The Original Forest Types of Southern New England

Stanley W. Bromley

Ecological Monographs, Vol. 5, No. 1 (Jan., 1935), 61-89.

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Ecological Monographs is currently published by The Ecological Society of America.

THE ORIGINAL FOREST TYPES OF SOUTHERN NEW ENGLAND[1]

By STANLEY W. BROMLEY

"The path led through woods which bore the mark of centuries, over barren hills that had been licked by the Indians' hounds of fire. . . ."

—*The Old Bay Path,* J. G. Holland.

[1] Papers from Department of Botany, the Ohio State University, No. 336.

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THE ORIGINAL FOREST TYPES OF SOUTHERN NEW ENGLAND

Introduction

To reconstruct the appearance of southern New England[2] when the forest was the domain of the Indian, wolf, and rattlesnake is indeed an interesting but difficult problem after the nearly complete obliteration of natural features by more than two centuries of cultivation, grazing, and industrialization. It is the common assumption that most of the country was originally wooded—but what were the forest types, what was the character of the forest, and what were the influences to which it was subjected compared with those of the present day? Obviously, any idea of the original conditions may be gained only through a composite study of the ecology of the present day forest and the meager records of the past.

Inasmuch as the original woodlands were destroyed early in the settlement of the country, little light can be shed on the problem of original types by correlating soil or climatic factors with the present associations, composed as they are largely of secondary species or of secondary communities. The historical factors must therefore be given consideration in outlining the original forest types. The present paper deals largely with this phase.

A method of studying the historical factors may be outlined as follows:

A. Prehistoric evidence.
   1. Fossil trees and plants.
   2. Laminated clay records.
   3. Fossil pollen (bog records).

B. Historic evidence.
   1. Early travelers' records.
   2. Early surveyors' records.
   3. Local histories.
   4. Contemporaneous writings.

Due to the paucity of prehistoric evidence in the region under consideration, little can be said at present. The historic evidence which I shall present has been largely gleaned from nos. 1, 3, and 4 under B.

Acknowledgments

The writer wishes to express his sincere thanks to Dr. E. N. Transeau, Chairman of the Department of Botany, Ohio State University, who suggested the preparation of this paper and whose suggestions and timely help have been invaluable; to Dr. R. B. Gordon of the Department of Botany, Ohio State University, Dr. G. E. Nichols and Dr. C. G. Deuber of Yale University, and Dr. R. P. Marshall, all of whom have materially aided the writer in one way or another in the prosecution of this study. I am greatly

[2] Massachusetts, Rhode Island, and Connecticut.

indebted also, to Dr. M. L. Fernald of the Gray Herbarium, Harvard University, for his kind assistance in supplying data on the location of *Chamaecyparis* bogs. The reference work was largely done at the New York City Library, the Colonial Library at New Haven, the Yale University Library at New Haven, the Southbridge Public Library, the Ferguson Library at Stamford, Connecticut, the Ohio State University Library, and the private library of Mr. F. A. Bartlett, Stamford, Connecticut.

HISTORICAL FACTORS: PRE-COLONIAL

The picture which may be gained from the writings of the early travelers is fragmentary, but at least it gives a basis for surmise as to the character of the forest at the time of settlement by the whites. On one subject, all are in accord and that is the observation that the original forest was, in most places, extremely open and parklike, due to the universal factor of fire, fostered by the original inhabitants to facilitate travel and hunting. We do not know the exact Indian population of southern New England at the advent of the whites, but it was probably about the maximum that could exist under the conditions of the times. Dwight (III, 31) gave an estimate of about 80,000 distributed over an area of thirty to forty thousand square miles. At any rate, there was probably a sufficient population to bring about an annual burning of most of the country sufficiently dry for a conflagration. The burning of the forests and grasslands, it must be remembered, was a universal custom among aboriginal people, not only in the Americas, but in many other regions of the world as well.

To quote from Thomas Morton[3] (1632), "the Salvages are accustomed to set fire of the country in all places where they come; and to burn it, twize a yeare, vixe, at the Spring, and at the fall of the leafe. The reason that moves them to do so, is because it would be otherwise so overgrown with underweedes[4] that it would be all a copice wood, and the people could not be able in any wise to passe through the country out of a beaten path. . . . The burning of the grasse destroyes the underwoods, and so scorcheth the elder trees, that it shrinks them, and hinders their growth very much: So that hee that will look to finde large trees, and good tymber, must not depend upon the help of a woodden prospect to find them on the upland ground; but must seeke for them . . . in the lower grounds where the grounds are wett when the country is fired. . . . For when the fire is once kindled, it dilates and spreads itself against as with the winde; burning continually night and day, until a shower of raine falls to quench it. And this custome of firing the country is the means to make it passable, and by that meanes the trees growe here and there as in our parks: and makes the country very beautifull, and commodius."

Dwight, somewhat more than 150 years later,[5] gives an additional purpose

[3] Chapter XVII. Morton's observations were in east central Massachusetts, in what might be termed the Boston region. He lived until his expulsion from the colonies near what is now Wollaston.

[4] Underwoods?

[5] Many of Dwight's travels took place in the latter part of the eighteenth century and the first part of the nineteenth. His descriptions, however, were not published until 1821.

for the Indian's fires. Although the character of the New England woods had greatly changed by his time as a result of clearing, grazing and other factors incidental to white settlement, he had visited western New York state which had been more recently subject to Indian influence. "The object of these conflagrations was to produce fresh and sweet pasture, for the purpose of alluring the deer. . . . Immediately after the fires a species of grass springs up, sometimes called fire grass."[6] "Of this nature were always the oak and yellow pine grounds: which were therefor usually subjected to an annual conflagration. The beech and maple grounds were commonly too wet to be burned." In Letter VIII, p. 103, the same author states that "The aborigines of New England customarily fired the forests that they might pursue their hunting with advantage . . . the grounds which were covered with oak, chestnut, etc., or with pitch pines, were selected for this purpose, because they alone were, in ordinary years, sufficiently dry. Such, to a great extent, were the lands in New England; and they were probably burned for more than 1,000 years."

This original open type forest is the direct antithesis of the present day type of "brush" or coppice wood which is characteristic of southern New England, and which is partly the result of clean cutting at frequent intervals. As the country was settled, much of the land was completely cleared and cultivated, mowed, or pastured. Many of the old records state that the colonists continued the burning of the woods after the expulsion of the Indians to maintain grass for pasturage in the areas not completely deforested. Progressive clearing of the land for agriculture continued until the early part of the nineteenth century. Between 1820 and 1850 the area of cleared land attained its maximum amounting to 75 or 80 per cent of the total in many southern New England counties. Since the Civil War, there has been a gradual abandonment of this cleared land in many places, and slow reversion to forest. During the seventies, the portable steam sawmill came in, and by the end of the nineteenth century, practically all of the remaining old woodland tracts had been cut. As a result of these two factors, approximately 60 per cent of southern New England is now brush land or young woods, either succeeding the older woods or invading land which was once cleared or cultivated. Woodland trees one hundred years old are scarce, and forests in which the dominant trees are several centuries old, as was the original condition, are practically non-existent.

