lumberman, invading that part of the Ammonoosuc valley between the Twin Mountain House and Fabyan's, swept away the forests which had made it one of the most pleasing localities in the mountains. He brought with him the sawmill, and defiled the clear waters of the streams with sawdust and worthless edgings. The work of destruction then commenced passed into the grand old woods then lining the road from Fabyan's to the Crawford House, and extending westward therefrom to the base of Mount Washington.

Ere long fire followed in the footsteps of the lumberman, and swept away in its fury whatever he had spared. An abomination of desolation, as lugubrious as that spoken of by Daniel the prophet, succeeded the fire.

This great tract of charred soil, dotted all over with blackened stumps, lying as it did along the main highway from Bethlehem to the Crawford House, arrested the attention of every visitor. Universal regret, with much indignation, was freely expressed on account of the great injury thus done to one of the finest portions of the whole mountain region. Public opinion was aroused to activity.

FORESTRY COMMISSION.

In 1883 the New Hampshire legislature, upon its attention being called to this and similar injuries to the forests, made provision for the appointment of a state commission to investigate their existing condition and report such suggestions for their protection and improvement as to its members might seem wise. This commission made their report in 1885, embracing the following subjects, viz. :

1. The area of the forests. 2. Their relation to the rainfall and climate. 3. The trees and shrubs found therein. 4. Forest management and reforestation. 5. Forest fires.

This report was printed by the state in a pamphlet of about one hundred pages. A part of the edition was distributed among the members of the legislature, a part was sent abroad, as exchanges, to other states, and the remainder was carefully packed away in the document room of the state house.

It awakened more interest abroad than at home, and yet there were some persons in New Hampshire who read it; and ere long an increased interest in the subject was manifested and a desire expressed, strongly and repeatedly, that something be done to protect our remaining forests, and at once.

This led, four years afterwards (1889), to the appointment by the governor and council of a second commission, which made a report to the legislature in 1891, suggesting legislation in the interests of our wooded domain. Two bills, embodying suggestions of the commission, were introduced to the house of representatives and referred to the committee of the judiciary, who, after considering their pro-

visions, returned them to the house with a recommendation that "the further consideration of the same be referred to the next session of the legislature," a phraseology not altogether uncommon in our legislature, and which generally means to the friends of a bill, fight or fail. Inasmuch as this recommendation of the committee was coupled with another, that the then existing commission be continued, its members concluded that their effort was in part successful. They accordingly tightened their belts, went to work, and waited.

When, two years later, the legislature of 1893 assembled, a second report of this commission was presented, and ere long a bill embodying its leading suggestions was introduced. Much discussion and long delays ensued, after which the present forestry law passed the house and senate, and was approved by the governor on the 29th day of March, 1893. Among its other provisions is one providing for the establishment and maintenance of a permanent forestry commission. Under it the members of our present commission hold their offices.

To accomplish this much has required about ten years; a long period apparently, considering the progress made. But during this time far more has been attained than is apparent to a superficial observer. Many persons now realize the value of forest property, and the importance of its proper management. Many have learned that it is God's decree that about one half of this state shall produce wood and timber and nothing else; and that that decree can never be reversed or barred by any statute of limitations, or by any changes likely to occur in this geologic period.

TWO SYSTEMS OF FOREST MANAGEMENT.

Two systems of forest management now prevail in this White Mountain region; one conservative, and the other destructive; one regardful of the present and the future both, the other of the present only.

The first restricts the cutting, at intervals more or less regular, to mature trees only, and generally to those above a minimum size. That was the old practice before the present facilities of transportation had been realized, when logs were floated to market upon the nearest streams. Of some lumbermen, it is the practice to-day.

Certain advantages attach to this usage. It is systematic. By

its adoption, a crop may be taken from a given tract once in some twenty years perpetually. If his forest is large enough to allow the owner to be satisfied with the removal of the mature trees from a twentieth or twenty-fifth part of it each year, he and his successors may log thereon forever. Thus treated, a forest well situated affords a safe and most desirable investment of capital.

The second system is that of cutting clean, and the removal at once of the whole growth of the area logged upon. The improved means of transportation, whereby the cutting of hard-wood lumber, small spruces, poplars, and cord wood, and the manufacture of charcoal, has been made profitable, accounts for this practice. The argument urged by the lumberman in its favor is, that he has put his money into his enterprise and must get it out again, with the most profit he can secure; and that this is the best system for him. He will also say, that even if it be not the best in the long run and for the other industrial interests, more or less injuriously affected by it, he is working for himself and for present profit, and not for his neighbors or posterity.

But this is a system of denudation, fraught with all the evils consequent thereto. Woodlands thus treated are left covered with scattered masses of inflammable debris. If, by any means, this takes fire, as it is very liable to do, the sphagnous coating of the forest floor, the "duff," as the lumbermen call it, is destroyed, with more or less of the vegetable matter of the soil itself.

This system involves also the loss of a very large portion of the winter precipitation of snow and rain. In this White Mountain region, unprotected ground freezes by the first or middle of November, and becomes impervious to water. From this time on, during the ensuing winter and early spring, its covering of snow and ice is largely dissipated by the sun and winds. Whatever of it remains melts rapidly at the advent of warm weather, and converts to short-lived torrents the peaceful streams which were wont to convey their waters harmlessly to the sea. The flood having passed, dry channels, strewn with confused masses of rocks and vegetable debris, remain. Thus, upon denuded areas, very little of the late autumn, winter, and spring rain and snow-fall enters the ground, there to be retained until gravity presses it out to make equable and permanent the volumes of the stream it was intended to feed. We have not at the base of these mountains, as has Italy at the foot of

the Alps, a series of deep lakes to act as reservoirs for the temporary retention of its spring floods, to be afterwards sent thence, as wanted, on their beneficent journey.¹

If it be said that this evil is but temporary, and that nature will again reforest her wooded domain, the reply will be encountered that nature will require from fifty to seventy-five years in which to produce a new forest of merchantable trees on a denuded area, and that any considerable, even temporary, injury to the numerous water powers for which this region serves as a reservoir, means disaster to some of the most important manufacturing interests of the state. When it is remembered that upon the Merrimack and its tributaries, more cotton is manufactured than upon any other river of the world, the serious consequences of denudation in the White Mountain region become apparent.

