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FOREST SURVEY

OF

LITCHFIELD COUNTY, CONNECTICUT

BY

AUSTIN F. HAWES, M.F., STATE FORESTER

AND OF

NEW HAVEN COUNTY, CONNECTICUT

BY

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INTRODUCTION.

Purpose of Report.

The original timber of Connecticut was largely cut off during the Colonial period, and was an important factor in the early shipbuilding industry of the State. During the past century our forests have been mostly of second growth, supplying only material of small dimensions, such as cordwood, railroad ties, poles, piles and inferior lumber. The great manufacturing cities of the State and their industries have been largely dependent upon an outside timber supply.

The relative amount of native timber used locally is increasing. As the lumber regions which now supply Connecticut approach exhaustion their product will grow scarcer and rise in price. This will, of course, lead to an increased local use of Connecticut grown timber. Woods which at present are not considered usable will have to be employed for lack of anything better. In general, as timber supplies diminish, each section of the country will have to depend more and more on its own immediate neighborhood. This holds true of Connecticut, which eventually might supply its own needs. To be in a position to do so the woodlands must be protected and more carefully managed than is the case to-day.

The chief object of this report is to arouse interest in the forest lands of these two counties, which may lead to the adoption of better methods of treatment, resulting in a steadily increasing production by the forest.

Classification of Areas.

In mapping these counties the agricultural land was separated from the forested areas, as shown in Table I. Under the former more land is included than that devoted strictly to agriculture.

All the land in the counties, with the exception of the forested areas, is thrown into this class, the idea being simply to separate from the remainder of the land the areas which are best adapted to growing trees. The figures, therefore, include land in cities and villages, rivers, ponds and salt marshes; although agri-

cultural land, in the narrowest sense, of course, forms most of the area.

Within the forested area three further subdivisions or forest types were recognized, depending on the character of the growth. These types are as follows:

1. Mixed Hardwoods Type.
2. White Pine Type.
3. Abandoned Field Type.

The forest in general is one of mixed hardwoods, with rarely a small patch of white pine or mixture of hemlock, and occasionally, in the southern region, a white cedar swamp. The abandoned fields, which are seeding up to forest, cover a large territory and are classed as forested areas.

Even aged stands characterize the woodlands. Of course, stands of all ages occur, from tracts which have just been cut over to timber one hundred or more years old. But within the same stand the age varies only slightly. The system of clear cutting, which is extensively employed, accounts for the even aged character of the forest.

This uniformity of age within the same stand makes it possible to classify the various tracts within each type into broad age divisions. It has been done in this way on the map,* all stands one to twenty years of age being mapped together, and so on in twenty-year divisions. All timber over eighty years of age was put into one class.

The abandoned field type is an exception, in that trees of all ages occur, so that the age could not be shown on the map.

Under the abandoned field type are included all fields, formerly cultivated, which are now lying idle and slowly reverting to forest. Many of these fields are as yet bare of tree growth, except for a few isolated seedlings which serve to show the condition of the field.

Starting from such open fields, examples are found of all stages of stocking up to stands where a dense cover exists.

Estimate of the Standing Timber.

The estimates secured for this report were made ocularly while passing through the various pieces of timber. The total amount of cordwood was first estimated, and then a separate estimate

* This map has been prepared but not yet printed.

made of the number of first-class oak and chestnut ties. Thus the figures in Table III show by age classes and types the total number of cords, if the whole stand were to be cut into cords, including the trees which would make ties and lumber; but the table also gives the number of ties which could be cut.

It was thought best not to attempt in the field an estimate of the lumber, inasmuch as satisfactory figures for this product would require more accurate and detailed work.

Lumbering.

The merchantable timber in Connecticut lies in small bodies, with rarely any large amount in one place. In order to handle these patches of timber economically, small portable mills are needed, which can be moved about from place to place cheaply. At present logging is done largely with mills of this type, cutting on the average less than 10,000 feet B. M. per day when running. The mill is set up on or near the woodlot, and the timber hauled in to the mill on wagons or sleds.

When timber was more abundant there were a great many stationary sawmills run by water power. Frequently a sawmill was combined with a gristmill. In late years, since the timber has grown scarcer and more remote, the stationary mills are either disappearing altogether or else are sawing less than formerly. This is because it is cheaper to set up a portable mill on a remote lot and haul the sawed product to market, rather than to haul the logs out to a stationary mill to be sawed.

Where the timber is still scarcer and occurs scattered in very small quantities, it does not pay to set up a portable mill for each tract. Under such circumstances, the stationary mill is the best and eventually may be used more than the portable mills.

It is difficult to obtain correct figures for the annual cut of forest products in the State. Ties, poles, piles and cordwood are cut and marketed by many different men, most of whom do not keep accurate account of the amount taken out in a year. Since the ties are purchased by the steam and trolley roads, it would seem as though an accurate estimate for this product could be secured. But as a matter of fact, it is impossible from their books to ascertain the number of ties cut in the individual counties. The cordwood cut is still harder to estimate, because of the

innumerable landowners who cut and market it. A large amount is burned each year as fuel by the farmers, by brickyards and manufacturing plants. The cities and villages consume the remainder of the cut for fuel.

Most of the sawmill operators keep account of the amount of timber sawed at their mills. The amount sawed each year by the same mill varies greatly, depending on whether or not the owner secured enough jobs to keep the mill running. On account of this fluctuation the attempt was made to estimate the average annual cut of lumber, rather than the actual cut for the year.

Management of the Forest.

At the present time no systematic plan of management is used in handling the woodlands of the State. Occasional large tracts are owned by individuals or companies, but the ordinary holding is small in size. Such ownership will prevent the use of any general scheme for treating the timberlands. Whatever is done in the line of improved methods must be done by the individual owner on his own woodlot.

The treatment needed, even by the same type of forest, varies greatly with circumstances, such as its present condition, past treatment, and location with regard to market. It is thus impossible to give in this report detailed directions for handling the various woodlots. But for each forest type there are certain general methods of treatment which give the best results in the long run. These methods will be briefly taken up for each type separately.

1. Mixed Hardwoods Type.

In cutting stands of this type the clear-cutting system can hardly be improved upon. This system is already in wide use. Close to markets it is almost universally employed; but in the back districts, where cordwood is often unsalable, a system of cutting out the larger trees is used. The chief species in the type coppice thriftily, so that the growth which starts after the cutting is largely composed of sprouts. This is not the case always, but as a general rule sprout reproduction may be counted on to replace the old stand. By clear cutting, with its abundant admission of light, a healthy sprout reproduction is favored as by no other method of cutting.

Another reason for cutting off the stand clear, rather than culling out the bigger trees, is that the habits of chestnut and the oaks, which form the bulk of the timber, fit them to develop best in full light. Small trees which have grown for many years in the shade of larger trees, when finally given room by the removal of the latter, are unable to develop rapidly or to produce the better grades of timber. To certain species, like the hemlock for example, the statement does not apply at all, but for the chief hardwood species in the mixed hardwoods type it is true, and makes advisable the use of a clear-cutting system in all tracts managed on a commercial basis.

This does not mean that the stands should not be thinned;* on the contrary, systematic thinnings should be practiced on all tracts where market conditions admit of the disposal of cordwood. But the aim of the thinnings is not to remove the bigger trees in order to increase the growth of the smaller. Such treatment produces poor results in the long run. The thinnings should remove the smaller trees, taking out from one-fifth to one-third of the volume, with the purpose of giving more growing space to the big, well-formed trees which can profit by the chance. The growth is thus centered in these best trees. When they again become crowded another thinning is made, removing the smallest trees, and the process is repeated until the time comes for harvesting the crop. Usually thinnings are needed at intervals of ten years, the first one coming when the stand is from twenty to twenty-five years of age.

The rotation (or period of time between any two clear cuttings) may vary in length according to the object of management. The general tendency of present methods is to cut the stands comparatively young. In the case of unthinned stands it is often necessary to cut the timber before it is of large size, because the trees crowd each other closely and cause deterioration of the stand. Wherever thinnings are made at regular intervals, a stand will keep on developing large, valuable timber, with no likelihood of deterioration until an advanced age. Moreover, bigger timber will be produced at a younger age than in an unthinned stand.

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*For full instructions regarding thinnings see Bulletin 154 of the Connecticut Agricultural Experiment Station.

Thus the rotation for thinned tracts may be safely either low or high, as the owner may wish. The possible range of rotation would run from about forty years as a minimum to eighty years as a maximum; the lowest limit applying particularly to stands composed largely of chestnut, and the highest figure being used occasionally for mixtures of less rapidly growing hardwoods.

2. The White Pine Type.

The stands of white pine as they exist to-day are essentially even aged in character, and the plantations now being made also fall into this class. Quite similar treatment to that recommended for the mixed hardwoods type is advisable here; namely, regularly repeated thinnings, followed by clear cutting at the end of a forty- to eighty-year rotation.

White pine, however, does not sprout, so reproduction must be secured by means of seedlings. This can usually be satisfactorily accomplished as a result of the thinnings. They, by admitting plenty of light to the ground, afford opportunity for the germination and growth of seedlings. Under average conditions these seedlings appear abundantly in thinned stands forty years of age or older, and frequently start in stands ten years younger. The seedlings grow slowly for a few years in the shade of the larger trees, but when the stand is cut they are given full light and begin to produce timber.

3. Abandoned Field Type.

Within this type are included fields almost entirely open, those partially stocked, and lastly, former fields now completely covered with tree growth, but of poor quality. In most cases the fields, for the present generation, at least, should be devoted to forest.

The treatment for the open and partially stocked fields differs from that needed by those fully stocked and will be considered first.

