REPORT 1 FROM A REAPPRAISAL OF THE FOREST SITUATION

GAGING THE TIMBER RESOURCE OF THE UNITED STATES

U. S. Department of Agriculture - Forest Service

1946

Foreword

During 1945 and 1946 the Forest Service has been making a reappraisal of the Nation's forest situation. This undertaking, carried out under the general direction of R. E. Marsh, brings up to date previous analyses of a similar nature.

The primary purpose of this report is to appraise our timber resources. Other reappraisal reports deal with potential requirements for timber products and with other aspects of the situation, some of which are referred to in this report.

The problem of timber supply is here approached in a somewhat different manner than in former reports, which have been concerned primarily with an exposition of acreage, timber volume, annual growth, and drain. Working from estimates of present drain and potential requirements for forest products, this report proposes goals toward which we should aim in timber growing. It then shows that we have enough forest land but that the problem lies mainly in the inadequacy and poor distribution of the growing stock. It supplements evidence on the deteriorated condition of the growing stock in many regions by discussion of how the major forest industries are affected. It points up the problem by giving salient facts about forest ownership.

In conclusion, the report suggests logical shifts in regional output of timber products and shows, by careful analyses of the possible course of growth and drain in each region, that it would take several decades for a comprehensive forest program to achieve the growth goals.

This report is the work of C. Edward Behre and S. Blair Hutchison. R. D. Garver, L. F. Kellogg, and Miss Lake F. Compton helped in the compilation of data. Most of the basic information for this report was supplied by the regional offices and experiment stations of the Forest Service with cooperation from State foresters, the American Forestry Association, and other public and private agencies.

Lyle F. Watts

Chief, Forest Service

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Appendix tables:

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The following Reappraisal Reports have already been issued by the United States Forest Service:

No. 1. Gaging the Timber Resource of the United States

No. 2. Potential Requirements for Timber Products in the United States

No. 3. The Management Status of Forest Lands in the United States

GAGING THE TIMBER RESOURCE OF THE UNITED STATES

Introduction

The great development of this country has been possible because of the abundance of her physical resources. A wealth of minerals, water power, farm land, forests, and other natural assets has been the foundation of the Nation's strength.

Timber has been one of the most abundant of the natural resources. It has contributed greatly to the good living which the Nation enjoys. During the war lumber, paper, plywood, and other forest products played a vital part in keeping a huge military machine rolling. Now, as the Nation turns back to the job of building and maintaining a more prosperous economy, we find our effort to provide the new housing so badly needed throughout the country hampered by inability to obtain enough lumber.

Evidence steadily piling up indicates that the current difficulty in lumber production is partly related to scarcity of suitable timber available for cutting. For three centuries we, as a Nation, lived in an era of timber abundance. Now we have passed into an era in which we must depend increasingly upon the timber we grow each year. So we need to take a fresh look at the forests which lie all around us to see what their condition means in terms of national strength and security. The question facing us is whether this great renewable resource is producing enough to satisfy the needs of a prosperous, vigorous nation. To bring the situation into sharp focus we need to consider how large these needs may be.

How Much Wood Do We Use Now?

The United States uses more wood and uses it more freely than any other nation in the world. Wood supports the fifth largest group of manufacturing industries in the United States. It gives direct employment to about 1.2 million workers and indirect employment to probably twice as many more. In 1944, 12 billion cubic feet of all timber, including 50 billion board feet of saw timber, was cut from our forests (table 1).1/

1/ The term "all timber" as used in this report includes all trees 5 inches and larger in diameter breast high. "Saw timber" includes merchantable trees large enough to yield logs for lumber, whether or not they are used for this purpose. Thus the term saw timber is not restricted to trees or stands cut or destined to be cut for lumber. Because the minimum size of logs acceptable for lumber varies, the minimum size of saw-timber trees ranges from 9 to 15 inches d.b.h., depending upon the species and region. The volume of all timber is expressed in cubic feet; of saw timber, in board feet.

Lumber is by far the largest item, making up 55 percent of the total and 70 percent of the saw-timber cut. Two-fifths of the 34.4 billion board feet cut for lumber comes from the South and another two-fifths from the Pacific Coast. Oregon and Washington alone account for almost one-third.

Table 1.--Timber cut[1/] in 1944, United States

	All timber, billion cu. ft.	Saw timber, billion bd. ft.
Lumber	6.7	34.4
Fuel wood	2.2	3.9
Pulpwood	1.3	4.8
Other products	2.0	6.6
Total	12.2	49.7

1/ Includes waste and breakage in logging.

The next largest item is fuel wood. Less than half of the 65 million cords of fuel wood used constitutes a drain on the forest. The rest is made from tops and limbs of trees cut for sawlogs or other products, from dead and cull trees, and from mill waste. On the other hand, a substantial part of the fuel wood is cut from saw timber which is potentially more valuable for other products. Fuel-wood drain makes up 18 percent of the cut of all timber. Contrary to what might be expected, it is greater for the South than for the North. Two-thirds of the fuel-wood drain is in hardwoods, one-third in softwoods. Since fuel wood has the least exacting physical and quality requirements of any wood commodity, it should be possible to supply a greater proportion of it from thinnings in pole timber, from trees of undesirable form or species, and from closer utilization of trees cut for other purposes.

Pulpwood is the third largest item: 11 percent of our timber cut. Pulpwood cutting has increased sharply during the past 15 years, largely because of a rapid expansion of the pulp and paper industry in the South, where some 20 mills have been erected or enlarged since 1931. The South now leads in pulpwood production, exceeding the North by nearly 40 percent and the West by 80 percent. Southern pines are the dominant pulpwood species in the South. Spruce, fir, hemlock, and pine, the first two predominating, make up three-fourths of the pulpwood cut in the North. In the West, western hemlock, Sitka spruce, and white fir are the chief pulpwood species. Although the technical specifications for pulpwood are more exacting than for fuel wood, a large part of our pulpwood cut could also be obtained from thinnings, inferior trees, the poorer parts of trees cut for lumber or other purposes, and waste. Currently more than 95 percent of the pulpwood cut is a direct drain on forest growing stock.

While lumber, fuel wood, and pulpwood make up 84 percent of the annual cut, the remaining 16 percent comprises some 25 items, including, in order of volume cut annually, veneer logs, hewn ties, round mine timbers, fence posts, cooperage, and shingles. Although small in volume, poles for rural electric lines present a critical problem currently. The South accounts for more than half of the cut in these miscellaneous items, while the West contributes only one-seventh.

Goals for Timber Growth

How much wood the Nation will use in years to come will depend in large part upon available supply and upon future economic conditions. Without attempting to forecast what actual use may be, we may well set as our goal the growing of at least as much timber as a prosperous people might use if the supply were sufficient to keep forest products available at reasonable prices. It would be short-sighted national policy to be satisfied with any less. To give all men the opportunity to enjoy a reasonable standard of living is a primary economic objective of the country, and it should be the yardstick against which our resources are measured.

Appraising the need in such terms, the Forest Service believes that the Nation should plan to produce annually a crop of from 18 to 20 billion cubic feet of all timber, including perhaps 65 to 72 billion board feet of saw timber. These goals are based primarily on our potential requirements for forest products, but include also an allowance for unavoidable losses from fire, insects, and disease, and margins for ineffective growth and for unforeseen new uses, export, and national security. These estimates of the place of forestry in an economy of abundance are, of course, largely a matter of judgment, but it is helpful to think of our objectives in concrete terms. The goals are not based on the present condition of our forest. Indeed, analyses show that they may be unattainable for several decades.

How much wood is needed?—As previously suggested, it is appropriate that our estimate of potential requirements be based on an economy of full employment in which consumers would have a free choice of readily available materials, including timber and timber products.

Looking ahead from 5 to 10 years, it is clear that the demand for lumber will be affected by the urgent need for housing. Behind the Administration's effort to provide 2-3/4 million homes during 1946 and 1947 is the estimated need for over 12 million within a decade. A high level of industrial activity also calls for more lumber than was used before the war—for general construction, for manufacture, and for shipping uses. All together, under the assumed conditions of full employment and plentiful supply, potential lumber requirements are estimated at 42 billion board feet as compared to 31 billion actually consumed in 1940, the last prewar year.

Production of paper and paperboard, expanding rapidly for 40 years, reached 17 million tons in 1944. In recent years the expansion has been based largely on increasing consumption of paper bags, cardboard boxes, and building boards. Indications are that the saturation point has not yet been reached. The American market may well call for 24 million tons of domestic production 5 to 10 years hence. This implies a potential requirement for domestic pulpwood of 20 million cords as compared with a cut of 15 million cords in 1944.

Because more efficient heating methods and changing living habits are expected to reduce the use of wood for fuel in the years ahead, fuelwood requirements are likely to be less than at present. On the other hand, under the assumed conditions the potential requirement for all other wood products together might be somewhat higher than present use.

In total our potential requirements a decade hence are estimated at almost 15 billion cubic feet of all timber including 61 billion board feet of saw timber (table 2).2/

Table 2.—1944 cut and potential timber requirements, United States

	All timber, billion cu. ft.	Saw timber, billion bd. ft.
1944 cut	12.2	49.7
Potential requirement	14.6	61.0

Looking further ahead to, say, the end of the century, there are reasons to believe that with the growth of the Nation to 167 million and possibly to 185 million people,3/ potential requirements will not be lower than in the period 1950-55. Lumber requirements may be somewhat less than the emergency need of the next few years. For one thing the trend toward smaller houses and less lumber per house, if unchecked, might more than offset the demand for more dwelling units. On the other hand, under the conditions of reasonable prosperity and adequate timber supply which we have assumed, the pulp and paper industry may be expected to continue its long-time upward trend, although perhaps at a reduced rate of increase.

These estimates of potential requirements for timber products do not represent the maximum quantities that might be called for in an economy of abundance. For example, the factors used for such items as lumber required per house and lumber required for industrial and commercial construction may unduly reflect current scarcity. National productivity greater than that envisaged in the estimates might lead to a greater demand. The estimates might also prove too low should population increase beyond the 167 million suggested by current estimates based on only medium fertility. But whether they prove to be high or low, these estimates do give us a reasonable basis for setting up future timber-growth objectives.

Allowance for losses.—Our goals for annual timber growth should go beyond the amounts needed to supply the lumber, pulpwood, and other commodities we think we should have. For one thing, there should be an allowance for unpreventable losses from fire, insect and disease epidemics,

2/ For a detailed analysis see: U. S. Forest Service. Potential Requirements for Timber Products in the United States. (Reappraisal report). Washington. 1946.

3/ Thompson, Warren S. Estimates of Future Population of the United States, 1940-2000. National Resources Planning Board. Washington. 1943.

and other natural causes. Such losses are not included in the normal mortality taken into account in our estimates of current growth. During 1944, losses due to fire and other destructive agents were 1.5 billion cubic feet of all timber, including 4.2 billion board feet of saw timber. It may be possible to cut the rate of unsalvaged loss per million feet of timber in half, but if we did so the amount of loss would not decrease by half because, as will be shown later, our eastern forests in the future should have a substantially heavier volume subject to loss than at present. Thus the growth goals include an allowance of 1.3 billion cubic feet, including 3.2 billion board feet for losses.

Margin for safety.—It will be wise also to set the goals so as to leave a margin above potential requirements and losses for at least four reasons:

First, we should have a margin for security. Timber played a vital part in the recent war. During the first year of the war enough lumber to build a million homes was required to house our army. After that our supply of high-quality timber for plywood, pontoons, ship decking, heavy construction, etc., and our ability to provide an enormous quantity of material for boxes, crates, and dunnage, contributed greatly to the success of the military effort. We have seen how invaluable the stands of heavy timber accumulated through long years of careful forest management in France and central Europe were to those who had access to them. The war demonstrated that wood can be substituted for metals and other materials in a wide variety of uses. An abundance of timber is a first-rate hedge against possible shortage of critical nonrenewable resources. And by chemical conversion wood can be used for the manufacture of other strategic materials, such as ethyl alcohol and rubber.

Second, we should have a margin for export. Timber is scarce throughout most of the civilized world. The more densely populated countries have no prospect of fully supplying their own needs. Even in Russia consumption is likely to keep pace with production. The undeveloped resources of the tropics may contribute to hardwood requirements, but there is no indication that they can take the place of the coniferous forests of the Temperate Zone, which supply the bulk of the world's construction timber. In any event, inaccessibility and adverse operating conditions will tend to limit the volume of timber they can send to world markets. Preliminary information given out by the United Nations Food and Agriculture Organization indicates clearly that world markets in both East and West need timber supplies from the United States. Although we are not now in position to fully supply our own needs for timber products, we have everything to gain from building up our resource to the point where we can export a substantial volume. Only in this way can the United States make an appropriate contribution to the world's timber economy.

Third, we should allow for new uses. Recent progress in the transformation of wood and in its use as a chemical raw material should not be ignored in planning for the future.

Fourth, total forest growth should be greater than prospective drain to allow for growth which will not be available for use. One example of this is growth that may be tied up by further withdrawal from commercial use of roadside strips, parks, and other scenic areas. Another example is growth on timber too scattered for economic operation, isolated or inferior stands that may remain permanently inaccessible, and trees of inferior species or poor quality that are often lost if they cannot be marketed along with the better trees with which they are mixed. Furthermore, some former agricultural lands now coming up to timber are likely to be cleared again for cultivation before the timber is mature. No matter how optimistically we approach the problem of getting full development of the commercial forests of the Nation, there is bound to be some timber which will be beyond the economic pale. The growth goal should provide for this contingency.

The 20 billion cubic feet of all timber including 72 billion board feet of saw timber suggested to cover all these items (table 3) provide a starting point for discussion of our forest problem. However, these figures are not arbitrary, inflexible criteria of the need for action. If the margins above potential timber-products requirements and losses seem unnecessarily liberal, or if independent analyses should result in lower estimates of commodity requirements, the reader may feel that goals of, say, 18 billion cubic feet of all timber and 65 billion board feet of saw timber would be adequate. We could expect to arrive at such goals sooner, but when all the cards are down, it will be apparent that the action program needed would be about the same whether the goals are set higher or lower.

Table 3.--Goals for annual timber growth, United States

	All timber, billion cu. ft.	Saw timber, billion bd. ft.
Timber products	14.6	61.0
Losses	1.3	3.2
Margin	4.1	7.8
Total	20.0	72.0

The importance of having plenty of saw timber in our growth goal can hardly be overemphasized. Our forest problem goes beyond that of just growing wood. A large part of our timber needs is, and probably always will be, for the kind of material that comes from big trees. Moreover, one way to keep the cost of timber products down is to manage the forests so that the bulk of the crop can be cut from trees of saw-timber size. Even for products like pulpwood, for which timber of saw-timber size is not essential, it is generally less expensive to handle large trees.

How Far to the Growth Goals?

The forests of the United States are now growing at the rate of 13.4 billion cubic feet of all timber including 35.3 billion board feet of saw timber. Thus present growth of all timber is only two-thirds of the 20 billion cubic feet believed desirable for a prosperous Nation. More important, the current growth of saw timber is only about half of the amount the forests should ultimately be growing.

This growth deficiency reflects two entirely different situations. In the eastern half of the country practically all of the forest area has been cut over one or more times. Here current growth really measures the extent to which we are using the productive capacity of the land. In the West, on the other hand, we still have a substantial area of virgin timber, most of which is making little or no net growth. Here we may expect annual growth to increase in time as the stagnant virgin timber is converted by cutting to effectively growing forest. In some virgin types saw-timber growth can be obtained immediately by selective cutting which takes the overmature and decadent trees and leaves a vigorous growing stock. Clear-cutting, however, usually postpones effective growth 50 years or more.

The significance of our growth goals in relation to current growth can be clarified by considering the situation by regions (fig. 1). The

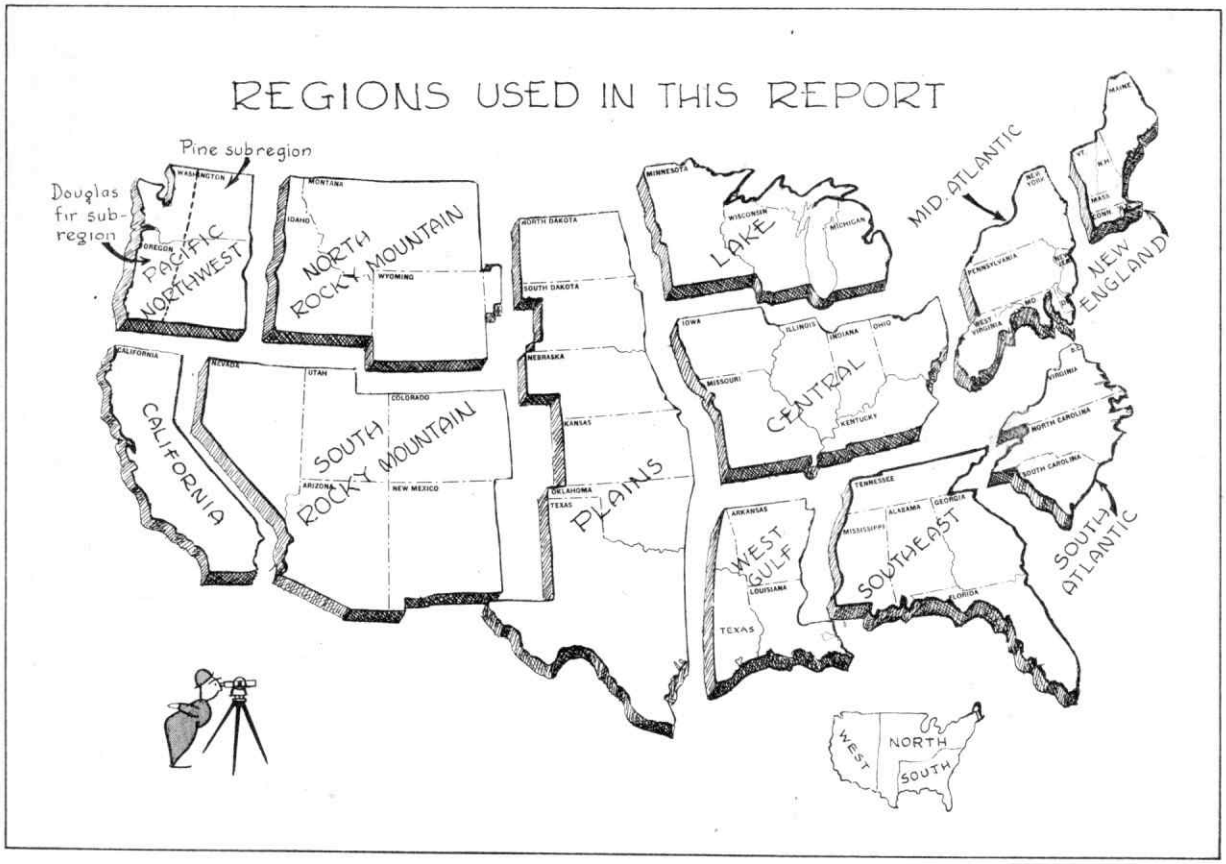

Figure 1

allocation of growth goals to regions suggested in table 4 is in no sense a forecast of what actual production may or should be. The regional goals are intended only as an indication of how the various timber-producing regions might contribute to the national goals, taking into account such things as the acreage of commercial forest land, the potential rate of growth in the principal types, local accessibility, ease of management, and position with respect to consuming markets. The same total output might, of course, be achieved by any other reasonable combination of regional figures.

