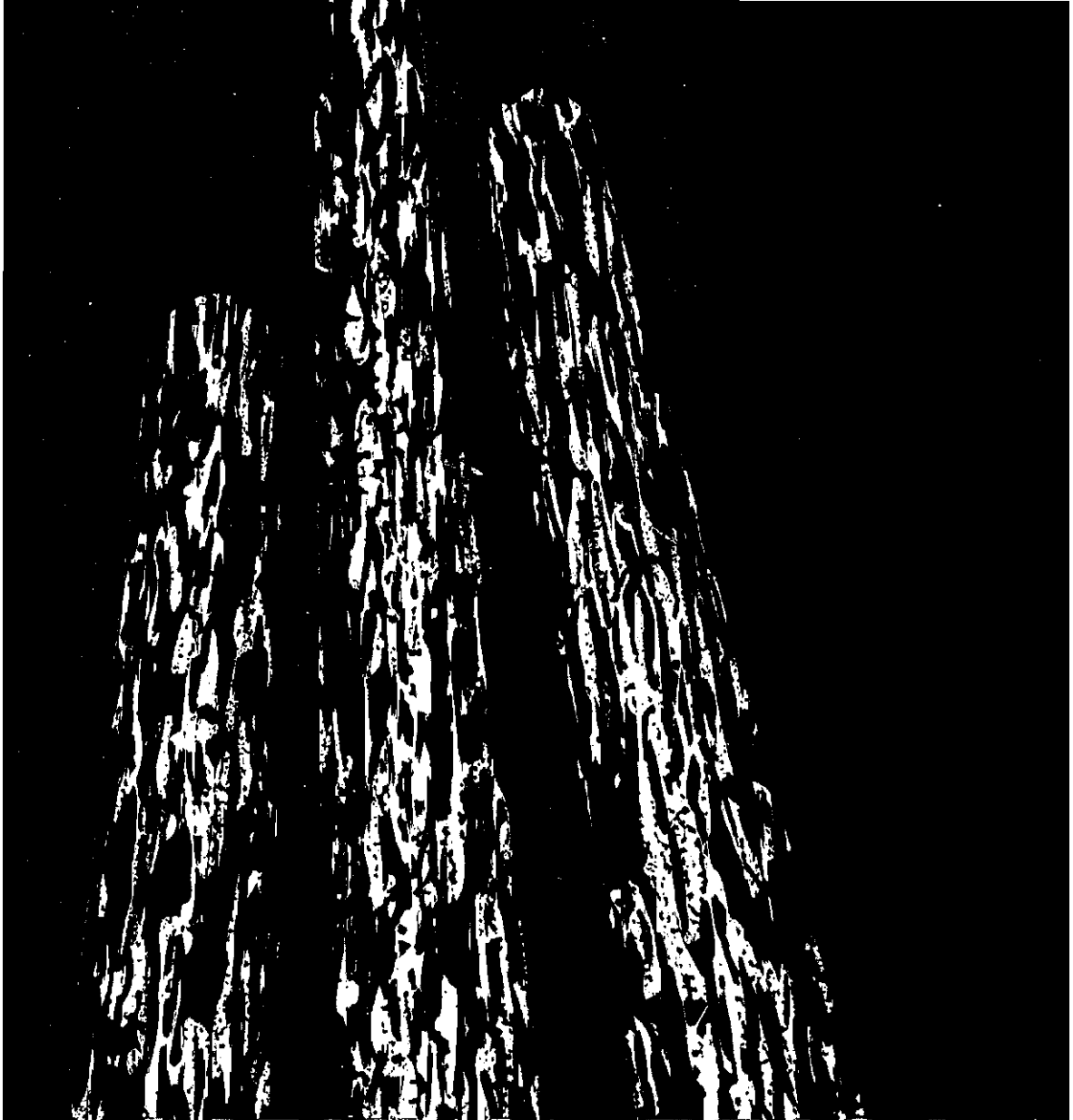

LATIN AMERICAN TIMBER TRENDS AND PROSPECTS

UNITED NATIONS

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

Economic Commission for Latin America
Food and Agriculture Organization of the United Nations

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Errata

PAGE 15, RIGHT COLUMN, SECOND PARAGRAPH, LINE 5:

For part of Durango, Chihuahua, and near *read* part of Durango in Chihuahua, and near

PAGE 20, RIGHT COLUMN, FIFTH PARAGRAPH, LINE 1:

For The deforestation of the Paraná forests of São Paulo has had a noticeable effect *read* The deforestation of the forests of São Paulo and surrounding areas has had a noticeable effect

PAGE 21, LEFT COLUMN, FIFTH PARAGRAPH, LINE 2:

For However, it is estimated that one-third of the *quebracho* in the northern part of the country (Chaco) has already been cut. *read* It is estimated that the growing stock of *quebracho colorado* in the northern part of the country is about 125 million tons, which is more than enough to meet the needs of the tanning industry during 80 to 100 years on the base of 600,000 tons yearly.

PAGE 25, RIGHT COLUMN, FIRST PARAGRAPH UNDER HEADING "OTHER INDUSTRY", LINE 3:

For in Mexico—the resin industry. *read* in Mexico—the resin industry, which occupies an important position among the principal producers of the world.

PAGE 25, LEFT COLUMN, LINE 5:

Delete —usually American-trained—

PAGE 25, RIGHT COLUMN, FIRST PARAGRAPH UNDER HEADING "OTHER INDUSTRY", LINE 6:

Delete Because of the scattered nature of the industry no comprehensive production statistics are available.

PAGE 30, RIGHT COLUMN, LINE 21:

After Bolivia. *add* Furthermore, it has to be taken into consideration, that because of marketing difficulties, the tanning industry in Argentina and Paraguay operates at only 40 per cent of its installed manufacturing capacity. Also, the raw material consists chiefly of *quebracho colorado* of Chaco (*Schinopsis balansae*) which yields more and is of better quality than *quebracho colorado* of Santiago (*Schinopsis Lorenzii*) which species exist in the forests of Bolivia.

PAGE 32, RIGHT COLUMN, FIRST PARAGRAPH AFTER HEADING "SECONDARY FOREST PRODUCTS", LINE 6:

After of as much as 290,000 tons. *add* It is worth noticing that the installed manufacturing capacity in both countries is of the order of 390,000 tons yearly, i.e., two-and-a-half times the present production.

PAGE 62, LEFT COLUMN, LINE 15:

For board production has been late in starting, but there are now plans for domestic manufacture in Argentina and the consumption should increase rapidly when this material is available to builders and other consumers. *read* board production has been late in starting, but, for instance in Argentina, successive installations of new mills and expansion of the initial ones have been observed after 1959 when the first mill, of a capacity of some 4,500 cubic metres, was installed; this has caused a rapid growth of this type of industry.

PAGE 88, RIGHT COLUMN, FOURTH PARAGRAPH, LINE 4:

For twenty-five years *read* fifty years

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SYMBOLS AND DEFINITIONS

m^3 (r)	=	cubic metre of roundwood
m^3 (s)	=	cubic metre of sawnwood
. .	=	not available
—	=	none
#	=	data submitted by correspondents
*	=	unofficial figure or estimate
†	=	figures do not add exactly to totals because of rounding
‡	=	less than half a unit

The terms "softwood" covers all wood derived from trees classified botanically as *Gymnospermae*; "hardwood" covers all wood derived from trees classified botanically as *Angiospermae*.

The unit "cubic metre roundwood" applies to solid volume without bark.

The use of hyphen (-), e.g., 1948-51, signifies an average of the full period of calendar years covered (including the end years indicated).

PREFACE

A few salient statistics serve to underline the reasons which prompted Latin American Governments to commission this study. In terms of forest area per head of population Latin America is the richest region in the world—5.3 hectares against 1.1 hectares in the rest of the world. Yet the region exports annually only 50 million dollars' worth of forest products, while imports of these goods cost it well over 300 million dollars every year.

This glaring anomaly is not a new development. But in recent years it has suddenly become more disturbing. This is because it is becoming clear that economic development and rising welfare will bring vastly increased needs of wood: for housing and other construction; for railways, mines and factories; for books, newspapers; for commerce, marketing and distribution. Unless more of these goods can be made in the region, then either the import bill will increase disproportionately or the region will go short of items essential for material and cultural progress.

This anomaly prompts a host of questions. Is the region really as rich in forest wealth as the foregoing comparison might suggest? Are the forests suited, by content and location, to support a significant expansion of forest industries? If they are, why has this expansion not taken place already? What are the obstacles? How can they be overcome? How big an expansion is needed?

These questions in turn give rise to countless others, and perhaps it is as well to make clear to the intending reader at the outset that he is unlikely to find complete answers to any of these questions in the pages which follow. For while this study marks the first serious attempt to assemble and analyse relevant data on a regional basis, it has to be admitted that presently available data do not admit of final and unequivocal answers to many of the questions this study was designed to answer. Nevertheless enough is already known to permit an analysis of the main problems in general terms, and to discern in broad outline the policies that need to be pursued. More importantly, the study directs attention to the principal gaps in information which need to be filled quickly if effective decisions are to be taken and detailed plans elaborated.

But this study is not solely concerned with an analysis in the trend of the demand for forest products, an appraisal of the region's forests, and a review of the existing state of the forest industries. Some broader issues have inevitably been invoked, and this for two reasons. First, the logic of the facts which were compiled and collated as the study progressed made it necessary to take account of events and trends extraneous to the forest and forest industry sectors. Second, the course of the study could not fail to be influenced by the critical reappraisal of developmental aims and methods which has engaged the attention of responsible Latin Americans—and interested parties in other regions—in recent years.

Latin American Governments accepted long ago the responsibility for promoting economic growth in their countries, and considerable effort has been devoted to the achievement of this aim. Yet the results have been disappointing—an annual rise in per capita gross product of around 2 per cent. This is progress certainly, and hard won progress, given the vulnerability of commodity export earnings and the relentless battle against inflationary conditions. But it is not enough. Not enough to narrow the gap between the Latin American countries and the industrialized countries. Not enough to satisfy the demands of the Latin American peoples for a better life. For by and large it has to be conceded that even this annual 2 per cent per capita has not reached the masses of the people—in the shape of better food, improved housing, educational facilities and medical care. In particular, it has not reached those who get their livelihood from the soil, and these account for over half of the 200 million people in Latin America.

The relative neglect of the agricultural sector and the failure of progress to date to bring social improvement to the broad masses of the people were recognized in the Act of Bogotá which, while also listing measures for economic development, gave precedence to measures for social improvement. Moreover, among these measures for social improvement it listed first measures for the improvement of rural living and land use, attaching particular importance to measures designed to achieve a broader distribution of land ownership.

The Act of Bogotá, approved by the Council of the Organization of American States on 11 October, 1960 thus had a two-fold significance. It marked a realization on the part of Latin American Governments that sound and sustained economic growth could not be achieved without a new approach to the problems of the rural sector, an approach which would require radical institutional changes. And it marked a realization of the fact that the time available for bringing about these changes was not limitless, since the patience of those demanding social betterment was not inexhaustible.

Thus it is that today a principal preoccupation of every Latin American Government is how to raise the productivity and income of the farm population; how to improve agricultural techniques and practices; how to satisfy the widespread demand for a more equitable distribution of the land and its fruits. This is no place to discuss the measures that will have to be applied. Clearly a whole series of measures will have to be applied simultaneously, and the blend of measures needed will differ from country to country, according to local circumstances. But some of these measures have a direct bearing on the subjects of this study.

A more equitable distribution of land ownership can be achieved in one of two ways: by dividing up land presently under cultivation and making it over to those who till it; or by settlement or colonization of land presently unused. Throughout Latin America there are vast areas of undeveloped land, and a substantial part of this land is publicly owned.

Since over half the region's land surface is currently classified as forest, it is clear that the coming years are

going to see a determined effort to convert substantial areas of presently forested land to permanent agriculture. Indeed, many of the colonization and settlement schemes now under way or in the course of preparation are located in forest areas.

Unless agricultural productivity is raised substantially, the economic development of Latin America will require the further alienation of areas presently forested to permanent agriculture. At the same time, no one who is coversant with what has happened in the region in the last few decades, and with what is happening today, can fail to understand that, unless adequate safeguards are provided, this process could be attended by catastrophic consequences—and not only in the very long run, but in our own lifetime.

The plain fact is that the forests of Latin America are being depleted. Perhaps the most discouraging feature of the present study is that it has not been possible to quantify this insidious process of forest attrition, so well attested by descriptions in the literature and by observers' reports. Maps are notoriously impermanent things, and nowhere more so than in Latin America. Over wide areas the maps of 5 or 10 years ago are already out of date. The consequences of uncontrolled alienation can be foreseen by reference to the recent past. Rivers in southern Chile, navigable to ocean-going boats in the memory of living man, are now silted up. In Cuba, for over half a century, sugar has devoured forest, leaving that country in a chronically wood-deficit position. In parts of Brazil deforestation of the uplands has meant that a number of rivers on which towns depend for hydroelectricity have dried up. It is these, and the countless similar facts that could be recited if space allowed, that provide a warning for those who would seek solace in the crude statistics which depict the region as singularly rich in forest.

The most important lesson emerging from this study is that the time has come for Latin American Governments to devise and implement integrated land use policies. In determining the role which the forest should play, it is necessary to take account not only of the timber needs of future generations, but also of the intimate relationship and delicate balance between forests and agriculture.

Some will argue, no doubt, on historical grounds, that human progress in Latin America as elsewhere will inevitably involve encroachments upon the region's apparently ample forest area. But it must not be forgotten that this process, in the past, was not effected on lines compatible with the rational use of forest resources. Today, however, the multiple role of the forest is well understood, as are the possible areas of conflict between short-term private interest and the long-term interests of the community. Moreover, while there is land hunger in Latin America, land famine—in the sense of physical scarcity—is limited and localized. Thus, in most of the region there is still time to act, and the leaders of contemporary Latin America must understand the full significance of their responsibility in this respect.

What are the safeguards which should be emphasized when colonization takes place in forest areas? Clearly it must be ascertained first that the soil is suited to permanent agriculture. Secondly, it is necessary to ensure that no part of the forest required for protective purposes is destroyed. Thirdly, sufficient productive forest area should be reserved, and brought under management, to satisfy the present and future demands of the new population. Fourth, the timber from the cleared forest should not be wasted: the establishment of wood processing facilities can permit this timber to be used for the settlers, for housing and other construction, furniture and tools. In favourable situations forest industries can be established on a scale to permit the shipment of processed wood to other areas, thus diversifying the local economy, providing additional employment opportunities, linking the area to the rest of the national economy and increasing the rural standards of living.

Carried out in this way, the settlement of people on presently forested lands becomes something more than a recipe for satisfying land hunger and for achieving the wider and more equitable distribution of land ownership called for in the Act of Bogotá. It is a practical demonstration of intelligent land-use policy, a means of releasing latent sources of human energy and enterprise, and a step towards the integration of the rural masses into national life.

A word of caution is necessary. Colonization and settlement do not represent, of themselves, a solution to the agrarian problem. In particular, it would be folly to regard them as a substitute for those institutional changes and technical improvements urgently needed on land now cultivated. Clearly there may be a temptation to do so where there is ample unused land in and where the vested interests resisting change are powerful. The basic problem remains that of raising agricultural productivity. The region's problem remains that of raising agricultural productivity. The region's population will double by the end of the century, and will continue to rise thereafter. The areas suited to permanent agriculture are not limitless. It should therefore be understood that if the settlement of new lands is allowed to weaken the attack on the basic agricultural problem, then this is simply a buying of time, a shifting of the problem into the future.

Today, on the Latin American scene, the farmer—so long in obscurity—has forced himself to the centre of the stage, and the Governments of the region have pledged themselves to bend their efforts to bring him a better life. This study shows that the farmer's future is, in many important ways, bound up with the fate of the forests. At the same time, the fate of the forests, and their capacity to contribute constructively to the economic development process (including agricultural development), hinges largely on the decisions which Latin American Governments are now called upon to take for solving the agrarian problem. Moreover, so far as the forests are concerned, it can be said quite bluntly that the worst decision of all would be no decision, the most catastrophic policy, inaction.

This rising preoccupation with the problems of the rural sector does not mean, of course, that the Governments concerned are prepared to let their plans for industrialization slide into the background. Efforts to industrialize will not only continue, but will be intensified in the coming years. In these efforts, as the following pages show, the forest industries will have to receive careful attention. One reason for this is that the measures of social betterment contemplated cannot be carried out without vastly increased quantities of processed wood. This study shows that, based on a conservative estimate, Latin America's need for industrial wood a quarter of a century hence is likely to be

nearly three times the recent level, and that this need will be felt in each and every sub-region:

FUTURE LATIN AMERICAN REQUIREMENTS FOR INDUSTRIAL WOOD, BY SUB-REGIONS

	Roundwood equivalent of recent consumption and future requirements	
	1956-59	*1985*
	(1,000 m³ (r))	
Mexico	4,500	13,900
Central America	2,700	8,400
The Caribbean islands	3,500	9,600
Northern South America	5,700	17,400
South-west South America	3,400	8,600
Brazil	17,100	48,500
South-east South America	5,800	12,500
Latin America	42,700	118,900

To mention some individual forest product groups: the region will require by 1985 two-and-a-half times as much sawnwood, eight times the present volume of wood-based sheet materials, and six times as much pulp and paper as it consumes today. These growth prospects, much more than mere awareness of need, provide considerable incentive for the development of industries based on the forests.

There are, however, many other factors which justify particular attention to the forest industries in drawing up development plans.

Most forest industries require to be located close to the source of raw material and thus, *ipso facto*, away from existing conurbations. A major problem today in many Latin American countries is how to check the drift to the big towns, the tendency for industry to gravitate there in search of external economies, bringing congestion, over-crowding, overtaxed utilities and social facilities and the like. Providing an adequate infrastructure exists, and in particular adequate communication with markets, the establishment of forest industries near the forest can provide new centres for urban development. Often the development can be linked with colonization and settlement schemes. New employment opportunities, both in the mills and in the forest, can raise incomes and enrich community life.

The primary forest industries can act as a catalyst in the economy by making possible the establishment of a variety of secondary, tertiary and associated industries—paper conversion, packaging, wood fabrication in different forms, chemicals, and so forth.

Most of these considerations are widely understood in Latin America, and indeed the last decade has seen a substantial growth of the forest industries. In several countries considerable encouragement has been given to new forest industries, partly for the reasons adduced above but more particularly because of their high import-saving potential. Yet the growth of forest industries over the last decade has not been sufficient to prevent a rise in the adverse trade balance on the forest products account. Without further expansion this adverse balance must inevitably rise further. For pulp products alone, extra needs by 1975, if met entirely by imports, would add not far short of 1,000 million dollars to the region's import bill. A pulp and paper expansion programme adequate to ensure that these extra needs are met from indigenous production would call for an average annual investment up to 1975 of around 190 million dollars.

An inhibiting factor in the past has undoubtedly been the limited size of national domestic markets for certain forest products, especially for those in the production of which the economies of scale are most pronounced. This problem is solving itself. Home markets are steadily expanding, and here it should be noted that the income elasticity of demand for several forest products is exceptionally high. At the same time the steps which are now being taken towards economic integration in the region may well break down the barrier imposed by the limited size of markets. Even so, a determined effort is required if the region is to succeed in avoiding growing dependence on imports for its essential supplies of forest products.

But it would be wrong to appraise the Latin American forest and timber economy solely in terms of its possibilities of satisfying the region's own present and future needs for timber and fibre. This study has shown that the region possesses abundant forest resources. Certainly not all of these are rich, and of those that are many lie beyond economic reach for lack of infrastructural development, while others, because of their heterogeneity, pose stubborn problems for development. What is of no less significance, however, is that the region is peculiarly blessed in areas which are especially adapted, by soil and climate, to the creation of new forests. In these areas, where pressure on the land is in many instances no problem, timber can be grown at a higher rate, per hectare and year, and at a lower price than in other parts of the world. These pronounced natural advantages point to a potential role for the region as supplier of forest products to other regions of the world. Plantation forestry in several countries of the region has already made a notable contribution towards satisfying forest product needs, and some export oriented forest industries are already being developed. These trends are of the utmost signifiance, for although they are recent and limited in scope, they represent a new and dynamic element in the world forest company. It should not be overlooked that recent studies have shown clearly that Europe's present wood-deficit is destined to grow in the remaining decades of this century, while other regions of the world, too, may encounter difficulty in assuring a growing volume of forest production to meet rising needs. But if Latin America's comparative advantages are to be harnessed in the interests of economic development, foresight, enterprise and planning will be needed. The significance of these facts will not be lost on those responsible for planning Latin America's long-term forest and forest industry development.

PART I

THE STUDY AND ITS SETTING

Chapter 1. Introduction

For the better part of three centuries Latin America has been called "The region with a future" but that future always remained elusive and never seemed to get much nearer. Today there are indications that Latin America is ready to move into that future—to take the steps which will permit its people to realize the vast potential that has always been present. From every Latin American nation come demands for more and better education, improved housing, increased nutritional levels—in short, for higher living standards. To raise levels of living will require substantial increases in the output of both producer and consumer goods. And this leads directly to Latin America's most pressing fundamental problem: how to combine the available human, cultural, and natural resources in a way that will promote sustained economic development.

Because this problem is so important, more and more Governments are establishing special agencies or bureaux to plan systematically for national economic development. The significance of these agencies and of their potential accomplishments can scarcely be overestimated. But in many cases they are neglecting the role that forests can and should play in developing Latin America. Levels of living are not wholly dependent on highway and air transport systems, or on steel mills, power plants, and automobiles. They also depend on housing and furniture, school buildings, textbooks and newspapers, packaging materials, and literally thousands of other products derived from the forest. Moreover, increased agricultural production will inevitably prove temporary unless a balanced programme of land use is developed. Wisely used, forests can protect the soil and water and at the same time provide a continually renewed source of raw materials for industry. Forestry must be an integral part of any rational, long-term plan for the development of Latin America.

Results of past and present misuse of the forests are abundant and obvious. Idle or derelict mills tell the story of forests recklessly plundered with no thought for tomorrow. Inhabitants of many communities must now travel a hundred kilometres for a glimpse of the receding forests. Rivers that once steadily supplied farmer and townsman alike now alternate between uncontrollable flood and arid trickle. And the air pilots spanning the length and breadth of this rich region are constantly aware of the hundreds of uncontrolled fires which devour the forest wealth.

Fortunately, most Latin American countries still possess substantial areas of untouched timberlands. Decisions must be made as to which of these forest areas to develop, when to develop them, and what industries to establish in order to utilize these natural assets. The forest resources of Latin America represent today a vast wealth for its people. They can be used wisely or can be squandered; they can be used for the immediate benefit of a few or for the long-term benefit of many. The decision rests with the Governments, the forest industries, and ultimately with the people themselves. The fact that decisions made over the next decade or two—or indecision that is allowed to continue—will determine whether future Latin Americans find themselves rich or poor in forests, lends a certain urgency to this study.

There is a close relationship between the ability to make good decisions and the amount and quality of information available on the question at hand. This study will present some of the information needed to make good decisions about the forests and forest industries of Latin America. It will also highlight some of the important informational gaps that exist, because nowhere else in the world is there such a large area of forests about which so little is known.

Aims of the study

The general aim of this study can be stated simply: it was undertaken to provide a basis of information for decisions by planning agencies, forest producers, and forest industries. The hoped-for result will be achieved if the information presented here helps the forests and forest industries of Latin America to contribute better to a rapid and orderly economic development.

Viewed more narrowly, the study has the following aims:

1. To present quantitative estimates of present forest-product consumption and corresponding estimates of the wood supplied by the forests for the manufacture of these products.

2. To present estimates of future requirements for forests products, based on probable demographic and economic changes.

3. To analyse the problems and opportunities revealed by a comparison of these estimated future requirements with the productive capability of the forest resource.

4. To offer recommendations regarding forest industry and resource development as an aid to planning agencies in their efforts to promote economic advance.

One should not conclude from this, however, that all the information needed to formulate detailed plans will be found in the chapters which follow. Only the individual Governments or industries concerned can undertake the detailed investigations which are necessary to answer all policy questions within a particular country or to solve problems pertaining to particular industries. This study will present the broad outline

of the problems, indicate their scope and relative magnitude, and in some cases suggest possible lines of action. To this extent it will help provide a basis for national planning of forest activities, which hitherto has been lacking.

Planning is an essential part of any forestry programme since the nature of tree growth forces foresters to look to future markets for the raw materials they produce. But the production period is long and the economic variables affecting the future are so many and complex that foresters tend to confine their planning activities to things concerned with tree growth and thereby to separate forestry-oriented activities from the rest of the economic world. Estimates of future requirements for forest products based on economic, demographic and industrial factors (rather than the biological ones of tree growth and reproduction) will help the forestry and wood-based industries to integrate their programmes more closely with the economy of the nation, the region, and the world. Such integration is not only desirable but absolutely necessary if the forest resources are to contribute their share to economic development.

Origin of the study

The study had its formal origin at the seventh session of the Economic Commission for Latin America at La Paz in 1957. The Commission decided to request the ECLA secretariat to undertake, in close co-operation with FAO, a regional study of trends in production, trade, and consumption of forest products in Latin America. The Commission also recommended that the Governments collaborate to the greatest extent possible in providing specialized financial, economic, industrial, agricultural, and forestry services for the study.

Later, in 1958, the Latin American Forestry Commission expressed its total support of the plan for a joint FAO/ECLA study as presented by the secretariat. The study was recommended to the Governments of Latin America and to the Director-General of FAO by the Fifth FAO Regional Conference for Latin America in November, 1958, and recommendations were repeated the following year. Preliminary work on the study started in 1959 and the main part was completed during 1960 and 1961.

The study area

The region called Latin America in this report consists of all of the Western Hemisphere south of the boundary line between Mexico and the United States of America. In most respects it is a logical natural region although the separation from northern North America is quite artificial.

Latin America has been divided into sub-regions in this report in an effort to simplify the presentation of data and the discussion of problems and prospects. Some of these sub-regions are natural geographical units but others were defined arbitrarily and do not necessarily imply a close economic or political relationship between the countries within them. The sub-regions recognized here are as follows:

Mexico

Central America:

British Honduras (Belize), Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama

The Caribbean Islands:

Bahamas, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, and other islands

Northern South America:

British Guiana, Colombia, Ecuador, French Guiana, Surinam, Venezuela

South-west South America:

Bolivia, Chile, Peru

Brazil

South-east South America:

Argentina, Paraguay, Uruguay

Future requirements—the keystone of the analysis

The core of this study lay in defining and then quantitatively specifying Latin America's future requirements for wood products. The future requirements presented in this study are estimates of what the consumption of forests products would be under assumed levels of economic activity and population and under the further assumption that supplies of forest products will be forthcoming on the scale needed without any change in relative price.[1] Dates are attached to these estimates (1970, 1975 and 1985) but these are really only "pegs" on which to "hang" the estimates. The future requirements for, say, 1975 can be interpreted as a forecast of wood product consumption on that particular date only in one narrowly restricted sense. That is if all of the assumed conditions are fulfilled by that particular year. The estimated future requirements for paper products in 1975, for example, assume specific rates of growth in population and gross national products, corresponding (or associated) changes in the educational levels of the population, certain rates of capital formation, certain transportation developments, and political and economic stability in the world at large and in the specific countries. They also assume that the relationship between per capita paper consumption and income which developed in other areas in the past will be duplicated in Latin America in the future. If any of these assumptions is not fulfilled—and particularly, if the rates of population or economic growth are different from those postulated—the estimated future requirements will not be correct for that particular date.

These estimates will still be valid and useful, however: valid for the time when the specific conditions are achieved, and useful as indicators of the extent to which forest and industrial policy must be changed. Should economic growth in Latin America proceed at an accelerated pace, the future requirements estimated for 1975 might become applicable to 1970 or 1972. On the other hand, if something intervenes to slow down the rate of economic development, the requirements estimated for 1975 might not be applicable until 1980 or even later. The important point is that these future requirement estimates provide a bench-mark against which to judge the adequacy of present plans for forest resource and industrial development. As such they provide guides for forest and industrial policy and that is the major purpose of this study.

[1] This therefore implies assumptions of constant production costs, a constant supply, and a constant price for forest products in relation to competing materials. Because none of these assumptions have been verified, the future requirements should not be taken directly as production goals. Such goals must take supply factors explicitly into consideration.

Study methods

Once the concept of future requirements had been defined and the major objectives determined, the necessary methodology became quite narrowly prescribed, both by the objectives themselves and by the sources, quality and availability of data. The methods adopted can be described in five steps:

Data were gathered for a reasonably accurate description of the existing situation of the forest resource and the consumption and production of forest products. Considerably information was already available as a result of FAO's preparation of the *World Forest Inventory—1958* and the annual *Yearbook of Forest Product Statistics*. Additional data were obtained directly from governmental agencies. Before the study was officially under way, however, it became evident that the data from these sources were inadequate for the study. Local authorities in the major producing and exporting countries were therefore engaged to prepare special "country reports" on their own areas. These provided much of the basic information on which the study rests.

Part of the economic and demographic data was already available from previous work of the Economic Commission for Latin America and the rest was extended or prepared by the ECLA staff. In consultation with the study team, estimates of the rates of economic growth were made for each sub-region. These estimates should not be taken as forecasts of what will actually happen. Rather, they represent a considered opinion of how fast the Latin American nations can progress if they take advantage of their opportunities and suffer no major reversals. Reasonable political and financial stability are prerequisites for anything approaching optimum economic growth and both have been assumed during the period dealt with by the study.

Using the information on historical forest-product consumption, trade in forest products, and anticipated rates of economic and demographic growth, estimates were made of the changing consumption of the various categories of forest products on the assumption that raw material supplies will be forthcoming without any increase in relative price. This gave the estimated future requirements for forest products.

These future requirements were compared with the yields the forests can be expected to produce under existing plans for management and exploitation and with the changes in forest area that can be expected from expanded and intensified agricultural activities and the bringing of new forest areas into production. This comparison provided the basis for an assessment of present and planned forestry activities and the international trade development that may be expected. From this analysis stem the conclusions of the study.

Plan of presentation

The study is presented in six major sections. Part I gives the general setting for the study, both economic and social. Part II is devoted to a description of the forest resources and their associated industries. Part III describes historical wood consumption patterns in quantitative terms and then develops the estimates of future requirements. Part IV is a description of timber trade patterns between Latin American and other countries. Part V presents an analysis of the foregoing information and of the problems and opportunities revealed by comparing future requirements with the present and potential productivity of the forests and industries and with trade possibilities. The policy implications of this analysis are also discussed. A limited number of recommendations pointing to specific areas where action appears especially fruitful are offered in part VI.

Statistical basis

Difficulties due to lack of basic information were particularly severe in this study. Forest surveys have not been completed in any of the countries making up the study area. Many countries do not know their total forest area with confidence and even the total land area is an unreliable figure in some instances.

Data on wood removals, or on wood consumption, vary greatly in reliability. In general, the production figures for those industries which require a high capital investment and a centralized production control, such as pulp and paper and plywood, are satisfactory. For other items, such as sawnwood, the data are far less satisfactory.

The greatest statistical weakness is the absence of studies specifically designed to determine wood consumption. Particular efforts were made in some countries to obtain reasonably detailed figures, though in no case were they a result of specific wood consumption studies. They did, however, provide a basis for estimating corresponding quantities for those countries lacking quantitative data. This study will have achieved one of its aims if the Latin American countries are encouraged to conduct detailed investigations into the pattern of their domestic wood use since such information is invaluable for forest and forest industry planning.

An entirely different sort of problem arose from the purely mechanical difficulties of communication. As the data were received from country correspondents or from official sources, they were checked against any other available figures and compared with information from other countries and indications given by statistics on related items. Wherever such checks revealed substantial discrepancies, enquiries were immediately instituted but frequently weeks or months elapsed before a reply was obtained. Distances were great and transportation difficult and all the desirable checks could not be made. The same factor prevented a rapid or complete fill-in of missing data. Communication between the study headquarters and individual countries was a minor difficulty compared to that faced by the country correspondents. Often the only possibility of checking data would have required substantial travel and therefore many desirable checks were virtually impossible.

Besides these general problems, there were difficulties peculiar to the Latin American study itself. Not all of these have been satisfactorily solved, and the reader should bear in mind the effect that they might have on the results presented. The major statistical problems encountered, and the approach taken to solve, circumvent, or mitigate their effect, are discussed below under the four principal types of data used.

Data concerning forests. Information on the area under forest cover, the composition of forest types, the density of growing stock, and the annual growth of the stand is best provided by systematic forest inventories. Many problems of definition arise in establishing an inventory procedure and in interpreting its results. In Latin America, where few nations have begun systematic inventories, the problems are multiplied. A simple example will show the way in which data can

be affected. Forests are classified into "accessible" and "inaccessible". An accessible forest is defined as an "area within reach of exploitation by existing transportation systems". Obviously there is room here for a variety of interpretations. Similar difficulties even exist in such an elementary a thing as defining "forest land". A more detailed discussion of these difficulties and of the approach taken to resolve them can be found in *World Forest Inventory—1958.*[2]

This problem has not been "solved" in the study; that is, statistics presented are not fully comparable between countries. But the data used are the best available and reflect the real problems which exist. Progress is being made in securing better data and various countries have initiated inventory work with the aim of obtaining national data, or directed towards specific, critical areas. There is still need, however, for an early inventory of all accessible, productive forests. Only when such work has been completed will it be possible to depict accurately the extent and variety of Latin America's forest resources.

Products of forests. Data on forest removals is particularly scanty, partly because of the wealth of the forest resource, and partly because most Latin American forest agencies are comparatively young. In some countries practically no quantitative data were available; in others, only data pertaining to areas officially recognized as forest reserves. Three main sources of difficulty were: removals for fuel, removals from "trees outside the forest", and fellings due to shifting agriculture.

The most important use of wood in Latin America in terms of volume is for fuel. However, fuelwood markets are seldom organized in any real sense. Fellings are frequently made by the consuming household from the most easily available source, which is often trees that are not in areas classified as forests. Such wood consumption is important, for as these sources become exhausted the pressure is transferred to other areas. Large areas which formerly supported sufficient tree growth to protect them from wind and water action have been transformed into treeless expanses, subject to rapid and serious erosion. Yet without incurring the large expense of special fuelwood consumption surveys, little more than informed guesses could be made as to the quantities being removed. Fuelwood consumption data is probably the least reliable of all that data used in the study.

Since part of the timber originates from "trees outside the forest", statistical information is practically non-existent. The figures reported in this study are therefore estimates which have substantial margins of error.

In the more remote regions of Latin America agriculture is not yet permanently tied to specific land areas. Instead the forests are cleared and crops are planted and harvested for one to three years. When the natural fertility of the soil has been depleted the cultivator moves on to a new area where the cycle is repeated. If the rotation is long enough to permit re-establishment and growth of true forest cover, little damage results. But as populations grow, the rotation is reduced and often the forest is replaced by brush which is worthless from almost any viewpoint. There are virtually no records of the areas affected but it is certain that this shifting agriculture constitutes one of the greatest threats of the forest resource. The extent to which this form of agriculture has depleted Latin America's forests will only be known after careful inventories.

Products of forest industries. When forest industries are widely scattered some production is bound to go unreported. In Latin America this situation is augmented by the facts that the output of many mills is small, the operations are often temporary, frequently no reporting procedure exists, and in some cases illicit operation is more profitable. Wherever a tax is levied on production, under-reporting of quantities produced must be expected. It has been assumed unwise (except where noted) to attempt any estimate of the extent of this "official" under-estimation.

Trade statistics. Nearly all of the countries concerned have agencies responsible for collecting data on foreign trade. However, there is wide variability in the detail with which these statistics are reported and in the accuracy of the figures. Little difficulty was experienced in obtaining the figures that exist, but there was little basis for correcting them or filling the gaps.

Another complicating factor that must be recognized is the undoubted effect of tax structures on the reporting of import and export information. In many Latin American countries import duties are high and several levy excise taxes on goods destined for export. Borders are long, patrolling difficult, and evasion of either import or export duties is often easy. As a consequence the quantities and values officially reported are apt to under-estimate the true situation. How much error has been introduced is impossible to estimate with precision and this study has accepted the official figures as being the best available.

Economic information. Economists in the highly industrialized countries have become accustomed to relying on monthly releases of large governmental statistical organizations which give official estimates of gross national product, net national product, national income, indices of industrial production, and employment.

It is difficult to obtain accurate statistical information in Latin America for such economic indicators. However, the Economic Commission for Latin America has a continuing programme of compilation and publication of economic data and in co-operation with member states is constantly improving these statistics. All of this information, both published and unpublished, was available for use in the preparation of the economic and demographic parameters for this study.

[2] *World Forest Inventory—1958*, Food and Agriculture Organization of the United Nations. Rome, March 1960. 135 pp.

Chapter 2. The economic setting

Latin America consists of twenty independent nations plus some European and American dependencies. It is one of the under-developed regions of the world and differs in many ways from the northern part of the hemisphere. Historically, it has been a raw material producer and as a result has lagged behind the more industrialized regions in economic development. But the Latin Americans yearn for the economic advantages

enjoyed by people in other parts of the world and are strenuously seeking ways to expand their economies. The future of the forest resources and wood-using industries of the region are inextricably bound up with this general economic development effort.

Although Latin America has characteristics which set it off from other parts of the world, it is not a homogeneous region. Conditions differ from country to country and some of these differences are very large. More than 120 people live in the average square kilometre in Haiti but there are less than 5 people per square kilometre in Bolivia. Natural resources are unequally distributed and countries like Venezuela are much better endowed than others like Paraguay. Annual per capita income ranges from 77 dollars in Bolivia to 558 dollars in Argentina.

The economic situation is further complicated by the variation in size between individual countries. The 846,000 square kilometres of surface area and 64 million inhabitants of Brazil are a striking contrast to the 2,000 square kilometres and 2.5 million people of El Salvador.

Land and natural resources

Latin America occupies 15 per cent of the world's area but has only 7 per cent of the arable land. Within the region itself, a mere 5 per cent of the land is classified as arable. Because of the lower population density at present, the amount of arable land per capita is slightly larger than the world average and the area of permanent meadows and pastures more than twice the world average.

In contrast with its limited agricultural land, Latin America contains a fourth of the world's forest area. Half of the region is covered with forests and the amount of forest land per capita is almost 4 times the world average. Some of the forest has been exploited wastefully and sizable areas have been cleared for agriculture, but in general the forest resources have never been developed. The reasons for this and the possibilities of future development will be explored in detail later in this report.

Latin America also has important mineral resources. Ten per cent of the known petroleum reserves are here and the iron deposits are among the largest in the world. Copper, tin, silver, lead and zinc have been exploited for years, and other minerals exist in significant quantities. Again, the regional distribution is not uniform. Over 85 per cent of the petroleum reserves are in Venezuela and Mexico; most of the iron deposits in Brazil and Venezuela; and three-fourths of the coal in Colombia and Chile.

In relation to its present population, Latin America is well endowed with land and natural resources. Their uneven distribution poses serious problems for uniform economic development. But, in general, the basic resources for economic growth appear adequate. The problem is to develop them and to carry production beyond the raw material stage.

Population

The population of Latin America in 1960 was slightly over 200 million, or about 7 per cent of the world total. Thirty per cent live in Mexico and Central America, 53 per cent in tropical South America, and 17 per cent in temperate South America. One-third of all Latin Americans live in Brazil and another third in Mexico, Argentina and Colombia.

The total population is growing at an annual rate of 2.6 per cent. This is a rapid increase compared to the world average of 1.7 per cent and is equalled only in South-west Asia. In five of these countries the population is increasing at an annual rate of over 3 per cent, and even in temperate South America the lowest rate of 1 per cent in Uruguay exceeds Europe's 0.7 per cent.

There is no evidence of slackening in the growth rate and the total will probably reach 295 million in 1975 and 380 million in 1985. The prospect that the population of Latin America may double in the next 25 years has a significant influence on analyses and plans for economic development of the region. What volume of wood products will such an expanded population require? What steps must be taken in forest management today to anticipate such future demands?

Somewhat over half of the population is now classified as rural; the rest live in towns of 2,000 or more inhabitants. The urban proportion increased from 39 per cent in 1950 to 46 per cent in 1960. Over 30 per cent of the people in Argentina, Chile and Uruguay now live in cities of more than 100,000 inhabitants. The rural populations of all the Latin American countries are still growing but the proportion living in urban areas is expected to increase to 54 per cent by 1975. Three-fourths of the consumers added to the total in the next 15 years will be urban dwellers, and these differ from rural people in the kinds and amounts of wood products that they use.

The economically active population is still largely agricultural. About 55 per cent of the people work in agriculture and only 11 per cent in manufacturing. A considerable amount of underemployment exists in all sectors of the economies. Lack of opportunity in agriculture has stimulated migration to the cities and added to the underemployment there. The proportion of the population engaged in agriculture will continue to decline in the future so all these countries have a problem of providing new kinds of more complete and effective employment for their people. The development of new wood-using industries and the expansion of existing industries may offer a partial solution.

Latin America in general has a low educational level since these countries have not yet been able to extend formal education to all their people. Only in Argentina and Uruguay can more than 80 per cent of the people read and write; in Haiti and Bolivia over 80 per cent are illiterate. This lack of education poses serious problems for these countries in their efforts to increase productivity and raise their standard of living. It also suggests that the future will bring a considerable increase in the use of newsprint and printing and writing papers in these countries.

National income

In 1959 the gross domestic product in Latin America was approximately 59,000 million dollars at 1950 prices. Its real value has more than doubled since 1945. This has been a continuous increase and domestic products have grown faster than population, as the following indices show:

Year	Gross domestic product	Population
1951	80	91
1953	89	95
1955	100	100
1957	112	105
1959	119	111

In 1957 the average per capita domestic income in Latin America was 293 dollars at 1950 prices whereas it had been only 202 dollars in 1945. This income and rate of growth compare favourably with those in many Asian and African countries but the average income is much less than in the more industrialized countries. The amount of goods and services—including most wood products—which people use is closely related to the incomes they have. The consumption of these products will likely increase more rapidly than does the population if per capita income continues to increase in Latin America as it has in the past.

Gross domestic product and income are unequally distributed over the region. Half of the product originates in Argentina and Brazil and another quarter in Mexico and Venezuela, although these countries have only 62 per cent of the total population. The following figures for 1957 indicate how much discrepancy there is between countries:

Country	Per capita income (dollars)	Percentage of regional average
Venezuela	965	330
Argentina	558	190
Cuba	408	140
Latin America	*293*	*100*
Paraguay	114	39
Haiti	86	29
Bolivia	77	26

These differences in income are reflected in present wood-product consumption and will influence future consumption in these countries.

The main sources of domestic product in Latin America are agriculture and manufacturing. There has been a gradual shift in the relative importance of these sectors, with agriculture contributing proportionately less to total income and manufacturing, mining, and some other sectors contributing more, as the following figures show:

	1945	1950	1958
	(percentages)		
Agriculture	27	24	22
Manufacturing	18	19	21
Mining	4	4	5

The contribution of different sectors to domestic product varies widely between countries as shown in table 1. It is affected by the natural resources which the countries have and by their stage of development and industrialization. The potential contribution to future economic development of the forest resources and the industries based on them will also vary and may be greater in those countries at present heavily dependent on agriculture as a source of domestic product.

Table 1

SECTOR DISTRIBUTION OF GROSS DOMESTIC PRODUCT IN CERTAIN COUNTRIES

(Percentage of total product)

Country	Agriculture	Manufacturing	Mining
Honduras	55	11	1
Ecuador	40	14	1
Colombia	33	21	3
Peru	27	17	5
Brazil	27	21	1
Mexico	21	20	2
Chile	17	17	5
Argentina	16	23	1
Venezuela	7	7	31

Source: ECLA, on the basis of national statistics.

FOOD AND AGRICULTURE

Traditionally, Latin America has been an agricultural area and has depended on agricultural products for a large part of its international trade. It still produces 80 per cent of the world's coffee, 70 per cent of the bananas, 35 per cent of the sugar. Almost every kind of agricultural crop is produced in Latin America, including over 10 per cent of the citrus fruit, wool, meat, cotton, tobacco, and maize.

If Latin America is considered as a whole and in comparison with pre-war years, per capita agricultural production has decreased but supplies available for domestic consumption have increased. Enough volume has been diverted from exports to domestic consumption to permit an increase in per capita consumption. Latin America has thus furnished its growing population with increasing supplies of food but these are still inadequate from a nutritional viewpoint. A major problem of Latin American agriculture is to increase supplies of food for domestic consumption faster than the population growth and at the same time to emphasize production of those foods now lacking in the national diets. This is quite an undertaking in view of the prospective annual population increase of 2.6 per cent.

However, reducing the amount of agricultural products available for export in order to increase domestic consumption creates another problem. Latin America needs imports, both for consumption and to provide the means for further development. The main way to pay for such imports is through exports and these still must be mainly foodstuffs and raw materials. In order to maintain or expand the volume of imports, these countries will have to increase production of agricultural materials for export. Thus Latin American agriculture must expand production enough to both satisfy the growing domestic demand and provide an increasing surplus for export.

In view of this it is significant that agricultural productivity in this region is low. The yield of maize is only 1,200 kg. per hectare compared to 3,000 kg. in North America. Wheat yields of 1,200 kg. are well below the European average of 1,800 kg. North America grows 440 kg. of cotton per hectare compared to Latin America's 270 kg. These differences are so large that it must be possible for Latin America to raise production of many crops substantially without increasing the amount of land used.

Both land and labour are inefficiently used in Latin American agriculture. Shifting cultivation is still common, in which the natural forest growth is cut and burned and the land cultivated for a few years until its productivity is depleted, when it is abandoned and the process repeated on new areas. Eventually the soil may be almost ruined for either agricultural or forest use. Even where agriculture is more stable, much land has been cleared which is not really suited to cultivation or pasture. Part of this has found its way back into forest and most of the rest eventually should be reforested. It appears that much of this marginal and sub-marginal land could be retired from cultivation without reducing agricultural production if suitable agricultural land were used more intensively. Increased use of fertilizers, irrigation, and improved crop varieties might raise productivity substantially.