What do the early commentaries say that would throw light on the original forest types in southern New England? Captain John Smith in his description of southern New England (1616) made the statement[7] "Oke is the chiefe wood." Morton (1632) in his list of trees of New England gives greatest prominence to oak, walnut (hickory), and chestnut. Wood (1634)

[6] Probably *Agrostis hyemalis* (Walt.) BSP.
[7] P. 16.

stated that the "chiefe and common timber for ordinary use is oake and walnut."[8] The latter author gives a description of the early forest which is quoted as follows, inasmuch as in addition to confirming Morton's account, it gives a better idea of the character of the woods: "The timber of the Countrey grows straight and tall, some trees being twenty, some thirty foot high, before they spread their branches; generally the trees be not very thicke, though there be many that will serve for mill posts, some beeing three foote and a halfe o're. And wheras it is generally conceived that the woods grow so thicke, that there is no more cleare ground than is hewed out by labour of man; it is nothing so; in many places, divers acres being cleare, so that one may ride a hunting in most places of the land, if he will venture himselfe for being lost; there is no underwood saving in swamps and low grounds . . . for it being the custome of the Indians to burn the wood in November, when the grass is withered, and leaves dryed, it consumes all the underwood and rubbish, which otherwise would over grow the country, making it unpassable, and spoil their much affected hunting; so that by this meanes in those places where the Indians inhabit, there is scarce a bush or bramble, or any cumbersome underwood to be seene in the more champion ground, small wood growing in these places where the fire could not come is preserved."

Southern New England,[9] except the mountains, was at the time of this narrative, very probably covered with oak-hickory and oak-chestnut on the uplands, while the sandy, so-called "Pine plains" were pitch pine. The climatic climax types (white pine, hemlock, maple, beech) largely composed of trees sensitive to fire, were very probably restricted to the moister areas or to protected ravines and gorges. The extensive annual fires to which the land was subjected for centuries would tend to make the xeric and fire-resistant oaks, the "chiefe wood." That the distribution of the white pine and hemlock in the region designated as the "white pine" area in Figure 1 and the hemlock type in the area in southern Connecticut mapped as the "oak" region, was greatly restricted until a comparatively recent date may be surmised from the following. As late as the beginning of the nineteenth century, Dwight (vol. IV, p. 218) states "that the pine, south of the district of Maine, if it were all collected into one spot, would scarcely cover the county of Hampshire" and that "nine-tenths of all the forests in this country, South of the District of Maine, are composed either of oak, hickory, etc., or of beach, maple, etc."

That most of southern New England was not typical forest, but a woodland greatly modified by fire and anthropeic factors seems quite certain. In addition to keeping the woods open by means of fire, the Indians had undoubtedly cleared certain regions, either for their primitive agriculture or for other reasons. The present site of Boston was reported to have been so

[8] In the old accounts—"walnut" was used synonymously with hickory and does not refer to *Juglans*.
[9] Probably most of the southern New England region, except the Berkshire, Taconic and possibly the hilly region of North Central Massachusetts had been subjected to the fires set by the Indians.

free of forest, presumed to have been cleared by the Indians, that the settlers were forced to obtain their firewood from the wooded islands in the harbor. There were so-called "natural meadows" along many of the streams, and on many of the higher, overdrained sandy or gravelly knolls were open areas dominated by *Andropogon scoparius,* the climax grassland of such sites in southern New England. In addition, there were open brushy plains in certain regions, composed largely of bear oak (*Quercus ilicifolia* Wang.) and sweet fern (*Comptonia asplenifolia* L.), which were the habitats of the heath-hen. While many of these were no doubt kept in this condition by fire, there were undoubtedly others such as the Seekonk plain, in Bristol County, Massachusetts; and the Plainfield area in Windham County, Connecticut, which were edaphic and physiographically similar to the Hempstead plain of Long Island, New York (Harper, 1912). Many of the natural wet meadows may have originated as beaver meadows.

Wood (1634) described the natural meadows: "There be likewise in divers places neare the plantations great broad meadows, wherein grow neither shrub or tree, lying low, in which Plaines growes as much grasse, as may be throwne out with a sithe, thicke and long, as high as a man's middle."

The activities of other native animals may have been important in influencing the original vegetative types. The browsing of great numbers of deer (Rhoads, 1903), the effect of the feeding, roosting and nesting of the millions of wild pigeons (Lawson, 1709), and the great numbers of wild turkeys, both of which fed largely at certain seasons of the year, on acorns and beech mast, were influences which in certain regions may have locally modified the character of the forest.

Fires, in addition to reducing the undergrowth, must have exerted a profound influence on the forest types. Such fire-sensitive species as hemlock, white pine, beech, and juniper must have been greatly restricted in areas where they would otherwise have occurred in abundance. Many other trees as a result of the fire-scorching became hollow, and it is probable that the great number of hollow trees reported in the early woodlands may have owed their condition to this cause.

HISTORICAL FACTORS: THE POST-GLACIAL PERIOD

As the ice mass of the last glaciation slowly retreated from Long Island Sound, the wave of vegetation that followed in its wake undoubtedly roughly corresponded in its successive stages to those which may now be encountered from the tundra southward. It is reasonable to suppose that southern New England was at one time tundra, followed by the boreal forest of spruce and fir, relicts of which now exist on the highest mountains of the north-western and north-central parts. As climatic conditions became less favorable to this type, an invasion of white pine and hemlock very probably occurred and also an infiltration of maple and beech from the west.

As we do not as yet have pollen analyses of peat bogs from New England, we do not know exactly how or when one forest type succeeded another. It is known, however, that in the middle West, a dry period occurred about 3,000 years ago which resulted in a dominance of xeric species, principally oaks. Although there is no present evidence of such a period in southern New England, it is not unreasonable to suppose that such did occur and very probably was the basic reason for the establishment of oak and pitch pine forests which were maintained by the Indians' fires until the white occupancy.

It seems probable also that fires were frequent on dry sites, even before the Indian occupancy. Such fires could have been started by lightning igniting the dead wood in hollow trees which might burn for several days and from the sparks of which a general conflagration could have been kindled. It can safely be assumed that fire has been a constant attendant of dry woods from time immemorial.

HISTORICAL FACTORS: COLONIZATION

During the seventeenth century, white settlement was hampered by Indian hostility and warfare, but this factor once removed, colonization went on rapidly. By the middle of the eighteenth century, settlements existed in all of the present counties, and most of the present townships. The woodlands were completely cleared over large areas; while in others, cessation of the Indian fires had resulted in a heavy undergrowth. Other woodlands were still burned by the settlers to keep them open for grazing. In many places woods were completely cleared for pasturage. This was done by felling the larger trees in June and burning the tangled windrows when the leaves had dried in late July or August. As settlement progressed, more and more of the entire region was fenced in with stone fences, making a marked and abrupt division between woodlands, pastures, fields, and cultivated grounds.

Much of the wealth of the settlers lay in their cattle and sheep, and the intense grazing to which a large part of the region was subjected for over 150 years had a profound effect upon the vegetational types, as will be described later.

Exploitation of the woodlands kept pace with the agricultural development. During the latter part of the seventeenth century and the early part of the eighteenth, the pitch pine forests were worked for tar, turpentine, and lampblack, which were exported to Great Britain. Temple (1889) in his history of Palmer, Massachusetts, in describing the early settlement of the region, states that as a means of raising money, "these first-comers to the Elbow Tract made considerable turpentine and tar. The pitch pines, which were then the old growth on our plains, were 'boxed'," while "candlewood" was obtained from the pitchy knots.

Pitch pine was an important source of fuel for the colonists and later,

during the early half of the nineteenth century, great quantities were consumed for fuel by the wood-burning locomotives. Emerson (1846) states that "pitch pine is preferred to any other wood in the northern states as fuel for steam engines and vast quantities of it are also consumed for the supply of families." The estimated annual consumption by the Massachusetts railroads at that time was 53,710 cords, which was almost entirely pitch pine.

The oak and hickory woods were also, as at the present time, largely cut for fuel. The sprouting of these trees after cutting perpetuated the "sprout lot" of the farmers. Dwight in 1821 (Vol. I, p. 80) states "when a field of wood is, in the language of our farmers, cut clean, i.e., when every tree is cut down, so far as any progress is made, vigorous shoots sprout from every stump, and having their nourishment supplied by the roots of the former tree, grow with a thrift and rapidity never seen in stems derived from the seed. Good grounds will thus yield a growth, amply sufficient for fuel, once in fourteen years."