Table 4.—Current annual timber growth and growth goals by regions

	All timber		Saw timber	
	Growth goal	Current growth	Growth goal	Current growth
	Billion cu. ft.		Billion bd. ft.	
New England	1.14	0.90	4.0	1.8
Middle Atlantic	1.64	1.40	5.8	2.7
Lake	1.15	.81	3.1	1.4
Central	1.73	1.44	4.5	2.3
Plains	.12	.12	.2	.2
North	5.78	4.67	17.6	8.4
South Atlantic	2.14	1.76	7.8	6.1
Southeast	4.80	2.71	17.5	8.2
West Gulf	3.20	1.92	12.1	5.6
South	10.14	6.39	37.4	19.9
Pacific Northwest:				
D.fir subregion	2.17	1.02	10.0	3.7
Pine subregion	.38	.22	1.4	.5
Total	2.55	1.24	11.4	4.2
California	.64	.33	2.8	1.2
North Rocky Mt.	.65	.54	1.9	1.3
South Rocky Mt.	.24	.20	.9	.3
West	4.08	2.31	17.0	7.0
United States	20.00	13.37	72.0	35.3

About half of the goal is assigned to the South, which has some 40 percent of the commercial forest land, very favorable growing conditions, and easy access to the country's major markets.

Achievement of the goals would require a substantial increase of current growth in all parts of the country except the Plains region.

The increase in growth of all timber suggested for the North is about 25 percent; for the South, almost 60 percent. In the West the suggested increase is only about 20 percent in the Rocky Mountain regions but about double for California and the Pacific Northwest.

To meet the suggested allocation of saw-timber goals, growth will need to be doubled in both North and South and increased 2½ times in the West.

The significance of our growth goals is further brought out by comparisons of current growth and drain[4/] (table 5 and fig. 2). Saw-timber drain is about 7 percent more than current growth in the North and 25 percent in the South. Although most of the timber in the South is now "second growth," saw-timber drain from this part of the country is still almost 5 billion board feet greater than from the West. The goal of doubling saw-timber growth is obviously made more difficult when growing stock is being steadily reduced by an excess of drain over growth. So long as this is the case, curtailment of output in the forest industries is likely to be necessary.

Table 5.—Comparison of growth and drain - 1944

	Growth	Drain
Saw timber	Billion bd. ft.	
North	8.4	9.0
South	19.9	24.9
West	7.0	20.0
U.S.	35.3	53.9
All timber	Billion cu. ft.	
North	4.7	3.7
South	6.4	6.5
West	2.3	3.5
U.S.	13.4	13.7

We must not be deceived by the apparently favorable relation between all timber growth and drain in the North and South. Largely as a result of the advanced stage of timber depletion, which has forced many older wood-using plants out of business and made it difficult for new ones to start, growth of all timber exceeds the present drain in the North by 27 percent. That this balance by itself is not satisfactory is apparent when we consider that there is a deficit of saw-timber growth and consider also the inferior quality and small size of the timber which now constitutes a large part of the forest in this section of the country. One of the major problems in the North is, in fact, to find satisfactory markets for much of the small, low-grade timber which is included in estimates of all timber growth, but which must be gotten out of the way to make room for more valuable growth. The North, as the big consumer of the Nation, should grow a larger part of its own saw timber. Our goal suggests that future output might be double what was cut in 1944.

The same problem exists to a smaller degree in the South. If this region is to hold its dominant position in the Nation's forest economy as suggested in our goals, its future output might be 50 percent greater than in 1944.

4/ Timber drain measures the total impact on the forest of cutting for commodity use (including waste and breakage in logging) and losses from fire, wind, ice, epidemics of insects or disease, and other destructive agents. Endemic losses from insects and disease are not included in drain but are accounted for in growth computations.

Because of the presence of the virgin timber, the relation between growth and drain has little significance in the West. However, the 1944 drain is believed to be about 3 billion board feet greater than can be permanently sustained. The great disparity between current growth and drain, taken in conjunction with the extent to which growth falls below the goals, throws light on the forest problem in the West. It is important that the virgin stands be cut at a rate and in a manner that will best promote future growth. There is also the prospect that improper and premature cutting of second-growth timber in private ownership, already under way, will remove growing stock that will be much needed in a few decades. Without good forest practice and farsighted planning in the West for both private and public lands, waning of the virgin timber supply may usher in a long period when annual saw-timber growth will fall far short of the goal and short of what is needed to sustain the timber industries there. This has already happened in some localities, notably in the Puget Sound and Grays Harbor areas of western Washington.

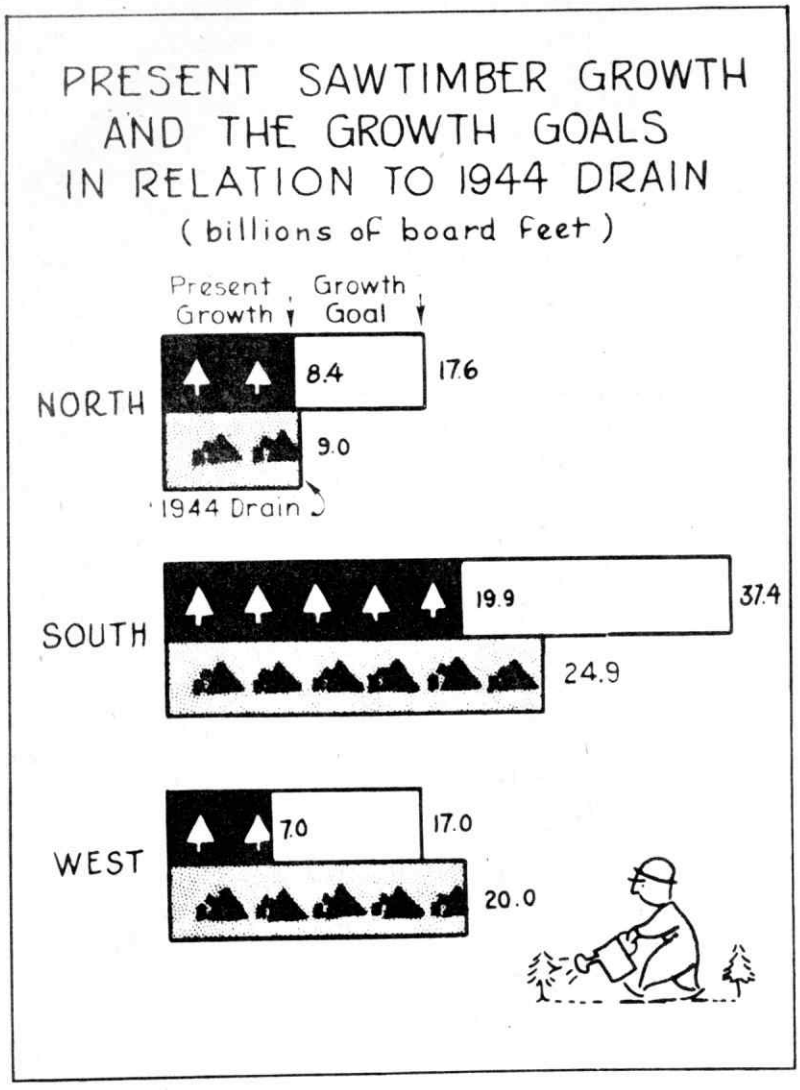

Figure 2

The Forest Land Area Is Adequate

Having suggested that we should aim to increase all timber growth 50 percent and to double saw-timber growth, we should consider whether we have enough land available to grow so large a timber crop.

Some 624 million acres, or one-third of the total land area of this country, is primarily useful as forest land. This huge acreage includes 163 million acres of noncommercial forest land: 150 million acres of mountain top, desert fringe, chaparral, and other scrub forests —mostly in the West; and 13 million acres of potentially productive land reserved from cutting in state and national parks and other public preserves. Excluding this noncommercial area, there are 461 million acres we can count on to some degree for growing timber for commercial use. More than three-fourths of this commercial forest land lies in the North and South. The Pacific Northwest and California together have less than one-seventh (fig. 3).

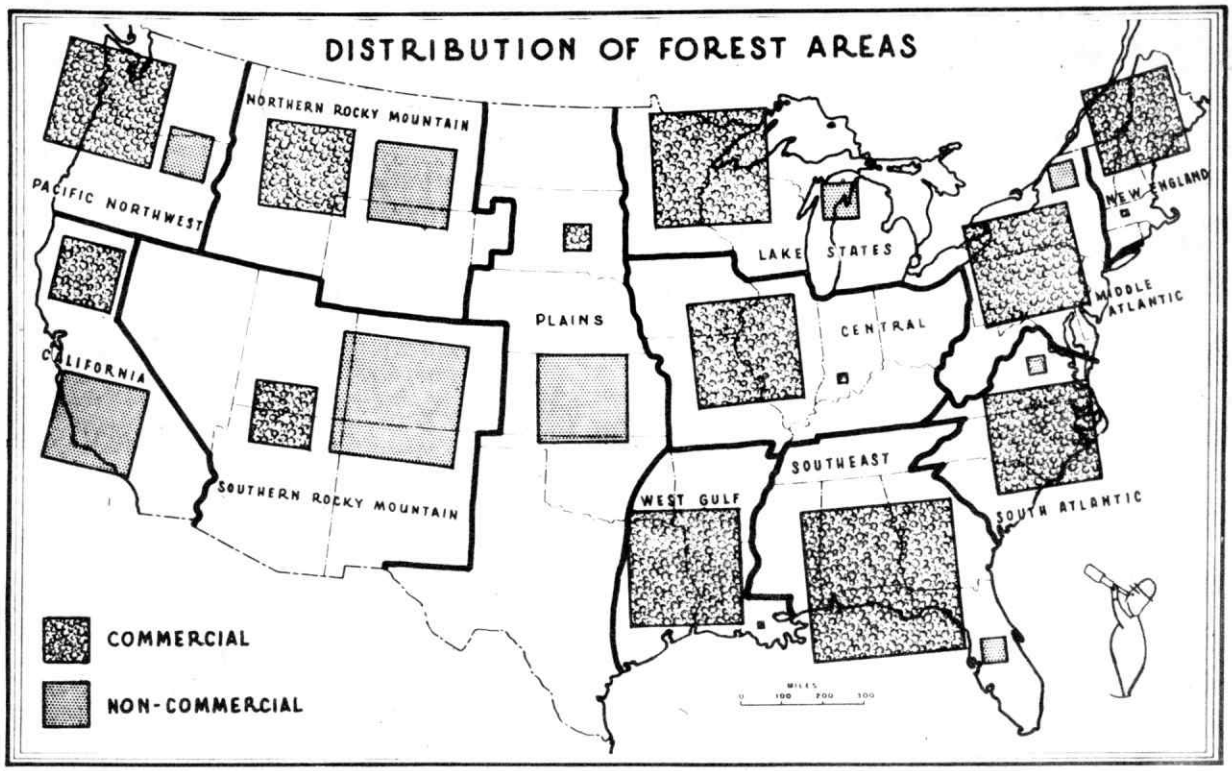

Figure 3

We have learned enough about the growth capacity of our important timber types to know that the acreage available for timber growing is ample if put to work under reasonably good timber management. Because of the wide range of natural and economic conditions in this country, the intensity of management will necessarily vary considerably. It is likely that highly intensive forest management—that would result in yields consistent, in both quantity and quality, with the full productive capacity of the land —will be most widely applied in fast-growing timber types and on lands that are easily logged and have easy access to diversified markets. But we cannot expect such management to be the rule; indeed, calculations indicate that if we had 100 million acres intensively managed, 300 million acres under a less intensive type of management, and some 60 million acres (chiefly the less productive or more inaccessible of the commercial forest lands) meeting only minimum standards or in nonoperating status, we should eventually be able to achieve our growth goals.

While the forests of the United States have the potential capacity to meet future wood requirements, it will not be easy to reach the growth goals. The planting job required to rehabilitate a great area of understocked and denuded forest is many times greater than anything of the kind we have accomplished in the past. It may not be possible to get very effective management on millions of acres held by small and needy owners in sections where living standards are low and the pressure of population on the land is great.

To bring extensive or better management to 400 million acres or 87 percent of the commercial forest land will, in fact, be difficult. At present about 33 percent is rated under extensive management, and only 2 percent under intensive management. The trial calculations mentioned above visualize raising the acreage of intensive management to one-third of the commercial forest in the South, to one-fifth in the North, to one-sixth in the Pacific Northwest and California, and to perhaps 6 or 7 percent in the Rocky Mountain regions.

Large-scale improvement in management must be started without delay if it is to bring the suggested increase in annual growth by, say, the end of the century. Clearly, this is a job to challenge our best efforts.

Growing Stock Is the Problem

The amount of annual timber growth at any time depends upon the volume and character of the forest growing stock or forest capital that we have. So it is important that we learn to think of our timber stand as growing stock, rather than as an inventory of a commodity awaiting utilization. We may find annual growth deficient in some regions because we do not have enough growing stock or forest capital, and in others because so much of the forest capital is nonproductive, tied up in the form of overmature or decadent virgin stands which have largely ceased growing.

In order to sustain the growth goals the forests of each region must be so organized that all age classes, from seedlings up to the age at which commercial needs for the most demanding products can best be met, are represented in sufficient volume to assure the required yield, year after year. Since growing stock is the sum of the volumes of all age classes needed to yield the specified crop, it is obvious that the amount of growing stock which must be maintained in any given forest type or region will depend largely upon the cutting age for the principal or final crop harvested. For saw timber of desirable size this ranges from 60 to 140 years. To a lesser extent it will depend upon the proportion of the total harvest that can be obtained from thinnings or improvement cuttings in immature stands. The amount of growing stock required will depend also upon the rate of growth. Fast-growing species will attain a size suitable for a given product at an earlier age than slow-growing species. Similarly, adverse climate and soil, because they limit the growth rate, increase the amount of growing stock required.5/

5/ Increasing the intensity of management means larger yields per acre and timber of better quality, but does not in itself affect the growing stock requirement. Under certain circumstances, intensive management may yield timber of a given size at an earlier age. On the other hand, intensive management may involve carrying timber to larger size before cutting. It certainly would avoid the premature cutting of young stands which keeps the output without management relatively high in relation to growing stock.

In the South, where growth is generally rapid and a substantial part of the harvest may be taken from thinnings or other intermediate cutting, it should be necessary to have only 16 to 17 cubic feet as growing stock for each cubic foot of annual yield. At the other extreme, in the South Rocky Mountain region, because of slow growth and less favorable markets for small trees, the cubic-foot stand will need to be 80 times the annual drain. For saw timber the ratios of growing stock to annual yield range from 16 or 18 in the South to 50 in the South Rocky Mountain region. Ratios for saw timber are less than for all timber because a smaller portion of the total stand is above the minimum size measured.

When estimates for all regions are brought together (table 6), the minimum forest capital needed to sustain our growth goals appears to be 594 billion cubic feet, of which 1,700 billion board feet is saw timber. About 40 percent of this growing stock should be in the West and 60 percent in the East.

Table 6.—Minimum growing stock to sustain future growth goals

	All timber, billion cu. ft.	Saw timber, billion bd. ft.
New England	32	87
Middle Atlantic	47	128
Lake	35	86
Central	52	99
Plains	4	6
North	170	406
South Atlantic	34	127
Southeast	86	284
West Gulf	59	210
South	179	621
Pacific Northwest:		
D.fir subregion	109	350
Pine subregion	30	70
Total	139	420
California	45	129
North Rocky Mt.	42	79
South Rocky Mt.	19	45
West	245	673
United States	594	1,700

These estimates of the growing stock needed to realize the growth objectives assume a proper distribution of timber sizes. They assume also that the bulk of the forest area will be managed so that the forest capital will be kept active. To the extent that these assumptions are not fulfilled, the volume of growing stock would need to be higher.

Any failure to achieve the extent of good management indicated in the previous section would lower the average growth rate and this would mean that more growing stock would be needed to yield a sustained harvest of the same volume in trees of the same size. In this connection it is well to recall that, in setting up the growth goals, a margin was allowed for ineffective growth in stands that may never be utilized. To this extent the indicated growing stocks are not expected to sustain an actual drain equivalent to the growth goals.

The Present Stand Is Inadequate

Using the growing stock required to sustain the growth goals as a yardstick, we can measure the adequacy of our present timber resources. There is in the United States (as of 1945) approximately 470 billion cubic feet of standing timber in trees 5 inches and larger. Of this volume 1,601 billion board feet is saw timber. Approximately half of the saw timber is in virgin stands. In the West about 80 percent of the saw timber is classed as virgin with 10 percent for the North and only 3 percent for the South. Because of this concentration of heavy stands of virgin timber, the one-fourth of the commercial forest land which is west of the Great Plains contains two-thirds of our saw-timber stand (fig. 4). Almost one-third of all the saw timber is on the 26 million acres of commercial forest land in western Washington and western Oregon.

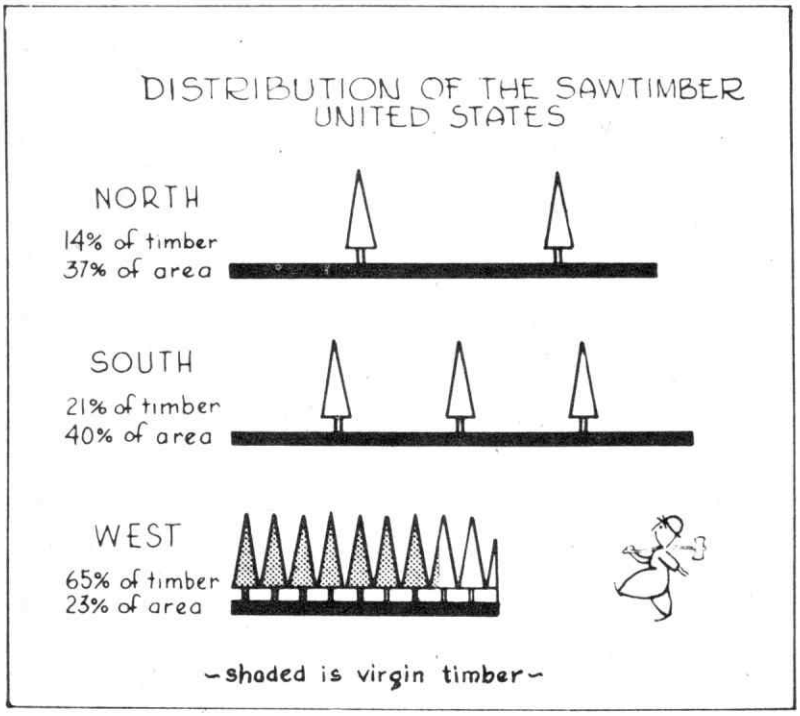

Figure 4

How these stands measure up to the growing stock requirements is shown in table 7 and figure 5. The North and South have little more than half of the required saw-timber stand. Nationally a 469-billion-board-foot deficit in these sections is partially offset by a stand in the West which is 370 billion board feet greater than required. However, the inactive capital in the non-growing virgin stands of the West cannot properly be balanced against a deficiency of growing stock in the East. Looking only at the second-growth saw timber in the West, we find that we have 235 billion board feet or only 35 percent of the active growing stock we shall need to develop there by judicious selective cutting in the virgin stands and by establishing new stands on clear-cut areas.