Because of the existing underemployment and inefficiency in agriculture, steps taken to increase production are likely to reduce rather than expand employment, particularly if the degree of mechanization in the sector rises. In parts of the region some of this surplus agricultural labour might be employed usefully in forestry and lumbering if the forest resources are developed and forestry might also absorb some of the seasonal unemployment.

In general, it appears that agriculture and forestry should not have to compete for land and labour in the foreseeable future. The needed increase in agricultural production should be obtainable by more efficient use of the present land base and the reclamation of arid lands through irrigation and forestry may well be compatible with agriculture in the use of labour.

Manufacturing and mining

Production in mining and manufacturing is increasing faster in Latin America than in the world as a whole, as shown in table 2.

Table 2

Manufacturing and mining production indices for 1959 (1953 = 100)

Product	*Latin America*	*World*
All manufacturing	148	131
Chemicals, etc.	198	159
Paper and products	160	140
Food products	130	124
Textiles	107	117
All mining	147	121
Petroleum	156	134
Metals	124	120
Coal	120	96

Source: United Nations *Monthly Bulletin of Statistics*, February 1961.

The most widely established manufacturing industries process foods, beverages and textiles. Substitution of domestic production for imports of these products has reached a maximum in most countries and further increases are limited to the growth of domestic demand. The industrial expansion that Latin America needs must come in other products.

The major dynamic industrial sectors are iron and steel, chemicals, and pulp and paper. The cement industry also has more than doubled production in ten years. Steel and cement compete directly with wood in construction and other uses while paper production uses wood as its most common raw material. Thus the current industrial expansion may have conflicting industrial effects on the demand for wood from the forests.

Manufacturing has progressed further in some countries because they possessed the necessary raw materials, complementary economic activities and a sizeable domestic market. Other countries, handicapped by a lack of raw materials or inadequate domestic markets, have not succeeded in entering the more dynamic fields of manufacture. Where they have forests, these countries might be able to develop their less dynamic wood-using industries or to export partially processed products to the more industrialized countries.

Mining is important in the economy of certain countries and production in general has been increasing, though not consistently for all minerals as the following indices (1955 = 100) show:

	1950	*1958*
Iron ore	34	168
Crude petroleum	71	121
Copper ore	87	107
Coal	79	104
Zinc ore	72	84
Nitrate	104	83
Tin ore	112	64

Iron ore production has expanded with the steel industry as has also coal production. The other metals are mostly exported for processing elsewhere and their production fluctuates with world demand which may be quite erratic from year to year. Eight countries are the major producers and, with the exception of Bolivia, these are the same countries that have progressed most in manufacturing. This may leave an important role for the forests and wood-using industries in the remaining countries.

Energy

In 1959, Latin America consumed energy equivalent to 108 million tons of petroleum. This was less than 4 per cent of the energy used in the world. Per capita consumption was 557 kg. of petroleum equivalent which is very low compared to the amount used in Western Europe and the United States.

This low energy consumption is not due to lack of resources. Latin America has relatively little coal but at least 10 per cent of the world's petroleum reserves and 11 per cent of the hydroelectrical potential are in this region.

The energy consumed in 1959 came from the following sources:

	Per cent
Petroleum derivatives	52
Wood and other vegetable material	23
Hydroelectricity	11
Coal	7
Natural gas	7

The relative importance of wood results from the low stage of industrial development and the unequal distribution of energy resources. Seven countries possess 98 per cent of the petroleum, 92 per cent of the coal, and 80 per cent of the hydroelectric potential. Fuels are generally scarce in Central America and the Carib-

bean, and hydroelectricity is also scarce in Honduras, Panama, Paraguay and the islands. These countries must depend on imported sources of energy and some may have to continue to use wood as a major source.

Transportation

Transportation is a serious problem in many parts of Latin America and in some areas only the most primitive forms of travel are possible. The high range of the Andes virtually cuts off the eastern parts of some South American countries from the large cities and ports on the Pacific coast and this has hindered the development of their forest resources.

The total length of railroads is about 140,000 kilometres. Some new lines have been built in recent years and there probably will be further extensions but any major change in railroad length appears unlikely.

There are almost 800,000 kilometres of highways in the region but only one-third of these are all-weather roads. The number of motor vehicles increased from 1.7 million in 1948 to over 4 million in 1958, and most countries are improving and expanding their road systems. The growth in total transportation is currently being absorbed by trucks rather than railroads and the presently undeveloped areas will probably be opened up with roads.

All but two of the Latin American nations border on oceans and the region has developed a substantial sea-borne trade. In 1958, these countries loaded 250 million tons of external freight and unloaded 100 million in return. Much of the timber-products trade between countries within the region moves by water.

Capital formation

Gross domestic fixed capital formation in 1958 amounted to almost 10,000 million dollars at 1950 prices, or over twice what it was in 1945. About 17 per cent of the gross domestic product has gone into fixed capital formation in recent years. Somewhat over half of this has been in the form of construction and the rest in machinery and equipment. During the last decade about 30 per cent of Latin American capital formation has resulted from public investment and the balance from private investment.

International trade

Ten per cent of all world trade involves Latin America and this trade is of vital importance to the region. Almost half of all Latin American trade is with the United States and another third with Europe. These industrialized areas have been complementary with the raw-material producing Latin Americas whose main imports and exports are shown in table 3.

Table 3

Composition of Latin American trade, 1958

(Percentage of total values)

Exports:	
Vegetable products	48
Fuels	24
Mineral products	12
Animal products	11
Imports:	
Non-metallic raw materials and intermediate products	26
Industrial equipment and machinery	18
Non-durable consumer goods	13
Fuels	11
Transport equipment and machinery	8

Source: ECLA, on the basis of national statistics.

Reciprocal trade within the region is about 10 per cent of the total. More than half of the volume traded is to satisfy food requirements. Another fifth consists of raw materials—mainly cotton, timber and copper—and petroleum and petroleum products make up most of the rest.

The common market

In order to make the progress it desires, Latin America must utilize its natural and human resources more efficiently than in the past. Besides producing raw materials, it must channel resources into the more productive, advanced stages of processing. At present, the region is vulnerable to external influences and needs to become more self-sufficient. As long as it depends heavily on imports for consumption and use in domestic production, development is limited by the foreign exchange that can be earned through exports.

One possible recourse is to substitute domestic production for imports and many countries have undertaken to do this. However, the domestic market in most of these countries is small, and many commodities have to be made available in large quantities if their production is to be efficient. Other commodities cannot be produced efficiently everywhere because certain natural resources or essential conditions are not present in all countries. Domestic products may therefore be more expensive than those which could be imported, and it may only be possible to produce them behind protective tariff barriers. Inefficient import substitution is not a very effective way to raise living standards.

Another approach is to increase exports in order to pay for more imports. But world markets for traditional Latin American exports are limited and most of the additional exports will have to be new products. These can penetrate the world market only if their prices are competitive with those of the older established regions. The limitations on size and efficiency of domestic production are a serious handicap here.

A solution which has been discussed for some time is the development of a Latin American common market. Under a common market, goods and services, human beings, and capital could circulate freely throughout the region. Enterprises could sell their products in the entire region and could expand production to an efficient scale. Different parts of the region could specialize in what they can produce most efficiently and intra-regional trade could substitute for many outside imports. Lower production costs might permit regional products to compete in the world market and thus exports can be expanded.

However, there are problems involved in the formation of a common market. The most serious arise from the large discrepancies in the stage of economic development and the natural resource endowments of the various countries. A form of common market which enabled some countries to advance very rapidly while others made little progress would not be acceptable to the whole region. So, the proposals which have been made include provisions for protecting the relatively

under-developed countries and for regional assistance in promoting their development.

Two moves towards a common market influence present trade and development in the region. The first in point of time is the Central American Economic Integration Programme. The five Central American countries have agreed to develop a uniform import tariff and progressively to reduce restrictions on trade among themselves. In addition, they are working towards the integration of industrial development, agriculture and other sectors of the economy.

The Latin American Free Trade Association came next. The original members were Argentina, Brazil, Chile, Mexico, Paraguay, Peru and Uruguay but any other Latin American country may join. The objective is to establish a free-trade area comprising the territories of member nations. Tariffs and other restrictions on commerce within the zone will be reduced gradually and eventually eliminated. The treaty establishing the association provides for aid to the relatively under-developed countries and for efforts to integrate and complement the economies of member countries.

Efforts to develop a common market will continue and probably will accelerate in the future. Colombia and Ecuador have already joined the Free Trade Association, and the remaining countries will likely be drawn into the undertaking in one way or another. The future development of the region's forest resources and wood-using industries will be influenced by the new environment that is thus being produced.

PART II

THE PRODUCING SECTOR

The basis for planning the development of the forestry economy of Latin America must be information on the resources which are available for producing wood and other forest products. The basic resource is land and forests. But wood is generally usable by people only after it has been converted into products. The facilities that exist for transforming wood into useful products are therefore also an important part of the productive resources.

This section of the report will describe, as completely as the available information will permit, the forest and industrial resources that now exist in Latin America. The information will be presented by sub-regions and, where data are sufficient, by individual countries.

Chapter 3. The forest resources

The forests of Latin America vary from open stands of pine in the mountains of northern Mexico through dense jungle in the Amazon basin, to temperate hardwood forests in southern Argentina and Chile. Taken together they represent an enormous natural resource, which, under proper management can not only maintain its production but substantially increase it.

The forest resources of Latin America embrace a wide variety of hardwood and softwood tree species, though in the mixed forests only a few of them are currently of commercial value. Statistics on area and production are given in tables 4, 5 and 6. The map shows the widespread range of forest types superimposed on the geographical outline of Latin America. About half of the gross forest resource is the large area of tropical hardwood forest in the Amazon basin. Yet for all practical purposes this has hardly been touched. The bulk of the forests now in use lies in the more highly developed and heavily populated parts of the region —in Central America and eastern and western South America. Here the pattern of forest use conforms to the population density and accessibility to it.

Detailed statistics on the forest resources of this great area—so far as they have been assessed—were compiled, in the FAO publication *World Forest Inventory—1958*. Surveys are currently under way in various Latin American countries and the statistics quoted below will require substantial amendment as new data become available. However, the revised figures are not likely to cause any serious modification of the general picture revealed by existing data.

Table 4

LATIN AMERICA: AREAS OF FORESTS AND FORESTS IN USE[a]

Sub-regions	Forest land				Forest in use			
	Total (thousands of ha.)	*Forests, per cent of total land area*	*Per capita forest area (ha.)*	*Accessible as per cent of total forest area* [a]	*Conifers (thousands of ha.)*	*Hardwood and mixed woods (thousands of ha.)*	*Forests in use as per cent of total forest area*	*Managed with working plans (thousands of ha.)*
Mexico	38 840	20	1.5	100	10 000	13 300	60	..
Central America:								
British Honduras (Belize)	1 810	80	21	76	180	1 020	74	430
Costa Rica	3 620	72	3.4	47		1 500[b]	41[b]	..
El Salvador	280	14	0.1	100	25	240	100	
Guatemala	5 350	51	1.5	83	840	1 810	50	1 150
Honduras	6 860	64	3.8	23	700	300	16	
Nicaragua	6 450	47	4.7	23	750	750	23	
Panama	5 270	71	5.3	22		1 180	22[b]	..
SUB-TOTAL	29 640		2.6		2 495	6 800		
Caribbean islands:								
Cuba	1 300	11	0.2	100	110	980	84	
Dominican Republic	2 230	47	0.8	40	125	75	9	130

Table 4 (continued)

Sub-regions	Forest land				Forest in use			
	Total (thousands of ha.)	*Forests, per cent of total land area*	*Per capita forest area (ha.)*	*Accessible as per cent of total forest area* [a]	*Conifers (thousands of ha.)*	*Hardwood and mixed woods (thousands of ha.)*	*Forests in use as per cent of total forest area*	*Managed with working plans (thousands of ha.)*
Caribbean islands: (*continued*)								
Haiti[b]	200	7	0.1	86	75	125	86	25
Other islands	1 270	28	0.2	58	170	450	49	..
SUB-TOTAL	5 000		0.3		480	1 630		
Northern South America:								
British Guiana	18 130	84	34	20		260	1.4	
French Guiana	7 000	80	226	21		50	0.7	..
Colombia	69 400	64	5.1	30		5 900	10	200
Ecuador	14 850	33	3.7	30		300	2	
Surinam	11 720	84	44	8		10		10
Venezuela	45 000	49	7.0	17		1 100	2.4	..
SUB-TOTAL	166 100		6.7			7 620		
Brazil	561 660	66	8.9	25	6 000	34 000	7.1	1 200
South-west South America:								
Bolivia	47 000	43	14	13		6 000	13	
Chile	20 440	28	2.8	48	490	4 120	23	140
Peru	70 000	56	6.8	21	50[b]	11 000[b]	16[b]	..
SUB-TOTAL	137 440		6.5		540	21 120		
South-east South America:								
Argentina	70 000	25	3.5	85	250	7 000	15	1 500
Uruguay	550	3	0.2	100	10	530	97	5
Paraguay	20 910	51	12	30		5 020	24	
SUB-TOTAL	91 460		3.7		260	12 550		
TOTAL	1 030 140		5.3		19 775	97 020		

[a] Figures abstracted from *World Forest Inventory—1958,* published by FAO, March 1960, with per capita figures adjusted where new population estimates are available.

[b] FAO estimates.

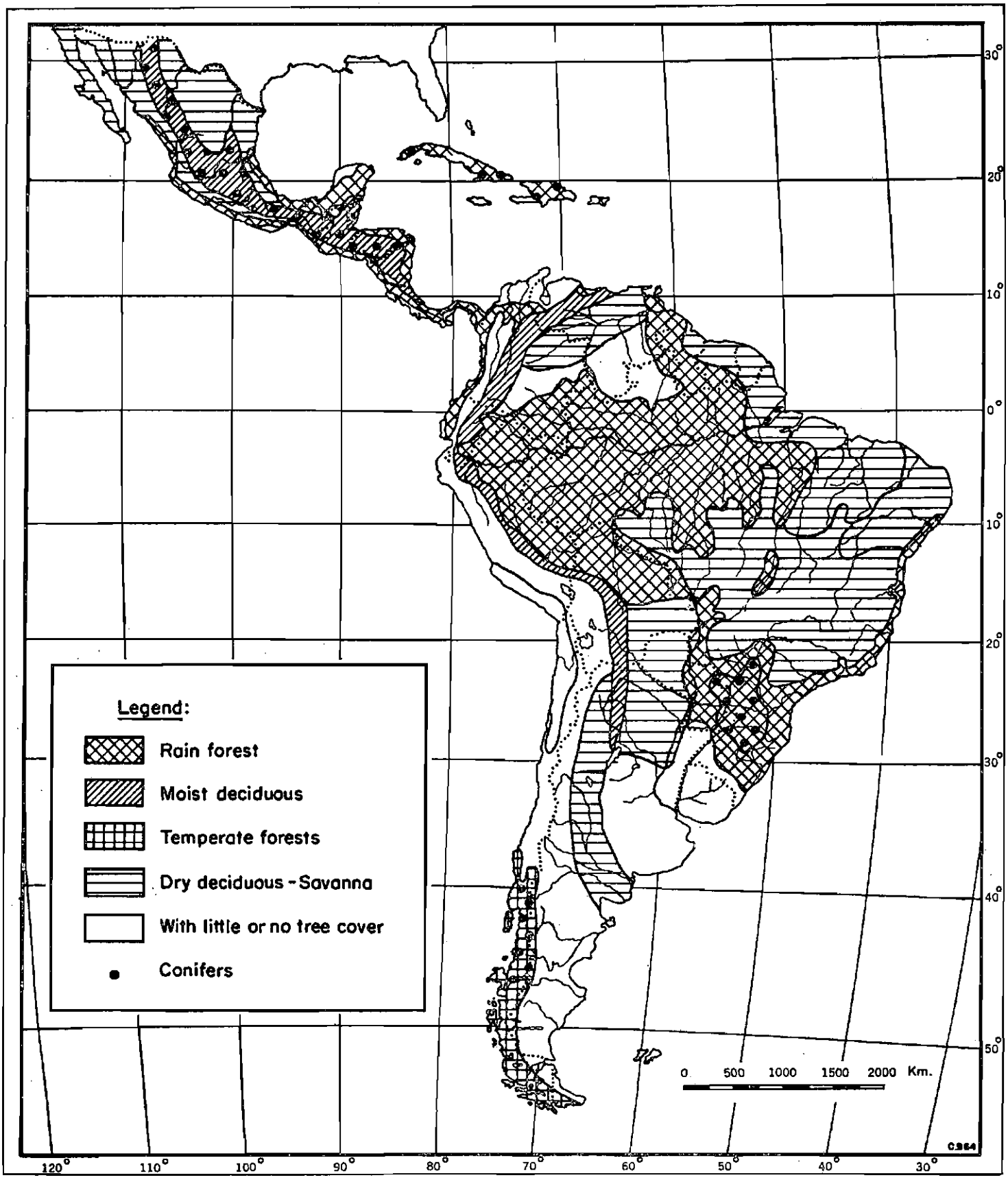
GEOGRAPHIC AND ECONOMIC DISTRIBUTION AND AVAILABILITY

With a forest area of over 1,000 million hectares, Latin America contains almost one-fourth of all the world's forests. South America's 54 per cent is the highest proportion of forest to total land area in the world. The 950 million hectares of forest in South America is the largest timber reserve in the western hemisphere. In Central America the proportion of land area covered by forests falls to 27 per cent but the forests are more accessible than in South America because of its higher density of population.

Less than a third of Latin America's forest resources are at present classed as accessible. Most of the inaccessible forests are of the tropical rain type while only about a quarter of the accessible forests are presently in use. There are, therefore, large areas of accessible but unexploited forests in Latin America which will eventually be exploited as the forests in other parts of the world become exhausted. The protective function of the unexploited forests must also be taken into account, since their exploitation for timber may in certain cases without proper management plans, damage those forests which are protecting watersheds and preventing erosion. It is clear that the figures showing a vast area of forests in Latin America must be qualified by statements about the timber content of those forests.

The forests of Latin America vary considerably in their location with respect to population. The forests in Chile, for example, are located reasonably close to the population centres and the forest industries are well-developed. By contrast, in the Amazon basin the population is thinly spread and the forests are not subjected to the same uses as in other parts of Latin America. The local Indian population pressure in heavily cultivated parts of Central and South America has led to the progressive destruction of the forests. The increasing development of Latin America will bring with it numerous schemes for agricultural colonization and resettlement, irrigation development and similar activities. These will all spread the destruction of the forests unless planned forest management is instituted simultaneously with their establishment. Equally clear is the need for much greater emphasis than has hitherto been accorded to raising the productivity of range and agriculture land already in use.

Many of the obstacles which hinder exploitation of the forests are common throughout the region. They include, in decreasing order of importance: a low concentration of present commercially valuable tree



Distribution of forests in Latin America

species (only 5 per cent of total volume in hardwood types), poor communications, difficult terrain and seasonal weather conditions. The first obstacle is being tackled, though at present on only a small scale, by seeking new commercial outlets for the secondary tree species. Foresters appreciate that even a low return on secondary species enhances the possibility of working the valuable species. Communications are being improved in most countries and will eventually permit the opening up of new forest areas with better and cheaper extraction facilities. New logging equipment may overcome some aspects of the terrain problem, as, for example, by the use of very wide-tracked caterpillar tractors for logging in swampy areas. Nevertheless, high equipment costs will still mean that primitive human-animal labour is cheaper in most cases. Seasonal working will always be a drawback in the wetter areas, where timber extraction has to be concentrated in the drier months. Wood-processing plants based on the forest in these areas must stockpile timber for the rainy season.

General forest types

Tropical rain forest. The forest formation which has attracted most interest on the part of the botanists is the West Evergreen or Tropical Rain Forest. This covers an extensive area of the deltas and tributary drainages of the Amazon and Orinoco Rivers, and certain coastal areas and foothills of Mexico, Central America, the Guianas, Colombia, Ecuador, Brazil and the tributaries of the Rio Plata. This forest type is estimated to cover 450 million hectares. These formations occupy uniformly warm areas of heavy rainfall, well distributed throughout the year, and usually from 2,000 to 5,000 mm annually. The soils are mostly heavy, but sandy loams, sandy clays, and even sands are found. In the lower and more level portions, the soils are wet, poorly drained, poorly aerated, usually acid, and not nearly as fertile, as is commonly thought.

The forests are dense and of several storeys. Little light reaches the forest floor, which is relatively free of ground vegetation but often covered with shrubs, vines and creepers. Litter is not common, but deep humus occurs in many places. The trees are very tall —often over 50 metres and girths of 3 metres or more above the buttresses are common.

Roots are frequently shallow, buttresses are heavy, and fluting is common, but the boles above the buttresses and fluting are usually clear and straight, with little taper for considerable lengths. The crowns of the dominant storey are round or flat and the foliage is broadleaved and evergreen.

A complete list of tree species would run into several hundreds. Quite a number—e.g. *Swietenia, Hura, Tabebuia, Hevea, Cybistax, Bertholettia* and *Cedrela*—have considerable commercial importance. Perhaps the best known, outside the region, are the valuable mahogany (*Swietenia macrophylla*), cedar (*Cedrela odorata*) and greenheart (*Ocotea rodiaei*). But there are many others, less well known.

The occurrence of these species is extremely variable, and does not appear to conform consistently to differences in soil conditions, elevation, or degree and frequently of inundation. The number of stems of each species per hectare is also extremely variable. Stocking, too, varies within wide limits, though the average is probably around from 200 to 300 m^3 per hectare.

It is this heterogeneity, rather than inaccessibility, which poses the main problem for development. Except in favoured areas, the volume of species of current commercial value may represent only a small fraction of the total standing stock. Intensive survey must therefore precede development planning. Any advances in utilization which will facilitate the valorization of secondary timbers enhance the prospects of economic exploitation and simplify one of the tasks of management—the deployment of silvicultural measures to reduce the occurrence of species of low or negligible commercial value.

Another factor which, in certain regions, affects the planning and conduct of large-scale logging operations is the occurrence, interspersed with the tropical rain forest, of savanna areas.

The ecology of the tropical rain forests has been investigated in various countries and investigations continue. Some of these studies have found certain similarities to rain forest associations in other parts of the tropics. For example, certain sub-types appear to be ecologically akin to those found in Africa and Asia, though the forests differ enormously in their botanical composition.

Moist deciduous forest. This forest is found in zones of seasonal variation in rainfall and temperatures, with distinct wet and dry seasons. The total precipitation may vary from 750 to 2,000 mm with 3 to 6 comparatively dry months. The soils are extremely variable, not as acid as in the rain forest, and usually well-drained and comparatively fertile. The forests are fairly open to moderately dense and of one or two storeys. Underbush is often thick, but vines and creepers are not abundant and ground cover is sparse. Grass is common and litter and humus are found in fairly deep layers. The trees are moderately tall, not excessively tapered, and have round wide-spreading crowns. The foliage is entirely or partly deciduous and many trees are bare during the dry months.

This formation occurs in south-western Mexico, the western slopes of Central America, the islands of the West Indies, in northern Colombia and Venezuela, on the eastern slopes of the Andes, down to Argentina, and in parts of Brazil. For Latin America as a whole it is estimated that this type of forest covers 85 million hectares, or less than 10 per cent of the total forest area, with stockings of 200-300 m^3. This is also the area of greatest population pressure and overcutting. Cultivation of coffee, cacao, manioc, wheat, tobacco, maize, cotton and citrus fruits has taken over the cleared or partially cleared moist deciduous forest area.

The species are not as numerous as in the rain forest, and include such important trees, often in association with conifers (*Pinus, Cupressus, Podocarpus*), as *Cedrela, Liquidambar, Quercus, Tabebuia, Chlorophora, Ochroma,* and *Piptadenia.* In this forest type, with population denser, more species have commercial value.

The principal method of logging has been heavy selective cutting, and often clear cutting on the pretext of clearing for agriculture. In most areas this has proved disastrous because widespread erosion and impoverishment of the soil has followed shifting cultivation with its frequent burning and over-grazing. Reforestation by planting or seeding may be needed but adequate protection and proper management plans are imperative. Extensive areas can be recovered at

relatively low cost. But the immediate need is for comprehensive surveys of land capability, followed by programmes to guide the inhabitants to proper land use and encourage better farming practices in those areas best suited to agriculture, and protection against fire and over-grazing on the lands best kept under forests.

Dry deciduous forest and savanna. These forest types are found in areas of scanty rainfall of only 250 to 750 mm. The soils tend to be impervious, often very alkaline or even saline. But with good farming practices they can give surprising results and produce good crops; most of the cotton belt has found its place in these areas.

The forests are open, with occasional thorny scrub thickets, and frequent savannas. Ground vegetation is confined to grasses and a few herbs, litter and humus are almost completely absent. The trees are short, badly formed, and have flat crowns. They usually possess deep tap-roots. The branches are often thorny and spiny. Seeds retain their relatively high germinative capacity for considerable periods.

These dry forests are found in Mexico, Central America, northeast and central Brazil, the dry interior valleys of the Andes of Bolivia, Peru, northern Chile, as well as in the Chaco region of Bolivia, Paraguay and Argentina.

The more important trees are *Piptadenia, Tabebuia, Aspidosperma, Schinopsis, Prosopis,* which are often accompanied by many species of cactus. These forests, which are estimated to cover over 400 million hectares, have a low timber content; its stocking is usually 20 to 50 m^3 per hectare and its growth rate 0.5 m^3/ha/year. They not only serve for stock-ranging, but also provide considerable volumes of fuel wood, charcoal, fence posts, sleepers, and palm poles. Important quantities of tannin are obtained from some of these forests. Poor silviculture practices are definitely destructive for these forests because of the great difficulties of natural regeneration unless properly assisted. Seeding and planting have been successful when the soil has been adequately prepared and protection afforded against grazing and fires.

Temperate hardwood forests. The mixed temperate forests of Chile and Argentina are also important, covering some 16 million hectares. Such trees as *Nothofagus, Lomatia, Laurelia, Eucryphia, Drymis,* often associated with *Podocarpus,* are receiving attention in the industrial development of those countries. These forests have a growing stock under normal conditions of 200-400 m^3 per hectare and rate of growth of 3-4 m^3/ha/year, which could technically be easily raised to 10-12 m^3/ha/year. Most of the species offer good possibilities of natural regeneration if properly handled. As yet, however, few of these forests have been brought under proper management, so that the forests continued to deteriorate under the influence of uncontrolled grazing and fire.

Coniferous forests. In addition to these major broadleaved forest formations, there are such important coniferous groups as the pine, fir and cypress forests of Mexico, the pines of Honduras and Cuba, the *Araucaria angustifolia* of Brazil and Argentina, and the *Araucaria araucana, Podocarpus, Fitzroya, Pilgerodendron, Saxegothea* and *Libocedrus* of Chile and Argentina. In a region which contains mostly hardwoods, these indigenous conifers, covering about 20 million hectares, have considerable significance for future forestry development. Their growing stock varies from 50 to 200-300 m^3 with rates of growth of 2-5 m^3/ha/year. Under adequate management they could yield 15-25 m^3/ha/year. They generally grow in mountainous areas and often occur in pure stands.

Only 11 per cent of the forests in use in South America are coniferous but in Central America these are more intensively exploited and form 29 per cent of the forests in use. These figures apply only to the natural forests; the appreciable areas of conifer plantations will be considered later.

Other forest types. Several special or transitional forest areas deserve mention. Valuable palm forests yield palm oil from *Orbignya martiana* and carnuba wax from *Corpernicia cerifera.* Bamboo forests are locally important in certain parts of Latin America. The extent of these bamboo forests is not really known since the natural bamboo forests are spreading through colonization of other areas after exploitation and shifting cultivation.

Mangrove forests grow along the Atlantic and Pacific coastlines and border the estuaries of many Latin American countries. Save in El Salvador, population pressure has not led to their exploitation on a scale comparable with that in Asia. But it is probable that more attention will be paid in the future to the potential yields of tannin and fuelwood from the mangroves.

Artificial forests. A significant element in the region's forest resource is represented by the plantation of forest trees which have been established—mainly in the southern part of Latin America. These now cover one and a half million hectares, and are being added to at the rate of over 150 thousand hectares annually. These plantations are most extensive in Brazil (600-700 thousand hectares, mostly eucalyptus species). Next comes Chile, with 250 thousand hectares, mainly of *Pinus radiata.* Argentina has about 200 thousand hectares of poplars and willows, and Uruguay about 100 thousand hectares of eucalyptus and pines. The rate of planting has increased considerably in recent years, and the current tendency is to give greater emphasis to coniferous plantings given the relative scarcity of long-fibred material for pulp and paper making in the region.

Most of these plantations are managed for short rotations (10 to 25 years). They carry a growing stock of 200-300 m^3 per hectare and more. Growth rates of 10-15 m^3 per hectare a year are usual, with rates as high as 30 m^3 and over by no means uncommon. The phenomenal growth rates recorded in these plantations represent a potential for producing raw material under what amounts to intensive agriculture with tree species. The widespread plantations of fast-growing eucalyptus in Brazil, Chile and Argentina were the result of efforts on the part of industries to meet their needs for railway sleepers, posts, poles, mine timbers, wood packaging and pulp and paper.

Production from man-planted forests and tree belts in the region is already estimated at from 12 to 15 million m^3 annually, i.e. around 6 per cent of total regional roundwood removals, even though in terms of area man-made forests represent but a fraction of one per cent of the total.

Forest resources of the sub-regions

Before passing on to a description of the forest resources of the several sub-regions in somewhat

greater detail, one or two general observations may serve to give perspective. Of the 1,000 million hectares of forest in Latin America, only about one-tenth is found in the zones of higher population density. Of this 100 million hectares or so, about one-fifth, is coniferous forest and 1.5 million hectares artificial plantations of fast-growing species. The yield from these last, however, equals that obtainable from ten or twenty times the corresponding area of natural forest.

Of the plantations currently being established, one-third are coniferous. This proportion is likely to rise, in some cases to compensate for over-cutting of native softwood (Brazil), in other to create new sources (Argentina, Uruguay and Chile).

Turning now to the several sub-regions, the statistical information available is presented in the preceding three tables. Table 4 shows the total areas of forest land by individual countries and also areas of forest in use for those countries. Table 5 shows the growing stock volumes. This table shows that the present commercial growing stock of forests in use is one per cent of the total growing stock of the forests in Latin America. It also shows that in the hardwood forests in use, only five per cent of the species are commercial. Table 6 shows the amounts of wood removed annually from the forests of the region.

Because of the scarcity of statistics, the descriptions in the following sections will be mostly in non-quantitative terms. It is believed that they will suffice to indicate the major characteristics and problems of the forests in the sub-regions.

Mexico

Because of its size and the extent and complexity of its forests, Mexico has been taken as a sub-region in this study.

The Mexican forests include large areas of both coniferous and broadleaved tree species. Conifers represent one-third of the total forest area in Mexico, running generally north to south, following the line of the main mountain ranges which form the backbone of Mexico, and occur mostly at the higher elevations on the slopes of the mountains. The broadleaved forests lie at lower elevations along the Atlantic and Pacific seaboards and reach their greatest extent in the Yucatan peninsula and in the extreme south near the Guatemala border. There are also large areas of savanna woodland and desert scrub in northern Mexico, where the low rainfall and infertile soil reduce vegetative growth to a minimum and where xerophytic species such as cacti predominate.

The coniferous forests, which account for almost half of the total growing stock of this type in Latin America, include many trees of commercial value such as *Pinus, Abies* and *Cupressus*, and have been heavily exploited in the more accessible areas. Mexico is the centre where the greatest concentration of species of *Pinus* in the world is found. The forests of the eastern and western Sierra Madre include many species found also in the southern United States and in adjacent countries of Central America. The same is true of the tropical hardwood forests of southern Mexico and specially of the Yucatan peninsula. Mahogany and cedar are the most valuable species though the relatively easy terrain and the demands of the local market have led to a substantial use of secondary hardwood species. Besides timber, several minor forest products, such as chicle, have considerable importance.

The Mexican forests are mostly accessible because the country has a fairly well-developed road and rail network.

The annual drain on these forests is estimated at 8 million cubic metres of coniferous wood and 5 million of non-coniferous wood. The exploitation of the forests is uneven and is concentrated in a few states, notably in the southern part of Durango, Chihuahua, and near Mexico City.

The main destructive agents are fire and insects, which account for the bulk of the losses in the coniferous forests. Shifting cultivation occurs also in Mexico and is serious because of the high population pressure and lack of suitable land.

Besides their value as producers of wood, the Mexican forests are very important in the protection of watersheds and prevention of erosion, since much of the country is arid and the volcanic soils are easily erodable. The mountain forests have considerable tourist value and Mexico is the most popular country for American tourists. The recreational value of the forests is also being developed, near the main population centres. Wildlife, unfortunately, is decreasing because hunting of all kinds is popular but the Forest Service is trying to remedy this situation.

Rapid progress is being made in the improvement of management practices and in bringing into production unused resources. This programme should in due course eliminate the present negative balance of forest products trade.

Central America

The forest resources are of considerable value to the Central American economy. They are relatively accessible in every country and are being worked for timber and other forest products.

The forest resources consist of both coniferous and non-coniferous woods. The number of pine species decreases towards the south, with none occurring south of 14° N. The areas of these forests is given in table 4 and their distribution is shown on page 12. The principal hardwoods are *Swietenia, Calophyllum, Ochroma, Cedrela, Quercus, Liquidambar*. Growing stock in the hardwood forests ranges from 90 m^3/ha. to 300 m^3/ha. and over. In coniferous forests it is around 60 m^3, with growth rates of 2 m^3/ha/year.

British Honduras (Belize). Eighty per cent of the country is forested but only portions are at present accessible. The forested area amounts to 1.8 million hectares. The principal species are mahogany (*Swietenia*), cedar, rosewood, pine (*Pinus caribaea*), and Santa Maria (*Calophyllum brasiliense*).

Costa Rica. About 25 per cent of the area is agricultural and the other 72 per cent is forest land. The three principal forest types are: evergreen rain forest—61 per cent; deciduous forest—13 per cent; and cloud forest—4 per cent. Costa Rica has virtually no conifers.

El Salvador. Only one-seventh of the area of El Salvador, which is approximately 2 million hectares, is covered with forests. The principal forest species are mahogany, cedar, guaiacum and rosewood. Oak and pine forests are found in the mountainous regions.

Guatemala. Of the total area of Guatemala (11 million hectares) 51 per cent is forested. Forests are scattered throughout the entire country but the province of Petén alone contains half the total wooded area. Only one section of it is being worked, although it

contains a considerable quantity of high quality precious woods. The Government owns approximately 70 per cent of accessible forests. Over the country as a whole, 85 per cent of the growing stock is hardwoods and 15 per cent softwoods. The principal trees are: mahogany (*Swietenia*), guaiacum (*Lignum vitae*); primavera (*Tabebuia*), balsa (*Ochroma*), pines (*Pinus caribaea* and *Pinus oocarpa*), and small quantities of cypress and cedar wood. The growing stock volume is about 90 cubic metres per hectare at an altitude of 1,200 to 1,800 metres.

Honduras. Honduras has substantial forest resources of both hardwood and coniferous species. Most of the accessible forests are in use as in British Honduras (Belize) and Nicaragua, and Honduras has the greatest positive trade balance in forest products in the sub-region. A forest inventory is to start soon to obtain accurate volume figures for the coniferous forests.

Nicaragua. Six and a half million hectares of 47 per cent of Nicaragua's total area is forested. A large part of the accessible forests have been exploited, but there still remain large unexploited forest tracts, especially along the Atlantic Coast. Exploitation is at present centred on the Pacific Coast. The hauling of timber is generally done by cattle or mules over dirt roads. River floating is limited to the rainy season and is not commonly used.

Panama. Seventy per cent of the 7.4 million hectares of land in Panama is covered with forests. It is estimated that two-fifths of the forested land is privately owned. The forests contain all the hardwood species commonly found in Central America, but no conifers. Unorganized and highly destructive exploitation is widespread.

The available volume figures are presented in table 5.

Table 5

LATIN AMERICA: GROWING STOCK OF FORESTS.[a] TOTAL VOLUME OF ALL FOREST AREAS (INCLUDING NON-COMMERCIAL SPECIES)

(Million m^3 without bark)

Sub-regions	*Total*	*Conifers*	*Hardwoods*
Mexico	4 900	500.0	4 400
Central America:			
British Honduras (Belize)	205	5.0	200
Costa Rica	660		660
El Salvador	36	1.5	35
Guatemala	820	40.0	780
Honduras	1 035	35.0	1 000
Nicaragua	1 020	20.0	1 000
Panama	1 000		1 000
SUB-TOTAL	4 776	101.5	4 675
Caribbean islands:			
Cuba	243	3.3	240
Dominican Republic	289	3.8	285
Haiti	118	3.0	115
Other islands	190	5.0	185
SUB-TOTAL	840	15.1	825
Northern South America:			
British Guiana	3 620		3 620
French Guiana	1 130		1 130
Colombia	11 800		11 800
Ecuador	2 460		2 460
Surinam	2 210		2 210
Venezuela	5 630		5 630
SUB-TOTAL	26 850		26 850
Brazil	79 150	150.0	79 000
South-west South America:			
Bolivia	6 960		6 960
Chile	3 820	100.0	3 720
Peru	11 100	0.2	11 100
SUB-TOTAL	21 880	100.0	21 780
South-east South America:			
Argentina	3 195	15.0	3 180
Uruguay	98	2.7	95
Paraguay	1 940		1 940
SUB-TOTAL	5 233	17.7	5 215
TOTAL	143 629	884	142 745

[a] Estimates by FAO.

Table 6 shows that the bulk of the coniferous wood harvest comes from Guatemala and Honduras, which export coniferous sawn timber to other countries in the sub-region and throughout the Caribbean. The hardwood forests are being exploited fairly heavily in Guatemala, Panama, Honduras and Costa Rica. Figures for removals from these forests are also given in table 6.

Table 6

LATIN AMERICA: REMOVALS 1959
(1,000 m³ roundwood)

	Total			*Industrial wood*			*Fuelwood*
	Total	*Conifers*	*Hardwood*	*Total*	*Conifers*	*Hardwood*	*Total*
Mexico	12 770	6 680	6 090	4 170	3 380	790	8 600
Central America:							
British Honduras (Belize)	190	48	142	100	48	52	90
Costa Rica	1 768	—	1 768	593	—	593	1 175
El Salvador	2 910	90	2 820	110	70	40	2 800
Guatemala	6 270	2 615	3 655	770	415	355	5 500
Honduras	3 715	2 665	1 050	1 215	1 165	50	2 500
Nicaragua	2 265	380	1 885	415	195	220	1 850
Panama	1 807	—	1 807	117	—	117	1 690
SUB-TOTAL	18 925	5 798	13 127	3 320	1 893	1 427	15 605
Caribbean islands:							
Cuba	1 790	70	1 720	320	70	250	1 470
Dominican Republic	1 960	250	1 710	300	250	50	1 660
Haiti	8 275	495	7 780	225	95	130	8 050
Other islands	1 230	70	1 160	410	70	340	820
SUB-TOTAL	13 255	885	12 370	1 255	485	770	12 000
Northern South America:							
British Guiana	289	—	289	195	—	195	94
French Guiana	49	—	49	22	—	22	27
Colombia	25 130	20	25 110	3 130	20	3 110	22 000
Ecuador	2 855	—	2 855	795	—	795	2 060
Surinam	290	—	290	90	—	90	200
Venezuela	5 275	—	5 275	775	—	775	4 500
SUB-TOTAL	33 888	20	33 868	5 007	20	4 987	28 881
Brazil	107 625	28 260	79 365	17 625	8 260	9 365	90 000
South-west South America:							
Bolivia	5 865	50	5 815	465	50	415	5 400
Chile	5 335	1 245	4 090	2 225	885	1 340	3 110
Peru	2 945	40	2 905	615	40	575	2 330
SUB-TOTAL	14 145	1 335	12 810	3 305	975	2 330	10 840
South-east South America:							
Argentina	11 980	235	11 745	2 605	235	2 370	9 375
Paraguay	1 674	—	1 674	395	—	395	1 279
Uruguay	1 215	130	1 085	215	130	85	1 000
SUB-TOTAL	14 869	365	14 504	3 215	365	2 850	11 654
TOTAL	215 477	43 343	172 134	37 897	15 378	22 519	177 580

Source: *Yearbook of Forest Products Statistics 1961,* figures provided by correspondents and estimates of unrecorded production.

The mountain forests, which are mostly coniferous, are valuable for protection of the headwaters of the streams and rivers rising from the central mountain range. But in certain areas—for example, El Salvador—an appreciable amount of soil erosion is apparent where coffee planting or other agricultural activities have led to removal of the forest cover from the readily erodable volcanic slopes. Intensive forest management is so far applied only to limited areas.

There is relatively little wildlife in the Central American forests, since it has largely been exterminated by the heavy local population for meat. Recreational values through national parks have had a limited development in the region.

A secondary forest product of considerable importance is chicle, the prime constituent of chewing gum. This is tapped in the hardwood forests of Mexico, Guatemala, British Honduras (Belize) and Honduras.

Present day harvesting habits are decimating the chicle yielding trees. The coniferous forests of Central America contain many trees suitable for resin tapping.

The Caribbean islands

The forests of the Caribbean islands are relatively unimportant. The total area of 5.5 million ha. is only 24 per cent of the land area of the islands. Over a third of the forest area is still classified as inaccessible, but accessible forests have been badly overcut on many of the islands. Both coniferous and broadleaved forests are found in this sub-region but only 20 per cent of the forests in use are coniferous. Many of the important species are closely related to the Central American flora but with the appearance of valuable new species of pines.

Cuba. The forested areas cover 11 per cent of the land surface and include coniferous, deciduous, and mangrove forests. The greater part of these forests (now virtually all publicly owned) have been exploited intensively in the past and Cuba is probably the most wood-deficient of all the islands. An intensive reforestation programme is now under way.

Dominican Republic. Of the total land area of the Dominican Republic, 2.2 million hectares, or 47 per cent, are covered with forests. The pine, *Pinus occidentalis*, deserves mention. The coniferous region is estimated to cover 125,000 hectares.

Haiti. Haiti is mostly mountainous and forests cover an area of 700,000 hectares, or 26 per cent of the total area. The greater part of the forested area belongs to the State.

The figures for removals from these forests are given in table 6, from which it will be seen that Haiti, with its more accessible forests, accounts for the bulk of the hardwood removals.

In the island territories, the watershed protection aspect of the forests has only recently been recognized. As a result protective measures in the catchment areas are of recent origin; in most cases, serious erosion on the watersheds has already been caused by deforestation.

On the other hand valuable experience is being gained in the French and British islands in the management and silvicultural practices for tropical forests to bring them to a higher productive capacity and stand quality.

Northern South America

This is a sub-region where the forest resources are extensive but generally inaccessible. Colombia has the greatest area of forest land, Venezuela almost as much, but Ecuador has only about one-third of the forest area of the other two countries. The forests lie in the remote interior of these three countries and in general away from the main consuming centres.

Both British Guiana and Surinam have relatively good information on the extent of their forest resources following inventory work carried out in these territories, much of it using modern survey methods and aerial photography. However, the information on the forest resources of these territories is by no mean complete and investigations are at present under way in both countries to obtain more up-to-date information on the forests. The forests of French Guiana, on the other hand, have been little explored and there are at present no plans for detailed inventory work.

British Guiana. British Guiana has a forest area of 18 million hectares, or 84 per cent of the total surface area. Rivers are the main form of transportation, the principal ones being the Essequebo and the Demerara. It has been estimated that 20 per cent of the total forest area of British Guiana is immediately accessible for exploitation. In this area there are about 350 million cubic metres of wood, of which 8 million are greenheart (*Ocotea rodiaei*). Land is held principally by the Crown, which grants concessions for cutting by private operators. There is some small private ownership.

Colombia. The total area of Colombia is 115 million hectares of which 30 million are mountainous with altitudes varying between 400 and 6,000 metres. The rest of the country consists of plains, mostly in the eastern and south-eastern regions. The forested area amounts to 69 million hectares or 64 per cent of the total area, with probably the second largest growing stock of the whole region, practically all hardwoods, two-thirds of it in the tropical rain forest type. Nevertheless Colombia has a heavy adverse trade balance in forest products. The forests along the coastal strips are of the evergreen tropical type with trees of considerable size, in the climatic belt where rainfall may exceed 5,000 mm. There are also areas of bamboo forests of commercial value. In the arid plains of La Goagira and in the central part of the country there are dry forest types. The problem of transportation is simplified by the 23,400 kilometres of navigable rivers, but the cost of moving timber to the consuming centres is high, and often prohibitive. Important is the production of secondary products such as rubber, nuts, oils and copra. Because of topography and density of population the mountain areas (with more than 600 catchments) need intensive protection and tree planting is therefore being accelerated; and this will ultimately increase the volume of forest products within economic reach.

Ecuador. Of the total land area of Ecuador, 14.8 million hectares, or 33 per cent, are forested. The forest lands may be grouped according to natural regions:

(1) The forests of the north-western Pacific coastal region and the western slopes of the Andes. Here the principal species are balsa (*Ochroma lagopus*), amarillo, lignum vitae, and mangrove. Several palms also occur, including the toquilla palm whose leaves furnish the fibre for Panama hats.

(2) The central Andean region. This is the most densely populated region and contains principally semi-desert species of shrubs and isolated trees. Plantations of *Eucalyptus globulus* are being widely established.

