

Adequate protection against fire, insects, and disease will reduce the losses of merchantable timber and save for future timber production millions of seedlings and saplings now destroyed each year. Planting a substantial part of the 75 million acres now denuded or only poorly stocked with seedlings and saplings would lay the foundations for additional timber growth in the future. But improved forest practices applied to the timber now standing are the surest and quickest means of increasing annual growth.

A crop of wood cannot be grown in a single year like a crop of corn. Tomorrow's wood supply is in the trees

growing in the forests today. It will take decades of good forestry, going far beyond what has been accomplished in the past, to develop a well-balanced growing stock that will meet future timber needs.

C. EDWARD BEHRE is staff consultant in the Forest Service. He was graduated from Yale with a master's degree in forestry in 1917. From 1919 to 1923 he was on the faculty of the School of Forestry at the University of Idaho. Mr. Behre joined the staff of the North-eastern Forest Experiment Station at the time of its organization in 1923 and was its director from 1929 to 1942.

FOREST RESOURCES AND THE NATION'S ECONOMY

EDWARD C. CRAFTS, MARTHA A. DIETZ

Natural resources and human ingenuity determine a country's wealth, security, standing among nations, and the welfare of its people.

One of the natural resources is the forest, which supplies timber, water, forage, wildlife, and spiritual strength.

So common are the products and services of the forest in everyday living that their presence often is taken for granted and their essentiality overlooked. But when one analyzes the relationship of the forest to the Nation's economy and considers all the products and services, he sees the part they have in the lives of all the people.

INDUSTRY AND TRADE, to a large degree, depend on natural resources. Such dependency is sometimes obvious, more often obscure, and rarely tied to only one resource. Nevertheless, one standard for measuring the value of any resource is the size and essentiality of that segment of industry and trade so closely tied to it that the dependency relationship is obvious. The forest supports directly dependent industries impressive both in variety and size.

The growing of timber is the most

obvious function of the forest. Timber, widely adaptable, is the backbone of a large group of conversion industries. With only crude shaping, splitting, or cutting, wood can be used as it comes from the forest—for fuel wood, posts, mine props, piling, and other rough uses. With relatively little processing, it is used as sawed lumber, shingles, railroad ties, veneers, and charcoal. In further processed form, it is consumed in housing, boxes and crates, cooperage, furniture, agricultural implements, truck bodies, boats, venetian blinds, baseball bats, and pencils. It is the basic raw material in pulp, paper, rayon, and a variety of other products. Extracts used in the tanning of hides and skins are produced from wood and the bark of certain trees. In addition, the living tree itself is a production plant for pine oleoresin, which is the raw material for turpentine, rosin, and other naval stores.

Since the Second World War, the average annual gross value of all timber products is estimated at 15 to 20 billion dollars.

Harvesting and primary manufacture of most timber products is con-

ducted near the logging site, because of the bulkiness of the raw material. Consequently, the primary manufacturing industries are widely dispersed, large in number, located in or near the forest, and generally far from centers of consumption. This is in contrast to many manufacturing industries for which nearness to markets, access to plentiful and cheap power, supplies of skilled or common labor, or other considerations are more important determinants of plant location than is proximity to raw materials.

In numbers, there are some 60,000 sawmills, 650 veneer and plywood plants, 325 shingle mills, 200 to 250 pulp plants, and a large number of miscellaneous and specialty plants. By far the greater number of these are in the East.

No reliable over-all estimates of investments in forest land, timber, and timber industries are available. The 1946 market value for timber purposes of all forest land and timber in the United States, public and private, was probably between 10 and 20 billion dollars.

The total capital investment in the lumber industry alone, including land and timber as well as buildings and equipment, may approximate 3 to 4 billion dollars. In the Douglas-fir area of Washington and Oregon, where there are heavy concentrations of large timber, a rough estimate of the investment in privately owned land and timber is about 1 to 1.25 billion dollars, with at least an additional 350 million dollars invested in logging improvements, equipment, and primary manufacturing plants.

Investment in individual establishments varies greatly, both within and among industries. For example, sawmills require initial capital outlays from a few thousand to several million dollars, and pulp mills from about 750 thousand dollars up, depending on kind and capacity. Investment per employee and per dollar of sales in the pulp and paper industry ranks among the highest in American industry. Mod-

ern steam distillation plants in the naval stores industry require an investment from 50 thousand to 250 thousand dollars. Other primary timber-products industries, excepting veneer and plywood, require comparatively small plant investment.