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Table 7.--The timber stand - 1945

	All timber		Saw timber	
	Billion cu. ft.	Percent of required growing stock	Billion bd. ft.	Percent of required growing stock
New England	25	78	58	67
Middle Atlantic	27	57	62	48
Lake	23	66	50	58
Central	21	40	44	44
Plains	4	100	6	100
North	100	59	220	54
South Atlantic	36	106	97	76
Southeast	54	63	136	48
West Gulf	41	69	105	50
South	131	73	338	54
Pacific Northwest:				
D.fir subregion	117	107	505	144
Pine subregion	29	97	126	180
Total	146	105	631	150
California	45	100	228	177
North Rocky Mt.	33	79	127	161
South Rocky Mt.	15	79	57	127
West	239	98	1,043	155
United States	470	79	1,601	94

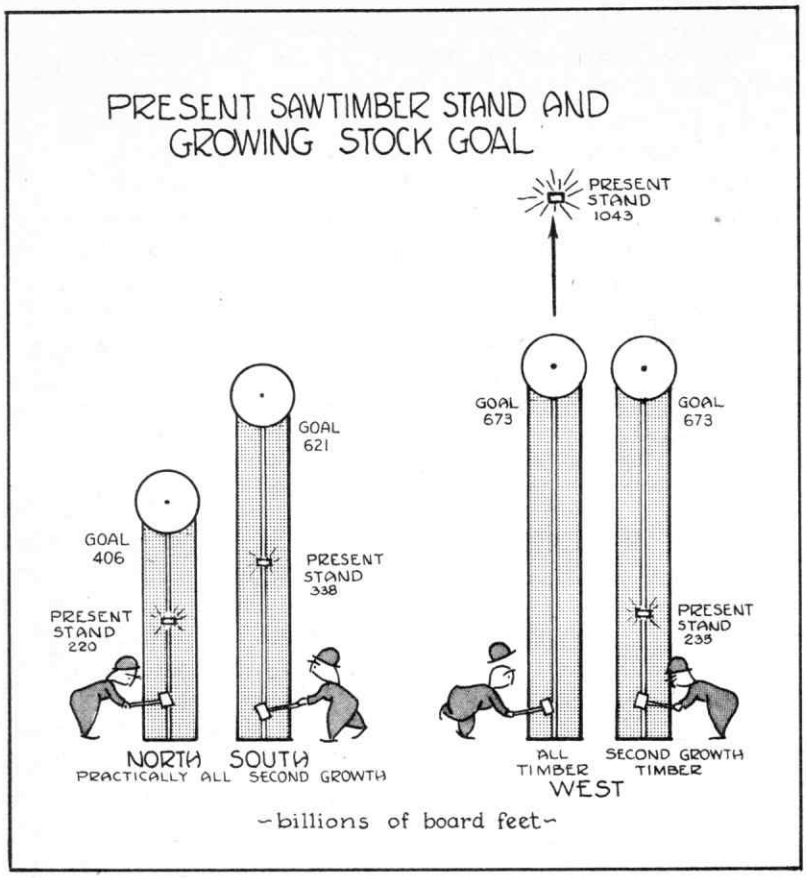

Figure 5

The cubic-foot figures also emphasize the special problem in the West. Despite the 55 percent excess of saw timber over the volume needed for the growth goals in the West, there is no excess in terms of all trees 5 inches and larger. In the Rocky Mountain regions there is a 21 percent deficiency. This is a reflection of the poor distribution of tree sizes and the shortage of small trees. This accentuates the need for partial cutting in the virgin stands to create productive growing stock, and to prolong the life of the present stand until younger timber is ready to replace it.

In the East the deficit of all timber is not so great as that of saw timber, the present cubic-foot volume being two-thirds of the required stand. In fact, in the South Atlantic region the present cubic-foot volume appears to be a little more than the estimated amount we would need to maintain.

Trends of Timber Volume

Whereas our long-range need is to build up productive growing stock, the past trend of timber volume has been in the other direction. Present figures show 43 percent less saw timber than reported by the Bureau of Corporations (Department of Commerce) for 1909 and 9 percent less than estimated by the Forest Service for 1938.

There are reasons to believe that the decline since 1909 has been greater than indicated. The 1909 estimate was necessarily incomplete and probably did not give adequate recognition to the smaller properties; and at that time many tree species which are now of commercial value were disregarded in cruising. Furthermore, in contrast to the practice 35 or 40 years ago, lumbermen and foresters now count trees of much smaller size as saw timber, particularly in the East.

Similarly, the 1938 estimates were weak in regions which had not been adequately surveyed. For example, in the North more saw timber is reported now than in 1938. The difference is primarily in the Middle Atlantic and Central regions, and there chiefly in hardwoods, which are reported at almost double the 1938 estimates. Clearly such differences do not reflect actual trends. They are much greater than could have resulted from timber growth for the period even if there had been no cutting. In the Middle Atlantic region they are largely a reflection of an increase in the estimate of saw-timber acreage. Better estimates in 1945 also resulted in a larger figure for saw timber in California, although observers have no doubt as to the progress of depletion in that region. On the other hand, the 1945 estimates for the two Rocky Mountain regions are much lower than in 1938 because a more realistic appraisal of operating prospects led to a reduction of almost 16 million acres in the commercial forest area of these regions.

Table 8.—Decline of saw-timber stand between original survey and 1945

	Years of original survey	Decrease	
		Billion bd. ft.	Percent
Lake	1934-36	6.9	12
South Atlantic (N.C. & S.C. only)	1936-38	1.6	2
Southeast 1/	1932-36	22.0	15
West Gulf 2/	1934-36	13.0	12
Pacific Northwest 3/	1933-36	112.3	15
15 States	Av.1934	155.8	14

1/ Tennessee not included.
2/ Northwestern Arkansas and northeastern Oklahoma not included.
3/ Volumes in original survey adjusted for subsequent shifts between commercial and non-commercial status.

Although the 1938 and 1945 figures are not directly comparable, the fact of a major decline in saw-timber volume in recent years is clinched by figures for the regions for which we do have comparable statistics (table 8). The saw-timber stand in the 15 States included in this comparison dropped 156 billion board feet or 14 percent between the time of original survey and 1945—a period of 11 years on the average. These States contain 60 percent of the saw timber in the United States and account for almost three-fourths of the annual drain. From the standpoint of needed growing stock these declines are more significant in the East than in the West, because of the large volume of virgin timber we still have in the West.

The regional estimates hide the fact of a much more drastic decline in some localities. In one of 53 survey units in the above States[6] that showed a decline of saw-timber volume, the drop was 40 percent between the original survey and 1945. In 19 units the drop was more than 20 percent. On the other hand saw-timber volume increased in only 10 units, and in only one was the increase more than 20 percent.

Table 9.--Saw-timber volume 20 years hence if 1944 drain and cutting practices continue

	Prospective growing stock	Percent change
	Billion bd. ft.	
New England	49	-16
Middle Atlantic	71	+14
Lake	35	-30
Central	43	- 2
Plains	6	-
North	204	- 7
South Atlantic	93	- 4
Southeast	55	-60
West Gulf	73	-30
South	221	-35
Pacific Northwest:		
D.fir subregion	299	-41
Pine subregion	84	-33
Total	383	-39
California	187	-18
North Rocky Mt.	119	- 6
South Rocky Mt.	52	- 9
West	741	-29
United States	1,166	-27

A good idea of where this trend is taking us can be had by projecting 1944 drain and cutting practices 20 years into the future. Actually the increasing difficulty of obtaining timber, especially in the North and South, makes it unlikely that the forest industries could go on for another two decades at the 1944 rate of output. But if the same cutting practices and rate of drain were continued regionally, it is estimated that our saw-timber stand would drop 27 percent in that period (table 9).

The Southeast region would suffer the biggest drop (60 percent), with the Pacific Northwest second. Significantly enough, these are the Nation's principal timber-producing regions.

For the South as a whole, continuation of the 1944 cut and prevailing forest practices would mean a decline of 117 billion board feet, or one-third of the present saw-timber volume (fig. 6). The remaining growing stock would be only 35 percent of the amount required to support the region's suggested share of our growth goal.

6/ Survey units are subdivisions for Forest Survey purposes, generally including from 2 to 5 million acres of commercial forest land. Because of a change in unit boundaries between 1936 and 1945, Minnesota is not included here.

In actual quantity, the greatest reduction of saw-timber stand is taking place in the Douglas-fir subregion where 20 years more at the 1944 rate would bring the stand down 206 billion board feet. Instead of having a surplus, the region would be left with 50 billion board feet less than the amount of growing stock needed to sustain the growth goal.

Twenty years more of the present drain would not materially reduce the saw-timber stands of the Rocky Mountain regions. California would be left with substantially more saw timber than required to sustain its share of the growth goal.

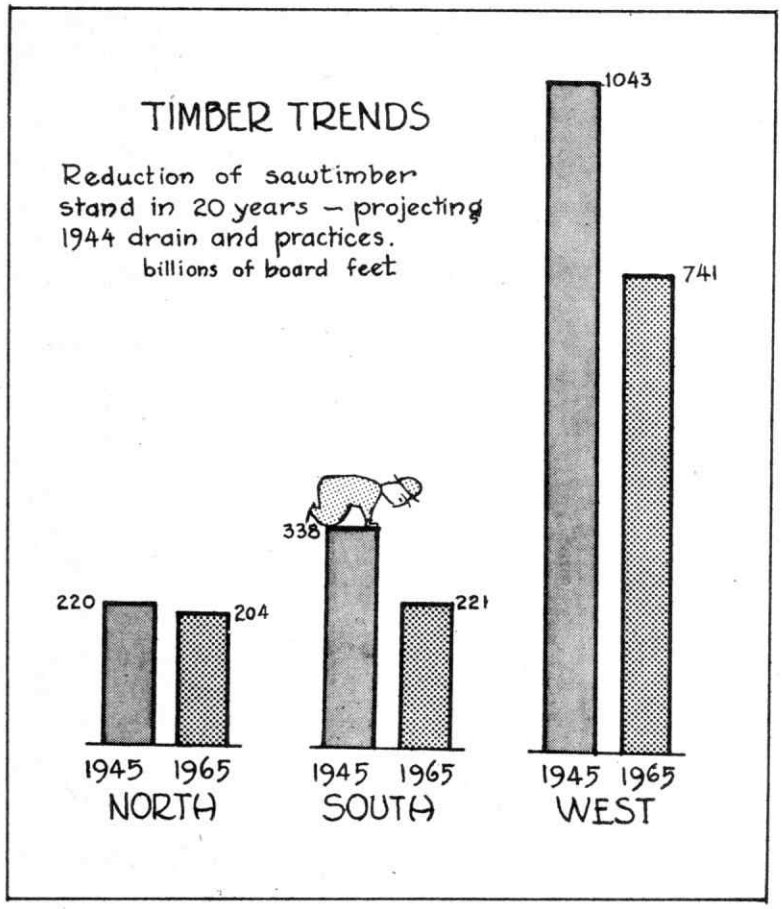

Figure 6

In the Lake States, the already depleted forest would drop in volume another 30 percent. A decrease might also be expected in New England. However, the saw-timber stand would probably increase in the Middle Atlantic region, so that on the whole the change in the North would not be very drastic. This reflects the relatively low level to which the output of forest industries has dropped over much of the North.

Condition of the Growing Stock

There is cause for concern in the trend of saw-timber depletion. But the seriousness of the situation is not fully revealed until we look behind the over-all statistics and examine other aspects of timber depletion. The effects of inadequate protection and poor or destructive forest practices are reflected in the kind of forest growth we now have and the degree of stocking that has followed past cutting.

We have much good timber and many well-stocked stands. But there are also less satisfactory elements of the situation which may interfere with our objective of a generous supply of good timber.

Take our virgin stands, of which there is the very substantial acreage of 44.6 million acres. Virgin timber is usually thought of as heavy stands of large, high-quality trees of good species and with relatively little defect. Yet only one-fourth of the virgin acreage meets this standard (table 10). A much larger area (37 percent) bears stands of doubtful economic value. Containing only 15 percent of the total volume of virgin timber, these latter stands are often highly defective or of low quality. Some of them are long past their prime and in advanced stages of decadence. Others contain a high percentage of inferior species; and others, now merchantable, are on poor sites which may never again grow good commercial timber.

Table 10.—Quality of virgin timber stands

	Area, million acres	Stand quality		
		Good	Medium	Poor
		-----Percent-----		
Pacific Northwest	18.5	39	40	21
California and the Rocky Mountain Regions	22.8	12	36	52
North	2.3	19	54	27
South	1.0	55	34	11
United States	44.6	25	38	37

Half of the virgin forest is in California and the Rocky Mountain regions and half of that is poor quality. In contrast, four-fifths of the virgin forest in the Pacific Northwest is of medium or good quality. Here on one-third of all the virgin area is concentrated 57 percent of the total volume of virgin timber.

Another significant aspect of depletion is the unbalanced pattern of age classes in the East. In the North, almost half of the commercial forest land bears only seedling and sapling stands or is deforested.

Another one-fourth of the area is pole timber or stands characterized by trees large enough for cordwood (5 inches or more in diameter) but too small for sawlog operation. One may drive for miles in some parts of the North without seeing any merchantable saw timber. In the South more than half of the commercial forest area is in saw timber; however, a stand with only 600 board feet per acre qualifies as saw timber in that region. Stands with more than half the saw timber trees over 18 inches in diameter occupy only 1 percent of the commercial forest area in the South. Clearly we need to increase the proportion of large saw timber in both the North and the South if we are to build up the output of good-quality lumber.

Stocking.—The shortage of growing stock in our eastern forests is a direct reflection of poor stocking on many million acres. About 35 percent of the entire area of commercial forest land is deforested or has less than four-tenths of the number of trees required for full stocking (table 11). This acreage includes 58 million acres of second-growth saw timber, chiefly in the South; 30.5 million acres of pole timber; and 75.3 million acres of seedlings, saplings, and denuded areas.

Table 11.—Poorly stocked and denuded forest land

	Million acres	Percent of commercial forest area
North	59.4	35
South	85.2	46
West	19.2	18
United States	163.8	35

In both the North and the South not over one-fourth of the second-growth saw-timber and pole-timber areas are well stocked, that is, have more than 70 percent of the number of merchantable or potentially merchantable trees required for full stocking. However, from 60 to 65 percent of these areas are at least 40 percent stocked. (In general the hardwood types have a smaller percentage of area well stocked than do the softwood types.) Even in the West, where second-growth saw-timber stands have until recently been subject to little exploitation, only about one-third are well stocked, although over four-fifths are more than 40 percent stocked. Almost nine-tenths of the poorly stocked stands are in the East. These figures are additional evidence of the degree to which the Nation's forest productive capacity is underdeveloped.

Stand deterioration.—In the process of exploiting our forests we have lowered the value of our timber in a number of ways not reflected in regional statistics of volume, growth classes, or degree of stocking. "High grading"—cutting the best trees and leaving the poor—destructive cutting, and fire have all replaced valuable timber with inferior growth and depreciated the quality of the timber that now appears in our inventory.

High grading as to both species and quality has been a factor in forest deterioration in all regions. This process began in Colonial days with the combing of the eastern seaboard for white pine masts and oak ship timbers. It went through another cycle as the country's growing lumber industry took the virgin white pine in the Middle Atlantic and New England States, leaving spruce and hardwoods for another generation.

Before the pulp and paper industry revolutionized utilization practices, lumbermen had again worked over the northeastern forests, selecting the big spruce that could be logged to the driveable streams. Pulp operations, in turn, have been concentrated on the remaining spruce and balsam fir, practically eliminating these species from some of the mixed stands and leaving much of the land in possession of hardwoods, which are often unmerchantable and highly defective.

Even where the northern hardwoods could be marketed, operators sought out the best yellow birch for veneers and sugar maple for flooring, furniture, etc. Beech, although an important element of the forest, has been largely neglected, not only because the wood is more difficult to season, but also because the trees are so commonly defective.

In southern New England the deterioration of the sprout hardwood forest by repeated cutting and fire (accentuated by the blight which killed all the chestnut some 25 to 30 years ago) has left little timber attractive to forest products industries. In fact, forest management in this region is handicapped by the problem of how to dispose of the inferior growth that now occupies the ground.

In the Middle Atlantic region between 5 and 6 million acres of forest land that once bore good commercial stands have been hit particularly hard. Destructive logging and repeated burning have reduced most of the oak-pine land of New Jersey to a condition verging on desolation. Similar practices in eastern Pennsylvania converted a large acreage of good forest to scrub oak. Under organized protection this land is now slowly recovering, but the composition and quality of the new forest is distinctly inferior to what might have been maintained, as is evidenced by isolated tracts that have escaped destruction.

In the Lake region forest destruction has perhaps been more complete and more extensive than in any other region. Farm woodlands in the oak-hickory sections are mostly stocked with short, limby, and defective trees. Farther north, five million acres which once bore magnificent pines now grow scrubby aspen—scrubby because on that dry, sandy soil aspen grows slowly and deteriorates at an early age. The adverse effect of this conversion is registered in the trend of sawtimber volume during the past decade: since 1936, the volume of white pine and red pine has dropped 29 percent. Birch, beech, and maple together have declined 16 percent. But the volume of the much less desirable aspen increased 55 percent in this period.

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During the war, Missouri produced only about 32 million board feet of softwood lumber a year. Yet in 1899 its softwood output was 273 million board feet. Although from 250 to 300 million board feet of hardwood lumber is still cut in the State, the forests of the Ozarks have largely degenerated into an inferior stand of oak that can support little industry. In a recent study there, two-thirds of the trees 5 inches and larger were found to be defective.

Throughout the South from Virginia to Texas the story is much the same, though the details are somewhat different. In the Appalachian Mountains the lumber industry has concentrated on yellow-poplar and the better oaks. Removal of these species from the coves has in many instances reduced the remaining forest to an unmerchantable condition from which it has been slow to recover. Longleaf pine has been succeeded by scrub oak on over 2 million acres, mostly in Florida. The inferior hackberry-elm-ash type has replaced valuable oak and redgum on from 10 to 15 percent of the forest lands of the Mississippi Delta.

In those parts of the southern pine region where mixed pine-hardwood stands predominate, heavy cutting, taking pine to a much smaller diameter than hardwood, has allowed the hardwoods—of increasingly inferior quality—to take over. For example, entire counties in the Piedmont of North Carolina are now covered with scrub hardwood, because the small mills have virtually exhausted the pine timber and better hardwoods.