(3) The rain forests of the Amazon region, east of the Andes, called the "Oriente". The best-known species are gum copa, canelo, cinchona (the bark of which yields quinine), and several palms.

The relative inaccessibility of the rain forest raises difficult problems and management depends on the extent to which communications—particularly land routes —can be developed. The greater part of the forested area belongs to the State, although in the western region considerable areas are privately owned.

French Guiana. Except for a narrow coastal strip, French Guiana is almost entirely covered with forests, estimated at 7 million hectares, of which approximately 5 million are dense mixed tropical forests.

The growing stock varies widely in composition according to locality. Stands are estimated to include

approximately one-third hard species, such as the wacapou (*Vouacapoua americana*) and balata, and two-thirds soft and semi-hard species, such as the simaruba and various mahoganies. It is estimated that the 500,000 hectares of readily accessible forest, if properly exploited, could yield from 10 to 20 m^3 of commercial timber per hectare and per year over a rotation of 50 years.

Surinam. Surinam's area of 14.3 million hectares supports a population of 200,000. Rivers are the main means of transportation into the interior. The coastal alluvial strip is the principal inhabited region and the mountainous area is largely unexplored. Eighty-four per cent of the country is forested land with an unknown but great volume of timber.

Venezuela. The country consists of the mountainous regions of the Andes and coastal ranges in the North-west, the Orinoco Basin and the Llanos in the South, the Guiana highlands in the East, and the coastal plain including the area around Lake Maracaibo. Almost half of the land—45 million ha.—is forested, but timber production is still in the early stages of development and the forests are as yet making an inadequate contribution to the Venezuelan economy. Much of the forest in the coastal range of the Andes and around the Maracaibo Basin has been cleared for agriculture, and erosion is a serious problem in these regions. It has been estimated that shifting cultivation destroys every year approximately 100,000 ha. of this land. The *llanos* are treeless except along the river; they should be accorded an important share of any future planting programme.

The vast forests south and east of the Orinoco River, in the Amazonas Territory and in the Guiana highlands, are largely unexplored. Most forests are owned by the Government. Even though half of the forest area is of the dry savanna type, and another quarter may presently lie beyond economic reach, yet an important area consists of rich tropical-temperate hardwood forest which should be able to satisfy—under proper management—most of the local needs.

Little intensive forest management has been applied to any of the forests in this sub-region, though a certain amount of silvicultural work of a research nature has been carried out in Surinam and British Guiana. These experiments have mainly been aimed at improving the quality of the natural forest by encouraging the growth of commercially valuable species. The results to date show that considerable improvement in quality can be obtained with little additional expense, but the shortage of trained staff and funds has prevented a wider adoption of the results obtained.

The animal life in the forests varies from sparse to relatively heavy, depending on the population pressure, being most abundant in the hinterland of the Guiana territories where there are upland savanna forests and a sparse population. As in the other parts of Latin America the forests have a considerable protection value since they clothe the main watersheds of these territories, control erosion and prevent excess run-off.

In all this sub-region, however, the forests are a useful source of other products such as chicle, rubber and tanning materials.

The scarcity of information on the forest resources of these countries indicates the extent to which they remain unexplored. If adequate development of the forests is to be undertaken, further investigations into the forest resources are essential.

South-west South America

These countries show very different features when their forest resources are considered. In Peru, for example, the bulk of the forests lie east of the Andes, but most of the population lives west of the Andes and in the high plateau and is therefore distant from its forest resources. Until transport communications are improved between the east and west of Peru, the interior forests will remain largely unexploited. The same situation prevails in Bolivia, but in Chile the accessible and inaccessible forests are divided in equal proportion. In Peru the bulk of the forests belong to the State; in Bolivia and Chile most of them are under private ownership.

Bolivia. The forest area, all of which is in Eastern Bolivia, is drained by the Amazon in the North and the Paraguay River in the South.

Forty-seven million hectares are estimated to be forested land, most of it privately owned. Although no survey figures are available, the timber volume has been estimated at over 990 million cubic metres.

Half of the forests are of the tropical rain type, rich in mahogany, which has been for some time shipped out by plane. Transportation is holding back exploitation, though the Amazon and its tributaries may eventually afford an outlet for the products of this zone. The south-eastern plains form part of the Gran Chaco. This forest area of the savanna (about a quarter of the total forest area) is rich in heavy durable hardwoods suitable for posts, poles and sleepers. Though much interest has been expressed in the considerable reserves of quebracho in this area, so far the uncertain prospects for tannin exports have discouraged ventures, and the quebracho remains untapped.

One-third of the country is mountainous; the rest lowland. The expansion of transportation facilities is hampered by rugged topography and scattered communities.

Present plans provide for resettling part of the altiplano population in the forest belt of the Alto Beni. Even so, tree planting in sheltered areas of the high plateau will play an important role in the creation of new wood resources.

Chile. This country consists of an extremely dry northern region, where most of the mining activities are located; a temperate central agricultural region, with important forest areas in the southern part; and a cold, wet southern portion which is principally forested.

Of Chile's total land area, 28 per cent is forest land. The virgin forest is 93 per cent temperate hardwoods and seven per cent conifers. Ownership of forest land is 54 per cent private, 43 per cent public and 3 per cent indeterminate because of unclear titles. The annual loss from fire, uncontrolled grazing and squatting is very high, rapidly reducing the best accessible forests, which could otherwise be easily restored. There are in the central region over 250,000 hectares of plantations, mainly Monterey pine (*Pinus radiata*), followed by *Eucalyptus* and *Populus*. Twenty-five per cent of the plantations are already of merchantable size. During the period 1953-57 some 77,000 ha. were added.

Annual cutting in recent years has been at the rate of almost 5.6 million cubic metres, with fuelwood as the principal use. Plantations of pine already provide

half the total output of industrial wood, and the contribution of the man-made forest is rising as the plantations reach maturity.

Peru. Peru consists of narrow, dry, coastal plain; a massive cordillera 320 to 400 kilometres wide; and a forested region which covers over half of the country and is made up of the eastern slopes and foothills of the Andes mountains and the Amazon River lowlands. Total forest area is estimated at 70 million hectares. The principal forested area in the Amazon Basin covers some 40 million hectares, only a small fraction of which is privately owned or inhabited. Eighty per cent of the production is represented by five species only, *Cedrela* contributing 40 per cent, *Swietenia* 13 per cent and *Podocarpus* 11 per cent. Secondary products (nuts, rubber, etc.) provide 2.6 million dollars worth of export. The city of Iquitos is the important lumber and shipping centre, with products moving down the Amazon through Brazil to the ocean. At great transport cost, significant amounts of timber are moved across the Andes to the Pacific Coast; 40,000 tons were checked through Tingo Maria in 1959. It would require but little improvement of these communications to encourage greater local trade.

Chile is the only country in this sub-region which has sizeable areas of forest plantations.

As may be expected in such mountainous country, the forests play an important role in protecting the erosion-prone volcanic slopes and in controlling run-off.

Brazil

The forests of Brazil represent about one half of the entire timber area in South America, rating this country's forest resources second only in extent to those of the U.S.S.R. The woodlands of Brazil are over three times as large as those of all Europe together, though of course their composition and growing stock are completely different.

Brazil contains four principal forest areas:

(*a*) The tropical forests on the Atlantic Coast. These, the first to be exploited, underwent several selective cuttings, creaming out more and more species as the first selected and more valuable ones disappeared. A large part of these forests has thus been destroyed by these wasteful cuttings and by the clearing of land for agriculture. The greater part of the remnants are found on the eastern slopes of the Sierra do Mar and in the Rio Doce valley. The most characteristic and valuable timbers—*Jacaranda* (rosewood), *Cedrela* (cedro), and *Paratecoma* (peroba)—have been cut out in many areas in the course of the last decades.

(*b*) The southern pine zone. The principal commercial species is the Paraná pine (*Araucaria angustifolia*) which covers about 6 million hectares. It is the only conifer in Brazil which occurs in large stands and has any commercial value. With the exception of a few *Podocarpus,* no other native conifers are found. The Paraná forests are really abundant only in the high plateau areas of the States of Paraná, Santa Caterina and Rio Grande do Sul. The Paraná pine, indigenous to this area, is the most important softwood in South America, and important quantities are exported to other countries in the region and to other continents.

Though sometimes found in dense and rather homogeneous stands (with a growing stock of up to 150 m^3 per hectare), it also appears in scattered, thin forests. However, *Araucaria* does not usually grow in pure stands, but in sub-tropical moist mixed forests, frequently with *Cedrela.* Paraná pine does not regenerate very easily, and strict protection against animals and shifting cultivation is essential to assure natural regeneration. It is being planted to a certain extent under private management and in a few government reserves, but the areas so far replanted fall far short of compensating for the steady depletion of the natural stands.

The above two forest areas coincide with the zones of denser population, industrial development and higher living standards. Forest depletion is taking place very rapidly while no consistent management plans have been put into operation yet for the native forest. The increasing shortage of wood and wood products has, nevertheless, encouraged in these areas one of the most ambitious programmes of reforestation with fast growing species and with *Araucaria.*

(*c*) The Amazon Basin. These forests, which cover about 240 million hectares, can be divided into moist deciduous and tropical rain types. Only in recent years has forest inventory work attempted to locate the main commercially valuable areas. The valuable tree species are widely scattered and the exploitation of mahogany, cedar and other valuable woods so far has been restricted to the neighbourhood of the navigable waterways. The opening of new roads through these forests, linking the main population centres, affords the possibility of sound development of the forest resource in the interest of present and future generations. Too often in practice, however, the new roads, in the absence of planned settlement schemes with technical supervision and advisory services, simply make accessible new tracts for uncontrolled squatting, bringing reckless forest destruction in its wake.

(*d*) The dry forest. In the interior, a dry forest formation extends from the north-east, meeting to the east the Atlantic Coast range or belt, the Amazon to the north and west, and the Chaco and the pine area, to the south. This formation practically corresponds to the eastern high plateau of "Escudo Brasileiro". Probably half the total forest area is of this type, with little forest productive value, but with an important soil protective role and considerable grazing potential.

While great parts of Brazil are still covered with forests—in the tropical rain forests of the Amazon Basin—other parts in the east and south are completely denuded. In many of the areas presently used for grazing, pastures need to be greatly improved to relieve pressure in the neighbouring forest areas.

The deforestation of the Paraná forests of Sao Paulo has had a noticeable effect in the hydrology of the area, causing water and hydroelectric power shortages in many parts of the State, with consequent effects on industrial production and development. Fortunately a strong trend towards forest rebuilding has started in this population-pressured area, and forestry is beginning to find its proper place in settlement schemes.

Thus Brazil has become a leading country in afforestation, now concentrated in areas previously deforested. This afforestation has been undertaken by both the State and private landowners, and is mainly confined to quick-growing exotics, such as *Eucalyptus* and pines, particularly Central American pines. The *Eucalyptus* plantations are particularly productive and now cover 560,000 hectares, with a growing stock of

73,000,000 m^3 which is expected to rise to 220,000,000 m^3 by 1970.

More attention is now being given to coniferous plantations as a source of long fibre for paper making, and to replace or complement the heavily depleted *Araucaria* forests. Other Latin American pines have been introduced because they have shown better growth rates.

The forests of Brazil also produce rubber, both from natural forests and from plantations. Several regions where *Hevea* is an exotic are pressing intensive planting programmes.

South-east South America

Argentina has the largest forest area and also the greatest area of accessible forests in this sub-region. Paraguay is second and Uruguay has relatively little forest. Paraguay, which exports a considerable amount of timber, mainly tropical hardwoods, to Argentina, has the highest positive balance in forest products trade in the whole region and ranks third after Brazil and Argentina in export values. Figures on the growing stock of forest in use in Argentina, Uruguay and Paraguay are shown in table 5. The largest timber removals occur in Argentina, which has the largest population of the three. In Argentina, ownership of the accessible forests is evenly divided between state (not federal) and private owners, but in Uruguay and Paraguay the bulk of these forests are privately owned. Most of the forests in this sub-region are hardwood, conifers representing less than one per cent of the total stock of the forests.

Argentina. The forested area lies in general along the Chilean frontier, in the region bordering Brazil, Bolivia, Paraguay and Uruguay, and in the far south. The types are therefore very different, and include the temperate hardwood region of the Patagonian Andes (with a few conifers, e.g. *Araucaria, Libocedros*), the Chaco formation and the sub-tropical moist types, one extension from Southern Bolivia and a second from Brazil (including some Paraná pine). But 70-80 per cent of the total area is represented by the Chaco and neighbouring dry savanna type bridging with the moister central grassland. Forests cover some 70 million hectares or 25 per cent of the total land area. Forest land ownership varies by territories and provinces, but the provincial authorities own about one-third of the forest land, including half of the accessible forests. Timber-cutting rights on government land are sold to private operators on bid.

Forest exploitation has not yet attained its full development. However, it is estimated that one-third of the *quebracho* in the northern part of the country (Chaco) has already been cut. Exploitation in the Misiones region in northeastern Argentina, the northwestern Andes and in southern Patagonia has been on a small scale, though cutting could be increased in these areas under proper management. Since Argentina has a relatively high level of wood consumption, and since the forests are far from the centres of dense population, plantations have been greatly encouraged. The Delta of the Paraná and Uruguay rivers contain some 100 thousand hectares of willow and poplar plantations, which represent a growing stock of approximately 15-20 million m^3. Eucalyptus is being planted at the rate of 20,000-30,000 ha. per year, and emphasis has recently been put on the planting of pines.

Paraguay. The country is divided by the Paraguay river into the Gran Chaco, a vast alluvial plain covered with grass, palms, open stands of scrub trees, cacti and swamps, and eastern Paraguay, which is the principal populated area and is where most of the commercial forests are located.

Five million hectares are virgin forest and the rest is cut-over or exploited forest land. About 92 per cent of the forests are privately owned, five per cent are government owned, and three per cent are in national colonies. Over half the privately owned forest is in holdings of more than 25,000 hectares.

The Chaco's chief product is *quebracho* for tannin and railroad ties. Rough estimates indicate that at the present rate of exploitation the supply of *quebracho* from a zone of some 4 million hectares will last for 100 years. Eastern Paraguay has 7.8 million hectares of deciduous hardwoods, which cover 49 per cent of the land area.

The forest zones of eastern Paraguay have been divided on the basis of predominance of certain commercially important species:

(*a*) Northeast—2.2 million hectares with considerable virgin timber. Palo de rosa (*Aspidosperma*) makes up 23 per cent of the stands. Cedro (*Cedrela*), laurel (*Ocotea*), and *Nectandra* are also important. This zone produces high-grade lumber and logs for export.

(*b*) Northern—1.4 million hectares. Trebol (*Torresea*), which is valuable for furniture, palo de rosa, curupay (*Piptadenia*), lapacho (*Tabebuia*), and cedro are the principal commercial species in this zone.

(*c*) Eastern—2.9 million hectares with a large amount of virgin timber. Cedro, lapacho, petereby (*Cordia*) and guatambu (*Balfourodendron*), are important species.

(*d*) Border (resembles Chaco region)—0.4 million hectares. Quebracho (*Schinopsis*) is the most common species.

(*e*) Southern—1.7 million hectares. Fuelwood and fenceposts are the chief products of this zone.

(*f*) Central—6.4 million hectares. This is mostly cut-over land but with considerable regeneration. It is estimated that of a total of 284 million cubic metres of standing timber in the Central Zone, 246 million are marketable.

Uruguay. There are almost 554,000 hectares of forest of which over 77,000 hectares of plantation are in Uruguay. The highest elevation does not exceed 700 metres above sea level and transportation facilities are well developed. Uruguay imports almost all of its lumber, Paraná pine from Brazil being an important item. Timber imports cost the country almost as much as the value of the total export of meat. The principal forest activity so far has been the planting of windbreaks, largely eucalyptus, willow, poplar and *Pinus radiata*, around farms, and also in the sand dunes of the Atlantic and River Plate coast. Plantings have also been made for local fuelwood, fencepost and pole production.

Few countries offer tree-growing conditions as favourable as Uruguay, where plantations are being started everywhere at very low cost. The central basin of the Rio Negro (the energy backbone of the country) is practically denuded, and needs an urgent programme of tree planting. This could also provide valuable forest resources in a very short time.

THE FOREST RESOURCES: SUMMARY

Latin America's forest resources are extensive and varied, though in many instances less rich than commonly supposed. This much is known, in spite of the limited extent to which these forests have been inventoried. It is also known that the total forest area is diminishing under the impact of settlement and nomadic agriculture (though the available data are insufficient to assess this eroding process in quantitative terms) and that uncontrolled shifting cultivation and selective exploitation practices are bringing about a progressive deterioration in the quality of the forest over large areas.

These facts are alarming. It might be supposed that they would have communicated a sense of urgency to all those concerned with making and carrying out forest policy. To some extent they have, though not as much as could be hoped. There are many reasons for the lack of concern in the past. The process of forest attrition is insidious, somewhat remote, largely unseen, and does not force itself upon the attention of policy-makers. The fact that Latin America still possesses one of the highest ratios of forest land per inhabitant (5.3 hectares) in the world, has perhaps given a sense of ample reserves to fall back upon. Finally, the immensity of the task which the public forest services have had to face with inadequate staffs and derisory budgets, has been discouraging.

It is too soon to say that all this is changing, but there are hopeful signs. There is a growing awareness of what is happening to the forests, and a growing will to do something to guard this resource. More important, there is increasing recognition of the absurdity of a high and mounting import bill for forest products in a region with the raw materials for domestic wood-processing industries at hand.

These considerations are prompting most Latin American countries to take a new look at their forest resources. This reappraisal of the domestic resource is concerned with answers to the following questions:

How much land, and which particular areas should be permanently devoted to forest to make sure that the timber needs of this and future generations are met and that the forest plays its necessary protective role?

Which areas are suitable for early settlement, and how can this be organized to avoid the deleterious effects that settlement has had in the past?

Which areas offer immediate or early prospect of industrial development based on forest raw materials?

There are other questions, too, the answers to which call for more than a simple quantitative and qualitative assessment of the forest. Typical questions are:

In which areas is silvicultural treatment to enrich the existing forest urgent and economically justifiable and what kind of treatment should it be?

Where should the creation of new forest resources for protective purposes or for eventual timber productions already be envisaged?

The task of taking an inventory of the region's forests has only just started. Considering the extent of the forests and the resources available to do the job, most countries cannot hope to complete a nation-wide inventory in less than decades. But recent progress has made it possible to carry out rapid and cheap reconnaissance surveys which can provide information of sufficient precision to answer some of the above questions and to pinpoint those areas where more detailed inventory is needed to answer others.

If the forests of the region are to be harnessed to meet the needs of its people priority must be given to rapid over-all surveys as a basis for land use planning and forest reservation.

Attention will no doubt concentrate first on the coniferous resources of the region, since more is already known about their economic extraction and utilization. Mobilization of the tropical and sub-tropical hardwoods presents greater problems. Once these resources are accurately known, existing research results can be applied to these problems and to the direction of additional research.

The most obstinate problems stem from the heterogeneity of these forests, in which the species of current commercial value often represent only a small fraction of the standing timber. The main attack on these problems must lie on the side of utilization: how to introduce new industries or enlarge the raw material basis of existing industries so as to turn to economic account a greater proportion of the standing timber. When more species can be utilized, extraction costs can be spread and the more precious woods can be removed more cheaply or extracted from a wider area.

But the problems have also to be attacked from the timber growing side. What kinds of economical silviculture treatments (and extraction practices) will ensure a progressive rise in the quality of the forest? Quality must be considered in economic terms. Most of the high-value hardwoods are slow growing and their financial yield is long deferred. Considerable inputs of labour and capital are necessary to grow them, compared to harvesting already mature trees. On the other hand they have a high market value, and this can be expected to increase in the future. How far present resources can and should be devoted to forest enrichment of this kind, with long-deferred returns, is a question each country must decide for itself. But as a general rule it would be unwise to liquidate existing forest capital without devoting some part of the returns to long-term investment of this kind.

Sawmilling industry

For many decades sawmilling in Latin America was based on satisfying local, and in most cases very limited, demand for constructional and other timber. The emergence of larger and more organized demand was met more often in the early stages by commercial export sawmills outside Latin America than by the region's own sawmills. Similarly, the establishment of sizeable commercial sawmills in Latin America was in many cases directed towards export markets outside the region rather than towards expanding requirements within the region itself.

The early sawmilling operations in Latin America were characterized by destructive utilization of the existing forest resources, by a selective creaming of the most valuable trees, yielding large and quick profits. When the resources vanished, or no longer permitted highly profitable operations, the mills were left idle, or worked only sporadically and at a fraction of their capacity. Long distances and difficult transport conditions frequently impeded the removal of equipment to other more profitable operation areas, so that new mills and additional capacity thus gradually developed.

Today Latin America possesses a theoretical sawmilling capacity many times larger than the current output of sawnwood in the region. It may be estimated that about 19,000 sawmills are registered in one way or another in different types of commercial or industrial registers; three quarters of them are in Brazil and Argentina, the rest of the region accounting only for one-fourth. It is obvious, however, that the actual number of sawmills in the region is far higher than this figure. Every time detailed local studies have been made of the existing sawmilling industry, whatever the country, the results have always revealed a far larger number of mills than had previously been recorded.

In Brazil 8,700 sawmills are officially registered and the average annual output per mill is given as 750 m^3. Tremendous differences, however, exist between the sawmills of different regions within Brazil. In the State of Santa Catarina, for instance, which has an annual output of sawn pine of 2 million m^3, a pilot survey was recently made of a typical area. This State accounts for half the total Brazilian pine production. The survey showed an average annual production of 12,000 m^3 of sawnwood per sawmill. This means that the majority of sawmills in other regions of Brazil have an average production far below the above mentioned average of 750 m^3 per year. Thus, average production per sawmill and year, as presently recorded, is far from being an adequate indication of a country's real sawmilling situation.

In other countries the recorded average annual output per sawmill varies from 11,000 m^3 (Honduras) to 126 m^3 (Panama). These figures, however, largely reflect the scarcity of detailed information on the sawmilling industry in general and the confusion which exists with regard to the definition of a sawmill. In certain countries even the smallest and simplest circular saws, even farm saws, may be listed as sawmills; in others only commercial and more or less adequately equipped mills are listed. Moreover, modern and complete sawmill installations, connected with furniture of other wood elaboration plants, using their sawlogs, may often escape enumeration or be listed under other industries, even though they may represent a considerable proportion of the total national sawnwood output.

The experience acquired in the course of this study shows clearly the great need for making in each country of the region a thorough survey of the existing sawmilling industry—input, output, equipment, cost structure, etc.

Such surveys could establish the role of the sawmilling industry in the national economy, including its calls on the labour market. They could provide the basis for planned modernization (and expansion) programmes needed to meet the rising sawnwood demand which development programmes will engender. By giving a true indication of the size and pattern of the industrial sector providing the most important outlet for forest raw material they would facilitate the preparation of plans for the rational management of the forest resource.

It must be observed, too, that the widespread lack of adequate forest management in exploited areas has reacted adversely on the organization of sawmill operations. At the same time insufficient attention to training and a general disregard of adequate maintenance requirements has meant low production standards in many instances. Thus all too often good quality sawlogs yield but mediocre or poor quality sawnwood, with the result that consumers prefer the imported sawnwood if it is available and turn to alternative materials if it is not. Thus many promising local markets have failed to develop as they might have done had an adequate marketing organization been available and had reasonably high and consistent standards of production been maintained. Similarly, efforts to develop new export outlets have often been frustrated after initial shipments had been well received simply because importers found themselves unable to rely on standards being maintained.

Another important problem facing many of the sawmills in Latin America is that of financing. Interest rates are unusually high over most of the region, discouraging new ventures and inhibiting the modernization of existing installations. To the high interest charges on initial loans has to be added a rapid amortization to allow for the swift deterioration of equipment. Producers are thus driven to aim at extremely high gross margins and the resultant high prices, even when the sawlog intake is reasonably cheap, adversely affect the development of consumption. Quite often old, even obsolete, mills which have paid off initial loans and been completely amortized are best able to survive.

The situation is not helped by the absence of adequate marketing arrangements and limited availability of credit facilities. At the present time sawnwood, once it leaves the producer, may pass through the hands of many intermediaries before it reaches the final consumer.

The picture is not, of course, uniformly black. There are many modern sawmills in the regions which, though not comparable in size to the leading mills of other regions, operate with surprising efficiency and turn out a good quality product. But it is difficult to escape the conclusion that the region's sawmilling industry as a whole is far from ready to meet the new calls for constructional and other timber which accelerated economic development will make upon it. Even less is it in a position rapidly to expand existing export outlets and to create new ones.

Nor is there any single panacea which can enable the industry to achieve lower costs and higher quality. The problem has to be attacked on many fronts simultaneously. Lower interest loans and ampler credit facilities; improved layout and modernized equipment; more training facilities and greater attention to maintenance; better marketing organization and closer links with consuming industries and export outlets; a combination of all these measures will be needed if this industry is to play its proper role in developing the region's forest resource and building the Latin America of the future.

Plywood and veneer industry

Production of plywood and veneer on an industrial scale in Latin America is of relatively recent origin and is still very modest compared with other regions. Recorded production, although it has trebled during the post-war period, still represents only about one and a half per cent of world output. Latin American production has expanded considerably slower than in other regions. Yet the region is undoubtedly one of the world's riches sources of raw material for plywood and veneers. This indicates excellent development possibilities, both for meeting the region's own requirements and for export.

Present total production of plywood may be estimated at close to 300,000 m^3; production of veneers is probably at least as much, probably more, although statistical data are almost completely lacking. There are just under 300 plywood mills operating in Latin America, of which 80 per cent are in Brazil and 10 per cent in Argentina, the rest of the region accounting for the remaining 10 per cent. Most of these mills are old and rather primitive, and have been developed from initial veneer plants; in some of them glueing and preparation of the products is still done by hand. The few more modern plants, however, are efficient, well run and stand comparison with modern mills anywhere in the world.

With regard to veneer output, it is, as already mentioned, very difficult to have an exact idea of its size. Many plants are not even registered as industrial enterprises, since they are run more or less on an artisan basis, with few operatives and primitive equipment. Moreover, many of them are attached to furniture factories, and are not registered as veneer plants, even if modern and efficiently equipped.

Chapter 4. The wood-using industries

The wood-using industries of Latin America cover a wide range of size, quality, efficiency, and type of product. Almost anything one wished to say about the industry could be substantiated by looking in the right place. This makes it difficult to generalize or to draw an outline of the industry for the whole region. The lack of adequate statistical coverage further complicates the problem.

Part of this difficulty stems from the geographical pattern of the continent's development. Latin America has been settled for a long period but is in many respects a "new" area. It is pioneer country, but with a long history of development on the fringes. Anyone seeking examples of areas in different "stages" of economic development can find illustrations of all the early phases in Latin America, in fact in any one of several countries. Sawmilling facilities, for example, are found to range from ultra-modern plants to primitive pit sawyers working under the most trying conditions.

Can any useful generalizations be made about these wood-using industries? The descriptions in this chapter will be presented mostly by sub-regions and by industries, but the following observations apply to the region as a whole.

Standards of manufacture, particularly in the sawmill industry, are generally low. Equipment is not well maintained and is seldom of modern design, a fact which contributes greatly to the usual low quality produced. Little attention is given to the final stages of manufacture or to quality control. Again taking sawmills as the example, planning equipment is seldom installed and dry-kilns are very rare.

Markets for the products are almost always poorly organized, with the channels from the initial manufacturing stage to the ultimate consumer being particularly neglected. Delivery schedules are not maintained, retailers seldom carry a full assortment of grades or sizes, and prices are frequently established by bargaining with only nominal attention being given to the real costs of production. Grading standards are most noticeable by their absence.

Again with reference primarily to sawmilling, there is during most periods a decided over-capacity on the production side. Few mills are able to operate on a full schedule and still dispose of their production, though those which pay strict attention to quality find little difficulty on this score. The market fluctuates widely, almost wildly. During periods of high demand new producers are encouraged to enter the production field, but by the time they are well-enough established to produce effectively the market may again be depressed. Stability is one of the requisites for long-term efficiency in industry, and this stability has been rare in Latin America.

Finally, the difficulties of an inadequately developed transport system are everywhere evident. Forest industries can seldom afford to bear the full cost of establishing the road or rail services required to supply market-oriented mills with raw materials from the distant forests, or economically to ship their product to the urban markets if they are located near their raw material supplies.

One further general observation is in order. Industrial change is the essence of economic development, and in Latin America economic development is being promoted strongly. One must, therefore, be cautious in interpreting the data available, for in a region intent on development the pace of past progress cannot be accepted as a guide for potential future development.

Mexico

The wood-using industry of Mexico, a country whose forest resources include the widest assortment of coniferous species in the world, presents a paradoxical picture. There are plants which have exhausted the surrounding timber stands and suffer from a lack of raw material. But there also are substantial areas of both coniferous and hardwood forests that have never been developed. Domestic production of both plywood and wood pulp tripled during the last decade but sawmill production decreased during the same period despite legislative action which forbade the export of roundwood. Certain difficulties, however, appear to be common to most of the wood-using industries. Domestic per capita consumption of practically all wood products is low. Production costs are relatively high. And both marketing procedures and distribution channels are poorly organized.

In spite of the many handicaps under which Mexican forest industries are operating, the future should be viewed optimistically. Few Latin American countries have displayed equal vigour in facing up to the realities which have hampered industrial development. The situation a decade hence will surely differ greatly from that shown by statistics for the last decade, or even the last three years. The facts given below describe the existing situation with reasonable accuracy but should not be taken as indicative of what the future will bring: Mexico is moving forward, and its forest industries will share in this advance.

The Forest Department in Mexico is well-organized and is concerned with the protection and planned

management of the public and, to some extent, private forests. Some 200 forestry graduates are practising in the country, most of them employed by the Forest Service. The larger private timber firms employ qualified forestry personnel—usually American-trained—and the pulp and paper manufacturers operate their forests efficiently.

These large operators employ modern methods of timber extraction such as tractors and specialized logging equipment. Cableways have been tried in the mountains, but have had only limited success because of the relatively open stands and low concentration of exploitable trees. River transport is not used because of the variable flow.

Sawmilling

The Mexican sawmilling industry has had a particularly erratic past. This was in part due to sudden and frequent changes in the tax structure and to a lack of well-developed policy on several fronts. Taxes on sawnwood increased more than tenfold between 1946 and 1952, with obvious direct and indirect results. One important side effect has been the almost certain under-reporting of statistics on both sawmilling capacity and production. The nationally-owned railways form an important market for sawnwood but the lack of any consistent purchasing policy by this administration has hampered production planning and affected market stability.

Sawnwood production has oscillated around a million cubic metres per year, most of which has been coniferous. Broadleaved sawnwood accounted for 10 to 20 per cent of the total in the post-war years but contributed only 4 per cent in 1959. Sawmills are typically small, under-powered, and both poorly equipped and maintained, although a few larger well-financed operations are beginning to install modern equipment.

The present industry is centred in the pine-producing areas. Sixty-five per cent of the production currently comes from the *Norte* zones, with heavy concentration in Chihuahua and Durango and another 20 per cent comes from the *Pacifico sur* area, mainly from Guerrero and Oaxaca. There still are extensive untapped reserves of conifers in Mexico and an inventory of these areas is now under way. This project will provide the information necessary to plan and promote a substantial shift of the industry. Hardwood production is at present small—around 50,000 cubic metres annually—and is centred in the Gulf of Mexico and in Campeche.

Wood-based sheet materials

Plywood production from the four mills reported in 1958 amounted to 31,000 cubic metres. Pine plywood is manufactured at Ayotla and Durango, while mahogany and cedar plywood comes from the Colonia Yucatan and Campeche factories. The quality of Mexican plywood is high, but marketing problems are severe and the industry has been reported to be operating at only 30 per cent of capacity.

Marketing problems also restricted the development of particle-board and fibreboard production. In 1959 the three particleboard plants reported a total output of 52,000 square metres, while the one producer of fibreboard produced 13,600 tons of finished product. Development of the wood-based sheet material industry is believed to depend more on its ability to establish profitable market outlets than on any other factor.

Pulp and paper

From a national viewpoint, Mexico has no dearth of pulping materials. Present reserves of conifers are believed to be large, while the well-established sugar industry could supply additional quantities of bagasse. Unfortunately the established mills are not all well situated with respect to these raw materials. In fact, a few mills have had to close down, because locally available supplies have been exhausted. Here, as in other Latin American countries, transport difficulties loom large. The lack of well-developed and low-cost transport facilities make pulpwood costs so high that competition with imported pulp and paper is difficult. Moreover, most of Mexico's mills are quite small—only three have a capacity of over 20,000 tons. In this industry, where economies of scale are pronounced, such mills operate under a severe handicap.

During the 1958-59 period, Mexico's 19 pulp-mills (17 of which are integrated with paper production) produced a total of 164,000 tons of wood pulp. This was supplemented by the annual output of some 35,000 tons of non-wood pulp (from bagasse and wheat straw) and by wood pulp imports of 25,000 tons in 1958 and 20,000 tons in 1959.

An increasing proportion of Mexico's paper consumption is produced domestically. In 1959 there were 35 paper mills, only 5 of which produced more than 20,000 tons annually. Most of these small mills produce semi-Kraft papers with secondhand equipment. The large mills produce a great variety of paper, a fact which contributes somewhat to their high costs. Total paper production from all materials including waste, was 361,000 tons in 1959. The distribution of this output among the different types of paper is given below, along with the proportion of total consumption produced domestically. Except for newsprint, Mexico comes close to being self-sufficient in paper products.

	Output in tons	*Percentage of total consumption*
Newsprint	14,000	14
Printing and writing paper.....	70,000	90
Other paper and board.....	277,000	90

Other industry

Of the many small industries dependent upon the forests for raw materials only one is of real significance in Mexico—the resin industry. The domestic pines typically have a relatively high resin content and the collection and processing of resin is locally important in several pine areas. Because of the scattered nature of the industry no comprehensive production statistics are available.

The output of Mexico's major forest industries is summarized in table 7.

MEXICO: HISTORICAL PRODUCTION OF MAJOR WOOD PRODUCTS

Year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broadleaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
1957	750	65	815	23*	..	133	38	307	—
1958	..	..	..	31	13.5*[a]	165	30	322	—
1959	860	36	896	39	14*	164	56	361	14

Source: FAO, *Yearbooks of Forest Products Statistics*, and other studies.
[a] Fibreboard.

CENTRAL AMERICA

Central America's forest industries are in the early stages of development and, as usual, sawmilling has been the first to appear. So far it is the only one to maintain itself successfully but even this must be qualified since only one of the seven countries is currently a major producer. In 1959 Honduras manufactured over half of Central America's total output. Future output of coniferous sawn timber is problematical in other countries because of diminishing supplies. Other wood-based industries are either in their infancy, still under consideration, or not yet conceived.

Sawmilling

Honduras accounted for 50 per cent of Central America's 1959 sawnwood output and for an even larger and increasing percentage of the coniferous sawnwood production (over 75 per cent in 1959). The increased production totals shown for the sub-region mask conflicting trends in the separate countries. The increase in Honduras' coniferous sawnwood output (from 205,000 cubic metres in 1947 to 520,000 in 1959) more than compensates for downward trends that may have developed in some other Central American countries, due in large part to severe overcutting in the coniferous stands. If the 50 known sawmills of Honduras operated at the reported 60 per cent of capacity during 1958, that capacity must have been fully employed a year later when total output reached a peak of 540,000 cubic metres. It is doubtful that an annual cut of this size can be maintained.

The only other country producing or exporting a significant quantity of coniferous sawnwood is Nicaragua, where a reported output has been nearly constant over the past decade. In 1958, one half of its total sawnwood output was coniferous. Because of widespread overcutting, however, a sharp fall in output seems inevitable.

Costa Rica and Guatemala produce substantial quantities of broadleaved sawnwood. Costa Rica had some 180 sawmills in 1955 while Guatemala reported 85 for the same year. Since production in Guatemala dropped by almost one half between 1956 and 1959, pressures on individual producers must be great.

Output from the remaining three countries is small, particularly in view of the relatively large number of mills reported. Twenty-nine sawmills were reported in British Honduras (Belize) but the bulk of the production comes from the mills of one large company. In El Salvador and Panama the situation is even more confused. Panama's 175 mills produced a reported total of only 22,000 cubic metres, though sawmilling is listed as the second most important industry in the country (after cement). El Salvador's annual production is given at 25,000 cubic metres, with six sawmills reported in 1946.

Wood-based sheet materials

Plywood production in Central America was about 10,000 cubic metres in 1958, with Guatemala and Panama contributing 4,000 each, and Honduras producing the remainder. Nicaragua apparently started production in 1959 with an output of 5,000 cubic metres, while British Honduras (Belize) produced a token 100. One mill in Costa Rica produces plywood cores and no fibreboard or particleboard mills are known to be operating in the sub-region.

Pulp and paper

The pulp and paper industry has barely been established in Central America with very small-scale production of paper and board in several countries, usually from non-wood materials. In 1959 Guatemala produced 1,400 tons of non-wood pulp and 2,000 tons of paper and board and its industry has been expanding. Costa Rica contributed about 3,000 tons of Kraft paper from abaca and El Salvador some 300 tons of paperboard. Plans are under consideration in Honduras for the establishment of a much larger pulp and paper industry.

The available statistical facts about Central America's forest industries are summarized in table 8.

Table 8

CENTRAL AMERICA: HISTORICAL PRODUCTION OF WOOD PRODUCTS

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broadleaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
British Honduras (Belize):									
1957	15	19	34	0.1					
1958	25	23	48	—					
1959	24	23	47	—	—	—	—	—	—
Costa Rica:									
1957	1	224	225						
1958	1	234	235				2*	2.7*	—
1959	1	242	243	—	—	—	2*	2.7*	

Table 8 (continued)

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broad-leaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
El Salvador:									
1958	20*	5*	25						
1959	20*	5*	25	—	—	—	—	0.4	—
Guatemala:									
1957	173	75	248	4					
1958	135	90	225	4*			1*		
1959	150	100	250	..	—	—	1*	1	—
Honduras:									
1957	205	5	210						
1958	293	10	303	2					
1959	520	20	540	2*	—	—			—
Nicaragua:									
1958	77	81	158						
1959	..	..	..	..	—	—			—
Panama:									
1958	—	22	22	4*					
1959	—	28	28	4*	—	—			—
Sub-region:									
1959	792	499	1 291	10*	—	—	3*	4	—

Source: See table 7.

The Caribbean islands

The wood-products industry is very small in all of the islands, mainly because of the limited forest resources.

Sawmilling

The sawmill industry is in a rather primitive state throughout the sub-region. Haiti's largest sawmill produces 7,000 cubic metres annually but the average yearly output of the other 10 mills is only 250 cubic metres. In Cuba only 28 of the reported 208 sawmills can be considered modern and the full range of grades is not produced.

Wood-based sheet materials

There is no production of sheet materials from wood in the islands. In Cuba there are two fibreboard mills making hardboard and insulating board from bagasse and a particle-board mill which also uses bagasse. A particle-board mill to use bagasse is under construction in the Dominican Republic.

Pulp and paper

Both Cuba and Puerto Rico are the only producers of bagasse pulp in the sub-region. Since 1959, two companies were operating in the former country, one of them (Técnica Cuba) manufacturing newsprint entirely made out of bagasse pulp, although it proved uneconomical.

Total paper and board output in Cuba, mostly from imported pulp, was 65,000 tons in 1959 though the industry's capacity was rated at 125,000 tons. The total output of 50,000 tons in 1958 represented no more than 30 per cent of the consumption.

Production from the sub-region's forest industries is summarized in table 9.

Table 9

The Caribbean islands: Historical production of major wood products

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broad-leaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
Cuba:									
1957	..	..	..	..	..	..	..	50	—
1958	15*	45*	60*	—	—	—	—	51	—
1959	9	45	54	—	—	—	10	65	8
Dominican Republic:									
1957	60	5	65	—	—	—	—	0.4	—
1958	77	5	82	—	—	—	—	—	—
1959	64	6	70	—	—	—	—	0.4	—
Haiti:									
1958	7	6	13	—	—	—	—	—	—
1959	7	6	13						
Other islands:									
1957	15	48	63	—	—	..	..	15*	—
1958	13	49	62	—	—	..	..	..	—
1959	11	69	80	—	—	..	..	24[a]	—
Sub-region:									
1959	91	126	217	—	—	—	10	89	8

Source: See table 7.

[a] *Pulp and Paper International Review Number 1961.*

Northern South America

The present industries in this sub-region are neither extensive nor well developed. Some steps are being taken to improve the situation from a local viewpoint. Venezuela, for example, has recently restricted imports of some timber in the hope of stimulating local production. Housing needs are great, timber availability poses no particular problem, and average per capita income is the highest in all Latin America. This high average income (derived almost entirely from exploitation of the oil reserves) unfortunately masks a most uneven distribution. The great need for housing lies in the large low income group which cannot support substantial construction industry. Hence the market for locally-produced timber is exceedingly small. Land settlement programmes designed to open the interior regions, if combined with measures to utilize the timber coming from the newly-cleared lands, may result in a decided stimulation of the sawmill industry. Perhaps the situation can best be described as promising but still unclear.

Sawmilling

This is the major forest industry of the sub-region and Colombia is the largest producer. Colombian production which is confined entirely to broadleaved species, declined by some 30 per cent in the decade ending 1957. Only two really modern sawmills existed in 1956 (at Barranquilla and Tumaco) each with a capacity of 70 cubic metres per day. These mills produce a quality product fully up to export standards. Some 300 small circular mills provide for the local market. Handsawing is also practiced on a large scale, with an annual output estimated at 100,000 cubic metres. Sawmilling in Ecuador is based largely on balsa wood and, in the province of Esmeraldas, on mangrove. Due to the new railway (Quito-Ibarra-San Lorenzo) the latter is rapidly growing in importance. In 1958, there were reported to be 58 mechanized mills in this province, with five having a capacity of over 10,000 cubic metres annually. While only two mills were equipped with dry kilns the general efficiency seemed well above the low standard which otherwise prevails. Total production of sawnwood in Ecuador is estimated at 260,000 cubic metres per year, including 44,000 of balsa.

Little information exists on the sawmill industry of Venezuela. Reported annual output fluctuates around 200,000 cubic metres with light broadleaved species accounting for over 50 per cent of this total. Most of the mills are band mills, the largest 3 or 4 having a production of 15 to 25 cubic metres per day. A few gang mills and circular mills also operate. There are no drying kilns.

French Guiana had only 11 sawmills in 1952, though the progressive BAFOG mill, which was established in 1956, has experimented with new equipment for sawing Guiana timbers. In Surinam the mills are generally out-dated, labour costs are high, and the capacity is excessive for the poor market. Some 92 mills are producing in British Guiana, though production is reasonably efficient and the machinery up to date in only the larger mills. These larger mills have gang saws and four of them have band-saw equipment but the majority of the mills are equipped with circular saws. Unfortunately a shortage of raw material is hampering sawmill development in British Guiana.

Wood-based sheet materials

Both Venezuela and Colombia produce plywood. In Venezuela the industry has developed rapidly over the past four years behind relatively high tariff protection. Here the industry is based on both local timbers (miajo, cedar and mahogany) and on imported veneers and peeler legs. The six major producers reported a total output of 8,000 cubic metres in 1958 but, partly due to the difficult economic situation, output declined to 6,000 in 1959. While exports of plywood are unlikely because of the high costs, the prospects may be better for veneers. The three Colombian mills operating in 1955 (in Bogotá, Barranquilla and Cali) were apparently unable to fulfil domestic demands, and a fourth mill was built at Tumaco. Total output for 1957 was reported at 24,000 cubic metres—three times the 1955 level. Since imports of plywood into Colombia were discontinued after 1955, present production apparently covers the effective demand for this commodity.

Colombia also has one fibreboard factory with a capacity of about 12,000 tons per year (8,000 tons of hard and 4,000 tons of insulating board), though no actual production figures were reported. While Colombia's three particle-board factories have a combined capacity of 12,000 cubic metres the production reported for 1958 was only 5,000 tons. There are two particle-board factories in Venezuela.

Surinam has one plywood mill which produces about 15,000 cubic metres annually. A particle-board mill with a capacity of 18,000 cubic metres has been built to use the residues from the plywood factory and some additional round material. A 7,000 cubic metre particle-board mill started production in British Guiana in 1959.

Pulp and paper

Practically all the sub-region's requirements for pulp are imported. Ecuador has one small mill producing pulp from banana stalks, though its output is virtually negligible. Colombia has a mill of 25 tons daily capacity which started operation in 1960 using local hardwoods as raw material, and a smaller mill producing bagasse pulp.

Paper and board production is highly concentrated in Colombia. One mill in Cali has 45,000 out of the country's total capacity of 54,000 tons. The remaining capacity is distributed between five small plants. The largest mill expects to increase its capacity to around 70,000 tons in the near future. Another company plans to build a mill with an annual capacity of 40,000 tons of pulp and 35,000 tons of paper. The domestic production of wrapping paper and board in 1958 supplied 80 per cent of Colombia's consumption.

Ecuador's two small mills produce a total of only 600 tons of board from waste paper. Venezuela in 1958 had four mills with a capacity of 6,000 to 7,000 tons and one new Kraft mill with a capacity of 35,000 tons. Total Venezuelan output was 13,000 tons of wrapping paper and 10,000 tons of board in 1958 and twice that amount in 1959.

The production reported for the wood-using industries of northern South America is summarized in table 10.