Where white pines occurred, these were prized above every other tree for masts. In fact, one of the early names for the white pine was "mast pine." Regarding restrictions on cutting this species, Belknap (1792) in his History of New Hampshire (Vol. III, p. 81) states that "before the revolution all white pines (excepting those growing in any township granted before the 21st of September 1722) were accounted the King's property, and heavy penalties were annexed to the cutting of them, without leave from the King's surveyor."

THE PRINCIPAL FOREST REGIONS

The preceding has dealt largely with the historical factors. This evidence may now be compared with what present day ecology offers.

For convenience, southern New England may be divided roughly into the following regions:

(1) The Oak Region, (2) The White Pine Region, and (3) The Northern Forest Region.

These terms are employed for simplification and do not imply that, for instance, the white pine region is solid white pine forest, but simply that the region mapped is characterized by an abundance of white pine. These regions, outlined in Figure 1, correspond, to a great extent to the classification adopted by the New England Section of the Society of American Foresters, except that they give Cape Cod a distinct classification, termed "Pine and Oak Region," while what the writer calls the "Northern Forest Region" is termed the "Spruce and Northern Hardwood Region."

Furthermore this classification does not imply that the terms refer to the climatic climax type for the region, the occurrence of which in each region will be discussed later.

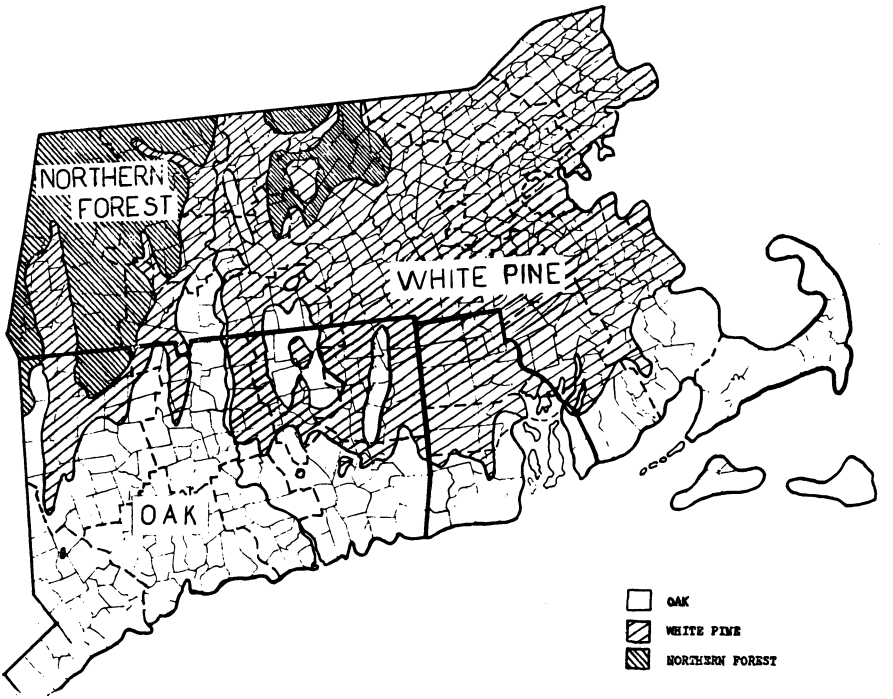

FIG. 1. The principal Forest Regions of southern New England. Approximate boundaries.

1. THE OAK REGION

This occupies a large part of Connecticut, southern Rhode Island, and southeastern Massachusetts, and is characterized by the dominance of oaks and the absence or scarcity of white pine. Originally a large part of the better drained soil, land which was largely cleared for agriculture, was oak-hickory, while oak-chestnut predominated on the drier ridges and south slopes. The upper portions of the steeper ridges were undoubtedly, as they are today, characterized by chestnut oak (*Quercus montana* Willd). The chestnut (*Castanea dentata* (Marsh.) Borkh.) has of course within the past twenty-five years been practically exterminated as a forest tree by the chestnut blight *(Endothia parasitica)*. The swamps were largely red maple (*Acer rubrum* L.)—elm (American elm, *Ulmus americana* L.)—pin oak (*Quercus palustris* Muench.), the latter oak in southwestern Connecticut characteristically overtopping the forest. Swamp white oak (*Quercus bicolor* Willd.) was a component here also, while black gum (*Nyssa sylvatica* Marsh.) occurred in most of the swamps of the entire oak region. The principal oaks are the white (*Quercus alba* L.), black (*Quercus velutina* Lam.) and red (*Quercus rubra* L.); the two latter becoming less abundant in the eastern part where scarlet oak (*Quercus coccinea* Muench.) becomes numerous, par-

ticularly in southeastern Massachusetts where it is frequently the predominating species.

The lower better-drained soils arising from the swamps, and also the sheltered rocky ravines and north slopes were dominated by the typical mixed mesophytic forest (Figure 2), originally composed of oak, chestnut, hickory (*Carya ovata* (Mill.) K. Koch and *C. glabra* (Mill.) Spach.), sugar maple (*Acer saccharum* Marsh.), beech (*Fagus grandifolia* Ehrh.), tulip poplar (*Liriodendron tulipifera* L.), which characteristically overtopped the forest, and a varying admixture of eastern hemlock (*Tsuga canadensis* (L.) Carr.). This type probably represents the climatic climax of the region. Black or sweet birch (*Betula lenta* L.) is common in this type and where clean cutting occurs is apt to come in abundantly and form a secondary type together with an increase in oaks. In southwestern Connecticut, sweet gum (*Liquidamber styraciflua* L.) is an abundant component of the forest near the coast.

The successional types in this region have been very well worked out by Lutz (1928) who found that the common "old field" associations such as red cedar (*Juniperus virginiana* L.), gray birch (*Betula populifolia* Marsh.), pin cherry (*Prunus pennsylvanica* L.f.), choke cherry (*Prunus virginiana* L.), red maple, black birch and dogwood (*Cornus florida* L.) occurring in varying admixtures are succeeded by hardwoods, such as oak, hickory, white ash (*Fraxinus americana* L.), basswood (*Tilia americana* L.) and sugar maple, tending toward the hemlock-hardwood climax.

Succession on old fields and open land depends to a considerable extent on the site, and its relation to the position of light or wing-seeded trees. Gray birch is one of the first to come in as a rule, although abandoned upland mowings frequently show an abundance of choke cherry or pin cherry; lowland mowings revert to red maple or alder (*Alnus incana* (L.) Moench. and in some places *A. rugosa* (DuRoi) Spring). Pastures usually become heavily stocked with red cedar. Succession on cut-over lands may be further complicated by the occurrence of fire.

For many years, repeated "clean" cuttings favored chestnut, due to its outstanding ability to sprout and its rapid early growth, but the chestnut is now no longer important in forest ecology. There is a tendency for oaks to increase following cuttings, even in the mixed mesophytic types, which types, especially the hemlock associations, clean cutting practically destroys. Hemlock, although originally restricted by fires, occurred locally throughout southern New England, except possibly in the Cape Cod region, growing principally in ravines, gorges, north slopes and protected swamps and low moist sandy grounds. Theoretically it is the tree best fitted to dominate the climax forest of southern New England, due to its longevity, shade tolerance and ultimate size. On the other hand its susceptibility to fire and drying winds, and its rather high moisture requirements render it poorly adapted to

such xeric sites as south-exposed ridges and such sandy, level, wind-swept coastal regions as Cape Cod.

