THE WORLD FOREST SITUATION

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Many countries lack the wood they need in manifold forms for construction and reconstruction, for industry, for pulp and paper products, even for the specialized needs of industrial agriculture. In some other countries, if the wood is available, it is at such high prices as to be effectively beyond the reach of those who need it. In western Europe, the lack of wood is one of the deterrents to reconstruction and industrial recovery. Only few countries have more than enough for their own immediate needs. To understand the whole situation is the first step in suggesting the effective measures through which an attainable abundance of forest products can become actually available to potential users.

In 1948 the Food and Agriculture Organization of the United Nations, through its Forestry and Forest Products Division and with the cooperation of many member and nonmember governments, assembled and analyzed information on such essential points as the total productive and accessible areas of forests; their potential growth; and the output, production, consumption, and distribution of forest products. Through questionnaires dealing with forests and forest products, it was possible to draw a clearer picture than ever before.

That is not to say, however, that everything is known that should be known. Even in the United States, which for nearly 20 years has had under way a well-organized forest survey, there are still sizable regions in which forest area, volume, growth and loss, production, and use of forest products are known only through substandard estimates. Thus is it understandable that in many countries the state of forest knowledge is inaccurate. In Latin America, most of Asia and the Far East, and elsewhere, a good deal of inventory and survey work remains to be done, and the best available figures are no more than an approximation of the truth. In most of Europe, by contrast, information on forests is relatively accurate and complete. Because the Union of Soviet Socialist Republics provided no official figures on her vast forests, it is necessary in this article to use estimates that lack authority of that government.

THE TOTAL FOREST AREAS—that is, including forests suited only for the production of fuel wood—are distributed unevenly in different regions and in individual countries. Whether forest area is expressed as a percentage of total land area or as area per person, it is evident that some regions and countries are relatively wealthy in forests, others impoverished. Such extremes—as between the South American (43 percent) and Pacific Area (9 percent) regions, and between Canada (37 percent) and Syria (2 percent)—show the differences in potential availability of wood supplies, expressed as percentage of total land area. The contrast between South America (18.03 acres) and Asia (0.99) and between Canada (67.2) and Egypt (0) illustrates the great spread in forest area per person among different countries. By measures like those, the United States stands in relation to the grand average for the world as 33 to 30 percent for area, and as 4.61 to 4.20 acres per person.

A striking feature is the great contrast between countries in the same region—for example, Sweden, with 57 percent forest area and 8.65 acres per person compared to Great Britain, with 6 percent and 0.32 acre, in Europe; or Brazil, with 46 percent and 22.35 acres, compared to Uruguay, with 2 percent and 0.49 acre, in South America. The other continents show sharp contrasts as well.

DISTRIBUTION OF FOREST AREA BY REGIONS AND SELECTED COUNTRIES

Region or country	*Total area*	*Forest area*	*Percentage forest*	*Population*	*Forest area per person*
	Million hectares [1]	*Million hectares* [1]	*Percent*	*Millions*	*Hectares* [1]
Europe (excluding Union of Soviet Socialist Republics)	482	1,046	38	578	1.8
Union of Soviet Socialist Republics	2,255				
North America	2,347	728	31	201	3.6
South America	1,755	755	43	103	7.3
Africa	3,060	849	28	191	4.4
Asia (excluding Union of Soviet Socialist Republics)	2,591	520	20	1,224	.4
Pacific area	855	80	9	12	6.7
Total	13,345	3,978	30	2,309	1.7
Sweden	41.0	23.5	57	6.7	3.5
Great Britain	22.7	1.3	6	49.6	.03
Canada	896.7	334.4	37	12.3	27.2
United States	771.0	252.5	33	141.2	1.8
Brazil	851.1	395.9	46	46.7	8.5
Uruguay	18.6	.5	2	2.3	.2
Belgian Congo	228.4	120.3	53	10.6	11.4
Egypt	100.0	.....	.....	18.6	0
Siam	51.3	32.4	63	18.1	1.8
Syria	18.6	.4	2	3.0	.1
Australia	770.4	30.9	4	7.5	4.1
New Zealand	26.4	6.8	26	1.8	3.8

[1] 1 hectare equals 2.47 acres.