It has been found that the length of time required to completely stock an open field with valuable tree species is a long one; except in rare instances never under fifty years, and more often eighty or one hundred years are required.

Moreover, in this period is not included the time needed to produce a merchantable crop, but simply to get established a stand of desirable young trees.

Stands of gray birch are often established on an old field inside of ten years, but gray birch is an inferior and undesirable species, and must be superseded by other better species before the field becomes thoroughly productive. Inasmuch as the seeding of old fields to good species by natural reproduction requires such a long period, the wisest policy is to plant the open and partially stocked fields with some valuable species.

The species to be planted will vary with the character of soil and the product which the owner desires to raise. In the majority of cases white pine will be the best species. Chestnut, red pine, red oak and white ash are also profitable trees for planting. The probable cost of, and returns from, a plantation, are discussed in a report of this station.*

The fields already covered with trees present a more difficult proposition for management. While completely covered with trees, the forest is inferior because made up largely of red cedar and gray birch, with such associates as alder, hornbeam and others. As already explained, this class of trees is the first to seize possession of an old field. Gradually under these inferior species, most of which shade the ground but lightly, seedlings of chestnut, hickory and the oaks creep in. In the course of time the latter outstrip the cedar and birch in height growth and take possession of the type, in the end shading out and killing the cedar and birch. When this process is completed the abandoned field type has given way to the mixed hardwoods type.

Fully stocked abandoned fields occur in all stages of this conversion process. How to treat them is the problem. The general method should be to allow the inferior species to obtain cordwood size and then cut them out. This allows valuable seedlings and saplings, which have gained a foothold, to immediately take possession of the stand, thus shortening the period of conversion to the mixed hardwoods type.

Where an old field stand of cordwood size occurs, and even young seedlings of good species as well as larger sized trees are lacking, it should be cut clear and *at once* planted to forest trees;

* See Report of the Connecticut Agricultural Experiment Station for the year 1907, pages 251 to 252.

or else left uncut, until enough valuable seedlings spring up under the cover to furnish a new stand. If such a stand were cut off and not immediately planted, the same kind of growth would follow, or else the field would lie vacant.

Protection Against Fire and Grazing.

Under any system of management protection against fire is essential. Plantations and stands of young trees are particularly liable to fire injury. At present the danger of fire is considerable in all parts of the State, and in some sections, as for example along railroad lines and in the vicinity of cities, it is enormous.

On any tract, unless efforts are made to keep out fires, forestry should not be practiced; only such things being done as show the greatest immediate profit, regardless of the future.

Fire protection can best be assured by creating a proper sentiment among landowners regarding the setting and extinguishing of fires. This may seem a rather intangible remedy, but it is the most effective. As soon as a community fully appreciates the damage caused by forest fires, their number and severity diminish.

Where 1,000 acres or more are in one tract under the same ownership, a system of patrol during the dangerous season in the spring and fall is a good and economical method of protection. Tracts of this size are exceptional, and on smaller holdings the cost of the patrol is too high for the amount of land protected.

The use of fire lines is advised under certain conditions. On land which can be easily plowed, such as a sandy plain, fire lines often make an excellent protection for a woodlot or plantation. Such lines to be effective must be at least fifteen to twenty feet wide, and be plowed or cultivated frequently enough to present a surface free from weeds or any inflammable material. When a surface fire reaches such a line it cannot pass, unless a strong wind should blow sparks across. In places too rough or stony to be plowed, fire lines cannot be cheaply constructed nor economically maintained, and their use is not advisable.

Unrestricted grazing on forested area should also be stopped. Grazing animals injure the forests principally in two ways: first, by feeding upon young sprouts and seedlings, either deforming

or killing them; and second by trampling and packing the soil so that the germination of seeds may be entirely prevented.

If grazing is allowed in a stand for a long series of years reproduction cannot start. As a result, when the old stand is cut off the land must be planted if another growth of trees is desired.

It is not necessary that grazing be prohibited during the whole rotation, but only for the first ten or twenty years, until the young trees grow out of the reach of cattle; and also during the last fifteen years of the rotation, in order that seedlings may have an opportunity to start under the shelter of the old stand. During the middle of the rotation grazing can safely be allowed.

Extent to which Improved Methods are now Employed.

Very few tracts are at present treated in a way to make them continuously productive. A few water companies owning large tracts around their reservoirs, such as the New Haven Water Company and the Ansonia Water Company, are now handling their lands with this object in view. The same thing can be said of a limited number of individual owners.

Seven hundred acres in Connecticut have been planted to forest trees, principally white pine, during the last five years. In the next five years a much greater acreage will, undoubtedly, be planted.

The fire warden system is doing much to arouse interest in the forest fire problem and is lessening the number of fires each year. In many towns the danger of fires is rapidly decreasing, because the inhabitants are practically united in carefulness about setting fires and promptness in extinguishing them.

LITCHFIELD COUNTY.

General Description.

Litchfield County occupies the northwestern portion of Connecticut and is the largest and, in many ways, the most interesting county of the State. The total area is 612,600 acres, constituting twenty-six townships. The topography is made up for the most part of a series of irregular ranges, running in a general north and south direction. Deep, tortuous valleys have been cut through the hard rock of the region by the rivers which drain it—the Housatonic and its minor tributaries; the Naugatuck, which later flows into the Housatonic, and the Farmington, which is one of the main branches of the Connecticut. All of these streams have the character of swift mountain torrents and have valuable water powers, but usually become very low in summer. Elevations vary from two hundred feet above sea level in the valleys of the southern part of the county to twenty-three hundred and fifty-five feet, the summit of Bear Mountain, in the extreme northwest corner of the State.

For the most part the rocks of this county are metamorphic gneisses and schists. In Litchfield and Bridgewater there are considerable areas of diorite. The only trap formation, so common in the center of the State, is found here in Woodbury. Throughout the western portion of this county long, narrow belts of limestone have been exposed. As might be expected from the geological formations, the soils of the county are for the most part sands and loams, formed of the disintegrated native rock mixed with a gravelly, glacial till. In the valleys and on the sides and tops of gently sloping ridges we find a deep, fertile soil, while on the steeper slopes the soil is thin and the bedrock is often exposed. In the western part lime is conspicuous in the soil.

The lines of traffic in this county are naturally the river bottoms. Railroads extend up the Naugatuck to Winsted; the Shepaug to Litchfield, and the Housatonic to Pittsfield, Massachusetts. The Central New England Railroad crosses the northern part of the region through Winsted. To the traveler on any of these lines the farm land appears naturally to be confined to a narrow strip in the valley bottoms. This is because the hill

slopes, as far as the eye can see, are usually wooded. As a matter of fact, however, the great bulk of the agricultural land occupies the tops of the plateaus and ridges. In the southern part of the county, especially, as in the towns of Washington and New Milford, there are extensive, nearly level stretches of fine farm land, four hundred or five hundred feet above the valleys. From many hilltops in such towns as Barkhamsted and Winchester the county appears almost wholly wooded. While it is true that there is much more agricultural land in the southern than in the northern townships, it is also true that an examination reveals more farm land than appears at first glance. This is because the steep slopes which are most conspicuous from a distance are nearly all wooded, while a level stretch of agricultural country may be completely hidden by a grove or single row of trees.

TABLE I.—LITCHFIELD COUNTY.

CLASSIFICATION OF AREAS.

	Area in Acres.		Per cent. of Total Area.
Agricultural:			
Including land in villages and cities, ponds and lakes		275,000	45
Forest:			
Mixed Hardwoods Type	264,000		
White Pine Type	3,600		
Abandoned Field Type	70,000	337,600	55
Total Area of Litchfield County		612,600	100

Agricultural Land.

From Table I it appears that the total area in the county classed agricultural amounts to 275,000 acres, or forty-five per cent. As has been said, the greater part of this lies in the southern towns, but there is a good sprinkling of farm land throughout, and especially in Salisbury and Sharon. The chief line of farming pursued is dairying. Most of the milk is collected from the farmers and sent either to New York or Hartford. They receive from two and one-half to three cents a quart at the farm, and in many cases this furnishes the only cash income. In portions of the valleys of the Shepaug and Farmington, and especially of the Housatonic, tobacco is quite extensively

raised; and in the southern portion of the county truck gardening plays an important part in farming. No attempt is made in this report to distinguish pasture from land under cultivation, but it is certain that a large proportion would come under the former head. With extensive areas of pasture little grazed by cattle, and the very large areas of land reverting to forest, it seems strange that sheep raising is relatively so insignificant. It would also seem that orcharding could be greatly developed beyond its present status.

Right here it is necessary to speak of the extreme change which is now taking place in many parts of the county, and more noticeably in such towns as Norfolk than in any other portion of the State, excepting, possibly, the southwest corner. Many city people, especially from New York, have acquired here during the past decade extensive tracts at reasonable prices. Usually purchased with reference to the beautiful views which abound, these owners have either fitted over the old farmhouses or built more elaborate dwellings, in which they spend the summer, and in some cases the whole year. While this movement is, at present, rather unaccountably confined to a few sections, there is no doubt that it will expand and that large holdings are to be the rule in the future. With this in mind it behooves the farmers to appraise their views hereafter, as well as their fertile acres and buildings. Along with this movement has come the natural influx of summer boarders and the building up of industries dependent upon them. Besides numerous hotels in some of the villages, and camps on the lake shores, many farmers now make a considerable portion of their income by taking boarders and renting cottages.

Forest.

Fifty-five per cent. of the area of the county is classed as forest, or an area of 337,600 acres. Only an insignificant portion of this can be considered as virgin forest.