Estimates of the output and value of rough (nonmanufactured) forest products in 1947 show that sawlogs, fuel wood, and pulpwood logs and bolts had the highest total value. Together they represented about 80 percent of the total value of nonmanufactured timber products, or about 2.4 billion dollars. In each of seven States (Oregon, Washington, Georgia, North Carolina, Alabama, Mississippi, and California) the value of nonmanufactured timber products exceeded 100 million dollars. The East produced 75 percent of the national total.

Since the Second World War, the estimated average annual value of timber products in the first stage of manufacture has been about 4.2 billion dollars. This includes sawed wood, veneer, and plywood, 3.3 billion dollars; wood pulp, 730 million dollars; and naval stores, 120 million dollars; and miscellaneous products, 100 million dollars.

Secondary manufacture of forest products is the third major step in preparing timber products for the market—the first two being harvesting the raw material and initial or primary manufacture.

Some of the secondary industries rely almost entirely on wood as raw material, such as the wooden box and crate industry, wood sash, door and other millwork, hardwood flooring, wooden furniture, and wooden handles. Many more, however, such as paper, paper products, rayon manufacture, ship and boat building, and residential and other construction, utilize wood as only one of many raw materials. The separate contribution of wood, other raw materials, labor, managerial skills, and capital to the finished product is difficult to assess. Each is needed to finish the product.

Industrial and residential construction, the largest single market for lumber, accounts for about two-thirds of all lumber used annually in the United States. Nearly every one of the 40 million dwellings in the United States contains a substantial amount of wood. From one-fourth to one-third of the cost of the average house is for wood in some form. The exterior walls of three-fourths of all dwellings are made of wood; most have a wood framework; and wood is also used extensively for interior finish and trim.

In 1947, total construction activity in the United States was 21 billion dollars, a substantial part of which represented the cost of timber products, including the cost of labor and overhead to incorporate them into the structure.

The fabricated wood products, too numerous to list, add to the Nation's real income and standard of living. The wood-furniture industry alone creates products valued annually at about 1.3 billion dollars. Among the wood-fabricating industries, it is one of the largest consumers of wood. It is exceeded only by the box and millwork industries. The total estimated use of wood in all fabricated products in 1940 was 12 billion board feet.

Annually since the Second World War the paper and paperboard industry has manufactured products valued at about 2.5 billion dollars. Paper of all sorts (news, book, wrapping, writing, tissue, and building) and paperboard for boxes and containers are the principal products of this industry. Two of the raw materials required in their manufacture are products of the forest, that is, wood pulp (made from pulpwood) and rosin, which together account for more than 80 percent of the value of all raw materials used in paper making. Converted paper products have an estimated annual value of another 2.5 billion dollars.

The rayon yarn and fiber industry, which now puts more than 750 million dollars' worth of products on the market annually, also depends largely

upon wood as a raw material. About 80 percent of the fibrous material used in rayon is wood pulp. Further processing of rayon yarns into textiles and apparel broadens the Nation's industrial structure by providing employment and additional manufactured products of great value and utility.

Trade in forest products is another important activity. The rough-timber products, such as fuel wood, fence posts, mine timbers, and poles, often pass directly from producer to consumer without entering wholesale or retail distribution channels. The more important primary products, such as lumber, veneer, cooperage, and pulp and paper, however, are normally distributed by wholesalers, retailers, and other middlemen.

Before the Second World War, 50 to 55 percent of the lumber produced reached consumers through some 25,000 retail yards, whose volume of sales equaled 1.5 billion dollars in 1939, the latest year for which we have data. The sale of lumber, millwork, plywood, lath, shingles, and other building materials of wood probably represented no more than half that amount. Total commodity sales of timber products from the 1,800 wholesale lumber and millwork establishments in that year were about 475 million dollars. Of the 600-million-dollar business that the wholesale paper and paper-products trade did in 1939, about 80 percent represented sales of paper and paper products. Since 1945, the annual dollar-volume sale of the wholesale trade in both lumber and millwork and paper and paper products is estimated to have trebled the prewar level, primarily because of increases in prices.

