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## THE RELATION OF GEOGRAPHY TO TIMBER SUPPLY

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EVER since Hiram, King of Tyre, shipped rafts of fir and cedar down the Mediterranean Coast to trade with the Jews of Solomon's day, timber has been an important factor in the commerce of the nations. Among the first exports from the American colonies to the mother country were clapboards split from the oak of Virginia, ship masts cut from the pine forests of New England, and pitch extracted from the piney woods of the South Atlantic. The progress of civilization has been called a struggle between human wants and natural resources. And no part of this age-long contest has been more clear cut than the effort of mankind to supply its need for wood.

Most of the industrially aggressive nations have lived in forested regions, and most of them have been liberal users of timber. The course of these nations in satisfying their requirements for forest-grown materials has usually run through three different stages. At first they have cut freely from their own virgin forests as long as the supply lasted. Then they have cast about for what they might barter from their neighbors. And finally they have settled down to the systematic growing of wood on all the land that could be spared for the purpose, still finding it necessary or convenient in many cases to import a substantial part of their national requirements from other countries whose virgin forests have not yet become depleted or whose timber culture produces an exportable surplus.

Man-grown timber, however, is costly, while timber stored up in nature's undrained warehouses is cheap. The source of supply is thus largely governed by the cost of growing timber at home as compared with the cost of hauling it from the nearest virgin forests still available for exploitation. In the long run, forestry is pitted against transportation.

The United States is still in the first of these three stages. By far the greater part of the wood we use is still obtained from our own virgin forests. But the end of this supply is plainly in sight. The necessity is at hand of finding a new source of wood, either in timber culture on our own soil or in the forests of other countries. The consumption of timber in this country is so enormous that the problem assumes staggering proportions. We use annually about 12 billion cubic feet of saw-log timber, or nearly half of the quantity consumed in the entire world. Our use of all forest products, including pulpwood, railroad ties, mine timbers, and fuel wood, aggregates 22½ billion cubic feet, or about two-fifths of the yearly consumption in the entire world.

Other countries which have likewise exhausted their virgin forests have found new sources of wood either in the practice of forestry or through imports from their neighbors or by combining both of these methods, without sudden industrial upheavals or serious timber famines. Their consumption of forest products has been relatively small; the change was

gradual and usually involved no great difficulty. The enormous use of wood in the United States, however, and its intimate relation to national living standards, manufactures, and basic industries like agriculture, mining, and transportation, make our problem far more serious. We must find, almost overnight, a fresh source of raw material sufficient to supply 60 or 70 million tons of forest products annually. Instead of a gradual industrial evolution, the change is coming with the suddenness of an economic crisis (Fig. 1).

The forest history of the United States strikingly illustrates the relation of geography to timber supply. To the colonists and explorers of the seventeenth century, America appeared a vast, unbroken forest. Even after geographers had mapped the full extent of the prairies and western deserts, they found that nearly half of her total land area, or more than 820 million acres, was originally in forest (Fig. 2). Although the export of timber products began in the early days of the Atlantic colonies, for several generations the forest represented a barrier to settlement and migration rather than an economic resource. Nothing could have appeared more remote than a shortage of timber. About 200 million acres of our original forest area have been cleared for cultivation and settlement, and the stumpage removed from three-fourths of this land was destroyed for lack of a market.

When the manufacture of lumber at little sawmills, run by water power, became a fairly established industry, there was no lack of the finest raw material at their very doors. Lumber was moved but very short distances and its cost was exceedingly low. In 1736 pine lumber prices in New England were commonly around \$5.00 per thousand board feet. Between 1799 and 1834 pine lumber cut on the Kennebec River in Maine was sold on the Boston market for from \$10 to \$14 per thousand board feet. Slowly, very slowly, the frontier of virgin forest began to move back from the centers of

population, and, as the sawmill followed its retreat, the element of transportation entered into the cost of forest products.

Up to the time of the Civil War, short and cheap lumber hauls, almost wholly by water, characterized our timber traffic. Lumber or logs moved down the Atlantic Coast from Maine to Boston, about 225 miles, from the upper Hudson to New York, not over 200 miles, and from the shores of the Great Lakes into Buffalo and Chicago. The rafting of the Pennsylvania rivers rarely covered more than 400 miles; and the bulk of the products of "Penn's Woods" moved much shorter distances, as from Williamsport to Philadelphia. One or two or three dollars at the most paid the freight bill on a thousand feet, and the consumer's price was correspondingly low. Even up to 1902, the short local shipments from the Lake region held cargo prices on white pine boards at Chicago down to \$16 per thousand feet or less.

The change came with the railroad building and industrial expansion that followed the Civil War. Lumber manufacture ceased to be a village industry. It caught the spirit of "big business" and rapidly forged into the lead with large organizations, tremendous capitalization, and the efficient tools of quantity production. It reached out with unequaled driving power in manufacture and merchandizing. It taught the American people to use wood in prodigious and unheard-of quantities. In 1840 the per capita consumption of lumber probably did not exceed 100 board feet. By 1906 it had become 516 board feet. Behind the sawmills came the paper mills, using more and more wood until it now forms 90 per cent of their raw material. Through their energetic attack upon the forests another great national appetite for wood has been created. The per capita consumption of paper has increased five-fold since 1840. Then came the veneer plants, the distillation plants, the vehicle and agricultural implement factories, the makers of railroad ties and telegraph poles, and