This is one useful measure of forests, but it fails to show what kind of forests, and more particularly, the accessible and productive forest estate. In the United States, for example, large areas are classed as forest that contain thin stands of short, scrubby trees, which may be useful as sources of local fuel, but can hardly contribute to national or world demands for manufactured wood, such as sawn lumber, pulp, ties, and poles.

The same condition exists in Australia, Africa, and elsewhere along the dry southern edge of forest belts and also generally on the cold, dry northern edge of the forests of Canada, northern Europe, and the Soviet Union. So, to form a more realistic picture of the productive forest estate, it is necessary to eliminate such local-use forests. From the second table, it is evident that for the world fully 34 percent, for the African region 64 percent, and for New Zealand 72 percent of the total forest area cannot be expected, under existing economics and technology, to yield forest products other than fuel. This reduces the grand average per person from 4.20 acres to 2.72. The United States, with a reduction from 4.61 to nearly 3.46, ranks ahead of the world average. (The United States has customarily reported its forest areas as commercial and noncommercial. Certain areas in the latter category are so classed because they are reserved for recreation or other purposes, but are reported by FAO as productive forest, because they are physically capable of producing crops of usable wood.)

This is the most realistic measure of the true productive forests yet available. It shows that no continent, and relatively few countries, are fortunate

DISTRIBUTION OF PRODUCTIVE ACCESSIBLE AND INACCESSIBLE CONIFEROUS AND BROAD-LEAVED FORESTS BY REGIONS AND SELECTED COUNTRIES

Region or country	*Accessible*			*Inaccessible*		
	Conifers	*Broad-leaved*	*Total*	*Conifers*	*Broad-leaved*	*Total*
	Million hectares [1]	*Million hectares* [1]	*Million hectares* [1]	*Million hectares* [1]	*Million hectares* [1]	*Million hectares* [1]
Europe and Union of Soviet Socialist Republics	316	108	424	212	91	103
North America	180	154	334	135	38	173
South America	10	297	307	5	352	357
Africa	2	148	150	.....	156	156
Asia (excluding Union of Soviet Socialist Republics)	31	143	174	43	141	184
Pacific area	4	20	24	4	22	26
Total	543	870	1,413	399	800	1,199
France	3.0	8.0	11.0	.....	.....	.....
Norway	4.5	.7	5.2	.8	.1	.9
Canada	72.8	39.8	112.6	83.0	15.0	98.0
United States	88.4	82.4	170.8	19.4	1.6	21.0
Argentina	.1	17.0	17.1	.1	5.6	5.7
Brazil	5.2	147.4	152.6	3.5	221.1	224.6
French Morocco	.6	1.9	2.5	.....	.....	.....
French Cameroons	.....	2.3	2.3	.....	16.5	16.5
Burma	.....	22.7	22.7	.....	.....	.....
China	13.5	3.4	16.9	34.9	4.5	39.4
Australia	1.6	12.1	13.7	.1	6.5	6.6
New Zealand	.6	.1	.7	.3	1.0	1.3

[1] 1 hectare equals 2.47 acres.

enough to have all or nearly all the forest land in the productive category.

Of this productive forest estate as presently measured or estimated, by no means all is now yielding goods for national and world needs. Even in the advanced economy of the United States, substantial areas of productive forests (52 million acres) remain inaccessible to use and lack transportation and industrial establishments.

In many other countries and regions, even higher fractions of the productive forests are not usable at present or for the foreseeable future. Thus, 46 percent of Canada's productive forest area is inaccessible, as is 60 percent of the great forests of Brazil, 64 percent of New Zealand's, and 80 percent of the large productive forest areas of the Netherlands East Indies. By contrast, a high proportion of the productive forests in Europe (excluding the Soviet Union) is accessible.

In comparison, the area of productive and accessible forest per person for the 2.3 billion people of the world (1.48 acres) is 50 percent of that available (2.96 acres) to the 146 million people in the United States from her own forests.