The Cape Cod region was originally partly oak forest on the better soils, pitch pine (*Pinus rigida* Mill.) on the lighter, sandy soils, and oak-pitch pine in the tension zone between the two. Dwight, 1821 (Vol. III, pp. 74-109) states that the woods from Wareham to Sandwich were of "yellow pine" with oaks interspersed at New Bedford and Rochester; from Orleans to Eastham, first "oaks," then "oak and pine" to Wellfleet and Truro. From Truro to Provincetown there were no woods but "whortleberry bushes and small oaks." From Sandwich to Plymouth were "yellow pine" plains. The region from Truro to Provincetown were originally wooded, to judge from Gosnold's account[10] "that the Pilgrims in 1620 found Cape Cod harbor compassed about to the very sea with oaks, pines, juniper, sassafras and other sweet wood." Nantucket was also reported to have been originally wooded with oak, hickory, pine and other trees (Chrysler, 1905). The complete destruction of forest in these places was due to cutting and grazing.

In northwestern Ohio, in the sandy regions near Lake Erie and western New York state in the Batavia region, were areas known as "oak openings," sandy areas supporting a scattered open growth of oaks intermingled with grass (*Andropogon scoparius*). A somewhat analogous condition exists on the sandy plains of North Haven, Connecticut, where there are areas of open sand. This condition has existed for a very long time. Dwight (1821) mentions it in his *Travels* (Vol. II, p. 30), stating that the soil "near the northern limit of the township is so light as in two or three places of small extent to be blown in drifts. In these places it is absolutely barren." (See Nichols, 1914.)

2. THE WHITE PINE REGION

This region is at present dominated by northern white pine (*Pinus strobus* L.) which although exceeded numerically by many other trees, is a striking feature of the landscape due to its height and evergreen appearance. The young trees are easily killed by fire and originally the species was undoubtedly much restricted by this factor. At the time of settlement it was probably abundant only in swamps; low, moist sandy areas (known as "pine flats"); and on exposed ridges. Where white pine occurs farther south in isolated stations in the oak region of southern New England, the sites are almost invariably exposed ridges, where competition with the more rapidly growing young hardwoods is less keen. Second growth stations of white pine in the oak region occur only where plantings have been made or where pastures or openings have seeded in from older trees, either planted or relicts on exposed areas.

The greater part of the area mapped as the white pine region was during

[10] Quoted in Freeman, F. *History of Cape Cod*, p. 62. Requoted by Chrysler (1905).

the Indian occupation probably oak-hickory on the lower slopes and better drained uplands, and oak-chestnut on the drier ridges and slopes, with only scattered white pines or groups of white pines overtopping the woodland. Even the so-called "pine flats" were probably not pure white pine, but white pine with pitch pine or hemlock, or in the swamps, with red maple and yellow birch (*Betula lutea* Michx.) as an understory.

However, the great height of the white pine, with scattered trees dominating the forest, gave the impression of greater abundance than was really the case. The white pine was by far the tallest tree in the original New England forest, and so impressed the early travelers. Michaux stated that it was the loftiest and most valuable of the productions of the North American forest. "Its summit is seen at an immense distance, aspiring to heaven, far above the heads of the surrounding trees." Its size may have been exaggerated, although the largest trees were cut early in the history of the country and we have no definite method of ascertaining exactly the proportions which the white pine may have reached. At least we do not have today any white pines of 250 feet in height and 6 feet in diameter as recorded by Dwight (1821, Vol. I, p. 36) or 264 feet, as a Lancaster, New Hampshire, tree was reported to have been; or the trees at Blandford, Massachusetts, said by Emerson to have been 223 feet in height. Probably, however, some of the very large trees in the original forest reached a height of 200 feet. In 1841, a 90 foot mast from the Penobscot Valley in Maine measured 36 inches in diameter at the butt and 28 inches in diameter at the top. Michaux recorded two trunks near the banks of the Kennebec, "one of which was 154 feet in length and 54 inches in diameter; the other 142 feet in length and 44 inches in diameter."

An interesting portrayal of the white pine forest is given by Jeremy Belknap (1812, Vol. III, Chapter VI, p. 56). "Notwithstanding the gloomy appearance of an American forest, yet a contemplative mind may find in it many subjects of entertainment. The most obvious remark, is the silence which reigns through it. On a calm day, no sound is heard but that of running water, or perhaps the chirping of a squirrel or the squalling of a jay. Another thing, worthy of observation, is the aged and majestic appearance of the trees, of which the most notable is the mast pine. This tree often grows to the height of 150 and sometimes 200 feet. It is straight as an arrow, and has not branches but very near the top. It is from 20-40 inches in diameter at its base and appears like a stately pillar, adorned with a verdant capital in form of a cone. Interspersed among these are the common forest trees, of various kinds, whose height is generally about 60 or 80 feet. In swamps and near rivers, there is a thick growth of underwood, which renders traveling difficult. On higher lands, it is not so troublesome; and on dry plains it is quite inconsiderable."

An account of a pitch pine-white pine-hemlock forest is given by Wilson Flagg (1890, pp. 226 and 304). He speaks of the pitch pine thus: "Some of the ancient pine woods in New England were made up principally of this species. Such was that extensive wood near Concord, New Hampshire, known by the poetic appellation of 'Dark Plains,' and in the early part of the century occupying a wide, flat region in the valley of the Merrimack river." "I watched the scenes as we rode slowly by them,—the immense pillars that rose out of a level plain, strewed with brown foliage, and interspersed with a few bushes and straggling vines; the dark summits of the white pines that rose above the round heads of the other species which were the prevailing timber; the twilight that prevailed these woods even at high noon; and I thought of their seemingly boundless extent, of their mysterious solitude, and their unspeakable beauty."

While the two preceding descriptions refer to regions just outside that considered in the present work, they would undoubtedly apply to certain restricted areas in Massachusetts and northern Connecticut and Rhode Island encountered by the original settlers. Wood (1634) stated that he had "seene of these statly high groune trees, ten miles together, close by the River side, from which by shipping they might be conveyed to any desired port." Morton (1632) listed an "infinite store" of pine in "some parts of the country. I have traveled ten miles together where there is little or no other wood growing." Such might, however, have referred to pitch pine.

The climatic climax in this region is probably white pine-hemlock. The original extensiveness of the oak-chestnut-hickory pine type may have been due to the prevalence of fire, or it may have been even edaphic on the drier sites. The occurrence of white pine in the climax, despite its low tolerance of shade, may be explained on the basis of the following factors: 1. The enormous amount of seed that may be set by an individual tree. 2. The wide scattering of the winged seeds and its rapid growth in openings in the forest, caused by windthrows, or fires. 3. Its great height, normally overtopping the forest 10 to 40 feet or more. 4. Its rapid growth, upward through gaps in the forest canopy in an open woodland. Once above the foresty canopy its position is secure. 5. Its longevity. Spaulding records white pine 400 years old. 6. The crashing of the aged trees, opening up spaces in the forest. 7. The greater ability to withstand ice storms and heavy snows which are more destructive to oaks and other hardwoods.

The present abundance of pure white pine stands in this region is due largely, as stated by Dana (1930), to its ability to take possession of abandoned farm lands. When these pure stands are cut clean, as they generally are after 30 or 40 years, they revert to a secondary type of deciduous trees in varying proportions, unless pastured. When pastured, white pine generally becomes reëstablished, if there are neighboring seed trees. As the prin-

cipal monetary value of the southern New England woodland lies in white pine[11] for lumber, and oak and birch for fuel, they are so managed. In the oak and birch types of woodland there is a regeneration due to sprouting, unless pastured; in the white pine stands, regeneration *does not* take place, *unless pastured.* Cleared pastures in this region almost invariably revert to white pine or gray birch, both trees frequently becoming established while pasturing is continued. Old fields are occupied by the same species, although on overdrained and sandy sites pitch pine or aspens are frequently the pioneers. Where pasturing does not occur, the grass *Andropogon scoparius*, a species quickly destroyed by grazing, has a tendency to dominate in such sites and produces a "prairie" (see photo by Nichols, 1914, p. 188), which greatly delays reforestation, particularly if burned. In meadows and low mowings red maple and alder are likely to be abundant, although white pines will frequently become established and eventually dominate the stand.