The largest tract of virgin timber in the county is that belonging to Mr. Carrington Phelps, in North Colebrook. He has from two to three hundred acres of timber, the equal of which it would be difficult to find in New England. It is for the most part a mixture of immense hemlock, beech, yellow birch, sugar maple, fine black cherry, ash, chestnut and oak, with a few giant white

pines, and represents the most perfect mixture of the northern and southern New England forest types that the writer has ever seen. That much of the timber is over mature and is deteriorating is true of this, as of all virgin forests.

While the Colebrook forest is the largest piece of virgin timber in the State, the most perfect piece is in Cornwall and belongs to Mr. John Calhoun. He has here a few acres of the most magnificent white pines that can be found in the East, and fully equal to the best timber of the lake states. Many of them tower up to a height of one hundred and fifty feet and have diameters of three to four feet. The stand is dense, so that the yield per acre will, in some cases, exceed one hundred thousand feet.

There are other patches of virgin timber in various parts of the county, but they are mostly in a poor condition.

What is true of the whole State is particularly true of Litchfield County, that its woodlands have been repeatedly cut over. In the northwestern portion there were, in early times, extensive operations in iron mining, and the whole tributary region was cut again and again for charcoal. Nearer the Naugatuck valley the damage in recent years has been even greater, on account of the immense amount of fuel and other wood products required by the brass foundries.

There is, perhaps, no part of the country which recuperates sooner after cutting than Connecticut. In sections that are protected from fire, the land is immediately reclothed with innumerable vigorous sprouts of chestnut, oak, maple, etc. The sprouts of the chestnut are most prolific in number and most rapid growing, so that with every successive cutting the proportion of chestnut is apt to become larger. While there was, undoubtedly, considerable chestnut in our virgin forests, it is probable that the proportion to-day is greater than ever before. Practically all the woodland of the county, then, is of one main type, mixed hardwoods, with a varying proportion of chestnut and hardwood trees. But scattered widely over the northern portion are little patches of white pine that have come up on abandoned farm land, so that the land might properly be classed in with that type.

White Pine Type.

There are several sections where patches of white pine, varying from a fraction of an acre to fifty or one hundred acres, are

common. They are mostly confined to glacial deposits of sand in the sides of the valleys, as for example, along the branches of the Farmington in New Hartford and Barkhamsted, and a branch of the Housatonic in Cornwall. With the exception of the two virgin forests mentioned above, all of the pine stands are young, and there can be no question that the area given over to pine is on the increase, although the supply of timber is diminishing. For the most part the stands are composed entirely of pine of fairly even age, for a field in the vicinity of good seed trees may become well seeded in ten or fifteen years of abandonment. In the younger stands birch is often conspicuous, but the tendency is for the pine to kill these more intolerant trees and to dominate the stand.

Hardwood Forest.

As has been said, chestnut is the most important species of the county, forming usually about sixty per cent. of the stand. Mixed with it almost everywhere are the red and white oak and red maple, hickories and birches. The white and red oak take nearly equal position for second rank. In some sections one and in others the other is a little more important. Red maple is more common than the sugar maple, although the latter is important in the northern part. Hickory is scattered fairly evenly throughout, but never forms any considerable proportion of the mixture. The most common birches are the gray and yellow birch, but black birch is found considerably, and in the northern part scattered specimens of the paper birch. Of lesser importance are the chestnut oak—sparsely found on the rocky ridges throughout the section—the black oak, and in the southern part the scarlet oak, sycamore in the river bottoms, tulip in moist situations, basswood, butternut, black cherry, beech, poplar, sassafras, elm, hemlock, ash, blue beech, ironwood, dogwood, hazel and alder.

Abandoned Field Type.

This represents the roughest of what was once agricultural land. Deserted roads overgrown with brush, dilapidated stone walls and half filled cellar bottoms, all point to more prosperous times; yet one must remember that with the desertion of this rougher land, agriculture has become more intensive and specialized.

The presence of red cedar in this type is much less noticeable than farther east in the State, the characteristic growth being rather the gray birch and sumac, with here and there groups of red maple. Scraggly old apple orchards and scattered oak, hickory and chestnut are frequent in the type. Alder and hazel are common, and in the northern section white pine, paper birch, poplar and hemlock. In fact, most of the white pine has come up on this class of land.

TABLE II.—LITCHFIELD COUNTY.

Showing Forested Area According to Age Classes and Types.

Type.	Age in Years.	Acres.	
Mixed Hardwoods	1–20	71,800	
	21–40	180,000	
	41–60	9,000	
	61–up	3,200	264,000
White Pine			3,600
Abandoned Field			70,000
Total			337,600

The figures given in Table II are important because they show that practically the whole county has been cut over during the last half century. That much of what was cut was a second or third growth, resulting from previous cuttings, is evidenced from the character of the sprouts in many areas. However, it is plain that up to the time of the Civil War there were considerable areas of virgin forest in the more inaccessible portions of the county. The substitution of the portable steam mill for the old water-power mill is responsible for the increased activity along lumbering lines. That the most extensive growth now to be found is between twenty and forty years old, bears out the testimony of the people that in the first few years after the introduction of portable mills they were everywhere. Much of the younger sprout growth to-day comes from trees that were too small to cut when the steam mills were first introduced, having been previously cut over for the water mills or for charcoal. The falling off in the demand for charcoal and the growing demand for larger materials, such as railroad ties and poles, is resulting

in land being left for an older rotation than was formerly the case in accessible regions. While the steam mill has been the bane of the forest, there is every reason to believe that in the future, used under forestry methods, it may be the most important factor toward their improvement.

Estimate.

One of the main purposes of this investigation was to form an estimate of the amount of growing material and also of the amount annually consumed. The two lines of data were secured at the same time, by men who spent on an average about a week in each town, traversing the roads and crossing through the woods wherever necessary. On the topographic sheets of the United States Geological Survey they mapped in the type of land, and in connection with the mapping they estimated the stand per acre in cords, or ties and cords. They secured information regarding the annual cut by conversing with mill men, contractors and farmers. Necessarily, a method which allows one man less than a week for estimating the standing wood on a tract of some twenty to forty thousand acres is only approximate. As there was no special appropriation available for the work, and as a general figure was all that was desired it did not seem advisable to spend more of the station's income on this work. The reader must, therefore, realize that the following estimates are not supposed to be strictly accurate.

TABLE III.—LITCHFIELD COUNTY.

Showing Amount of Standing Timber in Cords and Ties by Age Classes and Forest Types.

Type.	Age in Years.	Cords.	Ties.	M. B. M. Feet.
Mixed Hardwoods	1–20	754,000	210,000	
	21–40	3,400,000	6,500,000	
	41–60	462,000	750,000	
	61–up	180,000	284,000	
		4,796,000	7,744,000	
White Pine				4,500
Abandoned Field	All ages	260,000	70,000	
Totals		5,056,000	7,814,000	4,500

These estimates mean that if all the trees in the county were cut into fuel there would be, approximately, 5,000,000 cords. In cutting trees into ties there is always a portion of the tree which will make nothing but fuel. It is therefore estimated that one hundred ties would use about seven cords of wood; 7,814,000 ties are equal, therefore, to 547,000 cords. So if all the chestnuts and oaks which are large enough for ties were cut for that purpose, there would be about 7,814,000 ties and 4,500,000 cords. No estimate was made of the amount of saw lumber standing in the county. Considering thirty-one board feet as the equivalent of a railroad tie, the 7,814,000 ties would be equivalent to 242,234,000 feet, which would represent fairly well the stand of chestnut and oak lumber. In addition to this is a vast amount of lumber of maple, birch, ash, pine, hemlock and other species, which is included in the 5,000,000 cords. As an approximation it is safe to say that chestnut and oak together form seventy-five per cent. of the lumber of the county, so that 80,000,000 feet would cover the amount of lumber of the other species.

Summary of Yield of 337,600 Acres.

All trees cut into cordwood	5,000,000 cords.
All chestnut and oak cut into ties	7,814,000 ties.
The rest cordwood	4,500,000 cords.
Chestnut and oak cut into lumber	242,000,000 feet B. M.
Birch, maple, ash, pine, and other lumber	80,000,000 " "
The rest cordwood	4,300,000 cords.

These figures may be converted into money value by using stumpage prices for the various products. These prices depend, of course, upon the nearness to the market, so vary a great deal in different parts of the county. The average values for the county are considered as follows:

All lumber	@ $6.00 per thousand feet.
Ties	" .18 apiece.
Wood	" .60 a cord.

Using the third summary of yield, the money value of the timber is, then:

322,000,000 feet of lumber	$1,932,000.00
4,300,000 cords wood	2,580,000.00
	$4.512,000.00

Market Conditions.

Wood. There are in the county four large markets for cordwood. The districts tributary to these have, perhaps, suffered in the past more severely than any other portions from overcutting, but on the other hand their future is brighter, since it is only where there is a demand for cordwood that improvement thinnings can profitably be made.

1. The Barnum, Richardson Company of Lime Rock and East Canaan does a large business in mining and smelting iron ore, and also makes car wheels. Charcoal is used in the process of making steel, but most of this is imported from the West. The New England Lime Company, the Canfield Lime Company and the Connecticut Western Lime Company operate in the northwest part of the county, having offices at Canaan. While there is now comparatively little charcoal made in the region, a large quantity of wood is consumed by these lime companies, in all about 10,000 cords annually. (Part of this comes from Massachusetts.) Cordwood delivered at the lime kilns brings $2.50 to $2.75* per short cord, three-foot lengths. Sold for stove wood it brings $4.50 per cord for chestnut and $6.50 for hardwood.