World distribution of timber resources and rates of depletion are dominant factors in determining the pattern of foreign trade in timber products. The United States is traditionally a net exporter of lumber, primarily because of the high domestic rate of softwood production and the general world scarcity of softwoods. Naval stores produced in the United States

also are prominent in the export trade.

On the other hand, large United States requirements for paper and paper products, combined with limited timber resources and plant capacity for pulp and paper making, are major reasons why about one-third of the wood going into the paper consumed in the United States comes from foreign sources. Considering all timber products, the United States has long been a net importer. For example, in 1947 timber-product imports, valued at more than 800 million dollars, were more than twice as great as exports; other years show a similar pattern.

The transportation systems of the United States use large quantities of timber products, and also depend on them for much revenue freight.

Railroad track is laid on wooden cross, switch, and bridge ties. A great deal of lumber is used in railroad cars and the construction of bridges, stations, warehouses, and other structures.

Millions of feet of piling and lumber go into wharves and jetties. Wood is used extensively for bracing and holding cargo in place. Substantial amounts are used in boat and ship building as an integral part of the structure and as scaffolding. Naval stores are also used in boat and ship construction, although not so extensively as formerly.

Highway transportation depends partly on the timber supply, because road and bridge construction, as well as truck and trailer manufacture, requires wood.

The distribution of timber products by rail, water, and truck creates millions of tons of revenue freight each year. Before reaching the consumer, many timber products may be re-shipped several times from forest to primary manufacturing plant, secondary processing plant, wholesaler, retailer, and finally to consumer. Often several forms of transportation are used in these various steps.

In 1946, Class I railways carried more than 100 million tons of timber products, including paper and furniture other than metal, or nearly 8 per-

cent of all tonnage carried. About two-thirds of this tonnage was in the form of logs, pulpwood, and lumber. With an average haul of about 450 miles, timber products accounted for about 45 billion ton-miles. In 1946, Class I railways received more than 535 million dollars in revenue from timber products, or nearly 9 percent of the revenue from all commodities.

Truck transportation has become the most important means of getting raw material out of the woods for the forest-products industries. About 80 percent of all sawlogs and veneer logs produced, 90 percent of all pulpwood, and more than 90 percent of all commercial poles, posts, piling, and mine timbers are transported all or part of the way from woods to plant or market by truck. Trucks are used almost exclusively to move lumber from thousands of small mills to concentration yards and to haul about 30 percent of total lumber tonnage all or part of the way to its first destination beyond concentration yards and sawmills.

Since the Second World War about 300 million tons of timber products have been transported annually by truck. Although this is three times the volume hauled by rail, truck hauls are short compared with rail transportation and average only 10 to 15 miles. Thus, trucking of timber products accounts for about 4 billion ton-miles annually, or less than one-tenth of the ton-miles by rail.

Water transportation is also significant in the domestic movement of timber products. In 1946 about 30 million tons of logs, lumber, pulpwood, wood pulp, and paper were moved to domestic destinations through inland waterways and by coastal and inter-coastal routes. Logs alone accounted for two-thirds of this tonnage, which includes logs or pulpwood floated or driven on rivers. Domestic cargo shipments of poles, piling, posts, fuel wood, naval stores, tanning materials, furniture, and other timber products provided additional substantial tonnage. In terms of ton-miles, domestic water

shipments of timber products probably exceed truck shipments.

In other ways, also, timber from the forest influences industry and trade. Electric power and rapid communication depend on the 50 million poles that support telephone, telegraph, and power lines. About 8 million new poles are needed each year for replacements and additional lines.

Coal heats homes and factories, powers industry, and moves trains. Wooden mine props, ties, lagging, and cribbing are essential to mining.

The timber industries, themselves, offer a substantial market for goods and services. For example, manufacturers of logging and specialized wood-working equipment and paper and pulp machinery are wholly dependent upon the timber supply. A substantial volume of trucks, tractors, power generators, and a great variety of small tools are also consumed.

Another function of the forest, one of the most important, is to supply water by protecting watersheds. Practically all industry and trade depend, in one way or another, on a supply of water that is adequate in amount and effectively controlled.