Where an old white pine-hemlock forest has been cut clean, this type is succeeded by a mixture of such trees as sugar maple, white ash, basswood, yellow and other birches, particularly in the northern part of the region. In the southern part, oaks are more likely to come in, particularly where the stand has been largely white pine. In many cases an understory of young oaks becomes established in a white pine grove, before cutting of the pine, and is thus ready to take its place when the pine is removed. The following observations were made on such a grove at Southbridge, Massachusetts.

1910. A grove of white pines about 70 years old which had evidently seeded in from an old "cabbage" pine in the corner of the lot, about 130 years old. Most of the trees were 70 to 80 feet high and 20 to 36 inches in diameter. Fifty or 60 years before, this grove was evidently surrounded by pasture or meadow land. The floor of the woodland had been burned over repeatedly producing a grassy condition.

1911. Fires ceased.

1912. Young "brush" mowed out by scythe.

1915. Canada mayflower, false solomon seal, solomon seal and other herbaceous plants in great profusion; asters and golden rod in the autumn.

1918. An undergrowth of oaks 2 to 5 feet high. Fire scars still present on some of the pines.

1928. Heavy oak undergrowth 5 to 20 feet high. Thick oak and pine leaf litter, obliterating grass and herbage which was characteristic

[11] A small group of sentinel pines, the tallest and oldest white pines in the locality, towering high above a woodlot overlooking the Quinnebaug valley near the Massachusetts-Connecticut line at Dudley, Massachusetts, had been a prominent land mark since the memory of the oldest inhabitants. These trees, previously estimated, ranged from 100 to 125 feet in height. The woodlot in which they occurred was cut in the autumn of 1931, and on May 22, 1932, diameters and ring counts of some of the larger stumps, which had been cut about a foot from the ground, were: 48 inches, 198 rings; 41 inches, 191 rings; 36 inches, 173 rings; 39 inches, 157 rings. Contrast with this, a white pine stump in the fire-swept Douglas woods, described later. This stump, a foot from the ground, measured 20 inches in diameter and showed 151 rings.

a dozen or more years previous. The old fire scars on the pines practically overgrown in most cases.

3. THE NORTHERN FOREST REGION

In the mountainous areas of western and north central Massachusetts, a type quite different from the preceding occurs. Although white pine is occasional and hemlock abundant, the bulk of the forest is what is known to foresters as the northern hardwood type, consisting largely of yellow birch, white birch, sugar maple and beech; with white ash and basswood abundant in certain areas. Originally the physiographic areas were very well marked and no doubt corresponded to the condition in Vermont which was classified by Thompson (1824, p. 26):

1. Alluvial areas—oak, butternut, elm, walnut (hickory), chestnut.
2. Higher flats—"Pine."
3. Medium uplands—Sugar maple, beech, birch, ash, basswood, elm, butternut, cherry, hornbeam, spruce, hemlock.
4. Sides and summits of mountains—Hemlock, spruce, fir.

Intensive cutting as well as other factors incidental to settling greatly disturbed the original condition. Cutting as usual destroyed the conifers. Second growth stands are apt to be characterized by a greater per cent of yellow birch, white birch, striped maple, pin cherry, and aspen than the original.

On the higher altitudes, red spruce and balsam fir predominate and originally formed nearly pure stands with a characteristic undergrowth of moosewood and hobblebush. Clean cutting throughout the area generally results in the possession of the land by northern hardwoods, particularly birch; while the old pastures and abandoned fields revert to conifers. Annual fires probably did not occur in this region as was the case farther south, although occasional fires in dry seasons occurred, destroying the spruce-fir types over large areas and initiating the succession of fireweeds, aspen, pin cherry and birch with eventually the conifers again invading and finally dominating.

In this region the climatic climax types were undoubtedly the spruce-fir (Fig. 2) on the higher altitudes, and hemlock-hardwoods of the type described by Lutz (1928) on the lower slopes. A virgin forest, the last of its kind in Connecticut, occurring at Colebrook until 1912 when it was cut, was undoubtedly of the latter type and represented the climax which at one time probably clothed the greater part of the Berkshire hills. Fortunately an accurate census of this tract was made by Nichols (1913) before it was destroyed. To quote Lutz's summarization, it was "characterized by the predominance of hemlock and beech. On the whole these two species were about equally abundant and taken together, comprised at least 55 per cent of the stand. The relative proportions of the two were found to vary, but almost

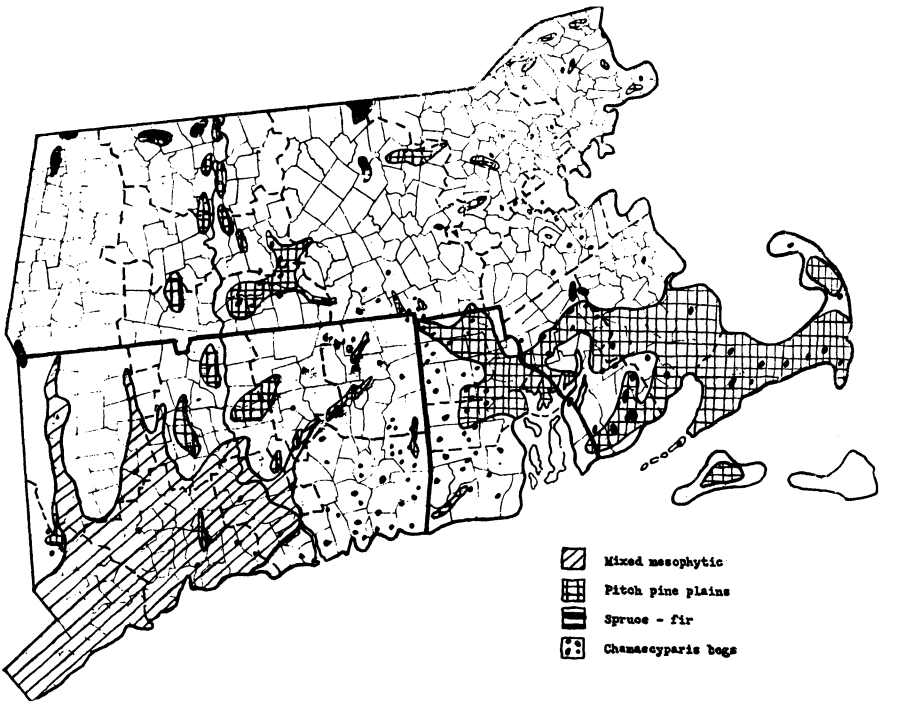

FIG. 2. Locations of certain forest types in southern New England. Approximate boundaries.

without exception one or the other was dominant. The remainder of the forest was made up approximately as follows (in per cent of the total number of trees): sugar maple, 12; yellow birch, 10; red oak, 6; chestnut, 6; white ash and basswood, 7; black cherry (*Prunus serotina* Ehrh.), red maple, black birch, and white pine, 4." Beech-maple, pure sugar maple stands and spruce-hardwoods, as physiographic climaxes, undoubtedly originally occurred in places, the two former on the drier upper slopes or tops of the lower hills and plateaus, and the latter in the tension zone between the spruce-fir of the higher altitudes and the hemlock-hardwoods of the moist slopes. On overlydrained dry ridges, oaks and chestnut also occurred.

CERTAIN PHYSIOGRAPHIC TYPES IN NEW ENGLAND

1. Flood Plain and Alluvial Woodland Associations.

A characteristic flood plain association occurred along most of the larger streams in southern New England, more extensive probably along certain portions of the Connecticut and Housatonic rivers than elsewhere. American elm and sycamore (*Platanus occidentalis* L.) were general, with silver maple (*Acer saccharinum* L.) and red maple abundant in some places. River birch (*Betula nigra* L.) was local and scarce as was also hackberry (*Celtis occi-*

dentalis L.). The sand bars and sandy banks were dominated by cottonwood (*Populus deltoides* Marsh.) and willow (*Salix* spp.).