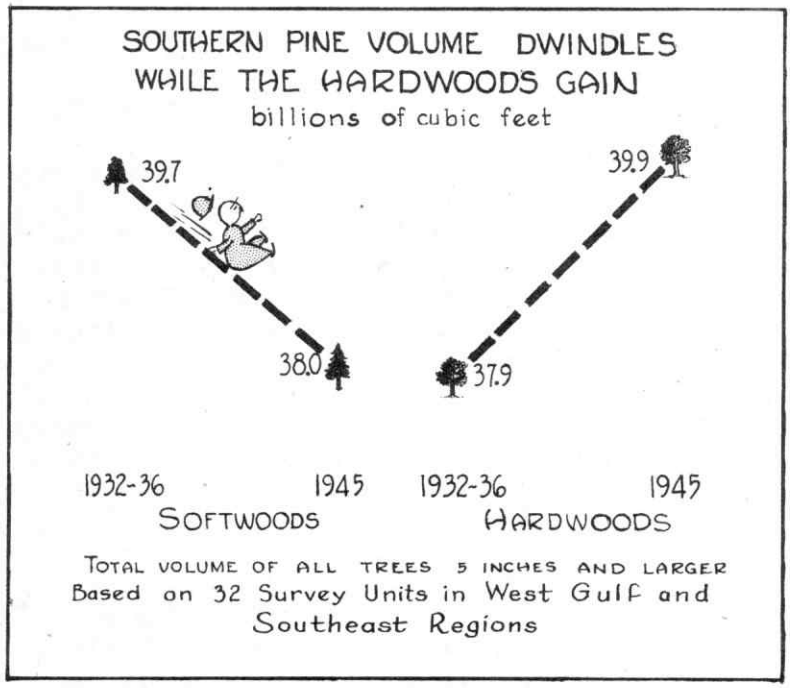

Figure 7

Estimates for 8 States in the Southeast and West Gulf regions indicate that the total cubic-foot volume of softwood timber decreased 4 percent from the early thirties until 1945, whereas the hardwood volume increased 5 percent in that period (fig. 7). In this case the combined cubic-foot volume remained practically unchanged, yet the forest was by no means holding its own. Hardwood saw timber declined almost as fast as the pine.

The depletion of pine and the encroachment of hardwoods are also reflected in the estimate of current annual growth. Softwood saw-timber growth in the entire South was 2 percent less in 1944 than in 1938; but hardwood growth was 12 percent greater.

In the Northern Rocky Mountains, particularly in the panhandle of Idaho, western white pine has been the mainstay of the lumber industry. The western hemlock and white fir with which the pine is associated have been largely without a market. Very often defective, the residual stand of these species, after high grading for white pine, precludes the re-establishment of a satisfactory new pine forest. In other Rocky Mountain types ponderosa pine has been taken, while Douglas-fir (of secondary value in the interior regions) has been left.

Similarly the lumber industry in California has been built around redwood, sugar pine, and ponderosa pine. These species, which make up less than half of the stand, supply more than 70 percent of the region's cut. Removal of these species, especially in the mixed type of the west side of the Sierras, leaves a forest in which the less desirable white fir and incense cedar often predominate.

As we draw heavily on the stands of the more desirable species in region after region, the intrinsic value of each billion board feet of the remaining resource is reduced because the proportion of inferior species in the total is increased.

Availability.--The western timber supply situation has in it the matter of availability which is hard to separate from the factor of quality.

Some of the virgin timber in the West is so defective, scattered, or in such small blocks that it may never be economically feasible to build the roads necessary to get it out. Or, if roads are built, we may not be able to log some that lies in difficult locations without revolutionary changes in logging equipment and methods. Relatively small size of timber and limited utility of certain species may also keep part of the present timber stand beyond economic access. As previously pointed out, it is such considerations that justify in part the margin over potential commodity requirements and losses which is included in the growth goals.

How Forest Products Industries Are Affected

The depletion and deterioration of our timber supply affect the economic life of the Nation primarily through their impact on forest products industries. Because these industries vary so greatly in raw material requirements, this aspect of the situation can be highlighted to advantage by considering separately:

(1) Those industries requiring high-quality logs or specialty woods.
(2) Those requiring saw timber but not needing high-quality logs.
(3) Those which operate in part on smaller-than-saw-timber material.

Quality industries.—The fine logs which gained for the forests of the United States the reputation of being the greatest in the world are no longer abundant. Only after a long period of purposeful management can the second growth ever approach the high quality of the original timber. As a consequence, industries which use top-grade logs look to the future with uncertainty.

In the Northwest, the young and rapidly expanding Douglas-fir plywood industry faces major readjustment almost before it has hit its full stride. Half a dozen concerns already are beset by a serious supply situation; and, because this industry now demands the best of logs, the chances are that half of the western plywood industry will be up against the same problem within two decades.

Across the Nation, in the Middle Atlantic and New England regions, high-grade hardwood veneer logs are also scarce, and in the Lake States there is only a 6- to 8-year supply of the first-class birch timber so much in demand for veneer during the war. In the South a number of commercial veneer companies, which produce many hardwood plywood items, assert that they are scratching to maintain an adequate flow of suitable logs. Some of the plants along the Atlantic Coast augment their intake with logs from South America.

In the Northwest, the supply of Sitka spruce of airplane quality was tight during the first year of the war. It was necessary to bring logs down from Alaska, and to relax exacting specifications so that other species might be used. Practically no eastern spruce was used for aircraft in World War II and the supply of this species suitable for piano sounding boards is almost exhausted.

White oak meeting the specifications for ship timbers became very scarce during the war. The supply of this species suitable for tight cooperage is playing out also. Some operators are going after as few as 10 trees per 40 acres.

So it is with other items. In the West, the end of the supply of Port Orford cedar for battery separators is in sight. The cedar pole industry faces radical curtailment in the coming years for lack of satisfactory stumpage. New England is running out of white birch for spools and other turned articles. Hickory ski blanks are hard to get. Durable heart cypress in any quantity will soon be a thing of the past. Evidence from all regions makes it clear that industries requiring timber of high quality are having increasing difficulty in obtaining the logs they should have.

Saw-timber industries.—A major effect of the depletion and deterioration of our forests has been a decrease in the size of logs coming to our sawmills. Because the lumber industry in the West still has virgin timber, the decline in log size there has not been so much a factor as in the East. But western second growth is being cut increasingly. It is clear that the trend in the West is following the pattern set in the East.

Recent resurveys give striking evidence of the steady shrinkage of tree size in the West Gulf and Southeast regions. The average pine saw-timber tree is about 20 percent smaller than 10 years ago. In certain survey units in Georgia and Florida the board-foot volume of the average pine saw-timber tree dropped more than one-third in the past decade. An increasing number of mills in the South are cutting 6-inch trees and it is not uncommon to see a logging truck carrying 50 or more logs. Such examples are extreme, but they are also signs of a trend. Obviously, mills cutting such small logs do so only because the supply of larger timber is declining.

To an important degree profitable operation of sawmills and related plants depends upon reasonably large logs. As log size gets smaller manufacturing costs go up and sawmill operation becomes more precarious. A recent canvass of most of the hardwood mills in the Mississippi Delta revealed that many plants are operating on logs one-half or one-third as large as formerly and that most of the rest are faced with the prospect of a similar decline in the near future. A survey in New England showed that in 69 out of 118 plants, cutting primarily softwoods, the average log size was 10 inches or less. Even in the Middle and South Atlantic regions, where saw-timber growth compares favorably with drain, the average size of the timber has been dropping.

Another effect of timber depletion is the loss of the larger sawmills which have dominated the situation in each region while the virgin timber was being exploited. In the East the time when the closing of large mills was a critical aspect of the situation is now past, and there are not many large mills left that will have to shut down for lack of timber. In fact some of those still in business are operating under forestry programs that will assure permanence.

In the West, however, the effects of local timber shortages are now being felt in full force.

The most striking situation exists in the Douglas-fir region of the Pacific Northwest, which is at present the country's leading lumber-producing region. When the industry expanded to serve other than local markets, mills, generally of large size, were set up on the major waterways—Puget Sound, Columbia River, Grays Harbor. Plant capacity, based upon liquidation of the virgin timber, far exceeded the volume of cut that could be permanently sustained. Consequently, as the original timber holdings of the operating companies have played out, new opportunities to acquire stumpage have become increasingly scarce. Many plants have already been forced to close down. A survey in 1943-44 revealed that the private old-growth timber still available for the 442

primary forest industrial units in western Washington represented only an average 10-year supply. Some plants had plenty of timber. Others had practically none, having been dependent upon an open log market which has virtually ceased to function. More than half of the plants had only enough private timber in sight to keep them going about 5 years. Cutting of publicly owned timber will help in many cases but it will not solve the problem. Obviously, loss of more mills with attendant economic readjustments is inevitable. Already Grays Harbor has been through the throes of acute depression from exhaustion of local timber supply. The Puget Sound and the lower Columbia River districts are now feeling the pinch of timber scarcity. And the situation is equally bad in some of the pine country of the West. In 5 northern counties of Idaho the white pine industry has shrunk to a small fraction of its former size and the closing of large mills has brought hardship to towns like Sandpoint and St. Maries.

As large mills drop out, small mills become an increasingly important part in the picture. The problems that they present are now uppermost in the East. Almost 25,000 of the 29,000 sawmills operating in 25 eastern and southern States during 1944 cut less than 1 million board feet each. Yet together they produced over $5\frac{1}{2}$ billion board feet of lumber, or 35 percent of the cut for the 25 States.

Because of their mobility, small mills are adapted to the cutting of scattered tracts usually left after the passing of the bigger plants. They are also adapted to the cutting of the small trees that become available as second growth. They could be a powerful aid to good forest management. However, small mill operators seldom own their own timber but purchase logs or stumpage from hand to mouth. Few of them use good forest cutting practices. Because of these factors and the ease with which the business may be entered by persons of limited financial and business qualifications, small mills are a continual threat to the growing stock in any locality.

The portable mills are particularly irresponsible. Having no interest in repeated cuts from a specific area, they usually attempt to get all they can at one setting. This results in indiscriminate clear-cutting. The land may be left unproductive for years to come. When the demand for lumber is strong, rapid increase in the number of mills may lead to a wave of exploitation which will last only a few years and will wipe out the opportunity for establishment or maintenance of more permanent forest enterprises. For example, as the aftermath of wartime activity, a marked reduction in the number of little mills has been noted in northeast Mississippi. Northeast Texas is experiencing a similar exodus of mills, and the same thing is occurring elsewhere in the South. These things are not good for the industry itself or for the communities concerned.

While the small mill is commonly regarded as a cause of forest depletion, the problems it presents are basically a result of depletion and lack of forest management. Much needs to be done to mold the small-mill industry into a strong arm of our forest economy. Part of the solution lies in removing the primary cause of trouble by building up the

growing stock and managing the forests as a permanent source of raw material for well-balanced industries. On the other hand, since this is something of a "hen or the egg" proposition, development of a better industry is an important means of improving the forest situation. Properly linked with permanently producing forests, and given the benefit of good management and modern equipment, small mills could greatly facilitate good forest practice.

Industries using smaller trees.--Pulp and paper manufacture dominates the industries that use trees below saw-timber size. In comparison with the lumber and veneer industries, the outlook of the pulp and paper industry as a whole is encouraging. Pulpwood now constitutes 11 percent of the cut of all timber products. In all probability it will be somewhat more important in the future. The fact that the pulp mills can operate in part on trees smaller than saw-timber size gives them a considerable measure of security. Furthermore, the pulp and paper industry now uses many more species than it did in earlier years.

Manufacturing plants in the older producing regions (New England, Middle Atlantic, and Lake) do, however, face a major timber supply problem arising from overconcentration. The supply of suitable raw material is inadequate to meet demands in each of those regions. The mills import pulpwood not only from Canada but also from other States. In these regions hope for continued operation of many of the older ground-wood mills which have been using spruce and fir lies in converting to the manufacture of other types of pulp from beech, birch, maple, and aspen.

In the South, the pulp and paper industry is relatively new and still growing. There the danger is that the expansion will result in overconcentration of plants along the coast. Competition with the lumber industry for timber is an important problem but solution may be found in opportunities for integration of wood requirements in plans for sustained yield forest management.

In the Pacific Northwest the supply of pulp timber of the species now used by the industry is inadequate to meet future needs. The sulfite mills which predominate in this region are pressing upon the supply of the favored species, western hemlock and Sitka spruce. Increasing amounts of hemlock are being used for lumber and the pulp industry faces competition with the sawmills for the higher-grade logs. On the other hand there are large quantities of the true firs and Engelmann spruce which should become economically available as logging moves farther up in the mountains. The western industry could also expand by using Douglas-fir and lodgepole pine for sulfate pulp.

Modern pulp mills must be large. For low-cost operation sulfite mills need a capacity of at least 100 tons per day and sulfate mills 200 tons. Because of large plant investment, raw material supply is important. Realization of the necessity for firm control of an adequate raw material supply and sharp competition from other forest products industries have stimulated the pulp and paper industry in recent years to an aggressive

policy of land acquisition and forest management, particularly in the South and Pacific Northwest. In New England and New York some units of the industry have long had an established policy of forest land ownership.

Some Aspects of Ownership

The problems of timber depletion and of future timber supplies are fundamentally related to the ownership of the land and the timber. In the long run, the interest of the landowners in tree growing will determine how easy or how hard it will be to meet our future timber requirements.

Bulk of output must come from private lands.--Three-fourths of the commercial forest land is in private ownership. The proportion varies greatly by regions (table 12).

It is low in the West where large untouched areas of the original public domain were set aside as national forests to stop fraud and preclude needless devastation. In the South Rocky Mountains only one-fifth of the commercial forest is privately owned. In California and the Douglas-fir subregion of the Pacific Northwest private ownership accounts for half of the total. But private holdings make up eight-tenths of the commercial forest land in the North and nine-tenths in the South.

Table 12.--Forest land ownership

	North	South	West	U.S.
	- - - Million acres - - -			
Farm	61	69	9	139
Other private	79	98	29	206
All private	140	167	38	345
National Forest	9	10	54	73
Other Federal	2	4	10	16
State and local	19	2	5	27
All public	30	16	69	116
All owners	170	183	107	461

The private forest land represents an even larger share of the Nation's timber growing capacity than is indicated by acreage. This is so because so much of the Federal land is located in the Rocky Mountains and in the interior basins of the West where climate and soil are not so favorable to tree growth as elsewhere. Moreover, in the more productive parts of the West, the cream of the forest land is largely in private holdings.

In most of the East the relatively small acreage of public forest land will also be low in productivity, at least for several decades: some of these lands were acquired only after the forest had been so badly depleted as to render them unattractive to private owners; others after they had been cleared for agriculture and later proved incapable of supporting successful farming. This shows up in a smaller percentage

of the public forest land in saw timber (24 percent) and a larger percentage in seedlings and saplings (34 percent) than for the private land in the East (44 percent and 18 percent respectively).

For the next few decades the relative importance of the public and private lands in output of forest products will be more closely related to volume of standing timber than acreage of forest land. In the East private owners hold 93 percent of the saw timber; in the West, only 38 percent (table 13). But the 400 billion board feet of western private timber, mostly in the Pacific Northwest and California, is generally more accessible and of better quality than the public timber.

Table 13.--Ownership of saw timber--1945

	North	South	West	U.S.
	-- Billion board feet --			
Farm	76	134	34	244
Other private	124	183	363	670
All private	200	317	397	914
National Forest	8	14	496	518
Other Federal	2	4	98	104
State and local	10	3	52	65
All public	20	21	646	687
All owners	220	338	1,043	1,601

Bulk of the problem lies with small holdings.--New information from field surveys emphasizes how much of our timber supply problem lies with the small holdings.7/ Properties of less than 5,000 acres each comprise 57 percent of all and 76 percent of the private commercial forest land (table 14). The 261 million acres in this ownership group is divided among 4,200,000 owners, 97 percent of them east of the Great Plains.

In contrast, the large holdings, two-thirds of which are in the hands of manufacturers of lumber and pulp, and which in turn include two-thirds of all such industry holdings, account for only 51 million acres or 11 percent of the commercial forest land.

Table 14.--Pattern of commercial forest land ownership

	North	South	West	U.S.
	-- Percent of area --			
Small private	69	66	20	57
Medium private	4	12	5	7
Large private	9	13	11	11
Total private	82	91	36	75
Public	18	9	64	25
All owners	100	100	100	100

7/ The following classification of private ownership is used: Small, under 5,000 acres; medium, 5,000 to 50,000 acres; large, 50,000 acres and up.

Judged by current cutting practice, which is our best criterion of landowner attitude toward forestry, the small holdings stand out as the crux of the problem of increasing our timber growth. Table 15 summarizes the results of a 1945 survey[8] covering all public lands, all private holdings of 50,000 acres or more, and a dependable sample of the smaller private holdings.

Table 15.--Cutting practices on commercial forest lands, United States - 1945

	High order and good	Fair	Poor and destructive
	Percent of cutting in ownership class		
Private			
Small	4	25	71
Medium	8	31	61
Large	29	39	32
All private	8	28	64
Public			
National Forest	80	19	1
Other Federal	43	32	25
State and local	47	10	43
All public	67	19	14
All owners	23	25	52

The survey brings out that cutting practices are in general better on public lands than on private. Two-thirds of all cutting on public lands is good or high order, whereas almost two-thirds of the cutting on private lands is poor or destructive.

Within the private ownership there is a significant difference between small owners and large. Almost one-third of the cutting by large owners is good or high order and only one-third is poor or destructive. Large owners show up so well primarily because of their progress in the South. More than half of the large owner cutting in the South is good or better, while in both North and West less than one-tenth is of this order.

8/ For detail see: U. S. Forest Service. The Management Status of Forest Lands in the United States. (Reappraisal report). Washington. 1946. The five classifications used in this survey follow: High order cutting requires the best practices to build up and maintain both quality and quantity of the yield at a high level. Good cutting requires a good silviculture and leaves the land in good condition for future growth of desirable species. Fair cutting marks the beginning of practices that will maintain any reasonable growing stock of marketable species. However, cutting practices of the future must average much better than "fair" to build up the growing stock required to meet the growth goals. Poor cutting leaves the land with limited means for natural reproduction, often in the form of seed trees, but may not forestall forest deterioration. Destructive cutting leaves the land without timber values and without means for natural reproduction.

Sixty-one percent of the cutting by medium-size owners and 71 percent of that by small owners is poor or destructive. Only 4 percent of the small owner cutting is good or better. Here then is where we have made least progress in our forestry effort (fig. 8).

