The woodlands and forest systems of the United States.

By Prof. William I. Brewer, New Haven, Conn.

This map showing the distribution of woodlands relates to no one merely. It exhibits the relative proportions of surface occupied by woodlands and by lands not occupied by trees, so far as the scale chosen will allow. It takes no account of the species which make up the tree-covering of the soil, nor of the density of the forests—that is, of the relative numbers of trees per acre—not of their size or economic value, or their fitness for sawing or other use or manufacture. The area of 940,000 represents the number of acres of "Woodland" and the number of acres "improved" and "unimproved" other than woodland in each form. The ratio of woodland to other land in farms, was calculated for each county, and made the first basis for the map. For some regions that were covered with farms, these data were reasonably satisfactory, but for other large areas were very imperfect and had to be modified by estimates. These data ceased with the first tier of States west of the Mississippi River, and overrated west of it. Such disagreements apparently arose from the different standards in the minds of the three to seven scientific observers connected with various explorations and surveys; the publication of learned societies, scientific periodicals, journals devoted to special industries dependent on wood, and other published information not necessary here to be enumerated. More than all this, was information given by those having personal knowledge of particular regions. These observers—private citizens resident in the different localities, travelers, persons concerned with various national explorations and surveys, with State geological surveys, and with land surveys of various kinds, railroad engineers, naturalists, botanists, persons connected with trades and industries that gave them peculiar facilities for information, many officers of the United States Army, U.S. engineers, and members of the Coast Survey, local engineers, etc.—in all a large number of persons who have kindly and carefully given what assistance they could, and whose names I would wish to have noted and thanks publicly be given, not that the line is entirely too long to be allowed here. The detached and scattered data from all these sources have been carefully worked over, and the general results are given on the map.

It is evident that for large areas the value of the map depends upon the accuracy of the estimates of intelligent observers. No published map of any considerable area in our country is known to us, on which the woodlands are laid down from actual surveys. The extensive and valuable information in the U.S. Land Office is largely accessible, but it is scattered through the thousands of books and original notes of the surveys. There has been no attempt to incorporate it in the maps of that office, and it is useless to know how much more could be shown in locating the forest limits than the woodlands on the maps of that office.

Regarding the value of estimates, it is sufficient to say, that usually the data relating to particular regions, have been derived from several independent sources. Over considerable areas, particularly in the southern Rocky Mountain region, I had independent estimates of from three to seven scientific observers connected with various explorations and surveys; and here the estimates agreed with unexpected closeness. Sometimes they all agreed, while they rarely differed more than by one degree of density as given on the map, and such disagreements apparently arose from the different standards in the minds of the different observers. It is probable that at a whole, the amount of wood and as illustrated on the maps is too small to show more than very general distribution. Nor is it possible to convey by this means a correct idea of the character of the forests themselves. The actual number of species is not known, but 300 is perhaps not too high an estimate.

In no dividing line in nature between trees and shrubs, the arbitrary rule adopted by most botanists is to call trees only such species as grow to thirty or more feet high; less than that are shrubs. Sometimes, however, the habit of the plant will place among the trees a plant which from size alone would be called a shrub.

An examination of various authorities shows that species of 300 indigenous species of trees are known to botanists, growing within the limits of the United States, which attain the height of thirty feet. About 290 of these are somewhere in the United States, and are classified and included in the map. The species are so numerous that it is impossible to list all of them. It is possible to convey the same idea to all persons by shades of density, especially not to persons who have kindly and cordially given what assistance they could, and whose names I would wish to have noted and thanks publicly be given. Many of the smaller species, however, and of the larger shrubs, give special character to large areas of woodlands and cannot be ignored in any discussion of American trees, whether considered botanically or economically.