Edaphic meadows, some of which were of great extent, also occurred in the river valleys and were known as Intervales. According to Dwight, these were most extensive at "Wethersfield, Hartford, Windsor, Glastonberry, East Hartford, and East Windsor in Connecticut; Longmeadow, Springfield, Northampton, Hadly, Hatfield, Sunderland, Deerfield and Northfield in Massachusetts." Brimfield and Brookfield, Massachusetts, both had extensive natural meadows.

Great woodlands also occurred on the alluvial soils and were composed of many of the species listed above with a greater admixture of red oak, chestnut, hickory, white ash and particularly butternut (*Juglans cinerea* L.). In the white pine region, this pine was also an abundant component of the alluvial forest.

2. Pine Plains.

The pine plains (Fig. 2) so frequently mentioned by the early writers were for the most part composed of pitch pine, although in the white pine region there tended to be an admixture of white pine and even hemlock, particularly in the lower moister areas. In the southern and southeastern parts there was a tendency to oaks, particularly scarlet, white and black. The pine plains were invariably on light, sandy soil. The abundance of pitch pine was probably due to the frequency of fire which favored this fire-resistant species by destroying the humus and eliminating competing species. With the fire factor removed, there is a tendency for white pine and hemlock to supplant the pitch pine in the northern area, and for oak or pitch pine and oak to dominate on these plains in the southern part. The pitch pine forests were early exploited and disappeared over a considerable portion of their original range. Cutting is particularly disastrous to conifers, due to the inability of most to sprout, and the cutting of the pitch pine woods almost invariably resulted in a replacement by oak. Dwight (1821, Letter XXXI, p. 39) observed "From Windsor the road, leaving the Connecticut River proceeds to Suffield over a plain of yellow pines, about five miles in extent. At the entrance upon this plain, the pines for near a mile were, many years since, entirely cut off: and in their place has sprung up a forest of oaks." He also spoke of Montague, Hatfield, Ware, Ludlow, Palmer, Sandwich and Plymouth, Massachusetts, as being characterized by extensive "yellow" pine plains. Letter L, p. 2, stated "Immediately after we left Plymouth we ascended the brow of a vast, yellow pine plain, spreading over the greater part of the county of Plymouth, a part of the county of Bristol and a part of the state of Rhode Island."

Some of the higher over-drained gravelly plains were, however, destitute of large trees from the earliest times. The difficulties of the early settlers at Concord, Massachusetts in 1635 were described in Johnson's "Wonder-work-

ing Providence" (Barber, 1848, p. 378). Much of the land was composed of "ragged plains," largely "shrub oak" and sweetfern, making traveling very difficult.

3. Chamaecyparis Bogs.

Scattered peat bogs bearing a growth of southern or coast white cedar (*Chamaecyparis thyoides* (L)BSP.) occur through the southern and eastern area of southern New England, invading stagnant pools and lakes (Fig. 2). Particularly in the more northerly located bogs, there is a fringe of tamarack (*Larix lariana* (Du Roi) Koch.) and black spruce (*Picea mariana* (Mill.) BSP.) at the edge of the water, the thick growth of cedar supplanting this type farther back. The *Chamaecyparis* is undoubtedly an evanescent type, being succeeded, as the swamps dry out, by the deciduous swamp forest in the oak region, and by white pine-hemlock in the white pine region. Clean cutting completely destroys the cedar type, red maple and yellow birch succeeding it. Sphagnum moss, pitcher plant (*Sarracenia purpurea* L.) and poison sumac (*Rhus vernix* L.) are common associates in the more open spots, with *Caltha palustris* growing in the shaded pools. In southeastern Connecticut, there is frequently a heavy undergrowth of *Rhododendron maximum.*

4. Maple Swamps.

Most of the swamps in southern New England are characterized by the presence of red maple. While there were undoubtedly many maple swamps originally, it is probable that most of those at the present time represent a secondary condition. The cutting of the white pine and hemlock in the swamps of the white pine region has left the red maple and yellow birch to occupy the site sometimes to the complete exclusion of the original dominant species; while in the oak region, the swamps which are now red maple, black gum (*Nyssa sylvatica* Marsh.) and elm, undoubtedly contained much more pin oak than occurs today. In old growth swamps in this region the pin oak almost invariably overtops the elm and maple, while the swamp white oak was also a dominant species. Probably the oaks and the white ash dominated the better sites, restricting the pure stands of elm and maple to the least drained situations.

EFFECTS OF PASTURING

Two centuries of pasturing have had a profound effect upon the vegetation of southern New England, although the country is not nearly so extensively pastured as it was 75 or 100 years ago. At that time the pastures were largely kept cleared of "brush" by means of the scythe and "grub hoe." This brush was composed principally of shrubs or young trees of species distasteful to cattle. As stock raising waned, many of the pastures were left idle and allowed to revert to brush and forest. In the white pine region, this became profitable to the farmer, who was able to realize on the young white

pine timber which quickly took possession of such sites. The larger trees coming in on pastured land in New England are almost invariably conifers. As a rule these are not browsed by cattle. The destruction of the young hardwoods by grazing has thus, by eliminating competition, favored the conifers.

In many parts of the oak region, particularly in western Connecticut where the soil is less acid, red cedar is an abundant invader of pastures. Originally, due to its low tolerance of shade, slow growth, and susceptibility to fire, this species was confined to exposed rocky ridges, protected open borders of swamps and along the seacoast. In the white pine region, the white pine frequently forms pure stands on pasture sites, while in the northern forest region where spruce and fir occur, these species are most likely to reclaim pastures on the higher land. In hilly regions, pure stands of hemlock frequently claim protected, pastured, north slopes; while in sandy regions, the pitch pine is a frequent pioneer. East of the Connecticut River, the patches of *Juniperus communis* are frequently indicative of former sheep grazing.

Probably the original grassland on the higher sandy or gravelly sites was almost pure *Andropogon scoparius*. This species is destroyed by grazing, its place being taken by shorter grasses. If grazing is abandoned, *A. scoparius* quickly becomes reëstablished. Along railroad rights-of-way which are frequently burned, *Andropogon scoparius* is the dominant grass.

Among the shrubs and small trees invading pasture land, may be mentioned the gray birch, which is abundant throughout southern New England, as well as species of *Vaccinium* sp., *Rhus* sp., and *Myrica* sp. *Comptonia asplenifolia, Juniperus communis,* and *Baptisia tinctoria* which are abundant pasture species in many localities east of the Connecticut River, while *Potentilla fruticosa* may spread over moist pastures on the higher lands of the Berkshire and Taconic ranges.

EXAMPLES OF OLD-GROWTH FOREST

1. Oak Region.

It seemed an almost impossible task to locate any woodland of even very limited extent which would at all approach original conditions. I eventually found a small tract near Stamford, Connecticut, which because of its proximity to a railroad had been burned over annually for a great many years, was not subject to grazing, and the trees were of relatively great age. Black oak, white oak, hickory, and sweet gum dominated and stood far apart. Flowering dogwood formed a scattered understory. There was no underbrush. A ring count on an oak stump showed somewhat over 200 years. Evidently the trees were old, but due to the dry site and prevalence of fires had grown slowly. The larger trees were 60 to 75 feet in height. Many were hollow or showed extensive fire scars. This was particularly true of the few beech, maple, elm, and pin oak which existed in the grove. The other oaks and hickories as a rule did not show fire scars (Figs. 3 and 4).