Table 10

NORTHERN SOUTH AMERICA: HISTORICAL PRODUCTION OF MAJOR WOOD PRODUCTS

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broad-leaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
Colombia:									
1957	10	946	956	24	4*[a]	—	3	40	—
1958	10	974	984	..	5*[a]	—	3	43	—
1959	10	980	990	..	5*[a]	..	3	48	—
Ecuador:									
1957	—	..	..		..	—	—	—	—
1958	—	..	..	..	..	—	..	1	—
1959	—	285	285	..	..	—	..	1	—
Venezuela:									
1957	—	206	206	6.1	..	—	—	19	—
1958	—	193	193	8.1	..	—	—	23	—
1959	—	226	226	6.4	..	—	—	45	—
British Guiana:									
1957	—	80	80	—	—	—	—	—	—
1958	—	83	83	—	—	—	—	—	—
1959	—	83	83	—	—	—	—	—	—
French Guiana:									
1957	—	11	11	—	—	—	—	—	—
1958	—	10	10	—	—	—	—	—	—
1959	—	6	6	—	—	—	—	—	—
Surinam:									
1957	—	29	29	15	—	—	—	—	—
1958	—	25	25	15	0.2[a]	—	—	—	—
1959	—	21	21	15	2.5[a]	—	—	—	—
Sub-region:									
1959	10	1 601	1 611	45	7.5		3	94	

Source: See table 7.

[a] Particle board.

SOUTH-WEST SOUTH AMERICA

This sub-region has presented many obstacles to the development of a wood-using industry. The forest areas of Peru and Bolivia lie to the east of the Andes and are virtually cut off from the heavily populated parts of those countries. Their natural outlet to the east entails some 5,000 kilometres of river travel in order to reach an ocean port. Chile is in a better position though its forests are far from the population centres and are separated from a natural market in Argentina by the Andes mountains. Transportation is difficult in all parts of the sub-region—existing roads are few and poor, new roads or railroads are expensive to construct, and ocean transport is handicapped by inadequate harbour facilities.

The most extensive industrial development has been in Chile. Here the large areas of pine plantations have provided the raw material base for new pulp, paper, and fibreboard industries. Peru also has made progress under more difficult conditions and the new trans-Andean highway has stimulated plans for industrial development of the eastern part of the country.

Sawmilling

Of the sub-region's 1,100 sawmills, some 800 are located in Chile, and Bolivia and Peru have about 150 each. Relatively few of these mills have any real industrial status; most are small and under-powered and operate intermittently. The major mills are located in the indigenous forests of Southern Chile and in the eastern part of Peru on tributaries of the Amazon. The pine plantations are producing a substantial shift of the industry in Chile. In Bolivia there are two principal sawmilling centres; one around Cochabamba and Santa Cruz in the central part and the other in the Chaco area on the Argentinian-Paraguayan frontier.

Chile is by far the most important sawn timber producer, accounting for 80 per cent of the sub-region's total output and for practically all of its sawnwood exports. Only 100 of its 800 mills are classified as permanent, the majority operating only when encouraged by a temporary upward swing in demand. The lack of agreement on grading standards, the lack of seasoning, and the generally poor manufacture, explain why imported timbers can compete with home-produced pine even in Chile itself. Recently steps have been taken to establish sound grading standards which will do much to aid the industry.

In Peru and Bolivia the sawmills are typically small and the product is typically sub-standard. Only 20 of Peru's sawmills are capable of a daily output exceeding 12 cubic metres, and it is estimated that the entire industry operates at from 20 to 25 per cent of capacity. Bolivia's largest sawmill (in Cochabamba) produces some 33 cubic metres daily, but the yield is estimated at 35 per cent of the roundwood volume, a sufficient commentary on efficiency.

Wood-based sheet materials

Annual production of plywood in the sub-region totals about 9,000 cubic metres, with Chile again the

largest producer. The one veneer mill and the three plywood mills in Chile together account for practically all of the sub-region's output. In both Bolivia and Peru annual production is less than 500 cubic metres, although Peru reports two plywood mills and Bolivia both a plywood and a veneer mill. The quality of production is highly variable because of poor adhesives. Plywood could prove a valuable asset to the timber economy of this sub-region for it is far less bulky and could carry much higher transport costs than lumber.

The one particle-board plant and the single fibreboard factory were both erected in Chile in 1957. Production of fibreboard reached 1,400 tons in 1960, and output of particle-board for the same year was reported to be 3,600 tons. A board mill based on bagasse is under construction in Peru.

Pulp and paper industries

Chile is also the sole producer of wood pulp in the sub-region, its four plants having a total annual output of about 60,000 tons. In addition, 26,000 tons of bagasse pulp are produced in Peru and a small amount of pulp comes from Bolivia's paja brava, a local grass.

Chile, whose pulp and paper manufacture have been integrated, produces the full range of paper products. Total output in 1959 amounted to 105,000 tons of paper (including 49,000 tons of newsprint) and some 13,000 tons of paperboard. Peru's paper and board production (from bagasse and imported pulp) is steadily increasing and reached 45,000 tons in 1959. It still must import all newsprint, however, along with sizable quantities of other paper and board. Bolivia's one small mill produces about 800 tons of wrapping paper and board annually.

Secondary forest products

Chicle and palo rosa extracts are of considerable importance to local economies in Peru. There is little doubt that quebracho extract could be produced in Bolivia, though so far this wood is used almost solely for sleeper production. With the present trend toward synthetic tannins and the general depression of tannin markets in the world, however, there seems little purpose in attempting to introduce this industry into Bolivia.

Table 11 summarizes the forest industry picture in south-west South America.

Table 11

SOUTH-WEST SOUTH AMERICA: HISTORICAL PRODUCTION OF MAJOR WOOD PRODUCTS

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broad-leaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
Bolivia:									
1959	—	22[a]	22[a]	.5	—	—	—	1	—
Chile:									
1957	158	628	786	7	—	21	3	71	20
1958	..	..	..	6	—	44	3	93	44
1959	293	428	721	9	5[b]	58	2	105	49
Peru:									
1957	12	93	105	.5*	—	—	17	36	—
1958	7	75	82	.5*	—	—	21	36	—
1959	6	76	82	.5*	—	—	26	45	—
Sub-region:									
1959	299	526	825	10	5	57	29	151	49

Source: See table 7.

[a] 1960.

[b] 1 400 tons of particle board and 3 600 tons of fibreboard.

BRAZIL

Brazil has tremendous areas of unexploited forests, but some of its major forest areas are being badly overexploited, particularly the Paraná Pine area in the southern States. Production is centred upon this type and most of the forest industries are found in the four southern States of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul, though serious attempts are being made to industrialize the interior and northern States.

Brazil is essentially self-sufficient in forest products. It produces a sizable export balance of sawn timber and meets its needs for veneer and plywood with home production. Most types of paper and board are produced in quantities sufficient to satisfy domestic consumption but Brazil has to import nearly 70 per cent of its newsprint requirements.

During the past decade Brazil has experienced a rapid economic development. It is richly endowed with natural resources, and particularly so with forests. With the possible exception of long-fibred woods for paper production and of coniferous sawn timber supplies, there seems to be nothing to prevent a rapid development of the forest industries, which is essential in order to meet the rising needs of its expanding population.

Sawmilling

Officially some 7,500 sawmills are registered for operation in the four southern States. About 1,200 other sawmills are scattered over the rest of the country, 150 of them in Minas Gerais and perhaps 90 in the Amazon region. Another large group of mills, estimated to number at least 1,000, operate illegally in the Paraná Pine area, where marketing problems and

the need to protect a dwindling forest have led to legal restrictions on the establishment of new mills.

The output of Brazilian sawmills for the years 1957 to 1959 is given in table 12. Most of the production is from the southern area; the coniferous sawnwood is largely from the Paraná Pine country of the southern States. With so many mills in operation one would expect to find all shades of efficiency and practically all types of equipment. In general, however, the mills are small; usually inadequately powered by diesel or gasoline units; fitted with circular, solid tooth saws; and poorly maintained. Drying facilities are often lacking and the common practice of selling poorly finished lumber has contributed substantially to the difficult marketing situation that currently exists.

The heavy concentration in the Paraná Pine area has produced a situation which may soon become critical. Stumpage supplies are dwindling rapidly, yet almost indiscriminate cutting continues. Within the next decade Brazil's sawmilling industry will face a major problem of rehabilitation, and at the same time the sawnwood economy of the country will necessarily see some far-reaching changes.

Wood-based sheet materials

Few industries can match the rapid expansion of wood-base sheet materials. In 1959 Brazil had some 200 plants producing veneers and 234 plants producing plywood, all located in the southern States. Annual output is around 340,000 cubic metres and is almost all consumed within the country. Only two particle-board plants exist, both in the State of São Paulo. One of these is expected to move and the other has so far concentrated on door production. The two plants producing fibreboard in Brazil reported their 1957 output as 36,000 cubic metres, though both plan to expand by 1962 to a total capacity of 75,000 cubic metres.

Pulp and paper

Brazil has a large number—estimated in the hundreds—of very small groundwood pulp mills in the southern States, practically all of which are now idle. Nearly all of the pulp production comes from the 37 relatively large (though still small by international standards) mills, of which 32 are in the southern sector. These mills produced some 320,000 tons of wood and non-wood pulp in 1959, while another 120,000 tons were imported. The raw materials used most were Paraná Pine, eucalyptus and bagasse.

Most of the producing mills are quite small compared to those typical of North America or Europe. In 1958 only one Brazilian mill had a capacity of over 25,000 tons. With the completion of mills now under construction, however, production should exceed 500,000 tons by 1962. This will call for a substantial increase in the use of eucalyptus and a corresponding decrease in the relative share of pine.

Paper mills are also mostly in the southern States —42 of the 64 mills in 1958 were in this area—and the rest in and around Rio de Janeiro. Total paper output in 1959 was under half a million tons, divided as follows:

Newsprint	15 per cent
Printing and writing paper	20 per cent
Other paper and paperboard	65 per cent

The production reported for the wood-using industries of Brazil is summarized in table 12.

Table 12

BRAZIL: HISTORICAL PRODUCTION OF MAJOR WOOD PRODUCTS

Year	*Sawnwood (1,000 m³)*			*Wood-based sheet materials*		*Pulp (1,000 tons)*		*Paper and board (1,000 tons)*	
	Coniferous	*Broad-leaved*	*Total*	*Plywood (1,000 m³)*	*Other (1,000 tons)*	*Wood*	*Non-wood*	*Total*	*Newsprint*
1957	3 234	2 992	6 226	..	36[a]	188	70	363	49
1958	3 455	3 079	6 534	341[b]	36	203	78	416	63
1959	3 204	2 888	6 092	..	46	222	94	440	67

Source: See table 7.

[a] Fibreboard; in addition, a small amount of particle-board was produced in the last years.

[b] *Produçao Industrial Brasileira 1958*; includes veneers.

SOUTH-EAST SOUTH AMERICA

Compared to most of Latin America, this sub-region is a high consuming area. On the whole it is short of forest materials, current exports from Paraguay being insufficient to supply the other two countries with the forest products they lack. In addition to sawnwood and logs from Paraguay, both Argentina and Uruguay import sizable quantities from Brazil and to a lesser extent from Chile. Pulp is brought in mainly from the Scandinavian countries and paper from Europe and North America.

Sawmilling

Along the Argentine-Chilean border and in the northern provinces of both Argentina and Uruguay sawmills process locally grown timbers, often inefficiently. The other sawmilling centres are in or near Buenos Aires and Montevideo and either process imported logs from Paraguay and Brazil or re-saw the rough product shipped in from the north.

Both countries import more sawnwood than they produce. Argentine sawnwood production hit a peak of over a million cubic metres in 1956, then dropped to 760,000 two years later. Imports reached their maximum in 1957 with 1,050,000 cubic metres and decreased to half this level in 1959, due to economic difficulties.

Paraguay's industry is different. Eighty per cent of its sawnwood production and more than half of the logs removed from the forest are exported to its southern neighbour. Most of the material is shipped in the round, the total sawnwood production for both export and domestic consumption being only 25,000 cubic metres. While there are some 60 sawmills in Paraguay, only five can be termed modern and have

a daily capacity of over 12 cubic metres. A few mills are clustered in and around Asunción but most are located in the south-eastern part of the country, far from the shipping points on the Paraguay River and also from the forest, which is receding under the pressure of exploitation. This location is responsible for Paraguay's high transport costs for both logs and lumber.

Wood-based sheet materials

Plywood production is concentrated in Argentina and Uruguay, Paraguay's one major mill accounting for only 1,200 cubic metres per year. Argentina's plywood industry developed under Second World War conditions and was later protected by tariff legislation. Freed from competition, the industry developed along uneconomic lines, and when in 1953 the Forest Administration imposed quality standards while limiting the creation of new mills the most inefficient ones were forced to close. As a consequence output fell from 50,000 cubic metres in 1951 to 30,000 in 1954. Production recovered to the 1951 level during 1957 and 1958 but dropped again in 1959 to 40,000 cubic metres. Argentina's 30 mills could probably increase production by at least 30 per cent without additional equipment. Uruguay's two plywood mills produced a total of 14,000 cubic metres in 1958.

The only fibreboard (hardboard) produced in the three countries comes from a single plant in Argentina. Annual output is reported to be 18,000 tons. Uruguay has one small particle-board plant which operates on wood waste and imported glues and produces about 800 tons per year.

Pulp and paper

The sub-region's pulp and paper industry is conconcentrated in Argentina and Uruguay. Argentina's 14 mills produce 50,000 tons of wood pulp and 36,000 tons of other fibres. Uruguay's annual production of 3,000 tons of mechanical pulp and 2,000 tons of straw pulp comes from two mills. The pulping industry is working at about 70 per cent of capacity. Imports of pulp to the two countries are large; Argentina's pulp import bill came to 20 million dollars in 1958, while Uruguay's amounted to 3 million dollars. Under existing plans Argentina's pulp industry should expand considerably during the next decade.

Uruguay's five paper mills produce some 30,000 tons annually, and in addition several factories manufacture paper-board from local raw materials. Annual imports of paper and board cost Uruguay about 7 million dollars each year.

The 64 paper and board mills in Argentina produce primarily wrapping paper and board. Of the 1959 total production of 350,000 tons only 5,600 tons were newsprint and 55,000 tons printing and writing paper. Paper imports to Argentina are valued at 20 million dollars annually. The major restriction on expansion of Argentina's pulp and paper industry is the shortage of long-fibred materials.

Paraguay has one small paper board factory near Asunción and a wrapping paper factory is being constructed at Fassardi. Production statistics are unavailable, but output is certainly small.

Secondary forest products

Argentina is a major producer of quebracho extract, which is the one export item that is derived from the forests. Annual production comes to about 140,000 tons in Argentina and 30,000 tons in Paraguay, though their combined production in the past has reached peaks of as much as 290,000 tons.

Table 13 summarizes the information available on south-east South America's forest industries.

Table 13

SOUTH-EAST SOUTH AMERICA: HISTORICAL PRODUCTION OF MAJOR WOOD PRODUCTS

Country and year	Sawnwood (1,000 m³)			Wood-based sheet materials		Pulp (1,000 tons)		Paper and board (1,000 tons)	
	Coniferous	Broad-leaved	Total	Plywood (1,000 m³)	Other (1,000 tons)	Wood	Non-wood	Total	Newsprint
Argentina:									
1957	51	775	826	48	..	34	32	303	12
1958	50	713	763	52	18[a]	43	32	357	12
1959	53	607	660	41	17[a]	50	37	346	12
Paraguay:									
1957	—	..	..	1.2[b]	—	—	—	.5	—
1958	—	25	25	..	—	—	—	.5	—
1959	—	36	36		—	—	—	1.0	—
Uruguay:									
1957	..	..	..	..	—	2.0	4.5	35*	—
1958	52	18	70	14	0.8[c]	1.9	3	35	—
1959	52	18	70	14	0.8[c]	3	3	36	
Sub-region:									
1959	105	661	766	56	18	53	40	383	12

Source: See table 7.

[a] Fibreboard.

[b] 1956.

[c] Particle-board.

SUMMARY

There is little to add by way of summary to the initial statement of the chapter. The data given for each sub-region confirm the under-development of the forest industries, although this is far from uniform. As may be expected, primary industries dominate the picture in most countries. Only in those that are well along the road to an industrialized economy does one

find any substantial representation of what might be termed "sophisticated" manufacturing—particle-board, plywood and especially pulp and paper. Thus, Mexico, Argentina, Brazil and Chile together account for 99 per cent of Latin America's total production of wood pulp, and 87 per cent of its paper output.

Sawmilling is usually the first forest industry to establish itself in a pioneer territory. Initially, the product is rough and poorly finished, a characteristic of sawmills in many Latin American countries today. But as income and living standards rise, people begin to demand quality products. Planing mills are added; dry-kilns are installed; lumber quality rises; grading rules are imposed by producer organizations to promote and protect their product's reputation and usefulness; and gradually a market is established which can distribute efficiently the industrial output. One can find examples of these later stages in the region, although most Latin American countries lag behind Europe and North America on this score.

A summary of the basic production statistics of the forest industries is given in table 14. Central America and the Caribbean clearly lag behind Mexico, Brazil, Argentina, Uruguay and Chile as far as present forest industry development is concerned.

The point to note here is not that the Latin American countries are following the pattern of forest industry development of the more industrialized nations but that Latin America has an opportunity to profit by the errors made in those countries and to take advantage of the technical knowledge that has accumulated. One can argue that the pine forests of the Lake States in North America were much used in building homes for those who settled the treeless plains of the present farm belt. It is absurd to maintain that the same philosophy should govern development of the Paraná area of Brazil. The problems of rehabilitating a cut-over area can be avoided while still obtaining the benefits of exploitation. The resource should be used; it does not have to be destroyed. Forest industries must be developed under some plan which considers both present and future needs for products.

Table 14

LATIN AMERICA: PRODUCTION OF WOOD PRODUCTS BY SUB-REGIONS, 1948-51 AND 1959

	Sawnwood (1,000 m³)			*Wood-based sheet materials*		*Pulp (1,000 tons)*		*Paper and board (1,000 tons)*	
	Coniferous	*Broad-leaved*	*Total*	*Plywood (1,000 m³)*	*Other (1,000 tons)*	*Wood*	*Non-wood*	*Total*	*Newsprint*
Mexico:									
1948-51	1 058	171	1 229	8	—	60	8	172	—
1959	860	36	896	39	14*	164	56	361	14
Central America:									
1948-51	320*	375*	695*	0.5	—	—	—	—	—
1959	792	499	1 291	10*	—	—	3*	4	—
Caribbean islands:									
1948-51	100	104	204	—	—	—	—	33	—
1959	91	126	217	—	—	—	10	89	8
North South America:									
1948-51	10	800	810	5	—	—	0.5	17	—
1959	10	1 601	1 611	45	7.5	—	3	94	—
South-west South America:									
1948-51	108	580	688	12	—	14	10	63	9
1959	299	526	825	10	5.0	57	29	151	49
Brazil:									
1948-51	2 651	2 777	5 428	134.1	—	131	19	228	36
1959	3 204	2 888	6 092	341.0[a]	46	222	94	440	67
South-east South America:									
1948-51	49	554	603	35	—	11	30	222	2
1959	105	661	766	56	18	53	40	383	12
Total Latin America:									
1948-51	4 296	5 361	9 657	195	—	216	68	735	47
1959	5 361	6 337	11 698	501	91.0	496	235	1 522	150

Source: FAO. See table 7.

[a] 1958, including veneers.

PART III

THE CONSUMING SECTOR

In planning for economic development a clear idea must be had of the quantities of various goods which will be required or consumed by the inhabitants of a country or region in the future. These must necessarily be estimates and their value will depend largely on the basis which is used in making them. A logical basis for such an undertaking is the consumption pattern of the existing population. Since consumption is almost certain to change with time, it is also helpful to know what changes have occurred in the past. Trends in consumption cannot be projected blindly into the future, but when careful allowance is made for over-all changes in the economy, they can provide a useful basis for estimates of future consumption. The purpose of chapter 5 is to present the information available on present and past consumption of wood products in Latin America.

Chapter 6 will then attempt to make a useful estimate of what consumption might be in the future. The actual future consumption will depend heavily on the amounts of wood products made available by the producing sectors of the economy. But in order to plan for the future development of those producing sectors, it is desirable to know what the future consumption would be if the products were available. The estimates made in chapter 6 are, therefore, estimates of future "requirements" for forest products. That is, they are estimates of the amounts that will be required to satisfy future consumers if the present supply of wood products is maintained and if prices remain relatively the same compared to competing products.

The most recent year for which complete data are available is 1958 and this is used as the "present" or base year in this report. In order to show what has happened to consumption in the past, figures are presented for two periods: 1948 through 1951 and 1956 through 1959. The annual averages for these two periods reflect most of the changes which have occurred during the past eleven years.

People use wood in a great variety of products. Many of these are of relatively minor importance and the quantity of wood used in making them is very small compared to the total. While it might be interesting to see how much wood goes into each of these products, such detailed information is not needed in planning the intelligent use of a country's forest resources. For this purpose, it is sufficient to have information about major classes of products which differ materially in the kind of timber they require from the forests. Chapters 5 and 6 present information about the consumption of five groups of wood products: sawnwood, roundwood products, wood-based sheet materials, pulp and paper, and fuelwood. In some cases, they also give information about important end uses of the products in these groups, where such detail appears to be useful and is warranted by the data available.

Chapter 5. Past consumption of wood products

Latin America is a region of vast forest resources and one would expect its people to be large consumers of wood. In total, the volume consumed is large, for it has been equivalent to some 220 million cubic metres of roundwood annually in recent years. But on a per capita basis the consumption of most wood products is much lower in the Latin American countries than in Europe or northern North America. The consumption of wood products has varied considerably from one sub-region to another and some kinds of products have been used to a much greater extent than others. There are many reasons for this and it is important to try to understand them because they may not influence future consumption in the same way as they have affected consumption in the past.

Despite its large area of forest, Latin America also contains extensive areas in which forest growth is completely lacking or in which the forests are thin and scattered. Many of these areas have been more suitable for human occupancy than the densely forested sections and much of the Latin American population is located in them. In addition, much of the present population is concentrated in areas that have been occupied by European immigrants for periods as long as four hundred years and which in some cases had been heavily used before that by the native Indian population. Whatever forests there were originally in these areas have been practically eliminated by heavy human use. The availability of wood at a reasonable cost has therefore been an important factor in limiting its use in the past.

Historically, the people of Latin America have had very low incomes and therefore a very low standard of living. Part of the population has probably always lived about as well as people anywhere else in the world but this has been a small fraction of the total. In all of the Latin American countries a large number of people can be counted as consumers only with regard to the absolute necessities of life. While most wood products are not luxuries, neither are most of them absolute necessities. The quantity of wood products which people use bears a definite relationship to their incomes and standard of living. In the parts of the world where these are low, per capita consumption of wood products is also low.

Wood as it grows in the forest is not a consumer product. It must be converted in form and made into useful products before people have any desire to use it. Consumption, therefore, depends on the amounts of the finished products made available to the consumers. Facilities for processing the wood are as important in determining consumption as is the source of forest raw materials. Chapter 4 pointed out that the wood-using industries in Latin America are generally under-developed and that factories to make products such as paper and board are almost completely lacking in some countries. Products such as particle-board have hardly been used in Latin America because there has been almost no domestic manufacture.

Many wood products are not consumer goods at all but are used in the production of other goods or services. This includes such important products as sleepers, fence posts, mine timbers, and the sawnwood used in packaging and in the construction of bridges, boats and buildings. The amount of wood used for such purposes clearly depends on the development of other sectors of the economy such as agriculture, transport, mining and construction. Since Latin America is in general an under-developed region, none of these sectors have been as active as in the more developed parts of the world. The amount of wood products consumed is closely linked to the condition of the general economy of a country and may be expected to follow a pattern of development similar to that of the whole economy.

The available information on historical consumption will be presented in this chapter by major product groups and by sub-regions. This will emphasize the differences and help to explain them. Within the major product groups, information will be presented on some of the more important end uses. This is important because the factors affecting the use of sawnwood in furniture, for example, are different from those affecting its use in packaging. Unfortunately, it was not possible to recognize as many end uses as would have been desirable because of the complete lack of information on most of them.

Methodology

Statistics on consumption were developed along two main lines and the results were then reconciled and combined to give the final figures. The first approach was based on production and international trade statistics. For each product, domestic production plus the amount imported and minus the amount exported gave a figure for apparent consumption. An accurate estimate of consumption by this method would require a correction for the stock on hand at the beginning and end of the period. Data on stocks are not available in Latin America and such a correction was not attempted. Because of the kinds of products involved, the size of the errors known to exist in the other data, and the fact that the figures presented are averages over a four-year period, it is believed that the failure to correct for stocks does not affect the usefulness of the consumption estimates.

The second approach was to obtain independent estimates of the actual consumption of individual products. Practically none of the Latin American countries compile official statistics on the consumption of any wood product. However, it was possible to obtain actual figures on some products from the consumers, such as the number of sleepers from the railroad companies. In other cases, local people who were familiar with the use of a particular product were able to give reasonably accurate estimates of consumption. The country correspondents, local government officials, and local representatives of international organizations were especially helpful in obtaining such estimates. Some estimates were based on relationships with other items on which figures were available, such as estimating the number of fence posts on the basis of the amount of fencing-wire consumed.

In several countries the local correspondents made limited attempts to sample such things as the amount of fuelwood used by a family and the quantity of sawnwood used in constructing a typical house. Finally, where reliable data were available for one country, the averages for that country could often be applied to other similar countries on the basis of population, number of houses built, area of land under cultivation, and similar statistics.

It is important to recognize that the consumption figures presented in this chapter are estimates and not measured data. However, they were based on every scrap of information which could be obtained, and were checked and supplemented by the observations of competent local people, and reconciled with similar data from other countries and other regions. These are the best estimates that it is possible to make today. It is to be hoped that the Latin American Governments will assume the very important task of collecting better data in the future.

Estimates of consumption

In the hope of giving as clear a picture as possible of the historical consumption situation, each major product group will first be considered separately in complete detail. Within each product group, the information will be presented by sub-regions and, where the data permit, information will also be given for individual countries within these sub-regions. After each product group has been considered individually, the information will be consolidated to show a complete picture of wood consumption in each sub-region and in Latin America as a whole.

Sawnwood

Sawnwood includes all wood sawn lengthwise from the log—such as boards, planks and beams—regardless of the further processing—such as planing—which may be applied to it. The one exception is sawn veneer, which in this report is included in the group of wood-based sheet materials. Box-boards and railway sleepers are included in sawnwood in this report, although they often are excluded in other statistics.

Sawnwood is the most important class of wood product used in highly-developed countries and is a major consumer of wood in all but the most primitive countries. A versatile material, it finds use in construction, packaging, and in the manufacture of furniture and a multitude of other products. It is considered first here because of its universal importance and the amount of information that is available on its consumption in Latin America.

Mexico

Mexico consumed an average of 1.2 million cubic metres of sawnwood annually between 1948 and 1951.

The average consumption decreased slightly to 1.1 million cubic metres in the period 1956-59. On a per capita basis, consumption decreased from 47 cubic metres per thousand inhabitants in 1948-51 to 34 cubic metres in 1956-59. Per capita consumption in Mexico is low compared to most other Latin American countries. Despite its sizable forest resources, wood is not geographically available to many of the people and other materials are cheaper for use in construction. This was the only sub-region in which the total consumption of sawnwood showed a decrease between the two periods and it is not clear why this should have occurred in Mexico. There is a possibility that this decrease is only an apparent one and is due to reporting errors in the statistics. But there is no doubt that a real decrease took place in per capita consumption.

The distribution of the sawnwood consumption among the major end uses is shown in table 15. The consumption of sleepers, which is based on separate statistics, increased materially during this period. The information on consumption in the other end uses is not very reliable for Mexico and the decreases shown for them stem from the same causes as the decrease in the total. This table also shows the roundwood equivalent of the sawnwood consumed. All but about 5 per cent of the logs to produce this sawnwood came from Mexican forests.

Table 15

MEXICO: ANNUAL CONSUMPTION OF SAWNWOOD BY END USES

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	621	516	52	47
Furniture	110	92	9	8
Packaging	140	116	11	11
Sleepers	209	267	17	24
Other sawnwood products	130	108	11	10
All sawnwood	1,210	1,099	100	100
Equivalent volume in roundwood	2,578	2,398		

Source: ECLA, on the basis of national statistics.

CENTRAL AMERICA

The Central American countries consumed an average of 540,000 cubic metres of sawnwood annually between 1948 and 1951. Consumption increased to 920,000 in the period 1956-59; an increase of about 70 per cent during the decade. On a per capita basis, consumption increased from 61 cubic metres per thousand inhabitants in 1948-51 to 82 cubic metres in 1956-59. This was the largest relative increase in per capita consumption shown by any sub-region. Central America now stands second behind Brazil in per capita consumption of sawnwood.

This is a heavily forested sub-region and timber is quite readily available to the people. Most of the countries have coniferous forests and since coniferous sawnwood is preferred for most uses, this undoubtedly encourages consumption. Some of these countries—in particular Costa Rica—use more wood in construction than is common in other parts of Latin America.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-58
Costa Rica	129	255
El Salvador	60	72
Guatemala	97	245
All other countries	258	344

Although the population of El Salvador is over twice as large as that of Costa Rica, it is concentrated in a very small country where the pressure on the land is heavy and the area remaining in forest is small. Domestic availability of timber is obviously an important factor affecting consumption.

The distribution of the sawnwood consumption among the major end uses is shown in table 16. Construction is the predominant use—to a greater extent than in any other sub-region. Railroads are not very extensive in Central America and the major products of the sub-region are not the kind that require much wood for packaging.

Table 16

CENTRAL AMERICA: ANNUAL CONSUMPTION OF SAWNWOOD BY END USES

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	384	682	71	74
Furniture	62	102	11	11
Packaging	16	25	3	3
Sleepers	34	37	6	4
Other sawnwood products	47	69	9	8
All sawnwood	543	915	100	100
Equivalent volume in roundwood	1,112	1,858		

Source: ECLA, on the basis of national statistics.

THE CARIBBEAN ISLANDS

The Caribbean islands consumed an average of 780,000 cubic metres of sawnwood in the period 1948 to 1951. Annual consumption rose to 990,000 in 1956-59, an increase of about 25 per cent during the decade. Per capita consumption increased slightly from 48 cubic metres per thousand inhabitants during the first period to 52 cubic metres in 1956-59.

The Caribbean islands have only limited forest resources and in 1956-59 they imported 40 per cent of the sawnwood they used, practically all of it coming from outside the sub-region. Despite this supply problem, the average per capita consumption of sawnwood was higher than that of Mexico and south-west South America. The comparatively high income of several of the islands, the fact that they produce largely for export, and the scarcity of other materials to substitute for sawnwood were undoubtedly all factors in this.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Cuba	330	340
Dominican Republic	64	68
Haiti	57	66
Other islands	325	518

Statistics on the other islands are not sufficiently accurate to warrant an island-by-island presentation

but consumption apparently increased materially in Puerto Rico and several of the other islands.

The distribution of the sawnwood consumption among the major end uses is shown in table 17. As in all other parts of Latin America, construction was the major consumer. Furniture was relatively more important here than in other sub-regions, perhaps due to the higher income and the relative unimportance of the railroads and packaging as consumers of sawnwood.

Table 17

THE CARIBBEAN ISLANDS: ANNUAL CONSUMPTION OF SAWNWOOD BY END USE

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	419	547	54	55
Furniture	129	168	17	17
Packaging	71	94	9	9
Sleepers	61	56	8	6
Other sawnwood products	96	127	12	13
All sawnwood	776	992	100	100
Equivalent volume in roundwood	1,599	2,025		

Source: ECLA, on the basis of national statistics.

NORTHERN SOUTH AMERICA

The countries of Northern South America consumed an average of 1.1 million cubic metres of sawnwood in the period 1948-51. Their consumption increased to 1.7 million in 1956-59, a rise of somewhat over 50 per cent in the decade. Per capita consumption rose from 53 cubic metres per thousand inhabitants in the first period to 65 in the second. The per capita consumption of sawnwood in this sub-region is just about the same as the average for the whole region.

This sub-region has extensive forest resources but is really only beginning to develop them. It has virtually no domestic conifers and this has limited the usefulness of the native timber for sawnwood. In addition, a large part of the population lives in the sections where there are little or no forests and at quite a distance from the forest areas.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Colombia	578	961
Ecuador	184	207
Venezuela	213	382
The Guianas	92	100

The consumption of the various countries is in proportion to their populations with the exception of the Guianas where per capita consumption of sawnwood is very high. It is significant, however, that consumption has been increasing much faster in Colombia and Venezuela than in the other countries.

The distribution among the major end uses is shown in table 18. The very large increase in sleepers between the two periods was due to the construction of a new railroad in Colombia. Consumption of other sawnwood products is relatively very high in this sub-region and may be partly due to inaccurate reporting of other end uses.

Table 18

NORTHERN SOUTH AMERICA: ANNUAL CONSUMPTION OF SAWNWOOD BY END USE

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	509	765	48	46
Furniture	117	195	11	12
Packaging	155	224	14	14
Sleepers	29	74	3	4
Other sawnwood products	258	392	24	24
All sawnwood	1,068	1,650	100	100
Equivalent volume in roundwood	2,158	3,356		

Source: ECLA, on the basis of national statistics.

SOUTH-WEST SOUTH AMERICA

The countries of south-west South America consumed an average of 780,000 cubic metres of sawnwood annually between 1948 and 1951. The annual consumption increased to 950,000 in 1956-59, an increase of about 20 per cent during the decade. Per capita consumption remained almost constant during this period, changing only from 44 cubic metres per thousand inhabitants in 1948-51 to 45 in 1956-59. Per capita consumption of sawnwood is lower in south-west South America than in any other sub-region except Mexico.

This sub-region has extensive forest resources but the bulk of them in eastern Bolivia and Peru and the far south of Chile are quite inaccessible. Most of the people live in the forestless *altiplano* of Bolivia and Peru, the almost desert coastal portion of Peru, and the central section of Chile. Sawnwood must be transported long distances to reach these population centres and the facilities for such transportation are generally poor. Sawnwood is not a common construction material in Bolivia and Peru and even in Chile it is used to a more limited extent than in some other sub-regions.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Chile	549	707
Peru	140	178

The statistics on Bolivia are too unreliable to warrant separate presentation. Since the population of Peru is much larger than that of Chile, the difference in consumption is striking. Peru consumed only 17 cubic metres per thousand inhabitants in 1956-59 while Chile consumed 97.

The distribution among the major end uses is shown in table 19. Packaging is a relatively large consumer of sawnwood, mainly because of the fruit and vegetable shipments in Chile. The proportion going into furniture appears very low but the available statistics stood up under thorough checking. As in Northern South America, the proportion of consumption in other sawnwood products is very high and may again be due to inaccurate reporting of other uses.

Table 19

SOUTH-WEST SOUTH AMERICA: ANNUAL CONSUMPTION OF SAWNWOOD BY END USE

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	332	392	43	41
Furniture	43	56	5	6
Packaging	115	148	15	16
Sleepers	107	127	14	13
Other sawnwood products	178	225	23	24
All sawnwood	775	948	100	100
Equivalent volume in roundwood	1,631	1,992		

Source: ECLA, on the basis of national statistics.

BRAZIL

Brazil consumed an average of 4.9 million cubic metres of sawnwood annually between 1948 and 1951. The average consumption increased to 6.0 million cubic metres in the period 1956-59, an increase of 24 per cent during the decade. On a per capita basis, consumption increased slightly from 94 cubic metres per thousand inhabitants in 1948-51 to 96 cubic metres in 1956-59. This is the highest per capita consumption of any sub-region.

Brazil has tremendous forest resources, the area per capita being exceeded only in the Guianas, British Honduras (Belize), Bolivia, and Paraguay. In addition it has extensive coniferous forests which lie close to the population centres and have been heavily exploited by numerous sawmills. Timber has been available much more to the Brazilians than to most other Latin Americans and this shows up in consumption. However, the combination of a rapidly expanding population and progressive deterioration of the accessible forests (particularly the Paraná pine) have made it difficult to increase the already high per capita consumption.

The distribution of the consumption among the major end uses is shown in table 20. Construction is the predominant use, the proportion going into this use being higher than in any other sub-region except Central America. This also reflects the availability of coniferous timber. As in south-west South America, the proportion going into furniture appears low but the average income in Brazil is low and many of its people have practically no furniture.

Table 20

BRAZIL: ANNUAL CONSUMPTION OF SAWNWOOD BY END USE

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	3,250	4,000	67	66
Furniture	363	436	8	7
Packaging	406	514	8	9
Sleepers	351	470	7	8
Other sawnwood products	500	595	10	10
All sawnwood	4,870	6,015	100	100
Equivalent volume in roundwood	10,000	12,400		

Source: ECLA, on the basis of national statistics.

SOUTH-EAST SOUTH AMERICA

South-east South America consumed an average of 1.8 million cubic metres of sawnwood annually between 1948 and 1951. The average consumption increased to 1.9 million cubic metres per year in 1956-59, an increase of only 6 per cent during the decade. On a per capita basis, consumption decreased from 87 cubic metres per thousand inhabitants in 1948-51 to 79 cubic metres in 1956-59. Despite this decrease, per capita consumption was still very high for Latin America and reflects the high average incomes of Argentina and Uruguay.

The distribution of consumption among the three countries in this sub-region was as follows (in thousands of cubic metres):

	1948-51	1956-59
Argentina	1,650	1,740
Paraguay	20	24
Uruguay	150	180

It is apparent that consumption in Argentina is relatively so large that the other two countries have little effect on the sub-regional averages. The economy of Argentina was in a state of virtual stagnation during this period. Consumption of sawnwood increased relatively much more in the other two countries than it did in Argentina and per capita consumption remained about constant in those countries while declining considerably in Argentina.

The distribution of the sawnwood consumption among the major end uses is shown in table 21 which also shows the roundwood equivalent of the total volume of sawnwood used. The high proportion of wood used in packaging is due to domestic production for export or requiring protection in shipping. The low proportion in construction during 1956-59 is partly due to depressed conditions in that industry.

Table 21

SOUTH-EAST SOUTH AMERICA: ANNUAL CONSUMPTION OF SAWNWOOD BY END USE

End use	Volume in thousand cubic metres		Per cent of total volume	
	1948-51	1956-59	1948-51	1956-59
Construction	962	884	53	45
Furniture	189	245	10	13
Packaging	428	460	23	24
Sleepers	48	100	3	5
Other sawnwood products	198	250	11	13
All sawnwood	1,825	1,939	100	100
Equivalent volume in roundwood	3,685	3,952		

Source: ECLA, on the basis of national statistics.

SAWNWOOD CONSUMPTION: SUMMARY

The figures for the individual sub-regions are now brought together in table 22 to show sawnwood consumption in Latin America as a whole, both on a total and on a per capita basis. There is little to add to the discussion of the individual sub-regions. The importance of Brazil in the regional picture is self-evident; it consumed 44 per cent of all the sawnwood used in 1956-59. Table 22 does show that there are large differences between the sub-regions. Despite the fact that per capita consumption remained constant in the region as a whole, it increased strikingly in Central America and declined heavily in Mexico. Clearly it is not safe to generalize about wood consumption in Latin America.

Table 22

LATIN AMERICA: SAWNWOOD CONSUMPTION BY SUB-REGIONS

Sub-region	Total annual consumption (1,000 cubic metres)		Per thousand inhabitants (cubic metres)	
	1948-51	1956-59	1948-51	1956-59
Mexico	1,200	1,100	47	34
Central America	540	920	61	82
The Caribbean islands	780	990	48	52
Northern South America	1,100	1,700	53	65
South-west South America	780	950	44	45
Brazil	4,900	6,000	94	96
South-east South America	1,800	1,900	87	79
Latin America	11,100	13,560	69	69

Source: ECLA, on the basis of national statistics.

The volume of logs that was used to produce the sawnwood consumed in the various sub-regions is shown in table 23. For all practical purposes, the volumes for the region in table 23 are the amount removed from Latin American forests, since the region was a net exporter of sawnwood and logs but the volume involved would add less than 1 per cent to the amount used for domestic consumption. The annual drain on Latin American forests is therefore approximately 30 million cubic metres of logs for the production of sawnwood alone.

Table 23

LATIN AMERICA: ROUNDWOOD EQUIVALENT OF SAWNWOOD CONSUMPTION BY SUB-REGIONS

Sub-region	Roundwood volume in thousand cubic metres	
	1948-51	1956-59
Mexico	2,600	2,400
Central America	1,100	1,900
The Caribbean islands	1,600	2,000
Northern South America	2,200	3,400
South-west South America	1,600	2,000
Brazil	10,000	12,400
South-east South America	3,700	4,000
Latin America	22,800	28,000

Source: ECLA, on the basis of national statistics.

Roundwood products

This group of products includes all wood which is used in the round with the exception of fuelwood which is shown separately. Included here are fence and other posts, telephone and telegraph poles, mine timbers, roundwood used in construction, and a miscellany of rural uses of wood in the round. Roundwood destined for further processing—such as sawlogs, veneer logs and pulpwood—is not included here. The one exception to this is extract wood for tannin which is produced in only a few countries and is included in this group for convenience since the volume does not justify separate presentation.

Statistics on roundwood consumption are only fragmentary where they exist at all and the data presented for this group are less reliable than those for all other groups except fuelwood. The total volume consumed in these uses is large and represents an important drain on the region's forests. But there is not enough information available to support reliable estimates of consumption in the various end uses. For this reason all of the uses are lumped together in the following estimates except for mine timbers which are shown separately in some of the sub-regions where information on them was available.

MEXICO

Mexico consumed an average of 620,000 cubic metres of roundwood products annually between 1948 and 1951. The average consumption increased to 930,000 cubic metres in 1956-59, an increase of almost 50 per cent during the decade. On a per capita basis, consumption increased from 24 cubic metres per thousand inhabitants in 1948-51 to 29 cubic metres in 1956-59.

The consumption was divided among the major end uses as follows (in thousands of cubic metres):

	1948-51	1956-59
Mine timbers	40	35
Other roundwood products	580	895

Despite the increase during the period, per capita consumption of roundwood was less in Mexico than in any other sub-region except south-east South America. Mexico has extensive forests but they occupy only 20 per cent of the land area—a smaller proportion than in any other sub-region. The population is large and only the Caribbean islands have less forest area per capita than Mexico. In addition, the bulk of the Mexican forests are concentrated in parts of the country where the population is small. Wood is not readily available to most Mexicans and this shows up in roundwood consumption.

CENTRAL AMERICA

The Central American countries consumed an average of 520,000 cubic metres of roundwood in the period 1948-51. Consumption increased to 610,000 in 1956-59, an increase of only 17 per cent during the decade. Per capita consumption is higher than in any other sub-region except Northern South America but actually decreased from 58 cubic metres per thousand inhabitants in 1948-51 to 55 cubic metres in 1956-59.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Costa Rica	64	81
El Salvador	39	40
Guatemala	217	243
Other countries	200	250

Roundwood consumption in El Salvador remained almost constant, due partly to the scarcity of timber in the country. The over-all decrease in per capita consumption may have been partly due to a substitution of sawnwood in various uses since the per capita consumption of sawnwood increased a great deal during the same period.

THE CARIBBEAN ISLANDS

Total roundwood consumption in the Caribbean islands amounted to 580,000 cubic metres per year during the period 1948 to 1951. Consumption increased to 670,000 in 1956-59, an increase of only 15 per cent during the decade. Per capita consumption is only slightly less than the regional average and has remained almost constant in recent years. It was 36 cubic metres per thousand inhabitants in 1948-51 and 35 cubic metres in 1956-59.

It is surprising that consumption of roundwood products has been so large because the area of forest per inhabitant is smaller than in any other sub-region. The islands import some posts, poles, and similar round products but the quantity is small in relation to the total consumption. Unfortunately, statistics on wood consumption are particularly scarce in this sub-region and do not give an adequate basis for analysis.

Northern South America

The countries of Northern South America consumed an average of 1.1 million cubic metres of roundwood products during the period 1948-51. The consumption increased to 1.5 million in 1956-59, a rise of 36 per cent during the decade. Per capita consumption was the highest in the region and remained almost constant during this period. The statistics show a slight increase from 57 cubic metres per thousand inhabitants in 1948-51 to 58 cubic metres in 1956-59.

The country consumption was distributed as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Colombia	710	951
Ecuador	145	205
Venezuela	250	260
The Guianas	40	52

This is a heavily forested sub-region and timber is quite readily available to much of the population. The very large relative increases in consumption in Colombia and Ecuador are not readily explained. There apparently was a general increase in all of the uses of roundwood in these countries.

South-west South America

The countries of South-west South America consumed 660,000 cubic metres of roundwood products annually in the period 1948 to 1951. In 1956-59, annual consumption rose to 1 million cubic metres, an increase of 50 per cent during the decade. Per capita consumption was about average for the region at 37 cubic metres per thousand inhabitants in 1948-51 but rose to 47 cubic metres in 1956-59 which was well above the regional average of 38.

The country distribution of this consumption was as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Chile	222	233
Peru	83	367

The information available on Bolivia does not warrant separate presentation.

The distribution by major product groups was as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Mine timbers	510	770
Other roundwood products	150	230

Mining is an important activity in all three of the countries in this sub-region. Most of the increase in consumption of mine timbers took place in Peru where there was a large expansion in mining during this period. Consumption of other roundwood products is relatively low because the bulk of the populations in all of these countries live at a considerable distance from the extensive forested areas.

Brazil

Brazil consumed an average of 2.3 million cubic metres of roundwood products annually between 1948 and 1951. Average consumption increased to 2.4 million cubic metres in 1956-59, an increase of only 3 per cent during the decade. On a per capita basis consumption decreased from 45 cubic metres per thousand inhabitants in 1948-51 to 38 cubic metres in 1956-59.