2. The Coe Brass Company of Torrington consumes annually about 15,000 cords of wood, of which about 6,000 cords are cut in Torrington and the rest in neighboring towns and even in Massachusetts. The price paid for mixed wood delivered is $3.25 per cord.

3. Although Waterbury is not in Litchfield County it furnishes a market for much of the wood cut in the towns of Plymouth, Thomaston, Watertown and Woodbury. The large rolling mills, brass factories and foundries use a great amount of wood, and even more is consumed for domestic purposes.

4. The southwest part of the county has a market for a considerable quantity of wood at Boardman's Bridge, in New Milford, where the New England Lime Company operates. This company uses about 8,000 cords a year, most of which it cuts itself, but it also pays $3.50 a cord for wood delivered.

In some regions too far from these centers to haul wood considerable wood is "coaled." In the northern parts of Cornwall

* It must be remembered that the prices here given are those which prevailed in the summer of 1907.

and Sharon, for example, about 15,000 cords are used annually for charcoal, which sells to the lime companies of Canaan at $9.50 per hundred bushels. Woodland for coaling is handled on a rotation of about thirty years. Pits are made up with fifteen to thirty-five cords each and require ten to fifteen days to burn. Three cords of wood make about one hundred bushels of charcoal. The teams delivering the coal haul about two hundred to two hundred and fifty bushels to a load. The best coal is made from butt logs and sells in the cities at twelve to fifteen cents a bushel.

Throughout the county a large amount of wood is used for domestic purposes, practically every farmhouse consuming ten to fifteen cords. Every village furnishes a local market for wood in limited quantities. But further back from the large markets and the villages much wood is left on the ground after lumbering. In the southern part of Sharon and Cornwall and the northern part of Kent and Warren it is estimated that 10,000 cords are wasted annually for want of a profitable market, and the same is true of other regions.

Ties. The price paid for ties has varied somewhat during the past two years, from forty-two to fifty-five cents for firsts and from thirty to thirty-five cents for seconds. For a few lots of ties as high as sixty cents has been paid, while some have been sold to a New York railroad at a higher price. Fifty-five cents apiece is at the rate of less than eighteen dollars per thousand feet, so the relative profit depends upon cost of manufacture and transportation. In 1907 28,510 ties were used on the Naugatuck and Berkshire Divisions, and 26,354 on the Central New England Railroad, making 54,864 in all.

Poles. There are three classes of poles in use—those for telephone, telegraph and electric power. The Southern New England Telephone Company used 5,018 poles in Litchfield County in 1906 and 1,259 in 1907. These were of the following dimensions and prices:

15	20	ft.	poles	at	$1.75	each.
727	25	"	"	"	2.00	"
306	30	"	"	"	3.00	"
123	35	"	"	"	4.25	"
50	40	"	"	"	5.25	"
36	45	"	"	"	6.50	"
2	50	"	"	"	9.50	"

The Western Union Telegraph Company reports that scarcely any poles were used in the county in 1907, none except to renew a few defective ones at various points on the Highland Division.

We have no figures at hand regarding the number of poles used for transmitting electric power, nor the prices paid for them.

Lumber. Most of the lumber of the county is used locally, although some is shipped to New York, Hartford and New Haven. Retail prices of native lumber in the summer of 1907 were as follows:

	Winsted.	Torrington.
Chestnut	$25.00 per M.	$20.00 to $25.00
Maple	$20.00 to 25.00 "	15.00 to 18.00
Oak	25.00 to 40.00 "	20.00 to 25.00
Hickory	25.00 "	25.00
Ash	25.00 to 30.00 "	20.00 to 22.00
Basswood	20.00 "	20.00
Poplar	25.00 to 40.00 "	25.00 to 35.00
White Pine	25.00 to 75.00 "	25.00 to 75.00
Hemlock	22.00 to 26.00 "	17.00 to 22.00

Shingles and Posts. In a few of the towns such as Colebrook, Kent and New Milford, shingles are made. One thousand shingles are equivalent to 700 feet B. M. From Kent chestnut shingles and posts are shipped to New Haven. The posts bring twenty cents a piece, delivered in the city, and the shingles $5.00 per thousand. They are put up in bunches of two hundred and fifty. Some 10,000 posts were shipped in 1907 from Warren.

Hemlock Bark. At Winsted George Douglass & Co. have a bark tannery in which sheepskins are tanned that are used for book coverings. They use four hundred tons of bark a year, purchased at $7.00 a ton. Bark weighs from 1,200 to 2,000 pounds per cord; average, 1,700 pounds.

Woodworking Establishments. On the Blackberry River in Canaan there is a mill where doors, window frames, sashes, blinds, molding and wainscoting are made.

At Riverton and on the east branch of the Torrington in Barkhamsted there are woodworking machines, and the factory of the Rogers Rake Company is located at Pleasant Valley. These establishments make handles of all kinds, using about all the native woods. Beech, birch and maple are used for handles and backs of shoe brushes, scrubbing brushes, bath brushes, and stove

brushes. Whitewood is somewhat used, but is too soft. Oak is used especially for bath brushes. Chestnut is not used. Ash is used for rake handles and hickory for the teeth and bows of rakes. Brushes are made in a factory at New Hartford. Lumber for this purpose is mostly purchased in two-inch plank. Prices paid in the summer of 1907 by the Rogers Rake Company were:

For beech, birch, maple	$14.00	per M.
" ash	20.00	" "
" pine (square edge)	15.00	" "
" hickory	8.00	" cord.

The pine is used for cases.

In Goshen the Gilmark Brothers make barrel heads, staves, sashes, windows and blinds, and use for the purpose about 300,000 feet of lumber annually—almost all native.

In Litchfield the Bigelow Brothers have a handle-turning machine, making handles for chisels, hammers, files, etc.

In Watertown F. C. Slathers & Co. have a sawmill, wagon-shop and woodtrimming-mill at Oakville. They manufacture delivery and farm wagons. The mill is equipped with band and circular saws. The principal woods used are oak, ash, hickory and elm. Elm is used only for hubs.

In Bethlehem there is a small woodturning shop.

In Washington the Akman Brothers do a little carriage-making, using about 10,000 feet of lumber.

In Winsted there is a factory which manufactures piano stools and benches. Beech, birch, maple and a little oak are used for this purpose.

TABLE IV.— LITCHFIELD COUNTY.

ANNUAL CUT.

Product.	Amount.	Stumpage Value.*
Lumber	16,265,000 ft.	$97,590
Ties	201,700	36,306
Poles and Piles	15,600	15,000
Cordwood	145,500 cords	87,300
Total		$236,196

* See stumpage prices on page 20.

Description of the Towns of Litchfield County.

SALISBURY. Percentage forested, 46. Salisbury occupies the northwest corner of the State and contains the highest elevations, that of Bear Mountain in the Berkshire Range being 2,355 feet. The town is marked by an extensive area of fairly level and continuous farming land on the south and east, and a large area of woodland in the mountain region of the northwest. The general elevation of the valley is between eight hundred and nine hundred feet. In the town there are five very beautiful little lakes which attract many summer residents. The industries are mining and smelting iron ore, cutlery manufacturing and a private school.

The only woodland type of importance is the mixed hardwoods. The sandy nature of the soil is well adapted to white pine, which is scattered everywhere in the region, but the stands of pure pine are very small. Tamarack is found in all the swamps, but it is not abundant and there are no large trees. There are very few ties made in Salisbury and practically no charcoal. Everything is sawed into lumber or cut into wood for the limekiln, or for stove wood.

CANAAN AND NORTH CANAAN. Percentage forested, 56. The most pronounced physical features are the "Great Canaan Swamp," occupying the flood plain between Falls Village and Canaan; and Canaan Mountain, a great mass of gneiss and schist, reaching an elevation of 1,927 feet. The soil of the lowlands is limey. The chief industries are agriculture, manufacturing pig iron, lime and hosiery, and marble quarrying.

The woodland is mostly of the mixed hardwoods type, but has white pine scattered through it. On the cool slopes hemlock is frequent, and both tamarack and swamp white oak occur in the swamps.

While charcoal was formerly made extensively, there was practically none made in 1907. Very few ties are made, as most of the mills cut lumber. Lime companies buy lots which have been lumbered and cut off the wood. Most of Canaan Mountain was coaled off by the Barnum, Richardson Company (which owns a great deal of land on the mountain) some thirty years ago.

NORFOLK. Percentage forested, 66. The region is characterized by numerous cone-shaped hills which are of glacial formation.

Norfolk has become a favorite resort of New York people, many of whom have built fine homes. Extensive areas acquired by them are purposely being abandoned, so that there are few prosperous farms left. The chief industries are caring for summer boarders and the manufacture of silk goods.

There are several small patches of white pine in the town and a few clumps of the Norway or red pine.

COLEBROOK. Percentage forested, 74. The formation and general character of the land is similar to that of Norfolk. The principal industry is agriculture. Within the last few years the town has developed in a small way into a summer resort.

Mention has already been made, on page 15, of the fine tract of virgin timber belonging to Mr. Carrington Phelps. Some of these trees were found to be from two hundred and twenty-five to two hundred and fifty years old. There are also a few stands of young pine, besides scattered trees throughout. For the most part the woodland is a mixed hardwoods type, largely of chestnut, oak and maple.

WINCHESTER. Percentage forested, 55. Highland Lake is the chief feature of the town and has become quite a summer resort. The principal industries are farming in the outlying districts and manufacturing knit goods, clocks, spool silks, cutlery, leather goods and a variety of novelty articles in the borough.