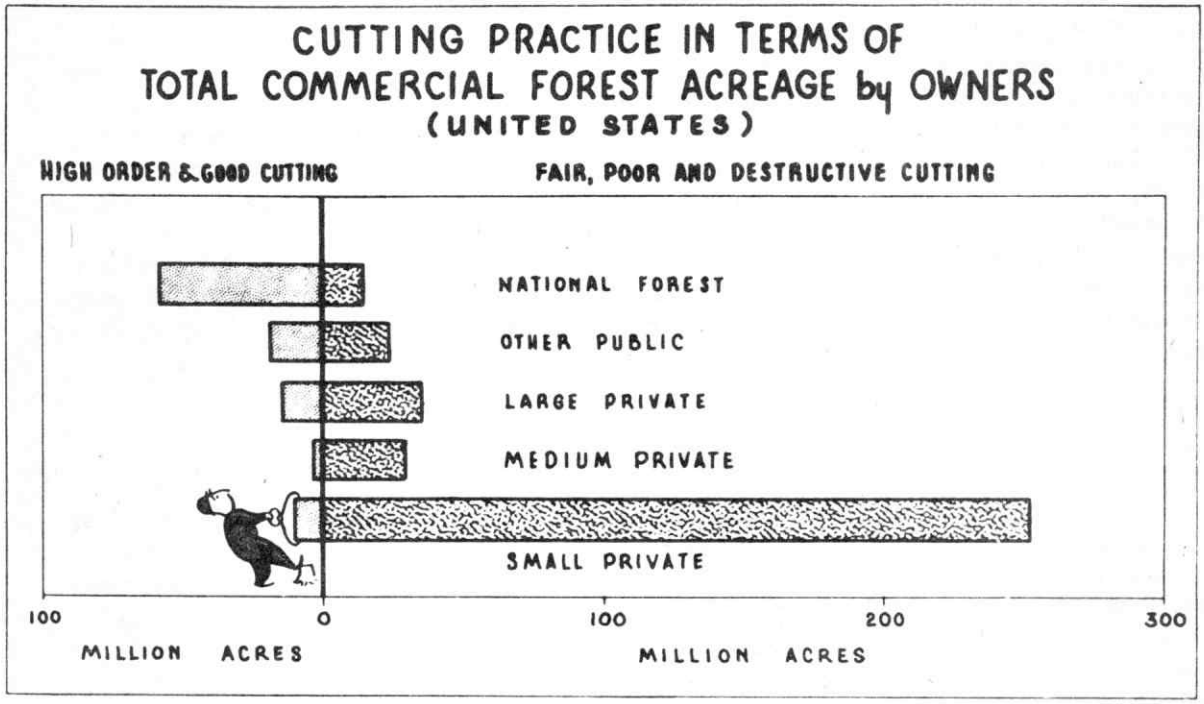

Figure 8

About half of the acreage in small holdings is on farms. Farmers, in fact, comprise more than three-fourths of the small woodland owners. They average only 41 acres of woodland each. While such small forest acreage cannot provide the main source of income to the owner, it can contribute to farm living by supplying fuel, posts, or lumber for farm use as well as some supplementary cash income. The farm woodland can be and often is handled as an integral part of the farm business. But unfortunately in the poorer farming sections, where the acreage of woodland may be above average, the perennial need for cash has generally resulted in liquidation of timber values. Thus where the need is greatest, the woodlands are seldom any longer in condition to contribute as they should.

The other half of the small holdings is owned by investors, professional people, farm estates, small businessmen, and others. While these holdings average more than three times as large as the farm woodlands (130 acres), they are like the latter in that they are generally too small to be the major support of their owners. These holdings frequently have the disadvantages of nonresident ownership and a lack of interest in forestry on the part of the owners. But these things may be largely offset by freedom from the day-to-day pressure to cut that faces so many of the farm owners and operators. At any rate, cutting practices are about the same for the two groups of small holdings.

It is likely that many of the small holdings will be purchased by large owners who need more land to sustain their operations. Others may be consolidated with farms that are expanded into more adequate operating units. In areas of serious maladjustment of rural population and land use, some of the small forest land holdings, both farm and nonfarm, should be taken into public ownership. All the desirable blocking of small holdings will, however, answer only a part of the problem. Small holdings, and especially family-size farms, will continue to be an essential feature of the American scene. We must find ways and means to help the small woodland owner practice better forestry and thus fully realize the values which these lands can produce.

The Job To Be Done

It has been pointed out that to achieve an annual growth goal of 20 billion cubic feet of all timber including 72 billion feet of saw timber with a reasonable proportion in trees suitable for exacting uses, we shall have to increase our annual growth of all timber by one-half and double the saw-timber growth. It remains to consider what needs to be done to put our forest in condition to yield such a quantity of desirable timber products, how we can bridge the gap created by short supply, and how soon we may hope to achieve our objectives.

Better forest practices.—The most important step to check the downward trend in our forest growing stock and to head it in the other direction is better forest practices, mainly on private lands.

It is worth while to turn again to figure 8 to emphasize this point. Good cutting on the national forests and other Federal lands, which now support two-fifths of all our saw timber, assures an important backlog of sustained output, principally in the West. Progress on State and local public lands and by a substantial number of large private owners who are interested in a permanent supply of timber is bringing additional millions of acres under good management. But as yet the efforts of all agencies—public and private alike—to improve practices on the small and medium-sized private holdings, which account for almost two-thirds of all our commercial forest land, have barely scratched the surface.

Good cutting practice alone would check the premature stripping of young second growth. It would not tolerate the "high grading" that has deteriorated our forests so badly in the past. It would remove the decadent and poor-risk trees from many virgin timber types, leaving a substantial number of thrifty trees to accumulate effective growth. And, if we are to achieve our goal, intensive management that will build up and maintain yields consistent in both quantity and quality with the full productive capacity of the land should be applied to something like one-fifth or even one-fourth of the commercial forest area. Improved forest practices are the surest and most effective means of increasing the annual growth without delay. If we would enjoy the security of an adequate timber supply, we must have a much stronger program to overcome unsatisfactory forest practice and a much wider application of sustained yield management. Some of the land now in private ownership may need to be shifted to public ownership.

More protection.—It is in the protection of our forests from fire that most progress has been made. From the time of the Miramichi fire which swept over 3 million acres of Maine and New Brunswick back in 1825 to the third Tillamook fire in Oregon in 1945, the history of this country has been studded with great conflagrations. Far more costly, though less spectacular, have been the year-after-year losses from thousands of smaller fires. To cope with this threat has been a big job and it is to the credit of both private and public agencies that the fire problem is today far less critical than it was even a few years ago. The big fires are not so frequent and seldom as large as they once were and the total damage from all fires is steadily being reduced.

Today organized fire protection covers 80 percent of all the forest land needing protection in the United States. While the burned area is still quite large—17.7 million acres in 1945, four-fifths of the annual burn is on the one-fifth of the forest which is not protected. Extending coverage to the land now unprotected would lead to a substantial increase of annual timber growth. Furthermore, much can be done to strengthen the fire control effort on areas already receiving some protection. The need is particularly great in the Southeast, West Gulf, and Central regions where more than half of the private forest land receives either no protection or poor protection.

Better fire control will reduce the losses of merchantable timber, but the effect of better protection will come chiefly in saving for future timber production the millions of seedlings and saplings burned each year. In the pine forests of the South, for example, fires are chiefly responsible for inadequate stocking.

It is also important to extend and improve our protection against insects and disease, which destroy more timber each year than fire. Furthermore, outbreaks of defoliating insects, like the gypsy moth, cut down the rate of timber growth. And diseases, such as blister rust which kills off white pine reproduction, reduce our forest growth potential.

More planting.--We have a huge tree planting job ahead to lay the foundations for timber growth on a large part of the 75 million acres of commercial land now denuded or only poorly stocked with seedlings and saplings. While some of this land will restock naturally, there are additional partially stocked areas which should be interplanted to build up the stocking of desirable species rapidly for better future yields. In addition agricultural conservation programs envisage planting several million acres of submarginal farm land. How much we can reasonably expect to plant is difficult to estimate. It might be 30 to 35 million acres. The size of the job can be gaged by the fact that all forest planting in the United States to date has covered little more than 5 million acres.

Less waste.--Only about half of the 12.2 billion cubic feet of timber cut in 1944 appeared in the primary products for which the trees were cut. The other half was left in the woods as waste in logging or went into mill waste as slabs, edgings, trimmings, sawdust, shavings, and other fine material. One-third of this 6 billion cubic feet of waste was used for fuel but the balance was not used at all. In addition about 9 million tons of lignin, cellulose, and other chemical residue from the manufacture of wood pulp was wasted. Along with the 9 percent of the standing timber which is in cull trees, this waste wood represents an important potential source of raw material. If a greater proportion of the trees cut and more cull trees can be put to commercial use, there will be a corresponding reduction in the amount of timber growth needed to meet total requirements for forest products.

The greatest opportunities for better utilization lie in the Pacific Northwest because there the heavy volumes-per-acre and big mills result in large concentrations of waste. It is estimated that in the Douglas-fir region the average logged-over acre contains 11,500 board feet of damaged trees and abandoned logs suitable for small mill operation. Already some operators are using portable mills, chippers, and light tractors to go in for the stranded logs and damaged trees after the main stand has been removed, or to take out in advance the trees likely to be damaged in the main logging job.

The vast quantity of slabs, sawdust, and other waste concentrated at the big mills in the West is a possible source of cheap raw material for pulp or chemical plants. The prospect that ethyl alcohol, fodder yeast, a variety of plastics, and other new products may be profitably made from wood is alluring. Actually, though, the intense competition to be expected from the chemical derivatives of coal, petroleum, and agricultural products gives reason to question whether the expansion of wood chemical industries will be as great as is sometimes assumed.

Progress in using waste has been slow for economic reasons and because individual wood-using enterprises have generally been organized for a single purpose. Clearly it is impossible to use all of the tree in the manufacture of a single product such as lumber, veneer, or pulp. So a large part of the tree is wasted or used to stoke the boilers. Integrating the industries is not as easy as it might seem. For example, an economical unit for pulp production requires more wood than most sawmills have available as waste. Again, though pulp mills should be able to use the tops of trees cut for lumber, it is easier and perhaps more profitable to make pulp from better-grade material.

While known processes may eventually lead to the use of several hundred million cubic feet annually of wood now wasted, the amount that is likely to be saved by these processes would not reduce our growth goal very much. However, the challenge to develop new processes to further reduce wood waste and use more of it remains before us.

Bridging the Gap

Today the Nation faces something of a dilemma. We are experiencing a critical shortage of forest products. The cry is to increase output. Yet even the present rate of saw-timber cutting exceeds our annual growth. To increase current output implies an acceleration of timber depletion. The question is, To what extent can we meet the urgent needs of the present situation without further impairing future productivity? If we are to bridge the gap between present output and potential requirements we shall for several decades have to exercise restraint in what we take from northern and southern forests and lean more heavily on the West.

At present the West, with 65 percent of our saw timber, accounts for only 37 percent of the drain. Sixty-three percent of the saw-timber drain, and a still larger part of all timber drain, takes place in the North and South. Under the impact of this drain, growing stock is diminishing; yet in the allocation of our saw-timber growth goal it was suggested that we should aim to make the forests of the North support twice the 1944 drain and those in the South 50 percent more. To accomplish this will require that growing stock be built up, and that in turn can be done only by cutting less than we are now. But the very fact of depletion is going to keep the growing stock under constant pressure for overcutting. It will take strong management and wise planning to withstand such pressure.

As we turn to the West to meet a larger part of our needs, we should plan to protect dependent communities from excessive timber depletion that will rob them unnecessarily of the means of existence. And we must recognize that the special values inherent in the high quality of the virgin timber can never be replaced. We should balance the need to maintain output of forest products against the desirability of making the high-quality virgin timber last just as long as possible.

Thus if timber from the West is to relieve the pressure on the eastern forests without detriment to its own future, it is essential to complete as rapidly as possible the job of opening up the undeveloped country. More than anything else, this opening up will involve road construction and plenty of it.

Extending a road system rapidly into undeveloped sections will spin out the old growth by making it possible to spread the cut over a wider area. It will permit salvaging of more bug-killed timber before it rots. It will enable us to market a large volume of inferior species now untouched. It will facilitate selective cutting in types adapted to it, thus adding to the volume of effective annual growth.

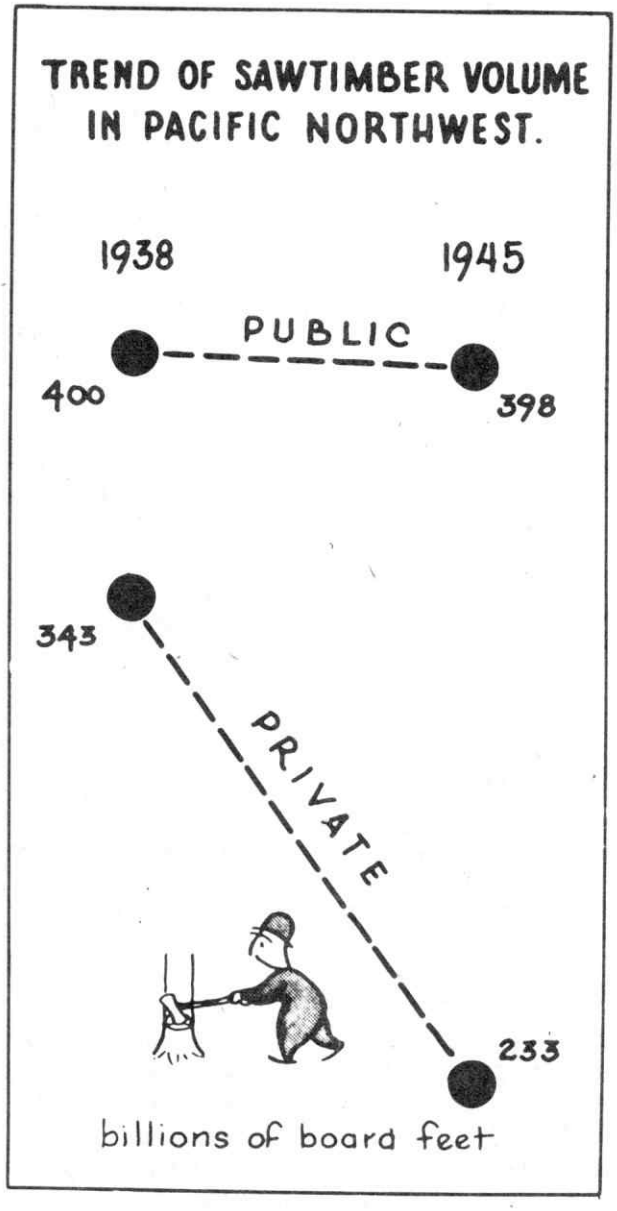

Figure 9

Fortunately a large part of the timber still awaiting access to market is on the national forests and other public land. With private timber playing out, the public forests are assuming a more important place in our current timber supply. This is highlighted by figures for the Pacific Northwest (fig. 9). During the middle thirties the public owned 54 percent of the saw timber in the region; in 1945, 63 percent.

The increasing importance of public timber in the West places a new responsibility on public forest managers.

Between World Wars I and II a major problem of the lumber industry was plant capacity in excess of the market for its products. With private timber pressing to be cut and the industry in a generally precarious position, the sale of national forest timber and the opening up of new units proceeded slowly. In fact, there was widespread opposition among private owners to the sale of public timber. Now that timber shortage is being widely felt and the major opportunities for opening up new timber lie on

the national forests, the Forest Service has embarked on a policy of obtaining from each forest the maximum possible output consistent with sustained yield management. To do this involves a great expansion in timber survey and management plan work. It means taking every opportunity to cull decadent timber from otherwise vigorous stands and to make desirable thinnings in young stands. A far-flung road-building program to gain access to undeveloped areas is already under way, financed in part by the National Housing Administration.

Although the volume of virgin timber in the West is substantial, the opportunities for increased output are limited. The national forest cut may eventually be more than doubled and the cut from other public lands may also be increased. But this is sure to be offset, at least in part, by a decline in the cut from private lands. The situation in most of the older lumber producing sections is precarious. Lack of available stumpage has caused many mills to shut down in recent years and this process is likely to be accelerated.

In the Pacific Northwest, new opportunities for large-scale operations are confined largely to southwestern Oregon. But it is doubtful if increased output from this part of the region will offset the decline in the older sections farther north. Although large-scale development is of recent origin in southwest Oregon, sawmill capacity has already risen close to the sustained yield capacity of the forest there.

Theoretically, there is considerable room for new operations in the Rocky Mountain regions and California, particularly the latter. But increasing the cut in these regions is not simple. Much of the timber is of little-used species and in light stands. A good part of it is on rough rocky ground where logging will be more expensive than at present.

We may also turn to Alaska, whose timber resources have not yet been tapped on a large scale. Alaska has a substantial volume of timber. Much of it, however, is in the vast undeveloped interior where the trees are of small size. It is unlikely that the interior forests can be opened up for commercial use. On the other hand, we have a rich resource in the coastal forests that may well make some contribution to our needs. The accessible commercial timber occurs in a narrow fringe on the lower slopes of the mountains along the tidewater of southeastern Alaska. Most of it is in the national forests. The bulk of the stand is western hemlock, intermixed on the better sites with Sitka spruce—often of large size and high quality—and some cedar.

Forest Service policy calls for the establishment of pulp mills in Alaska as the foundation for an integrated group of industries making effective use of all the timber. Such an undertaking would entail a heavy capital investment. The pulp plants would have to be large and self-contained, and transportation costs might present some problems in getting the output of the supplementary industries to markets in the States. When such enterprises can be attracted to Alaska, the territory should be able to supply 1,500,000 cords of pulpwood annually or about 7 percent of our potential requirements.

Import prospects.—To a certain extent we may look outside the borders of the United States and Alaska for timber products to help bridge the gap. However, there is less opportunity to increase our imports than might be supposed.

Canada's forests are in much the same condition as ours. During the war imports of forest products from Canada were greater than they had been previously. It is doubtful if we can continue to get as much lumber there as we did during the war. The United Kingdom takes the bulk of Canada's lumber export. On the other hand indications are that for 20 years or more we may be able to get somewhat more of our pulp and paper from Canada, especially newsprint paper.

Some consumers have turned to Central and South America for timber supplies, but relief from this direction is not likely to be large and it will be chiefly in hardwoods.

For a number of years Europe will have difficulty meeting its own requirements. However, we can count on some pulp and paper from the Scandinavian countries. Russia holds the only possibility for greatly increased production, but her own expanding needs are likely to take most of the timber she can cut for some time.

All in all, there is a world shortage as well as a domestic shortage of timber. So we must make every possible effort to meet our needs from our own forests. And if we are to provide adequately for the future, we may, after the housing shortage has been eased, need to curtail timber use for a number of years in order to build up and safeguard essential growing stock.

When Could We Reach Our Objective?

The seriousness of the situation and the size of the job to be done can be driven home by inquiring how soon we could reach our objective in saw-timber growth if a comprehensive program dealing adequately with all phases of the problem were in effect. Assuming that the forests were all well protected, that 400 million acres of commercial forest were really being managed with the idea of building up growing stock and output, that from 20 to 25 percent of all the commercial forest land were under truly intensive management, that planting of nonproductive lands were undertaken on an unprecedented scale, and that access road construction were pushed rapidly ahead of the need for new operating chances in the West: How much timber could we plan on harvesting each year, and how rapidly could we build up our forests to the point where they would support our growth goals?

No hard and fast answer can be given to a proposition of this sort. But we know enough about the condition of our forests and their potential growth capacity to be able to give a fairly reliable picture of possible accomplishment. Using information supplied by fieldmen familiar with local conditions, calculations of growing stock in each region have been carried forward for 75 years, balancing the growth that might be realized under such a comprehensive forestry program against an assumed saw-timber drain decade by decade. In these calculations a major consideration was how nearly the annual output could be kept from dropping below the level of 1944 without precluding the possibility of reaching the regional growth goal in a reasonable period. The story is told graphically in figure 10.