Permanent and prosperous industries and communities need an adequate water supply. Consumption is enormous. For example, the five main urban centers from Boston to Washington consume about 3.5 billion gallons of water daily. Good management of the forest cover at headwaters is one way of protecting the source.

In many parts of the West, water shortages are potentially and actually acute. As population and per capita consumption of water increase, many cities are going greater and greater distances in search of water. San Diego, Los Angeles, and San Francisco tap sources hundreds of miles away, and spend large sums for reservoirs, aqueducts, and pumping stations. The headwaters of nearly all lakes and rivers lie in forested areas.

Supplying water to homes and industry is the largest of municipal en-

terprises. In 1945, operating revenue from water-supply systems in cities that have populations of 25,000 or more was 310 million dollars, or nearly 150 percent greater than operating expenses. To the extent that such water originates from forest land, municipal water systems depend upon the forest.

All but three States use power developed from streams. Manufacturing industries in most sections partly depend on hydroelectric power. In 29 States water power is also important as a source of electric current for homes and city lighting. Water is the source of nearly one-fourth of the country's electric-power capacity, yet water power still undeveloped is capable of producing electric energy greater than that now supplied by both fuel and water. Good management of forest cover on upland watersheds is vital to safeguarding power development.

Conversion of stream flow to electric energy creates a market for goods and services by providing construction contractors and producers and distributors of materials with millions of dollars' worth of business. Dams built to store water for power production rank among the Nation's great engineering feats. One of the latest, the 2,160-foot-long earth and concrete Center Hill Dam in north-central Tennessee, built for hydroelectric-power production and flood control and completed in 1948, cost the United States about 33 million dollars; the Grand Coulee Dam in Washington cost more than 110 million dollars.

Rivers and lakes of the United States are important media in the distribution of goods. Between 1938 and 1947, freight commerce on the natural waterways averaged about 200 million tons annually, more than 20 billion ton-miles. Maintenance of an adequate forest cover materially aids navigation by retarding sedimentation, lessening floods, and maintaining more stable water levels.

Another major function of the forest is to produce forage in the form of grasses, weeds, and shrubs under trees

and in openings. This forest range covers 350 million acres and represents more than one-half the total forest area of the United States and more than one-third of the total range area. Roughly, 155 million acres lie west of the Great Plains, representing nearly 70 percent of the total western forest area; 142 million acres of forest range occur in the South. By supporting large numbers of domestic livestock, forest ranges contribute significantly to the Nation's meat, wool, and leather industries. The proper utilization of forest range is of primary importance in multiple-use management of the forest resource.

There is no way to isolate and measure precisely the contribution of forest range to our industry, trade, and general economy. It is enough to recognize that large numbers of western livestock summer on forest range, that a great many fat cattle and sheep are marketed directly from far western ranges, and that the rural South would be hard-pressed indeed if its forest range were not utilized by the cattle and hogs that roam the piney woods.

Wildlife and recreation are linked closely with the forests.

Varied climates and habitat conditions of the forest lands are conducive to many species of fur bearers and birds. About 95 percent of the country's big game—deer, elk, moose, big-horn sheep, mountain goat, and bear—live in the forest. Roughly one-fourth of the small game and fur bearers are associated with wooded areas.

Camping, picnicking, winter sports, sightseeing, and similar recreation constitute another major service of the forest. For hunting and fishing alone during the 1946-47 season, nearly 25 million licenses were sold. It is estimated that more than a third of the hunters and fishermen went to forested areas.

Expenditures for sporting arms and fishing tackle in 1945 exceeded 60 million dollars, and nearly equaled all other expenditures for sporting goods. Annual cost to the hunters and fisher-

men in the forest for travel, food, and lodging is currently placed at about 750 million dollars. At least half a million people earn all or part of their living supplying goods and services to forest recreationists.

AGRICULTURE also is linked to the forest. No longer is the forest an enemy to be cut down, burned, and destroyed. The farmer's own wood lot and the forest cover on the more distant hills and mountains provide protection against erosion, water for irrigation, essential timber products, and forage for livestock. Local forest industries also provide an outlet for truck crops and employment in the non-farming season.