A glance at the map shows large regions either treeless or very sparsely wooded. It is possible to cross the continent, from the Pacific to the Gulf of Mexico, without passing through a forest five miles in extent, or large enough to be indicated on the map. Then, again, the woodlands of the east are separated from those of the west by a broad treeless plain from six to fifteen degrees wide. The forests and woodlands on the two sides of this gap are entirely unlike in their aspect and in their botanical characters. On the eastern side, broad-leaved, hard-wood species predominate, both in abundance of individuals and in number of species, the forests of large areas consisting entirely of such kinds. On the west, the forests are entirely of coniferous, other species occur, some of great value, but they nowhere (or at most in only rare cases in the eastern west) form a conspicuous or even noticeable element in the forests. Not a single species forms a noticeable element in the forests of both sides; the nearest approach to it is the aspen (Populus tremuloides) which is a common tree in the north from the Atlantic to the Pacific. Two species of cottonwood-are also abundant in some localities, and form an important element in the woods of wood-burning sections, but are never extensively a conspicuous element in the forests of the west. These three species of poplar are the only broad-leaved trees that figure as trees both sides of the central treeless plains; but others occur sometimes as scarce trees on one side. Among the Coniferae one cedar is found on both sides an abundant wood in places, but in the east is growth west, a large slow offender than a tree. Neither birch, nor elm, nor hickory, nor maple, nor hawthorn, nor maple, nor magnolia, nor sassafras forms an element in the forest of the Rocky Mountains and westward.

For convenience in discussing the kinds of wood, we may divide our domain into ten geographical divisions, viz.:—1st, New England; 2d, The Middle States; 3d, The South Eastern region; 4th, The Northernwestern; 5th, The Southwestern; 6th, The Plains; 7th, The Rocky Mountain region; 8th, Arizona, New Mexico and the Great Basin; 9th, The Pacific region; and tenth, Alaska. Only native species are considered in the following discussion of the kinds of wood. Such conditions exist in the popular and commercial names of many of the trees, that the botanical name is given where necessary for precision. One example is sufficient to illustrate this confusion of names. The most widespread and valuable of eastern timber trees, Ohio (Quercus alba), which grows from British Columbia to New Mexico, is known in its different localities under the various names of Douglas Fir, Red Fir, Black Fir, Douglas Spruce, Red Spruce, Black Spruce, Hemlock, Oregon Pine, Western Pitch, Bear River Pine, Swamp Pine, and perhaps others. It is, however, nearly all of these names are also applied to other species. Similar confusion exists in the popular names of not a few species.

New England was originally entirely wooded, and has about eighty or eighty-five species of trees of which about thirty may reach fifty feet in height. Maine is a great source of pine and spruce lumber, but as a whole, hard wood species predominate, particularly south of the 43d parallel. Many of these hard woods are noted for their durability and texture, and form the raw material for a great variety of manufactures, particularly of canoes and various tools and implements where tough wood is an essential part. The extent and variety of manufacture in wood is relatively greater in this region than else-
The area of woodlands as a whole has not probably much diminished of late years; but yearly growing, and the adjacent States are contributing largely to the supply. But this forests of broad-leaved species of the Ohio bottoms, and the dense corn ferae forests either of the regions before enumerated.

In very many cases the land is despoiled of only its best timber-trees; the broad-leaved species are the most abundant element in the forests. Here we find the magnificent along the belt mentioned and is at present of greater commercial importance; the most species, which are shrubs or small trees.

There are still large forests of excellent timber almost untouched by the axe; but very much of it the forests were very heavy, and there are still enormous quantities of timber available. The forests of this region are usually made up of quite a number of species, in some places the broad-leaved species prevail, in others the Coniferous. On the edges of the Appalachian region, the forests are more abundant and are growing rapidly.

This is a matter of great importance in ship and boat building, and in the manufacture of railroad cars and of agricultural implements, all of which industries are here prominent. In portions of New York and Pennsylvania there are still large forests of excellent timber almost untouched by the axe; but as a whole the woodlands and forests are rapidly diminishing, both in area and in aggregate value, and there is no corresponding compensation. Probably the price of timber must advance considerably before adequate revenue will be taken to purchase a future supply by growth. How much this may be raised by wise legislation is a topic.