NEITHER SYSTEM SATISFACTORY.

But neither of these systems, if such they may be called, is satisfactory. The objections to the latter, already stated, suffice to condemn it. To them may be also added the temporary marring of the scenery and the danger of destroying altogether the spruce, the most valuable of all our White Mountain trees.

Of the two systems, the former is by far the preferable one. Yet it but partially secures the object sought—maximum returns at reliable and regular intervals. Nature is capricious in her seedings, and does not sow the ground evenly. As a result, much space is left vacant and succeeding crops are but partial ones. While on some acres, twenty thousand feet or more of spruce are often cut, others bear nothing, and the average yield is but about five. If the removal of selected trees were followed by the judicious planting of vacant areas, and by judicious thinnings where needed on the whole tract, this system would be greatly improved and the income from the forest greatly enhanced.

¹ The loss consequent upon extensive denudation of the White Mountain region, is made apparent by a glance at the mean annual rainfall recorded at Laconia, the nearest point to this locality at which accurate records have been long kept. Here, the average annual precipitation—snow being reduced to water—during the period of twenty-seven years, extending from 1857 to 1884, was 43.12 inches, while the average annual amount from the last half of October to the close of the first half of the following April was 21.57 inches.

From this record, it is apparent that the entire denudation of the water sheds of the Merrimack and Saco rivers would involve a loss of at least one half of the water power on these streams, and render them substantially valueless for manufacturing purposes.

A person acquainted with the woodland practices of Europe is liable to tell us that we have no forestry in this country, and I regret to say that such is substantially the fact. But, that in time we shall have, there is no reason to doubt. When, how, or by whom, is not so clear.

Too much must not be expected of the state, for it does not own a single forest acre. In 1867 it sold the last of its timber lands for the paltry sum of \$25,000. If standing to-day, they would command \$1,000,000. But it has already done something, and can, and doubtless will, do more to encourage forest improvement, and diffuse correct ideas as to the management of woodland property.

Our main reliance, however, for the introduction of a true system of forestry, must be upon the proprietors of such property. Under our laws, these have the right to manage their forests as they please. This right they will be slow to relinquish, and they will not change their present practices for better ones until convinced that those proposed are superior to those in use. To find a better system than any we now have, and to commend it to the capitalist, the lumberman, and the owner of forest lands, is to be one great effort of our able and efficient Forestry Commission.

INJURY TO THE SCENERY.

There has been painful apprehension that the inroads upon its woods will destroy the beauty of the scenery of this region. That is in part, at least, unwarranted. Lands entirely denuded are soon covered with new growths which conceal their nakedness. A portion of the Russell mountain, which you will see to-morrow, was cut over some fifteen years ago. It now looks as attractive from the front piazza of the Deer Park hotel, as when covered with its primeval growth; unless, indeed, you insist that the absence of the dark masses of spruce, which formerly broke the monotony of its deciduous foliage, detracts from its former beauty.

INJURY TO THE WATER POWERS AND RAILROADS.

The greatest injury to be feared from a hasty and unwise removal of these forests is the impairment of the water powers upon which many of our most important manufacturing interests are dependent,

and to the railroads to which a lasting supply of freight is of consequence. But, strange to say, neither the manufacturers nor the railroads have, as yet, expressed any concern as to this matter.

LUMBER RETURNS.

Of the great lumber industries of New Hampshire, which center largely in the White Mountain region, I will say that I have here the preliminary totals, as given in the last census of the United States.

From these it appears that 831 establishments report an aggregate capital of \$12,311,513; that the officers, firm members, clerks, and operatives number 8,572; whose aggregate wages were \$2,414,461, and that the whole value of their products was \$10,907,438. These figures afford some idea of the magnitude of our lumber industry. To my great surprise, and perhaps to yours, they are about double those representing the same industry in our neighboring state of Maine.¹

A SANITARIUM.

Owing to its nearness to the immense population which surrounds it, this White Mountain region has also become important as a summer sanitarium. Its air is of the purest, its waters of the clearest, its scenery of endless variety, its boarding-houses and hotels are comfortable, some of the latter being sumptuous. Ten millions of people, more rather than less, living within a radius of three hundred miles from Mount Washington, can leave home in the morning and reach its summit by a daylight ride of twelve hours or less. It attracts the man of science, the seeker after health, and the general tourists.

PRESENT STATUS.

The present status of the forestry interest in New Hampshire is about this:

1. More than half of the state is to-day in forest, and being insusceptible of arable culture, must ever remain so.
2. During the last decade an increased interest in the welfare of forest property has been awakened, a forest law has been enacted, and a permanent forestry commission has been established.

¹ See Appendix, Paper I.

3. It is now the opinion of all intelligent owners of forest property,—

(1) That the present methods of lumbering are faulty, and may be improved to the profit of all parties interested therein.

(2) That, so far as possible, every acre should be kept adequately covered with growing trees.

(3) That all forest products should be harvested, from time to time, as they mature.

(4) That, when properly managed, forest property will yield sure and fair returns, and form a desirable investment of capital.

(5) That the true objective point in New Hampshire forestry is the attainment of such a systematic management as shall secure to the owners of wooded property, at regular croppings, maximum returns therefrom.

CONCLUSION.

I have sometimes wished that some person in supremest sympathy with the spirit of these mountains and forests might appear, to record in prose or verse their history and their traditions; to do, in short, for this region, what Sir Walter Scott has done for Scotland. But with the wish has come the thought that this work has been done in part, at least, already.

The geologist has been here and told us how, out of this immense elevation of rock and earth, Omnipotence has sculptured with chisels of frost and stream and air these towering mountains and intervening valleys. So, too, has the historian, and made record in graceful prose of the destruction of the Willeys by an avalanche in 1826; of dangerous wanderings upon the mountains by strangers dazed by mist and cold;¹ of old Chocorua, the last of his people, retreating up the mountain which bears his name, before his enc-

¹ *Mountain Tragedies*.—The destruction of the Willey family, by a landslide in the White Mountain Notch, occurred August 28, 1826.

Frederick Strickland, an Englishman, perished in the Amonoosuc Ravine, in October, 1851.

Miss Lizzie Bourne, of Kennebunk, Me., perished on the Glen Bridle path, near the summit, on the night of September 14, 1855.