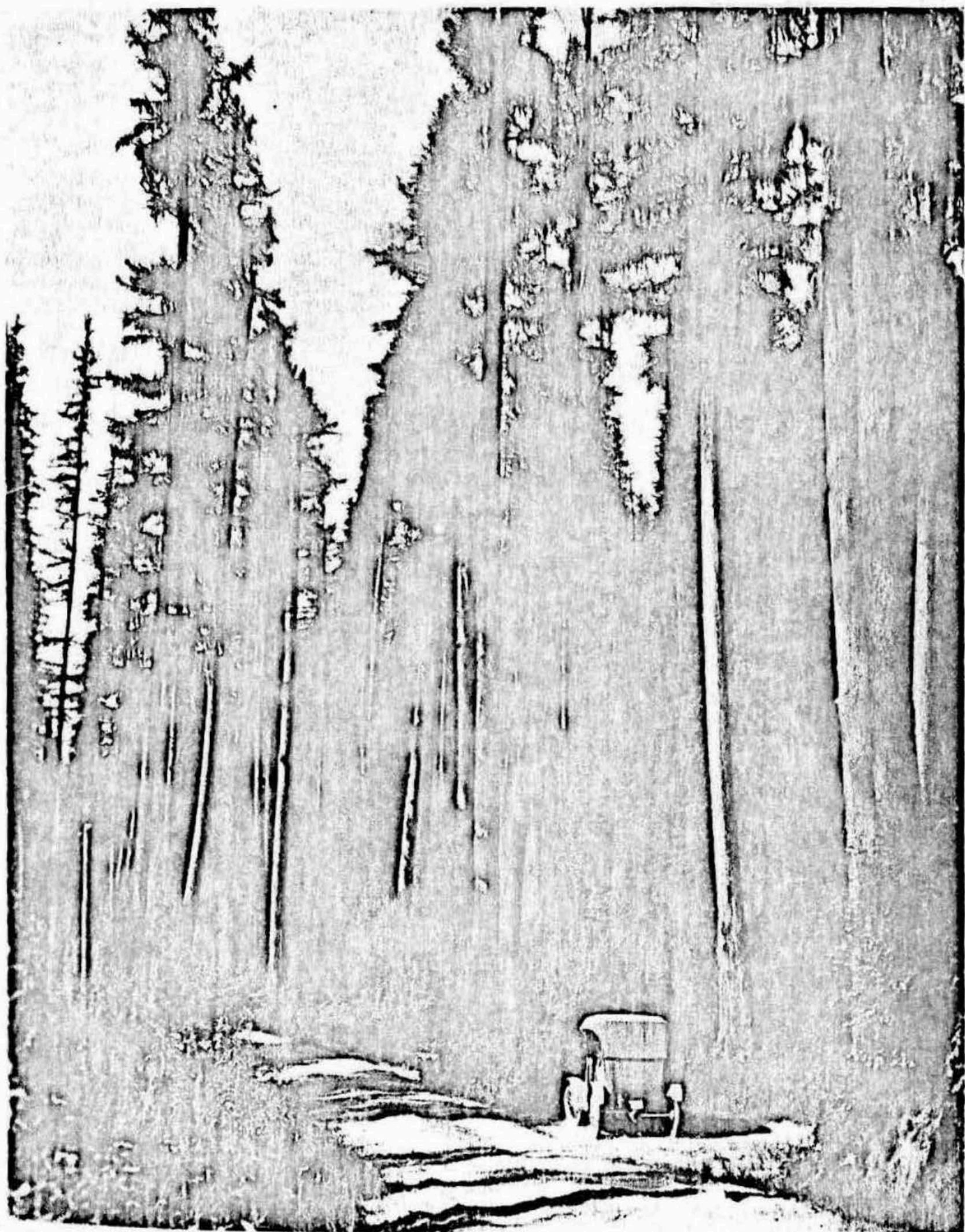


FIGURE 1.—The United States must shortly find some means of replenishing the storehouse of splendid virgin timber whose end is in sight. (Photo from U. S. Forest Service.)

a hundred industrial developments with their greater or lesser demands for timber. The exploitation of virgin forests has been a foremost contributor to the

It was inevitable that our timber resources should shrink rapidly before this terrific onslaught. The story is told in the maps showing the approximate ex-

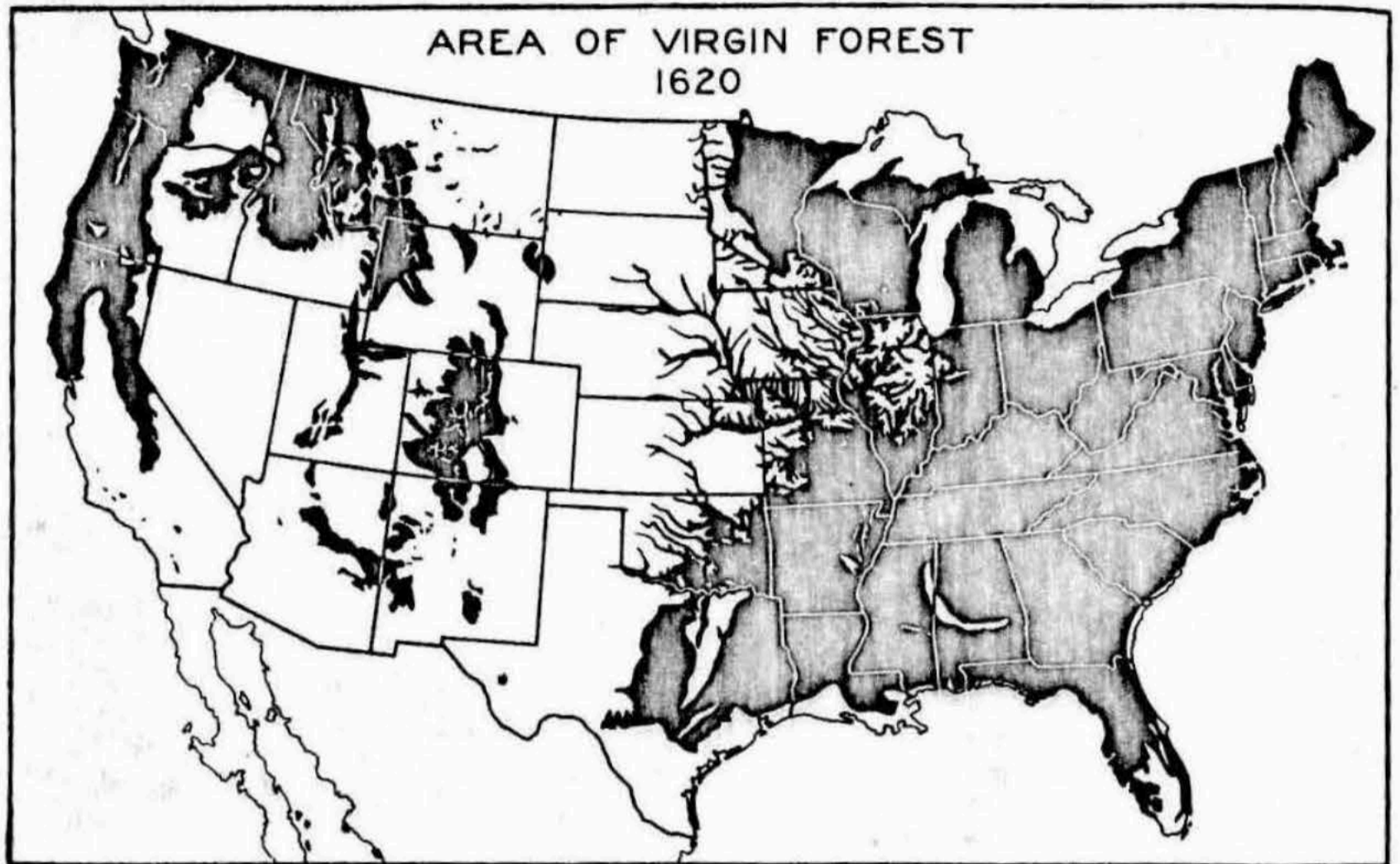


FIGURE 2.—When the early colonists settled along the Atlantic Coast nearly all the country east of the Mississippi River, and much land to the westward, notably in Arkansas, Louisiana, Texas, and the Pacific Northwest, was covered with a vast virgin forest,—about 820 million acres in all. (Map from U. S. Forest Service.)