The southeastern region, extending from Virginia to Florida, is the richest in species, is of peculiar interest to the botanist, and of first-class importance in commerce. (We may say that any one wooded region is more important than others, because as wood is a prime necessity in any civilized community.) This region, originally entirely wooded, but now with less than forty acres woodland per square mile, if sparsely settled, may have sufficient timber and wood for the ordinary wants of such a population. Again, there are other regions without actual trees but with large shrubs sufficient for fuel and many other uses. The privilege of this region is the typical province of the country. Expectation and the conditions which have rendered them treasured, there have been many mistaken, which is not necessary here to discuss. Periods of excessive drought, fires, the physical texture of the soil, are the leading theories, some advocating one, and some another. Where the prairies are unenclosed, or have at most a small population, the patches of wood (where they occur) are designated diminishing in number and size, even though the supply is ample. When however a prairie region is largely occupied by settlers and a considerable part in under cultivation, the amount of wood is doubtless rapidly decreasing. This is brought about in part by clearing the land for buildings; otherwise, if well managed, the trees are not touched.

The woodlands and forests are rapidly diminishing, both in area and in aggregate value, and there is no corresponding compensation. Probably the price of timber must advance considerably before adequate revenue will be taken to purchase a future supply by growth. How much this may be raised by wise legislation is a topic.

The northwestern region extends from Ohio to Iowa and Minnesota inclusive. In its original state, it had every variety of forest trees represented, from the heavy forests of broad-leaved species of the Ohio bottoms, and the dense corn ferae forests of Michigan through every gradation of lighter forests, "openings" and "holes" along the streams, the grizzly pine, and the timber pines which everywhere terminates this district on the west. It is represented by about 150 to 200 species, about 60 or 70 of which may reach a height of 80 feet. In southern Ohio and Indiana, the forest species are of broad-leaved species; oaks and various hard woods grow to magnificent size, and of good texture, while black walnut, basswood, white wood, or tall pine attain here their greatest development. The pine region may be said to begin in southwestern Ohio and extend across Michigan and Wisconsin to southern Minnesota. The northerly parts of the three States being mentioned produce a larger quantity of sawed lumber than any other part of the country. The output of 1870 was about two million feet per year for each of the three States. It is probable that the total production of sawed lumber in the United States was 1.5 million feet, that of Michigan furnished over 1.5 million feet, and Wisconsin over 0.5 million, the two States producing upwards of seven-tenths of the total output of lumber in the United States.

The Chicago Lumberman's Exchange gives as the number of "lumber" at that city over a million feet per year for three years, since that census. This is a much smaller, exclusive of lands, shingles, and all forms of housed timber. A prominent journal devoted to the lumber trade gives the production of one for a single month during the last winter (1872-1873) as 45,417 million feet and the daily trade as shown by such a short crop. To illustrate the capacity for sawing lumber, it may be stated that a single mill in Michigan, recently (on June 30, 1873) as a point of capacity, sawed 175,725 feet of lumber in three working hours, the actual running time being two hours and forty minutes. The data on the official tables of the lumber trade.

The data for northeastern Minnesota are very meagre, and that portion of the map has been prepared according to such scanty information as could be collected. For southeastern Minnesota I am indebted to the State Surveyor's report for a detailed map of the northwestern-woodlands and pines.

Between the pine forests and the treetless plains, the prevailing trees are of broad-leaved species, sometimes forming forests of considerable density and size. Sometimes the limits of pinelands and woodlands are well-defined; at others there is a regular transition through "glades" and "openings" from the open forest to the prairie. This must be remembered that the unco ered portions of the map are by no means always treetops. A region with less than forty acres woodland per square mile, if sparsely settled, may have sufficient timber and wood for the ordinary wants of such a population. Again, there are other regions without actual trees but with large shrubs sufficient for fuel and many other uses.

The position of this region is the typical province of the country. Expectation and the conditions which have rendered them treasured, there have been many mistaken, which is not necessary here to discuss. Periods of excessive drought, fires, the physical texture of the soil, are the leading theories, some advocating one, and some another. Where the prairies are unenclosed, or have at most a small population, the patches of wood (where they occur) are designated diminishing in number and size, even though the supply is ample. When however a prairie region is largely occupied by settlers and a considerable part in under cultivation, the amount of wood is doubtless rapidly decreasing. This is brought about in part by clearing the land for buildings; otherwise, if well managed, the trees are not touched.