The consumption was divided among the major end uses as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Mine timbers	45	50
Other roundwood products	2,270	2,340

The reason for the decline in per capita consumption in Brazil is not very clear. The population has grown very fast but the country has tremendous forest resources. Production of other wood products has increased and has perhaps replaced roundwood in some uses. As the forests have been depleted in the more heavily populated sections the use of roundwood has undoubtedly become more difficult. The most heavily forested areas—such as Amazonia—are very lightly populated and local consumption is not relatively large.

South-east South America

South-east South America consumed an average of 260,000 cubic metres of roundwood products annually between 1948 and 1951. The average consumption increased to 390,000 cubic metres in 1956-59, an increase of 50 per cent during the decade. On a per capita basis consumption increased from 12 cubic metres per thousand inhabitants in 1948-51 to 16 cubic metres in 1956-59. This was the lowest per capita consumption in the region and equal to only about one-third of the regional average.

The distribution of this consumption among the three countries in this sub-region was as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Argentina	132	232
Paraguay	100	130
Uruguay	26	26

This is one product group of which Paraguay is a relatively large consumer, the consumption per thousand inhabitants being 71 cubic metres in 1948-51 and 81 cubic metres in 1956-59 compared to the sub-regional averages of 12 and 16 cubic metres respectively. Consumption of roundwood products is low in the other two countries partly because timber is not readily available but mainly because so many of the people live in cities. The urban portion of the total population is relatively larger than in any other part of the region, being 81 per cent in Uruguay and 68 per cent in Argentina. Rural uses thus consume less wood in relation to the population than in a country where most of the people are rural dwellers.

The total consumption in the sub-region was divided among the major end uses as follows (in thousands of cubic metres):

	1948-51	*1956-59*
Mine timbers	9	39
Other roundwood products	250	350

The large increase in the consumption of mine timbers was due to the opening of the new coal mines in southern Argentina.

CONSUMPTION OF ROUNDWOOD PRODUCTS: SUMMARY

The figures for the individual sub-regions are now brought together in table 24 to show roundwood product consumption in Latin America as a whole, both on a total and on a per capita basis.

Table 24

LATIN AMERICA: CONSUMPTION OF ROUNDWOOD PRODUCTS BY SUB-REGIONS

Sub-region	Total annual consumption (1,000 cubic metres)		Per thousand inhabitants (cubic metres)	
	1948-51	1956-59	1948-51	1956-59
Mexico	620	930	24	29
Central America	520	610	58	55
The Caribbean islands	580	670	36	35
Northern South America	1,100	1,500	57	58
South-west South America	660	1,000	37	47
Brazil	2,300	2,400	45	38
South-east South America	260	390	12	16
Latin America	6,040	7,500	38	38

Source: ECLA, on the basis of national statistics.

It is interesting that as with sawnwood the per capita consumption remained unchanged in the region as a whole during this period. The changes in individual sub-regions do not show any particular pattern. This group of products includes such a variety of different things that consumption must be analysed on an individual country basis if it is to be understood.

Wood-based sheet materials

This group includes all of the various forms of sheet materials made from wood by cutting, lamination, or breaking down and reconstitution. Four major groups are recognized: veneers, plywood, fibreboard and particle-board.

Veneers and plywood have been produced or used in most Latin American countries for many years. Statistics on their production and international trade are fairly complete. However, in some cases it was not possible to separate all of the veneer and plywood statistics and in those countries the two products are reported jointly. Fibreboard and particle-board are relatively new products in Latin America and have not been used extensively up to now. Since a large part of this material had to be imported, the statistics are fairly reliable. However, these products have not been readily available to consumers in most countries and past statistics do not tell much about their potential consumption.

MEXICO

Mexico consumed an average of 12,000 cubic metres of wood-based sheet materials annually between 1948 and 1951. The average consumption of these materials increased to 53,000 cubic metres in 1956-59, an increase of 340 per cent during the decade. Per capita consumption also increased materially—from an average of 0.5 cubic metre per thousand inhabitants in 1948-51 to 1.6 cubic metres in 1956-59. This per capita consumption is still low compared to other sub-regions. The problem does not lie in supply because the plywood industry, in particular, is actively seeking export markets.

Available statistics in Mexico do not permit an accurate separation of veneers from plywood so these two are grouped together in the following figures. The distribution of the total consumption among the major sheet materials was as follows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneers	6	34
Fibreboard	6	18
Particle-board	—	1.2

The equivalent volume in roundwood of the logs and bolts required to produce these sheet materials was 25,000 cubic metres annually in 1948-51 and 120,000 cubic metres in 1956-59. Since Mexico imported practically no sheet materials during this latter period, this volume represents a drain on the Mexican forests.

CENTRAL AMERICA

The Central American countries consumed an average of 8,000 cubic metres of sheet materials during the period 1948-51. Consumption increased to 14,000 in 1956-59, a rise of 75 per cent during the decade. Per capita consumption also increased about one-third during this period, from 0.9 cubic metre per thousand inhabitants in 1948-51 to 1.3 cubic metres in 1956-59. This is the lowest per capita consumption of any sub-region except South-west South America.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Costa Rica	—	0.5
El Salvador	—	1.1
Guatemala	8.1	11.1
Other countries	—	1.5

It is evident that the wood-based sheet materials are a relatively new product to Central American consumers. Guatemala was the only country which had domestic production during the first period.

The distribution of the consumption among the major sheet materials was as follows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneer	4	8
Fibreboard	—	1
Particle-board	4	5

Plywood is the only product which has been produced domestically in any quantity. The statistics on particle board consumption in Guatemala are questionable since there are no particle board plants in the sub-region.

The equivalent volume in roundwood of the logs used in making these sheet materials was 16,000 cubic metres in 1948-51 and 30,000 cubic metres in 1956-59. This did not all represent a drain on Central American forests since part of this material was imported.

THE CARIBBEAN ISLANDS

The Caribbean islands consumed an average of 17,000 cubic metres of sheet materials during the period 1948-51. Consumption increased to 42,000 in 1956-59, an increase of almost 150 per cent during the decade. Per capita consumption more than doubled during this period, rising from 1 cubic metre per thousand inhabitants in 1948-51 to 2.2 cubic metres in 1956-59. The distribution of the consumption among the various products was as follows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneers	17	38
Fibreboard	—	4
Particle-board	—	—

Probably all the plywood was imported as there is no record of production in the islands and the trade statistics show considerable imports. The fibreboard reported is probably not a wood product as there are mills in the sub-region which make this type of board from bagasse.

The roundwood equivalent of the sheet materials consumed was 42,000 cubic metres in 1948-51 and 100,000 in 1956-59. None of this represents a drain on domestic forests.

Northern South America

The countries of Northern South America consumed a total of only 4,000 cubic metres of wood-based sheet materials annually during the period 1948-51. Consumption rose to 38,000 cubic metres in 1956-59, an increase of 850 per cent during the decade. This was the largest proportionate increase registered by any sub-region during that period. Per capita consumption also increased remarkably, rising from 0.2 cubic metres per thousand inhabitants in 1948-51 to 1.5 cubic metres in 1956-59.

The country distribution of consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Colombia	2.3	23.2
Ecuador	—	0.2
Venezuela	1.4	12.4
The Guianas	0.2	2.0

Domestic production of these materials has increased rapidly in Colombia and Venezuela with Government encouragement. Surinam has also been a large producer. The changes show the importance of domestic production as a factor in consumption. The production of plywood in particular has increased rapidly and this shows up in the following distribution of consumption among the various materials (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneer	2	22
Fibreboard	2	9
Particle-board	—	7

Particle-board is a relatively new product in the sub-region but there is now production in four of the countries.

The equivalent volume in roundwood of the sheet materials consumed was 8,000 cubic metres in 1948-51 and 80,000 in 1956-59. Since this sub-region is a net exporter of these products, all of this represents a drain on domestic forests.

South-west South America

The total consumption of wood-based sheet materials during the period 1948-51 by the countries of South-west South America was 8,000 cubic metres. By the period 1956-59 the annual consumption had increased to 16,000, a rise of 100 per cent during the decade. Per capita consumption in this sub-region is the lowest in Latin America. It was only 0.4 cubic metre per thousand inhabitants in 1948-51 and rose to only 0.7 cubic metre in 1956-59.

The country distribution of this consumption was as follows (in thousands of cubic metres):

	1948-51	1956-59
Chile	7.6	13.1
Peru	0.3	1.9

Consumption in Bolivia was very small, even in the second period. Most of the industry is in Chile and Peru, and Bolivia produced domestically only a small amount of plywood.

Plywood consumption has not increased very much in recent years as the following breakdown by products shows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneer	8	9
Fibreboard	—	4
Particle-board	—	3

The fibreboard and particle-board plants in Chile are new and the output of fibreboard, in particular, has been increasing each year. It is probable that these boards have supplied part of the increasing market which might otherwise have gone to plywood. Plywood in Chile has not been used as a substitute for sawnwood in concrete forms as it has in Brazil and the United States.

The roundwood equivalent of the sheet materials consumed was 20,000 cubic metres per year in 1948-51 and 33,000 in 1956-59. Imports of these products have amounted to less than 15 per cent of the consumption so most of this roundwood came from the sub-region's forests.

Brazil

Brazil consumed an average of 223,000 cubic metres of wood-based sheet materials annually between 1948 and 1951. Average consumption increased to 388,000 in 1956-59, an increase of about 75 per cent during the decade. Per capita consumption of wood-based sheet materials in Brazil was the highest of any sub-region. It increased from 4.3 cubic metres per thousand inhabitants in 1948-51 to 6.2 cubic metres in 1956-59.

The distribution of the total consumption among the major sheet materials was as follows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneers	223	357
Fibreboard	—	31
Particle-board	—	—

There are a large number of plants producing veneers and plywood in Brazil and these products are readily available to builders and other consumers. This is the only Latin American country where plywood is used extensively in concrete forms. The production of fibreboard is recent and has been growing year by year. Particle-board, for some reason, has not so far found general acceptance in Brazil.

The equivalent volume in roundwood of the logs and bolts required to produce these sheet materials was 560,000 cubic metres annually in 1948-51 and 940,000 cubic metres in 1956-59. Since Brazil does not import any plywood, all of this represents a drain on the domestic forests and in particular the Paraná pine forests.

South-east South America

South-east South America consumed an average of 62,000 cubic metres of wood-based sheet materials annually between 1948 and 1951. Average consumption

increased to 87,000 in 1956-59, an increase of 40 per cent during the decade. Per capita consumption of sheet materials was high for Latin America and increased from 3.0 cubic metres per thousand inhabitants in 1948-51 to 3.6 cubic metres in 1956-59.

The distribution of this consumption among the three countries in the sub-region was as follows (in thousands of cubic metres):

	1948-51	1956-59
Argentina	51	67
Paraguay	1.5	2
Uruguay	10	18

Argentina has a large plywood industry and also a fibreboard mill but the per capita consumption is smaller than in Uruguay. Although average income is higher in Argentina, the general economic stagnation between the above periods prevented per capita consumption from increasing at the rate it did in Uruguay.

The distribution of total consumption in the sub-region among the major sheet materials was as follows (in thousands of cubic metres):

	1948-51	1956-59
Plywood and veneers	51	68
Fibreboard	11	18
Particle-board	—	0.8

The consumption of fibreboard has increased more rapidly than that of plywood and the use of particle-board has only just begun.

The equivalent volume in roundwood of the logs and bolts required to produce these sheet materials was 140,000 cubic metres annually in 1948-51 and 200,000 cubic metres in 1956-59. Although imports of sheet materials were small, part of the logs used in making plywood were imported.

Consumption of wood-based sheet materials: summary

The figures for the individual sub-regions are now brought together in table 25 to show the consumption of wood-based sheet materials in Latin America as a whole, both on a total and on a per capita basis.

This is one group of products in which per capita consumption increased in every sub-region. The total consumption of these products has risen quite rapidly. During the same period in which the consumption of sawnwood and roundwood products increased by about 15 per cent, the consumption of wood-based sheet materials almost doubled.

Table 25

LATIN AMERICA: CONSUMPTION OF WOOD-BASED SHEET MATERIALS BY SUB-REGIONS

Sub-region	Total annual consumption (1,000 cubic metres (s))		Per thousand inhabitants (cubic metres (s))	
	1948-51	1956-59	1948-51	1956-59
Mexico	12	53	0.5	1.6
Central America	8	14	0.9	1.3
The Caribbean islands	17	42	1.0	2.2
Northern South America	4	38	0.2	1.5
South-west South America	8	16	0.4	0.7
Brazil	223	388	4.3	6.2
South-east South America	62	87	3.0	3.6
Latin America	330	640	2.0	3.3

Source: ECLA, on the basis of national statistics.

The volume of roundwood required to produce the sheet materials consumed in Latin America is summarized in table 26. Since the net imports of sheet materials was equal to only about 2 per cent of the total consumption, the volumes in table 26 practically all came from Latin American forests.

Table 26

LATIN AMERICA: ROUNDWOOD EQUIVALENT OF CONSUMPTION OF WOOD-BASED SHEET MATERIALS BY SUB-REGIONS

Sub-region	Roundwood volume in thousands of cubic metres	
	1948-51	1956-59
Mexico	25	120
Central America	16	30
The Caribbean islands	42	100
Northern South America	8	80
South-west South America	20	33
Brazil	560	940
South-east South America	140	200
Latin America	810	1,500

Source: ECLA, on the basis of national statistics.

Fuelwood

This group includes all forms of wood used as fuel. Where possible, the consumption of charcoal was calculated separately from wood used as such. This was not possible in every country and the two forms of fuel are therefore not shown separately in the sub-regional totals. There are virtually no records of production or consumption of wood as fuel in Latin America. Where available, they are known to represent only a fraction of actual consumption. However, attempts have been made in a number of countries over the years to estimate the amount of wood used as fuel. The statistics presented here are frankly estimated but are felt to be reasonably close to actual consumption.

MEXICO

An average of 9 million cubic metres of fuelwood were consumed annually in Mexico between 1948 and 1951. The average consumption decreased somewhat to 8.8 million in 1956-59. On a per capita basis, consumption decreased from 0.35 cubic metre in 1948-51 to 0.27 cubic metre in 1956-59. Other fuels—particularly kerosene—which have been made available at reasonable prices as a Government policy have tended to displace charcoal and fuelwood, especially in the cities. As a result, the per capita consumption in Mexico is the lowest of any sub-region.

CENTRAL AMERICA

The Central American countries consumed an average of 12.5 million cubic metres of fuelwood annually during 1948-51. The total consumption increased to 15 million in the period 1956-59. During this decade per capita consumption decreased only slightly from 1.4 cubic metres to 1.34. Other fuels are not readily available in Central America and wood or charcoal are still used by most people for cooking. The distribution of total consumption among the individual countries was as follows (in millions of cubic metres):

	1948-51	1956-59
Costa Rica	1.0	1.2
El Salvador	2.2	2.7
Guatemala	4.1	5.2
Other countries	5.2	5.8

The Caribbean islands

The total annual consumption of fuelwood in the islands amounted to 11.6 million cubic metres in 1948-51. It increased slightly to 11.8 million in 1956-59. Per capita consumption declined during this decade from 0.71 cubic metre in 1948-51 to 0.61 cubic metre in 1956-59. The distribution of consumption among the islands was as follows (in millions of cubic metres):

	1948-51	*1956-59*
Cuba	2.0	1.4
Haiti	7.3	8.0
Other islands	2.3	2.4

In Cuba wood was replaced by other fuels, especially in the cities. Haiti is still largely dependent on wood for fuel but has depleted its forests very badly. There has been replacement by other fuels in many of the other islands.

Northern South America

The countries in this sub-region consumed an average of 25.2 million cubic metres of wood annually in the period 1948 to 1951. The total consumption increased to 29 million cubic metres in 1956-59. During this decade, however, the per capita consumption declined from 1.25 cubic metres to 1.15. The distribution of this consumption among the countries was as follows (in millions of cubic metres):

	1948-51	*1956-59*
Colombia	19.3	21.9
Ecuador	2.2	2.4
Venezuela	3.3	4.4
The Guianas	.4	.3

In Colombia, where per capita consumption of fuelwood is highest, there is a large rural population and many people live at high altitudes. Despite the petroleum resources of Venezuela, this fuel is not generally available outside the cities.

South-west South America

The total annual consumption of fuelwood by the countries in this sub-region was 13.2 million cubic metres in the period 1948-51. The total consumption decreased to 10.8 million in 1956-59, a drop of 18 per cent during the decade. Per capita consumption decreased from 0.75 to 0.51 cubic metre in this same period. The distribution of the consumption among the countries was as follows (in millions of cubic metres):

	1948-51	*1956-59*
Chile	4.5	3.2
Peru	1.9	2.3

Per capita consumption was very low in Peru but remained about the same during this period despite a sizable population increase. Per capita consumption in Chile was much higher but experienced a 40 per cent decrease during the decade. This was largely due to replacement with oil, gas and other fuels which have become available in recent years.

Brazil

An average of 89 million cubic metres of fuelwood was consumed annually in Brazil between 1948 and 1951. The average consumption increased to 90 million in 1956-59, an increase of not quite 2 per cent during the decade. On a per capita basis consumption decreased from 1.7 cubic metres in 1948-51 to 1.4 cubic metres in 1956-59. Despite this decrease, per capita consumption was still higher than in any other sub-region. The very large rural population and the general availability of wood have led to a large total consumption.

South-east South America

The countries of this sub-region consumed an average of 11.7 million cubic metres of fuelwood annually between 1948 and 1951. The average consumption increased very slightly to 12 million in 1956-59. On a per capita basis, consumption decreased from 0.55 cubic metre in 1948-51 to 0.49 in 1956-59.

The distribution of consumption among the three countries in the sub-region was as follows (in millions of cubic metres):

	1948-51	*1956-59*
Argentina	9.8	9.7
Paraguay	1.2	1.3
Uruguay	.7	1.0

As might be expected, per capita consumption was largest in Paraguay where two-thirds of the population is rural and timber is available. It was lowest in Uruguay where 80 per cent of the population is urban and timber is relatively scarce.

Consumption of fuelwood: summary

The information for the individual sub-region is now brought together in table 27 to show the consumption of fuelwood in Latin America as a whole on both a total and a per capita basis. The total amount of wood used for fuel in the region is very large—close to 180 million cubic metres. However, the total consumption increased only 3 per cent during the last decade while the population was increasing over 20 per cent. The growing availability of other fuels, the trend toward urban living, and the depletion of accessible forests have all contributed to a large decrease in per capita consumption of fuelwood.

Table 27

Latin America: Consumption of fuelwood by sub-regions

Sub-region	*Total annual consumption (1,000 cubic metres)*		Per capita *(cubic metres)*	
	1948-51	*1956-59*	*1948-51*	*1956-59*
Mexico	9,000	8,800	0.35	0.27
Central America	12,500	15,000	1.40	1.34
The Caribbean islands	11,600	11,800	0.71	0.61
Northern South America	25,200	29,000	1.25	1.15
South-west South America	13,200	10,800	0.75	0.51
Brazil	88,700	90,400	1.70	1.44
South-east South America	11,700	12,000	0.55	0.49
Latin America	171,900	177,800	1.06	0.90

Source: ECLA, on the basis of national statistics.

Pulp products

This group of products includes all classes of paper and paperboard. It does not include fibreboard and particle-board which are in the group of wood-based sheet materials. Dissolving pulp and the products made from it, such as rayon, is not included in the statistics presented here. It forms a very small proportion of the total consumption of pulp products in Latin America, the bulk of which is made from materials other than wood, such as cotton linters; and there is virtually no

domestic production of this pulp from wood in the region.

The consumption of pulp products has been increasing rapidly and in terms of value this is the second most important group of wood-based products. However, all pulp is not made of wood and in Latin American domestic production there are other important raw materials. The figures which follow show the total consumption of pulp products regardless of their raw material base or source of supply. An estimate is then given of the amount of wood which was actually used as the raw material in the production of the pulp products consumed.

The statistics on consumption of pulp products are superior to those for any other wood product in Latin America because a large proportion of the total has been imported and domestic production has been concentrated in a relatively few plants in only some of the countries.

Mexico

Mexico consumed an average of 242,000 tons of pulp products annually between 1948 and 1951. The average consumption increased to 412,000 in the period 1956-59, an increase of 70 per cent during the decade. Per capita consumption in Mexico was higher than the regional average. It increased from 9.4 metric tons per thousand inhabitants in 1948-51 to 12.7 tons in 1956-59. Mexico has a large domestic paper industry and produces about 90 per cent of the paper it consumes, other than newsprint. This domestic availability of paper shows up in the higher than average per capita consumption.

The quantities consumed in the major end uses are shown in table 28. The composition of the consumption changed somewhat between the two periods, with newsprint and printing and writing papers becoming relatively less important (on a volume basis) and other papers and paperboard increasing in relative importance.

Table 28 also shows the pulpwood equivalent of the pulp products which were made of wood. In the period 1948-51, 69 per cent of the pulp products used were based on wood; in 1956-59, this proportion decreased slightly to 66 per cent. The rest of the pulp was made from bagasse, straw, waste paper, and similar materials. The volumes of pulpwood shown in table 28 were not all cut from the forest in Mexico nor converted to pulp in that country because a substantial part of the pulp products were imported. However, the domestic production used about 235,000 cubic metres of pulpwood per year in 1948-51 and 576,000 in 1956-59.

Table 28

MEXICO: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USE

End use	Quantity in thousand metric tons		Per cent of total quantity	
	1948-51	1956-59	1948-51	1956-59
Newsprint	50.5	78.8	21	19
Printing and writing paper	53.8	72.8	22	18
Other papers	70.7	136.0	29	33
Paperboard	66.8	124.8	28	30
All pulp products	241.8	412.4	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	624	1,014		

Source: ECLA, on the basis of national statistics.

Central America

The Central American countries together consumed an average of 25,000 tons of pulp products annually between 1948 and 1951. Their consumption increased to 52,000 tons in 1956-59, an increase of 109 per cent during the decade. Per capita consumption of pulp products also showed a large proportionate increase, from 2.8 metric tons per thousand inhabitants in 1948-51 to 4.6 tons in 1956-59. However, this is the lowest per capita consumption of any sub-region in Latin America, being only 40 per cent of the regional average. The cause is to be found in the almost complete absence of a pulp and paper industry in Central America. With no domestic industry and a shortage of exchange for imports, these countries have done without paper products despite their abundant supply of excellent raw material.

The total annual consumption was distributed among the various countries as follows (consumption in British Honduras (Belize) was relatively insignificant):

	1948 to 1951	1956 to 1959
	tons	
Costa Rica	3,800	8,800
El Salvador	4,400	10,600
Guatemala	5,800	11,600
Honduras	1,800	3,800
Nicaragua	2,000	4,300
Panama	6,800	12,300

Despite small difference in the rate of growth, all the Central American countries have shared in the sub-regional increase in pulp-product consumption.

The quantities consumed in the major end uses of paper and pulp are shown in table 29, for Central America as a whole. The relative importance of the major end uses (in terms of weight) changed somewhat between the two periods. Newsprint is still an item of major importance but consumption of the other types of paper and board has been increasing more rapidly.

Table 29 also shows the pulpwood equivalent of that part of the pulp products which was made of wood. Since all of this wood-based material was imported during these periods, the figures in table 29 do not represent the drain on Central American forests for pulpwood. But if these products had been produced locally, the forest would have been called on to provide this quantity of wood.

Table 29

CENTRAL AMERICA: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USE

End use	Quantity in thousand metric tons		Per cent of total quantity	
	1948-51	1956-59	1948-51	1956-59
Newsprint	9.8	15.8	40	31
Printing and writing papers	2.9	8.0	12	16
Other papers	9.6	18.7	39	36
Paperboard	2.3	8.9	9	17
All pulp products	24.6	51.4	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	71	149		

Source: ECLA, on the basis of national statistics.

The Caribbean islands

The Caribbean islands together consumed an average of 157,000 metric tons of pulp products per year between 1948 and 1951. Their annual consumption rose to 255,000 tons in 1956-59, an increase of 62 per cent during the decade. Per capita consumption in this sub-region has been relatively high for Latin America. The average consumption per thousand inhabitants was 9.6 metric tons in 1948-51 and 13.3 tons in 1956-59.

The sub-regional consumption was distributed among the various countries and dependencies as follows:

	1948 to 1951	*1956 to 1959*
	tons	
Cuba	103,900	154,800
Dominican Republic	6,300	12,100
Haiti	2,000	3,100
Other islands	44,400	85,000

The large differences in economic development and income between the countries in this sub-region show up in their consumption of pulp products and in the extent to which they have shared in the over-all increase. The very large consumption in Cuba, where per capita consumption was at least equal to that of any other Latin American country, raised the sub-regional average. Cuba's relatively large income permitted the import of substantial quantities of pulp products.

The quantities consumed in the major end uses in the Caribbean islands as a whole are shown in table 30. The relative importance of the major end uses (in terms of weight) changed somewhat between the two periods, newsprint becoming slightly less important and the other classes increasing in relative importance, with the exception of other papers.

Table 30 also shows the pulpwood equivalent of that part of the pulp products which was made of wood. During these periods there was no domestic production of pulp from wood. The pulpwood equivalents shown in table 30 therefore represent wood removed from forests in other countries in order to make the pulp products that were exported to the Caribbean islands.

Table 30

THE CARIBBEAN ISLANDS: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USES

	Quantity in thousand metric tons		*Per cent of total quantity*	
End use	*1948-51*	*1956-59*	*1948-51*	*1956-59*
Newsprint	44	60	28	24
Printing and writing papers	16	34	10	13
Other papers	64	100	41	39
Paperboard	33	61	21	24
All pulp products	157	255	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	460	733		

Source: ECLA, on the basis of national statistics.

Northern South America

The countries of Northern South America together consumed an average of 110,000 metric tons of pulp products per year between 1948 and 1951. Their annual consumption increased to 252,000 tons in 1956-59, an increase of 129 per cent. This was the largest relative increase in pulp-product consumption shown by any sub-region for this period. Per capita consumption in this area was less than the regional average, being only 5.5 metric tons per thousand inhabitants in 1948-51. However, it has increased more rapidly than the average and reached 10 tons per thousand inhabitants in 1956-59.

The sub-regional consumption was distributed among the countries as follows:

	1948 to 1951	*1956 to 1959*
	tons	
Colombia	55,300	106,300
Ecuador	9,100	15,300
Venezuela	43,100	126,300
The Guianas	2,100	3,800

As might be expected from their general level of economic development and income, consumption has increased most rapidly in Venezuela and least rapidly in Ecuador and the Guianas. The domestic paper industries of Colombia and Venezuela have expanded considerably in recent years and more paper is therefore available to the people than previously.

The quantities consumed in the major end uses in Northern South America are shown in table 31. In this sub-region also, newsprint decreased in relative importance (in terms of weight) and the other papers increased their share of the total consumption.

Table 31 also shows the pulpwood equivalent of that part of the pulp products which was made of wood. Since none of the domestic production during these periods was made from wood, the wood-based products were all imported and the pulpwood was drawn from forests outside the sub-region.

Table 31

NORTHERN SOUTH AMERICA: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USES

	Quantity in thousand metric tons		*Per cent of total quantity*	
End use	*1948-51*	*1956-59*	*1948-51*	*1956-59*
Newsprint	30.4	52.8	28	21
Printing and writing papers	16.9	49.0	15	19
Other papers	39.8	97.2	36	39
Paperboard	22.5	52.7	21	21
All pulp products	109.6	251.7	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	332	801		

Source: ECLA, on the basis of national statistics.

South-west South America

The countries of South-west South America together consumed an average of 98,000 metric tons of pulp products per year between 1948 and 1951. Their annual consumption increased to 149,000 tons in 1956-59, an increase of 52 per cent during the decade. The per capita consumption in this sub-region was less than that of the region as a whole and from an average of 5.6 tons per thousand inhabitants in 1948-51 increased to only 7.1 tons per thousand in 1956-59.

Sub-regional consumption was distributed among the countries as follows:

	1948 to 1951	1956 to 1959
	tons	
Bolivia	4,300	4,600
Chile	62,800	79,600
Peru	31,400	64,600

Consumption was especially low in Bolivia, being only 1.4 tons per thousand inhabitants in 1948-51 and actually decreasing to only 1.3 tons in 1956-59. Chile had a higher than average consumption of 10.3 tons per thousand inhabitants in 1948-51 but increased this to only 10.9 tons in 1956-59. During much of this period the Chilean economy was in a state of stagnation and the total gross domestic product increased at only a very slow rate. Peru's per capita consumption was low but increased substantially from 3.7 tons per thousand inhabitants in 1948-51 to 6.3 tons in 1956-59.

The quantities consumed in the major end uses are shown in table 32. In this region also, newsprint decreased in relative importance as a component of total pulp-product consumption while paperboard increased materially its proportionate share of the total. This happened despite the initiation of production of newsprint in Chile which completely replaced imports of this product.

Table 32 also shows the pulpwood equivalent of that part of the pulp products which was made of wood. Pulp was being made from wood in Chile during both of these periods, but the Peruvian production was based on bagasse. Of the round-wood volumes shown in table 32, the volumes of pulpwood produced in Chile were approximately 39,000 cubic metres per year in 1948-51 and 102,000 in 1956-59. The remainder represents wood removed from forests in other countries to produce pulp products for export to South-west South America.

Table 32

SOUTH-WEST SOUTH AMERICA: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USES

End use	Quantity in thousand metric tons		Per cent of total quantity	
	1948-51	1956-59	1948-51	1956-59
Newsprint	35.9	41.6	36	28
Printing and writing papers	19.3	24.1	20	16
Other papers	32.0	50.7	33	34
Paperboard	11.3	32.4	11	22
All pulp products	98.5	148.8	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	253	357		

Source: ECLA, on the basis of national statistics.

BRAZIL

Brazil consumed an average of 296,000 metric tons of pulp products per year between 1948 and 1951. The consumption rose to 580,000 in 1956-59, an increase of 96 per cent. The per capita consumption in Brazil was somewhat below the regional average. However, it increased from 5.8 metric tons per thousand inhabitants in 1948-51 to 9.4 tons in 1956-59.

The quantities consumed in the major end uses are shown in table 33. Brazil was one of the two sub-regions in which the relative importance of newsprint in total pulp-product consumption increased during this period. The reason for this is not clear since most of the newsprint consumed is imported, but presumably it is due to the favourable exchange rate enjoyed by these imports in recent years. Brazil has a substantial pulp and paper industry, although it is concentrated in the southern part of the country. The industry has been expanding rapidly and this will undoubtedly affect future consumption.

Table 33 also shows the pulpwood equivalent of that part of the pulp products which were made of wood. A substantial part of these wood-based pulp products were produced in Brazil. The pulpwood equivalent of this domestic production amounted to 393,000 cubic metres per year in 1948-51 and 740,000 in 1956-59, all of which came from the Brazilian forests.

Table 33

BRAZIL: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USES

End use	Quantity in thousand metric tons		Per cent of total quantity	
	1948-51	1956-59	1948-51	1956-59
Newsprint	96.1	203.7	32	35
Printing and writing papers	56.8	109.5	19	19
Other papers	106.2	186.5	36	32
Paperboard	36.7	80.8	13	14
All pulp products	295.8	580.5	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	922	1,458		

Source: ECLA, on the basis of national statistics.

SOUTH-EAST SOUTH AMERICA

The countries of South-east South America together consumed an average of 455,000 metric tons of pulp products in the years between 1948 and 1951. Their annual consumption increased to 540,000 in 1956-59, an increase of 19 per cent during the decade. This was the smallest relative increase registered by any of the sub-regions for this period. However, consumption was higher in South-east South America during the first period than in any other sub-region and the relative increase was therefore made over a much larger basic consumption. Per capita consumption in South-east South America was well over double the regional average, amounting to 21.7 metric tons per thousand inhabitants in 1948-51. This increased only very slightly to 22.0 tons in 1956-59 but was still well above the per capita consumption in any other sub-region.

Sub-regional consumption was distributed among the countries as follows:

	1948 to 1951	1956 to 1959
	tons	
Argentina	404,800	476,100
Paraguay	2,300	2,500
Uruguay	47,600	61,600

The highest per capita consumption was in Argentina, but this increased hardly at all from 23.5 metric tons per thousand inhabitants in 1948-51 to 23.6 tons in 1956-59. The Argentine economy was in a state of stagnation during practically all this period and the gross domestic product barely increased. Per capita consumption was very low in Paraguay and remained at only 1.6 tons per thousand inhabitants during the entire period.

Table 34 also shows the pulpwood equivalent of that part of the pulp products which was made of wood. Argentina was producing some pulp from wood during the first period and both Argentina and Uruguay during the second period. The amount of wood consumed was approximately 32,000 cubic metres per year in Argentina during 1948-51 and 133,000 cubic metres in Argentina and 4,000 cubic metres in Uruguay during 1956-59. The proportion of the pulpwood equivalent which represented a drain on domestic forests thus increased from 3 per cent in 1948-51 to 11 per cent in 1956-59 but still was a relatively small part of the total. The sub-region remains largely dependent on imports to satisfy domestic consumption.

Table 34

SOUTH-EAST SOUTH AMERICA: ANNUAL CONSUMPTION OF PULP PRODUCTS BY END USES

End use	Quantity in thousand metric tons		Per cent of total quantity	
	1948-51	1956-59	1948-51	1956-59
Newsprint	130.6	167.1	29	31
Printing and writing papers	85.6	97.8	19	18
Other papers	125.2	165.5	27	31
Paperboard	113.3	109.8	25	20
All pulp products	454.7	540.2	100	100
	Volume in thousand cubic metres			
Pulpwood equivalent of wood-based pulp products (round-wood volume)	1,038	1,254		

Source: ECLA, on the basis of national statistics.

PULP PRODUCTS CONSUMPTION: SUMMARY

The figures for the individual sub-regions are now brought together in table 35 to show pulp-product consumption in Latin America as a whole, both on a total and on a per capita basis.

Table 35

LATIN AMERICA: PULP-PRODUCT CONSUMPTION BY SUB-REGIONS

Sub-region	Total annual consumption (1,000 metric tons)		Per thousand inhabitants (metric tons)	
	1948-51	1956-59	1948-51	1956-59
Mexico	242	413	9.4	12.7
Central America	25	51	2.8	4.6
The Caribbean islands	157	255	9.6	13.3
Northern South America	110	252	5.5	10.0
South-west South America	98	149	5.6	7.1
Brazil	296	580	5.8	9.4
South-east South America	455	540	21.7	22.0
Latin America	1,383	2,240	8.5	11.4

Source: ECLA, on the basis of national statistics.

There clearly have been large differences between the sub-regions in their historical consumption of pulp products. Part of this reflects the difference in size and population between sub-regions. But there have also been large differences in per capita consumption. Total pulp product consumption increased substantially during this period (62 per cent) and per capita consumption also showed a marked increase (34 per cent). If general economic development continues it seems certain that the consumption of pulp products will continue to increase rather rapidly in the future and particularly in those sub-regions where per capita consumption has been low in the past.

The historical consumption of the four major end use classes—newsprint, printing and writing paper, other paper, and paperboard—in the sub-regions is consolidated in table 36. The relative composition of the total consumption in Latin America as a whole changed little during this period.

Table 36

LATIN AMERICA: HISTORICAL CONSUMPTION OF PULP PRODUCTS BY END USES AND SUB-REGIONS

(Annual consumption in thousand metric tons)

Sub-region	1948 to 1951					1956 to 1959				
	Newsprint	Printing and writing	Other paper	Paperboard	Total	Newsprint	Printing and writing	Other paper	Paperboard	Total
Mexico	50	54	71	67	242	79	73	136	125	413
Central America	10	3	10	2	25	16	8	18	9	51
The Caribbean islands	44	16	64	33	157	60	34	100	61	255
Northern South America	30	17	40	23	110	53	49	97	53	252
South-west South America	36	19	32	11	98	42	24	51	32	149
Brazil	96	57	106	37	296	204	109	186	81	580
South-east South America	131	86	125	113	455	167	98	165	110	540
TOTAL, LATIN AMERICA	397	252	448	286	1,383	621	395	753	471	2,240
Per cent of total quantity	29	18	32	21	100	28	18	33	21	100

Source: ECLA, on the basis of national statistics.

Newsprint and the group of "other papers" (which consisted largely of papers used for packaging) continued to be the most important items, although newsprint was losing some of its relative importance.

Under each sub-region an estimate was given of the pulpwood equivalent of the new wood pulp used in manufacturing the products consumed in that region. Table 37 now shows for all of the sub-regions and Latin America as a whole the pulpwood equivalent of the wood-based pulp products. That much pulpwood was not actually consumed in these countries because a large part of the products was imported. But these figures show the amount of pulpwood that would have been consumed if all the products had been made from domestically produced pulp.

Table 37

LATIN AMERICA: PULPWOOD EQUIVALENT OF WOOD-BASED PULP PRODUCT CONSUMPTION BY SUB-REGIONS

Sub-region	Roundwood volume in 1,000 cubic metres	
	1948-51	1956-59
Mexico	624	1,014
Central America	71	149
The Caribbean islands	460	733
Northern South America	332	801
South-west South America	253	357
Brazil	922	1,458
South-east South America	1,038	1,254
Latin America	3,700	5,766

Source: ECLA, on the basis of national statistics.

Historical consumption of wood products: summary

The historical data presented in this chapter have shown that consumption of wood products is a complex activity in Latin America. The amount consumed and the trends which past consumption has followed differ from country to country and from product to product. What can be said on a regional basis about this past consumption that will be useful for future planning?

The total regional consumption of the various product groups is summarized in table 38. The importance of fuelwood in the total consumption picture is immediately apparent from this table. Four out of every five cubic metres of wood used to supply Latin America are burned as fuel. The drain on the forest resources for all other uses of wood is relatively small compared to this tremendous drain for fuel. These relative magnitudes are emphasized when the trends in past consumption are considered. In the period between 1948-51 and 1956-59, the total consumption of industrial wood increased 28 per cent while the consumption of fuelwood rose only 3 per cent. But during this period the proportion which fuelwood comprises of total wood consumption dropped only from 84 per cent to 80 per cent. It is clear that fuelwood is going to continue to be an important part of total wood requirements for many years even though the total consumption of fuelwood declines and the consumption of industrial wood increases tremendously.

Table 38

LATIN AMERICA: HISTORICAL CONSUMPTION OF WOOD PRODUCTS

Product group	Unit of volume	Volume in units		Equivalent volume in roundwood[a] (thousand cubic metres)	
		1948-51	1956-59	1948-51	1956-59
Sawnwood	1,000 m³ (s)	11,100	13,560	22,800	28,000
Roundwood products	1,000 m³ (r)		6,100	6,100	7,500
Sheet materials	1,000 m³ (s)	330	640	800	1,500
Pulp products	1,000 tons	1,380	2,240	3,700	5,800
TOTAL, INDUSTRIAL WOOD				33,400	42,800
Fuelwood	1,000 m³ (r)	171,900	177,800	171,900	177,800
All wood products				205,300	220,600

Source: ECLA, on the basis of national statistics.

[a] The volume without bark of the logs and bolts required to produce the products shown.

A similar situation exists with sawnwood. The consumption of sheet materials and pulp products has been increasing much more rapidly than that of sawnwood. But in proportion to the total consumption of industrial wood, sawnwood dropped only from 68 per cent to 66 per cent. Sawnwood will certainly continue to be the most important industrial wood product—at least in terms of volume—for many years.

Consumption has increased most rapidly in recent years in the group of wood-based sheet materials. Two of these—fibreboard and particle-board—are relatively new products in the region. Where plants have been installed to manufacture them domestically, consumption has developed on a considerable scale. The use of these products apparently has been restricted by their availability. The consumption of pulp products presents a similar picture. These products have been imported on a much larger scale than the sheet materials but consumption in the past has been closely related to the amount of domestic consumption. It appears that consumption of both of these groups of products will continue to increase faster than the population if manufacturing facilities are installed to produce them domestically.

The consumption of wood products as a group by the various sub-regions is summarized in table 39. Total wood consumption in the region increased by 7 per cent between 1948-51 and 1956-59. The trend of total consumption was also upward in every sub-region except South-west South America. There, the very sharp decline in the use of fuelwood also caused the total wood consumption to drop.

Table 39

LATIN AMERICA: TOTAL WOOD CONSUMPTION BY SUB-REGIONS

Sub-region	Roundwood equivalent of consumption (1,000 cubic metres)			
	All wood products		Industrial wood	
	1948-51	1956-59	1948-51	1956-59
Mexico	12,900	13,200	3,900	4,500
Central America	14,200	17,700	1,700	2,700
The Caribbean islands	14,300	15,300	2,700	3,500
Northern South America	28,800	34,800	3,600	5,800
South-west South America	15,800	14,200	2,600	3,400
Brazil	102,500	107,600	13,800	17,200
South-east South America	16,800	17,800	5,100	5,800
Latin America	205,300	220,600	33,400	42,800

Source: ECLA, on the basis of national statistics.

Consumption of industrial wood increased by 28 per cent in the region as a whole and an upward trend was also reflected in every sub-region. The amount of growth differed materially, however, from one sub-region to another. The sub-regions fall into three broad groups: Central America and Northern America with an increase in industrial-wood consumption of about 60 per cent; the Caribbean islands, South-west South America, and Brazil with an increase of about 30 per cent; Mexico and South-east South America with an increase of approximately 15 per cent. The first two sub-regions have extensive forest resources and have enjoyed a considerable expansion of industry and exploitation in recent years. Per capita consumption has risen a great deal in both of them as is shown in table 40. The second group of sub-regions has not grown as rapidly for various reasons. The Caribbean islands, despite the high income of Cuba, have been handicapped by lack of forest resources. The economic stagnation in Chile and inaccessibility of the forests in Bolivia and Peru held down industrial-wood consumption in South-west South America. Brazil started this period with the highest per capita consumption in Latin America and its further expansion was undoubtedly handicapped by the large proportion of the population who have very little income and provide no market for any except absolutely essential commodities. In the last group, per capita consumption actually declined in both of the sub-regions. South-east South America already had a high per capita consumption which, because of the stagnation of the general economy of Argentina, it was unable to maintain. The situation in Mexico is more difficult to explain. The decline was due to a decrease in total sawnwood consumption since per capita consumption of all the other groups increased. Depletion of the most accessible forests was undoubtedly a factor but various other factors must also have been at work. This is an example of the need for more information about timber markets and the various end uses of wood as a basis for production planning.

Finally, table 40 shows the pattern of diminishing fuelwood use in Latin America. Although the total consumption is still increasing, per capita consumption is declining in every sub-region. The largest users are clearly the sub-regions with readily available forest resources—Central America, Northern South America and Brazil. But even here per capita consumption is on the downward trend. The indications are that this decline in per capita use will soon be reflected in total consumption.

Table 40

LATIN AMERICA: WOOD CONSUMPTION PER THOUSAND INHABITANTS BY SUB-REGIONS

Sub-region	Roundwood equivalent of volumes consumed (cubic metres)			
	All industrial wood		Fuelwood	
	1948-51	1956-59	1948-51	1956-59
Mexico	149	137	350	270
Central America	193	237	1,400	1,340
The Caribbean islands	164	184	710	610
Northern South America	181	225	1,250	1,150
South-west South America	146	160	750	510
Brazil	265	274	1,700	1,440
South-east South America	244	236	550	490
Latin America	206	217	1,060	900

Source: ECLA, on the basis of national statistics.

Chapter 6. Future requirements for forest products

Chapter 5 presented figures showing the actual consumption during the two periods 1948-51 and 1956-59. These figures in themselves have historical interest, but for planning purposes they are useful only as a basis for estimating future consumption patterns. Plans for the wise use of a country's resources must consider future possibilities because all production takes time. Changes made today cannot affect the availability of a product until some time has elapsed. In forestry production this necessary time lapse involves years or even decades.

Future consumption cannot be measured; it can only be estimated. The level—and even the pertinence—of such estimates depends on the assumptions on which they are based. The actions of the potential consumers of a product at any particular time are influenced by many factors. In the case of wood products, these include disposable income, the availability of the product itself, its price, the prices of competing products, the existing state of technology, consumer tastes, habit patterns, and many others. Even if the future condition of all these factors were known, future consumption would still be uncertain because their effects are not constant. All estimates of future consumption are therefore vague but this does not diminish their importance for planning.

The assumptions made in this study about the future levels of these factors are realistic. They are careful estimates of what these levels might actually prove to be. The one exception is the assumption made about the future availability of forest products. The availability of wood products to consumers is closely related to the prices at which they are sold. Both of these depend on the availability of wood as a raw material. The availability of this raw material, in turn, depends on the rate at which forests are harvested and the way in which they are managed. But, economically, the rate of exploitation and level of management are guided by the consumption of forest products. The management of forests and the consumption of wood products are thus mutually interdependent—an assumption about one necessarily includes an assumption about the other. But an estimate which is to guide resource use will not be very useful if it is based on an assumption about the use of that resource.

To get around this difficulty, the future estimates in this study assume that wood supplies will be as abundant in the future as they are today and that their prices in relation to competing materials will remain unchanged over the period in question. Because of this assumption, the figures presented in this report are not forecasts of what the future consumption actually will be. Instead they are estimates of what the future consumption would be under the special conditions of abundance and price assumed above. In this report these estimates are called "future requirements"

to indicate that they show the amount of wood that will be required to supply the consumption which it is estimated will exist if wood is as available as at present and at no higher prices. With these estimates of requirements as a base, later chapters will analyse the problems involved in the future availability of wood.

This chapter presents estimates of future requirements for three points in time: 1970, 1975 and 1985. Because uncertainty tends to increase with time, the figures for 1970 may be considered more reliable than those for later periods. However, the estimates for 1975 and 1985 indicate the trends that may be anticipated after 1970 and the general magnitude of requirements for those dates.

Methodology and assumptions

The development of future requirements for wood products will be related to the development of two other factors: population and gross domestic product. Information about these factors provides a base for projecting wood requirements, although it must be supplemented with other information for specific products. The assumptions made about the future trends of population and gross domestic product are therefore crucial to this study and will be described in detail.