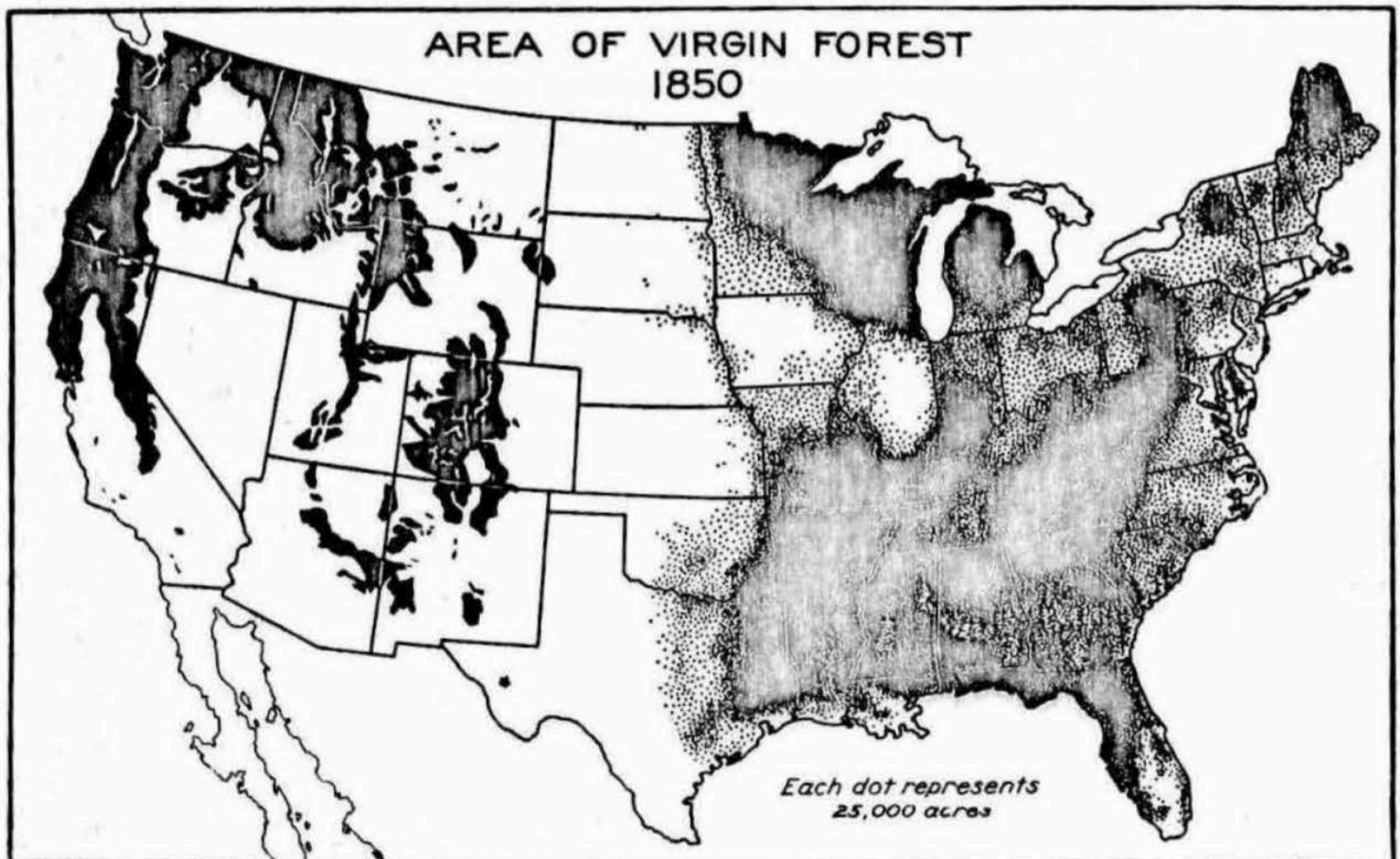


FIGURE 3.—Even in 1850 much of the forest in the eastern United States was still in a virgin condition, and the forests in the Rocky Mountain and Pacific states had scarcely been touched by man. The map was based on estimates by states and the dots are not all correctly located. Northwestern instead of south central Ohio should be densest, as the Black Swamp was almost a solid forest in 1850. Northern Indiana should likewise show a denser distribution of virgin forest, and in southern Indiana, where settlement first occurred, the dotting should be thinner. (Map from U. S. Forest Service.)

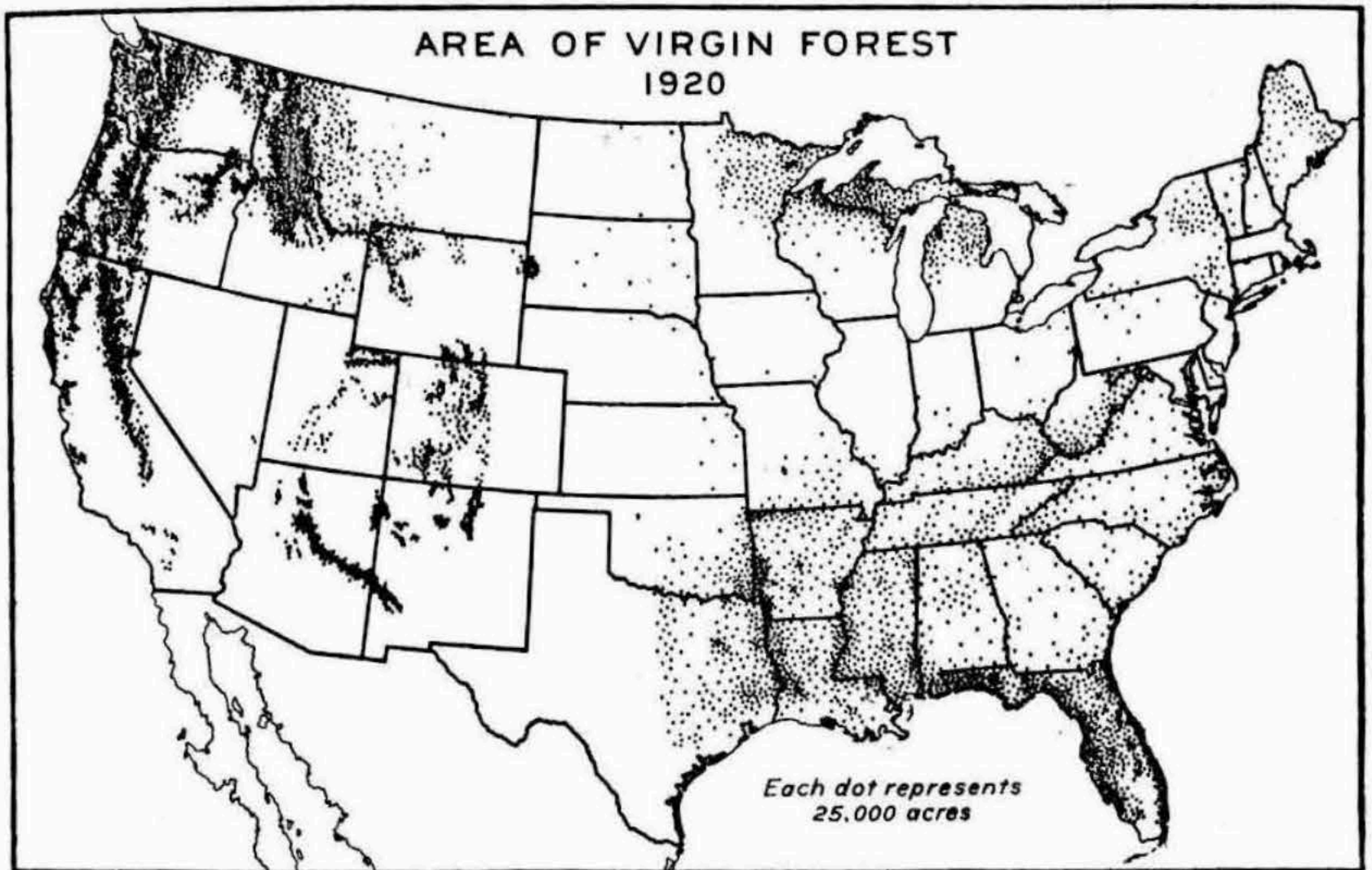


FIGURE 4.—By 1920 the area of virgin timber in the United States had been reduced to about 138 million acres, of which more than half was in the Rocky Mountain and Pacific Coast states. Culled and second growth trees of sufficient size for lumber covered about 114 million acres more, and there were about 136 million acres of forest having small young growth or trees of cord-wood size. In the United States in 1920 the amount of virgin timber has been estimated at 1,600 billion board feet, and the culled and second growth stands at 600 billion feet, a total of 2,200 billion feet, as compared with probably 5,200 billion feet originally. Over half of this remaining saw timber is in the Pacific Coast states. (Map from U. S. Forest Service.)