The woodlands and forests are rapidly diminishing, both in area and in aggregate value, and there is no corresponding compensation. Probably the price of timber must advance considerably before adequate revenue will be taken to purchase a future supply by growth. How much this may be raised by wise legislation is a topic.

The southeastern region, extending from Kentucky and Missouri to Alabama and the western edge of the timber in Texas. Originally the eastern and southeastern portions were largely wooded; pine, however, occurring for many miles in the interior, growing in dense forests, and the western parts, the best timber trees are disappearing. In the western borders, where the supply is at the best sparse, it grows poorly less by the destruction or use of the scanty supply, and no...
The woodlands and the forest systems of the United States

West of the Rocky Mountains is another treeline or sparsely wooded region which extends from the Columbia River to Mexico. Its northern portion extends northward, but forms an important part of the valley of the Columbia and its tributaries; it embraces the whole of the great basin except irregular edges of the rim; it thrusts out an eastern extension through the Black Hills of South Dakota and, southward, through parts of the Rockies or sparsely wooded region which extends across the continent along our southern frontier.

In this area occur the richest and the most unmistakable deserts of our country. It is of the same character to admit here of details. Some portions are grassy plains, some are plains of lava, others are deserts of shifting sand, others are half-baked mud; here by cataclysms, others are "alluvial plains" and "salt valleys," others are great areas covered with "sage brush" and "grease wood"; others pass into chapparal - i.e., there is such a gradation from naked barrenness to great forests. Some of the mountain chains found in this area are as bare of trees as are the valleys themselves; others have large stretches of arable or cultivable places or cities, while others are clothed with forests. The extreme northern part consists largely of lava-plains. South of this, the Blue Mountains of eastern Oregon have heavy forests of pine, fir and spruce of the same species found in the northern Rocky Mountains. South of these are the "sage-plains" and "deserts." In Nevada the valleys are treed with "very rare exceptions"; the ridges sometimes have, sometimes do, shrubs and snarlsly pine, the actual amount of wood being small, yet of investible value, as timber so rich in minerals, and so poor in wood. Over parts, there is a desultory growth, becoming in place, chapparal, but otherwise of scattered shrubs forming in favorable places the size of small trees. One of these, called "mountain mahogany" (Cotoneaster viscosus), is often over thirty feet high with a base two feet in diameter, the wood very hard, close-grained, dark-colored, and taking a beautiful finish when worked. The shrubs of this region include the "sage" bushes, "grease wood," "cross-ribbed brush," etc., of great interest to the botanist, but can hardly claim farther notice here.