Forests are the principal source of the irrigation water, supplying roughly 300,000 farms in the United States. Irrigation agriculture has improved 20 million to 25 million acres of low-productivity land, increasing crop yield and materially enhancing land values. In the arid valleys of the West, intensive agriculture is made possible only by harnessing and applying to the land water which originates in the forested mountains. The forest cover markedly influences water-table levels and this affects the supply of irrigation water even in those areas where water is obtained from wells.

More than 95 percent of both the number of irrigated farms and acreage irrigated are located in 17 Western States and Arkansas and Louisiana. In 1945, although less than 18 percent of the total farm acreage in these States was irrigated, 27 percent (5 billion dollars) of the value of all farm lands and buildings was on farms wholly or partly irrigated. In 1939, capital invested in irrigation enterprises in 19 Western States exceeded one billion dollars.

Timber products are essential to the operation of the 6 million American farms. Much lumber, to begin with, is used on the farm for new dwellings, barns and other service buildings, and fences and for repair and maintenance.

Lumber and veneer also are used in baskets, boxes, barrels, and crates for shipping farm products. Many agricultural implements and equipment—wagons, tool handles, and feeding troughs—are made of wood. The bulk of the posts used on farms are wood. More than three-fourths of the 330 million wooden fence posts used annually in the United States are for farms. Like everyone else, farmers consume wood in the form of paper, furniture, and in numerous miscellaneous wood products.

Most farmers still depend on wood for fuel, although such use is steadily declining. Each year between 50 million and 60 million cords of wood are burned for fuel; about half of it is used by the rural population in the form of cordwood from the forest. More than one-third is waste from wood-manufacturing industries which use it for fuel. In the aggregate, fuel wood still constitutes the second largest use of our timber supply, the first being lumber.

Of approximately 7 million farm dwellings in the United States, nearly 95 percent are of wood construction—a considerably higher proportion than of either urban or rural nonfarm dwellings. The average farmhouse requires more lumber than the average urban dwelling. The average annual replacement of nonrepairable farm dwellings following the Second World War has been about 150,000; this construction requires about 2 billion board feet of lumber. Current annual requirements for both new farm construction and maintenance and repair total between 4 billion and 5 billion board feet.

An additional 1 billion to 1.5 billion board feet of lumber is consumed annually in the manufacture of boxes, crates, barrels, and baskets, which are used for the distribution of fresh fruits, vegetables, and other farm products. Although the amount of wood used in agricultural implements, including tool handles, is declining, roughly 125 million board feet is used annually for that purpose.

Wood lots are an asset to most farms.

They provide timber products for farm use, are a source of supplementary cash income, and afford protection against the elements. In 1944 farm woodlands totaled 166 million acres, or nearly 15 percent of all land in farms, and on many farms the sale of forest products comprised more than half the value of all farm products sold.

Farm woodlands are an important component of the total forest economy, comprising nearly a third of our total commercial forest area. Nearly 85 percent of the farm woodland is commercial forest actually or potentially valuable in supplying commercial timber products. Although so seriously depleted or poorly managed that they produce no more than one-third to one-half the volume of wood they are capable of producing, farm forests nevertheless supply nearly one-fourth of the total output of sawlogs, one-third of the pulpwood and gum naval stores, and the bulk of the fence posts, cordwood used for fuel, and maple syrup and maple sugar. They also furnish large quantities of railroad ties, poles, pit props, wood naval stores, and numerous other forest products.

It is estimated that in 1947 the value of nonmanufactured forest products obtained from farm woodlands (including both products sold and those for home use) was about 700 million dollars, or 29 percent of the value of such products from all forest land. Ten States, all but one of which were in the South, each produced farm timber products valued at more than 25 million dollars.

THE INDIVIDUAL benefits from the forest in many ways. Not only does it contribute to his well-being and the national standard of living but also it offers many persons a livelihood that can be both secure and challenging, advantages of residence in stable and progressive communities, and spiritual and physical welfare.

Employment and income that can be attributed to the timber resource have not been estimated authorita-

tively. Several incomplete and not wholly comparable estimates in the aggregate indicate reasonably well the size of forest-based employment.

According to the United States Bureau of Labor Statistics, the average number of wage and salary workers in the lumber and timber basic-products industries gradually increased from 465,000 in 1939 to 716,000 in 1947. The Forest Service estimated that, in July 1944, 356,000 workers were employed in the woods and 509,000 workers at plants that use rough timber products, such as round logs or bolts, poles, bark, crude gums.