230 years of settlement and industrial expansion made relatively slight inroads. In the last 70 years the depletion of our timber supply has gone on apace. And as the virgin forests disappeared, the relation of geography to timber supply has become more and more pronounced. It is summed up in the cost of transportation from the standing tree to the user of its products. From the economic viewpoint, our forest history is a record of widening gaps between the consumer of lumber or paper and the source of his supply (Fig. 5).

As long as Maine, New York, and Pennsylvania were the foremost lumber-producing states, lumber was cheap in the great markets of the country, primarily because the hauls were short and largely by water. When the center of lumber manufacture moved to the Lake States in the 80's and 90's, the era of the box car as a lumber carrier began.

Freight rates were long tempered by water transportation on the Lakes, through the Erie Canal, and down the Mississippi; but at that it cost \$6 or \$7 per thousand feet to ship lumber a thousand miles from Saginaw to New York, by water, or treble the old rate on Hudson River pine. As steadily as the more accessible virgin forests went through the hopper, the railroads gained ascendancy in lumber traffic, the hauls lengthened, and average retail prices rose from one level to another.

During and following the 90's, the pineries of the Lake States rapidly approached exhaustion and the center of the national supply of softwood lumber shifted to the South. Rail shipments in excess of 750 miles and freight bills of \$8 or \$10 or more per thousand board feet became common. As southern pine gradually secured control of the Chicago market, lumber prices advanced to 75

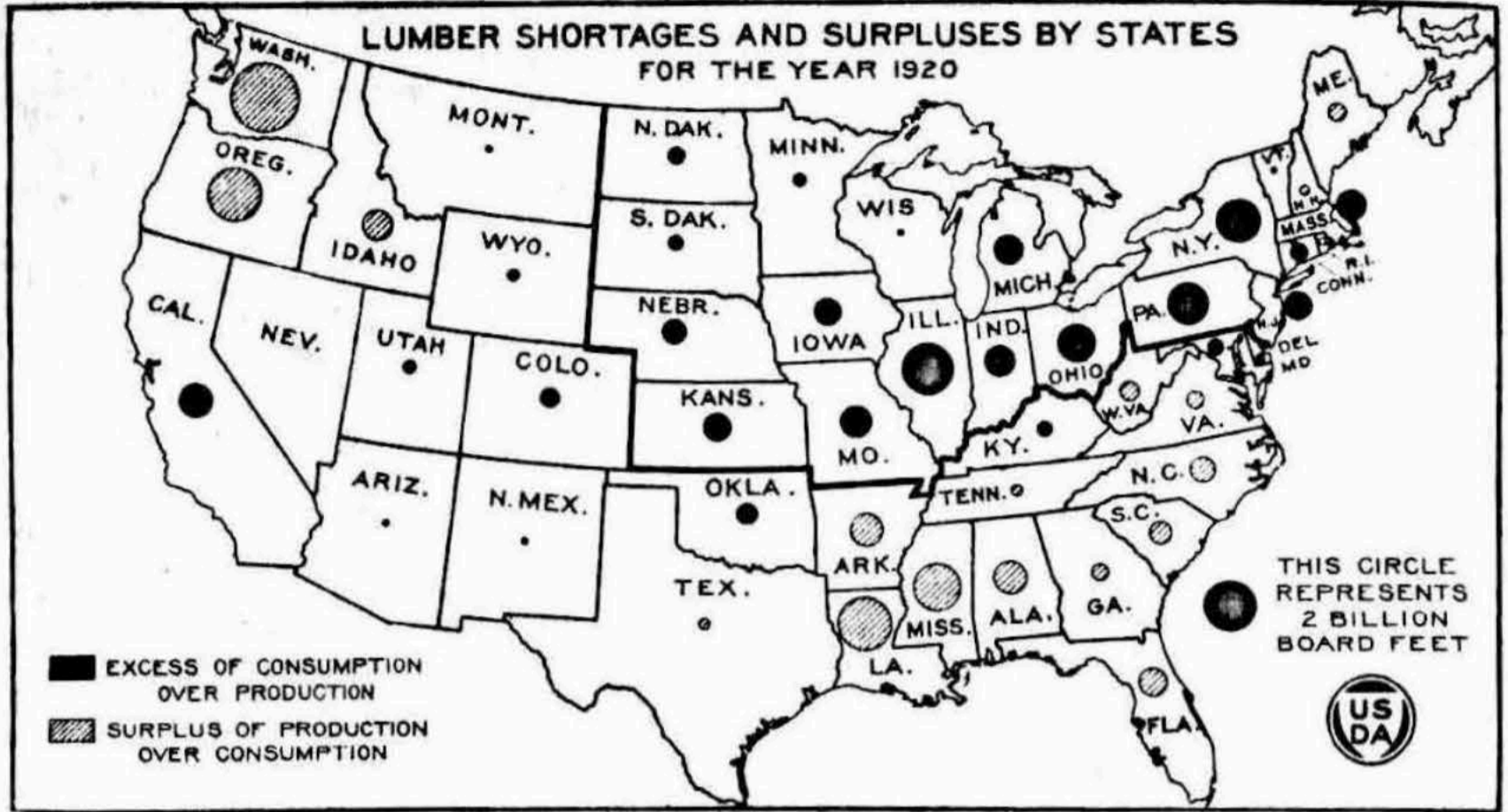


FIGURE 5.—Our greatest industrial and food producing regions—the area north and east of the heavy line—cut only 23 per cent of the lumber they use, and must ship in 77 per cent, chiefly from the South and far West. (Map from U. S. Forest Service 1922 yearbook, U. S. Dept. of Agriculture.)

or 100 per cent beyond the old rates fixed by water transportation from Michigan or Wisconsin mills. Southern lumber moved 1,100 miles to Pittsburgh and 1,500 miles to Boston, at freight rates which, since the World War, have ranged from \$12.50 to \$15 per thousand feet. Retail prices necessarily climbed to a higher level, but only as a stepping stone to what has followed as the last chapter in the exploitation of our virgin forests is being written.

The virgin pineries of the south covered 130 million acres and contained probably 650 billion board feet of saw timber (Fig. 6). They formed one of the richest reservoirs of softwoods on the earth's surface, and for the past thirty years they have been the mainstay of the eastern and central lumber markets of the United States. But the process of timber depletion is running its course in the south as it has previously been run in the Lake States and the Alleghenies. The production of southern pine lumber passed its peak in 1916, and the last great migration of American sawmills is under way—across the Great Plains to the virgin forests of the Pacific Coast. In 1920 over 600 million board feet of

western lumber was shipped to New England and over 1,200 million feet was marketed in Illinois, Michigan, Wisconsin, and Minnesota. In 1923, 34 per cent of our entire lumber cut was manufactured on the Pacific Coast as compared with 36 per cent in the southern states (Fig. 7). Western lumber is now moving in a steadily increasing volume 2,000 or 2,300 miles by rail to the Middle West at a freight cost of \$17 or \$18 per thousand board feet, and 7,000 miles by sea and the Panama Canal to northern Atlantic ports at a charter rate of \$14 or \$15 per thousand feet. Lumber manufactured on Puget Sound is now, indeed, moved by steamer to Chesapeake Bay and reshipped inland, past the old sawmill towns of the Alleghenies, as far as Pittsburgh and Cincinnati.