There is a good deal of young pine coming up on the deserted pastures which are making excellent stands. Almost all of the wood growth is under forty years old. Tamarack occurs in a few swamps.

BARKHAMSTED. Percentage forested, 59. It is a rough country, composed chiefly of high ridges extending in a general north and south direction, the result of the wearing away of the high plateau by the east and west branches of the Farmington River, which unite at New Hartford. The rock is largely pre-Cambrian gneiss, with schist in the eastern part.

Barkhamsted is a typical declining hill town, its population having decreased from 1,715 in 1850 to 864 in 1900. Dairying is the chief line of farming pursued, but considerable tobacco is raised in parts of the valleys. This town, together with the preceding towns, lies in the southern extremity of the white pine belt of Massachusetts and New Hampshire, so there is a sprink-

ling of pine on the abandoned land as well as in much of the woodland.

New Hartford. Percentage forested, 59. The hills are more gentle than those of the preceding towns, and for this reason a large proportion was formerly under cultivation. This is evident from the fact that only 38 per cent. of the total area is now mixed hardwoods, while 21 per cent. is abandoned field type.

Throughout the town there are everywhere abandoned farmhouses and the whole appearance indicates a declining condition. Dairy products form the chief staples of the farm. In the village is a factory for manufacturing benches, planes and rules.

The wood industries of New Hartford have practically ceased to exist and almost no cutting is now being done in the town. Two or three large lots have been recently cut. The town has suffered from forest fires, especially in the eastern part, known as the "Satan's Kingdom" region, more, perhaps, than any other portion of the county.

Torrington. Percentage forested, 64. It is a rolling country, with elevations varying from six hundred to one thousand three hundred feet. Due to the increased manufacturing in the borough, the whole town is fairly prosperous, dairy products having a large home market. The principal industry is the manufacture of brass materials.

Most of the woodland is of the mixed type under twenty years of age, having been cut off by the Coe Brass Company, which owns the greater part of it. More land has been cut over recently in Torrington than in any other town. In the vicinity of Burrville there is considerable white pine.

Goshen. Percentage forested, 52. It is primarily an agricultural community, relying on dairy products and keeping summer boarders. A great deal of the abandoned field type is covered with hardhack, a shrub which makes the land practically worthless for pasture purposes.

Cornwall. Percentage forested, 54. It is a rough, hilly country with beautiful scenery. Dairying and lumbering are now practically the only industries.

There are considerable bodies of white pine throughout the town which give color to the landscape, and mention has already been made, on page 16, of the magnificent stand belonging to

Mr. Calhoun. As there is no profit in cordwood except near villages or limekilns, most of it is left in the woods after a lumber job.

SHARON. Percentage forested, 42. Farming forms the principal industry. There is much less pine in this town than in Cornwall. Little lumber has been cut recently, most of the wood being used for charcoal. This is all sold to the iron furnace company at Lime Rock, which owns some two thousand acres in Sharon.

KENT. Percentage forested, 50. The closing down of the iron furnaces resulted in many people leaving this town. The town is too far south to send wood or charcoal to Canaan, so when the iron furnaces were abandoned land became very cheap. A few men picked up large holdings at that time.

The northern end of this town marks the southern extension of the forest type so common in the previous towns, which was characterized by a considerable mixture of white pine and paper birch. Most of the tops resulting from lumbering are here left in the woods. Considerable chestnut is used for making shingles and some for posts, but ties and lumber are the principal products of the woodlots.

WARREN. Percentage forested, 45. The character of the country is similar to Kent, but somewhat less rugged on the east. In the southwest corner is Lake Waramaug, which is quite a summer resort. The character of the woodland and the market conditions are the same as for Kent.

LITCHFIELD. Percentage forested, 46. It is rightly famous, not only for its beautiful scenery but for its village, which is one of the finest in New England, with its rows of elm trees overhanging old, colonial houses. The country is somewhat more open than in the preceding towns. Bantam Lake, which is partly in Litchfield and partly in Morris, is a favorite summer resort. Dairying and keeping summer boarders are the chief lines of industry.

HARWINTON. Percentage forested, 52. It is an open, rolling country, with a good many dairy farms. There is practically no other industry. In the forest section tributary to the brass factories wood has an average stumpage value of $1.00 a cord.

PLYMOUTH. Percentage forested, 50. This town is similar in character to New Haven County. The numerous flat-topped open hills make desirable dairy farms.

THOMASTON. Percentage forested, 55. The elevation varies from one hundred to nine hundred feet above sea level. Agriculture and manufacturing are the principal industries.

WATERTOWN. Percentage forested, 35. This is principally a farm country, dairying and truck gardening being the chief lines of industry.

MORRIS. Percentage forested, 36. Besides numerous summer boarders the Columbia School of Surveying spends the summer here.

BETHLEHEM. Percentage forested, 30.

WASHINGTON. Percentage forested, 34. This town is one of the most beautiful of the county, and is, accordingly, a popular summer resort. In the village are two large private schools. Elevations extend from four hundred to one thousand three hundred and twenty-five feet, the summit of Mount Tom.

Since the introduction of portable mills the water mills have been reduced to an insignificant business of a custom nature. About 1860 there was in this region an extensive business in the manufacture of tool handles from hickory for the California miners. These were shipped around the Horn.

NEW MILFORD. Percentage forested, 36. This is the largest town in the county. For the most part the region consists of rolling, flat-topped ridges and peaks, many of which are entirely cultivable. The principal industries are agriculture, dairying and tobacco growing, tobacco packing, manufacture of hats and upholstery, lime burning and making silica paints.

A good many chestnut and hemlock shingles are made in this town, but no charcoal. All the wood which is not used for domestic purposes goes to the New England Limekiln Company at Boardman's Bridge.

BRIDGEWATER. Percentage forested, 30. This is a small town southeast of New Milford and similar to it in character.

ROXBURY. Percentage forested, 43. This town is similar in character to Bridgewater and Washington. There are no elevations over one thousand feet.

WOODBURY. Percentage forested, 46. It is a rolling country, with few hills over seven hundred feet high. Dairying is practically the only industry. A large amount of wood cut in this town is used by the rolling mills of Waterbury. The market for charcoal is also somewhat better than formerly.

NEW HAVEN COUNTY.

Introductory.

In the spring of 1907 a study of the forests in New Haven County, Connecticut, was undertaken by the Junior class of the Yale Forest School as a part of their field work. The county was divided into sections, based usually on township lines, and a section alloted to each member of the class. The field work consisted in mapping the open areas and the forest land according to various types, in roughly estimating the amount of standing timber, and in gathering information which might bear on the forest conditions in the territory.

This report is based on the data thus gathered, supplemented by personal trips of the writer throughout the county. Inasmuch as the mapping and estimating were done by students, in connection with one of their courses and with the primary object of giving them training in such work, the same accuracy must not be expected as if men already trained had been employed. It is believed, however, that a correct report on existing conditions has been secured, and one sufficiently accurate for us to see clearly the forest problems which this region presents.

New Haven County must be classed as a manufacturing county. With such cities as Waterbury, New Haven and Meriden within its limits, besides a number of smaller ones, the manufacturing interests necessarily predominate. As in other sections of New England, the range of articles manufactured is wide. Most of the manufacturing plants require wood in one form or another. In the brick yards, for example, wood serves as fuel; in tool factories it is often used to form the handles. Even those industries which do not need wood in the manufacture of their product, usually need it in the form of boxes or crates for shipping purposes. In the coming years these plants, as well as lumber dealers, must depend more and more on local timber.

Location and Physiographic Features.

New Haven County lies in southern central Connecticut, with New Haven its county seat. On the south Long Island Sound forms a natural boundary, while the Housatonic River on the

west and the Hammonasset River on part of the eastern side serve similar purposes. But to the north and northeast a much broken line, not determined by natural factors, bounds the county.

The drainage system is in general from north to south. Small rivers with parallel courses emptying into the Sound drain the eastern half of the county. In the western half the water is carried off by a more complex system, made up of the Housatonic and its tributary, the Naugatuck, both rising far north of the territory studied.

For our purpose the underlying rock may be classified as follows: (1) ridges and isolated hills of trap rock, (2) soft sedimentary rocks, and (3) various metamorphic rocks less hard than the trap rock. Except for a few small areas, the western half of the county is underlaid with rocks of class three. Similar rocks occupy the southeastern corner. The remaining section, *i. e.,* a belt through the central eastern part, has a base of sandstone. The trap rock, less abundant than either of the other two types, appears chiefly as ranges of hills near the east and west borders of the standstone belt. (For further details see Preliminary Geological Map of Connecticut, by H. E. Gregory and H. H. Robinson, issued as Bulletin No. 7 of the State Geological and Natural History Survey of Connecticut.)

These classes of rock exert influence on the forest problems of the region; not so much through their direct effect on the composition and character of the forest (which can be shown only in a general way), as by controlling quite extensively the development of the county along industrial and agricultural lines, and thus, indirectly, affecting forest conditions. For instance, the trap ridges, steep and rugged in character and usually with thin soil, as a class are practically worthless for agriculture and should be devoted to forestry. On the other hand, almost the opposite condition would hold for the sandstone area.

Quite naturally the topography follows the main geological divisions. The sandstone area stretching from New Haven northward is gently rolling country, rising gradually from sea level to about three hundred feet, and is distinctly lower than the land adjoining its east and west sides. From this lowland the trap hills rise abruptly several hundred feet above the general level. One of the Hanging Hills of Meriden at the north, attaining over one thousand feet elevation, is the highest point in the

county. Throughout the remainder of the county, namely, the western half and the southeastern section, the county is more broken than in the lowland. Rising from the seacoast, with salt marshes along the rivers, the land surface northward becomes rougher, especially along the larger streams, which have in some cases developed deep, steep-sided valleys. As a rule, in the western section the tops of the hills are fairly level and are often cultivated.