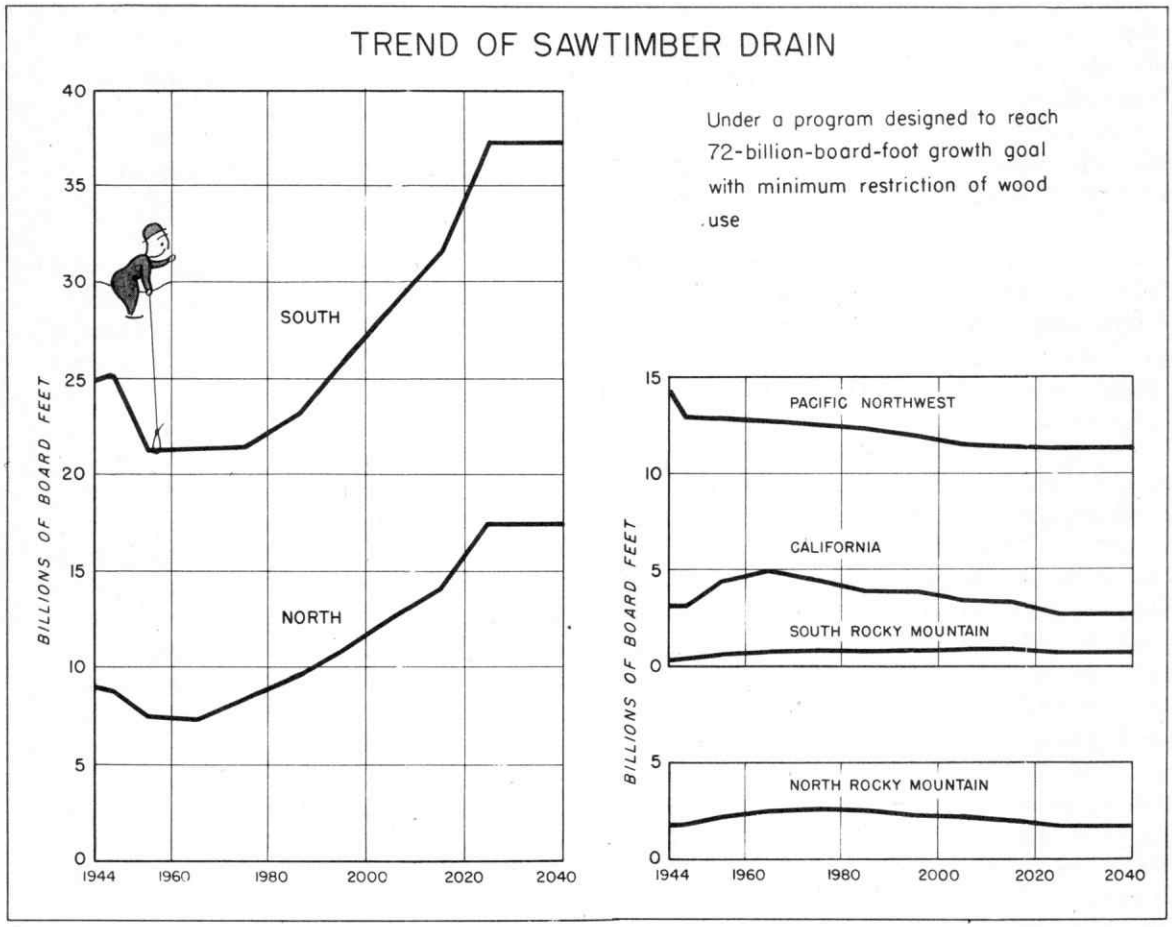

Figure 10

Because of growing-stock shortages in every eastern region except the Middle Atlantic and South Atlantic, it does not seem likely that the North and South can ward off for more than 5 years a decline of saw-timber cut to some 5 billion board feet below the 1944 level. Moreover, there is little prospect that output could safely be boosted again for 30 years after that. Indeed, experience since 1944 indicates that only by extraordinary measures can we hope to get the East to contribute at the 1944 level to the urgent housing and other needs of the next few years. Eventually of course eastern forests should yield much larger quantities, but only after the growing stock has been substantially increased.

In the Pacific Northwest, timber depletion has already progressed so far that there is little hope that saw-timber cut will again come within 1½ billion board feet of the 1944 level. In fact, after a few decades of operation under forced draft, local timber surpluses would be exhausted and output of this region would need to taper off an additional 1½ billion. This would bring it down to the level suggested in our allocation of the growth goals.

In the North Rocky Mountains, access roads and utilization of the less favored species may increase drain almost 1 billion board feet annually for 30 to 40 years. But after that, output would need to taper off again to somewhere near the 1944 level, which is about as high as it is reasonable to set the regional growth goal. Similarly, if economic conditions permit, the output of the South Rocky Mountains region could theoretically be doubled. But that would represent a gain of only ½ billion board feet.

In spite of prospective shortages in several of its producing centers, California seems to hold most promise for increased output in the years immediately ahead. With access roads to permit operating in all the remaining virgin areas in the course of 30 to 40 years, and with partial cutting generally applied, the effective growth that might be realized appears sufficient to permit the drain in that State, reported at 3.1 billion board feet in 1944, to rise to 5 billion board feet 20 years hence. However, after the virgin stands had all been worked over, output would need to drop again, probably to a level somewhat below the 1944 figure.

Summing up the situation nationally, these calculations indicate that even with the best possible progress under a constructive program of forestry, we cannot hope in the next 25 to 30 years to come within 14 billion board feet of potential requirements plus losses, to say nothing of providing a margin for security, export, and other factors (fig. 11).

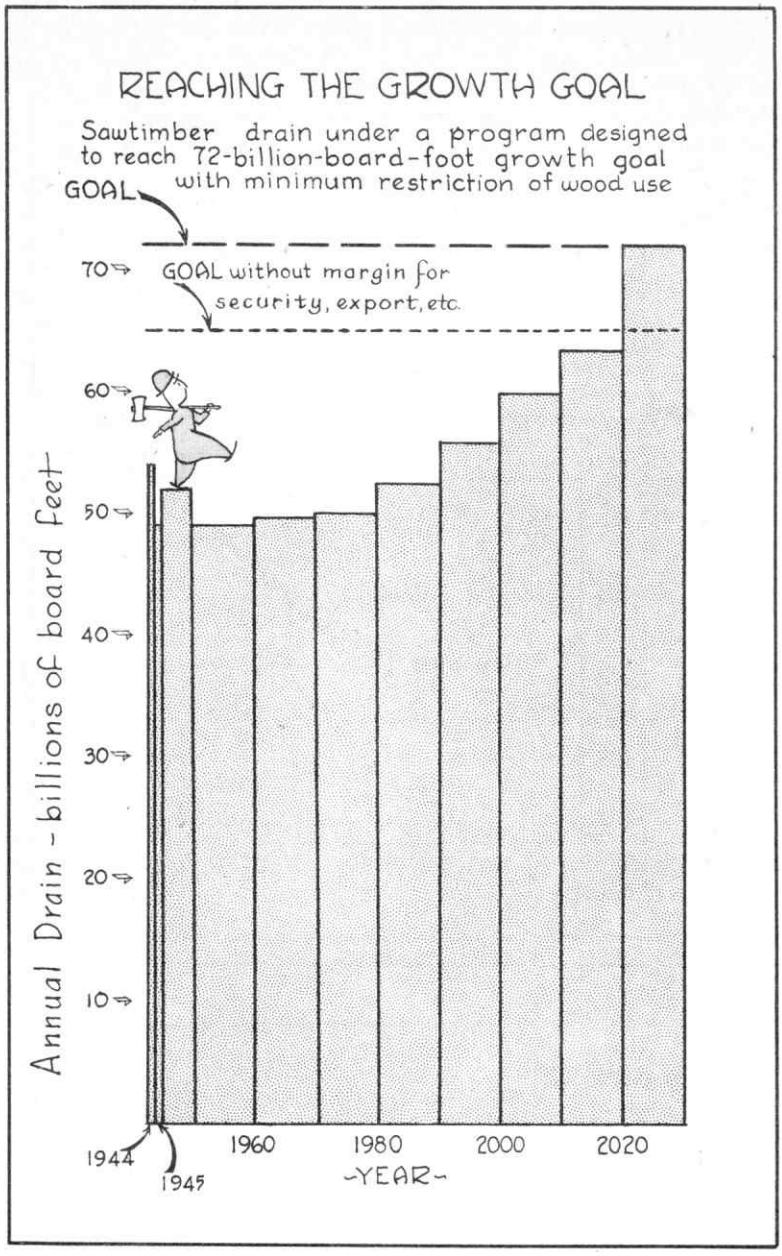

Figure 11

It looks as though drain should be held below 50 billion board feet for several decades (as contrasted to 54 billion in 1944) before any large net expansion of forest industry could safely get under way. Ordinarily a total drain of 50 billion board feet or less would mean a lumber output of only 30 or 31 billion board feet. Because of the urgent demand for new homes, figure 11 has been drawn to show an average drain for the next 5 years some 3 billion board feet above this level. Under the stimulation of the housing program, output in the next few years may go even higher than that. But such an increase in output would mean further reduction of growing stock and greater curtailment later.

If the suggested forestry and cutting program were followed, our sawtimber stand would sink from its present level of 1,600 billion board feet to 1,400 billion board feet 25 to 40 years hence. After that it would rise toward the level of 1,700 billion thought necessary to sustain our growth goals. In the North, growing stock would build up from 220 to 405 billion board feet (fig. 12); the South would slump some 50 billion board feet to about 290 billion some 20 years hence before rising steadily to the more than 600 billion we should have there in the future. Timber stands in the West would decline from 1,043 to 715 billion board feet --rapidly for 30 to 40 years, more gradually thereafter.

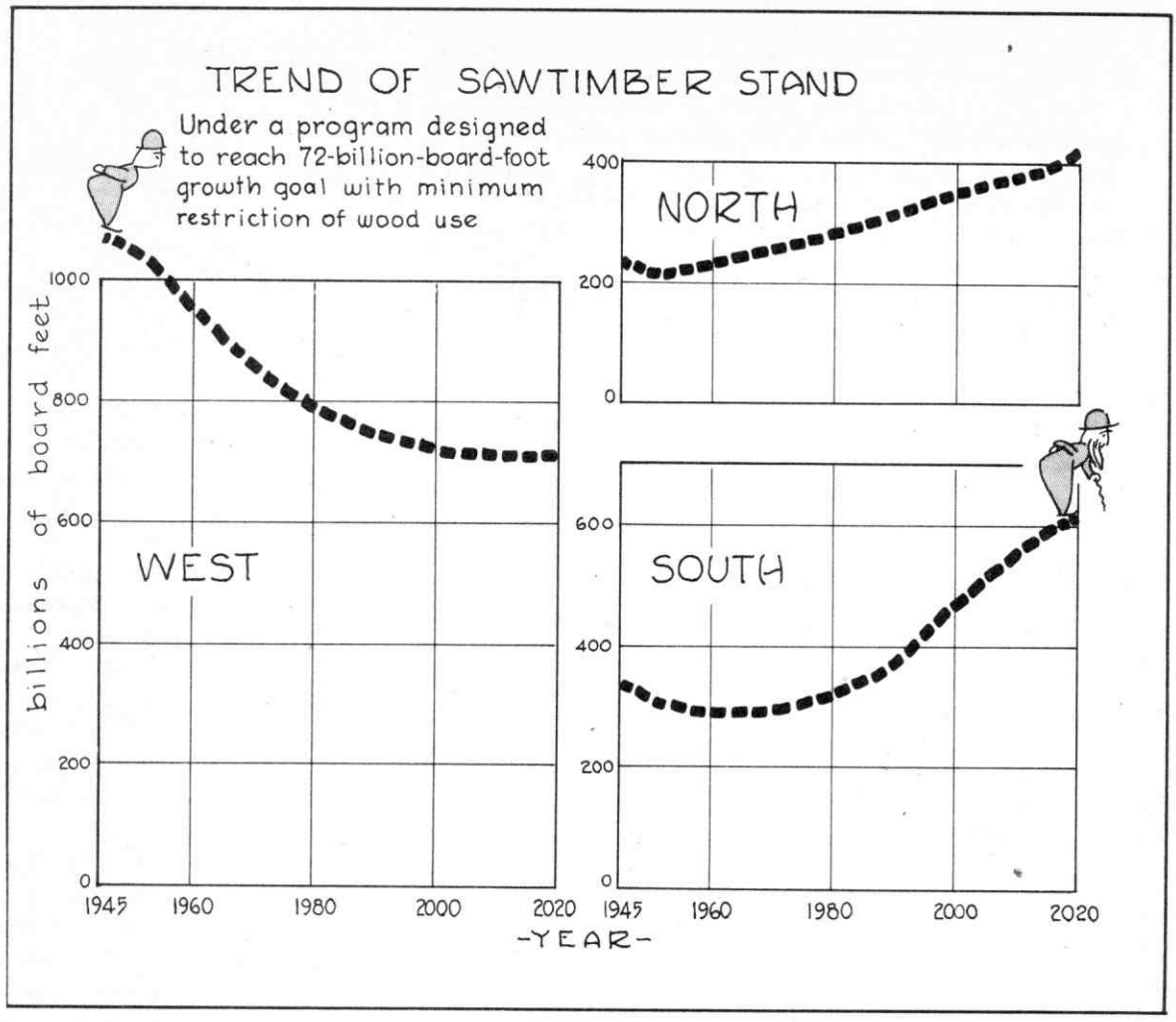

Figure 12

Figure 13 shows how annual saw-timber growth might increase under the comprehensive forestry program with drain following the hypothetical course suggested in figure 11. For the first 30 years, drain might remain higher than annual growth. From the outset, however, growth would be increasing steadily. This would be possible chiefly because of the large part the remaining virgin timber would play in the early decades of our program of cutting.

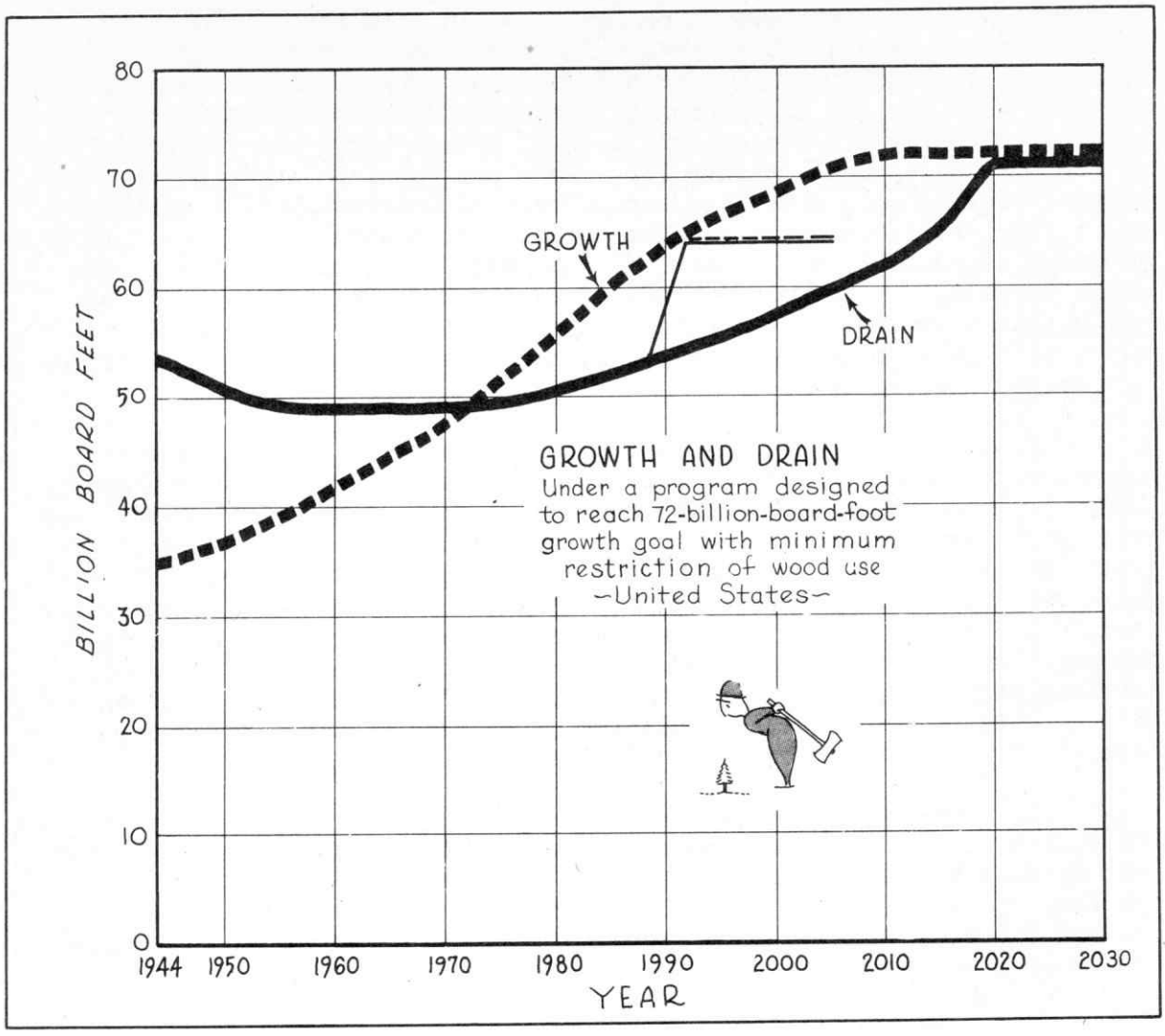

Figure 13

In 45 years timber growth in the United States would have advanced under the program to about 64 billion board feet, which is the level of estimated potential requirements plus losses, with no margin for security, export, new uses, or ineffective growth. By that time the assumed program would be adding to productive growing stock at the rate of 10 billion board feet yearly. If growing stock were not to be built up beyond this 64-billion-board-foot level, the annual drain could rise to that point about the year 1990 and annual growth would then level off, as indicated by the light lines in figure 13. However, if the 72-billion-board-foot goal were to be achieved, it would be necessary to continue the build-up of growing stock and growth for another 25 or 30 years.

It is important here to emphasize again that there is nothing rigid about the growth objectives we have proposed, or the possible course of growth and drain under a forestry program designed to achieve the goal with minimum disruption of forest industries and markets. The growth goals simply represent one view of what a large and vigorous nation like ours should strive for. They are based on study of potential requirements under the assumptions of reasonably full employment and timber available at reasonable price. If we should not have full employment we probably would not feel the need for as much timber as the goals suggest. On the other hand, if we did have full employment, but did not have enough timber (which would seem to be the inescapable reality with full employment), we would doubtless use more brick and stone and metals instead of wood.