It is clear that large areas of productive forest, totaling 2,862 million acres, once made accessible, are still available to contribute to national, regional, and world needs for wood. This presently unused resource represents one of the great and widespread opportunities to improve living standards. Only 54 percent of the productive forests of the world have been made accessible, and well over half of these are in Europe,

DISTRIBUTION OF PRODUCTIVE AND ACCESSIBLE FOREST AREAS BY REGIONS AND SELECTED COUNTRIES

Region or country	*Total forest area*	*Productive forest area*	*Percentage productive to total forest*	*Accessible forest area*	*Percentage accessible productive to total forest*
	Million hectares [1]	*Million hectares* [1]	*Percent*	*Million hectares* [1]	*Percent*
Europe and Union Soviet Socialist Republics	1,046	727	70	424	41
North America	728	507	70	334	46
South America	755	664	88	307	41
Africa	849	306	36	150	18
Asia (excluding Union Soviet Socialist Republics)	520	358	69	174	33
Pacific area	80	50	63	24	30
Total	3,978	2,612	66	1,413	35
Hungary	1.1	1.1	100	1.1	100
Norway	7.5	6.1	81	5.2	69
Canada	334.4	210.6	63	112.6	34
United States	252.5	191.8	76	170.8	68
Argentina	48.6	22.9	47	17.1	35
Brazil	395.9	377.2	95	152.6	38
Belgian Congo	120.3	119.5	99	69.0	57
French West Africa	170.0	50.0	29	25.0	15
Japan	22.3	22.3	100	19.7	88
Netherlands Indies	120.0	70.0	58	11.0	9
Australia	30.9	20.3	66	13.7	44
New Zealand	6.8	1.9	28	.7	10

[1] 1 hectare equals 2.47 acres.

Soviet Russia, and in North America.

AS TO THE KINDS OF FORESTS, it is well known that industrially developed countries—such as the United States and those in western Europe—require large amounts of manufactured coniferous products for their economics. It is less well recognized, but equally true, that public education depends largely on the printed page, which is made of paper coming mostly from softwood trees. And advanced irrigation agriculture depends on containers for shipping, which are largely of board or paperboard made mostly from softwood trees. So it is particularly important to know the availability of softwood supplies.

The broadleaved forests, both those of the Temperate Zones and of the Tropics, have great values, but so far these have been used more for specialty woods than for the general utility woods required in industry, building, agriculture, and publishing. Hardwoods can be substituted to some degree for softwoods, but by no means generally. Relative costs are important.

IN RESPONDING TO OUR INQUIRY, countries classified their productive, accessible forests into two broad categories, conifers and broadleaved.

Conifers (softwoods): All trees classified botanically as Gymnospermae (that is, pine — *Pinus,* fir — *Abies,* spruce—*Picea,* larch—*Larix,* Parana pine—*Araucaria,* and ginkgo—*Ginkgo*) have been included in this category. Broadleaved species (hardwoods): All trees classified botanically as Angiospermae. The species belonging to this group are generally broadleaved (that is, oak—*Quercus,* beech—*Fagus,* maple—*Acer,* lignum

DISTRIBUTION OF FOREST COMMODITY PRODUCTION AND USE BY REGIONS AND SELECTED COUNTRIES

Region or country	*Production (1946)*	*Population*	*Use per person*		
			Fuel wood	*Other wood*	*Total*
	Million cubic meters [1]	*Millions*	*Cubic meters*	*Cubic meters*	*Cubic meters*
Europe	262	578	0.435	0.465	0.900
Union of Soviet Socialist Republics	252		(2)	(2)	(2)
North America	352	201	.440	1.680	2.120
South America	179	103	.530	.200	.730
Africa	49	191	.460	.090	.550
Asia	300	1,224	.350	.070	.420
Pacific area	16	12	.850	.530	1.380
Total	1,410	2,309	.31	.30	.61
		Thousands			
Finland	22.4	3,877	2.700	.81	3.510
Greece	3.7	7,400	.420	.11	.530
Sweden	39.0	6,719	2.200	1.60	3.800
Lebanon	.02	1,160	.005	.04	.047
Canada	77.0	12,307	1.690	1.99	3.680
United States	258.1	141,229	.390	1.60	1.990
Honduras	1.8	1,220	1.125	.35	1.480
Puerto Rico	2.4	2,128	1.100	.07	1.170
Japan	55.9	75,323	.670	.26	.930
French Equatorial Africa	10.0	3,984	2.010	.53	2.540
French West Africa	1.9	16,200	.100	.20	.120
Australia (1945 data)	9.9	7,516	.460	.86	1.320
New Zealand	2.6	1,761	.480	1.11	1.590

[1] Millions cubic meters roundwood equivalent.