Every year the cost of transportation enters more largely into the lumber bills paid by the American home builder or the American factory (Fig. 7). Two-thirds of the lumber which we use is consumed in the Central and Eastern States. The lumber traffic in 1920 exceeded 1,660,000 carloads and cost, in freight and charters, over \$250,000,000. The average carload was hauled 485



FIGURE 6.—A pine forest in southern Georgia. These southern pine forests have provided most of the lumber used in the North during recent years, but the supply is now approaching exhaustion. (Photo from Natural Vegetation Section, Atlas of American Agriculture, U. S. Dept. of Agriculture.)

miles. Between 1914 and 1920, the average rail haul on lumber was lengthened by more than 30 per cent, and the

total yearly freight paid on lumber shipments advanced \$100,000,000.

These mounting costs for transporta-

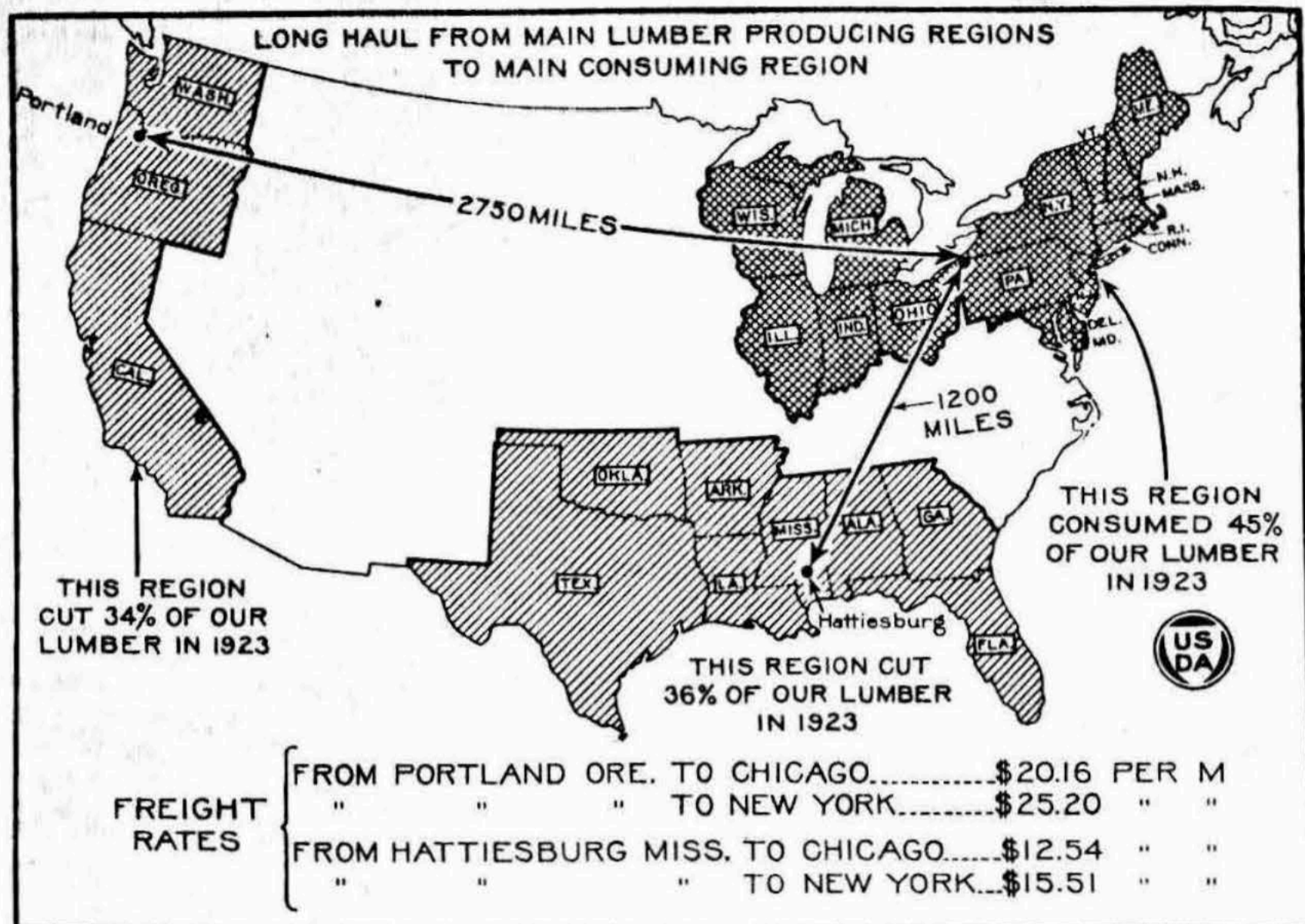


FIGURE 7.—The northeastern quarter of the United States consumes nearly one-half the lumber produced in the United States. More and more of this lumber must come across the continent from the Pacific Coast, or else by the Panama Canal. The cost of freight is \$12 to \$25 per thousand feet, and the cost to the consumer is increased much more than this by distributors' costs and profits. (Map adapted from 1922 Yearbook, U. S. Dept. of Agriculture.)

tion underlie the rise in lumber prices. Costs and profits in retail distribution tend to pyramid upon every increase in freight. And as the sawmills become more largely concentrated in distant and restricted regions, the competitive movement of lumber into consuming markets is curtailed. Retail prices seldom fail to advance in response to such opportunities. The story of lumber prices in a group of Minnesota towns is illuminating. In 1905, 91 per cent of their supply came from the Lake States. The average freight cost was \$3.25 per thousand feet and the average selling price was \$26.00. In 1921, over 92 per cent of the lumber handled in these towns came from the Pacific Coast. The average freight bill was \$18.12 per thousand feet and the average selling price \$53.58. Transportation cost had increased from 12½ per cent to 34 per cent of the retail price, but

the actual cost to the consumer, it will be noted, had more than doubled.

In fact, the prices paid by the average user of every day construction lumber the country over have more than doubled within the last twelve years. The very freight paid on lumber is now often more than its delivered price thirty years ago. Hence it is not difficult to understand why lumber prices have advanced, during the last eighty years, three and a half times as rapidly as the index price based upon all staple commodities. It took \$510 in 1921 to buy as much lumber—and poorer lumber at that—as \$100 bought in 1840.