A good many fresh-water swamps occur, not only in the more level towns near the coast, but all through the hill section as well. Their presence is due to the debris left as a result of glacial action which interfered with the local drainage of the land. The soils also show the effect of such action, being as a rule very stony. Over the sandstone area the soils are often free from stones. They vary through the country from nearly pure sands to clay soils. Along the valley of the Quinnipiac extensive sand plains are found having soils of exceedingly poor quality.

Agricultural Land.

The mapping shows that 54 per cent. is agricultural land. This agricultural land varies greatly in character from level, rich, truck garden land, worth from three hundred to four hundred dollars an acre, to farms so stony, poor-soiled or rough as to be sold for twenty to thirty dollars per acre. Cleared land which cannot command this lowest price is usually too poor to farm profitably under present conditions and is reverting to forest.

In the vicinity of the larger towns and cities farm land is devoted largely to the raising of garden truck and small fruits. Back from the centers of population dairying takes precedence over other types of farming. As carried on here the dairy farm requires a considerable acreage in pasture, and besides the open fields a woodlot is often used for this purpose to the detriment of the latter.

The growing of fruit, principally peaches, receives an increasing amount of attention. It promises to be profitable. Forty years ago large quantities of apples were grown, as is shown by the orchards of decrepit apple trees scattered abundantly over the hill farms. But comparatively few young apple orchards are found.

Forest Lands.

Of the total area in the county 46 per cent. is classed as forested. In the two types mapped by age classes, young timber predominates. The following figures show in per cent. of the total acreage of these types the relative acreage occupied by each of the age classes:

Age Class.	Per cent.
1–20 years	27
21–40 "	43
41–60 "	22
61–80 "	6
81–up "	2

Table II gives the areas covered by each type arranged according to age classes.

Around New Haven and near the larger towns the timber averages younger than in the remoter districts in the eastern and western ends of the county. In the latter sections the markets for cordwood and small-sized materials are comparatively poor, a fact which tends to increase the age at which timber is considered ready to cut.

1. Among the forest types the mixed hardwoods type is by far the most important, including as it does 76 per cent. of the forested area, with a widespread distribution. Chestnut and the oaks, white, chestnut, red and black, growing in mixture form the bulk of the timber and characterize the type. Oftentimes chestnut grows almost alone over considerable areas. Hickory abounds in the southern end of the county, but elsewhere is not commercially abundant. All these species grow on the hills and well-drained sites. In the swamps and low, moist lands occupied by the mixed hardwoods type other species prevail, such as soft maple, which frequently grows alone in dense stands, whitewood, black birch and ash. The timber in the swamps is of less value, acre for acre, than the upland timber. Moreover, it covers only a small portion of the mixed hardwoods area.

About 8 per cent. of the area in this type is occupied by timber over sixty years of age, while approximately only one quarter of one per cent. bears timber over one hundred years old.

2. The white pine type, composed of stands of pure white pine, covers a little over one tenth of one per cent. of the forested area. This type, at present, is of no importance commercially,

but, scattered broadly throughout the county in little patches on sandy or gravelly soil, it shows conclusively that white pine will grow and thrive in this region. The knowledge is of value, because landowners are beginning to plant their abandoned fields to forest trees, and are wondering whether or not white pine can be safely planted. Within the next ten years the area covered by this type will increase considerably.

The upper age classes are proportionately better represented than is the case in the mixed hardwoods type. The pine stands range in age from one to one hundred years, 45 per cent. being over sixty years of age.

3. Abandoned field type. The characteristic species in this type are two, red cedar and gray birch. These two are the first to seize possession of a field after its abandonment. If a field was used as meadow or pasture immediately before being abandoned, red cedar is likely to precede gray birch and to come in the most thickly of the two. But where the field had been plowed the year before abandonment, gray birch often comes in first and as thickly as a crop of grain. Other trees slowly follow the birch and cedar.

Some of the abandoned fields are already so thickly stocked with trees as to resemble the mixed hardwoods type of forest. The distinguishing difference is the presence of red cedar or gray birch, forming together 80 per cent. of the stand. Usually, however, the fields are partially stocked with trees exhibiting a wide range of age, from seedlings to those which started in the first years after the field was abandoned. Fields can be found which have been abandoned for over eighty years and are not yet completely covered with trees.

Besides the four already given, two other types might have been distinguished.

First, one including stands composed chiefly of hemlocks. Over any area sufficiently large to be conveniently mapped hemlock rarely grows in pure stands, although small patches of pure hemlock occur. Usually the hemlock is mixed with various hardwood trees. For this reason the stands containing hemlock were mapped with the mixed hardwoods type. A record, however, was kept of tracts containing 40 per cent. or more of hemlock, which shows that approximately twenty-five hundred acres of this character of woodland occurs within the county.

The second comprises the open swamps, which contain a considerable mixture of white cedar (*Chamæcyparis thyoides*). Mixed with the cedar, soft maple and some other hardwoods occur. The white cedar is the most valuable tree in such stands and the big trees have been largely culled out. This gives an advantage to the soft maple and other hardwoods which are less heavily cut, enabling them in the long run to supercede the cedar and establish a hardwood stand. For this reason, and because only a small area (about two hundred and seventy-five acres) bears cedar, the swamps containing it were thrown into the mixed hardwoods type.

TABLE I.—NEW HAVEN COUNTY.

CLASSIFICATION OF AREAS.

	Area in Acres.		Per cent. of Total Area.
Agricultural:			
Including land in towns and cities, lakes, ponds, large rivers and salt marshes		213,521	54
Forest:			
Mixed Hardwoods Type.....	140,807		
White Pine Type	233		
Abandoned Field Type.....	43,086		
		184,126	46
Total Area of New Haven County		397,647	100

TABLE II.—NEW HAVEN COUNTY.

SHOWING FORESTED AREA ACCORDING TO AGE CLASSES AND TYPES.

Type.	Age in Years.	Acres.	
Mixed Hardwoods	1–20	37,782	
	21–40	61,086	
	41–60	30,413	
	61–80	7,745	
	81–100	3,394	
	101–up	387	140,807
White Pine.....			
	1–20	22	
	21–40	69	
	41–60	36	
	61–80	73	
	81–100	33	233
Abandoned Field	All ages		43,086
Total.....			184,126

Timber Estimates.

The total number of ties in the county is estimated at 4,359,000 (See Table III), and the total number of cords at 2,808,000, which latter figure includes the ties.

Although no careful estimate was made of the lumber, yet from general observations and deductions the amount of standing lumber is placed at not less than 25,000,000 feet, board measure, *exclusive* of the tie estimate. Most of the timber estimated as ties could be sawed into lumber if desired. This figure does not include the timber in the white pine type. The estimate for this type was made only in lumber, and shows a total of 4,350,000 feet, board measure, of white pine.

TABLE III.—NEW HAVEN COUNTY.

Showing Amount of Standing Timber in Cords and Ties by Age Classes and Forest Types.

Type.	Age in Years.	Cords.	Ties.	M. B. M. Feet.
Mixed Hardwoods	1–20	226,000	40,000	
	21–40	1,178,000	1,706,000	
	41–60	761,000	1,722,000	
	61–80	282,000	682,000	
	81–100	109,090	172,000	
	101 up	16,000	16,000	
White Pine	21–40	.....	.....	550
	41–60	.....	.....	400
	61–80	.....	.....	2,500
	81–100	.....	.....	900
Abandoned Field	All ages	236,000	21,000	
Total		2,808,000	4,359,000	4,350

Summary of Yield of 184,126 Acres.

All trees cut into cordwood	2,808,000	cords.
All chestnut and oak cut into ties	4,359,000	ties.
The rest cordwood	2,538,000	cords.
Chestnut and oak cut into lumber	140,000,000	feet B. M.
Birch, maple, ash, pine, and other lumber	26,000,000	" "
The rest cordwood	2,488,000	cords.

These figures may be converted into values by using stumpage prices for the various products. The stumpage prices, especially for cordwood, vary considerably in different parts of the county,

depending on the location with reference to markets. The following figures are considered average:

Lumber		
White Pine	$10.00 per M. ft. B. M.	on the stump
Other species	7.00 " " " "	" " "
Ties	.20 apiece	" " "
Cordwood	.75 per cord	" " "

In order to make a complete money estimate of the standing timber it is necessary to deduct the wood contained in lumber and ties from the total amount of cordwood. An allowance of 320,000 cords is made for these items, leaving the number of cords, less ties and lumber, at 2,488,000.

The money value of the timber is, then:

Lumber	
White Pine	$ 43,000.00
Other Species	175,000.00
Ties	872,000.00
Cordwood	1,866,000.00
Total	$2,956,000.00

These figures may seem to some people surprisingly high for a county commonly supposed to contain little or no timber. But it should be remembered that under present methods of lumbering small sized logs are taken to the mills and utilized.

The Annual Timber Cut of the County.

There are a very large number of mills operating in the county. Approximately forty-five stationary mills do some sawing each year. Many of them run but a few days in the year, while the average amount sawed by each mill is far below that sawed by the portable mills. About forty portable mills were operating in the county the year the figures were taken. Undoubtedly the number varies considerably from year to year, as a mill may be sawing in New Haven County one year and in another county the next year.

The lumber and ties sawed by these mills in an average year are included in Table IV, together with the cut of poles, piles, cordwood and hewn ties. Large quantities of minor products, such as fence posts, charcoal, etc., are harvested every year. It was, however, impossible to secure satisfactory data on any but the major products.