[2] Data not available.

vitae—*Guaiacum,* ebony—*Diospyros,* balsa—*Ochroma,* poplar—*Populus*).

The really substantial softwood forest areas of the world are confined to the United States and Canada, northern Europe, and the Soviet Republic. The countries of Latin America report only 2 percent of their total productive forest area in softwoods, which is 0.25 acre per person. The relative scarcity in Australia and New Zealand is reason for their extensive softwood planting programs. Asia and Africa have extremely limited natural coniferous forests.

It seems correct to say that countries that possess relatively abundant supplies of softwood have a great competitive advantage in maintaining or developing an industrial economy and in advancing the general level of public education.

THE ESSENTIAL FACTS about the forests of the earth as a source of commodities may be summed up as follows: They are distributed unevenly in relation to total area of regions and countries and per person. Substantial parts are unproductive except for fuel. Substantial parts of the productive forests are inaccessible. The softwood forests are more unevenly distributed than are all forests. Relative to the world, the United States is in a strongly favorable position in all these respects.

THE MANAGEMENT OF FORESTS can-

not be described in detail—nor is that necessary in drawing the broad picture of the world forest situation. It is first necessary to note that in most of the forest and geographic regions the same destructive practices still persist on a large scale which have been traditional throughout history. These destructive forms of land use destroyed forests and wrecked agriculture in many of the ancient countries of the Mediterranean, China, and India.

ONE MAJOR FORM of destruction of forest and land is shifting cultivation—that is, deliberate clearing of the forest to make room for annual field crops. The practice, particularly destructive on sloping land, is today widespread in many parts of Latin America, Africa, the East Indies, and elsewhere. Through erosion induced by clearing forests, the soil, agriculture, and downstream lands suffer. Associated with shifting cultivation is the use of fire for clearing land, a practice that, if unwisely used, expands and speeds up the ill effects of shifting cultivation.

Overgrazing, another widespread practice, first depletes the natural grasslands, then drives flocks and herds to seek new lands—the forest lands. Since these may not be naturally productive of forage, fire or logging is used to open them up in the first place, and firing is often repeated to make feed accessible. Great areas of Africa and Asia have been treated in that way. In Africa it is estimated that more than 60 percent of the original forest has been destroyed by shifting cultivation, overgrazing, and the associated use of fire. The process is continuing.

In countries and regions in which those practices are sanctioned, it is found that no effective effort is made to control forest fires; fire, whether deliberate or accidental, continues to be a major destructive force in most regions and many countries. In the United States, which has an advanced organization for the control of forest fires, there remain, according to the United States Forest Service, about 111 million acres of productive forest on which fire control is not applied.

In many lands, the exploitation of forests for their useful products remains on a destructive basis, in whole or in large part. The effect, whether caused by logging alone or by logging plus fire, is to prevent or delay regrowth, thereby retaining unproductive land.

The effect of any or all of these destructive forces is twofold: Regrowth is prevented or delayed or reduced in volume far below what the land could support. Further, the beneficial effects of forests in stabilizing waterflows and soils are reduced or destroyed; thereby the ill effects of alternating floods and low water stages, of erosion and deposition of unwanted soil and rock, are visited on crop lands in the lower river basins.

ALL THIS is the negative side of forest management. That there is a large continuing reduction of productive forest area and a failure to realize the potential useful growth of the productive forest lands there can be no doubt, even though statistical measures of extent are now lacking. Destructive forces and practice must, of course, be brought under control before forestry can be most effective. Information for the world as a whole is far less complete than it is for the United States.