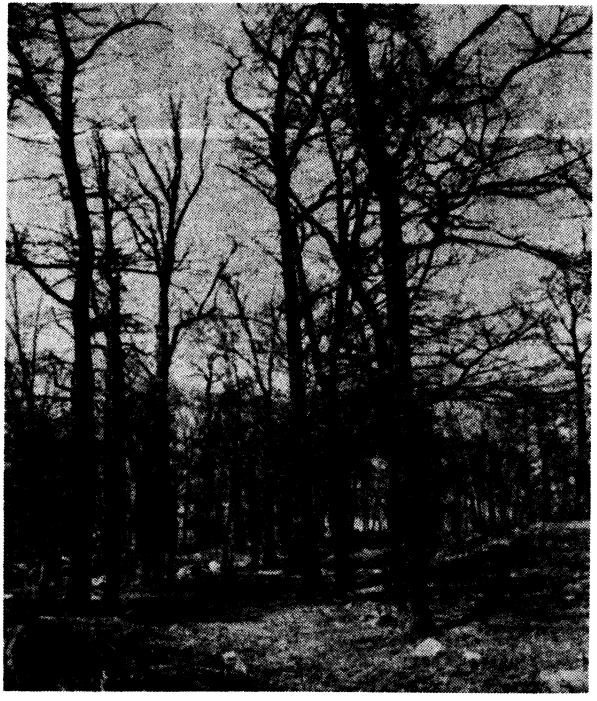

FIG. 3. Oak-hickory woodland, Stamford, Connecticut, subject to annual fires, resulting in an open stand free from underbrush.
(Photo by Dr. R. P. Marshall)

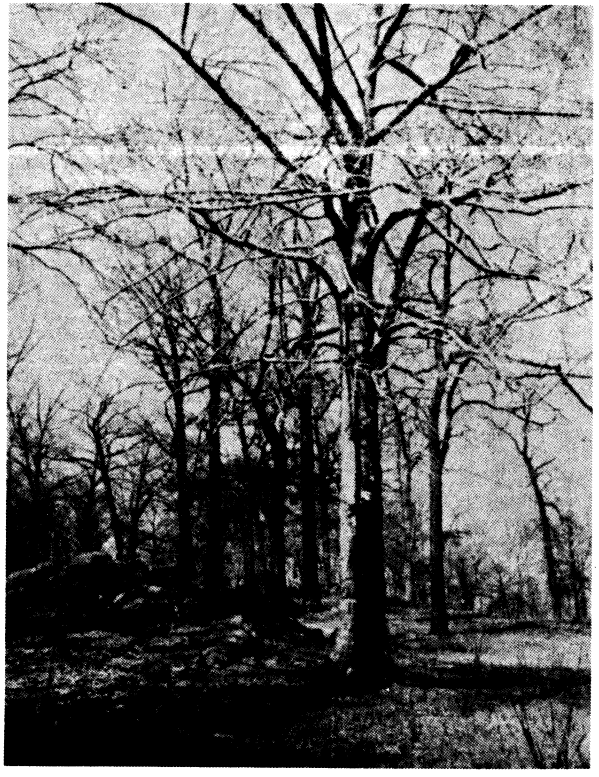

FIG. 4. Same grove as in Fig. 3, showing fire scars on beech. The ground cover near the ledge is largely *Dicentra cucullaria* (L) Bernh.
(Photo by Dr. R. P. Marshall)

In direct contrast to this grove was an original hardwood grove north of Stamford, which had probably not been pastured for many years (Fig. 5). The trees were much larger and the average age may have been slightly greater. Although the large trees stood far apart, there was a dense undergrowth of sweet birch, *Cornus florida, Viburnum,* greenbrier (*Smilax* sp.) and others. Fires had only rarely occurred as evidenced by the dense undergrowth. This grove shows an interesting transition from swamp to upland condition; that is from the swamp type with pin oak, red maple and elm, through mixed mesophytic beech, sugar maple, oak, and tulip poplar (the latter overtopping the forest) to oak-hickory on the higher ground and oak-chestnut (the latter now dead) on the steep, drier slope. There is no hemlock in this grove.

At Laddin Rock, near Stamford, is an old grove of hemlock and mixed mesophytic woodland (Fig. 6). This is in a protected ravine and many of the trees are 200 years or more old.

2. White Pine Region.

An interesting old tract, formerly occurring in this region and known as the Lawson lot, was located near the Woodstock-Union township line in Connecticut. Largely white pine-hemlock, a very interesting transition was shown from swamp to high dry ridge. This grove was dominated by white pine, whose crests overtopped the rest of the forest ten to forty feet, their jagged crowns outlined against the horizon, producing a landmark recognizable for miles around. The swamp sites were largely forested with white pine, hemlock, yellow birch, red maple, and elm. Large sugar maples and red oaks were scattered through the grove on the slightly higher ground; while chestnut, red oak, black oak, white oak, and sweet birch occurred on the higher, drier slopes. White pine was omnipresent; the hemlocks were everywhere also but most numerous in the ravines. This was a wild-appearing woodland. Local inhabitants claimed it to be original forest. There were no signs of fire, pasturing, or cutting. The forest floor was spongy with vegetational debris, and windthrown trees extended their great lengths along the ground. Moss-grown and lichen-covered trunks of standing trees gave the impression of great age, while on the lower slopes great banks of mountain laurel 7 to 15 feet high added to the wildness of the scene. The writer first visited this region in 1917. It was a windy April day and in travelling through the woodland, one was impressed by the fact that although it appeared calm down in the woods, the tops of the great pines were swaying, and the silence was broken by the creaking and groaning of rubbing branches and the roar of the wind through the evergreen tops. The writer was unable to make accurate estimates of the heights of the trees, although he suspected that some of the taller pines may have been 120 feet in height, some of the hemlocks exceeded 90, while the average height of the oaks and chestnuts was

FIG. 5. Oak-hickory woodland, Stamford, Connecticut, not subject to frequent fires. The large trees stand far apart but there is a dense undergrowth. The black oak in the foreground is 114 feet in height.
(Photo by Dr. R. P. Marshall)

FIG. 6. Laddin Rock near Stamford, Connecticut; Hemlock grove in mixed mesophytic woodland. The deciduous tree in the right foreground is a red maple. A few beech are discernible in the grove. Undergrowth has probable been artificially removed. The tallest hemlock in the foreground is about 100 feet in height.
(Photo by Dr. R. P. Marshall)

70 to 80 feet. The trees of largest diameter were red oaks and chestnuts, some of the latter being nearly 5 feet through the trunk near the base. The young growth was largely hemlock. This led the writer to suspect that the predominance of the evergreens might have been a recent development, and that in colonial times the area might have been an open oak-chestnut woodland, particularly as in a part of the woods which had just been felled, it was impossible to find a pine stump showing more than 150 rings. Some of the oaks were over 200. This whole region was cut over a few years after the World War, and every vestige of the conifers destroyed. When the area was revisited in 1931, the predominating trees of the second growth were birch and sugar maple. The latter had seeded in from old maples which had been left standing. A few years prior to cutting, most of the chestnuts had succumbed to the blight.

A somewhat similar tract, in which the pines are much older and larger, is a white pine-hemlock grove at Cornwall, Connecticut, known as the Cathedral Pines (Figs. 7 and 8). Scattered through this grove are large beech, red oak, and sugar maple. There are also chestnuts, but these have now been killed by the blight. The tallest pines here are about 140 feet in height, and judging by the number of rings on a windfall, some of them may be 200 to 300 years old.

The so-called Gulf woods near Southbridge, Massachusetts, long since cut off, were, according to local tradition, largely white pine, hemlock, with here and there large oaks, chestnuts, and beech trees.