(The value of the minor products probably raises the total stumpage value of the annual cut to approximately $200,000.)

TABLE IV.—NEW HAVEN COUNTY.

ANNUAL CUT.

Product.	Amount.	Stumpage Value.
Lumber	10,000,000 ft.	* $70,000
Ties	200,000	40,000
Poles and Piles	5,000	5,000
Cordwood	90,000 cords	67,500
Total		$182,500

* Stumpage values per unit of product have been already given in the section on "Estimate of the Standing Timber."

Outlook for the Future Supply.

Can the present rate of cutting be continued indefinitely without exhausting the wood supplies of the county? An answer to this question is best secured by comparing the annual cut with the amount added annually to the forest by growth and noting the relation of these two factors to the present estimated stand. For the purpose of this comparison figures for the annual cut, growth and total stand are given in cords, as in this unit the total amount of wood can be better represented than in the form of ties and lumber.

The annual cut, as already given for the year 1906-7, was as follows:

Cordwood	90,000	cords.
Lumber (figured in cords)	20,000	"
Ties " " "	9,000	"
Poles and Piles " " "	1,000	"
Total	120,000	"

The annual growth on all types of forest land, including the abandoned field type, averages .38 cords per acre, or a total of 70,000 cords. The large area of partially open fields in the abandoned field type, as well as many repeatedly burned over and badly damaged stands in the mixed hardwoods type, bring down the average rate of growth. Thus the amount cut each year exceeds the growth by 50,000 cords.

The total estimated stand for the county was, in round numbers, 2,800,000 cords, of which about 1,200,000 cords were found in tracts averaging forty years in age or over. This latter figure may be considered as the present amount of merchantable timber available for cutting in the next few years. Each year the annual growth increases the supply on hand while the annual cut decreases it.

If the cut and the growth remain at the present figures the supply of merchantable timber will be exhausted in about twenty years. At the end of that period there will be a large amount of wood standing in the county, but it will be altogether in tracts under forty years of age, containing wood below the most profitable size for cutting. Cordwood could still be cut, but supplies of the most profitable products, like ties and lumber, would be practically exhausted.

Two methods of preventing such a calamity present themselves. First, to reduce the amount of the annual cut. Financially this would be poor policy and in all probability could not be done, for the reason that the demands for wood throughout the country are increasing while the supplies are diminishing. Important lumber regions are already on the point of exhaustion, and with the lessening output from the chief timber regions the local supply in each case comes more and more into demand. Hence the tendency will be during the next twenty years to increase rather than lessen the cut in New Haven County.

The second method to prevent exhaustion of the supply is by increasing the annual growth of the forest lands. At the present time, through mismanagement and injuries by fire and grazing, the forest areas as a whole are producing much less than is possible under the proper treatment.

To raise the productive power of a forest which has been abused is a slow, gradual process. For the first ten years the increased growth would be small, afterward gradually rising. If the next forty years are considered as forming one period, it is reasonable to expect that the growth could be increased so as to average annually during the period .65 cords per acre, or approximately 120,000 cords for the county.

To obtain this increase it would be necessary to follow out the general lines of treatment advised earlier in the report for the different types, including the planting up of abandoned fields,

open or partially stocked land, and protection for all types against fire and grazing. Fire protection is now the one thing most needed.

Were the forest lands in the county all protected and handled conservatively, the annual growth would be sufficiently increased as to equal the annual cut and thus permit of continuous cutting at the present rate. If the annual cut were increased the growth would not be sufficient to offset it. On the other hand, in the long run the growth under the best methods of treatment could be increased beyond the figures given.

The large numbers of owners among whom the woodlands are divided render it improbable that concerted action will be taken toward better treatment of the forest lands. Many individuals, however, are already handling their holdings conservatively. Throughout the county the outlook in general points to a steady increasing number of such owners, so that finally they may come to predominate.

Notes on Individual Towns.

Ansonia. Percentage forested, 50. The forested area is restricted to the hills composing the eastern third of the town and to the northwestern corner. Nearness to the city of Ansonia has resulted in heavy cutting of the forest lands and young stands are the rule. On Sundays and holidays the woods are full of mill hands, who cause many forest fires. As a consequence of these fires the woodlands are fast deteriorating.

Beacon Falls. Percentage forested, 59. The gorge of the Naugatuck River, which cuts the town into two parts, is the principal topographic feature. This town is one of steep slopes and deep, narrow valleys, with hills reaching a height of about seven hundred feet. No swamp land and but one natural pond occur within the area.

While a considerable portion is classed as open land, it is largely meadow, pasture and orchard, with but a small percentage of plowed fields. The forest lies on such steep slopes and shallow soils that growth is slow. Heavy cuttings have taken out the large timber, so that now stands under twenty years of age predominate. Occasional forest fires do great damage to the woodlands.

BETHANY. Percentage forested, 65. On the eastern and western sides the town of Bethany is nearly all wooded, while through the center runs a belt of rolling land which is largely farmed. A relatively high amount of lumber is now cut each year, compared to adjoining towns. Owing to the location of the town, back from railroads and distant from large markets, considerable large timber still remains standing. During late years there have been but few fires in the forests, which are usually in thrifty condition, except for their need of thinnings.

BRANFORD. Percentage forested, 35. The forests of Branford are in small holdings much broken up by fields. Along the seacoast the timber-lands are coming into the hands of wealthy men who take care of their woods. Here can be found the bulk of the mature timber, though it is not abundant. Elsewhere stands over fifty years are exceptional. The damage caused by fires is comparatively slight. Those occurring tend to be along the railroad line. Nearness to the New Haven markets results in good prices for wood.

CHESHIRE. Percentage forested, 45. Two distinct types of country are found in Cheshire; one, forming the western border of the township, is mountainous and well wooded, while the eastern and central districts are comparatively level, with fertile soils, and, therefore, devoted to agriculture. Here the forest is in the shape of isolated woodlots and the old pasture type predominates. In the mountainous section a practically continuous belt of timber occupies the land, which does not show signs of ever having been cleared.

Damage by fire, while in evidence, is not so widespread as in many other towns. The town is fairly well located with respect to markets, being crossed by several steam or trolley roads and lying within reach of such cities as New Haven, Meriden and Waterbury.

DERBY. Percentage forested, 42. The city of Derby with its suburbs occupies the greater part of the area. In the northwestern and in the southwestern ends large areas of forest occur. The growth is under forty years of age and most of it much younger. Damage by fire is excessive. Forest fires are usually set on Sundays and holidays by boys and mill hands.

A ready market exists for even the smallest classes of wood.

East Haven. Percentage forested, 31. With the exception of Saltonstall Ridge and the territory near Rabbit Rock, both of which regions are continuously wooded, the forests of East Haven town occur as isolated woodlots. Those in the central and southern portions of the town serve to supply East Haven and Fair Haven with wood.

Forest fires have been troublesome on Saltonstall Ridge and in the woodlands to the west of the ridge. This is owing to the ease with which these places can be reached from the city by careless pleasure seekers, who often set fires.

Guilford. Percentage forested, 57. The northern-central and southwestern portions of the town are largely under cultivation; elsewhere extensive blocks of forest prevail. Fires, unfortunately, are of common occurrence. They decrease in number as the remoter parts of the town toward the north are approached. In the southern half of the territory good markets exist, centering in Guilford town. Throughout the northern half, however, owing to lack of local markets and distance from railroad lines, owners are at a disadvantage in selling wood.

Hamden. Percentage forested, 52. The south-central and eastern parts lie in an excellent agricultural region devoted to truck farming and dairying. The forest, occurring in small blocks, covers only a small percentage of the area. Rough, hilly land, usually underlaid with trap rock, characterizes the northern and western portions of the town, comprising nearly two-thirds of the total area. The slopes here are so steep and the ground so stony as to prevent their use for farming. Consequently, except along the valleys, unbroken woodland exists. Excellent transportation facilities are afforded by the trolley and steam railroad lines which run northward through the town. The southern part of the town is within easy hauling distance of New Haven. On West Rock Ridge forest fires are a great menace to woodlands. This is especially true of the south end, over which pleasure seekers from New Haven are fond of walking.

Madison. Percentage forested, 63. Farm land predominates in the southern fourth of the town, but northward the forest occurs in nearly unbroken distribution. The stony nature of the soil accounts largely for this arrangement. Red and white oaks and chestnut are the chief trees. Along the Hammonasset River on swampy lands considerable white cedar grows to merchantable size.

Forest fires are rare, especially in the northern half of the town. This is due to the absence of railroads, and to the sentiment of the population, which is against fires. Only one railroad traverses the town, and along its line there is but little wooded land in which fires could be set.

Madison is a sparsely inhabited town, so that local demands for forest products are poor. Nor are there good facilities for shipment to other towns. At present ties are the principal product, being cut and marketed usually by the woodlot owner himself.

Meriden. Percentage forested, 32. A large part of the territory is taken up by the city of Meriden and its suburbs. The forest is confined to the ridges and slopes on the edges of the town, and the better timber is in parks and private estates. Excellent markets are available, as the woodland is practically all within three miles of the center of the city. Fires have done but little damage in recent years, except on Cat Hole Mountain.

Middlebury. Percentage forested, 43. Middlebury contains much excellent, cultivable land, the higher lands as a rule being cleared, while along the streams belts of forest are frequent. The location of the town near such good markets as Waterbury and Naugatuck, with easy hauls into both these places, enables the forest owner to dispose profitably of his wood. Timber of medium age, between twenty and forty years old, occupies a greater area than is taken up by the other age classes. Serious damage from forest fires has not taken place lately.