But the other side of the story—constructive and effective forest management—needs emphasis as well. Many forest lands in Europe are handled to obtain a high percentage of their full growth capacity, and idle land is the exception. But considerable areas are only partly stocked; on them the full growth capacity is by no means utilized. Large and increasing areas of Canadian and United States forests are kept at work, though generally on a less intensive (that is, fully productive) basis than those of western Europe. A great deal of the forest

areas of India, Pakistan, Burma, and of parts of the East Indies has been placed under good forest management. So, too, with parts of colonial empires in Africa.

For many other regions and countries no records are available to show what fraction of forest land is handled so as to remain a productive asset. Though available evidence is far from detailed, it seems that in Latin America and Africa, at least, the destruction of forests is outstripping the adoption of sound practices.

THE RATE OF APPLYING FOREST MANAGEMENT is, of necessity, slow.

First of all, a nation itself must have the genuine intent, expressed in forest policy and forest law, to conserve its forests for its own benefit. Then a forest organization must be established to put into effect the policy and law decided on. To build a competent organization where none has existed always involves such time-consuming steps as providing professional education and training, developing operating facilities, deciding on the form of the organization, developing leadership, and obtaining required financial support. A vital forestry program must come from within the individual country.

A true and insistent initial realization of the need for forestry seldom arises until forest products become locally or nationally scarce. Until that stage is reached, exploitation is commonly tolerated or accepted by governments and peoples. At present, the greatest continental area in which this realization is developing seems to be Latin America. Certainly the response in the Latin-American Conference on Forestry and Forest Products in April 1948, sponsored by the Food and Agriculture Organization, shows active interest. At the conference, several countries, large and small, planned for the establishment of effective forestry, spurred on by the existence of local wood shortages and by a realization of the part forests and forestry can have in the whole economy.

European countries generally are placing great emphasis on restoring forests destroyed by war and on improving the growth in overcut forests, as part of their basic recovery programs.

In several countries of Asia, new governments are taking over the forestry programs already set up by former colonial services. The United States is particularly interested in the program in the Philippines, which is continuing from the foundation work done by this country.

THE CURRENT GROWTH on productive forest lands is a measure of the effectiveness of forestry. In the countries with the most advanced practices, the actual growth is a relatively high proportion (up to 80–85 percent) of that which forest soils could produce under the best conditions.

The growth potential is realized by curbing destructive forces, such as fire, insects, and diseases; by productive use of small trees and limbs of trees for pulp, fuel wood, and so on; and by frequent working of the forest so that slow-growing trees are removed and used.

In contrast, no net current growth is obtained from forest lands when the forest is undisturbed (virgin forest) and growth is offset by natural loss and decay. That is the situation in many unworked forests—that is, the productive, inaccessible forests. Nor is net current growth obtained when restocking of productive forest soils has failed. That is the situation when destructive forces, such as fire or logging followed by fire, have destroyed forests and prevented regrowth.

The estimation of total growth of forests is complex and difficult, and it is understandable that in many countries only a general attempt to do so has been made. Indeed, valid estimates usually can be prepared only after forests have been placed under systematic management.

Even more difficult is the estimation of natural losses caused by fire, insects, and disease. Fire and insect losses tend

to occur irregularly, and many losses of wood caused by disease are concealed within the boles of trees.

Nevertheless, some countries have solid estimates of both total and net growth obtained under management, so that it is possible to appraise what the productive forests of the world can produce. It must be emphasized that such an appraisal assumes reasonably good management—that is, keeping forest lands productive.

The reported present growth rates for coniferous forests in Europe range downward from 104 cubic feet per acre in Denmark to 21 for Great Britain and 23 for Poland. The figures for Great Britain and Poland reflect devastation of forests during the war. The average of the rates reported is about 31. It is fair to assume that as the forestry programs are expanded, this rate can be increased to not less than 43 cubic feet per acre.

An unofficial estimate of growth in the coniferous forests of the Soviet Union is 28 cubic feet per acre. It would be unwise to assume a higher average for the future, because of the northerly location of many of the forests.

In Canada the current rate of growth of coniferous forests is about 14 cubic feet per acre, and an attainable rate of 28 can be assumed as better management is applied.

In the United States the reported growth rate of 33 cubic feet per acre reflects the high-growth potential of many of the coniferous forest lands. It is estimated that improved management could increase the average to 57.