In 1946, it is estimated, there were the equivalent of 3.3 million man-years of full employment by persons productively engaged in activities that can be traced back basically to the timber resource. If the concept of attributing to one of the basic resources a fraction of total productive employment is acceptable, approximately 6 percent of the national total man-years of full employment in 1946 may be attributed to timber-based industries and trade. By a similar analysis, timber resources contributed 6.3 billion dollars of wages and salaries to persons productively engaged in 1946. This is equal to 5.7 percent of total wages and salaries in the Nation.

The proportion of total national income attributed to timber is slightly less than corresponding proportions of persons productively engaged or wages and salaries paid; similarly, the proportion of wages and salaries paid is less than the proportion of productive employment. These facts mean that the wages and salaries paid to persons engaged in economic activity attributable to timber are slightly less than the average for all economic activity and that other components of national income also are below average in timber-based activities.

From 1939 to 1947 in the lumber and timber basic-products industries the average hourly wages increased from 48.9 to 102.7 cents; weekly earnings from \$19.02 to \$43.45; and weekly

hours from 39 to 42.2. Great seasonal and geographical variations are known to exist in not only these items but also working conditions.

Managed forests improve communities: If the forest resource is to fulfill its potential in building and supporting a strong economic and social structure, it must be managed in the broadest sense of the term. Mismanagement of growing stock through continued utilization in excess of long-term productive capacity leads only to forest destruction and a boom-and-bust type of community.

On the other hand, an important natural resource is unnecessarily wasted if there are too few wood-using industries in a particular area or if they are not diversified enough to permit full utilization of the raw material commensurate with leaving the land reasonably productive and on its way to producing another crop.

A balance between the continuous productive capacity of the forest and the size, number, and kinds of wood-using industries in a particular area means permanent communities at a reasonably high living standard. This in turn means good schools, churches, hospitals, service businesses, public libraries, and other cultural, economic, and social advantages.

THE NATIONAL ECONOMY is an imprecise concept. It is a synthesis of all the factors that comprise the national life. Its goodness is tested by things that American citizens hold dear: Security, high standard of living, progress, freedom, free enterprise, opportunity. The discipline of economics is too restrictive to embrace more than a few of the standards that gage the national economy, but all too often these are taken as the total.

We have described so far some of the varied contributions of the forest resource to the national economy. Attempts to express the value of such contributions in dollars are not only impractical but also misleading and undesirable because of their inade-

quacy. Forest values transcend the dollar concept. How is it possible, for example, to assess in dollars the essentiality of wood in wartime, or the saving of lives by reduction of peak floods, or the restoration of health and spirit by play and rest in the forest?

Besides the contributions of the forest to industry, trade, agriculture, and the individual that have been discussed, the relation of timber resources to national security and income merits consideration.

As to national security, the essentiality of wood can be judged by the extent and character of its military uses and its importance in recovery from the effects of war.

In 1940 and 1941, the United States used about 6.5 billion feet of lumber for military purposes, or the equivalent of total military consumption in all of the First World War. During the four subsequent years (1942-45), an estimated 101 billion board feet of lumber was consumed for military purposes, as follows: 49 percent for construction; 42 percent for boxes, crating, and dunnage; and 9 percent for fabricated products. That was 70 percent of the amount of lumber consumption for all purposes, or enough to build more than 9.5 million average-sized five-room frame houses, a number equal to about one-fourth of all houses existing in the United States in 1940.

In 1942 alone, nearly 12 billion board feet of lumber was used for building cantonments and other military structures. New factories and plants, built for the manufacture of implements of war, and new houses for war workers called for additional amounts of construction lumber. The building of every Liberty ship took 350,000 board feet. The capture of a strategic point was often accompanied by heavy damage to existing facilities. For example, following the capture of Naples by Allied forces, 50 million feet of lumber was required to put the port on a temporary operating basis.

Huge quantities of lumber in the form of boxes, crating, and dunnage

were used in the shipment of supplies and material. Each 10,000-ton cargo ship took 250,000 feet to brace the cargo. For every soldier sent overseas, 300 board feet of lumber was required to box and crate his initial supplies, and nearly 50 feet of lumber per month was needed to maintain him. A crate for an airplane took about 5,000 board feet. The need for lumber for shipment of military goods reached a peak in 1944—about 10 billion feet.