Dr. B. L. Ball, of Boston, was lost on Mount Washington in October, 1855, in a snowstorm, but was rescued after a two days and nights exposure, without food or sleep.

Benjamin Chandler, of Delaware, perished near Chandler's Peak, half a mile from the top of Mount Washington, August 7, 1856, and his remains were not discovered for nearly a year.

Harry W. Hunter, of Pittsburg, Pa., perished on the Crawford Bridle path, September 3, 1874, a mile from the summit. His remains were found nearly six years later, July 14, 1880.—Crawford's History of White Mountains, pp. 201, 202.

nies, to its summit, thence to curse the surrounding country and throw himself to the depths below, a victor vanquished.

And the poet, also, has been here, to tell us of the wonderful apotheosis of the great Passaconaway:

“A wondrous wight ! Far o'er Siogee's ice,
 With brindled wolves, all harnessed three and three,
 High-seated in a sledge, made in a trice,
 On Mount Agiochook, of hickory,
 He lashed and reeled and sung right jollily.
 And once upon a car of flaming fire,
 The dreadful Indian shook with fear to see
 The king of Penacook, his chief, his sire,
 Ride flaming up to heaven, than any mountain higher.”

And hither, from time to time, have come, and made records of their visits, the first President Dwight, Professor Thomas C. Upham, William Oakes, Thomas Starr King, Whittier, Emerson, Henry Ward Beecher, William C. Prime, Julius H. Ward, Appalachians many and still others more—a goodly company all. ¹

Hither, also, you, ladies and gentlemen, have to-day found your way, to read upon these broad, unfolded pages of earth and stone God's great record of the Past. Permit me, in closing, to express to you the heartiest wish of our New Hampshire people, that your stay with us may be as pleasant as the welcome we tender you is cordial and sincere.

¹ See Bibliography of the White Mountains, post p. 107, II.

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APPENDIX D.

FOREST PRESERVATION THROUGH CO-OPERATION.

AN ADDRESS

DELIVERED BY GEORGE B. JAMES BEFORE THE
AMERICAN FORESTRY ASSOCIATION,
AT THE PROFILE HOUSE,
AUGUST 25, 1894.

FOREST PRESERVATION THROUGH CO-OPERATION.

BY GEORGE B. JAMES.

That America has been wasteful with her forest products is beyond question. Still they have been one of the greatest elements in the rapid civilization of this continent, and in the building up of moderate cost homes for the million. Even now American forests are more extensive than those of any other nation. Russia stands second. Aside from Russia, the forests of the United States number more acres than the combined forests of the world. Forests cover ten per cent. of the earth's landed area, and twenty-five per cent. of the area of Europe.

Admitting that the forests of the United States stand at the head in their extent, so also does the value of our annual consumption of forest products, which is fully one-half that of the whole world. It is fourteen times that of Great Britain, nearly ten times that of Sweden and Norway, and almost three times that of Russia. The annual yield of the forests of the United States is fully \$1,000,000,000. This represents ten times the value of gold and silver mines, three times that of the wheat fields, and three times the combined coal, iron, and petroleum products of the country. Of course our forests cannot supply the present demand for many years without increased attention to their preservation, or without importing timber from other sections of the world.

It is likely that timber will soon be dearer in the United States than in Europe, where the consumption is less. Next to the United States and Russia, Brazil stands third in forest area, with Canada, Sweden and Norway, Austria, Hungary, Germany, the Argentine Republic, and France following in the order named. Hence, how important that Americans consider well the claims of forestry preservation.

Our forest products are to play a still more important part in the future national progress than in the past. The production of wood pulp mainly for paper consumes the forest growth of five hundred acres per day. The starchy products of wood now wasted in the soda and sulphite processes of pulp making can be utilized for human and cattle food and in the arts, ranking with the starch from potatoes and grain. Wood-pulp manufacturers utilize fifty per cent. of all the spruce logs cut in the United States. Within ten years half as much wood will be demanded in the production of textile fabrics. French chemists have succeeded in making silk and other fabrics from wood pulp. The nearer the forests are to manufacturing centres, the more valuable their products. Scientists predict that the cheap carbon compounds of wood must serve a useful purpose in the combination of the elements in synthetic chemistry. The United States burns more firewood, builds more wooden fences, and erects more wooden houses than any other nation on earth. Great Britain consumes less firewood and burns more coal per capita than any other country.

The most hopeful sign of the times in connection with forestry preservation is the increasing interest and discussion manifest among the intelligent classes. Public sentiment thoroughly aroused will define some plan for effective work. Coöperative work, a union of forces, will knock down existing prejudices and render available the needed capital for inaugurating one or more model forestry preserves.

Enthusiasts in forestry matters chafe at the apparent indifference of the masses, and wonder at the general apathy in face of impending danger to our American forests. America has given less attention to forestry preservation than any other nation, simply because there was less need of it, owing to the abundance of primeval forests. The rapid exhaustion of these forests now brings the problem prominently to the front. Individuals, communities, or nations are not inclined to anticipate the scarcity of raw materials, or famine in standard products. The abundance and former cheapness of forest lands in America have prevented that appreciation of their value which exists in the older communities in Europe. Our policy has been to utilize the forests as rapidly as possible. The general idea of land values on this continent since its discovery has been on a low basis of cost. Low cost has given the false impres-

sion of inexhaustible supply. Let us briefly glance at the original cost of lands in America, and thus discover one cause of the lack of appreciation among our people.

History tells us that in 1497 John and Sebastian Cabot planted the cross and the flags of England and St. Mark on American soil, and thus claimed the continent for Henry VII., the English king. He wanted the earth. The original cost was trifling. Jacques Cartier, in 1535, ascended the St. Lawrence river, claiming possession of Canada for the French. Canada was conquered by the English, and by the treaty of Paris, 1763, the English flag waved over the whole eastern half of America, from the Atlantic ocean to the Mississippi river. The land speculations of the nineteenth century sink into insignificance beside these kingly ventures of earlier days.