All in all, the accessible coniferous forests of the world, with reasonably good management, could be made to produce an average net yield of about 31 cubic feet per acre, or a total of more than 40 billion cubic feet. The present normal use of coniferous wood is estimated as about 26 billion cubic feet.

The inaccessible coniferous forests are not likely to attain rates of growth as high as are assumed for the accessible forests, because growing conditions are generally less favorable. But the 986 million acres of inaccessible coniferous forests, as put under management, should yield an annual average growth of 22 billion cubic feet.

Thus, with reasonably good management, the coniferous forests of the world could be made to yield continuously well over twice the amount of wood now normally used and lost. That result cannot be expected in a short time, and an expansion of the current rate of consumption of the coniferous wood is not safe at the present time.

About 64 percent of the total productive forest area of the world consists of broadleaved species. Of this, about 14 percent is temperate hardwoods and 50 percent tropical hardwoods.

In Europe and in North America, the present estimated growth of the temperate hardwoods is about the same as for coniferous forests. We estimate that these rates of growth can be increased substantially.

In the tropical broadleaved forests, only a few of the many species are being exploited. For the merchantable species only, annual growth rates of 7 to 21 cubic feet per acre have been estimated. Growth as high as 100 cubic feet per acre has been estimated as attainable where it is possible to use all the species, including those that are at present unused.

The future productivity of the tropical hardwood forests thus depends on finding uses for many more species, and, most important, on curbing the current rates of forest destruction through controlling the practices mentioned earlier.

The world can have a far larger supply of wood than it now uses, and can have it permanently, if the productive forests are given reasonably good management.

ONE OVER-ALL MEASURE of the forest-management situation is the relation between average growth and drain on the accessible productive forests, that is, those that have been or

are being worked over. Growth on all trees in the forests is one side of the balance sheet; losses from natural causes plus fellings, the other. Comprehensive world figures are not available, because by no means all countries have been able to report both growth and drain.

Sixteen European countries report in total an almost exact balance between growth and drain for all forests, both the coniferous and broadleaved. Seven have a plus balance, nine a minus balance. The Soviet Union, Germany, and Hungary are not included. On the same basis, the United States reports a drain of 2½ percent in excess of growth. The same European nations report a small excess (1.4 percent) of drain over growth for coniferous forests. The excess drain on conifers in the United States is 23.5 percent; the excess of growth over drain for broadleaved species is more than 18 percent.

In the United States, the Forest Service reports an excess of drain over growth of about 50 percent for trees of saw-timber size, a significant imbalance. Comparable figures have not been reported for the European countries, but in general the saw-timber supply seems to be fairly well kept in balance with the allowed cut. Some countries are now contemplating an attempt to offset severe overcutting during the war by reduced rate of cutting.

A large excess of drain over growth, particularly if it is in larger size trees, is a danger signal, indicating need for measures to reduce the gap. The general nature of the steps is mentioned in the latter part of this paper. The detailed measures, applicable to the specific urgent situation in the United States, have been reported by the Forest Service (*Gaging the Timber Resource of the United States,* U. S. D. A. Forest Service, 1946). Continuation of a process of taking out more than is grown can have only the effect of reducing the growing stock—the situation already reported in detail by the Forest Service.

I NOTED EARLIER that forests were unevenly distributed, both in relation to population and as a fraction of the total land area of countries and regions. It is equally true that the production and use of forest products varies enormously from country to country and from region to region.

The figures in the table on page 746 are based on responses, covering 1945–46, from 75 countries. It is known that the figures for use of wood as fuel are at best wide approximations, because detailed records are seldom kept. And since not all nations are able to report on production, exports, and imports, it has been necessary to estimate regional production and use of forest products.

The total estimated production in 1946 was nearly 50 billion cubic feet, about 6 percent less than the 53 billion, which was regarded as the prewar normal. More than 61 percent of this total came from the forests of Europe, the Soviet Union, and North America, with 47 percent of the productive forest area of the world, and about 13 percent from South America, with 25 percent of the productive forest area.