Studies made by ECLA indicate that the population of Latin America will grow at an average rate of 2.6 per cent during the next twenty-five years, increasing as follows:[1]

	Million
1958	196
1970	266
1975	305
1985	389

Populations will not grow at the same rate in all countries, the estimated annual rates ranging from 0.8 per cent in Uruguay to 3.3 per cent in the Dominican Republic. The future populations assumed for this study in the various sub-regions are shown in table 41.

Table 41

LATIN AMERICA: ESTIMATED FUTURE POPULATION BY SUB-REGIONS

Sub-region	*Population in millions*			
	1958	*1970*	*1975*	*1985*
Mexico	32.5	46.6	53.6	70.0
Central America	11.2	15.6	18.1	24.4
The Caribbean islands	19.2	25.0	28.1	35.8
Northern South America	25.3	35.7	41.2	55.0
South-west South America	21.1	28.6	35.4	42.0
Brazil	62.7	84.4	95.8	124.0
South-east South America	24.5	30.0	32.5	37.7
Latin America	196.5	265.9	304.7	388.9

Source: ECLA, on the basis of national statistics.

There has been a gradual change in the urban-rural distribution of the populations of all Latin American countries. This study assumes that the trend towards larger urban populations will continue as follows:

	Per cent
1950	39
1960	46
1975	54

It is more difficult to estimate how gross domestic product will grow in the future. This depends on so many factors which could vary over such a wide range that it is impossible accurately to project it for more than a few years. A practical approach is to make a reasonable assumption about the future rate of growth and to use the products calculated with this rate. This approach does not try to say that the gross domestic product in a given future year will be of a certain size. Instead it says it is reasonable to assume that the product might be of the estimated size and, if it should be, the effects on wood consumption will be those shown in this study.

Gross domestic product per capita in Latin America as a whole grew at an average rate of 2.5 per cent between 1945-47 and 1956-58. Growth in individual countries varied from minus 0.5 per cent to plus 5.9 per cent. In some countries the annual rate increased during this period; in others it decreased. There is little reliable basis on which to make separate assumptions about growth rates in individual countries. It appeared preferable to use a simple assumption about future product growth. The countries were divided into two groups: Argentina, Bolivia, Chile, Paraguay and Uruguay in a southern group and all the rest in a northern group. The historical product growth and the present stage of economic development indicate that per capita gross domestic product is likely to grow more rapidly in the northern countries than in the southern group. The assumption was therefore made that the per capita product will increase between 1958 and 1985 at an average annual rate of 2.8 per cent in the northern group, and 2.3 per cent in the southern group. The use of these rates is equivalent to assuming that the average per capita product of Latin America will grow at a rate of 2.6 per cent in the future, or practically the same as in the recent past.

With these assumptions about population and domestic product as a base, the consumption of each wood product was projected separately into the future. Where sufficient information was available, the major product groups were subdivided according to end uses and each was projected separately. The methods and assumptions used in these projections are described in the following sections.

SAWNWOOD FOR CONSTRUCTION

Residential and non-residential construction were separated wherever possible.

The basic assumption regarding sawnwood for residential construction was that a minimum number of dwelling units would be built in the future equal to the number required to provide housing for the increase in the population and to replace houses which become uninhabitable.[2] On the basis of census and other reports, an estimate was made, for each country, of the proportion of the population living in permanent type housing in 1950 and the average number of persons per housing unit. Separate estimates were made for the urban and rural populations. For the minimum requirements, it

[1] Latin America as defined for this study includes all the mainland from Mexico south plus all the islands of the Caribbean area.

[2] O. Cabello, *Necesidades mínimas de construcción anual de viviendas en los países latinoamericanos*, preliminary report, ECLA, 1961.

was assumed that the proportion of the population in permanent type housing and the number of persons per unit would remain the same in the future as in 1950. These figures were applied to the estimated annual increase of the urban and rural populations in future years to obtain the number of housing units needed to house the annual population increment. To this was added 2 per cent of the number of existing urban houses and 1.5 per cent of the rural houses to allow for replacement of the dwellings which become uninhabitable each year.

In theory the construction of these minimum requirements would maintain housing conditions at the same average level as in 1950. Since during the decade 1950-60 actual construction amounted to only about half of the minimum requirement in most countries, there has been a progressive deterioration in housing conditions since 1950. Construction of the required minimum number of dwellings in the future would therefore represent an improvement over the conditions which existed in 1958. In addition, the allowance for replacement is such that by 1985 over half of the existing houses would be less than 25 years old. The estimates of minimum requirements, therefore, in fact allow for some improvement over the conditions existing in 1958. In view of the progressively growing historical housing deficit it seems unreasonable to assume that most of these countries will be able to accomplish more than this minimum in the near future.

To convert the estimated number of new housing units to volumes of sawnwood it was necessary to make some assumptions about the amount of wood used per house. The average number of persons per dwelling in each country or sub-region in 1950 was multiplied by an assumed minimum space of 15 square metres per person to obtain an average floor space per dwelling. The average number of cubic metres of sawnwood used per square metre of floor space was calculated from the historical construction statistics in each sub-region and multiplied by the average floor space to obtain the number of cubic metres per dwelling.

In most of these countries an unrecorded quantity of sawnwood is used to build shacks and other temporary housing and to maintain existing dwellings. This material is included in the estimates of historical consumption but may not be adequately accounted for by the minimum requirements estimates of future construction. As a check, the consumption of sawnwood in residential construction in the period 1956-59 was projected into the future at the same rate of growth as that assumed for the gross domestic product in each country. To allow for future changes in housing which may cause sawnwood to be a smaller proportion of the total value than in the past, these projected figures were then reduced by 20 per cent. This projected historical consumption figure was compared with the estimate obtained from the minimum requirements and the larger of the two figures was used as the estimated future requirements for sawnwood for residential construction.

The basic assumption concerning the future use of sawnwood in non-residential construction was that consumption would increase in relation with the gross domestic product but that sawnwood would not maintain the same relative position that it had in 1956-59. The consumption of sawnwood in non-residential construction for the period 1956-59 was projected to the future at the same rate assumed for the growth of gross domestic product and the resulting figures were then reduced by 20 per cent.

In all the developed areas of the world there has been a gradual substitution of plywood, fiberboard and particle-board for sawnwood in construction. It was assumed that a similar substitution would take place in Latin America and that starting with 1958 the proportion of the total sawnwood consumption replaced by sheet materials would increase by 0.5 per cent each year. The total estimated consumption of sawnwood in construction (both residential and non-residential) would therefore be reduced by 6 per cent in 1970, 9 per cent in 1975, and 15 per cent in 1985 to allow for this substitution.

Sawnwood for furniture

The basic assumption concerning furniture was that the per capita consumption would increase in relation with the per capita gross domestic product. However, because of the low standard of living in these countries it was felt that people would buy many other things with any increase in income and might spend proportionately less on furniture. An income elasticity of 0.8 was therefore assumed for all countries and it was further assumed that this elasticity would not change during the period in question.

To allow for the substitution of sheet materials for sawnwood in the manufacture of furniture, the same assumption was made as for construction and the projected consumption was reduced by 6 per cent in 1970, 9 per cent in 1975, and 15 per cent in 1985.

Sleepers

The basic assumption concerning sleepers was that future consumption would be for maintenance and improvement of the existing lines and that the total length of the railroads would increase little if at all. On the assumption that all of the sleepers now in use will have to be replaced by 1985 a minimum annual consumption was calculated by dividing the existing stock of sleepers by the number of years in this period. In some countries where the lines are now in very bad condition, it was assumed that the railroads would be forced to replace a large number of sleepers in the next few years and that later annual consumption would drop back to the number necessary to maintain the lines in good condition. An effort was made to take into account the possible substitution of concrete sleepers for wooden ones in some countries and also the increase in the useful life of wooden sleepers which will result from more extensive use of preservative treatment.

Sawnwood for packaging

The basic assumption concerning packaging was that consumption of sawnwood would increase at the same rate as the gross domestic product. In the parts of the world where paperboard is readily available, this product has displaced sawnwood in packaging to a large extent. It seems reasonable that a similar substitution will take place in Latin America, but at a slower rate because of the many other uses waiting to absorb expanded supplies of paperboard. It was assumed therefore that part of the increase in consumption of paperboard would replace sawnwood in packaging and that the proportion going into this use

would grow with time. Different proportions were assumed in the various sub-regions in accordance with the anticipated local availability of sawnwood and paperboard. It was assumed that 1 ton of paperboard would replace 6 cubic metres of sawnwood in packaging.

Sawnwood for other uses

The basic assumption about sawnwood for other uses was that per capita consumption would remain the same in the future as it was in 1956-59. This means that total consumption will increase at the same rate as the population. It was also assumed that sheet materials would replace sawnwood in some of these other uses. As for construction and furniture, the total estimated consumption was reduced by 6, 9 and 15 per cent respectively in 1970, 1975 and 1985.

Pit-props

The basic assumption concerning pit-props was that consumption would increase in relation with the production of coal and minerals extracted from underground mines. However, it was assumed that the volume of wood used per ton of mineral extracted would gradually decrease with time.

Roundwood for other uses

Where there was sufficient information, an attempt was made to separate consumption in the form of telephone poles, fence posts, piling, and rural construction and to project these separately. The predominant use everywhere was fence posts and rural construction. It was assumed that the consumption in these uses would increase in proportion with the investment in agriculture (other than machinery), the area of land under cultivation, or the rural population, depending on the information that was available for the particular sub-region. Where telephone pole and piling consumption could not be reliably separated, the total was projected as if it were all fence posts and rural construction.

Wood-based sheet materials

Consumption of these sheet materials has been small in most Latin American countries. Up to 1958 many countries had used no particle-board at all and only limited amounts of fibreboard. Past consumption alone did not, therefore, provide a satisfactory base for projecting these materials.

It was assumed that the consumption of veneers would grow in the future at the same rate as the gross domestic product.

The earlier sections on sawnwood describe the estimates of future replacement of sawnwood in construction, furniture, and other uses by sheet materials. These volumes were converted to sheet materials in the ratio of 1 cubic metre of sheet material for each 1.5 cubic metres of sawnwood. It was then assumed that 10 per cent of this total would consist of plywood, 45 per cent of fibreboard, and 45 per cent of particle board.

The consumption of plywood in 1956-59 was projected to the future on the assumption that per capita consumption would remain constant in the kind of uses to which plywood was put in that period. To these projected figures was added the 10 per cent described above as the estimated substitution of plywood for sawnwood in the various uses.

The consumption of fiberboard and particle-board in 1956-59 was projected to the future years at the same rate as the gross domestic product. To these projected figures was added the 45 per cent described above as the estimated substitution of these materials for sawnwood.

Fuelwood and charcoal

Statistics on the consumption of these products are, at best, fragmentary and often only estimates. The conditions which influence the consumption of fuelwood and charcoal vary greatly from one country to another. It was necessary to take every scrap of available information into account and the methodology differed somewhat from one country to another. An effort was made to separate the amounts consumed in industries, by the railroads, and in domestic uses. It was assumed that use by industries and the railroads will gradually diminish with the substitution of other fuels and will have practically disappeared by 1985 except for a few industries such as steel. Domestic consumption will decrease in both rural and urban areas but more rapidly in the cities. A separate rate of decrease was assumed for each country, taking into account the availability of wood and other fuels, the level of economic development, and other pertinent conditions.

Pulp and paper

The basic assumption was that the per capita consumption would increase in accordance with the per capita gross domestic product, but that the income elasticity of demand would gradually decrease as the per capita product increases.[3] The consumption was divided into four categories: newsprint, printing and writing paper, other papers, and paperboard. The average per capita consumption during the period 1955-57 was calculated for each category and each of the twenty Latin American countries plus Canada and the United States. For each category of product a parabolic curve was then fitted to the relationship between per capita consumption and per capita gross domestic product in these twenty-two countries. For each country the coefficients of elasticity were determined from this curve for the gross domestic products of that country in 1955-57 and in 1985. The average of these two coefficients was then used as the demand elasticity for that category of product in that country during the entire period of projection from 1958 to 1985.

The roundwood equivalent of the future pulp and paper requirements was calculated separately for each class of paper and board and for each country. An estimate was made of the amounts of the different kinds of pulp required to produce these products and of the proportion of pulp which would be made from new wood rather than from other materials or waste paper. The factors used to convert the pulp to roundwood volumes are given in the appendix.

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[3] These projections were based on those made for *Pulp and paper in Latin America: present situation and future trends of demand, production and trade* (E/CN.12/570; FAO/ETAP/1346; TAO/LAT/30), with adjustments for a different base period, different assumed rates of product growth, and a different terminal year.

Estimates of future requirements

As was done in the chapter on historial consumption, each major product group is presented separately and in detail in this chapter. Within each group the information is given by sub-regions. Where the basic data warrant such detail, information is also presented for individual countries within the sub-regions. Finally all the information is assembled to give a picture of the future requirements for wood products in Latin America as a whole.

Sawnwood

In terms of volume, sawnwood will continue to be the most important group of industrial-wood products in the future. By 1985 the total consumption is likely to be 2.3 times what it was in 1956-59. This increase is not expected to be uniform for all of the end uses of sawnwood because of differences in the factors affecting demand and in the possibilities of replacement by other materials. Estimates of future requirements are therefore presented separately for the various end uses. It must be kept in mind, however, that information about the present consumption of sawnwood in these end uses is scarce in many sub-regions. More confidence can be placed in the estimates of total sawnwood requirements than in the estimates for individual end uses. Similarly, the estimates of requirements for the end uses in the region as a whole are probably more reliable than those for individual sub-regions.

Mexico

The total requirements for sawnwood in Mexico are expected to be 1.9 million cubic metres in 1970, to increase to 2.2 million in 1975, and to reach a figure of 2.8 million cubic metres in 1985. This means increases over the average 1956-59 consumption of 100 per cent by 1975 and 150 per cent by 1985. The division of these future requirements among the major end uses is shown in table 42.

Table 42

MEXICO: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USES

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	510	1,270	1,470	1,960
Furniture	90	160	200	310
Packaging	120	140	140	80
Sleepers	270	180	190	210
Other sawnwood products	110	150	170	200
All sawnwood	1,100	1,900	2,170	2,760
Cubic metres per 1,000 inhabitants	4	41	40	39
Roundwood equivalent of total sawnwood (thousand cubic metres)	2,400	3,900	4,500	5,700

Source: ECLA, on the basis of national statistics.

Consumption of all sawnwood products is expected to increase in the future with the exception of packaging, in which use sawnwood will gradually be replaced by paperboard. The very large increase in construction use by 1970 is due to the assumption that Mexico can expand residential construction enough to be covering its minimum needs for housing by that year. Because construction is such a large item in sawnwood use, this also causes sharp increases in total and per capita sawnwood consumption. The per capita consumption of sawnwood is expected to remain almost constant after 1970. Table 42 also shows the volume of roundwood which will be necessary to manufacture the sawnwood required in the future. This volume should logically come from Mexico's own forests.

Central America

The total requirements for sawnwood in Central America are expected to be 1.4 million cubic metres in 1970, to increase to 1.8 million in 1975, and to reach 2.8 million cubic metres in 1985. This would represent increases over the 1956-59 consumption of almost 100 per cent by 1975 and 200 per cent by 1985.

The division of these requirements among the countries in the sub-region is expected to be as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Costa Rica	250	400	510	810
El Salvador	70	140	170	230
Guatemala	240	360	470	760
Other countries	350	530	650	980

The division of the future requirements among the major end uses is shown in table 43. The consumption of sleepers is expected eventually to level off as the railroads get on a maintenance basis. Sawnwood in packaging will run into competition from paperboard and its use will eventually decline. All other end uses are expected to require constantly increasing quantities of sawnwood. Because of the availability of timber and the importance of wood in the economies of these countries, per capita consumption is expected to continue to increase in the future even though it is now high for the region. Table 43 also shows the roundwood needed in future to produce this sawnwood. It may be assumed that this volume will have to come from the Central American forests.

Table 43

CENTRAL AMERICA: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	680	1,100	1,400	2,200
Furniture	100	180	230	360
Packaging	20	30	30	20
Sleepers	40	50	50	50
Other sawnwood products	70	90	100	130
All sawnwood	910	1,400	1,800	2,800
Cubic metres per 1,000 inhabitants	82	92	98	114
Roundwood equivalent of total sawnwood (thousand cubic metres)	1,860	2,900	3,600	5,600

Source: ECLA, on the basis of national statistics.

The Caribbean islands

The future requirements of the Caribbean islands for sawnwood are estimated at 1.3 million cubic metres in 1970, 1.6 million in 1975, and 2.5 million in 1985.

Consumption will be 60 per cent higher than in 1956-59 by 1975 and 150 per cent higher by 1985.

The division of these future requirements among the major end uses is shown in table 44. The islands are well located for imports from Central America and Northern South America and it is anticipated that they will be able to continue to meet their requirements for all uses, despite their limited domestic forest resources. The estimates for packaging assume a substantial displacement of sawnwood by paperboard but the displacement could be greater than indicated if the domestic production of paperboard from bagasse increases more rapidly than assumed in this study. The average per capita consumption of sawnwood is expected to continue to increase in the future due to rising income and the scarcity of domestic substitutes. The roundwood equivalent of the sawnwood consumption will reach 5 million cubic metres by 1985. This is undoubtedly more than the domestic forests can support and part of the sawnwood will have to be imported. But it indicates that strenuous efforts should be made to increase the productive capacity of the sub-region's forest resources in order to supply this growing market as much as possible from local sources.

Table 44

THE CARIBBEAN ISLANDS: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	550	760	960	1,500
Furniture	170	230	300	480
Packaging	90	100	100	60
Sleepers	60	70	70	70
Other sawnwood products	130	170	220	360
All sawnwood	990	1,300	1,600	2,500
Cubic metres per 1,000 inhabitants	52	54	59	70
Roundwood equivalent of total sawnwood (thousand cubic metres)	2,000	2,700	3,300	5,100

Source: ECLA, on the basis of national statistics.

Northern South America

The total requirements for sawnwood of the countries in this sub-region are expected to be 2.7 million cubic metres in 1970, to rise to 3.2 million in 1975, and to reach 4.4 million cubic metres by 1985. This means an increase of almost 100 per cent over the 1956-59 consumption by 1975 and an increase of 170 per cent by 1985.

The distribution of these requirements among the major countries in the sub-region is expected to be as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Colombia	960	1,700	2,000	2,500
Ecuador	210	300	370	550
Venezuela	380	560	680	1,030

Colombia is expected to maintain its dominant position in sawnwood consumption in the sub-region, and together with Venezuela will continue to use 80 per cent of the total.

Table 45 shows the division of the future requirements among the major end uses. The consumption of sleepers during the period 1956-59 was usually high because of the construction of a new railroad in Colombia. It is expected to level off in the future as the need becomes primarily one of maintenance. The total use for packaging will eventually decline because of replacement by paperboard. The figures in table 45 assume that a gradual replacement in this use will begin immediately. The proportion of the total sawnwood going into construction is expected to rise from 48 per cent in 1956-59 to 64 per cent in 1985. There is a large and serious housing shortage in all of these countries and the estimates here assume that there will be sufficient construction to at least cover the minimum requirements in the future. Since the construction now in progress is not adequate to satisfy the present minimum requirements, the consumption of sawnwood in table 45 shows an abrupt increase by 1970.

The per capita consumption of sawnwood is expected to increase gradually up to 1985. Historically, per capita consumption has been less than the regional average but by 1985 it is expected to be about equal to that average. Table 45 also shows the roundwood volumes which will be required to produce the sawnwood consumed in the future. Northern South America has the resources to produce all of this roundwood domestically but definite steps will have to be taken to raise the productive capacity of the forests if they are to be in condition to absorb the annual drain of almost 9 million cubic metres that is projected for 1985.

Table 45

NORTHERN SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	770	1,500	1,900	2,800
Furniture	200	340	420	660
Packaging	220	270	270	160
Sleepers	70	60	60	60
Other sawnwood products	390	530	590	740
All sawnwood	1,700	2,700	3,200	4,400
Cubic metres per 1,000 inhabitants	65	76	78	80
Roundwood equivalent of total sawnwood (thousand cubic metres)	3,400	5,500	6,400	8,800

Source: ECLA, on the basis of national statistics.

South-west South America

The countries of South-west South America are expected to consume a total of 1.4 million cubic metres of sawnwood in 1970, 1.6 million in 1975 and 1.9 million cubic metres by 1985. This indicates an increase, over the 1956-59 average consumption, of 70 per cent by 1975 and 100 per cent by 1985. The proportionate increase to 1985 is expected to be less in this sub-region than in any other except South-east South America.

The distribution of these future requirements among the countries for which reasonable estimates are possible is as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Chile	710	1,100	1,100	1,300
Peru	180	260	310	450

Population in Bolivia and Chile is expected to grow at a rate lower than the regional average. In addition this study has assumed a lower rate of growth of gross domestic product for these countries than for most of the rest of Latin America on the basis of past performance and resources. Since Chile consumes such a large proportion of the sawnwood in this sub-region, this lowers the total future expansion despite the expected faster increase of consumption in Peru.

The distribution of the expected requirements among the various end uses is shown in table 46. Packaging has been an important consumer in the past—particularly in Chile—but with the development of new manufacturing capacity for paperboard production in Chile and Peru, sawnwood is certain to lose a growing proportion of this market. There is a serious housing deficit in this sub-region but the common methods of construction do not use a large quantity of sawnwood. It is possible that the relative use of sawnwood in construction may increase in the future but no large increase has been assumed here.

Table 46 shows that the per capita consumption of sawnwood is expected to eventually level off at about the present volume. This and South-east South America are the only sub-regions in which per capita consumption is not expected to be higher in 1985 than it is today. The roundwood needed to produce the sawnwood for future consumption should all come from domestic forests. The anticipated future requirements of 4 million cubic metres per year is not large in relation to the forests of the sub-region, but those resources will have to be developed if they are to support this drain on a continuous basis.

Table 46

SOUTH-WEST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	390	740	850	1,100
Furniture	60	90	110	160
Packaging	150	160	150	90
Sleepers	130	150	150	150
Other sawnwood products	220	290	320	390
All sawnwood	950	1,400	1,600	1,900
Cubic metres per 1,000 inhabitants	45	50	45	45
Roundwood equivalent of total sawnwood (thousand cubic metres)	2,000	3,000	3,300	3,900

Source: ECLA, on the basis of national statistics.

Brazil

The total requirements for sawnwood in Brazil are expected to be 9.1 million cubic metres in 1970, to increase to 10.1 million in 1975 and to reach a figure of 14.4 million cubic metres in 1985. This represents increases, over the average 1956-59 consumption, of 70 per cent by 1975 and 140 per cent by 1985.

The distribution of these requirements among the major end uses is shown in table 47. The use of sawnwood for packaging is expected to increase for some years but eventually to decrease considerably as a result of the competition from paperboard. The Brazilians are planning to improve their railroad lines so as to carry heavier traffic in the future. This will involve converting all tract to standard gauge and increasing the number of sleepers per kilometre. The consumption of sleepers is therefore expected to increase materially in the near future. As a result of this modernization, however, and particularly because an increasing proportion of sleepers is being treated with preservatives, the lines will reach a condition in 10 or 15 years in which less annual replacement will be needed to maintain them. The total consumption of sleepers is therefore expected to be less in 1985 than at present. Brazil has a very serious housing deficit and must do something about it. The proportion of total sawnwood going into construction is therefore expected to increase from the 66 per cent of 1956-59 to 80 per cent by 1985.

The per capita consumption of sawnwood is at present higher in Brazil than in any other sub-region. It is expected that per capita consumption will increase in the future and that Brazil will retain its place as the largest per capita consumer. The roundwood required to produce this sawnwood will amount to almost 30 million cubic metres per year by 1985. This will be about 45 per cent of all the roundwood consumed in Latin America for making sawnwood. All of this should come from Brazilian forests and the country should start immediately to develop the productive capacity of its resources in order to handle this tremendous annual drain.

Table 47

BRAZIL: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	4,000	6,400	7,300	11,500
Furniture	440	730	890	1,300
Packaging	510	590	570	330
Sleepers	470	580	470	310
Other sawnwood products	590	760	840	1,000
All sawnwood	6,000	9,100	10,100	14,400
Cubic metres per 1,000 inhabitants	96	107	106	117
Roundwood equivalent of total sawnwood (thousand cubic metres)	12,400	18,600	20,600	29,100

Source: ECLA, on the basis of national statistics.

South-east South America

The total requirements for sawnwood in South-east South America are expected to be slightly less than 2.6 million cubic metres in 1970, to increase to somewhat over 2.6 million in 1975 and to reach 3.0 million cubic metres in 1985. This represents increases, over the average 1956-59 consumption, of about 40 per cent by 1975 and 60 per cent by 1985.

The distribution to these future requirements among the three countries in the sub-region is expected to be as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Argentina	1,740	2,300	2,300	2,700
Paraguay	24	54	61	83
Uruguay	180	240	250	260

Paraguay, with plentiful forest resources and a serious housing deficit, is expected to expand sawnwood consumption considerably. The other two countries are already in better shape as far as housing is concerned and have been importing a substantial part of the sawnwood they consume; their consumption is not expected to increase to the same extent as in the rest of Latin America.

The distribution of the requirements among the major end uses is shown in table 48. Packaging use is expected to decline heavily as paperboard is substituted for sawnwood. The railroads are generally in very bad condition today and it appears that these countries will have to replace a great many sleepers during the next 10 years. Preservative treatment is being used in Argentina and the number required for maintenance is expected to level off after 1975. Construction will be relatively a more important use in the future but more as a result of the decreased use in packaging than of the size of the increase in construction.

Per capita consumption is expected to rise for about a decade and then to decline again to about the present level. The roundwood required to produce this sawnwood will amount to 6.2 million cubic metres by 1985. The sub-region has imported both sawnwood and sawlogs and probably will continue to do so. But the resources of these countries if intensively developed can produce a large part of the future roundwood needs.

Table 48

SOUTH-EAST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	880	1,200	1,300	1,800
Furniture	240	350	400	520
Packaging	460	460	420	210
Sleepers	100	260	180	180
Other sawnwood products	250	290	300	330
All sawnwood	1,900	2,600	2,600	3,000
Cubic metres per 1,000 inhabitants	79	86	81	80
Roundwood equivalent of total sawnwood (thousand cubic metres)	4,000	5,400	5,400	6,200

Source: ECLA, on the basis of national statistics.

FUTURE REQUIREMENTS FOR SAWNWOOD: SUMMARY

The estimated future requirements for all of the sub-regions are now combined in table 49 to show the expected requirements for the various end uses in the region as a whole. Consumption in all of the end uses is expected to increase up to 1970. After that, the use of sawnwood in packaging and of sleepers is expected to gradually decline and by 1985 to be somewhat less than it was in 1956-59. Consumption in all of the other end uses is expected to continue to increase and by 1985 the total amount of sawnwood used in the region should be two and a half times what it was in 1956-59.

In the region as a whole, the per capita consumption of sawnwood is expected to continue to increase during the next 25 years. Even then it will be only half as large as the present day per capita consumption in Europe and only one-fifth as large as in northern North America and the USSR. If the Latin American forest resources are developed properly and if per capita income increases as is hoped for, the experience in the more developed countries indicates that consumption could grow more than this report shows.

Table 49

LATIN AMERICA: FUTURE ANNUAL REQUIREMENTS FOR SAWNWOOD BY END USE

End use	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Construction	7,800	13,000	15,200	22,900
Furniture	1,300	2,100	2,500	3,800
Packaging	1,600	1,700	1,700	900
Sleepers	1,100	1,300	1,200	1,000
Other sawnwood products	1,800	2,300	2,500	3,200
All sawnwood	13,600	20,400	23,100	31,800
Cubic metres per 1,000 inhabitants	69	77	76	81
Roundwood equivalent of total sawnwood (thousand cubic metres)	28,000	42,000	47,100	64,400

Source: ECLA, on the basis of national statistics.

ROUNDWOOD PRODUCTS

This group includes a miscellany of products—pitprops, posts, poles, and wood used in the round for construction and other purposes. Information on past consumption of these products is scarce in most countries and little is known about the relation between the quantities used and other economic activities in Latin America. The estimates of future requirements were worked out country by country and to the greatest possible extent by individual products. However, the lack of uniformity of information between countries and the large errors known to exist in the forecasts for individual products make it impossible to present detailed estimates of future requirements for the sub-regions. All products are therefore combined and only a total estimate is given for all roundwood products.

Mexico

Total roundwood product requirements are expected to increase 50 per cent by 1975 and to double by 1985. The estimated future requirements are as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
All roundwood products	930	1,270	1,430	1,860
Per 1,000 inhabitants (m^3)	29	27	27	27

Per capita consumption of these products has been lower than in any other sub-region except South-east South America but is expected to stay about the same in the future. As a result, the proportionate increase in consumption expected by 1985 is higher than in any other sub-region. With a large rural population and active mining, Mexico has been using close to a minimum quantity of these products in the past and since timber is available in the country, the per capita consumption is not expected to change in the future.

Central America

Total roundwood product requirements in Central America are expected to increase 40 per cent by 1975 and about 65 per cent by 1985. The estimated future

requirements for some of the countries and for the sub-region as a whole are shown in table 50. Per capita consumption of these products in the past has been higher than in any other sub-region except Northern South America. It is expected to decline in the future but still to be the highest in the region in 1985. The population of Central America is increasing very rapidly and there is a definite trend toward urban living. In El Salvador and in the heavily populated parts of other countries the local timber has been badly depleted. Sawnwood is readily available and is replacing roundwood in many rural uses. All of this leads to a declining per capita consumption. But the fact that timber is so plentiful in the sub-region means that it will still be used more than in other areas.

Table 50

CENTRAL AMERICA: FUTURE ANNUAL REQUIREMENTS FOR ROUNDWOOD PRODUCTS

Area	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Costa Rica	80	110	130	160
El Salvador	40	40	40	40
Guatemala	240	310	340	420
All Central America	610	780	860	1,100
Cubic metres per 1,000 inhabitants	55	50	47	43

Source: ECLA, on the basis of national statistics.

The Caribbean islands

The requirements for roundwood products in the islands are expected to increase about 25 per cent by 1975 and 40 per cent by 1985. This is the smallest proportionate increase anticipated for any sub-region. The estimated future requirements are as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
All roundwood products	670	780	820	940
Per 1,000 inhabitants (m^3)	35	31	29	26

Per capita consumption of these products has been almost equal to the regional average in the past but is expected to decline materially in the future. Local timber resources are very limited in relation to the population and have been badly depleted in many of the islands. Rural uses of roundwood are closely related to timber availability and are expected to decrease in the future. The cost of transportation is high on these products because of their bulk and weight and imported products are therefore relatively expensive. The total consumption indicated by the above requirements may be impossible to attain unless these countries increase the productive capacity of their forest resources through plantations of fast-growing species.

Northern South America

The total requirements for roundwood products in this sub-region are expected to increase one-third by 1975 and almost one-half by 1985. The future requirements for the major countries and for the sub-region as a whole are shown in table 51. Per capita consumption of these products has been the highest in the region. It is expected to decline materially in the future but still to be well above the regional average. In Venezuela the urban population is growing much faster than the rural and consumption is expected to expand slowly. Ecuador, by contrast, with a large proportion of rural people, extensive eucalyptus plantations, and expanding population in the forested coastal section is expected to use much larger quantities of roundwood products in the future.

Table 51

NORTHERN SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR ROUNDWOOD PRODUCTS

Area	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Colombia	1,000	1,300	1,300	1,500
Ecuador	200	260	290	350
Venezuela	260	270	290	300
Whole sub-region	1,500	1,900	2,000	2,200
Cubic metres per 1,000 inhabitants	58	53	48	40

Source: ECLA, on the basis of national statistics.

South-west South America

Total roundwood-product requirements are expected to increase 40 per cent by 1975 and 70 per cent by 1985 in this sub-region. The future requirements for the major countries and for the area as a whole are shown in table 52. Per capita consumption of these products has been fairly high for Latin America but is expected to gradually decline in the future. Consumption is expected to expand only slowly in Chile where three-fourths of the population will be urban by 1975 and where the bulk of the forests lie far from the centres of population. Peru, which has a much larger rural population, is pushing colonization of the forested eastern portion of the country, and uses many pit-props in its rapidly expanding mining industry. This is a sub-region of extreme contrasts and the use of roundwood products will be very high in some sections and very small in others.

Table 52

SOUTH-WEST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR ROUNDWOOD PRODUCTS

Area	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Chile	230	250	260	270
Peru	370	530	600	680
Whole sub-region	1,000	1,300	1,400	1,700
Cubic metres per 1,000 inhabitants	48	45	40	39

Source: ECLA, on the basis of national statistics.

Brazil

Total roundwood product requirements are expected to increase by 50 per cent by 1975 and 90 per cent by 1985. The estimated future requirements are as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
All roundwood products	2,400	3,200	3,600	4,500
Per 1,000 inhabitants (m^3)	38	37	37	37

Per capita consumption in the past was about equal to the average for the region but is expected to remain about the same in the future, instead of declining as will the regional average. The rural population of Brazil is very large and is growing rapidly. Much of the population lacks permanent housing and large quantities of roundwood are used for rural construction. The area of agricultural land is expected to increase materially in the next 25 years and this will require large amounts of roundwood for fence posts and construction materials. The very large eucalyptus plantations are now producing poles and will provide more roundwood products in the future close to the large population centres.

South-east South America

Future requirements for roundwood products are expected to increase by 30 per cent by 1975 and 50 per cent by 1985. The future requirements for the individual countries and the sub-region as a whole are shown in table 53. Per capita consumption has been the lowest in the region and is expected to remain at about the same level in the future. The consumption is naturally highest in Paraguay where there are extensive forests and lowest in Uruguay where forests are limited. Total consumption is expected to increase more rapidly in Argentina than in the other countries because the rural population will increase relatively more, more new land will be brought into agricultural use, and expansion is expected in the mining industry. It will increase least in Uruguay, where only 16 per cent of the population will be rural in 1975 and where timber is relatively scarce.

Table 53

SOUTH-EAST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR ROUNDWOOD PRODUCTS

Country	Requirements in thousands of cubic metres			
	1956-59	1970	1975	1985
Argentina	230	300	320	370
Paraguay	130	150	150	170
Uruguay	26	30	31	34
Whole sub-region	390	480	510	570
Cubic metres per 1,000 inhabitants	16	16	16	15

Source: ECLA, on the basis of national statistics.

REQUIREMENTS FOR ROUNDWOOD PRODUCTS: SUMMARY

In Latin America as a whole, the total requirements for roundwood products are expected to increase by 40 per cent by 1975 and 70 per cent by 1985, compared with the amount consumed annually in 1956-59. The total future requirements for the region are estimated to be as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
All roundwood products	7,500	9,700	10,600	12,900
Per 1,000 inhabitants (m^3)	38	36	35	33

Despite the expected decline in per capita consumption, the population of Latin America is growing so fast that the total amount of roundwood products required in the future will be very large. Since this type of product is best produced locally, the above figures indicate a prospective drain on the Latin American forests of about 13 million cubic metres in 1985 for this class of product alone.

WOOD-BASED SHEET MATERIALS

This group of products has not been very important in the total wood consumption picture of Latin America in the past. However, it is a type of product whose consumption has grown very rapidly in other parts of the world. Plywood and veneers have been produced in most Latin American countries for many years but fibreboard is a relatively new product in the region and particle-board is almost unknown in many countries. The future requirements for these products are therefore very difficult to forecast. It has been assumed here that they will be used primarily as a substitute for sawnwood in the traditional uses of that product. But it is also likely that new uses will be discovered for these materials once they are readily available to manufacturers and consumers in the region. The estimate presented here that the total regional requirements for these sheet materials in 1985 may be almost eight times as large as the actual consumption was in 1956-59 may appear exaggerated. But it must be remembered that the past consumption was very small and that the estimate presented for 1985 amounts to less than one square metre of these materials for each person in the future population.

Mexico

The total requirements for wood-based sheet materials in Mexico are expected to be 160,000 cubic metres in 1970, to increase to 230,000 in 1975, and to reach 450,000 cubic metres by 1985. This would represent increases over the average 1956-59 consumption of 330 per cent by 1975 and 750 per cent by 1985.

The division of these requirements among the various types of sheet materials is shown in table 54. Mexico has had a fairly substantial plywood and fibreboard industry but has had difficulty in developing adequate domestic markets. The consumption of sawnwood has also been comparatively low in Mexico. It is believed, however, that with a rising standard of living and with increasing effort to overcome the housing deficit, Mexican consumption of both sheet materials and sawnwood will rise considerably. Mexico has the timber resources to produce its own sheet materials and the estimated 800,000 cubic metres of roundwood required in 1985 should come from Mexican forests.

Table 54

MEXICO: ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer	34	56	69	103
Fibreboard	18	67	103	214
Particle-board	1	33	58	137
All sheet materials	53	156	230	454
Cubic metres per 1,000 inhabitants	1.6	3.3	4.3	6.5
Roundwood equivalent of total sheet materials (thousand cubic metres)	120	300	430	820

Source: ECLA, on the basis of national statistics.

Central America

The requirements for wood-based sheet materials in Central America are expected to be 82,000 cubic metres in 1970, 143,000 in 1975, and 369,000 in 1985. This would mean requirements in 1975 ten times the 1956-59 consumption, and requirements in 1985 twenty-six times as large as in 1956-59. This is the largest relative increase in consumption expected for any of the sub-regions.

The distribution of this consumption among the countries in the sub-region is expected to be as follows (in thousands of cubic metres):

	1956-59	*1970*	*1975*	*1985*
Costa Rica	1	17	33	95
El Salvador	1	7	12	29
Guatemala	11	35	55	130
Other countries	1	23	43	115

Guatemala, which has been producing plywood domestically and also has the largest population in the sub-region, will be the largest consumer in the future. El Salvador's over-all wood consumption is low because of lack of forest resources, but might increase more than indicated above if substantial wood-product trade develops in the Central American Integration Programme.

The distribution of the consumption among the various types of material is shown in table 55. Fibreboard and particle-board are expected to increase faster than plywood but the distribution between these two types of material is little more than a guess. The very large increase in per capita consumption foreseen in table 55 would give this sub-region the second highest per capita consumption in Latin America in 1985. The potential productive capacity of the Central American forests and the great need for housing and other kinds of construction should combine to produce a very high consumption of sheet materials. The total roundwood needs of 640,000 cubic metres in 1985 will put no strain on the forest resources if they are properly developed in the future.

Table 55

CENTRAL AMERICA: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	*Requirements in thousands of cubic metres (s)*			
	1956-59	*1970*	*1975*	*1985*
Plywood and veneer.....	8	18	26	53
Fibreboard	1	27	52	147
Particle-board	5	37	65	169
All sheet materials.....	14	82	143	369
Cubic metres per 1,000 inhabitants	1.3	5.2	7.9	15.1
Roundwood equivalent of total sheet materials (thousand cubic metres)	30	150	250	640

Source: ECLA, on the basis of national statistics.

The Caribbean islands

Future requirements for sheet materials in the islands are expected to be 109,000 cubic metres in 1970, to rise to 167,000 in 1975, and to reach 369,000 cubic metres by 1985. This would mean requirements four times as large as the 1956-59 consumption by 1975, and nine times as large by 1985.

The division of these future requirements among the various materials is shown in table 56. The islands have already been consuming a substantial amount of imported plywood and this is expected to increase considerably. However, the board materials are expected eventually to reach much larger volumes. Part of this board will be produced domestically from bagasse and most of the rest will probably be imported. The roundwood volumes shown in table 56 will therefore represent a drain on the forests of other sub-regions rather than on the domestic forests.

Table 56

THE CARIBBEAN ISLANDS: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	*Requirements in thousands of cubic metres (s)*			
	1956-59	*1970*	*1975*	*1985*
Plywood and veneer.....	38	54	64	96
Fibreboard	4	31	56	144
Particle-board	—	24	47	129
All sheet materials.....	42	109	167	369
Cubic metres per 1,000 inhabitants	2.2	4.4	6.0	10.3
Roundwood equivalent of total sheet materials (thousand cubic metres)	100	220	330	680

Source: ECLA, on the basis of national statistics.

Northern South America

The future requirements for sheet materials in this sub-region are expected to amount to 165,000 cubic metres in 1970, to rise to 268,000 in 1975, and to be 614,000 in 1985. This means an increase to seven times the 1956-59 consumption by 1975 and to fifteen times that figure by 1985. Next to Central America, this sub-region will enjoy the greatest proportional increase in consumption of sheet materials.

The future requirements will be distributed among the major countries as follows (in thousands of cubic metres):

	1956-59	*1970*	*1975*	*1985*
Colombia	23	100	160	360
Ecuador	—	12	23	63
Venezuela	12	43	68	160

Both Colombia and Venezuela already have a substantial existing industry producing plywood and boards and therefore a good base for future expansion. Ecuador has had no domestic production thus far but is expected to start using these products as its neighbours have.

The distribution of the requirements among the various materials is shown in table 57. Plywood has been the most important material in the past but it is expected to be surpassed in terms of volume by both fibreboard and particle-board by 1970. The per capita consumption is expected to increase materially but it will be exceeded in at least three other sub-regions. All the future requirements are expected to be met from domestic production and the 1.1 million cubic metres of roundwood required for 1985 will have to come from forests within the sub-region.

Table 57

NORTHERN SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer.....	22	41	55	97
Fibreboard	9	64	110	264
Particle-board	7	60	103	253
All sheet materials.....	38	165	268	614
Cubic metres per 1,000 inhabitants	1.5	4.6	6.5	11.2
Roundwood equivalent of total sheet materials (thousand cubic metres)	80	300	480	1,100

Source: ECLA, on the basis of national statistics.

South-west South America

The future annual requirements of the countries in South-west South America for sheet materials are estimated at 72,000 cubic metres in 1970, 114,000 in 1975, and 237,000 in 1985. These requirements would be seven times the 1956-59 consumption in 1975 and fifteen times that consumption in 1985. This is one of the sub-regions in which a large proportionate increase is expected.

The distribution of this consumption among two of the countries in the sub-region is as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Chile	13	54	84	160
Peru	2	12	21	54

Chile is the only country in this sub-region in which there has been significant domestic production in the past. The lack of domestic production has limited the past consumption in Peru, but with plans now under way for installing plants to make sheet materials, future consumption may be expected to increase materially. Peru's problem is the inaccessibility of its forest resources, and the necessary transportation may be borne better by these lighter and higher valued products.

The distribution of the requirements among the various materials is shown in table 58. As in all other sub-regions, requirements for the boards are expected to outstrip those for plywood despite the advantage which plywood has enjoyed in the past. The past consumption per capita in this sub-region has been the lowest in Latin America. Despite the eight-fold increase anticipated by 1985, South-west South America will continue to have the lowest per capita consumption. This is related to the low consumption of wood products in general in the sub-region, as described under the other products. Roundwood consumption at 410,000 cubic metres in 1985 will not be large in relation to the forest resources of these countries and should be met domestically without difficulty.

Table 58

SOUTH-WEST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer.....	9	17	22	37
Fibreboard	4	28	47	101
Particle-board	3	27	45	99
All sheet materials.....	16	72	114	237
Cubic metres per 1,000 inhabitants	0.7	2.5	3.2	5.6
Roundwood equivalent of total sheet materials (thousand cubic metres)	30	130	200	410

Table 58 (continued)

Source: ECLA, on the basis of national statistics.

Brazil

The total requirements for wood-based sheet materials in Brazil are expected to be 880,000 cubic metres in 1970, to increase to 1.2 million in 1975, and to reach 2.5 million in 1985. This would represent increases over the average 1956-59 consumption of 220 per cent by 1975 and 540 per cent by 1985.

The division of these requirements among the various types of sheet materials is shown in table 59. Brazil has a large existing plywood industry and has used this material in considerable quantity in the past. The consumption of both fibreboard and particle-board are expected to grow faster than that of plywood, but plywood will remain a major component of this group within the foreseeable future. Per capita consumption of these materials is the highest in the region, and Brazil is expected to maintain that predominant position in the future. The anticipated roundwood requirements of 4.7 million cubic metres in 1985 will add to the heavy drain on Brazil's forest resources. Much of the supply in the past has come from the Paraná pine area, and the rapid depletion of these forests will have to be stopped and the trend reversed if the future requirements are to be met.

Table 59

BRAZIL: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer.....	357	520	610	880
Fibreboard	31	210	350	860
Particle-board	—	150	270	730
All sheet materials.....	388	880	1,230	2,470
Cubic metres per 1,000 inhabitants	6.2	10	13	20
Roundwood equivalent of total sheet materials (thousand cubic metres)	940	1,900	2,500	4,700

Source: ECLA, on the basis of national statistics.

South-east South America

This sub-region is expected to require 196,000 cubic metres of wood-based sheet materials annually by 1970, 265,000 by 1975, and 471,000 by 1985. This means future requirements three times the 1956-59 consumption by 1975, and somewhat over five times that consumption by 1985.

The distribution of these requirements among the countries is expected to be as follows (in thousands of cubic metres):

	1956-59	1970	1975	1985
Argentina	67	160	220	400
Paraguay	2	4	6	11
Uruguay	18	31	38	56

The largest consumer in terms of volume will continue to be Argentina, but Uruguay is expected to maintain the lead in per capita consumption. The limited domestic market in Paraguay, and the ready availability of sawnwood, will make it difficult to establish sheet material industries in that country.

The distribution of the requirements among the various materials is shown in table 60. The domestic production of plywood has been substantial and this is expected to continue to be a major product. Particle-board production has been late in starting, but there are now plans for domestic manufacture in Argentina and the consumption should increase rapidly when this material is available to builders and other consumers.