Similarly, the hypothetical cutting program with the resultant increase in annual growth, while based on careful analysis of the possibilities in each region, is only one course that might be followed. Cutting more heavily than indicated for any extended period would delay or preclude the increase in annual growth envisaged for the North and South. It might lead to a protracted period of greatly reduced cut in the West, should the virgin timber be exhausted before new growth was ready to support the indicated sustained volume of output. On the other hand, several years of greatly reduced output in a depression like that of the thirties might result in building up growing stocks, and hence annual growth, more rapidly than indicated.

Whether the goals are several notches high or low, and whether we follow the indicated course of output, will not change the character of the action needed. And whether the goals are several notches high or low, and whether we follow the indicated course of output, does not change the fact that we cannot hope to meet the potential wood requirements of a prosperous economy for many years.

The question, however, is not whether we can get along without the generous supply of timber products we might obtain from productive forests, but rather what economic strength and security we lose in getting along with a short supply. Among other things, the timber products industries provide the base of employment for an important segment of the population. No nation with vision can afford to let a renewable resource that is so vital to its welfare deteriorate. When we realize that the goals, however high and distant they may seem, can be achieved by a well-rounded Nation-wide forest program in no more than the time required in most of our timber types to grow good sawlogs from seedlings, we should not hesitate to accept the challenge. If we are wise, we will take steps to keep our wood box full.

Table 16.--Land area of the United States, by major uses and by region [1/]

Region	Total Land Area	Forest Land					Crop land in farms	Pasture and range [5/]			Other [6/]
		Total	Commercial [2/]	Non-Commercial				Total	In farms	Not in farms	
				Total	Withdrawn [3/]	Other Values [4/]					
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
New England	40,451	31,092	30,851	241	165	76	5,180	1,321	1,321	...	2,858
Middle Atlantic	[7/] 87,369	44,214	41,586	2,628	2,489	139	27,650	6,550	6,550	...	[7/] 8,955
Lake	122,718	55,700	50,345	5,355	1,138	4,217	47,911	6,027	5,881	146	13,080
Central	191,129	44,919	44,213	706	432	274	115,189	11,058	10,672	366	19,983
Plains	380,016	35,828	3,326	32,502	54	32,448	168,594	160,985	124,651	36,332	14,611
North	821,683	211,753	170,321	41,432	4,278	37,154	364,524	185,919	149,075	36,844	59,487
South Atlantic	76,566	43,843	42,923	920	639	281	21,914	2,816	2,816	...	7,993
Southeast	162,074	91,842	89,390	2,452	671	1,781	46,806	6,108	4,780	1,328	17,318
West Gulf	87,405	51,119	50,953	166	37	129	22,806	2,506	2,108	398	10,972
South	326,043	186,804	183,266	3,538	1,347	2,191	91,526	11,430	9,704	1,726	36,283
Pacific Northwest											
Douglas fir sub-region	35,119	29,145	26,027	3,118	1,032	2,086	2,749	1,576	1,533	43	1,649
Pine sub-region	69,410	24,710	20,177	4,533	472	4,061	9,686	34,335	12,579	21,756	679
Total	104,529	53,855	46,204	7,651	1,504	6,147	12,435	35,911	14,112	21,799	2,328
California	100,354	45,515	16,405	29,110	705	28,405	11,899	15,366	9,373	5,993	27,574
North Rocky Mtn.	212,782	53,246	29,066	24,180	2,876	21,304	23,638	131,633	57,437	74,196	4,265
South Rocky Mtn.	339,971	72,655	15,782	56,873	1,883	54,990	21,089	229,225	61,432	167,793	17,002
West	757,636	225,271	107,457	117,814	6,968	110,846	69,061	412,155	142,354	269,781	51,169
All Regions	1,905,362	623,828	461,044	162,784	12,593	150,191	525,111	609,484	301,133	308,351	146,939

1/ Prepared by Forest Service, U. S. Department of Agriculture. Status beginning of 1945.
2/ Land capable of producing timber of commercial quantity and quality, and available now or prospectively for commercial use.
3/ Commercially valuable land in parks, preserves, etc., withdrawn from timber use.
4/ Land chiefly valuable for purposes other than timber production, such as the oak-cedar breaks of Texas and Oklahoma, mesquite, pinon-juniper in the West, chaparral in southern California, remote and inaccessible alpine ranges, and other areas which appear to be permanently out of the commercial timber-producing class because of low productivity or extreme inaccessibility. About half is publicly owned. Much of the area has an important value in protecting the watersheds of navigable streams, preventing or reducing soil erosion, protecting wildlife, providing game cover, etc.
5/ Exclusive of that in forest land.
6/ Farmsteads, roads, urban waste, etc.
7/ Includes District of Columbia, 39 M acres.

Table 17.--Total commercial-forest area of the United States by character of growth and by region 1/

Region	Total		Saw-timber area 2/			Pole-timber area 3/	Seedling and sapling area 4/	Poorly stocked seedling and sapling, and denuded area 5/
			Total	Virgin growth	Second growth			
	Thousand acres	Percent	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
New England	30,851	6.69	13,895	188	13,707	8,116	5,503	3,337
Middle Atlantic	41,586	9.02	14,813	161	14,652	12,714	8,200	5,859
Lake	50,345	10.92	6,470	1,510	4,960	9,505	20,480	13,890
Central	44,213	9.59	11,936	230	11,706	10,049	14,642	7,586
Plains	3,326	.72	1,082	200	882	1,061	545	638
North	170,321	36.94	48,196	2,289	45,907	41,445	49,370	31,310
South Atlantic	42,923	9.31	22,854	..	22,854	7,195	9,155	3,719
Southeast	89,390	19.39	43,537	436	43,101	15,869	8,992	20,992
West Gulf	50,953	11.05	31,986	537	31,449	6,258	4,726	7,983
South	183,266	39.75	98,377	973	97,404	29,322	22,873	32,694
Pacific Northwest								
Douglas-fir subregion	26,027	5.64	13,158	9,348	3,810	4,394	3,040	5,435
Pine subregion	20,177	4.38	13,140	9,171	3,969	3,107	3,115	815
Total	46,204	10.02	26,298	18,519	7,779	7,501	6,155	6,250
California	16,405	3.56	10,897	8,400	2,497	3,398	53	2,057
North Rocky Mountain	29,066	6.31	11,991	7,292	4,699	9,913	5,524	1,638
South Rocky Mountain	15,782	3.42	9,417	7,145	2,272	3,454	1,577	1,354
West	107,457	23.31	58,603	41,356	17,247	24,246	13,309	11,299
All regions	461,044	100.00	205,176	44,618	160,558	95,013	85,552	75,303

1/ Prepared by Forest Service, U. S. Department of Agriculture. Status beginning of 1945. Includes land capable of producing timber of commercial quantity and quality, and available now or prospectively for commercial use.

2/ Includes areas characterized by timber large enough for sawlogs (lumber) regardless of its actual use, and in sufficient volume per acre for economic operation, both in accordance with the practice of the region.

Virgin saw timber includes mature or overmature forests not seriously disturbed by cutting or by fire, insect and disease infestations, or other natural causes, and generally characterized by the absence of any net growth; and mature or overmature forests so lightly cut or otherwise disturbed as not to make any material change in the original forest canopy or the quality of the original stand, or to induce net growth in any appreciable amount.

Second-growth saw timber includes forests which have been cut over or which have been so disturbed by fire, insects or disease, windstorms, or other natural causes that net growth occurs and they no longer qualify as virgin forests.

Minimum specifications are as follows:

New England and Middle Atlantic: 2,000 board feet per acre in softwood trees 9" D.B.H. and larger and 11" D.B.H. and larger in hardwoods.

Lake and Plains: 2,000 board feet per acre in trees 9" D.B.H. and larger.

Central: 1,000 board feet per acre in trees 10" D.B.H. and larger.

South Atlantic, Southeast, West Gulf: At least 600 board feet per acre in trees 9" D.B.H. and larger of pine and cypress, and 13" and larger of hardwoods.

Pacific Northwest (Pine subregion), North Rocky Mountain, South Rocky Mountain: In pine type, at least 3,000 board feet per acre in trees 11" D.B.H. and larger of pine, cedar and cottonwood and 13" and larger of fir and hemlock; in fir type, 5,000 board feet per acre in trees 11" D.B.H. and larger.

Pacific Northwest (Douglas-fir subregion): 5,000 board feet per acre in trees 15" D.B.H. and larger.

California: East side, 4,000 board feet per acre in trees 12" D.B.H. and larger; West side, 7,500 board feet per acre in trees 12" D.B.H. and larger; Redwood, 10,000 board feet per acre in trees 24" D.B.H. and larger.

3/ Pole timber areas are characterized by timber too small for sawlog operation but large enough for cordwood (5" D.B.H. and larger) regardless of whether the stand is cut for this use or held for saw timber. Timber of pole size or larger must occupy more than 10 percent of the growing space. For the East generally, a minimum volume of 2 cords per acre was set; does not include noncommercial woodland, even though subject to some cordwood cutting.

4/ Seedling and sapling areas are those on which at least 40 percent of the growing space is occupied by commercial species predominantly below pole-timber size and below minimum volume per acre for saw-timber or for pole timber.

5/ Poorly stocked seedlings and saplings and denuded includes lands that do not qualify in any previous class.

Table 18.--Board-foot volume of saw timber on commercial forest land in the United States, by softwoods and hardwoods, and by virgin and second-growth saw timber and other areas; by regions 1/

Region	Total		Softwoods	Hardwoods	On saw-timber areas		On other than saw-timber areas
					On virgin areas	On second-growth areas	
	Million board feet	Percent	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet
New England	58,197	3.63	33,263	24,934	726	48,605	8,866
Middle Atlantic	62,045	3.89	14,017	48,028	1,197	47,459	13,389
Lake	50,710	3.17	15,670	35,040	17,390	23,280	10,040
Central	43,747	2.75	2,418	41,329	1,249	36,616	5,882
Plains	5,750	0.36	468	5,282	1,090	3,426	1,224
North	220,429	13.77	65,836	154,593	21,642	159,386	39,401
South Atlantic	97,141	6.07	59,328	37,815	...	90,205	6,936
Southeast	135,887	8.49	76,992	58,895	4,674	121,473	9,740
West Gulf	104,959	6.55	57,472	47,487	6,943	94,155	3,861
South	337,987	21.11	193,790	144,197	11,317	305,833	20,537
Pacific Northwest							
Douglas fir sub-region	504,931	31.54	501,065	3,866	406,271	95,811	2,849
Pine sub-region	125,963	7.87	125,876	87	104,878	17,895	3,190
Total	630,894	39.41	626,941	3,953	513,149	111,706	6,039
California	227,565	14.21	227,565	...	180,082	32,624	14,859
North Rocky Mountain	127,229	7.95	126,293	936	69,810	43,212	14,207
South Rocky Mountain	56,868	3.55	55,952	916	44,040	7,958	4,870
West	1,042,556	65.12	1,036,751	5,805	807,081	195,500	39,975
All Regions	1,600,972	100.00	1,298,377	304,595	840,540	660,719	99,913

1/ Prepared by Forest Service, U. S. Department of Agriculture. Status beginning of 1945. Includes volume on land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use. Includes trees large enough for sawlogs regardless of the actual use, in accordance with the practice of the region. Volumes are on lumber-tally basis.

Minimum sizes of saw-timber trees:
New England, Middle Atlantic: 9" D.B.H. for softwoods and 11" for hardwoods.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Atlantic, Southeast, West Gulf: 9" D.B.H. for pine and cypress and 13" for hardwoods.
Pacific Northwest (Pine sub-region), North Rocky Mountain, South Rocky Mountain: in the pine type, 11" D.B.H. for pine, cedar and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas fir sub-region): 15" D.B.H.
California: all except redwood type 12" D.B.H.; redwood type 24" D.B.H.

Virgin growth includes mature or over-mature forests not seriously disturbed by cutting or by fire, insects and disease infestations, or other natural causes, and generally characterized by the absence of any net growth; and mature or over-mature forests so lightly cut or otherwise disturbed as not to make any material change in the original forest canopy or the quality of the original stand, or to induce net growth in any appreciable amount.

Second growth includes forests which have been cut over or which have been so disturbed by fire, insects or disease, wind storms, or other natural causes that net growth occurs and they no longer qualify as virgin forests.

Table 19.--Cubic-foot volume of softwoods and hardwoods on commercial forest land in the United States, by size of trees and by region 1/

Region	All Material				Saw-timber trees 2/			Pole-timber trees 3/		
	Total		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cubic feet	Percent	Million cubic feet	Million cubic feet	Million cubic feet	Million cubic feet	Million cubic feet	Million cubic feet	Million cubic feet	Million cubic feet
New England	24,626	5.24	11,318	13,308	13,314	6,651	6,663	11,312	4,667	6,645
Middle Atlantic	27,359	5.82	5,376	21,983	15,231	2,831	12,400	12,128	2,545	9,583
Lake	23,200	4.94	7,000	16,200	13,700	4,200	9,500	9,500	2,800	6,700
Central	20,992	4.47	1,479	19,513	10,956	546	10,410	10,036	933	9,103
Plains	3,723	0.79	269	3,454	1,067	90	977	2,656	179	2,477
North	99,900	21.26	25,442	74,458	54,268	14,318	39,950	45,632	11,124	34,508
South Atlantic	35,965	7.65	17,031	18,934	22,189	12,436	9,753	13,776	4,595	9,181
Southeast	54,220	11.53	23,841	30,379	31,021	15,828	15,193	23,199	8,013	15,186
West Gulf	40,689	8.66	17,460	23,229	23,624	11,507	12,117	17,065	5,953	11,112
South	130,874	27.84	58,332	72,542	76,834	39,771	37,063	54,040	18,561	35,479
Pacific Northwest										
Douglas fir sub-region	117,222	24.94	115,499	1,723	90,603	89,926	677	26,619	25,573	1,046
Pine sub-region	28,657	6.10	28,623	34	21,976	21,960	16	6,681	6,663	18
Total	145,879	31.04	144,122	1,757	112,579	111,886	693	33,300	32,236	1,064
California	44,600	9.49	44,600	...	41,250	41,250	...	3,350	3,350	...
North Rocky Mountain	33,350	7.09	32,926	424	21,055	20,856	199	12,295	12,070	225
South Rocky Mountain	15,442	3.28	14,575	867	10,498	10,312	186	4,944	4,263	681
West	239,271	50.90	236,223	3,048	185,382	184,304	1,078	53,889	51,919	1,970
All Regions	470,045	100.	319,997	150,048	316,484	238,393	78,091	153,561	81,604	71,957

1/ Prepared by Forest Service, U.S. Dept. of Agr. Status beginning of 1945. Volume does not include bark. Includes volume on land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use.

2/ Includes tops and limbs (tops only in softwoods) as well as portion of tree suitable for sawlogs.

Minimum sizes of saw-timber trees:
New England, Middle Atlantic: 9" D.B.H. in softwoods and 11" for hardwood.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Pacific, Southeast, West Gulf: 9" D.B.H. for pine and cypress and 13" for hardwoods.
Pacific Northwest (Pine sub-region), North Rocky Mountain, South Rocky Mountain: in pine type 11" D.B.H. for pine, cedar and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas fir sub-region): 15" D.B.H.
California: all except redwood type 12" D.B.H.; redwood type 24" D.B.H.

3/ Includes trees between 5" D.B.H. and minimum saw-timber size.

Table 20.--Volume of saw timber in the United States by species and by region 1/

EASTERN SOFTWOODS

Region	Total	Southern yellow pine	Spruce and fir 2/	White and Norway pine	Hemlock	Cypress	Others
	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet
New England	33,265	142	20,649	7,330	3,764	...	1,378
Middle Atlantic	14,017	4,035	2,718	5,050	3,996	...	218
Lake	15,670	...	3,600	3,690	5,950	...	2,430
Central	2,418	1,727	...	161	345	126	61
Plains	468	51	...	...	...	1	3/ 416
North	65,836	5,955	26,967	14,231	14,053	127	4,505
South Atlantic	59,326	54,954	40	817	726	2,277	512
Southeast	76,992	70,927	...	335	142	3,284	2,304
West Gulf	57,472	56,491	...	...	...	548	433
South	193,790	182,372	40	1,152	868	6,109	3,249
All North and South	259,626	188,327	27,007	15,383	14,921	6,236	7,752

EASTERN HARDWOODS

Region	Total	Oak	Beech, birch and maple	Sweet gum	Tupelo and black gum	Cottonwood and aspen	Yellow poplar	Other
	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet
New England	24,934	2,265	20,740	...	...	1,385	56	488
Middle Atlantic	4/ 48,028	19,012	19,310	...	...	1,154	1,710	6,842
Lake	35,040	5,090	17,090	...	...	6,380	...	6,480
Central	4/ 41,329	20,370	7,207	616	348	2,472	2,169	8,147
Plains	5,262	702	...	36	3	2,414	...	2,107
North	154,593	47,439	64,347	652	351	13,805	3,935	24,064
South Atlantic	4/ 37,815	12,815	2,330	6,667	6,250	116	4,512	5,125
Southeast	4/ 58,895	21,017	1,210	10,516	7,309	907	3,900	14,036
West Gulf	47,987	20,110	...	8,641	5,047	834	...	12,855
South	144,197	53,942	3,540	25,824	18,606	1,857	8,412	32,016
All North and South	4/298,790	101,381	67,887	26,476	18,957	15,662	12,347	56,080

1/ Prepared by Forest Service, U.S. Dept. of Agr. Status beginning of 1945.
2/ Balsam fir.
3/ Ponderosa pine. The total volume of ponderosa pine in the United States is 185,441 million board feet including the 416 million feet in the Plains Region.
4/ Dead chestnut of sawlog size still standing and usable not included, as follows:

Middle Atlantic	453
South Atlantic	890
Southeast	706
Total for North and South	2,049

Also smaller quantities in portions of the Central Region.

Table 20.--Volume of saw timber in the United States by species and by region[1]--continued

WESTERN SPECIES

Region	Total	Douglas-fir	Ponderosa pine	True firs	Western hemlock	Sugar pine and western white pine	Redwood	Spruce	Larch	Lodgepole pine	Other softwoods	Hardwoods
	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet
Pacific Northwest												
Douglas-fir sub-region	504,951	510,525	4,850	46,464	94,469	6,171	...	8,020	145	37	30,386	3,866
Pine sub-region	125,963	20,704	75,548	11,390	1,386	1,918	...	...	8,582	1,134	5,414	87
Total	650,894	531,227	80,198	57,854	95,855	8,089	...	8,020	8,727	1,171	35,800	3,953
California	227,565	2/ 68,613	3/51,191	4/ 43,012	...	19,505	5/ 58,114	...	...	...	7,130	...
North Rocky Mountain	127,229	26,718	26,771	9,360	1,352	12,650	...	12,499	17,879	14,406	4,678	936
South Rocky Mountain	56,868	3,470	26,865	5,315	...	...	...	15,361	...	6,483	458	916
West	1,042,556	430,028	6/185,025	113,541	97,207	40,224	58,114	35,880	26,606	22,060	48,066	5,805

1/ Prepared by Forest Service, U.S. Dept. of Agr. Status beginning of 1945.

2/ May include some white fir, Sitka spruce, western hemlock, Port Orford cedar and western red cedar which are commonly lumped with Douglas-fir in redwood cruising.