It is estimated that, as a world average, 48 percent of wood is used for construction and industrial purposes and slightly more as fuel. The best available estimates indicate that in North America about 78 percent of the total consumption is as industrial wood, whereas in South America and Asia only about 17 percent is so used, the rest going as fuel.

Thus it is clear that the industrialized regions and countries are relatively heavy users of processed wood, both as lumber and as pulp. A relatively large part of this is coniferous wood. Moreover, a relatively small part of their total use of wood is as fuel.

The great industrialized regions—Europe, the Soviet Union, and North America—have about one-third of the people of the world and use 80 percent of all the processed wood.

The great bulk of the world's population uses relatively little manufac-

tured wood—far less per person than the industrialized nations.

The slightly industrialized regions—Asia, Africa, and South America—and countries such as Greece, Lebanon, Honduras, and French West Africa use relatively little manufactured wood. The slightly industrialized regions and countries are in two broad categories—those with little forest area per person and those with relatively much. The first group uses little wood, even for fuel. This in extreme form, as in China, India, and the Middle East, results in use of agricultural refuse and dung as fuel, materials that should be returned to the cropped soils. The second may have a relatively high per person use—mostly for fuel—as in Honduras, Puerto Rico, and French Equatorial Africa.

The per person rate of consumption for the United States is among the highest for any region or country and indicates the level toward which a vigorous and developing economy and a growing population may push the use of wood.

About half of the world's total consumption of wood is as fuel.

How significant these present generalizations may be in the future will depend on future developments in various regions and countries, and these are not predictable.

But it is worth noting that the Soviet Union has changed in a few years from a net exporter to a net importer of forest products, partly because of a major program of industrial development. The United States has long been a net importer of all forest products. From 1920 to 1940 she was a net exporter of lumber, but has since become a net importer, except by a narrow margin in 1947.

On the whole, an extremely large latent demand for wood must exist in many of the present low-use countries.

Either of two developments could turn potential use into actual use. Any substantial industrial development would do so, and this could include certain forms of intensive agriculture, particularly those involving fruits and vegetables and other foods processed and packed for consumer use. Any substantial increase of living standard also could do so. A relatively small change upward in housing standards, the addition of a small weekly newspaper, or another use of pulpwood to the average family income would add greatly to the total and per person use of wood. If the nearly 1¼ billion people of Asia should raise consumption to the level now in effect in South America, an increase of more than one-third in the total drain on the world's forests would result. Even a continuation of present per person use will mean increased total demand, for population is increasing rapidly, particularly in the countries with low use of wood or with a low level of industrialization.

It is speculative whether all of this increased demand will develop. But it would appear prudent for countries, regions, and the world to act in the expectation that some increase in effective demand for wood products will develop.

The essential facts of the forestry and forest-products situation and of the trends in economic affairs indicate how possible is an increased consumption of forest products.

The essentials are:

1. Industrialization requires use of relatively large quantities of general utility softwoods. Substitution of tropical hardwoods for softwoods under existing technological and economic conditions will be slow and difficult.

2. The major sources of supply for softwoods are Canada, United States, the Soviet Union, and northern Europe. Of these, only the first is now a net exporter. The United States and northern Europe cannot supply their own net estimated needs for some time.

3. Native softwood supplies in South America, Africa, Asia, and Oceania are less than required for the long run for those regions. They are now net importers.

4. Industrial development of additional countries, such as is now apparently planned in parts of South America, Asia, and Africa, would increase competition for the already limited softwood supplies available for export.

5. The best opportunities for piecing out existing supplies of softwoods lie in four directions:

Larger recovery of products from forests and trees, which might increase supplies from 15 to 20 percent (i. e., pulp as a byproduct of lumber), and salvaging the unused material in the woods.

More efficient design in the use of wood, for example, in housing, which might reduce use in the order of 10 to 15 percent.

Substitution of other materials, for example, in housing—steel, stone, cement, brick.

Substitution of hardwoods for softwoods. The great area of tropical hardwoods offers an apparent opportunity to do so. Many such substitutions are technologically feasible and are primarily questions of economics, that is, of price levels.

But established habits and patterns change slowly and substantial changes in forms and economy of use are seldom made overnight, even under the most severe pressure of need.