Table 60

SOUTH-EAST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer.....	68	93	106	138
Fibreboard	18	66	97	192
Particle-board	1	37	62	141
All sheet materials.....	87	196	265	471
Cubic metres per 1,000 inhabitants	3.6	6.5	8.2	12.5
Roundwood equivalent of total sheet materials (thousand cubic metres)	200	400	510	880

Source: ECLA, on the basis of national statistics.

Per capita consumption has been higher than in any other sub-region except Brazil and is expected to maintain a comparatively high level. South-east South America imports some plywood now and may import more in the future, but if the forest resources are properly developed it should be possible to produce domestically all of the 880,000 cubic metres of roundwood required in 1985.

FUTURE REQUIREMENTS FOR SHEET MATERIALS: SUMMARY

The information for the individual sub-regions is now assembled in table 61 to show the future requirements for wood-based sheet materials in Latin America as a whole. By 1985 these requirements are expected to be eight times the 1956-59 consumption. Because of the existing production facilities, plywood is expected to be consumed in larger quantities than the other products up to 1975. However, the use of the other boards will increase more rapidly as domestic production becomes available, and by 1985 both fibreboard and particle-board are expected to be consumed in larger quantities than plywood. The regional total in table 61 is strongly affected by the consumption in Brazil, which amounted to 60 per cent of the total in 1956-59 and will be about half in 1985. In a number of the individual sub-regions, fibreboard and particle-board are expected to outpace the consumption of plywood within the next ten years.

Table 61

LATIN AMERICA: FUTURE ANNUAL REQUIREMENTS FOR WOOD-BASED SHEET MATERIALS

Type of material	Requirements in thousands of cubic metres (s)			
	1956-59	1970	1975	1985
Plywood and veneer.....	540	800	950	1,400
Fibreboard	80	500	850	1,900
Particle-board	20	400	650	1,700
All sheet materials.....	640	1,700	2,400	5,000
Average per 1,000 inhabitants	3.2	6.2	7.9	12.8
Roundwood equivalent of total sheet materials (thousands of cubic metres)	1,500	3,400	4,700	9,200

Source: ECLA, on the basis of national statistics.

FUELWOOD

The information on the past consumption of fuelwood is so poor that it provides a very weak base for estimates of future requirements. However, it is known that wood is used in very large quantities for fuel in all parts of Latin America. An idea of the magnitude of the future requirements for this important forest product is therefore essential in any planning for forest resources development. It is believed that the figures presented here indicate this magnitude with sufficient accuracy for immediate planning needs. The relative importance of this product is so great, however, that studies should be undertaken immediately to obtain more reliable information on the present consumption of fuelwood and on the trends which are taking place in its use. The data available will not permit separate estimates of the future requirements for charcoal. A large amount of wood is still used in this form throughout Latin America, but in the figures presented here the wood required to make that charcoal is included with the wood that is used directly as fuel.

The total future requirements for fuelwood in each sub-region are presented in table 62. In the region as a whole requirements are expected to increase 14 per cent over the 1956-59 average by 1975 and 22 per cent by 1985. The sub-regions differ considerably in their trends, however, and these differences will be commented on briefly.

Table 62

LATIN AMERICA: FUTURE REQUIREMENTS FOR FUELWOOD BY SUB-REGIONS

Sub-region	Requirements in thousands of cubic metres (r)			
	1956-59	1970	1975	1985
Mexico	8,800	8,600	8,400	7,900
Central America	15,000	18,200	19,700	23,300
The Caribbean islands.....	11,800	12,300	12,500	13,000
Northern South America..	29,000	32,600	32,900	34,200
South-west South America	10,800	9,700	9,300	8,600
Brazil	90,400	108,800	109,800	110,800
South-east South America	12,000	11,600	10,400	9,200
Latin America	177,800	201,800	203,000	207,000

Source: ECLA, on the basis of national statistics.

Table 63

LATIN AMERICA: FUTURE PER CAPITA REQUIREMENTS FOR FUELWOOD BY SUB-REGIONS

Sub-region	Per capita requirements in cubic metres (r)			
	1956-59	1970	1975	1985
Mexico	0.27	0.18	0.16	0.11
Central America	1.34	1.16	1.09	0.95
The Caribbean islands	0.61	0.49	0.45	0.36
Northern South America	1.15	0.91	0.80	0.62
South-west South America	0.51	0.34	0.26	0.20
Brazil	1.44	1.29	1.15	0.89
South-east South America	0.49	0.39	0.32	0.24
Latin America	0.90	0.76	0.67	0.53

Source: ECLA, on the basis of national statistics.

The future per capita requirements for fuelwood in each sub-region are shown in table 63. In the region as a whole, per capita requirements are expected to decline 40 per cent by 1985. This same downward trend is evidenced by every sub-region, although they differ in the rate at which the per capita consumption is expected to drop. The average per capita consumption of fuelwood in Latin America is higher than in any other major region of the world. Despite the expected future decrease, Latin American per capita requirements in 1985 will still be about 60 per cent higher than the present world average.

Mexico

Per capita consumption of fuelwood in Mexico is now the lowest of any sub-region and is expected to maintain that relative position in the future. By 1985 it is expected to be only about 40 per cent of what it now is. The Mexican government has followed a deliberate policy of making kerosene available at low prices and there is no reason to assume that this policy will change. The total consumption will still represent a substantial drain on the country's forests, which are much more valuable for other wood products.

Central America

A substantial increase in the total requirements for fuelwood is anticipated in this sub-region, despite the decline in per capita consumption, because of the rapid rate of population growth. The expected requirements for three of the countries are as follows (in millions of cubic metres):

	1956-59	1970	1975	1985
Costa Rica	1.2	1.5	1.7	2.0
El Salvador	2.7	3.1	3.3	3.7
Guatemala	5.2	6.4	7.0	8.3

It is interesting that the requirements for fuelwood in Guatemala may exceed those of Mexico by 1985 although the population will be much smaller. Central America is short of other fuels and does have potentially very productive forest resources, so wood will undoubtedly continue to be an important fuel in the future.

The Caribbean islands

Per capita requirements are expected to decline considerably in the islands but the total consumption will continue to rise. This sub-region has only limited possibilities of domestic production of other fuels and will have to import most of what it uses. Such imports are expected to increase, but the sub-region's forests will still have to provide a substantial part of the fuel needed.

Northern South America

This has been one of the large fuelwood consuming sub-regions and requirements are expected to continue to increase in the future. Per capita consumption is expected to decrease about 50 per cent as a result of the substitution of other fuels which are available in Colombia and Venezuela. However, this is another sub-region with rapid population growth and the gradual opening up of the under-developed areas will mean that for many people wood will still be the most available fuel. Future requirements in the major countries are expected to be as follows (in millions of cubic metres):

	1956-59	1970	1975	1985
Colombia	21.9	25.1	25.2	25.9
Ecuador	2.4	3.0	3.2	3.8
Venezuela	4.4	4.1	4.1	4.0

South-west South America

The downward trend in total fuelwood consumption which this sub-region exhibited in the past is expected to continue in the future. Per capita consumption will drop some 60 per cent by 1985. The requirements for two of the countries will be as follows (in millions of cubic metres):

	1956-59	1970	1975	1985
Chile	3.2	3.1	3.0	2.9
Peru	2.3	2.4	2.6	2.7

There is a strong trend toward the cities in Chile and by 1975 it is expected that three-fourths of the population will be urban. In addition the country has hydroelectric power and petroleum resources which will provide much of the fuel for the urban population. Peru will continue to have a larger rural population and is actively promoting settlement of the forested regions east of the cordillera.

Brazil

Brazil has had the highest per capita consumption of fuelwood in Latin America, and despite the considerable decline which is anticipated in the future it will still share that honour with Central America in 1985. Despite the growth of the cities, over half of the population will still be rural in 1985. Wood is generally available, income of the rural population is low, and other fuels will displace wood only slowly.

South-east South America

This sub-region has had a relatively low per capita consumption and is one of the areas in which the total consumption of fuelwood is expected to decline in the future. The requirements for the individual countries are expected to be as follows (in millions of cubic metres):

	1956-59	1970	1975	1985
Argentina	9.7	9.1	7.7	6.1
Paraguay	1.3	1.6	1.8	2.3
Uruguay	1.0	0.9	0.9	0.8

Paraguay, with abundant forests and little in the way of other sources of fuel, is expected to continue to increase its consumption of fuelwood. Argentina is developing its petroleum and coal resources and has a very high average income; with many of the people living in the cities or in the lightly forested sections,

these other fuels are expected to replace wood. Uruguay does not have other sources of fuel and has found that it can grow wood rapidly in plantations. Consumption is expected to decline but wood will remain an important source of fuel.

Pulp products

The consumption of pulp products is expected to increase greatly in all Latin American countries in the future. By 1985 the total requirements for all pulp products may amount to six times the 1956-59 consumption. Since wood will be the raw material for much of the pulp going into these products, pulpwood will occupy a place of growing importance in the total Latin American consumption of wood.

The past consumption statistics for pulp and paper are better than for any other wood product. There is also more information available on the relationship of consumption to income. The estimated requirements presented here are therefore probably more reliable indicators than those for the other products. It has been possible to separate out four major classes of pulp product or end uses, and to take into account the different factors that affect their consumption.

Mexico

The total requirements for pulp products in Mexico are expected to be 1 million tons in 1970, to increase to 1.4 million tons in 1975, and to reach 2.9 million tons in 1985. These figures represent increases over the 1956-59 consumption of 250 per cent by 1975 and 600 per cent by 1985. The division of these future requirements among the major product groups is shown in table 64. The ranking of the products in terms of quantity is expected to remain about the same, with paperboard increasing its proportion of the total somewhat and newsprint dropping back a little. The per capita consumption in Mexico is about average for the region, but the total consumption is expected to increase faster than that of the region because the population of Mexico is growing at a faster rate.

Table 64

Mexico: Future annual requirements for pulp products by end use

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	79	180	260	500
Printing and writing papers	73	180	260	520
Other papers	136	400	530	1,000
Paperboard	125	240	400	900
All pulp products	413	1,000	1,400	2,900
Tons per 1,000 inhabitants	13	22	27	42
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	1,000	1,600	2,400	5,500

Source: ECLA, on the basis of national statistics.

Central America

The total requirements for pulp products in Central America are expected to be 130,000 metric tons in 1970, to increase to 180,000 in 1975, and to reach 390,000 in 1985. These figures represent increases over the 1956-59 consumption of 260 per cent by 1975 and 650 per cent by 1985.

The future requirements are expected to be distributed among the countries as follows (in thousands of metric tons):

	1956-59	1970	1975	1985
British Honduras	—	1	1	3
Costa Rica	9	24	35	74
El Salvador	11	25	37	79
Guatemala	12	26	39	86
Honduras	4	9	14	29
Nicaragua	4	11	16	35
Panama	12	29	41	81

No major differences between countries in the rates of increase are expected. Per capita consumption is higher in Costa Rica and El Salvador and this situation is expected to continue.

The division of these requirements among the major products groups is shown in table 65. Requirements for paperboard are expected to increase faster than those for the papers and it is expected to be the major product in terms of volume in 1985. Per capita consumption has been the lowest in Latin America and the sub-region is expected to occupy this same relative position in the future. This has been a result of the low average income and the lack of domestic manufacturing facilities. Per capita consumption is expected to rise but it has a long way to go to catch up with the rest of the region.

Table 65

Central America: Future annual requirements for pulp products by end use

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	16	37	54	110
Printing and writing papers	8	18	26	55
Other papers	19	38	52	100
Paperboard	9	32	51	120
All pulp products	52	120	180	390
Tons per 1,000 inhabitants	5	8	10	16
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	149	360	520	1,100

Source: ECLA, on the basis of national statistics.

The Caribbean islands

The total requirements for pulp products in the Caribbean islands are expected to be 560,000 metric tons in 1970, to increase to 780,000 in 1975, and to reach 1.5 million tons by 1985. This would amount to increases over the 1956-59 consumption of 210 per cent by 1975, and 490 per cent by 1985.

The future requirements are expected to be distributed among the countries as follows (in thousands of metric tons):

	1956-59	1970	1975	1985
Cuba	155	340	450	820
Dominican Republic	12	27	40	90
Haiti	3	7	11	24
Other islands	85	190	280	580

Cuba will maintain its dominant position in the sub-region, but consumption is expected to increase at a faster rate in the other islands because of their lower use in the past.

The division of these future requirements among the major product groups is shown in table 66. Paperboard consumption is expected to increase more rapidly than that of any other pulp product. Per capita consumption in the islands has been about average for the region. Despite the scarcity of local wood supplies, the sub-region is expected to maintain that position through the use of bagasse and the importation of pulp and paper. The bulk of the pulpwood equivalents shown in table 66 will probably not represent a drain on the sub-region's forests, although with proper management they should be capable of supporting a limited domestic woodpulp industry.

Table 66

THE CARIBBEAN ISLANDS: FUTURE ANNUAL REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	60	130	180	340
Printing and writing papers	34	78	100	210
Other papers	100	200	270	480
Paperboard	61	150	230	480
All pulp products	255	560	780	1,500
Tons per 1,000 inhabitants	31	23	28	42
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	730	1,100	1,500	2,900

Source: ECLA, on the basis of national statistics.

Northern South America

The total requirements for pulp products in Northern South America are expected to be 730,000 metric tons in 1970, to increase to 1.1 million tons in 1975, and to reach 2.5 million tons by 1985. Such figures would indicate increases over the 1956-59 consumption of 340 per cent in 1975 and 880 per cent in 1985.

The future requirements are expected to be distributed among the countries as follows (in thousands of metric tons):

	1956-59	1970	1975	1985
Colombia	106	290	430	880
Ecuador	15	40	59	130
Venezuela	126	390	600	1,400
The Guianas	4	9	14	32

The largest expansion is expected in Venezuela, where there is already some domestic production. Venezuela has the highest average income in Latin America, and if the distribution of this income among the population improves in the future there will be a substantial domestic market for all types of paper products.

The division of these future requirements among the major product groups is shown in table 67. As in most other sub-regions, the consumption of paperboard is expected to grow rapidly, and by 1985 it will be the dominant product. Per capita consumption has been below the regional average, but is expected to increase more rapidly so that after 1970 it will be above the average. Eventually, the pulpwood for this consumption should all come from domestic forests, since this sub-region has adequate forest resources and pine plantations are feasible for long fibre production.

Table 67

NORTHERN SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	53	150	210	440
Printing and writing papers	49	150	230	520
Other papers	97	240	350	740
Paperboard	53	190	310	770
All pulp products	252	730	1,100	2,500
Tons per 1,000 inhabitants	10	20	27	45
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	800	1,600	2,500	5,300

Source: ECLA, on the basis of national statistics.

South-west South America

The total requirements for pulp products in South-west South America are expected to be 380,000 metric tons in 1970, to increase to 540,000 in 1975, and to reach 1.1 million tons in 1985. This would mean an increase over the 1956-59 consumption of 260 per cent in 1975 and of 640 per cent in 1985.

The future requirements are expected to be distributed among the countries as follows (in thousands of metric tons):

	1956-59	1970	1975	1985
Bolivia	5	12	17	34
Chile	80	200	270	530
Peru	65	170	250	550

Chile has been the largest consumer, but Peru with its larger population is expected to forge ahead eventually. Chile already has a substantial pulp and paper industry, based mainly on the pine plantations, and there are plans for considerable expansion. Peru manufactures pulp mainly from bagasse, but may eventually develop production from wood in Amazonia.

The division of these requirements among the major product groups is shown in table 68. It is expected that newsprint consumption will increase considerably —in part because of domestic production in Chile—and that in 1985 it will still be almost as large as the consumption of paperboard. Per capita consumption is low in this sub-region, and will probably still be well below the regional average in 1985. Consumption in Bolivia has been very low and is not expected to increase rapidly. It is possible that as the pulp and paper industry grows in Chile and Peru it may actively seek domestic markets and consumption may increase more rapidly than the requirements presented here indicated. The pulpwood part of the raw material used for domestic production should come from local forests, and the 2.6 million cubic metres indicated for 1985 should place no serious drain on these resources if they are developed as they should be.

Table 68

SOUTH-WEST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	42	110	150	320
Printing and writing papers	24	69	96	190
Other papers	51	100	140	250
Paperboard	32	100	150	340
All pulp products	149	380	540	1,100
Tons per 1,000 inhabitants	7	13	15	26
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	360	940	1,300	2,600

Source: ECLA, on the basis of national statistics.

Brazil

The total requirements for pulp products in Brazil are expected to be 1.4 million metric tons in 1970, to increase to 2.0 million in 1975, and to reach 3.9 million tons in 1985. This would represent increases over the 1956-59 consumption of 240 per cent by 1975 and 580 per cent by 1985. The division of these future requirements among the major product groups is shown in table 69.

The largest use in Brazil is for newsprint, and this will continue to be a major item of consumption. At present a large part of the newsprint is imported but the country has the potential for domestic production. The other papers are now mostly produced in Brazil and in the future certainly all will be. The wood requirements of 10.2 million cubic metres expected for 1985 will therefore probably all come from domestic forests. Per capita consumption in Brazil has been slightly below the average for the region and is expected to maintain that relationship. Of course, since Brazil consumes over a quarter of the pulp products in the region, developments in this country have a heavy influence on the regional average.

Table 69

BRAZIL: FUTURE ANNUAL REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	204	480	670	1,300
Printing and writing papers	109	340	480	970
Other papers	186	340	450	750
Paperboard	81	230	360	910
All pulp products	580	1,400	2,000	3,900
Tons per 1,000 inhabitants	9	17	21	31
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	1,460	3,300	4,800	10,200

Source: ECLA, on the basis of national statistics.

South-east South America

The total requirements for pulp products in South-east South America are expected to be 960,000 metric tons in 1970, to increase to 1.2 million tons in 1975, and to reach 1.9 million tons in 1985. These figures represent increases over the 1956-59 consumption of 120 per cent in 1975 and 250 per cent in 1985.

The future requirements are expected to be distributed among the countries as follows (in thousands of metric tons):

	1956-59	1970	1975	1985
Argentina	476	840	1,100	1,700
Paraguay	3	5	6	12
Uruguay	62	110	130	200

Argentina is the predominant consumer and Paraguay is expected to be still a minor consumer in the future.

The division of these requirements among the major product groups is shown in table 70. This sub-region has had the highest per capita consumption in Latin America and will maintain this position in the future. Paperboard consumption in particular is expected to grow very rapidly. There is already a substantial pulp and paper industry in the sub-region, and if advantage is taken of the possibilities of fast-growing plantations this area should be able to supply its own needs for pulpwood in the future.

Table 70

SOUTH-EAST SOUTH AMERICA: FUTURE ANNUAL REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	167	270	330	500
Printing and writing papers	98	200	250	400
Other papers	165	240	280	400
Paperboard	110	250	340	580
All pulp products	540	960	1,200	1,900
Tons per 1,000 inhabitants	22	32	37	50
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	1,250	2,400	3,100	4,800

Source: ECLA, on the basis of national statistics.

FUTURE REQUIREMENTS FOR PULP PRODUCTS: SUMMARY

The information for the individual sub-regions is now assembled in table 71 to show the future requirements for pulp products in Latin America as a whole.

The total requirements for pulp products in Latin America are expected to double by 1970, to triple by 1975, and to be six times the 1956-59 consumption in 1985. This will result from the large increase in the population and the anticipated substantial increase in per capita consumption. The amount of pulpwood required to produce these pulp products will increase in approximately the same proportions as the requirements for the finished products.

Table 71

LATIN AMERICA: FUTURE REQUIREMENTS FOR PULP PRODUCTS BY END USE

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Newsprint	620	1,400	1,900	3,500
Printing and writing papers	400	1,000	1,400	2,900
Other papers	750	1,600	2,100	3,700

Table 71 (continued)

End use	Requirements in thousands of metric tons			
	1956-59	1970	1975	1985
Paperboard	470	1,200	1,800	4,100
All pulp products	2,250	5,200	7,200	14,200
Tons per 1,000 inhabitants	11	19	24	37
Pulpwood equivalent of wood-based pulp products (thousand cubic metres of roundwood)	5,800	11,300	16,200	32,400

Source: ECLA, on the basis of national statistics.

Future requirements for wood products: summary

The future requirements of Latin America for wood products have been estimated in detail by product groups and sub-regions. This information will now be brought together to give an over-all picture of future requirements in the region as a whole.

Table 72 presents the future requirements of the region for each of the major product groups in the units in which they are commonly measured. The most rapid increase in future requirements is expected in the groups of wood-based sheet materials, with the pulp products group close behind. A major expansion of industry will be needed in Latin America if the future requirements for these two groups of products are to be met. Requirements for fuelwood will increase less than for any other product, but will be 16 per cent higher in 1985 than in 1956-59.

Table 73 presents the future requirements in terms of the volume of roundwood required to make the products shown in table 72. The great importance of fuelwood as a consumer good and also as a drain on the forests is brought out by this table. In 1956-59 80 per cent of the wood volume consumed was in the form of fuel. In 1985, despite rapid growth requirements for other products and diminishing per capita use of fuelwood, this product will still make up almost two-thirds of the total volume. Roundwood, requirements for industrial uses (everything except fuel) will be almost three times as much in 1985 as at present. Since quality of the wood is more important in these uses than in fuelwood, this will mean a heavy drain on the region's forests. If that timber is to be available in the future, a start must be made immediately on building up the productive capacity of the forest resources.

Since there are large differences between various parts of Latin America, a comparison of the requirements in the various sub-regions is helpful. Table 74 presents the total future wood requirements (equivalent volumes in roundwood) for each of the sub-regions, and table 75 presents the same information for industrial wood alone. The dominant position of Brazil in the wood-products economy of Latin America shows up clearly—almost half the total regional consumption of wood takes place in Brazil. In terms of industrial wood, Brazil's share is smaller but still amounts to 40 per cent of the regional total. South-east South America, because of its high income, has been a large consumer of wood products and in particular industrial wood. It will lose its relative standing in the region, however, as the other sub-regions increase more rapidly in population and income. Table 75 shows that the requirements for industrial wood will be rather uniformly distributed throughout the region by 1985. It is clear that the forest resources and industries will be important in all parts of Latin America and that their development is a genuine regional problem.

A more detailed picture of the future situation of Latin America with regard to wood requirements is presented in tables 76 and 77 which show, for 1975 and 1985 respectively, the requirements by both product groups and sub-regions. These tables bring out the changing position of fuelwood, which by 1985 will no longer outweigh all other products combined in three of the sub-regions. By 1985 wood requirements for pulp products will have become more important than those for roundwood products in every sub-region, and in Mexico they will almost equal the volume required for sawnwood. Sawnwood will remain the most important product group up to 1985, but both pulp products and sheet materials will be gaining on it rapidly.

Two over-all conclusions appear justified by these requirements estimates. First, the potential future consumption of wood products is very large in all parts of Latin America and the wood-using industries should therefore receive considerable emphasis in industrial development planning for the region. Second, the quantity of wood needed as the raw material to meet these future requirements will be very large and will continue to increase rapidly. The region's forests are potentially capable of supplying such quantities of wood on a continuous basis, but only if their productive capacity is developed and maintained by intelligent management. As a corollary of this second conclusion, the rate at which the requirements for wood are expected to increase indicates that immediate and large-scale action is needed to develop the forests if their yield is to be increased in time to take care of the needs of the future.

Table 72

LATIN AMERICA: FUTURE REQUIREMENTS FOR WOOD PRODUCTS

Product group	Unit of measurement	Requirements in units			
		1956-59	1970	1975	1985
Sawnwood	1,000 m^3 (s)	13,600	20,400	23,100	31,800
Roundwood products	1,000 m^3 (r)	7,500	9,800	10,600	12,900
Sheet materials	1,000 m^3 (s)	640	1,700	2,400	5,000
Pulp products	1,000 tons	2,250	5,200	7,200	14,200
Fuelwood	1,000 m^3 (r)	177,800	201,800	203,000	207,000

Source: ECLA, on the basis of national statistics.

Table 73

LATIN AMERICA: ROUNDWOOD EQUIVALENT OF FUTURE WOOD PRODUCT REQUIREMENTS

Product group	Equivalent roundwood volume (1,000 m³)			
	1956-59	1970	1975	1985
Sawnwood	28,000	42,000	47,100	64,400
Roundwood products	7,500	9,800	10,600	12,900
Sheet materials	1,500	3,400	4,700	9,200
Pulp products	5,800	11,300	16,200	32,400
All industrial wood	42,800	66,500	78,600	118,900
Fuelwood	177,800	201,800	203,000	207,000
All wood products	220,600	268,300	281,600	325,900

Source: ECLA, on the basis of national statistics.

Table 74

LATIN AMERICA: TOTAL FUTURE WOOD REQUIREMENTS BY SUB-REGIONS

Sub-region	Roundwood equivalent of future requirements (1,000 cubic metres)			
	1956-59	1970	1975	1985
Mexico	13,200	15,700	17,200	21,800
Central America	17,700	22,400	24,900	31,700
The Caribbean islands	15,300	17,100	18,400	22,600
Northern South America	34,800	41,900	44,300	51,600
South-west South America	14,200	15,100	15,500	17,200
Brazil	107,600	135,800	141,300	159,300
South-east South America	17,800	20,300	19,900	21,700
Latin America	220,600	268,300	281,500	325,900

Source: ECLA, on the basis of national statistics.

Table 75

LATIN AMERICA: FUTURE REQUIREMENTS FOR INDUSTRIAL WOOD BY SUB-REGIONS

Sub-region	Roundwood equivalent of future requirements (1,000 cubic metres)			
	1956-59	1970	1975	1985
Mexico	4,500	7,100	8,800	13,900
Central America	2,700	4,200	5,200	8,400
The Caribbean islands	3,500	4,800	5,900	9,600
Northern South America	5,800	9,300	11,400	17,400
South-west South America	3,400	5,300	6,200	8,600
Brazil	17,200	27,700	32,500	50,500
South-east South America	5,800	8,700	9,500	12,500
Latin America	42,800	67,100	79,500	120,900

Source: ECLA, on the basis of national statistics.

Table 76

LATIN AMERICA: 1975 WOOD REQUIREMENTS BY SUB-REGIONS AND MAJOR PRODUCT GROUPS

(Thousand cubic metres of equivalent roundwood volume)

Sub-region	Sawnwood	Roundwood products	Sheet materials	Pulp products	All industrial wood	Fuelwood	All wood products
Mexico	4,500	1,400	430	2,400	8,700	8,400	17,100
Central America	3,600	860	250	520	5,200	19,700	24,900
The Caribbean islands	3,300	820	330	1,500	6,000	12,500	18,500
Northern South America	6,400	2,000	480	2,500	11,400	32,900	44,300
South-west South America	3,300	1,400	200	1,300	6,200	9,300	15,500
Brazil	20,600	3,600	2,500	4,800	31,500	109,800	141,300
South-east South America	5,400	510	510	3,100	9,500	10,400	19,900
Latin America	47,100	10,600	4,700	16,100	78,500	203,000	281,500

Source: ECLA, on the basis of national statistics.

Table 77

LATIN AMERICA: 1985 WOOD REQUIREMENTS BY SUB-REGIONS AND MAJOR PRODUCT GROUPS

(Thousand cubic metres of equivalent roundwood volume)

Sub-region	Sawnwood	Roundwood products	Sheet materials	Pulp products	All industrial wood	Fuelwood	All wood products
Mexico	5,700	1,900	820	5,500	13,900	7,900	21,800
Central America	5,600	1,100	640	1,100	8,400	23,300	31,700
The Caribbean islands	5,100	940	680	2,900	9,600	13,000	22,600
Northern South America	8,800	2,200	1,100	5,300	17,400	34,200	51,600
South-west South America	3,900	1,700	410	2,600	8,600	8,600	17,200
Brazil	29,100	4,500	4,700	10,200	48,500	110,800	159,300
South-east South America	6,200	570	880	4,800	12,500	9,200	21,700
Latin America	64,400	12,900	9,200	32,400	118,900	207,000	325,900

Source: ECLA, on the basis of national statistics.

PART IV

TRADE

The preceding two chapters have described the past consumption of forest products in Latin America and presented estimates of the possible future consumption. Part II described the forest resources and industries which supply products for this consumption. But not all of the wood products used in Latin America are produced in the consuming countries and not all of the production is consumed in the producing countries.

International trade is a possible way to obtain products for consumption and to find profitable markets for the yield from a country's resources. This part of the report will describe briefly the past pattern of commerce in wood products among the Latin American countries and of trade between this region and other parts of the world. Chapter 10 will then consider how international trade might help in covering future domestic requirements and in making the most of the potential productivity of the region's forest resources.

Chapter 7. Trade in forest products

In 1958 the Latin American countries exported 100 million dollars' worth of forest products and imported somewhat over 300 million dollars' worth. Timber was a small component of the region's trade, making up only 1 per cent of the value of the exports and not quite 4 per cent of the imports. Latin America played a minor role in world forest products trade, contributing only 2 per cent of the value of all exports and taking only 6 per cent of all imports. Up to now international trade has been a minor factor in the timber economy of the region. In 1958 Latin America exported less than 2 per cent of the volume removed from its forests and imported only 3 per cent of the volume it consumed.

Such regional averages and generalized statistics give a false impression of the significance of international trade for Latin America. For example, there is little trade in fuelwood, which makes up a large proportion of total wood consumption. But there is a relatively large amount of trade in products such as sawnwood and woodpulp. Some countries are practically self-sufficient in wood products, but others like Argentina and the Caribbean islands depend heavily on imports. These differences will be brought out in the following sections.

Composition of forest products trade

Pulp and paper is the most important group of forest products in world trade and contributes over half of the value of all forest products traded. Next most important is processed wood products such as sawnwood, veneers and plywood. Roundwood products —such as logs, poles and mine timbers—make up less than 10 per cent of the forest products commerce.

Table 78 shows how the pattern of Latin American trade compares with this world picture. The import pattern resembles the world average, with a greater concentration on pulp and paper products, but the export pattern is strikingly different. Pulp and paper make up over two-thirds of the value imported but contribute only 5 per cent of the value exported. Only about two-tenths of 1 per cent of the total world exports of pulp and paper originate in Latin American countries. The most important Latin American exports are the processed wood products, and these countries contribute about 5 per cent of the world exports of them. Roundwood products are more important in Latin American exports than in world commerce. Thus Latin America is at present primarily an exporter of roundwood and processed-wood products and Quebracho extract, and an importer of pulp and paper and processed-wood products.

Table 78

Composition of international forest products trade in 1958 and 1959

(Percentage of total value)

Class of product	*Total world trade*	*Latin American trade*	
		Imports	*Exports*
Roundwood products	9	5	13
Processed-wood products	33	27	63
Pulp and paper products	58	68	5
Quebracho extract	—	—	19
Total	100	100	100

Source: FAO, *Yearbook of Forest Products Statistics*, 1960, and ECLA, *Economic Bulletin for Latin America*, vol. V, No. 2, October 1960.

Table 79

Composition of Latin American trade in roundwood and processed-wood products, 1956-58

(Percentages)

Product	*Volume*		*Value*	
	Imports	*Exports*	*Imports*	*Exports*
Sawn lumber	83	81	80	83
Sawlogs and veneer logs	13	16	12	14
Posts and poles	2	1	2	1
Plywood and veneer	1	1	5	2
Sleepers	1	1	1	‡
Fuelwood and charcoal	..	..	..	..
Particle-board	..	..	..	..
	100	100	100	100

Source: Official foreign trade statistics.

The actual trade situation can be seen better in a more detailed break-down. Table 79 shows the relative importance of the major roundwood and processed-wood products in terms of both volume and value.

Sawn lumber is clearly the outstanding product in this group, making up over three-fourths of the value of both imports and exports. In fact, sawn lumber occupies a dominant place in the export picture as a whole, since it represents 63 per cent of the total value of all forest product exports, including pulp and paper. It is relatively less important in the import picture because of the predominance of pulp and paper, but one-fourth of the imports consists of sawnwood.

Sawlogs and veneer logs comprise the second most important product in this group. Because of their relatively lower value, they provide a larger proportion of the tonnage than of the value of both imports and exports. Sawnwood and logs together account for the major part of Latin American trade, leaving less than 10 per cent for all other roundwood and processed-wood products. In fact, these two products account for over 90 per cent of the export value, even when pulp and paper products are included.

The sawnwood which enters into external trade is predominantly of coniferous species but the logs are almost entirely of non-coniferous species. These species made up the following proportion of the volume of exports and imports of these products in 1956-58:

	Sawnwood		*Logs*	
	Imports	*Exports*	*Imports*	*Exports*
Coniferous woods ...	90	88	1	1
Non-coniferous woods	10	12	99	99

The bulk of the world trade in sawnwood—89 per cent—consists of coniferous woods. It is interesting that despite the predominance of non-coniferous species in the forests of Latin America, the external trade in sawnwood closely follows the world pattern. The trade in logs is largely intra-regional, however, and consists mostly of the more available non-coniferous species.

Table 80 shows the relative importance of the products in the pulp and paper category. The limited exports of this group consist largely of newsprint, with woodpulp as the second most important item. Newsprint is also most important among the imports, though not as dominant as in exports. Woodpulp is again in second place, but the imports of printing, writing and other papers have a total value almost as great as that of the imported pulp. Imports of board are of relatively minor significance.

Table 80

COMPOSITION OF LATIN AMERICAN TRADE IN PULP AND PAPER PRODUCTS IN 1958 AND 1959

(Percentage of total value)

Product	*Imports*	*Exports*
Newsprint	42	75
Woodpulp	27	15
Printing and writing paper.....	12	
Other papers	13	3
Paperboard	4	‡
Fibreboard	2	7
	100	100

Source: FAO, *Yearbook of Forest Products Statistics*, 1960.

Quebracho extract for tanning is exported by only two countries—Argentina and Paraguay. However, the quantity exported has been sufficiently large and its value is greater than that of any other wood products exported by the whole region except sawnwood.

TRENDS IN FOREST-PRODUCTS TRADE

The total volume of Latin American trade in wood products other than pulp and paper has increased substantially in the past twenty-five years. Table 81 shows that this has been true of both imports and exports. Exports have increased most rapidly, being five times as large in 1956-58 as they were in 1934-38. During the same period, imports of such products doubled.

Table 81 shows that trade in wood products has increased more rapidly within the region than it has between Latin America and the rest of the world. Exports to countries outside the region have continued to increase, though at a slower rate than intra-regional exports. But imports from outside countries actually decreased while those from countries within the region were increasing materially. There has been a marked trend towards greater regional self-sufficiency, but this has not prevented an increase in exports from the region.

Table 81

LATIN AMERICA: PAST TRADE IN WOOD PRODUCTS OTHER THAN PULP AND PAPER[a]

(Thousand metric tons)

	Latin American exports			*Latin American imports*	
Period	*To the world*	*To the region*	*Percentage to the region*	*From the world*	*Percentage from the region*
1934-38	405	232	57	822	28
1946-51	1,266	768	60	1,142	67
1956-58	2,015	1,366	68	1,730	74

Source: ECLA, *Study of Inter-Latin American Trade* (United Nations publication, Sales No.: 53.II.G.4) and official foreign trade statistics.

[a] For the twenty republics only.

Latin America has changed from a net importer of wood products (other than pulp and paper) to a net exporter during the last twenty years, as the following figures on trade with countries outside the region show (in thousands of tons):

Period	*Exports*	*Imports*	*Surplus of exports*
1934-38	173	554	—381
1946-51	498	342	156
1956-58	648	446	202

It is significant that Latin America has been able to increase its exports to the rest of the world during a period in which exports to other countries within the region were increasing almost five-fold.

The same general pattern of development has taken place in pulp and paper trade, as shown in table 82. However, the increasing production of pulp products has been almost completely absorbed by domestic consumption within the producing countries, so that relatively little has been available for export either to other Latin American countries or to the rest of the world. Only a small part of the total regional imports has been supplied by other Latin American countries. Latin America is still a net importer of pulp and paper and will probably continue to be for some time.

Table 82

LATIN AMERICA: HISTORICAL TRADE IN PULP AND PAPER[a]
(Thousands of metric tons)

Period	Total Latin American exports	Latin American imports	
		Total	Percentage from the region
1934-38	0.3	583	0.05
1946-51	3.3	868	0.06
1956-58	7.1	1,237	0.60

Source: ECLA, *Study of Inter-Latin American Trade*, op. cit., and *Pulp and paper in Latin America* (E/CN.12/570); (United Nations publication, Sales No.: 53.II.G.2).

[a] For the twenty republics only.

The export trade in quebracho extract for tanning has exhibited an opposite tendency. The average annual exports during three periods in the past were as follows (in thousands of tons):

1936-39	239
1946-50	212
1956-59	142

The competition of other tanning materials, and in particular synthetic materials, has seriously affected the world market for quebracho extract. However, it still is exported in significant volumes and represents an important source of foreign exchange for the exporting countries.

ORIGINS AND DESTINATIONS OF TRADE

The previous sections have discussed Latin American wood products trade without specifying where the imports came from or where the exports went to. However, there is a definite pattern of trade which is significant in understanding the situation. In this section details will be given about the origins of imports and destinations of exports. The trade with other countries within the same sub-region is here separated from trade with other Latin American countries. Northern North America (Canada and the United States) and Europe are important regions for wood products trade with Latin America and are therefore shown separately. No other region or country carries on sufficient trade to justify separate mention.

Over two-thirds of the foreign trade of Latin American countries in wood products other than pulp and paper is with other Latin American countries. Table 83 shows for each of these products the average annual volume imported by the Latin American countries during 1956-58 from various parts of the world. Of the total, 71 per cent came from other Latin American countries and 26 per cent from Canada or the United States. The rest of the world is relatively unimportant as a supplier of these products to Latin America, with the exception of plywood and veneer, of which 28 per cent comes from Europe and 11 per cent from the rest of the world.

The export picture as seen in table 83 is similar except that the western hemisphere is somewhat less dominant. It receives only 83 per cent of the exports but supplies 97 per cent of the imports. Europe provides an important market for some Latin American products, particularly sleepers, posts, and sawnwood. The trade in logs is mainly between countries within the sub-regions. Almost no logs are imported from outside Latin America, and less than one-fourth of the log exports go outside the region. The high shipping cost in relation to value is one reason for not shipping logs over long distances. But perhaps even more important is the desire of the exporting countries to obtain the domestic benefits of carrying processing as far as possible before exporting the product.

Table 83

LATIN AMERICA: ORIGINS AND DESTINATIONS OF TRADE IN WOOD PRODUCTS OTHER THAN PULP AND PAPER BY PRODUCT GROUPS, 1956-58
(Annual volume in thousands of cubic metres)

Product group	Within own sub-region	Rest of Latin America	Canada and United States	Europe	Rest of the world	Total
Imports:						
Sawnwood	98	986	450	53	7	1,594
Logs	203	44	1	1	..	249
Veneers and plywood	1	9	9	8	3	30
Sleepers	1	2	19	—	—	22
Posts	17	5	16	‡	—	38
TOTAL	319	1,046	495	62	11	1,933
		1,365				
Percentage of total	17	54	26	3	—	100
		71				
Exports:						
Sawnwood	68	1,064	261	232	77	1,702
Logs	214	51	61	16	..	342
Veneers and plywood	1	10	8	1	..	20
Sleepers	..	4	—	20	—	24
Posts	16	6	..	12	—	34
TOTAL	299	1,135	330	281	77	2,122
		1,434				
Percentage of total	14	53	16	13	4	100
		67				

Source: Official foreign trade statistics.

Table 84

LATIN AMERICA: ORIGINS OF IMPORTATIONS OF PULP AND PAPER, 1956-58

(Annual quantity in thousands of metric tons)

Product group	*Canada and United States*	*Scandinavian countries*	*Other countries*	*Total*
Pulp	92	273	19	384
Paper and board	469	307	77	853
TOTAL	561	580	96	1,237
Percentage of total	45	47	8	100

Source: *Pulp and paper in Latin America*, op. cit.

The origins of the imported pulp and paper are shown in table 84. Exports by Latin American countries and imports from other regional countries have been insignificant in the total. The Scandinavian countries and Northern North America share almost equally as sources of pulp and paper for Latin America. Scandinavia is the dominant supplier of pulp, providing 71 per cent of the total. But 55 per cent of the paper and board comes from the United States and Canada and only 36 per cent from Scandinavia. All the rest of the world together provides only 8 per cent.

Quebracho extract is exported by Argentina and Paraguay to almost all parts of the world. The average annual distribution of these exports during the period 1956-59 was as follows (in thousands of tons):

Latin America	21
Canada and the United States	56
Europe	57
Rest of the world	8
TOTAL EXPORTED	142

The major markets are in northern North America and Europe; only about one-fifth of the extract exported stays within the Latin American region.

The individual sub-regions do not all follow the same pattern of trade. In order to bring out these differences, table 85 shows the trade of the individual sub-regions with the various parts of the world recognized in table 83. In table 85, however, the volumes of all wood products other than pulp and paper have been combined to show the total trade of the sub-regions.

Most of the wood products, other than pulp and paper, imported by Mexico and South-west South America originate in the United States or Canada. This area is also an important source for the Caribbean islands and Northern South America, although those sub-regions import heavily from Latin America. The Central American countries obtain most imports within their own sub-region. South-east South America imports mainly from Latin America and a substantial part of the imports come from within the sub-region itself.

Most of Mexico's exports go to the United States and Canada, which is also a major market for Central and Northern South America. Europe is an important market for Brazil and Northern South America, and Brazil and Central America also send substantial quantities to other parts of the world. The Caribbean islands and South-east South America export little outside their own sub-regions. Latin America is the dominant market for Brazil, Central America, and South-west South America.

Table 85

LATIN AMERICA: ORIGINS AND DESTINATIONS OF TRADE IN WOOD PRODUCTS OTHER THAN PULP AND PAPER BY SUB-REGIONS, 1956-58

(Annual volume in thousands of cubic metres)

	Within own sub-region	*Rest of Latin America*	*Canada and United States*	*Europe*	*Rest of the world*	*Total*
Imports:						
Mexico	—	7	53	..	‡[a]	61
Central America	51	..	6	..	..	57
The Caribbean islands	16	145	270	10	6	447
Northern South America	18	74	79	3	1	175
South-west South America	2	1	80	1	..	84
Brazil	—	—	—	—	—	—
South-east South America	232	819	7	48	3	1,109
LATIN AMERICA		1,365	495	62	11	1,933
Exports:						
Mexico	—	1	189	..	—	190
Central America	38	210	44	8	39	339
The Caribbean islands	10	—	1	3	1	15
Northern South America	17	31	66	42	1	157
South-west South America	1	90	5	3	..	99
Brazil	—	802	25	224	36	1,088†
South-east South America	233	1	..	—	..	234
LATIN AMERICA		1,434	330	281	77	2,122

Source: Official foreign trade statistics.

BALANCE OF TRADE IN WOOD PRODUCTS

The preceding tables 83 and 85 show the total annual exports and imports of individual countries to and from all other countries. A considerable part of the trade of each sub-region consists of trade between individual countries within the same sub-region. Similarly, over two-thirds of the wood products trade of Latin America consists of trade between individual

countries and sub-regions within the region. Trade with outside countries is important, however, and the extent of this trade for each of the major products is shown in table 86. In this table, the figures for each sub-region represent trade only with other countries outside that sub-region and the figures for Latin America as a whole represent trade only with countries outside that region.

Table 86 shows the volume of wood products exported from and imported into the individual sub-regions and the Latin American region. The major importing sub-region was South-east South America, and next most important the Caribbean islands. Because of the large imports of Venezuela, Northern South America appears in third place. Brazil did not import any wood products of this kind and Central America imported very little. The largest exporting sub-region, by far, was Brazil, with Central America in second place. The Caribbean islands and South-east South America exported very little. Latin America as region both exported and imported substantial quantities of wood products to and from the rest of the world.

The trade status of the various sub-regions with regard to individual products is brought out in table 87, which shows the net annual exports or imports during the period 1956-58. South-east South America and the Caribbean islands were decided net importers of wood products while Brazil, Central America and Mexico were net exporters. The other two sub-regions held an almost equal balance between imports and exports. The importing sub-regions imported almost all kinds of wood products and exported little of any. However, South-east South America was more nearly self-sufficient in veneers and plywood, sleepers and posts than the Caribbean islands. Brazil exported all wood products except posts, but the bulk of its trade was in sawnwood. Central America was primarily a sawnwood exporter. Mexico exported sawnwood and plywood but was a substantial importer of sleepers and posts. Northern South America was a net importer of sawnwood, because of Venezuela, but exported large quantities of logs and posts from the Guianas. In world trade, the region as a whole was a net exporter of sawnwood and logs but a net importer of veneers and plywood and posts.

Table 86

LATIN AMERICA: EXTERNAL TRADE IN WOOD PRODUCTS OTHER THAN PULP AND PAPER BY SUB-REGIONS AND PRODUCT GROUPS, 1956-58[a]

(Annual volume in thousands of cubic metres)

	Sawnwood	*Logs*	*Veneers and plywood*	*Sleepers*	*Posts*	*Total*
Imports:						
Mexico	36	1	‡	14	11	62
Central America	3	—	2	..	1	6
The Caribbean islands	391	12	20	2	5	430
Northern South America	151	..	3	3	—	157
South-west South America	78	1	2	2	..	83
Brazil	—	—	—	—	—	—
South-east South America	837	32	3	—	5	877
Latin America[b]	511	2	20	20	17	570
Exports:						
Mexico	152	30	7	—	—	189
Central America	290	7	2	..	2	301
The Caribbean islands	5	..	..	..	..	6
Northern South America	75	41	5	4	14	139
South-west South America	95	1	..	—	2	98
Brazil	1,017	48	4	19	—	1,088
South-east South America	—	1	—	—	—	1
Latin America[b]	570	77	10	20	12	689

Source: Official foreign trade statistics.
[a] Does not include trade between countries within the sub-regions.
[b] Does not include trade between sub-regions within the region.