It will be remembered that in 1606 King James I. of England granted all lands from 40th to 48th degree of latitude to the council established at Plymouth in England. The Plymouth council made sales in 1624 to Sir Ferdinando Gorges and John Mason, of parts of Maine and New Hampshire. In 1639, Charles I. chartered to Gorges the province of Maine, not even then dreaming of the value of its forests, or not placing any value upon them in those early days. The equivalent for the charter was that King Charles should receive one fifth the output of gold and silver mines and pearl fisheries. No mention was made of forest products. In 1652 Massachusetts Bay colony claimed the heritage of Sir Ferdinando Gorges, and deposed Edward Godfrey, first governor of the province of Maine. Maine continued a part of the Massachusetts colony for 168 years, until 1820. History does not report that the province of Maine cost Massachusetts anything except its protection with the single payment of £1,250 in 1677 to Gorges's grandson or about \$6,000.

Now, let us see what Massachusetts secured for this insignificant outlay. Massachusetts owned in Maine at the close of the French and English war 17,000,000 acres, mostly primeval forest. She immediately commenced the policy of getting rid of it as fast as possible. From 1783 to 1821 she sold nearly 5,000,000 acres of land for \$800,000, or about 17 cents per acre. She granted to public uses 1,200,000 acres. In 1795, Massachusetts, in her anxiety, to get rid of these lands, established a lottery, and thus

sold many townships. In 1820, at the separation of the state of Maine from Massachusetts, 11,000,000 acres of land were still unsold. These were divided, Massachusetts taking half and Maine one half. The same year Massachusetts offered to sell her entire interest in her 5,500,000 acres of land to the state of Maine for the insignificant sum of \$150,000. The Maine legislature voted to accept the proposition. The Massachusetts house of representatives assented to the transfer, but the Massachusetts senate refused to confirm the sale. Thus it will be seen that Massachusetts was willing to sell its timber lands in 1821 for less than three cents per acre. Massachusetts, however, sold many a township of pine trees at \$5,000 each, or less, which were worth, within twenty-five years afterwards, \$200,000 each, and would be worth to-day, if standing, a much larger sum. If the state still owned her 11,000,000 acres, as in 1820, \$30,000,000 would be a fair valuation in 1894.

Even in more modern times, France sold her landed possessions in the United States, extending from the Gulf of Mexico to British America, and from the west bank of the Mississippi to the Rocky mountains, under what is known as the Louisiana purchase, for \$15,000,000. The purchase of Alaska, rich in forest wealth, is familiar to all. Thus it will be seen that the average American has been educated to place a very light value upon forest lands, and hence it is little wonder that intelligent forestry has made little progress in our American communities.

Advancing values insure better systems of forestry preservation. Even the lumberman practises improved methods on an acre of forest land costing \$10 to \$15 when his wasteful systems would prevail upon similar land, costing \$1 per acre, 25 years ago. The average lumberman is more influenced by his pocketbook than by his sentiment. The forestry idea will grow because it is right. As our forestry area gets small, people will wake up and call the forestry agitators blessed.

The main White mountain forests lie in incorporated towns in New Hampshire, and were granted by royal charters through the provincial governors to proprietors from 1763 to 1775. These towns were divided into lots and ranges and apportioned to each proprietor. Some other grants were made by the crown for services in the French and Indian wars. The balance has since been sold by the state at various times at low prices. These forest

had little intrinsic value in those days. They were largely inaccessible until the advent of the railway systems. Large areas were sold and resold for taxes, the original owners preferring to lose their lands rather than pay the taxes. Forest-land values have advanced materially since the early days.

It is important that our accessible forests at least should be owned and controlled by those who have the highest and most comprehensive idea of their value. If only a block here and there could be thus controlled it would leaven the whole system of forestry ownership. Co-operation is the watchword. Appoint a representative board of trustees, create a general fund to which all classes may contribute, purchase desirable blocks of forest land. Develop the same under comprehensive plans of forestry management. Commence in a moderate way if need be. Purchase a few hundred or a few thousand acres at the start. The all important feature is to make a beginning. Show to the world practical work in demonstration of theory and sentiment. One such co-operative forest preserve, under favorable conditions, will check the tide of destruction and prove a beacon light on the coast of progress.

Similar results may be obtained through corporations or clubs organized for the purpose, or let 200 or 500 capitalists subscribe \$1,000 each and purchase a forest preserve in the White mountains, erect hotels, club or boarding houses or cottages, with well-constructed roads. Managed in a public-spirited way, these enterprises would form object lessons of great value. They would also prove healthful and pleasurable resorts among the beauties and wonders of the forest, at the same time in association with congenial and intelligent people. Americans have too little recreation. Interested in a forest preserve, they would have an incentive to dwell among its beauties, to study its growth and development, and to benefit by the pure air, sparkling water, and healthful exercise.

Co-operative ownership would aim at the preservation and proper working of present growth. The present low cost of forest lands renders any attempt at tree planting inadvisable during the present generation. Nature shows us forests, averaging 100 years old, which can be purchased at a cost not exceeding 10 cents per tree. Can the minds conceive of more satisfying and more substantial investment! Forest lands are the most valuable of all forms of

real estate, and the most difficult to duplicate. Co-operative purchasers of forest land are advised, not on sentimental grounds alone, but also by reason of their being investments worthy the investigation of the most critical and conservative capitalists.

Co-operative ownership is recommended to investors because a forest preserve supplies a healthful and attractive vacation spot; it furnishes an income to pay the bills, and finally, it will afford a rapid increase in the value of growing timber. Old Time keeps right along reeling off the centuries, and rational forestry should not be limited to the work of a single human life, but developed under methods covering generations.

The American people need to be educated up to the importance of forestry matters in the school, in the college, in legislative halls and in the clubs. Agricultural colleges should establish a chair of forestry. We need educated foresters, learned as well in theory as in practise. All those interested in forestry should co-operate heartily in the work of forestry commissions, forestry clubs and associations.

Good resolves, brilliant speeches, learned essays will not alone save the forests. This exemplary work must be directed towards co-operation in the absolute purchase and control of forest areas. A few forest preserves systematically managed would furnish needed object lessons for individual operators, many of whom are sacrificing their property in one indiscriminate slaughter of trees. Rational forestry demands a cutting out of the ripe and fully-grown trees, thus stimulating the growth of immature specimens. In this manner the forest becomes a perpetual source of income.