THE EXISTING SHORT SUPPLY, particularly of softwoods, emphasizes the need for the installation of forestry practices everywhere, and the opening to use of inaccessible productive forests. There is little evidence that any country, great or small, can continue to depend indefinitely on readily available imports, at least to the degree that now exists. It appears, rather, that full use of native supplies, even though they are not ideal, will be forced. The opening up of unused forests, constructive management of forests now under exploitation and, for the long run, restoration of forests are all required to insure supplies as needed.

It is worthy of note that a large fraction of the productive inaccessible forests are classed as "tropical hardwoods." This generic term encompasses thousands of tree species, of which only at most a few hundred have been adequately studied to determine the use values of their woods. Most of these are now of interest to consumers only for highly special—and valuable—qualities, such as beauty, hardness, softness, durability.

THE TASK OF FINDING out what the tropical hardwoods can do to better balance the world's needs for utility woods requires a vast deal of technological research. Effective market demand and substitution of one wood for another is not apt to come about through vague generalizations. The industrialized wood-using areas of the world can potentially ease their supply problems by research programs in wood technology, regardless of where the raw material supplies may be. Supply, as well as quality, needs to be known for the thousands of presently unused tropical hardwood species. The using nations have a valid motive to take interest in forest exploration and inventory and in technological research.

The meaning of the world's forest situation as here sketched seems reasonably clear. The Food and Agriculture Organization, an international organization set up to study, analyze, advise, and help, needs to continue to do everything proper to stimulate and aid governments to apply forest management. Primary initiative must, of course, come from each nation acting in its own self-interest. A country such as the United States, which possesses a great estate of productive forest land, which has appraised its own current and prospective needs, which has estimated current and prospective forest growth, needs to keep its own balance sheets in continuous review and decide on and apply production goals for its own needs and for export. There is every reason to believe that growing industrialization of presently underdeveloped coun-

tries will add to the demand for forest products and thereby give an outlet to those countries with an exportable surplus, especially of softwoods. The danger of unwieldy surpluses is remote, in a world-wide sense, if national and regional economics recover or advance.

IT IS CLEARLY IMPRACTICABLE to set down in detail the steps through which nations may realize the full value of their estates of forest land, lands which in most instances are unsuited to other uses. Situations vary so greatly—from the thoroughly devastated forests of many Near and Middle East countries, to the largely unknown, untouched, and inaccessible forests of the Amazon basin, to the perennially productive forests of western Europe, to the mixed situation of the United States with some elements of the ruling conditions of all continents.

The general nature of the essential steps that must be taken to establish forestry are well established by world experience:

1. To halt and control the major destructive forces and processes—shifting cultivation, overgrazing and burning, exploitative and excessive rate of utilization of productive forests.
2. To create a body of public forest policy and law and to apply it through a competent professional organization.
3. To obtain the understanding and support of affected people for the program. To estimate prospective needs for forests and their products and to determine what the forest lands of the country can produce under forestry.
4. To apply the forestry practices which may be effective and economically feasible with a forward-looking view of economics in making the forest lands productive.
5. To learn a great deal more about forests and forest products than is now known.

THE INFORMATION AVAILABLE indicates that forests will be called on to play a greater rather than a lesser part in the economics of nations and regions, and that constructive management—that is, realization of the growth of potential forest soils—will be more rather than less necessary.

Thus, it is important that each nation move aggressively to improve its own forest situation. It is equally important that nations act with full knowledge of the total and regional forest situations, that they have access to data on improved methods and techniques, and that they consult regularly with each other on questions of regional concern.

THE GREAT FACT about the world's forest situation is that there is enough productive forest land to turn out continuously much more wood than at present, and thereby to raise standards of living and support increased industrialization. But this goal can be reached only if nations replace destructive exploitation by forestry. Such exploitation is no longer the problem of individual nations, to be noted with regret. It is a matter of deadly seriousness to all nations.

The unsatisfied needs for forest products are less potent than is lack of food as a cause of unrest. But all the basic requirements of food, clothing, and shelter need to be met to create a decent standard of life.

Greater attention to forests everywhere is one of the steps that must be taken to build a more solid foundation for peace.

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