The story of the American paper industry is somewhat different but reflects no less clearly the extent to which our virgin forests have been depleted. Paper manufacture requires exceptionally heavy plant investments. Hence it has



## PAPER AND PULP MILLS OF THE UNITED STATES, 1922

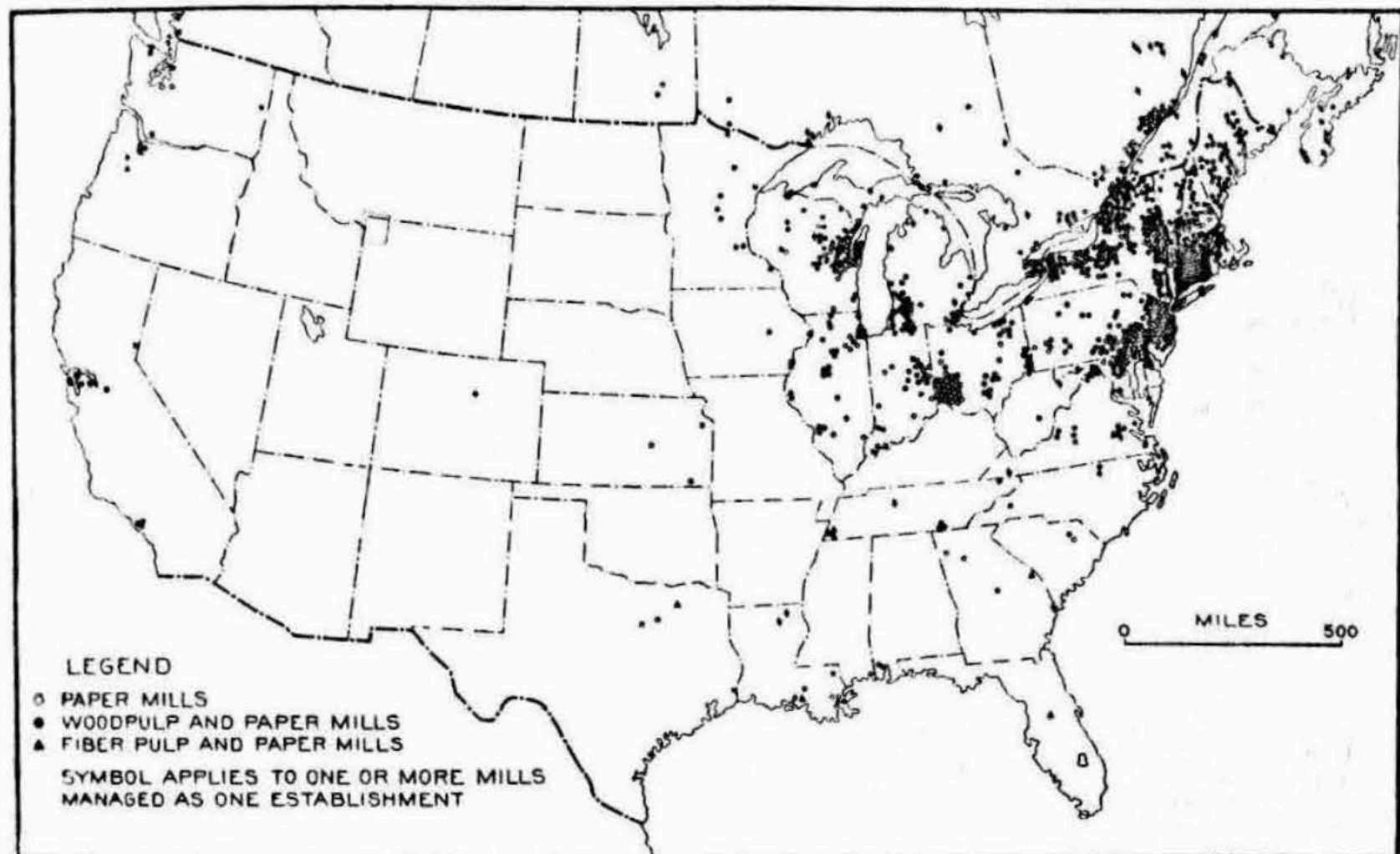


FIGURE 8.—Owing in part to the great expense of installing a plant, in part to the ability to utilize small second growth timber, and in part to the preference for certain coniferous woods, paper and pulp mills have not followed the lumberman into the South and far West to any notable extent. As a consequence, these mills are compelled to depend upon Canada for a substantial part of their supplies. (Map from U. S. Forest Service.)

not followed the retreating frontier of virgin forests to nearly the same extent as have the sawmills, but has remained largely concentrated in the northeastern states (Fig. 8). As a consequence, the raw material available on American soil has been wholly unable to sustain our increasing consumption of paper. Of the eight million tons used in the United States in 1922, 53 per cent came from foreign countries in the form of pulpwood, manufactured pulp, or finished paper. Thirty-seven per cent was imported from Canada alone, including over one million cords of raw pulpwood. The cost of the pulpwood delivered at American plants, much of which is now hauled excessive distances, has probably increased even more rapidly than the price of lumber. In satisfying its needs for this important forest product, therefore, the United States has already outstripped the resources of her own virgin forests. She has been driven to the paper and pulpwood markets of the world.

The stern facts of geography have largely controlled these past developments in our forest industries and in the cost of their wares to the American consumer. The true measure of timber supply is not quantity but availability. Sixty per cent of all the wood that is left in the United States and 75 per cent of its virgin timber lie west of the Great Plains, whereas two-thirds of the population and an even larger proportion of our agriculture and manufactures are east of the Great Plains. The forests bordering the Pacific Coast contain over a trillion board feet of virgin stumpage (Fig. 9). At the most, they will not supply our present consumption very long; but already the unbalanced geographical distribution of this resource is creating well-nigh famine prices in the parts of the United States where forest products are used in the largest quantities. Dependence upon the softwood forests of Siberia as the principal source of supply would differ from our present situation only in degree.

And as geography controls the cost of the products of virgin forests when they reach the ultimate consumer in Massachusetts, Illinois, or Florida, so will geography control the substitution of other sources of timber supply. Most of the



FIGURE 9.—A virgin forest in the Pacific Northwest. These coniferous forests now constitute our last great timber resource. (Photo from U. S. Forest Service.)

other countries have progressed from one stage to another in their source of wood more or less as single geographical units. In the United States the distances are so great and the local conditions so diverse that this transition is bound, for some time to come, to be regional rather than national. We have already seen that, owing to the concentration of the paper industry in the northeastern states, more than half of our consumption of wood fiber products is now drawn from foreign sources. And by the same token, the exigencies of the portions of the country farthest removed from the dwindling frontier of virgin forests are driving them to a new source of wood, namely the timber crop.

Forestry is the economic competitor of transportation. As long as cheap virgin stumpage available at no great distance dominated our lumber and paper markets, there was no place in the economic scheme of things for systematic timber growing. But once the cost of transporting forest products from the nearest virgin sources exceeds the cost of growing them at home, timber culture not only becomes economically feasible but sooner or later is impelled by purely commercial forces. This is just what is taking place today, to a limited degree, in New England, New York, Pennsylvania, and New Jersey; and, to a still more limited degree, in the South. Second growth white pine in New England, 30 or 40 years old, is worth from \$10 to \$18 per thousand board feet standing in the woods (Fig. 10). Second growth southern pine of the same age brings from \$8 to \$12 on the stump. With such returns before them and with



FIGURE 10.—A second growth pine stand in New England. Such forests, many of which have grown up in old fields, demonstrate that commercial forestry pays. (Photo from U. S. Forest Service.)