In conclusion, there are thousands of intelligent Americans who are fully alive to the importance of wise provisions for preserving the forests. This individual taste and desire needs to be crystallized into co-operative work. Union of forces in the purchase and control of a single block of forest lands would set the example certain to be followed by others. A rallying point is needed. Leaders in the good cause will find a willing army of supporters. Who shall inaugurate the co-operative movement in the preservation of our forests?

APPENDIX E.

THE GROWTH OF SPRUCE.

SUMMARY OF ALL BIOLOGICAL INVESTIGATION
OF THE WHITE MOUNTAIN SPRUCE, CON-
DUCTED UNDER THE DIRECTION OF PROF.
B. E. FERNOW, BY AUSTIN CARY, 1894.

THE GROWTH OF SPRUCE.

Mr. Cary's investigation dealt with individual trees, and with sample acres, and the results aimed at were the discovery of the type of the White Mountain spruce, its fibrous structure, its tensile, supporting, and breaking strength, its average age, and its annual increase in volume.¹

The most striking fact which Mr. Cary's investigation discovered was the importance of the obvious topographical division of the state into two areas of plain and mountain. In the northern division, the mountainous portion, the spruce is the dominant tree. South of that, the spruce is very scarce, and species of a deciduous growth predominate. Comparing the forests of the northern division of the state with those of Maine (the whole of Maine, except York and Cumberland counties, being included so far as tree growth is concerned in the northern division), the timber in New Hampshire is found to stand much heavier than in Maine. Sargent's report in the census of 1880 averages the stand of spruce in Coös county to be five to six M. per acre, though 25 M. is not an extraordinary yield, which is perhaps twice as great as the average stand in eastern Maine. The observation of the investigator also led to the conclusion that the spruce is less mixed in New Hampshire, and seems also to stand thicker; while he reports that for size and quality he has never seen elsewhere such spruce trees as those which grow in the valley of the Ammonoosuc.

¹ See Appendix.

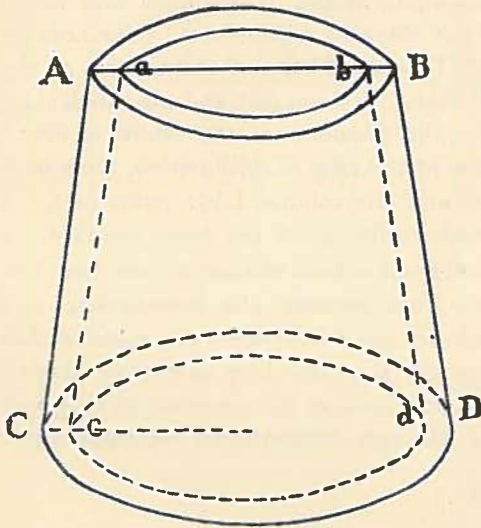
The spruce forests of New Hampshire, examined by Mr. Cary, are largely virgin growth. He writes,—

The rough topography and the fact that the state is not well-watered with the streams which may be easily driven by the lumbermen, have saved the country for many years. Railroads are essential in lumbering large tracts in New Hampshire, and it is only within the past five years that they have been built to any considerable amount. They also require much capital, and hence the operations and the land are in the hands of large concerns, so that a scheme of forestry management could much more easily be put into effect in New Hampshire than in Maine. An obstacle to the successful introduction of scientific forestry in New Hampshire is found in the fact that under present conditions of the lumber business small trees are valuable. The large capital invested in railroads which it would be expensive to maintain for many years also tends to the cutting of small trees, and the pressure is to cut all the growth available when once the operation is begun. Thus, accessible forests in the state, which were cut over forty, fifty, thirty, and even twenty years ago, have been cut generally at two or three successive steps, thus favoring the reproduction of the spruce, while the present method of lumbering is likely to diminish the reproduction.

The chief question of scientific and economic import is, to what extent does cutting, as practised now, turn the land over to the undesirable growth. On most of the tracts now under operation, considerable young spruce is left, and trees that have been permanently crippled can be depended upon to make good growth; in fact spruce can be counted upon to make its way in any sort of competition, though it is idle to look for a successful crop, as lumbering is now carried on in this state, in less than fifty years at least.

The determination of the annual increase in volume of tree growth, by the agent of the forestry division, deals necessarily with the individual tree, and a description of the process used by him may properly find a place here. The tree at any time is approximately a cone in shape, the last year's or ten years' growth being spread as a layer over its surface. The log, therefore, is the frustum of a cone, and the wood added to it in the last ten years is the present volume of the log less its volume ten years ago. The accompanying diagram will make this matter clear.

The volume of a log of this kind is approximately one half the area of the two bases multiplied by the length. In the schedules printed elsewhere, the length is directly given, and the area of the sections AB and CD may be calculated from the diameters. Bb and Dd are given also—the thickness of the outer ten rings in the sections—from which the diameters and the areas of ab and cd may be obtained. In this way, introducing factors to reduce all measures to feet, and adopting the formula



for logarithmic work, or better, tables of circles, the growth of trees has been calculated.

One modification, however, needs explanation. In the case of butt logs the area of the ring at the top is presumed to be equal to its area at any point below, and is multiplied directly by the length. This proves to be a close approximation to the truth if the logs are not butts. In this work the large trees are figured on from one foot above the ground to about four and six inches in diameter, so that the result represents the annual addition to the merchantable trunk.