The Sierra Nevada, Blue Mountains, and Cascades extend from California to Texas, and in the future will doubtless be extensively planted and cultivated. The cedars and silver forest of the treeless areas are still doubtlessly and annually increased and cultivated. The cedars and silver forest of the treeless areas are still doubtlessly and annually increased and cultivated. The cedars and silver forest of the treeless areas are still doubtlessly and annually increased and cultivated. The cedars and silver forest of the treeless areas are still doubtlessly and annually increased and cultivated.
and botanic, has perhaps the most interesting vegetation known. The whole number of species known to botanists amounts to eighty-eight or ninety, but a vastly smaller number are found in any one botanical or commercial district. Many of the more noted species are very restricted in their range, and not more than three or four important timber trees extend the whole length of the region. It is therefore necessary to treat the past more in detail than in the case of the other districts. In this district are perhaps the greatest forests of the globe. In Washington Territory they are made up of but few species of which Abies douglasii (called here Red Fir) is the most important. Commonly 150 or more feet high and four or more feet in diameter; but sometimes fifteen feet (in extreme cases over twenty feet) in diameter and over 600 feet high, straight growth the wood firm, elastic, holding spires with great beauty, produces the most noted timber of the territory. Oregon cedars (Tetra grandis), yew or "Puddin" pine (P. ponderosa), Yellow Fir (Abeis grandis), Black Spruce (A. Menziesi), are the next most abundant species, all attaining a great size. The popular names are much confused; the generic terms of cedar, pine, spruce, fir and are all very loosely and capriciously applied. The forests of the forests are about Puget Sound and on the western flanks of the Cascades. On the Coast Ranges the forests are dense and with tangled undergrowth; but the trees out of such large average size. Regarding the wonderful quantity of wood produced, our authority (for many years surveyor-general of the territory) states that the whole region west of the summit of the Cascades to the Pacific and north of the Columbia, will yield "an average of 3,000,000 feet per acre of merchantable lumber." He states that about one thirty-second part of this area is in timber. This follows the annual reports of the Commissioner of the General Land Office of the United States relaying to this territory—"the land will produce from 2500 to 30000,000 feet per acre" and there are vast tracts that would cover the entire surface with mixed-wood ten feet in height; there are localities that would afford double that quantity." Again the reports speak of the forests of pine, fir and cedar which "grow thickly," from one to fifteen feet in diameter and 200 to 300 feet high, and again of the forests of "red and yellow pine of gigantic growth, when attaining a height of 200 feet and from one to twelve feet in diameter." Similar testimony could be greatly extended. In the extreme combinations east and west of the Cascades, are forests of pine; these forests are in character more like those of the Rocky Mountains with which they are constantly intermixed.

Passing south of the Columbia River the same species occur; but the forests are not so heavy, although individual trees may be as large. Prairies become more numerous and larger, and oak and other mixed forest trees become more common in the valleys. In places, Larix (lodgepole pine) is prevalent, and the Yew (Taxus brevifolia) attains in Oregon and northern California a height of fifty or seventy-five feet, a greater size than is attained by any tree elsewhere in America. As a whole, Oregon is very heavily timbered.

Passing southward to California the two-vegetation changes still occur, and become more pronounced in species of any region won of the great plains, excluding a total of every eighty species. Some fifty species of Conifers have been enumerated by botanists, entering several species and even genera not found elsewhere. All the Conifers of Washington and Oregon are found here, but not in the same relative abundance or size. The yellow pine (P. ponderosa) attains its greatest development and is often over 300 or 350 feet in height and eight to twelve (sometimes twelve) feet in diameter. The Sugar Pine (P. Laricina) is perhaps the most valuable pine of the State; it is abundant, of excellent quality and great size (height of the section), its three long spruce, the long white spruce, and the yellow pine; twelve species of pine are more or less abundant (more than twice the number of supposed species have been described by botanists). The Big Trees (Sequoia gigantea) occur on the western slope of the Sierra Nevada, and are too well known to need notice here. Between the great and dwarfed with which they are associated and their values of less or more rapid growth will doubtless give them great value for cultivation in the far west. In the present State, the Redwood (Sequoia sempervirens), which only grows very near the sea between Lat 36 and 43 degrees and on portions of this ocean forest forests rivaling; if inferior to these, they must find elsewhere in these regions. The coast redwood, which sometimes more than twenty feet in diameter, very straight, tall, 300 feet high, and the wood, which is light, is straight-grained, very durable, and adapted to many uses. It is extensively cut and the lumber shipped to South America, the Pacific Islands, China, and even to New Zealand. It is rapidly diminishing in quantity, and the only slight compensation is that in Chihli, the forests are dense and with tangled undergrowth; but the trees out of such large average size. Regarding the wonderful quantity of wood produced, our authority (for many years surveyor-general of the territory) states that the whole region west of the summit of the Cascades to the Pacific and north of the Columbia, will yield "an average of 3,000,000 feet per acre of merchantable lumber." He states that about one thirty-second part of this area is in timber. This follows the annual reports of the Commissioner of the General Land Office of the United States relaying to this territory—"the land will produce from 2500 to 30000,000 feet per acre" and there are vast tracts that would cover the entire surface with mixed-wood ten feet in height; there are localities that would afford double that quantity." Again the reports speak of the forests of pine, fir and cedar which "grow thickly," from one to fifteen feet in diameter and 200 to 300 feet high, and again of the forests of "red and yellow pine of gigantic growth, when attaining a height of 200 feet and from one to twelve feet in diameter." Similar testimony could be greatly extended. In the extreme combinations east and west of the Cascades, are forests of pine; these forests are in character more like those of the Rocky Mountains with which they are constantly intermixed.