Milford. Percentage forested, 37. Milford contains no rough, rugged lands, the surface being low and rolling in nature. Near the Housatonic River sandy and stony soils prevail. Here the forest occurs as a long belt, paralleling the river, but elsewhere throughout the town isolated blocks of woodland are typical. The timber is mostly less than sixty years of age. Forest fires are well controlled, except along the Naugatuck Division of the New York, New Haven & Hartford Railroad. This line sets numerous fires, which annually run over the adjacent forest with disastrous results. Good local markets for forest products are available, as well as excellent transportation facilities to the neighboring cities, Bridgeport and New Haven.

Naugatuck. Percentage forested, 46. The forests of Naugatuck have been heavily cut. About half the wooded area consists

of young stands below ten years of age. Nearly an even distribution is found between the farm and forest land, although the latter appears as scattered blocks of considerable size. The local markets and those of Waterbury, four miles away, particularly the brass foundries, which use large amounts of cordwood, are partially responsible for the heavy cutting, but frequent and disastrous forest fires are much more to blame. These often injure middle-aged stands to such an extent that it is necessary to cut them prematurely for cordwood instead of allowing the growth to reach tie or pole size.

New Haven. Percentage forested, 12. The only bodies of woodland are found on East and West Rocks and in the extreme western and eastern ends of the district. Various city parks and private preserves, in which very little, if any, cutting is allowed, include nearly the whole wooded area. Thus the amount of wood annually cut in New Haven is small.

North Branford. Percentage forested, 52. The central and west-central portions of the town are taken up by a ridge of trap rock. To the west and north is the valley of the Farm River, while across the southeastern corner flows the Branford River. Practically a solid block of forest covers the trap ridge, but in the rest of the town agricultural lands predominate and the forest is scatteringly distributed. On the whole, hickory and the oaks are more abundant than chestnut, due to the fact that the latter is very scarce in the rougher parts of the territory.

No railroads pass through the town of North Branford, nor is there a large local demand for wood. But the town is within hauling distance of New Haven, and also within a few miles of the Air Line Division of the New York, New Haven & Hartford Railroad. The remoteness from railroads and the absence of factory hands in the town has done much to render secure the woodlands from injury from fires, of which but few occur.

North Haven. Percentage forested, 33. This town lies in the valleys of the Quinnipiac and Mill Rivers. It is comparatively level and contains only about 25 per cent. of true forest soils. These soils comprise a sand plain in the north-central part of the town and a few rocky trap ridges near the eastern border.

Some woodlots west of the Quinnipiac are found on agricultural soils. The forest is owned in woodlots and occurs in small patches, except on the sand plain, where a continuous belt of

forest exists. In the isolated woodlots forest fires are infrequent, but on the sand plain, near the New York, New Haven & Hartford Railroad tracks, they burn repeatedly. Practically no stands are over forty years of age. Within the town itself, the local demands of the farmers, townspeople and brickyards create an excellent market for cordwood. In fact, the brickyards (five in number) are obliged to secure their wood largely outside the town. The electric and steam railroads enable the farmers to sell ties profitably.

Orange. Percentage forested, 40. Orange is an agricultural town, with the forest in small woodlots. The only exceptions are in the western end, where the soils are unsuited to agriculture, and in the neighborhood of the Maltby Lakes, where the land is held as a protection for the New Haven water supply. Markets for forest products are excellent; which, as usual, has resulted in the disappearance of mature timber. On the whole, forest fires are not prevalent, due, undoubtedly, to the woodlot character of the holdings. However, in the well-wooded section near the Housatonic River fires are frequent alongside the Naugatuck Division of the New York, New Haven & Hartford Railroad. Around the Maltby Lakes surface fires sometimes occur.

Oxford. Percentage forested, 48. The woodlands of Oxford have been heavily cut in the past, and at present are nearly all less than twenty years of age. West of Eight Mile Brook the timber averages considerably older, as this western corner is more remote and hence less heavily logged. Only one railroad traverses the town (running across the north end), but the eastern border is near the Naugatuck valley, so the manufacturing cities of this valley furnish an outlet for the wood of Oxford. Fires do not run through the woods frequently, yet when they do occur the stands are seriously injured, medium-sized trees often being killed outright.

Prospect. Percentage forested, 63. Prospect is located on high land (four hundred to eight hundred feet) which is rather plateau-like in character. The forests are fully half of chestnut. Stands of pure chestnut compose 20 per cent. of the forest. Very few stands are over forty years of age and none are over seventy. The location of the town, within easy hauling distance of Waterbury and with a steam railroad and a trolley line close to the northern border, makes it possible to dispose profitably of

cordwood as well as of other forest products. Forest fires do considerable damage each year.

SEYMOUR. Percentage forested, 41. The woodlands in Seymour form extensive bodies along the slope of the Housatonic valley and on the western border of the town. Elsewhere they lie in more or less isolated blocks. Fires set by mill hands, as in the towns of Ansonia and Derby, are a serious menace to forest property. Market conditions throughout the town are good.

SOUTHBURY. Percentage forested, 58. The forest area of Southbury is on the increase, undoubtedly. In the Pomeraug valley, and in one or two other smaller valleys, the country is nearly all farmed; but back on the hills only the very best land is still cultivated. The town is characterized by the large proportion of abandoned fields which mark the location of former hill farms. Southbury is a large town, and over the greater part of the area only such products as ties and lumber can be marketed. One railroad runs along the extreme western border and another goes through the southern-central section. These lines, however, are not sufficient to give the town adequate transportation facilities. Forest fires are of rare occurrence, except along the railroad.

WALLINGFORD. Percentage forested, 28. Wallingford is a well-settled town, devoted to agriculture and manufacturing. The forest lies in small, isolated patches, and is most abundant along the eastern and western edges. Areas of absolute forest soil are comparatively infrequent. In fact, some of the land formerly devoted to timber is now being used for peach growing. Relatively high prices can be secured the forest products, owing to good transportation facilities and excellent local markets.

WATERBURY. Percentage forested, 32. Approximately one-third of the township is occupied by the city of Waterbury and a few small villages. The area required for residence purposes is increasing yearly, so that the portion of the township that can be devoted permanently to the production of timber is limited. Existing stands are in small pieces located on ridges, steep slopes, or swampy sites. Less than 10 per cent. of the forest is over forty years old, so at present practically nothing but cordwood can be cut in the town.

Waterbury, with its many manufacturing plants, requires large supplies of wood, which can be met only by importing timber.

Forest owners do not as yet attempt to prevent fires on their holdings, consequently annual surface fires are the rule. Owing to the isolated location of the average woodlot, fires could be successfully controlled.

Wolcott. Percentage forested, 74. Wolcott is the most extensively wooded town in the county. The farm land lies mainly along the streams and valley bottoms, with a belt of pasture separating it from the woodland above. While the city of Waterbury is only two miles from the southwestern corner of the tract, yet the lack of railroads or trolley lines makes long hauls necessary in carrying forest products to market. During the last ten years fully one-half of the wooded area has been burned over more or less severely, in a few instances stands sixty years or over being killed. Campers are commonly considered responsible for setting these fires.

Woodbridge. Percentage forested, 50. The wooded area lies in many scattered blocks. Fully 40 per cent. of the forest is under twenty years of age. As a rule, the stands in the southern half average younger than in the northern part. This is due to the fact that southern Woodbridge lies close to the New Haven markets and hence is closely cut. Forest fires are not especially severe. The small size of the wooded tracts in many cases assists in affording protection.

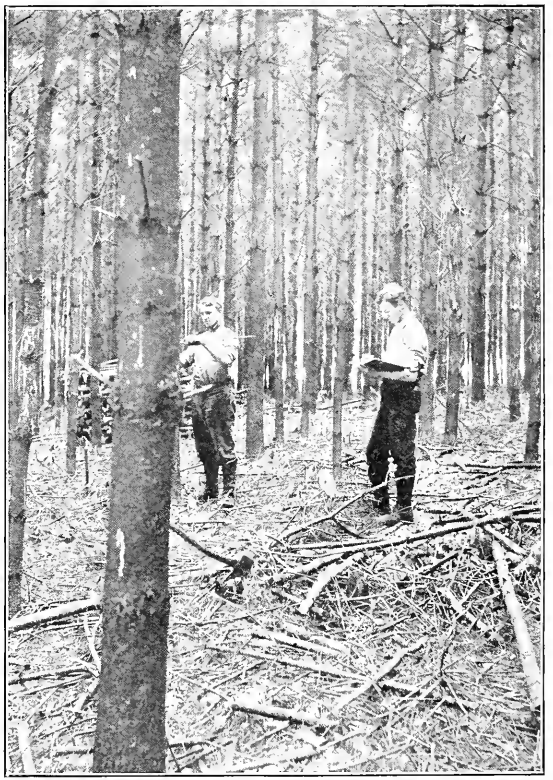
SCENE IN A VIRGIN HEMLOCK FOREST. COLEBROOK, CONN.

(See page 15.)

A SWAMP OF WHITE CEDAR. *(Chamaecyparis thyoides.)*

(See page 35.)

THROUGHOUT LITCHFIELD COUNTY THE WOODS HAVE SUFFERED SEVERELY FROM ICE-STORMS.



A WHITE PINE PLANTATION THIRTY YEARS OLD, BEFORE AND AFTER THINNING.

A WOODLOT FROM WHICH THE MATURE TIMBER HAS BEEN REMOVED. HAMDEN, CONN.

THE MOST NORTHERLY GROVE OF PERSIMMON. LIGHTHOUSE POINT, NEAR NEW HAVEN.