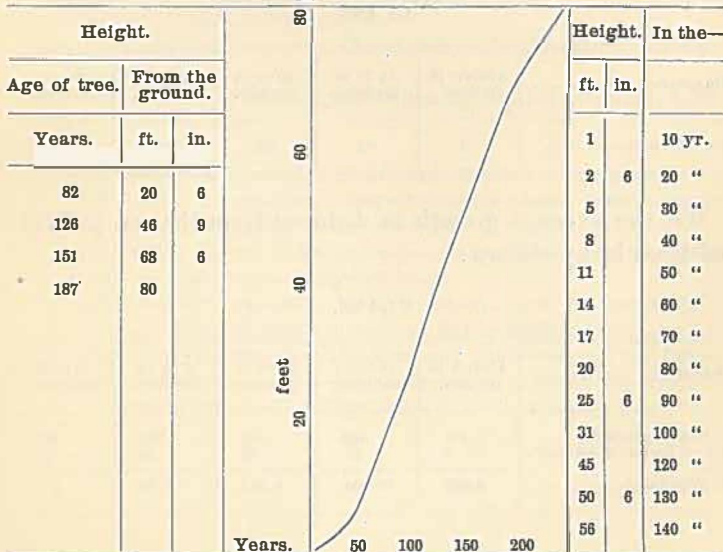
Smaller trees than ten inches are figured to the extreme top. By referring to the individual tree schedule herewith presented, for example, the processes may be followed. In this case the length of the butt log is called $19\frac{1}{2}$ feet, the diameter of the wood at the top is 11.8 inches, and the thickness of the outer ten rings 11 millimeters. Calculating as described, the area of the ring formed by the last ten years' growth is 1.073 square feet, and its volume 2.093 cubic feet; ascending to the next section, $26\frac{1}{2}$ feet higher, the wood of the tree was eight inches in diameter, and the thickness of the outer ten rings 15 millimeters. The area of this ring, then, is .0954 square feet, and the volume of the growth is .2658 cubic feet. Sixteen feet and nine inches higher at the next section, the diameter of the trunk is four inches, and the thickness of the ring 12 millimeters, the area being .0363 square feet, and the volume 1.107 cubic feet. Adding the three partial results gives the total result of the last ten years, or 5.858 cubic feet, or that of one year, practically .6 cubic feet. This, remarks the investigator, is the largest growth made by any of the trees measured within the state, and is large for a spruce tree anywhere, according to his observation, and justifies the selection of this particular tree to represent the best development of the country.

INDIVIDUAL TREE-SCHEDULE.

POSITION: CROWN PARTLY FREE.

Diameter breast high.		Length of timber.		Diameter below crown.		Length of crown.		Length of leader for last 5 years.		Stump.		Sections.																							
in.	ft.	in.	in.	in.	ft.	in.	in.	in.	in.	ft.	in.	Number.	Length.		Diameter at top.	No. rings at top.	Thickness of bark at top.																		
													ft.	in.	in.		in.																		
14	30	....	10.7	46	....	33	48	14.3	25	162	6.4	1	16	6	11.8	105																	
												2	26	8	8.	61																			
												3	16	9	4.	36																			
												4																							
												5																							
Diameter at	Inch.	4	ft.	8	"	12	"	16	"	20	"	24	"	28	"	32	"	36	"	40	"	44	"	48	"	52	"	56	"	60	"	64	"	68	"

AGE OF TREE, 187 YEARS. TOTAL HEIGHT, 80 FEET.



The curve represents graphically the growth in height.

DETAILS OF SECTIONS.—MEASURES IN MILLIMETERS.

Number.	Sapwood.		Thickness.	Distance from bark through ring.									
	Rings.	Thick.	Bark.	10	20	30	40	50	60	70	80	90	100
1	31	35	7	11	23	34	49	65	85	104	121	132	144
2	23	33	7	15	30	44	61	80	99				
3	19	24	4	12	25	40							

Passing now from the individual tree to the growth upon the sample acre, the schedule for which is printed herewith, it will be noted that the trees are divided into diameter classes, a summary of which is as follows (only spruce being counted):

CLASS.

Diameter.....	24 to 30 inches.	18 to 24 inches.	14 to 18 inches.	10 to 14 inches.	6 to 10 inches.	3 to 6 inches.	Under 3 inches.
No. of Trees.	2	11	29	28	14	22	134

On the largest trees a proportion doubtless are much past their prime and growing but little. Throwing out a proportion on this amount leaves the score:

CLASS.

Diameter.....	Above 18 inches.	14 to 18 inches.	10 to 14 inches.	6 to 10 inches.	3 to 6 inches.
No. of trees.....	8	27	28	14	22

But the average growth as deduced from that of individual trees is, by classes:

CLASS.

Diameter.....	Above 18 inches.	14 to 18 inches.	10 to 14 inches.	6 to 10 inches.	3 to 6 inches.
Average growth.....	.424	.448	.339	.165	.05
No. of trees on an acre.	8	27	28	14	22
Multiplying.....	3.392	12.096	9.492	2.31	1.1

The total growth on the acre as thus figured is 28.39 cubic feet. Omitting the two smallest ones, and deducting 20 per cent. for safety, and because the trees from which the growth was derived were somewhat better than the average of the country, the result shows the annual replacement of wood material available for lumber upon this sample acre to be about 20 cubic feet.

SAMPLE ACRE SCHEDULE.

FIELD RECORD.

Italics indicate topographic conditions.

Species: *Picea nigra*.

STATION (denoted by capital letter):

State: New Hampshire. County: Coös. Town: Thompson and Meserve's Purchase.

Longitude: 71°15'. Latitude: 44°15'. Average latitude: Say 800 feet.

General configuration: Plain—hills—plateau—*mountainous*. General trend of valleys or hills: North and south.

Climatic features: Cold winter, short summer; mean annual temperature, 41°—20°; mean annual rainfall, about 40 inches, Stratford; about 84 inches, Mt. Washington.

SITE (denoted by small letter): g.

Aspect: Level—ravine—cove—*bench—slope* (angle approximately: 20°—40°.)

Exposure: East. Elevation (above average station altitude): 3,000 feet above the sea.

Soil conditions:

- (1) Geological formation (if known): Samentian gneiss.
- (2) Mineral composition: Clay—limestone—loam—marl—*sandy loam—loamy sand—sand—gravelly*.
- (3) Surface cover: Bare—grassy—*moosy*. Leafy cover: Abundant—moderate—*scanty—lacking*.
- (4) Depth of vegetable mold (humus): Absent—moderate—*plenty*—or give depth in inches: Six or eight inches.
- (5) Grain, mechanical conditions, and admixtures: Very fine—fine—*medium—coarse—p o r o u s—l i g h t—loose—moderately loose—compact—binding—stone or rock, size of:*

(6) Moisture conditions: Wet—*moist*—fresh—dry—arid—*well drained*—liable to overflow—swampy—near steam or spring or other kind of water supply.....

(7) Color: Brown.

(8) Depth to subsoil (if known): (*Shallow*, 6 inches to 1 foot)—*deep*, (1 foot to 4 feet)—very deep, (over 4 feet)—shifting—shallow except in hollow. Rocks form much of surface.

(9) Nature of subsoil (if ascertainable): Country rock.

Forest conditions: *Mixed timber*—pure—dense growth—*moderately dense*—open.