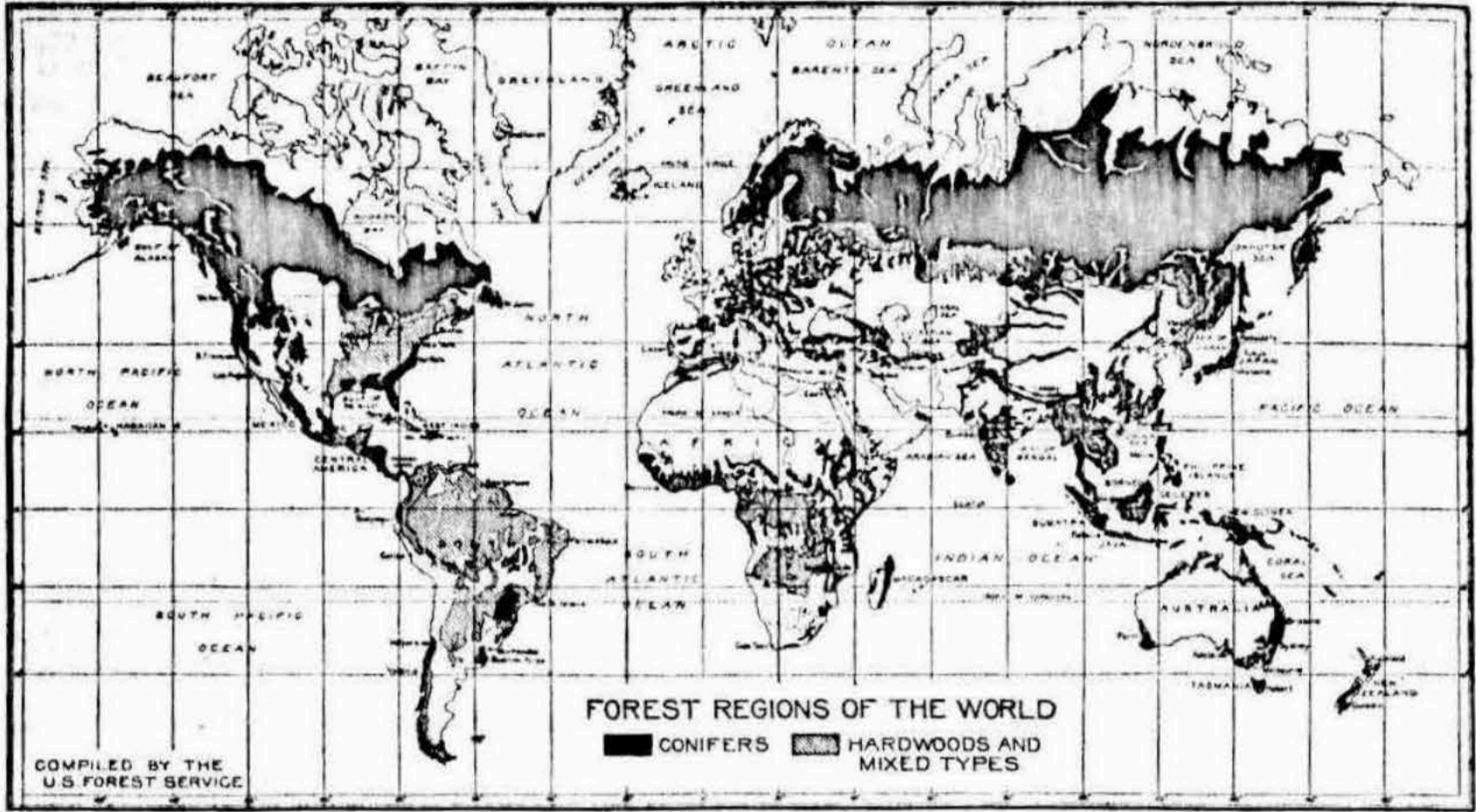


FIGURE 12.—The coniferous forests of the world, which supply nearly all of the softwood timber, are practically confined to the north temperate zone. The map, however, a Mercator projection, greatly exaggerates the extent of this coniferous forest. Moreover, much of the area shown in black consists of timber so small or stunted as to be fit only for firewood and pulp. The cut of saw timber at present in the United States is about as great in all other countries of the world combined, but an annual growth is only about sixteen per cent of the world total. (Map from "Forest Resources of the World" by Zon and Sparhawk, McGraw, Hill Book Co., 1923.)

countries of the world shows that the markets of the whole earth are short of raw materials for paper and construction lumber, and that the accessible supply of timber, particularly of coniferous timber, is not adequate to meet the requirements of modern civilization. The cost of importing Asiatic or South American timber to the United States, added to the cost of a source fixed by keen international competition, would be wellnigh prohibitive for ordinary construction or manufacturing purposes (Fig. 12).

We must get all the forest resources we can to tide over the present emergency and we must go after it intelligently and systematically. For one thing, a thorough study should be made of the resources available in the hardwood forests of Central and South America and their utility for the replacement of our rapidly waning supply of native hardwoods.

Undoubtedly we must and will learn to use less wood. The high cost of lumber has already decreased its per capita consumption in the United States about 40

per cent below the peak of 1906 (Fig. 13). Steel, cement and clay products have been substituted for much of the construction lumber formerly used; and coal, oil, and electricity have taken the place of much fuel wood. These substitutions are increasing, as wood becomes more dear; and it is well that they should. On the other hand, the use of wood is constantly widening as the chemist and engineer discover new methods of converting or fashioning it for modern requirements. Wood is now manufactured into grain alcohol and artificial silk, even into baking powder and electrical conduits. The field for wood fiber products is constantly enlarging. Notwithstanding the substitution of other materials and the curtailed use of wood for many of its old functions, the total drain upon our forests thus far has not materially lessened. The danger lies not in reducing the use of wood where satisfactory substitution is possible, but in the growing shortage for many essential needs for which there are no substitutes. In most of the industrial countries of Europe the per capita con-

sumption of wood is not diminishing, but increasing; and the United States cannot expect permanently to follow a different course if it is to hold its living standards and retain its industrial leadership.

One of the most essential constructive remedies is to reduce the drain upon our forests by reducing the waste in the manufacture and use of their products. The very abundance and cheapness of virgin timber in the United States has bred wasteful methods of logging, manufacture, and refabrication which are yielding but slowly to the pressure of scant supply and high costs. The general application of even our present knowledge of waste elimination in logging, milling and refabricating lumber, in timber preservation, in the conversion of wood into fiber products and the like, would reduce the current drain upon our forests by 20 or 25 per cent. And we still have much to learn before all the possibilities of economy in the use of our forests are fathomed. The elimination of preventable losses from forest fires and

from destructive insects and tree diseases would save an enormous total of useful timber. A cord of wood saved is equal to a cord of wood grown. And one of the most obvious things that should be done with all possible dispatch is to conserve our existing timber supply to the last foot by research in the conversion and use of forest products on an adequate scale, accompanied by wide dissemination of its results through the forest industries and forest consumers.