3/ Includes Jeffrey pine.

4/ Includes the western white pine, mountain hemlock, and lodgepole pine recorded in cruises of fir areas.

5/ Redwood exclusive of volume of 1,000 bigtree reported on cruises in the west-side Sierra sub-region.

6/ Excludes 416 million board feet in Plains Region. Grand total of ponderosa pine in the United States is 185,441 million board feet.

Recapitulation of Table 20

Regional species group	Total	Softwoods	Hardwoods
	Million board feet	Million board feet	Million board feet
Eastern softwoods	259,626	259,626	...
Eastern hardwoods	298,790	...	298,790
Western species	1,042,556	1,036,751	5,805
Total United States	1,600,972	1,296,377	304,595

Table 21.--Ownership of commercial forest land of the United States, by region[1/]

ALL AREAS

Region	All ownerships	Federally owned or managed			State, county and municipal	Private		
		Total	National forest	Other		Total	Farm	Industrial and other
	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
New England	30,851	891	822	69	666	29,294	6,477	22,817
Middle Atlantic	41,586	1,476	1,265	211	3,613	36,497	11,854	24,643
Lake	50,345	6,495	5,455	1,040	14,805	29,045	13,930	15,115
Central	44,213	2,117	1,951	166	326	41,770	25,789	15,981
Plains	3,326	332	30	302	4	2,990	2,960	30
North	170,321	11,311	9,523	1,788	19,414	139,596	61,010	78,586
South Atlantic	42,923	3,485	2,775	710	536	38,902	23,377	15,525
Southeast	89,390	5,909	3,802	2,107	1,216	82,265	33,134	49,131
West Gulf	50,953	4,684	3,561	1,123	408	45,861	12,549	33,312
South	183,266	14,078	10,138	3,940	2,160	167,028	69,060	97,968
Pacific Northwest								
Douglas fir sub-region	26,027	10,201	7,682	2,519	2,616	13,210	1,951	11,259
Pine sub-region	20,177	12,811	9,659	3,152	819	6,547	1,383	5,164
Total	46,204	23,012	17,341	5,671	3,435	19,757	3,334	16,423
California	16,405	8,099	7,684	415	23	8,283	1,309	6,974
North Rocky Mountain	29,066	20,012	18,061	1,951	1,702	7,352	2,847	4,505
South Rocky Mountain	15,782	12,445	10,765	1,680	380	2,957	1,498	1,459
West	107,457	63,568	53,851	9,717	5,540	38,349	8,988	29,361
All Regions	461,044	88,957	73,512	15,445	27,114	344,973	139,058	205,915

1/ Prepared by Forest Service, U.S. Dept. of Agr. Includes land capable of producing timber of commercial quantity and quality, and available now or prospectively, for commercial use. Status beginning of 1945.

Table 22.--Ownership of saw timber on commercial forest land of the United States by region[1/]

Region	All ownerships	Federally owned or managed			State, county and municipal	Private		
		Total	National forests	Other		Total	Farm	Industrial and other
	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet	Million board feet
New England	58,197	2,014	1,894	120	842	55,341	12,214	43,127
Middle Atlantic	62,045	1,863	1,652	211	3,877	56,305	15,855	40,450
Lake	50,710	4,300	3,285	1,015	5,340	41,070	10,910	30,160
Central	43,747	1,431	1,253	178	557	41,759	31,825	9,934
Plains	5,730	138	3	135	1	5,591	5,565	26
North	220,429	9,746	8,087	1,659	10,617	200,066	76,369	123,697
South Atlantic	97,141	6,130	4,316	1,814	1,427	89,584	51,847	37,737
Southeast	135,887	6,406	4,638	1,768	386	129,095	55,743	73,352
West Gulf	104,959	5,575	4,873	702	847	98,537	26,720	71,817
South	337,987	18,111	13,827	4,284	2,660	317,216	134,310	182,906
Pacific Northwest								
Douglas fir sub-region	504,931	265,641	208,384	57,257	35,354	203,936	8,099	195,837
Pine sub-region	125,963	92,860	70,177	22,683	3,856	29,247	2,601	26,646
Total	630,894	358,501	278,561	79,940	39,210	233,183	10,700	222,483
California	227,565	104,192	99,770	4,422	157	123,216	15,348	107,868
North Rocky Mountain	127,229	80,541	73,641	6,900	10,828	35,860	5,424	30,436
South Rocky Mountain	56,868	51,183	44,531	6,652	954	4,731	2,180	2,551
West	1,042,556	594,417	496,503	97,914	51,149	396,990	33,652	363,338
All Regions	1,600,972	622,274	518,417	103,857	64,426	914,272	244,331	669,941

1/ Prepared by Forest Service, U.S. Dept. of Agr. Status beginning of 1945. Includes trees large enough for sawlogs in accordance with the practice of the region regardless of the actual use. Volumes are on lumber-tally basis. This volume occurs on land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use.

Minimum sizes of saw-timber trees:
New England, Middle Atlantic: 9" D.B.H. for softwoods and 11" for hardwoods.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Atlantic, Southeast, West Gulf: 9" D.B.H. for pine and cypress and 13" for hardwoods.
Pacific Northwest (Pine sub-region), North Rocky Mountain, and South Rocky Mountain: in the pine type, 11" D.B.H. for pine, cedar and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas fir sub-region): 15" D.B.H.
California: all except redwood type 12" D.B.H.; redwood type 24" D.B.H.

Table 23.--Current annual growth of all timber and of saw timber on commercial forest land in the United States, by region 1/

Region	All timber growth 2/			Saw-timber growth 3/		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cubic feet	Million cubic feet	Million cubic feet	Million board feet	Million board feet	Million board feet
New England	897	419	478	1,799	910	889
Middle Atlantic	1,397	273	1,124	2,712	597	2,115
Lake	812	178	634	1,403	346	1,057
Central	1,440	95	1,345	2,248	128	2,120
Plains	120	11	109	193	19	174
North	4,666	976	3,690	8,355	2,000	6,355
South Atlantic	1,761	1,007	754	6,106	4,016	2,090
Southeast	2,714	1,480	1,234	8,224	5,284	2,940
West Gulf	1,916	1,033	883	5,608	3,619	1,989
South	6,391	3,520	2,871	19,938	12,919	7,019
Pacific Northwest						
Douglas-fir sub-region	1,024	992	32	3,741	3,669	72
Pine sub-region	219	219	...	483	483	...
Total	1,243	1,211	32	4,224	4,152	72
California	335	335	...	1,160	1,160	...
North Rocky Mountain	540	537	3	1,306	1,302	4
South Rocky Mountain	195	177	18	318	315	3
West	2,313	2,260	53	7,008	6,929	79
All Regions	13,370	6,756	6,614	35,301	21,848	13,453

1/ Prepared by Forest Service, U.S. Dept. of Agr. Status beginning of 1945. Includes growth on land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use.

2/ Annual growth of all trees 5" D.B.H. and larger, including tops and limbs (tops only in softwoods) of saw-timber trees and total volume of trees reaching 5" in D.B.H. each year. Bark not included.

3/ Annual growth on the trees above the following minimum saw-timber sizes and total volume of trees reaching these minimum sizes each year, all on lumber-tally basis:

New England, Middle Atlantic: 9" D.B.H. for softwoods and 11" for hardwoods.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Atlantic, Southeast, West Gulf: 9" D.B.H. for pine and cypress and 13" for hardwoods.
Pacific Northwest (Pine sub-region), North Rocky Mountain, South Rocky Mountain: in the pine type, 11" D.B.H. for pine, cedar, and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas-fir sub-region): 15" D.B.H.
California: All except redwood type 12" D.B.H.; redwood type 24" D.B.H.

Table 24.—Annual drain from all timber and from saw timber on commercial forest lands of the United States, by region 1/

Region	All Timber 2/			Saw Timber 3/		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu.ft.	Million cu.ft.	Million cu.ft.	Million bd.ft.	Million bd.ft.	Million bd.ft.
New England	761	375	386	2,204	1,438	766
Middle Atlantic	846	180	666	2,304	582	1,722
Lake	747	323	424	2,006	839	1,167
Central	1,201	49	1,152	2,342	120	2,222
Plains	118	7	111	176	11	165
North	3,673	934	2,739	9,032	2,990	6,042
South Atlantic	1,596	1,063	533	6,144	4,301	1,843
Southeast	3,023	1,789	1,234	11,924	7,538	4,386
West Gulf	1,842	851	991	6,851	3,798	3,033
South	6,461	3,703	2,758	24,899	15,637	9,262
Pacific Northwest:						
Douglas-fir subregion	2,150	2,145	5	12,006	11,981	25
Pine subregion	468	468	...	2,526	2,526	...
Total	2,618	2,613	5	14,532	14,507	25
California	489	489	...	3,158	3,158	...
North Rocky Mountain	516	310	6	1,792	1,763	29
South Rocky Mountain	104	102	2	480	475	5
West	3,527	3,514	13	19,962	19,903	59
All Regions	15,661	8,151	5,510	53,893	38,530	15,363

1/ Prepared by Forest Service, U. S. Dept. of Agriculture. Includes timber cut for commodities, 1944, and timber removed by destructive agencies (fire, insects, disease, wind, etc.), the latter an average for the 10-year period 1934 - 1943.

This drain comes from land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use.

2/ Annual drain of all trees 5" D.B.H. and larger, including tops and limbs (tops only in softwoods) of saw-timber trees and total volume of trees reaching 5" in D.B.H. each year. Bark not included.

3/ Annual drain on trees above the following minimum saw-timber sizes and total volume of trees reaching these minimum sizes each year. All on lumber-tally basis:
New England, Middle Atlantic: 9" D.B.H. for softwoods and 11" for hardwoods.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Atlantic, Southeast, West Gulf: 9" D.B.H. for pine and cypress, and 13" for hardwoods.
Pacific Northwest (Pine subregion), North Rocky Mountain, South Rocky Mountain: In the pine type, 11" D.B.H. for pine, cedar, and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas-fir subregion): 15" D.B.H.
California: All except redwood type, 12" D.B.H.; redwood type, 24" D.B.H.

Table 25.--Annual drain from all timber and from saw timber on commercial forest lands of the United States, by cutting for commodities and by destructive agents 1/

TIMBER CUT FOR COMMODITIES

Item	All-timber drain 2/			Saw-timber drain 3/		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Lumber	6,711	4,778	1,933	34,391	26,130	8,261
Fuel wood	2,203	719	1,484	3,863	1,957	1,906
Pulpwood	1,306	1,163	143	4,757	4,500	257
Hewed ties	363	153	210	1,643	777	866
Fence posts	220	59	161	226	82	144
Veneer logs	392	165	227	1,971	942	1,029
Mine timbers	225	40	185	320	70	250
Cooperage	174	40	134	744	195	549
Shingles	72	72	..	334	334	..
Other	516	159	357	1,409	604	805
Total	12,182	7,348	4,834	49,658	35,591	14,067
TIMBER REMOVED BY DESTRUCTIVE AGENTS						
Fire	460	247	213	859	547	312
Insects, disease, wind, etc.	1,019	556	463	3,376	2,392	984
Total	1,479	803	676	4,235	2,939	1,296
Aggregate	13,661	8,151	5,510	53,893	38,530	15,363

1/ Prepared by Forest Service, U. S. Dept. of Agr. Commodity drain for 1944, drain by destructive agents, average for the 10-year period 1934-43. Includes drain in volume from land capable of producing timber of commercial quantity and quality and available now or prospectively for commercial use.

2/ Drain from all trees 5" D.B.H. and larger, bark not included.

3/ Drain (lumber-tally basis) from trees above the following minimum saw-timber sizes:
New England, Middle Atlantic: 9" D.B.H. for softwoods and 11" for hardwoods.
Lake, Plains: 9" D.B.H.
Central: 10" D.B.H.
South Atlantic, Southeast, West Gulf: 9" D.B.H. for pine and cypress, and 13" for hardwoods.
Pacific Northwest (Pine subregion), North Rocky Mountain, South Rocky Mountain: In the pine type, 11" D.B.H. for pine, cedar, and cottonwood, and 13" for fir and hemlock; in the fir type, 11" D.B.H.
Pacific Northwest (Douglas-fir subregion): 15" D.B.H.
California: All except redwood type, 12" D.B.H.; redwood type, 24" D.B.H.

Table 26.—Annual drain from all timber on the commercial forest lands of the United States by major items and regions, 1944

Region	Total	Lumber	Fuelwood	Pulpwood	Other commodities 1/	Fire	Insects, disease, etc.
	Million cu. ft.						
New England	761	201	194	154	82	5	125
Middle Atlantic	846	313	224	52	204	18	35
Lake	747	333	96	179	90	6	43
Central	1,201	395	380	32	291	57	46
Plains	118	9	79	-	10	1	19
North	3,673	1,251	973	417	677	87	268
South Atlantic	1,596	707	373	166	133	24	193
Southeast	3,022	1,356	498	257	473	149	289
West Gulf	1,842	774	298	152	398	107	113
South	6,460	2,837	1,169	575	1,004	280	595
North Rocky Mt.	316	246	19	5	20	17	9
South Rocky Mt.	104	71	4	-	7	3	19
Pacific Northwest	2,618	1,934	36	309	232	44	63
California	490	372	2	-	22	29	65
West	3,528	2,623	61	314	281	93	156
United States	13,661	6,711	2,203	1,306	1,962	460	1,019

1/ Veneer logs, hewn ties, mine timbers, fence posts, cooperage, shingles, and other small items.

Table 27.--Annual drain from saw timber on the commercial forest lands of the United States by major items and regions, 1944

Region	Total	Lumber	Fuelwood	Pulpwood	Other commodities 1/	Fire	Insects, disease, etc.
	Billion bd. ft.						
New England	2,204	864	156	590	297	3	294
Middle Atlantic	2,304	1,361	254	157	433	23	76
Lake	2,006	1,170	98	382	236	8	112
Central	2,342	1,479	264	32	353	102	112
Plains	176	36	100	-	12	1	27
North	9,032	4,910	872	1,161	1,331	137	621
South Atlantic	6,144	3,536	808	586	576	48	590
Southeast	11,924	6,867	1,222	737	1,866	229	1,003
West Gulf	6,831	3,819	693	487	1,428	156	248
South	24,899	14,222	2,723	1,810	3,870	433	1,841
North Rocky Mt.	1,792	1,499	92	27	77	60	37
South Rocky Mt.	480	387	9	-	9	7	68
Pacific Northwest	14,532	10,877	154	1,758	1,254	131	358
California	3,158	2,496	13	1	106	91	451
West	19,962	15,259	268	1,786	1,446	289	914
United States	53,893	34,391	3,863	4,757	6,647	859	3,376

1/ Veneer logs, hewn ties, mine timbers, fence posts, cooperage, shingles, and other small items.

Table 28. - Future growth goals and growth rates by regions

Region	All timber			Saw timber			Percent of total commercial forest area
	Growth goal		Growth per acre of commercial forest	Growth goal		Growth per acre of commercial forest	
	Billion cu. ft.	Percent	Cu.ft.	Billion bd. ft.	Percent	Bd.ft.	
New England	1.14	5.7	37.0	4.0	5.6	130	6.7
Middle Atlantic	1.64	8.2	39.4	5.8	8.0	140	9.0
Lake	1.15	5.8	22.8	3.1	4.3	62	10.9
Central	1.73	8.6	39.1	4.5	6.2	102	9.6
Plains	.12	0.6	36.1	0.2	0.3	60	0.7
North	5.78	28.9	33.9	17.6	24.4	103	36.9
South Atlantic	2.14	10.7	50.0	7.8	10.8	182	9.3
Southeast	4.80	24.0	53.7	17.5	24.4	196	19.4
West Gulf	3.20	16.0	62.8	12.1	16.8	237	11.1
South	10.14	50.7	55.3	37.4	52.0	204	39.8
Pacific Northwest:							
D.fir subregion	2.17	10.9	83.6	10.0	13.9	384	5.6
Pine subregion	.38	1.9	18.6	1.4	1.9	69	4.4
Total	2.55	12.8	55.2	11.4	15.8	247	10.0
California	.64	3.2	39.0	2.8	3.9	171	3.6
North Rocky Mt.	.65	3.2	22.4	1.9	2.6	65	6.3
South Rocky Mt.	.24	1.2	15.2	0.9	1.3	57	3.4
West	4.08	20.4	38.0	17.0	23.6	158	23.3
United States	20.00	100.0	43.4	72.0	100.0	156	100.0

Table 29.--Possible course of saw-timber drain by regions

Region	Under a program designed to reach 72-billion-board-foot growth goal with minimum restriction of wood use:						
	1944	1945-1950	1951-1960	1961-1970	1971-1980	1991-2000	After 2000
	Billion board feet						
New England	2.2	2.3	2.0	1.7	1.7	2.2	4.0
Middle Atlantic	2.3	2.3	2.2	2.3	2.8	3.7	5.8
Lake	2.0	1.7	1.2	1.3	1.8	2.3	3.1
Central	2.3	2.3	1.9	1.9	2.0	2.5	4.5
Plains	0.2	0.2	0.2	0.2	0.2	0.2	0.2
North	9.0	8.8	7.5	7.4	8.5	10.9	17.6
South Atlantic	6.2	6.5	6.3	6.3	6.5	6.8	7.8
Southeast	11.9	11.7	9.0	9.0	9.0	11.5	17.5
West Gulf	6.8	7.1	6.0	6.0	6.0	7.5	12.1
South	24.9	25.3	21.3	21.3	21.5	25.8	37.4
Pacific Northwest	14.5	12.9	12.9	12.7	12.5	11.9	11.4
California	3.2	3.1	4.5	5.0	4.5	4.0	2.8
North Rocky Mt.	1.8	1.8	2.2	2.5	2.6	2.4	1.9
South Rocky Mt.	0.5	0.5	0.7	0.8	0.8	0.9	0.9
West	20.0	18.3	20.3	21.0	20.4	19.2	17.0
United States	53.9	52.4	49.1	49.7	50.4	55.9	72.0

Table 30. - Trends of saw-timber growing stock by regions

Region	Under a program designed to reach 72-billion-board-foot growth goal with minimum restriction of wood use:						
	1945	1951	1961	1971	1981	2001	2021
	Billion board feet						
New England	58	56	54	55	59	73	87
Middle Atlantic	62	64	71	80	90	109	128
Lake	51	50	53	60	65	78	86
Central	44	43	47	53	61	79	99
Plains	6	6	6	6	6	6	6
North	221	219	231	254	281	345	406
South Atlantic	97	94	91	89	87	103	127
Southeast	136	117	107	106	122	207	285
West Gulf	105	97	92	94	103	149	210
South	338	308	290	289	312	459	622
Pacific Northwest[1/]	658	652	582	527	486	455	464
California	227	219	195	173	157	138	127
North Rocky Mt.	127	125	118	109	101	87	79
South Rocky Mt.	57	56	55	52	50	47	45
West	1,069	1,052	950	861	794	727	715
United States	1,628	1,579	1,471	1,404	1,387	1,532	1,743

1/ Includes trees 12 inches d.b.h. and larger except in virgin stands where the minimum diameter is 16 inches.

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