Fabricated products required lumber of the highest quality and most exacting specifications for such items as aircraft, firearms, pontons, military trucks, boats and ships, tanks and vats, freight cars, tool handles, and furniture. A PT boat required 28,000 board feet of lumber; each submarine chaser 200,000 feet for decks, bulkheads, and other uses; each escort carrier a similar amount of high-grade Douglas-fir for the flight deck alone. About 50 million feet of high-quality wood was consumed for Army rifle stocks in a year.

Timber products other than lumber are equally essential. During the Second World War, plywood and veneer were used for boat hulls, life rafts, trucks, freight cars, torpedo boats, landing craft, containers, and radar equipment. One cord of pulpwood made smokeless powder for 90,000 rounds of ammunition for a Garand rifle, or 24 rounds for 16-inch naval shells, or 1,800 containers, or 4,200 waterproof packages for shipping blood plasma, or 1,480 paper parachutes for dropping supplies or flares, or 800 wadded paper vests for high-altitude flying.

Timber is a key component in the economic recovery of a nation from the debilitation of war. Although timber-import needs of the 16 countries (and western Germany) participating in the European Recovery Program represent only 4.4 percent (2.5 billion dollars) of the total value of recommended imports of all commodities, the importance of timber to European economic recovery is far greater than the proportion indicates.

Without timber, recovery would be ineffective, even if other import needs were met. For example, timber is required as pit props to make possible the restoration of coal mining, as cross ties for the reconstruction of the European railway system, for construction and rebuilding of damaged factories and homes for the agricultural population, for the new hydroelectric plants, and for poles for transmission of communications and power.

Although immediate timber needs of the participating countries are 40 percent greater than their own expected production, the long-term value of forests is so well recognized that the countries are determined, despite the immediate need, to maintain their forests on sustained-yield or its approximate equivalent, and to rehabilitate promptly those overcut or otherwise damaged during the war.

Timber resources of the United States have been so reduced by long-continued overcutting and lack of forestry measures that requirements of another emergency similar to the Second World War could be met only by extraordinary measures, and would greatly reduce growing stock and virtually exhaust high-quality material of certain species.

In terms of economic activity, the timber resource contributes an important share of national income and gross national product. National income is based on an industrial classification permitting comparison between industries, and includes such items as wages and salaries, business profits, interest and rents, dividends, and transfer and miscellaneous income payments.

Assuming that timber resources are basically responsible for certain segments of economic activity, it is estimated that in 1946 the national income attributable to timber resources was 5.4 percent of the total national income, or 9.6 billion dollars. This estimate is crude and subject to challenge because it overlooks the interdependence between different raw materials

and between materials and human effort. For example, all economic activity in the lumber and timber basic-products industries is ascribed to the timber resource, even though the industries depend upon the mineral resource for machinery and other equipment. The proportions of other economic activities attributable to the timber resource vary widely and are difficult to estimate, but the over-all estimate (5.4 percent) is conservative, and other estimates have approximated 10 percent. Certainly, if other forest resources besides timber were included, the proportion of total national income attributable to all forest resources might exceed 10 percent.

It is wrong to conclude that national income would drop by 5 or 10 percent if activities based on timber or forest resources were eliminated. Theoretically, alternative activities would partly replace forest activities, but at the cost of a reduction in standards of living. Of far more import, however, and based on considerations of history, biology, and security, which override economics, is the inescapable conclusion that without forests this Nation would not long survive.

EDWARD C. CRAFTS is chief of the Division of Forest Economics in the Forest Service.

MARTHA A. DIETZ is a forest economist in that Division.



ESTIMATED PULP PRODUCTION AND PULPWOOD REQUIRED TO MEET THAT PRODUCTION, UNITED STATES, 1950-55

Type of pulp	Required pulp production	Conversion factor	Pulpwood required
	1,000 tons		1,000 cords
Ground wood.....	2,294	1.10	2,085
Sulfite.....	2,037	.55	3,704
Sulfate.....	8,071	.65	12,417
Soda.....	459	.58	791
Other.....	3,029	1.10	2,754
Total.....	15,890	21,751