The WOODLANDS AND THE FOREST SYSTEMS OF THE UNITED STATES.
THE WOODLANDS AND THE FOREST SYSTEMS OF THE UNITED STATES.

The question of future supply suggests itself in any discussion of our woodlands and forests. Incessantly bearing on this is the experience of other countries, now civilized, once forest clad, and the relations of our own forest with theirs. We have already stated that our flora was rich in native species of trees. How much richer than central and western Europe a few figures will show. We have already roughly stated the number of our native trees as above 300 species. Gray's "Manual of the Botany of the Northern United States" (east of the Mississippi and north of the Carolinas) enumerates 315 indigenous trees. Torrey's "Flora of the State of New York" gives 82 species of trees for that State alone. Cooper in his "Catalogue of the Native Trees of the United States" gives for the eastern forest regions (of North America north of Mexico) 254 species; for the western, including the Mexican boundary, 256 species. In this discussion we have considered only the more abundant kinds, and the three authors are merely cited to illustrate by their figures this single point, the wealth of our flora in tree species. In comparison with this, Germany, embracing the whole of central Europe from the frontiers of France to those of Russia and from the Adriatic to the Baltic sea, has but about sixty native species. In France the number is given by some authorities as thirty, by others as thirty-four species. In Great Britain, there are twenty-nine species above thirty feet high, and the local botanists describe but fifteen of these as "large" or "moderately large" trees. But in all of these countries, tree culture began early, and the resources in wood and timber have been enormously increased by the introduction of foreign species, sometimes by private enterprise, sometimes with government aid. Lindley gives in detail the history of the introduction of foreign trees and shrubs into Great Britain. He states that in the 16th century 89 new species were brought in, in the 17th 131 species, in the 18th 455, in the 19th, up to 1850, 669 species; the total number of foreign trees and shrubs introduced up to the year 1850 appears to be about 1,500, but among them are not more than 300 trees which attain a timber-like size. The most valuable of these he considers the Larix, but many other valuable timber trees have been planted; and he added, "our principal forest trees are from Asia, but by far the finest ornamental trees and shrubs are from North America." In France a similar process has been going on. Professor Thomis stated in the "Mémorial d'agriculture" for 1776 that "France then possessed about eighty-four different species of trees, of which twenty-four were of first rank in point of size or exceeding 100 feet." And the work has gone on since. A similar process has been going on in most countries of Europe, and the production of wood and timber has been increased. If these countries, having annually a tree flora so much poorer than ours, have been so successful in the cultivation of woods and forests, may we not infer that we may be equally or more so, in a country where the natural conditions seem more favorable, as indicated by the number of our species and the luxuriance of the native growth.

But what species are to be most advantageously used for cultivation here cannot be predicted by any scientific observations yet made. Prolonged and extensive experimental only can tell which will be the most successful kinds. The success attending the introduction of foreign fruit trees is significant; so also that of a few forest trees introduced for ornament—some in the eastern States being already over a century old. The luxuriance of the European Elm, the Lombardy Poplar, various willows, the Alnus and other species in limited cultivation in the eastern States, and of the Eucalyptus west, indicates that ultimate success is certain. The first-mentioned tree has perhaps been the most extensively planted of late of any one foreign species, one or two millions having been planted within the last ten years. One tree recently cut (1874) in Sonoma, Cal., of nine years growth, we are told by a local authority had attained a height of ninety-six feet and a diameter of eighteen inches at four feet from the ground. The fact that so many ornamental species flourish in cultivation also points to ultimate success in the cultivation of the useful ones; yet, our hopes of future supply must be mainly from native kinds, either the spontaneous growth of nature or as a product of cultivation.