The famous Douglas woods, a large tract between Douglas and Webster, Massachusetts, lying on sterile rocky ground, has been cut over at frequent intervals and is now largely low "brush" of young scarlet oak, black oak, and white oak sprouts. Twenty years ago there was considerable chestnut and when I visited the region in 1916, in a tract where the woods seemed the oldest, white, scarlet, and black oaks predominated with scattered white pine and chestnut; and considerable pitch pine in the sandier areas. The swamps were largely white pine, red maple, and yellow birch, with several *chamaecyparis* bogs. This is still a fire-swept area. At the writer's first visit, he thought that originally it may have been predominantly white pine and hemlock, and that frequent fires and repeated cutting had contributed to the destruction of this type. However, the Indians' fires had undoubtedly swept the region long before white settlement and it is probable that in colonial days the distribution of the various forest trees did not differ greatly from that of the present time. Dwight visited the region in the latter part of the eighteenth century and to quote his account: "In the Southwestern part of this township is a large tract of forest known by the name of the Douglas Woods. The trees which are of oak, chestnut, etc., are of moderate size and prove the soil to be indifferent. In the year 1805, when I passed through this

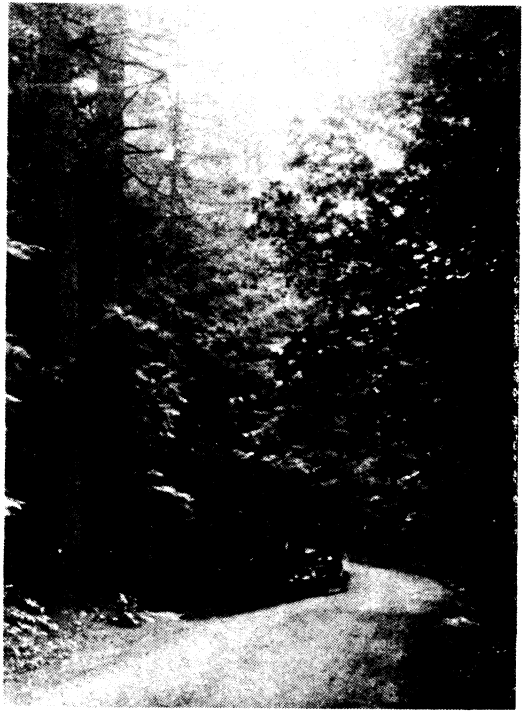

FIG. 7. White pine-hemlock at Cornwall, Connecticut. The tallest white pines are about 140 feet in height.

(Photo by Dr. R. B. Gordon)

FIG. 8. Hemlock ravine in same grove as Fig. 3. The tallest hemlocks are about 100 feet tall.

(Photo by Dr. R. B. Gordon)

region again, I perceived that the inhabitants had begun to make serious depredations on this tract." Dwight's route through the Douglas woods was the old Boston-Hartford stage road from Douglas to East Thompson. Due to repeated cuttings at frequent intervals, this particular part of the region is now largely scarlet oak and bear oak scrub. In the very few relict patches of old trees, the undergrowth on the drier sites is slight and composed mostly of low species of *Vaccinium*.

At South Pond near Brookfield, Massachusetts, on a sandy bluff extending into the lake, known as the Point of Pines, is a very interesting bit of woodland. When I first visited the spot in 1918, the blight had not yet killed the chestnuts, which were the most massive trees scattered through the grove. There were a number of white and red oaks of considerable size and age while scattered white pines, one of which was considerably over 100 feet in height, overtopped the stand. There were a number of very tall pitch pines also, 80 to 90 feet high, but most of the understory was composed of hemlocks of varying ages. The cleared land and pasture east of the grove had seeded in heavily to white pine, with a few of the more sandy spots to pitch pine.

3. The Northern Forest.

A beautiful example of the northern forest still exists in the State Park at Mt. Graylock in the northwestern corner of Massachusetts. The spruce-fir forest is in a natural condition and is one of the most strikingly beautiful groves left in Massachusetts. The grove referred to is that which occurs on the west side of the peak, on the upper slope at the camping ground toward the "Hopper." Most of the stand is red spruce. Balsam fir, canoe birch and a scattering of other northern hardwoods also occur. The trees are tall and straight and give the impression of great age. Some of the taller spruces may be 90 feet or over in height. The undergrowth is rather sparse and is largely hobble bush and striped maple.

AGES OF FOREST TREES IN THIS AREA

Oaks are noted for their longevity, but it is doubtful whether any of our species, even if allowed to live, would attain the age (the proverbial 900 years) of European species. The white oak probably reached the greatest age of our trees under original conditions. The famous Charter Oak at Hartford, Connecticut, presumably a white oak, destroyed by a windstorm on August 21, 1856, was estimated as 1,000 years old, but as it was hollow and no accurate ring count could have been made, this estimate is no more than a guess. *The New England Farmer* (Vol. IV, p. 242) in 1826 recorded its girth at the ground as 36 feet, making it easily the largest oak of which we have record in New England. Sycamores attain a relatively great age, and the large tree at Sunderland, Mass., has been estimated as 500 years of

age.[12] Probably hemlock commonly attains the greatest age of our forest trees. A tree cut on the Holyoke range in 1922 showed over 400 rings. Frothingham (1915) reports hemlocks of 500 to 600 years old. The white pine although a relatively long-lived tree, probably did not ordinarily attain this age. Trees 400 years old have been recorded.[13] One of the oldest white pines in southern New England was the famous "Bear Tree" in Palmer, Massachusetts. This tree was cut about 1921. When I saw it in 1919 it was hollow and badly infested with carpenter ants. I described it in my notes as a triple-leader tree, branching about 20 feet from the ground, 100 feet in height, and about 5½ feet in diameter at the base. It gained its name from the tradition that in the days of early settlement, about 175 years before, a black bear was shot out of the lower branches.

Some specimens of *Chamaecyparis thyoides* in the cedar bogs were reported to be old. Their growth in most cases is extremely slow. At the cedar swamp in Charlton, Mass., a tree about 35 feet in height and a foot in diameter showed 148 rings. The chestnut was a rapidly growing, but comparatively short-lived tree.[14] The largest stump which I found in southern New England, although 75 inches in diameter a foot from the ground, showed only 250 rings.

PRESENT DAY TENDENCIES

As the white pine-hemlock was the most striking and spectacular type in southern New England, it is deplorable that old stands could not have been preserved here and there. It would seem advisable to foster this type on reservations, estates, and in state forests, particularly in the white pine region. Although reproduction of white pine is abundant here, the high value of this tree for lumber leads to cutting it as soon as merchantable size is reached. There are many sites, however, even now where young white pines 50 to 80 years of age are associated with hemlocks and other trees in a proportion similar to the old groves, and if some of these could be saved and natural conditions preserved for a century or two, some of the aged and impressive appearance of the climax forest could be attained.

The value of the white pine is leading more and more to its culture in the white pine region. Fields and pastures are allowed to seed in. Attempts are made by owners to increase their acreage of pine. The value of hardwood groves lies in their fuel production, and when cuttings are made for this purpose, the scattered pines are usually spared with a view to their increase. Many sites are known which have been transformed from pine-hardwood to predominately pine in the past 15 years by simply removing the hardwoods

[12] In 1929 recorded as 24 feet 3 inches in circumference at the base and over 100 feet high.

[13] Spaulding (1899) records (p. 27) a white pine in Michigan, 48 inches in diameter breast high, 170 feet in height and 460 years old.

[14] Chestnut is frequently struck by lightning and many of the large old trees of 25 years ago showed the effect of lightning strokes. Probably the death of many of the larger older trees was hastened by this cause.

for fuel. There has been considerable planting of white pine with many thrifty young stands resulting, although some of these outside the white pine region have not been preëminently successful. The hazard of fire so destructive to young white pine is an ever-present menace to the white pine. During the past 25 years there has been a definite movement towards the protection of woodlands for aesthetic purposes, in the increase of state forests, state parks, reservations and estates.

Chestnut groves were fostered until the blight destroyed the species. The place of the chestnut in the forest is now being taken by other trees, principally oaks.

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