After everything else has been said, no solution of our forest problem is possible without the generous growing of trees. We must come, in the last analysis, as every other country treading the same path has come, to forestry as the necessary and economic employment of much of our land. This solution is as complete as it is inevitable. Intensive timber culture on the 470 million acres of forest land in the United States, timber culture on a par with that of Germany, France and Scandinavia, can produce a yearly crop equivalent to more than all the

RELATION OF RETAIL LUMBER PRICES TO PRODUCTION AND CONSUMPTION

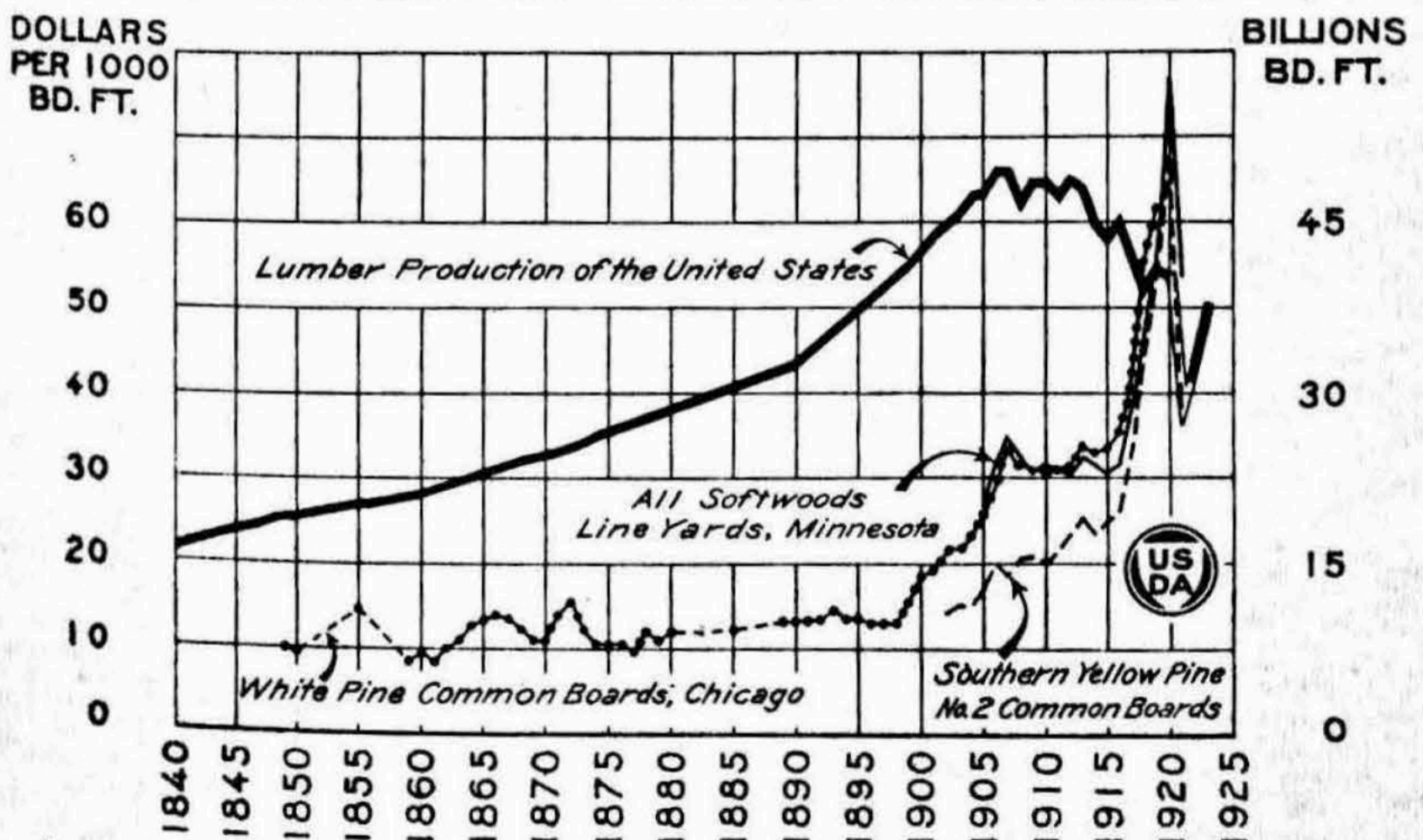


FIGURE 13.—The United States still has mills and timber capable of producing a cut equal to that of 1907, but prices of lumber are now so high and transportation so costly that the consumer cannot afford to buy as much lumber as he once did. (Chart adapted from 1922 Yearbook, U. S. Dept. of Agriculture.)

wood which the United States now consumes. There will be a margin of 20 per cent or more to take care of the greater requirements of the future. The only question is how quickly can this be brought to pass and how much national suffering must be endured before a perpetual supply of timber is assured on our own soil. National habits in the use of land and its resources change slowly; and at best we must travel a slow and painful road before the goal is reached.

Underlying this whole question is one of the outstanding facts of the economic geography of the United States, namely, that one-fourth of her soil remains today, after three centuries of settlement and expanding agriculture, *forest land*. There is small prospect that the area available for growing trees will be reduced materially, if at all, for many years to come. While the inroads of the farm are continuing here and there, the great tide of forest clearing for cultivation seems largely to have spent itself. For many years indeed, the abandonment of farm land in forest growing

regions of the older States has practically offset new clearing on the agricultural frontier.

Wholly aside from the need for timber, the problem of keeping one-fourth of the soil of the United States productively employed is one of no small urgency in the national economy. The idleness of cutover land, following the migration of the sawmills, has already been a widespread cause of depopulation, decline in taxable values, and general rural bankruptcy. In the busiest timber manufacturing regions of a few decades ago, there remain today over 80 million acres of practically unproductive and unused land. No country can afford such wastage.

Forestry not only is the only way to re-establish an adequate source of timber in the United States: it is the only way to utilize a large part of her land—to maintain a vigorous rural population with industries, communities and good roads. On both counts, forestry should become part and parcel of our program of land utilization.

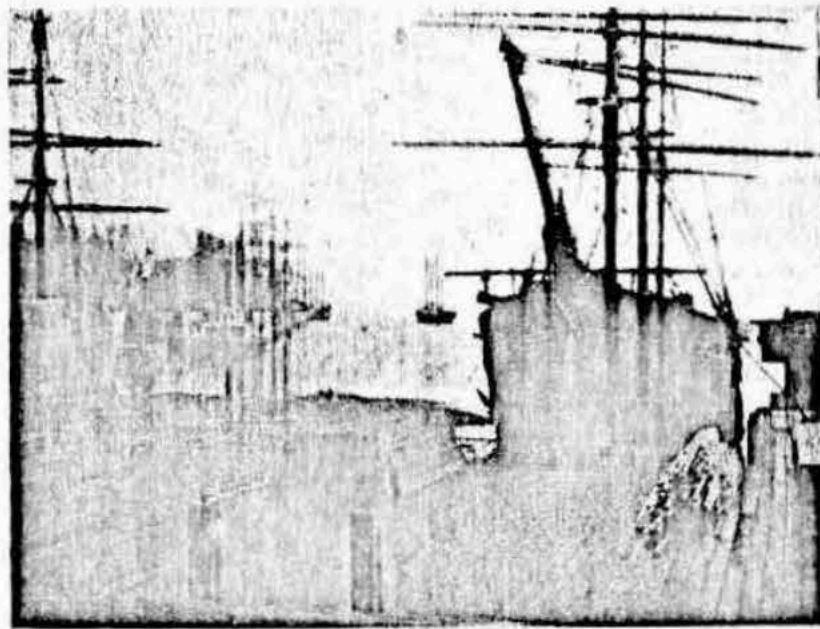


FIGURE 14.—Lumber cargoes from Puget Sound are fast becoming the main source of supply for the north Atlantic seaboard. (Photo from U. S. Forest Service).