Associated species: Fir, birches, maples.

Proportions of these: Spruce, one-half—seven-eighths of large trees.

Average height: Say 70 feet.

Undergrowth: *Dense—scanty—kind*: Varies; Young fir and maple, moosewood, etc.

Conditions in the open: Field—pasture—lawn—clearing (how long cleared):

Nature of soil cover (if any): Weeds—brush—sod.

1. Openings: Form about five per cent. of the entire space.
2. Distribution of trees: In clusters, the smallest trees of each species notably so.
3. Crowns of large spruce well developed; fairly dense; 3-6 and 6-10 classes generally thin and suppressed. Crowns of large firs open, straggling, often dying.
4. Trunks of large spruce straight, unless noted; covered with limbs generally above ten or fifteen feet. About one third of those over eighteen inches in diameter are clear twenty or twenty-five feet. Trunks of large firs straight; covered with limbs from a few feet above ground.

On the east slope of Mt. Adams in the Presidential range, about 1,000 feet below timber line, on very steep and rough ground, rocks form a considerable portion of the surface, but clinging to the slopes and in crevices and hollows is enough soil to support a large crop of trees. Most of this soil, so far as can be seen, is of vegetable origin.

On the large spruce live limbs begin as a rule 25—30 feet from the ground; 40—45 feet is an average length of crown for the larger timber trees. The smaller ones in the 10—14 class would not equal these dimensions, while there is in all classes much variation. Crowns are fairly dense and in good condition, being generally much heavier down hill.

The birches on this acre were generally crooked, with low limbs. Crowns were not as a rule large, and the general impression is that they are above the level of quick and smooth growth.

As regards fir the great number of small trees, and the comparative fewness and poor condition of the larger ones, are the most noticeable points.

SUMMARY OF GROWTH UPON ACRE.

Spruce:

No. trees on acre.....	241
Estimated volume.....	2,550 cu. ft.
No. over 10 inches in diameter.....	70
Estimated value of same.....	2,300 cu. ft.
Merchantable lumber about.....	9,000 ft. B. M.

White and Yellow Birch:

No. of trees on acre.....	180
Estimated volume.....	400 cu. ft.
No. over 10 inches diameter.....	10

Fir:

No. trees on acre.....	1,005
Estimated volume.....	900 cu. ft.
No. over 10 inches diameter.....	23
Total no. trees on acre.....	1,533
No. over 10 inches diameter.....	103
No. about 6 ft. high and 1 in. diameter, about	500
Total volume of wood on acre, estimated.....	3,860 cu. ft.

This estimate of annual increase may be verified by a study of the individual sample trees upon this acre of which measurements, similar to those presented in the schedule upon page 35, were taken. These individual samples, numbered to 26, and their measurements, with the consequent deductions, are presented in the subjoined table:

TABLE SHOWING CALCULATED ANNUAL GROWTH OF TREES
MEASURED ON THE SITE.

	No. tree.	Over 18 in.	14-18 in.	10-14 in.	6-10 in.	3-6 in.	Under 3 in.
131					
225				
324					
411		
529					
604	
759	.46	.32			
846	.48	.29			
981					
1040	.20			
1148	.50	.11			
1256	.48	.35	.17		
1346					
1411		
1502	
1611	
1708	
1807		
1902	
2037			
2147	.48				
2245					
2335					
2409		
2523			
2626			
Average of above by classes.....		.42	.45	.34	.16	.05	.005
Average revised.....		.45	.45	.34	.16	.05	.005
Number trees on acre by classes.....		.18	29	28	14	22	134
Multiplying through.....		5.85	18.05	9.52	2.24	1.1	.67

Sum of these products 33.4. Deducting 20 per cent...	26.7 cu. ft.
Percentage of annual growth to stand.....	1.05 per cent.
Annual growth on spruce trees over 10 inches diameter	23.6 cu. ft.
Less amount added to defective trees.....	20 cu. ft.
Equivalent of 20 cubic feet in board measures about..	120 feet.
Annual growth on acre supposing all species add same ratio to their volume as spruce.....	40.7 cu. ft.

Concerning the application of this result, however, it is worth noting that this acre is better than the average, and contains perhaps twice as much merchantable lumber, yet scattered trees would do better according to their number than thicker growth. Moreover, in old growth like this, old trees, slow-growing or perhaps dead, both of which are allowed for upon this acre, take up much light and room, which otherwise might be utilized by young and vigorous trees. Nevertheless, these figures illustrate the principle that in old and uncut timber, growth is neutralized by decay. In order to utilize fully the growth of our country, these areas of virgin forest should be cut through early. By processes of this kind the growth of large regions may be easily estimated, though the volume of facts is not sufficiently large at present for generalization. The basis for the true scientific work, however, is here, and as this body of knowledge is enlarged from year to year, the results will be laid before the people of the state.

The figures which these investigations produce are on file in the forestry division of the department of agriculture at Washington, and in a brief discussion of the figures above presented, relating to acre yields in a virgin spruce forest, Professor Fernow, the originator of the scheme of investigation, says:

The measurements of acre yields and tree growth carried on by the division of forestry, will attain their full value only when sufficient facts are accumulated, tabulated, and digested. It will then be possible to furnish tolerably accurate data, regarding the laws of growth of our species, from which profit calculations may be made.

Nevertheless, even the few data at hand give us an insight of what our natural forests are producing, and how they compare with those

grown under skilful management, allowing us an estimate of the value of such management in increased amount of product.

For this comparison we have selected an acre of spruce forest in Thompson & Meserve's Purchase, Coös county, New Hampshire, which was carefully measured. It lies 2,800 feet above sea level sloping east at an angle of 25 degrees; the soil is a medium loose, sandy loam, fresh and well drained, overlying the laurentian gneiss. The soil is shallow with a moderate amount of humus; the surface cover consists of mosses. This acre, which is considered typical of the region was covered with a mixed growth of spruce, fir, birch, and maple; the first two kinds forming the dominant growth, the latter with some of the spruce and fir appearing more in the nature of an under growth of varying height.

All trees, large and small, were counted, and it was found that the acre contained 1,533 trees in all, as follows: 241 black spruce, 1,005 balsam fir, 156 white birch, 24 yellow birch, 104 maple, 3 cherry.

Of this number, however, only 102 were large enough to furnish saw timber, being the dominant growth, namely, 71 spruces, 23 firs, and 9 birches, with a height of over 60 or up to 85 feet. The balance were all small trees, under 10 inches, and mostly under 3 inches in diameter. The diameters breast high of the timber trees were measured and arranged according to diameter classes, and there were found, with diameter of 24 to 30 inches, 2; 18 to 24 inches, 12 (1 birch); 14 to 18 inches, 33 (2 birch); 10 to 14 inches, 55 (6 birch).

The average diameter, therefore, would be 14.6 inches. Height and upper diameter of the log timber having been estimated, it was found that the 93 conifers (spruces and firs), which were lumber trees, would, under the present practice, yield 9,130 feet board measure, according to Doyle's rule, or if we reduce this amount to cubic volume, allow as much as one half for saw waste, round 1,500 cubic feet of round log timber.

The age of the dominant trees according to eighteen cut and measured ones, on which the rings were counted, varied from 198 to 300 years; even some of the lower growth, of which thirteen were also cut, measured and rings counted with diameters, breast high, of six to thirteen inches and height between forty to sixty feet, showed ages of 195 to 230 years, and those with diameters of three and one half to seven inches and heights of twenty-six to thirty-seven feet showed ages of 90 to 170 years, exhibiting the disadvantages under which they had struggled from early youth.

If we, then, place the dominant growth from which the lumber is cut at 250 years of age on the average the annual growth of lumber wood per acre had been not more than six cubic feet.

The total amount of wood on the acre including forty-six trees with diameters of six to ten inches was with the aid of the measured trees figured to be 3,450 cubic feet and this may be increased to 4,000 cubic feet by adding the trees over three inch diameter and then reducing

the average age correspondingly to say 200 years, we find the annual average accretion to be twenty cubic feet per acre and year. This we may consider the result of nature's unaided efforts.

For comparison as to what might be attained under good forest management we are, to be sure, lacking data from the same conditions, but it would be fair to compare with results obtained on the Norway spruce in the Harz mountains of Germany. The German forester divides his forest lands into four and sometimes five classes, varying in productiveness by from fifteen to thirty per cent. We will be about right to compare with second class soil in the region mentioned.

In a well managed forest of that region we would find at the age of 120 years 290 trees as dominant growth of nearly three times as many as on our natural grown acre at 250 years of age. To be sure, there would be hardly any undergrowth, the dominant trees standing so close as to prevent its development.

The height of the dominant growth would vary from seventy to ninety feet, or about eighty-five feet on the average as against our sixty to seventy feet. The crowns would be small and the trunks clearer; the diameters would range from ten to twenty-five inches averaging probably fourteen inches, and a total yield of wood of 14,300 cubic feet of which ninety per cent., or 12,820 cubic feet, is over three inches, and fifty per cent. is saw timber, or 6,400 cubic feet besides furnishing about 5,280 cubic feet of posts and poles, and twenty-four cords of good firewood.

The annual average growth would be over 100 cubic feet for wood over three inches, and over fifty cubic feet for saw timber. We find, then, a normally grown, well managed spruce forest to produce in half the time more than three to five times the amount of wood and timber which our virgin woods produce. And if we take the best results in our virgin spruce lands, say 3,000 cubic feet of saw logs per acre, and reduce the German output by twenty per cent., there is still three times the advantage in forest management. Nor should it be forgotten that the German forest, yielding such quantities is not the result of planting, but of judicious cutting of the virgin forest. We have it in our hands to do likewise.

NEW HAMPSHIRE FORESTRY LAW.

(SESSION OF 1893.)

Be it enacted by the Senate and House of Representatives in General Court convened:

SECTION 1. There is hereby established a forestry commission, to consist of the governor, *ex-officio*, and four other members, two Republicans and two Democrats, who shall be appointed by the governor, with the advice of the council, for their special fitness for service on this commission, and be classified in such manner that the office of one shall become vacant each year. One of said commissioners shall be elected by his associates secretary of the commission, and receive a salary of one thousand dollars per annum. The other members shall receive no compensation for their services, but shall be paid their necessary expenses incurred in the discharge of their duties, as audited and allowed by the governor and council.

SEC. 2. It shall be the duty of the forestry commission to investigate the extent and character of the original and secondary forests of the state, together with the amounts and varieties of the wood and timber growing therein; to ascertain, as near as the means at their command will allow, the annual removals of wood and timber therefrom, and the disposition made of the same by home consumption and manufacture, as well as by exportation in the log the different methods of lumbering pursued, and the effects thereof upon the timber-supply, water power, scenery, and climate of the state; the approximate amount of revenue annually derived from the forests of the state; the damages done to them from time to time by forest fires; and any other important facts relating to forest interests which may come to their knowledge. They shall also hold meetings from time to time in different parts of the state for the discussion of forestry subjects and make an annual report to the governor and council, embracing such suggestions as to the commission seem important, fifteen hundred copies of which shall be printed by the state.

SEC. 3. The selectmen of towns in this state are hereby constituted fire wardens of their several towns, whose duty it shall be to watch the forests, and whenever a fire is observed therein to immediately summon such assistance as they may deem necessary, go at once to the scene of it, and, if possible, extinguish it. In regions where no town organizations exist, the county commissioners are empowered to appoint such fire wardens. Fire wardens and such persons as they may employ shall be paid for their services by the towns in which such fires occur, and in the absence of town organizations, by the county.

SEC. 4. Whenever any person or persons shall supply the necessary funds therefor, so that no cost or expense shall accrue to the state, the forestry commission is hereby authorized to buy any tract of land and devote the same to the purposes of a public park. If they cannot agree with the owners thereof as to the price, they may condemn the same under the powers of eminent domain, and the value shall be determined as in the case of lands taken for highways, with the same rights of appeal and jury trial. On the payment of the value as finally determined, the land so taken shall be vested in the state, and forever held for the purposes of a public park. The persons furnishing the money to buy such land shall be at liberty to lay out such roads and paths on the land, and otherwise improve the same under the direction of the forestry commission, and the tract shall at all times be open to the use of the public.

SEC. 5. This act shall take effect upon its passage.

[Approved March 29, 1893.]

PROVISIONS OF THE PUBLIC STATUTES 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 wilfully, 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.