Table 87

LATIN AMERICA: EXTERNAL BALANCE OF TRADE IN WOOD PRODUCTS OTHER THAN PULP AND PAPER BY SUB-REGIONS AND PRODUCT GROUPS, 1956-58[a]

(Net annual exports in thousands of cubic metres)

	Sawnwood	*Logs*	*Veneers and plywood*	*Sleepers*	*Posts*	*Total*
Mexico	116	29	7	—14[c]	—11	127
Central America	287	7	1	—1	1	295
The Caribbean islands	—385	—12	—20	—2	—5	—424
Northern South America	—76	41	3	1	14	—17
South-west South America	17	..	—2	—1	2	16
Brazil	1,017	48	4	19	—	1,088
South-east South America	—837	—31	—3	—	—5	—876
Latin America[b]	59	75	—11	..	—5	118

Source: Table 86.
[a] Does not include trade between countries within the sub-regions.
[b] Does not include trade between sub-regions within the region.
[c] A minus sign indicates net imports.

Pattern of trade in individual products

In the preceding section, tables 83 and 84 showed the total trade pattern of each of the major wood products in the region as a whole. Table 85 then showed the total trade pattern in each sub-region of all wood products as a group. However, the same product often has a different pattern in different sub-regions, and some important differences are therefore covered up in the averages of the previous tables. In this section, each individual product will be considered separately, and the pattern of trade in that product shown separately for each sub-region.

Sawnwood

Details of the average annual trade in sawnwood during the period 1956-58 are shown in table 88. Brazil was entirely self-sufficient in sawnwood and the Central American countries covered practically all of their needs within the sub-region. Both were large sawnwood exporters. The large importers were South-east South America (over half of the regional sawnwood imports), the Caribbean islands, and Northern South America. All three drew part of their sawnwood from Europe and the rest of the world. They differed, however, in that the Caribbean islands and Northern South America obtained about half of their sawnwood from Canada and the United States, while the South-east drew less than 1 per cent of its imports from this source. About 93 per cent of the sawnwood imported by South-east South America came from Latin America (mainly Brazil).

Brazil, Central America and South-west South America export mainly to Latin American countries. Twenty per cent of Brazil's sawnwood exports went to Europe, which was also a relatively important market for Northern South America. The United States is the main sawnwood market for Mexico and Northern South America and also takes about 12 per cent of Central American exports. The extra-regional sawnwood trade of eastern South America is orientated towards Europe, while that of the rest of Latin America is tied mainly to Northern North America.

Table 88

Latin America: International trade in sawnwood by sub-region and origin and destination, 1956-58

(Annual volume in thousand cubic metres)

Sub-region	*Own sub-region*	*Rest of Latin America*	*Canada and United States*	*Rest of the world*	*Total*
Imports:					
Mexico	—	7	29	..	36
Central America	50	—	3	..	53
The Caribbean islands	15	127	257	7	406
Northern South America	1	72	76	3	152
South-west South America	1	..	78	..	79
Brazil	—	—	—	—	—
South-east South America	31	780	7	50	868
Latin America	1,084		450	60	1,594
Percentage of total	68		28	4	100
Exports:					
Mexico	—	..	152	—	152
Central America	38	200	43	47	328
The Caribbean islands	9	—	1	4	14
Northern South America	1	10	38	27	76
South-west South America	1	87	5	3	96
Brazil	—	767	22	228	1,017
South-east South America	19	—	—	—	19
Latin America	1,132		261	309	1,702
Percentage of total	66		15	19	100

Source: Official foreign trade statistics.

Logs

Table 89 shows the trade pattern for logs during 1956-58. South-east South America was the major log importer and the greater part of its imports originated within the sub-region (in Paraguay). Imports of logs from outside of Latin America were insignificant.

South-east South America was the major log exporter, but again the destinations were mainly within the sub-region. About a third of the Brazilian exports went to Europe and a substantial part of those from Mexico and Northern South America to the United States. However, trade in logs is mainly between countries within the region.

Table 89

LATIN AMERICA: INTERNATIONAL TRADE IN LOGS BY SUB-REGION AND ORIGIN AND DESTINATION, 1956-58

(Annual volume in cubic metres)

Sub-region	*Own sub-region*	*Rest of Latin America*	*Canada and United States*	*Rest of the world*	*Total*
Imports:					
The Caribbean islands	..	12	..	..	13
Northern South America	17	—	..	..	17
South-west South America	—	..	1	..	1
South-east South America	185	32	—	1	218
LATIN AMERICA	247		1	1	249
Percentage of total	100		—	—	100
Exports:					
Mexico	—	..	30	..	30
Central America	..	7	..	..	7
The Caribbean islands	..	—	..	..	..
Northern South America	16	12	28	1	57
South-west South America	—	1	..	..	1
Brazil	—	30	3	15	48
South-east South America	198	1	..	..	199
LATIN AMERICA	265		61	16	342
Percentage of total	77		18	5	100

Source: Official foreign trade statistics.

Table 90

LATIN AMERICA: INTERNATIONAL TRADE IN VENEER AND PLYWOOD BY SUB-REGION AND ORIGIN AND DESTINATION, 1956-58

(Annual volume in cubic metres)

Sub-region	*Own sub-region*	*Rest of Latin America*	*Canada and United States*	*Rest of the world*	*Total*
Imports:					
Mexico	—	—	..	..	..
Central America	1	..	1	..	2
The Caribbean islands	—	5	7	8	20
Northern South America	..	..	1	1	3
South-west South America	..	1	..	1	2
South-east South America	—	2	..	..	3
LATIN AMERICA	10		9	11	30
Percentage of total	33		29	38	100
Exports:					
Mexico	—	1	7	..	8
Central America	..	1	1	—	2
The Caribbean islands	—	—	..	—	..
Northern South America	..	5	—	—	5
South-west South America	..	..	—	..	..
Brazil	—	2	..	1	4
LATIN AMERICA	10		8	1	20†
Percentage of total	52		42	6	100

Source: Official foreign trade statistics.

Veneer and plywood

The trade in veneer and plywood is shown in table 90. The major importer of veneer and plywood—the Caribbean islands—drew its supply from all sources. The importing countries drew almost three-fourths of their imports from outside the region, which came in equal proportions from Northern North America and Europe.

Some 10 per cent came from the rest of the world. South-east South America, however, again obtained most of its imports from Brazil.

A large part of the exports of veneer and plywood from Mexico and Central America went to the United States, and 30 per cent of those from Brazil went to Europe. Over half of the exports, however, stayed within the Latin American region.

Sleepers

The trade in sleepers during 1956-58 is shown in table 91. Internal trade within the region was relatively unimportant.[1] The only source of sleepers outside the region was the United States, and the main exporting sub-regions—Brazil and Northern South America—sent the bulk of their sleepers to Europe.

[1]The discrepancies between exports and imports in the first two columns of table 91, and also in other tables in this chapter, result from the difficulty in identifying products under the different nomenclatures and classifications used in the various national statistics, from apparent differences in measurement, and from incomplete statistics for some countries.

Table 91

LATIN AMERICA: INTERNATIONAL TRADE IN SLEEPERS BY SUB-REGION AND ORIGIN AND DESTINATION, 1956-58

(Annual volume in thousands of cubic metres)

Sub-region	*Own sub-region*	*Rest of Latin America*	*Canada and United States*	*Rest of the world*	*Total*
Imports:					
Mexico	—	—	14	—	14
Central America	..	—	1	—	1
The Caribbean islands	..	1	1	—	2
Northern South America	—	1	2	—	3
South-west South America	..	—	1	—	2
LATIN AMERICA		3	19	—	22
Percentage of total		14	86	—	100
Exports:					
Central America	..	—	..	—	..
The Caribbean islands	..	—	..	—	..
Northern South America	—	1	—	3	4
Brazil	—	3	—	16	19
South-east South America	..	—	—	—	..
LATIN AMERICA		4	..	20†	24
Percentage of total		18	—	82	100

Source: Official foreign trade statistics.

Table 92

LATIN AMERICA: INTERNATIONAL TRADE IN WOODEN POSTS BY SUB-REGION AND ORIGIN AND DESTINATION, 1956-58

(Annual volume in cubic metres)

Sub-region	*Own sub-region*	*Rest of Latin America*	*Canada and United States*	*Rest of the world*	*Total*
Imports:					
Mexico	—	—	10	—	10
Central America	—	—	1	..	1
The Caribbean islands	1	—	5	—	6
South-west South America	—	—	..	—	..
South-east South America	16	5	—	—	21
LATIN AMERICA		22	16	..	38
Percentage of total		56	44	—	100
Exports:					
Central America	—	2	—	—	2
The Caribbean islands	..	—	—	—	..
Northern South America	—	2	—	12	14
South-west South America	—	2	—	—	2
South-east South America	16	—	—	—	16
LATIN AMERICA		22	—	12	34
Percentage of total		65	—	35	100

Source: Official foreign trade statistics.

Posts

The pattern of trade in posts during 1956-58 is shown in table 92. The major post importer—South-east South America—obtained most of them within the sub-region and the rest from other Latin American countries. Mexico and the Caribbean islands drew theirs from the United States. As with sleepers, there was virtually no import trade with the rest of the world. The only extra-regional exports were those from Northern South America to Europe. South-east South America absorbed its own exports and Central America and South-west South America sent theirs to other Latin American countries.

Pulp and paper

The average annual imports of the major pulp and paper products during 1956-58 are shown in table 93 for the individual sub-regions. In terms of weight, 30 per cent of the imports were pulp and 70 per cent paper. Pulp was relatively more important in the total import picture in South-west and South-east South America than in the other sub-regions. Newsprint was the major paper import on a regional basis but made up less of the total paper imports than did the class of "other paper and board" in Central America, the Caribbean, and Northern South America.

The origins of the imports of the major classes of pulp products are shown for each sub-region in table 94. (Statistics on the countries of origin were not available for Central America.) The Scandinavian countries dominated the import picture in Brazil and South-east South America. The latter sub-region, however, drew substantial quantities from other countries outside the western hemisphere. North America was important to these two sub-regions only as a source of newsprint. South-west South America divided its imports between North America and Scandinavia and also obtained a significant amount of newsprint from other countries. Northern North America was the dominant source for the other sub-regions, although Scandinavian pulp was an important factor in the Mexican market.

Table 93

LATIN AMERICA: COMPOSITION OF THE IMPORTS OF PULP AND PAPER BY SUB-REGION, 1956-58
(Thousands of metric tons)

Sub-region	*Newsprint*	*Printing and writing paper*	*Other paper and board*	*All paper*	*Pulp*	*All pulp and paper*
Mexico	70	10	19	99	37	136
Central America	15	7	26	48	—	48
The Caribbean islands	40	21	62	123	27	151†
Northern South America	49	49	78	176	36	212
South-west South America	25	6	9	41†	32	72†
Brazil	150	29	5	184	107	291
South-east South America	155	16	10	181	146	327
TOTAL	505	138	209	852	385	1,237
Percentage of total	41	11	17	69	31	100

Source: *Pulp and paper in Latin America*, op. cit.

Table 94

LATIN AMERICA: ORIGINS OF PULP AND PAPER IMPORTS DURING 1956-58 BY SUB-REGIONS
(Percentages)

Sub-region	*Canada and United States*	*Scandinavian countries*	*Other countries*	*Total*
Pulp:				
Mexico	54	46	—	100
The Caribbean islands	94	6	—	100
Northern South America	83	17	‡	100
South-west South America	33	67	—	100
Brazil	2	97	1	100
South-east South America	7	82	11	100
Newsprint:				
Mexico	92	6	2	100
The Caribbean islands	93	5	2	100
Northern South America	83	12	5	100
South-west South America	50	49	1	100
Brazil	30	67	3	100
South-east South America	38	50	12	100
All other paper and board:				
Mexico	83	12	5	100
The Caribbean islands	95	2	3	100
Northern South America	62	30	8	100
South-west South America	18	64	18	100
Brazil	9	67	24	100
South-east South America	1	47	52	100

Source: *Pulp and paper in Latin America*, op. cit.

The pattern of intra-regional trade

Previous sections have presented information about the trade in wood products between individual sub-regions and the rest of Latin America, but have not given any details on that trade within the region. From the view-point of the common market and of regional development in general, this intra-regional trade is quite important. This section will therefore describe briefly the characteristics of this trade between Latin American countries.

About 70 per cent of the wood products trade of the Latin American countries (other than pulp and paper) is with other countries in the region. Some 15 per cent is with other countries in the same sub-region. The pattern of this intra-regional trade is shown in table 95.[2]

[2] Because of discrepancies in the statistics, two versions of the intra-regional pattern are given in table 95; the upper one is based on import statistics and the lower on export statistics. The discrepancies are not large enough to alter the general pattern.

Table 95

Latin America: Pattern of trade between sub-regions in wood products other than pulp and paper, 1956-59

(Volume in thousands of cubic metres)

Sub-region	*Mexico*	*Central America*	*Caribbean islands*	*Northern South America*	*South-west South America*	*Brazil*	*South-east South America*	*Total*
Imports:								
Mexico	—	‡	..	..	..	—	—	1
Central America	2	(51)[a]	110	70	..	—	—	233
Caribbean islands	—	—	(17)	..	—	—	—	17
Northern South America	5	..	30	(18)	1	—	2	56
South-west South America	—	—	..	..	(2)	—	97	99
Brazil	—	—	5	2	—	—	720	727
South-east South America	—	—	—	..	..	—	(232)	232
Total	7	51	162	91	3	—	1,051	1,365
Exports:								
Mexico	—	1	—	5	—	—	—	6
Central America	..	(39)	—	—	—	—	—	39
Caribbean islands	..	125	(10)	24	1	5	—	165
Northern South America	—	66	—	(18)	—	3	—	87
South-west South America	—	..	—	..	(1)	—	—	2
Brazil	—	—	—	—	—	—	1	1
South-east South America	—	—	—	—	89	793	(232)	1,114
Total	1	231	10	47	91	801	233	1,414

Source: Official foreign trade statistics.

[a] ( ) indicates trade between countries in same sub-region.

The major importing sub-regions are South-east South America, the Caribbean islands, and Northern South America, in that order. South-east South America drew its intra-regional imports from its neighbours Brazil and Chile (South-western South America) and had virtually no wood-products trade with the rest of the region. The Caribbean islands received the bulk of their wood imports from the nearest sub-regions—Central America and Northern South America. However, the islands also had some trade with all other sub-regions except South-east South America, which exports practically no wood products. Northern South America drew almost all its regional imports from its neighbour, Central America, but had some wood product trade with all the other sub-regions. Central America imported little from the rest of the region, and that was from its immediate neighbours. Mexico reached as far as Northern South America for its small amount of imports, and South-west South America imported some from every sub-region except the Caribbean, but took very little from any of them. The general pattern apparently was to import mainly from nearby sub-regions and to take occasional shipments from farther away when there was some advantage in doing so.

The major exporting sub-regions were Brazil, Central America, and South-west South America. Brazil sent most of its exports to South-east South America and a relatively small amount to the Caribbean islands and Northern South America. Interestingly enough, South-west South America followed the same pattern, though with smaller quantities. Central American exports went to the Caribbean islands, Northern South America, and a small amount to Mexico. Exports from Northern South America went mainly to the Caribbean. The Caribbean islands provided a market for all parts of Latin America, but the much larger South-east South American market was dominated by Brazil and Chile. Both of these countries are anxious to export wood and are strategically located near to Argentina and Uruguay.

Various Latin American countries have at one time and another exported small quantities of pulp or paper product but not in any consistent manner. However, Chile has recently developed an export trade in newsprint which has grown each year and has now reached significant size. Practically all this newsprint has gone to other Latin American countries. The past development of its distribution among the sub-regions is shown in table 96. As might be expected, South-east South America has provided a major market, but it is interesting that substantial markets have also developed in Mexico and Brazil.

Table 96

CHILE: EXPORT TRADE IN NEWSPRINT BY SUB-REGIONS

(Metric tons)

Destination	*1957*	*1958*	*1959*
Mexico	—	—	5,700
Central America	—	100	100
The Caribbean islands	—	—	—
Northern South America	80	1,400	2,900
South-west South America	210	1,500	2,700
Brazil	—	1,500	10,900
South-east South America	750	15,700	13,100
LATIN AMERICA	1,000	20,200	35,400

Source: ECLA, on the basis of national statistics.

FOREST PRODUCTS TRADE: SUMMARY

Latin America, a region rich in forest resources, is in the anomalous position of being a net importer of wood-based products. This broad statement is quite misleading, however, and some more details are needed to clarify the situation. During the period 1956-58, the equivalent volume in roundwood of the products which Latin America annually exported to and imported from the rest of the world was as follows (in millions of cubic metres):

	Exports	*Imports*
Sawnwood	1.2	0.8
Other wood products	0.5	0.4
Wood pulp	—	1.7
Paper and board	—	2.3
TOTALS	1.7	5.2

From these figures it is apparent that Latin America is actually a net exporter of wood products other than pulp and paper. In 1958 the Latin American countries produced only about 63 per cent of the pulp and paper that they consumed. Their domestic manufacturing facilities were not adequate to produce all they needed and they had to import the rest. It was not lack of raw material supply that was responsible for the need to import in most cases, but rather a lack of manufacturing capacity. The potential productivity of the forests can only be realized when there is industrial capacity sufficient to convert it into usable products.

In terms of value of the total trade of Latin America with the rest of the world, wood-based products are not very significant. During the period 1956 to 1958, the value of the forest-based products which Latin America exported to and imported from the rest of the world was as follows (in millions of US dollars):

	Exports	*Imports*
Sawnwood	23	16
Other wood products	3	6
Quebracho	22	—
Pulp and paper	—	310
All forest-based products	48	332
All Latin American trade	7,740	7,750

The exports of quebracho for tanning had a value almost as large as that of all the rest of the wood products exported from Latin America. Even so, the forest products made up less than 1 per cent of the value of all Latin American exports. On the other hand, they accounted for 4 per cent of the value of all imports and, as can be seen above, this was almost entirely due to the imports of pulp and paper.

The imports of pulp and paper are clearly an item deserving of attention. Latin American expenditures abroad for these products in 1958 were equal to the region's total dollar earnings from the export of cotton, or to almost half of the earnings from sugar exports, or to one-sixth of the earnings from coffee. In total, some 4 per cent of the value of the products exported by Latin America goes to pay for the pulp and paper that the region imports.

Another product group worth considering is plywood and veneers. During 1956-58, the net annual expenditure of Latin America for imports of these products was about 3 million dollars. While this is insignificant in the total trade picture, it is similar to the pulp and paper situation in that forest resources exist to supply the raw material but industrial capacity is inadequate to meet the domestic demand.

About 70 per cent of the Latin American trade in wood products other than pulp and paper is with countries within the region. During the period 1956-58, this intra-regional trade amounted to about 75 million dollars per year. If the Latin American countries continue to import wood products in the future, there does not seem to be any reason why practically all these products should not come from within the region. The present pattern of intra-regional trade bears a close relationship to the distribution of the forest resources and of the population. Future development will probably follow much the same pattern.

PART V

PROBLEMS AND OPPORTUNITIES

Previous chapters have described the forest resources of Latin America and the present consumption, production, and exchange of forest products, and have presented estimates of future requirements for wood products in this region. The next four chapters will analyse the existing situation in the light of these estimated future requirements. Is Latin America capable of meeting these requirements with its own resources? What would this involve in management of the forests; in industrial development; in international trade? Is it possible that Latin America might be able not only to cover its domestic requirements but to produce a surplus to trade with the rest of the world? What long-run policies would be necessary to exploit these possibilities? What immediate policies are needed to safeguard the opportunities and to start capitalizing on them?

Latin America has valuable resources in its forests. It also has many problems to solve if these resources are to make their optimum contribution to the region's economy. It will take time and patience and ingenuity to solve these problems. A general report like this cannot pretend to furnish the answers. What can be attempted here is to spell out the broad problems that exist, to indicate some areas of impelling urgency, and to suggest what actions would be most fruitful in the immediate future.

Chapter 8. Requirements and forest productivity

The forest resources of Latin America produce many goods and services which are important to the people of the region. The estimates made in chapter 6 indicate that the domestic requirements of the Latin American people for wood products will be much larger in the future than they are today. The discussion of international trade in chapter 7 showed that Latin America has depended on imports from outside the region for a substantial part of its pulp and paper consumption and also for part of its consumption of other wood products. Can it or should it depend on such extra-regional imports to supply its expanded future requirements? Latin America is also an exporter of wood products. Would it be possible to expand such exports in the future? What Latin America can do about covering its own future requirements with domestically produced wood products and about exporting such products to the rest of the world depends basically on the region's forest resources.

Chapter 3 showed that Latin America has extensive forests but that they consist of a great variety of species and conditions. The past use of these forests has not been at all uniform, some having been overused and virtually destroyed while other large areas are untouched and even unexplored. What are the possibilities of these forests with regard to future requirements for wood? What opportunities do they present in the general Latin American development effort? The purpose of this chapter is to explore these questions, to spell out the problems that are involved, and to offer some suggestions for action.

Productive capacity of the forest resource

In order to discuss these forest resources, we need some way to measure and describe them. For this purpose we will use their "productive capacity". The productive capacity of a forest resource is the value of the goods and services that it can produce on a continuous and sustained basis. This production may include watershed protection; flood and erosion control; recreational opportunities; wood in various forms; and other vegetable and animal products of the forest. The discussion in this chapter will be confined almost entirely to wood as a forest product. This does not imply that the other values are not important. In many places the protection function of the forest outweighs any other possible product. But these other values are difficult to measure and there is little information about them in Latin America. They will be mentioned where necessary in the present chapter and discussed at greater length in chapter 11.

The basis of the productive capacity of a forest resource is the soil and the general physiographic and climatic conditions of the area. These ecological conditions limit the kinds of trees that will live there, the rate at which they will grow and the volumes of wood they will produce. It is possible to change these natural conditions to some extent through drainage, irrigation, fertilization and similar practices.

Forests differ from most agricultural crops in that trees require many years to mature. If people are to harvest logs and bolts from a forest every year, that forest must contain trees of all ages. Part of these trees can be harvested each year; the rest must be left to grow for harvest in the future. Many of the growing stock trees which should be retained for future harvests will be large enough to cut and use now. But if they are cut there will not be enough growing stock to produce the same amount of wood and future yields will be reduced. Productive capacity depends heavily on the amount of growing stock maintained on the ground. If it is reduced by overcutting, the forest is not destroyed but its productive capacity is reduced. Cutting is necessary, however, if an optimum amount of growing stock is to be maintained. If too little is cut the growing stock trees may become overmature and defective and

the amount of wood produced annually may then be less than what is possible.

The combination of soil and site factors and growing stock results in the growth of wood, which is the basis of forest productivity. The volume of wood that grows is not in itself a sufficient measure of productive capacity. Wood is not a homogeneous product; there are many species of trees and the wood of each is different. Many of the species growing in Latin America are commercially unknown. Their woods may be too hard to be worked, too soft for any ordinary use, too brittle, or weak or not durable. In an economic sense, a forest which produces such trees is not productive. Even within the commercially valuable species trees vary in size, in form, in the amount of defects present, and in other characteristics which affect the use. Productive capacity must consider the quality as well as the volume of the wood produced.

Productive capacity must also consider where the wood is growing. Vast areas of forest land are completely inaccessible to anyone wishing to use the trees on them. These forests might be made physically accessible by the construction of roads or other transport facilities. But even where transport facilities exist, the terrain is sometimes so difficult or the distance so great that the cost of harvesting and transporting the timber is more than its market value. Such areas are economically inaccessible and the wood which grows on them is not a part of the productive capacity of the forests.

Wood as it grows in the forest is not generally a product that people can use directly. Even such products as fuelwood, posts and poles require a certain amount of processing before they can be used. But wood products like sawnwood, plywood, and paper have to pass through a rather elaborate and expensive manufacturing process on their way from the forest to the consumer. The productive capacity of a forest, therefore, depends on the facilities that exist to extract the timber and manufacture it into products. A forest whose only possible current use is as a source of fuelwood to be cut by hand has a low productive capacity. If a pulpmill were in existence and drew wood from this forest, the productive capacity of the same forest would be much higher. The only productive forests are those from which wood can be removed and made into useful products. A country may have extensive forests but if there are no facilities for processing the wood from those forests—as in the case in the Amazonia regions of Colombia and Venezuela—they do not contribute anything to the productive forest capacity of that country.

Finally, the productive capacity of a forest resource depends on the state of knowledge about the utilization of the kind of timber that grows in that forest. The productive capacity of a particular forest may be virtually zero if it contains only species of trees for which no economical use is known. If a process were developed for making satisfactory paper pulp from these species, the potential productive capacity of the forest would immediately be increased.

The productive capacity of a forest resource (in terms of wood products) is the value of the products that could be produced on a sustained basis under the currently existing conditions of the forest itself and of the extraction and processing facilities. Under this definition, the productive capacity of a forest is not a fixed and permanent characteristic. It will vary with the volume of wood growing annually on a unit of area, the species composition and quality of that wood, the state of knowledge about the characteristics and uses of that wood, the accessibility of the area, and the facilities that exist for manufacturing products with the raw material from that forest. Productive capacity may be increased or decreased by changing some or all of these characteristics.

The productive capacity of a forest resource is not necessarily the same as the value of the products that are currently being produced from it. The actual current production depends not only on the productive capacity but also on the demand and markets for the products. It is possible, therefore, that a country might not be using all of the existing productive capacity of its forest resources. In such a case it could expand domestic consumption or exports by taking advantage of the currently idle capacity. Such unused existing capacity is not common in Latin America. But most of the Latin American forest resources have a "potential" capacity quite a lot larger than their present productive capacity. This potential capacity is the value of the products which could be obtained by overcoming the factors that limit present capacity to what it now is. In order to raise the productive capacity of these forest resources —or to develop their full potential capacity—investments will have to be made in the forests themselves, in transport facilities, in manufacturing plants, and in silvicultural and wood-utilization research.

Present productive capacity

Despite the vast amount of forest land in Latin America, the present productive capacity of the forest resources (as defined here) is not adequate to supply the present consumption. This is indicated by the fact that a number of the countries are net importers of wood products. The pulp products and wood-based sheet materials are imported in most cases because of a lack of manufacturing facilities to make them domestically. The industry may not exist in some countries, however, because the kind of wood growing in the forests is not suitable. Other countries, such as Peru, import wood products because their own forests are inaccessible. Per capita consumption of processed wood products is low in most Latin American countries. While this is partly due to other factors—such as low incomes—it lends support to the above thesis that the productive capacity is generally not adequate to cover domestic demand.

Some Latin American countries are net exporters of wood. But the productive capacity of their forests does not necessarily exceed local consumption. Brazil, for example, exports paraná pine in addition to using large quantities at home, but in the process is destroying its pine forests. It is estimated that within twenty years there will be little pine left to cut. In this case, the manufacturing facilities are excessive for the productive capacity of the land and growing stock in the pine forests. Transport and processing facilities may limit the productive capacity of the forest resource in many cases, but where they are adequate the ultimate limiting factor is the productive capacity of the forests themselves. It is essential that manufacturing facilities be developed in balance with the raw material that the forests can produce on a sustained basis.

Almost all Latin American countries are cutting timber beyond the present productive capacity of their

forests. The area of forest land is decreasing as it is cleared for agricultural and other uses. (Much of the timber from such clearings goes into present consumption.) Even when the land is not deliberately cleared, most present harvesting drastically reduces forest productivity. No provision is made for regeneration, immature growing stock is destroyed or damaged, and fire is permitted to run rampant. Selective removal of the valuable species without provision for their regeneration is converting the mixed forests into stands composed entirely of worthless and poor quality species. To this must be added the destruction caused by insects, diseases, and uncontrolled fires throughout the accessible forest areas.

This reduction in the productive capacity is offset to some extent by the establishment of plantations, the opening up of formerly inaccessible areas with new roads, and the development of uses for previously unused species. In Chile, for example, where large areas of plantations are now reaching commercial size, the total productive capacity may be increasing despite the continuing destruction of natural forests. In Latin America as a whole, however, it appears that present consumption is being supplied partly through liquidation of the existing growing stock and that the productive capacity of the forests is diminishing.

If the present productive capacity is not adequate to supply present consumption, what about the greatly increased requirements envisaged for the future? The present productive capacity is less than the potential capacity in every Latin America country. This present capacity can be increased by investments in forest development, in transport facilities, and in manufacturing plants. What would then be the potential capacity of these forest resources?

Potential productive capacity

From a physical point of view, the potential productive capacity of the Latin American forests is tremendous. Except for the Caribbean islands and a few countries such as Uruguay and El Salvador, Latin America possesses substantial forests which have never been exploited. The areas already exploited, but not completely cleared and put to other uses, could under better management grow much more wood than they now do. Practically every country contains sizable areas of agricultural land which have been abandoned, are unproductive, or represent an erosion and flood hazard. Most of these areas can grow trees, and Latin American experience indicates that many of them might support very productive plantations. In addition to such increases in total wood production, the proportion of the growth which can be converted into useful consumer products could be raised materially through research and development in the utilization of the presently worthless or low-value species. And, finally, the establishment of new manufacturing facilities could increase the productive capacity wherever the full yield of the forests is not now being utilized.

From an economic point of view the potential capacity may not be as great as this would seem to indicate. The procedures suggested in the previous paragraph will require sizable investments and operating expenditures. If the most advantageous possibilities are exploited first, the costs of continuing expansion will get higher and higher. Some of the physically potential capacity may not, therefore, be economically potential. Commercial exploitation of the most remote and low-quality forests will not be economically justified for many years, if ever.

The little information now available on costs of production and possible yields from various cultural practices under Latin American conditions is not sufficient to permit a calculation of what it will cost to produce the amount of wood that will be required in the future. However, in view of the opportunities that exist for expanding the productive capacity of the Latin American forests, it appears that this amount of wood could be produced without any substantial increase in the relative price.

The total potential productive capacity of Latin America's forest resources is adequate to meet the requirements visualized for 1985, but conditions vary between sub-regions and countries. The Caribbean islands and South-east South America are not now meeting their own requirements. Some individual islands may be self-sufficient, and may even export, but the sub-region as a whole will probably continue to import wood or wood products. Paraguay should export wood products in the future, but Uruguay and Argentina are not likely to meet all their own requirements. The domestic productive capacity of all these countries can be increased by planting fast-growing species such as pine and eucalyptus. But there is no reason why every country should try to be self-sufficient when it will be cheaper to buy part of the needed products from other Latin American countries better endowed with forest resources.

The other sub-regions should be able to meet their own requirements if they take advantage of the potential capacity of their resources. This does not mean that all individual countries should try to do so. El Salvador may increase its own output but also depend on other Central American countries. Peru can realize more from domestic sources but may logically also draw from Chile.

All these other five sub-regions appear to be potential exporters, since they have the basic forest resources. Whether they can become net exporters will depend on whether they develop the potential of their forests and the necessary industry and can find profitable export markets. This will be discussed more fully in the next two chapters.

The situation, in brief, is this. The consumption of wood products will continue to increase in Latin America. If these products are available at competitive prices, the amount of industrial wood consumed in 1985 may be triple the amount consumed in 1956-59. The amount of wood used as fuel may remain about the same as in that period. The forest resources of Latin America are potentially adequate to supply such a greatly expanded consumption (assuming that some of these countries will be able to import part of their needs from the others). In fact, the forest resources of many sub-regions appear potentially adequate to supply domestic consumption and provide a surplus for export. The present capacity of the forest resources is not even adequate to supply current consumption, but can be increased materially. The steps that can be taken to increase productive capacity are simple in concept, but many problems will arise in putting them into effect. The following sections will try to show what these problems are and what will be needed to overcome them.

Increasing productive capacity

In order to meet the future requirements for wood products, the forests must produce wood which has the qualities needed in making those products. Coniferous woods in general have superior technological characteristics for construction, paper-making, the manufacture of plywood and other uses. Three-fourths of the wood used in the world is coniferous. Unfortunately, less than 5 per cent of the total forest area of Latin America supports coniferous forests. It is estimated that 13 per cent of the forests now in use are coniferous, which indicates that the Latin Americans have exploited what coniferous forests there are more heavily than the others. Some of the hardwood species have characteristics which make them valuable for uses such as furniture and flooring. These species also form a relatively small proportion of the total hardwood forests. Sometimes they occur only as scattered individuals in stands of other species.

A large proportion of the trees in the Latin American forests are species which are considered inferior to those now in use, which have characteristics that make them unsuitable for may common uses, or whose characteristics and possible uses are at present unknown. To further complicate the situation, most forests are mixtures of many different species which are quite dissimilar in their properties and characteristics.

The problem posed by the species composition of the forests may be attacked from two directions: through silviculture and through utilization. The most immediate possibility lies in the afforestation or reforestation of areas now idle with valuable tree species, preferably conifers. Experience shows that some conifers will grow successfully (and sometimes spectacularly) in parts of Latin America where the natural forest was of other species. The composition of existing natural forests may also be changed in time by stimulating the regeneration of desirable species after harvest, by supplementary planting with desirable species, and by the selective elimination of undesirable species through harvest and improvement cuttings.

Through changes in utilization, the species now accepted may be used more effectively and valuable uses may be developed for species now unknown or considered worthless. Certain undesirable characteristics may be overcome through better processing and seasoning. Impregnation with chemicals can materially increase the durability of species naturally susceptible to decay and insect damage. Products such as particleboard may absorb the mixture of species remaining after those more valuable for other uses have been separated out. The simultaneous pulping of a mixture of hardwood species is now technologically possible and will provide another use for the miscellaneous species.

The quality of wood is not exclusively a species characteristic. Within any given species, trees vary in characteristics such as specific gravity, width of annual rings, number and size of knots, straightness of grain, size and form of the bole, and many others. These characteristics must be accepted as they are in the trees now mature in the Latin American forests and may cause them to be undesirable or unacceptable for certain uses. All of these characteristics can be controlled to some extent in the trees which are growing for the future. Silviculture can influence some of them directly through practices like pruning, and can control other characteristics of the final crop by progressively eliminating undesirable trees and bringing through only those with the desired characteristics.

The quality of wood is also affected by decay organisms, insects, fire and other natural factors such as wind. Such damage accumulates as a forest gets older under natural conditions, and eventually a large proportion of the timber may be defective. This situation exists in part of the virgin forests of Latin America. The amount of usable material may not justify the cost of getting it out, but the productivity of such forests can only be raised by eliminating the old, defective trees and making room for vigorous young growth. Where such conditions are especially bad there is probably nothing to be done except to wait for nature to take its course. The same amount of investment will produce much greater yields in other forest areas and those overmature, defective stands should have a low priority for management. Where economically possible, these defective stands should be harvested rapidly and steps taken to restock them with valuable species. Under proper management defects of this kind can be held to a very small amount if not eliminated entirely.

The quantity of wood used for fuel in all of these countries presents problems but also opportunities. Quality of the wood is much less important in fuel than in other products. It is possible to use species which are not suited for other uses; trees too small or crooked for other uses; trees damaged by decay, insects, or fire; and even trees killed by any of these causes. The removal of trees for fuel presents an opportunity to improve the growing stock of the forest by the selective removal of defective or undesirable trees. Since tops and branches, broken portions of the boles, and slabs and edgings from sawmills are all usable as fuel, the removal of these materials for fuelwood can also serve to reduce the fire hazard.

Accessibility

The most serious single limiting factor on the productive capacity of Latin America's forests is probably accessibility. An area can be said to be accessible when there exist some means of getting the products of the area to markets or to where consumers can use them. Accessibility includes the ability to move around within an area as well as the ability to get from the area to the consumers. In Amazonia, for example, the rivers provide a means of transport to the markets, but only the narrow strip of forest along the rivers is accessible because there are no roads or other facilities to move forest products to the rivers from further inland.

Accessibility is relative. When there are no means of transport at all an area may be absolutely inaccessible, and considerable areas of forest land in Latin America at present are. Much larger areas, however, are relatively accessible. It is possible to take products from them to the markets, but the distances involved are long or the transport facilities poor. An area may be economically inaccessible, even though it is physically accessible, if the transport cost is greater than what can be recovered from the market price.

The productive capacity of most Latin American countries can be increased by making more forest areas economically accessible. This will require the improve-

ment of highways and port facilities and the construction of new roads or railroads. Such construction must be well planned if the results are to justify the investment. Roads are very expensive to build in the difficult topography of Latin America and few forest operations or industries will be able to bear the whole cost of such roads. However, better communications are essential to the development of the Latin American countries and must be planned to take into account the needs of the whole economy. The value to the country of opening up and developing new forest areas should carry considerable weight in the location of new road and rail links. At the same time, the prospective forest values can help to justify the construction of such facilities for multiple purposes. (The same is true of power and water developments. If these developments are planned to permit forest industries to utilize them, the values produced by the forest resources can help materially to justify the developments.)

Most Latin American forest areas now inaccessible will probably only be opened up in conjunction with the process of settlement for agriculture or mineral development. While not the primary source of income, the forests will be able to contribute greatly to the success of such settlement. It is important, therefore, that the road networks which must be constructed for the benefit of the new settlement centres be planned to favour the development of the forests around those centres.

First priority should be given to improvement of the transport facilities for the productive forest areas already under exploitation. Transport is so poor in most Latin American countries that the forests are being exploited inefficiently. Seasonal shut-downs due to weather, low possible speeds in transit, and rapid depreciation of equipment reduce the effective production and increase its cost. Priorities for other areas should be based on a combination of their potential productive capacity and the amount of new construction required to open them up. Planning is essential to the rational use of the forest resources and such planning must include the problem of accessibility. This will be discussed in more detail under the section on management.

All industrial wood products require considerable processing between the tree in the forest and the final consumer good. Wood is heavy and bulky and therefore expensive to transport. Sawnwood weighs less than half as much as the logs from which it was cut, and the relationship is similar for other wood products. Proper location of the processing plants can reduce transport cost and make more areas accessible. The development of industry and of the forest resources must always be planned to complement each other.

Silviculture

The possibilities of controlling or improving the quality of the wood produced by the forests has already been discussed. It is also possible to increase the quantity of wood grown. Natural forests commonly produce less wood per hectare each year than the same land could under intensive management. On the average, Latin American forests are understocked and grow less wood than they could. If the stocking of these forests were built up with fast-growing species through planting and improvement cuttings, and the optimum stocking were maintained through thinnings, the yield per hectare could be increased materially. There are good opportunities for increasing the productive capacity of these forests by using the best sites more intensively.

The problems of silviculture in Latin America are many because there has been little experience on which to base decisions about cultural operations. What is the best way to reproduce the various species? What is the optimum stocking for satisfactory growth? Under what conditions of site and stand composition do the various species grow best? These and many more are questions to which the correct answers are not known. A useful start has been made on getting experience, as, for example, at Curua on the Amazon. Almost a half century of planting eucalyptus in Brazil has yielded valuable knowledge of this species. Silvicultural research is under way in Mexico, Puerto Rico, Venezuela, and other countries. But the Latin American forests cover such a vast area and such a range of conditions that more knowledge will be required before they can be managed intensively. There is a pressing need for more applied research and field trials of various silvicultural techniques.

Although the unknowns are many, application of better silviculture to Latin American forests need not wait for the results of years of research. Since these forests at present are absolutely unmanaged, quite simple practices can increase the yield. Adequately educated professional foresters can recognize the major deficiencies and improvise practices to improve the condition of the forests. It is urgent that a start be made immediately on trying to manage these forests so that the forestry profession can begin to learn from experience the forms of silviculture which are best. Research can help almost from the beginning to guide this work, but field application and trials on an extensive scale are needed right away if the research is to be of full value.

Silvicultural problems in Latin America cannot be viewed purely from a biological angle. It is important to know what is technically feasible, but equally important is the problem of what is economically justifiable. These forests must be managed to provide the optimum long-run benefit to their countries, and this means that they must be managed in terms of future domestic requirements and possible export markets. The precious hardwood—such as mahogany—are an example of the kind of problems that must be faced. The silvicultural practices required to grow these species will be expensive and it may take as long as eighty years to produce trees of commercial size. Can any Latin American country afford to invest in growing precious hardwood? Probably the answer is "yes". These timbers will become scarce in the future but may then be in even greater demand. The world will probably be willing to pay many times what it now pays (in real terms) for such hardwoods. It would appear sensible to devote some part of the current forest revenues to growing these valuable species. A country which has forests containing precious hardwoods has in them a source of funds for the necessary silvicultural practices to produce a new crop. Such a country would be wise to establish a definite policy of "plowing-back" a certain part of the revenues from the forests as a silvicultural investment for the future.

Protection

Fire is used deliberately and indiscriminately throughout Latin America by cattle growers and people

clearing land for various purposes. Little attention is paid to these fires except when they threaten buildings or agricultural crops. The damage they do to the forests is generally not recognized, and even when recognized is often ignored. The actual extent of such damage is difficult to assess and varies considerably from one part of the region to another. However, wherever serious fires occur they are bound to lower the productive potential of the forest. This becomes critical when forests are put under management because the investment in planting or other cultural practices may be wiped out in one severe fire. Control of wild fire is therefore well-nigh essential to silvicultural management of the forests.

There is virtually no organized forest fire protection in Latin America. But effective protection cannot be obtained overnight. It involves three kinds of activities, all of which are important. The first and most simple is the suppression of the fires which occur; the second is the work done in advance to reduce the damage by fires which may occur (called pre-suppression), and the third is the organized effort to keep fires from starting (called prevention).

The most difficult of these activities is fire prevention. Since most fires are started by people, prevention is largely an educational undertaking. It takes time and persistence to change people's ideas and habits. In the present state of Latin American forestry, laws to prevent people from starting fires would have little effect, since it would be practically impossible to enforce them. But the countries in which fires are a serious hazard should start to develop educational programmes designed to acquaint the public with the damage fires do and gradually persuade people to be more careful with fires.

Pre-suppression is expensive because it involves activities such as the construction of fire breaks, the disposal of logging debris after harvest, and the maintenance of towers or other forms of vigilance to detect fires promptly when they start. In most parts of Latin America it is not justified at present and should only be undertaken where warranted by the values to be protected and the hazards involved. Chile, for example, has a valuable resource in its pine plantations which are at present quite vulnerable to fire damage. Certain pre-suppression activities are justified in these plantations which should not be undertaken in the natural forests of the country.

The development of some form of fire suppression organization is imperative in those countries where fires do serious damage. At first such organizations may be very simple, depending primarily on volunteers, and using mainly the tools already available for agriculture and logging. The important thing is an organized assignment of responsibility, so that when fires occur someone will see that they are extinguished. This responsibility must be accompanied by adequate authority to carry out the necessary operations.

The organization of fire protection should be a main responsibility of the government forestry agency in those countries where fires are a serious hazard. This work can be integrated with other activities of the agency but should have priority, since the other activities may be relatively fruitless if fire damage continues.

Protection of the forests from insects and diseases is more difficult. At present the only work which can be justified is investigative activity to gather information about what appear to be the most threatening insects and diseases. Wherever trees are planted over large areas insects or diseases are likely to become a problem eventually. Countries with large areas of plantations should devote some effort to the detection of pest damage in these plantations and to research on the characteristics and possible control of the pests involved.

Management

The basic aim of forest management is to produce wood (and other forest values) as a continuous process. Forests can produce one crop after another perpetually without exhausting the land or growing stock, if they are properly managed. This characteristic makes the forest resource more valuable in the long-run than resources such as mineral deposits which can be completely exhausted. If forests are treated like mines, they too can be exhausted, and this has happened in parts of Latin America. Unless forest land is thoroughly cleared it will continue to produce some wood, but this will be inferior in quality and quantity to what the land is capable of producing. The objective of management is to realize, within economic limits, the potential productive capacity of the land and forests.

Only a small part of the Latin American forest is under management today. In the majority of the forests being used, timber is cut with no other thought than how to extract the material desired in the easiest possible way. If the Latin American countries are to realize the full economic benefits of their forest resources, they must start to manage them. In most countries a start has been made, but it is a very limited one so far. The following analysis of the problems will therefore speak as though a start were being made from a situation of no management at all.

None of these countries is in a position to put all of their forest land under management immediately. This would be undesirable even if possible because both the management and the organization to carry it out will be more efficient if they develop gradually, with time to learn from experience and experimentation. Each country needs a general plan for the development of its forest resources, in accordance with which the area under management should expand gradually but continuously as the domestic demand and possible markets for products increase and as technical and financial resources become available.

Where should a country start to put its forests under management and in what directions should it proceed with expansion? The basis for these decisions must be reliable information about the lands and forests of the country. Detailed information is not necessary but it must be accurate. Enough information is needed about species composition, types of stands, volumes, size distributions of trees, and physiographic characteristics that influence exploitation to enable experienced technicians to judge the relative possibilities of the various areas under management.

The first step is to make a rough classification of the forests of the country. Much of the information for this is already available in many countries or is being gathered currently. It should be brought together systematically and supplemented with actual surveys where needed. (With the development of high-precision cameras and photo-interpretation techniques, such surveys are no longer prohibitively expensive. Every country should have a programme for eventually

obtaining total coverage.) Included in this must be information on accessibility. What transport facilities already exist? How difficult and expensive will it be to expand them or to construct facilities where there now are none? The areas which are now accessible should probably receive management first. But it is necessary to determine whether there are presently inaccessible areas which are of such high quality as to warrant prompt development.

This reconnaissance and classification should furnish the basis for a rough calculation of the proportion of the country's forests which must be put under management to supply the estimated future wood requirements. This will be sufficiently accurate to show the magnitude of the problem and to indicate whether it is urgent to reserve now areas which may not be exploitable for some years. Reservation and putting under management are not the same thing. Since the wood needs of Latin America will be growing each year, a larger and larger area of managed forest will be needed to produce that wood on a sustained basis. Additional land must be available for management if this managed area is to continue expanding. Most countries should therefore reserve—or dedicate to permanent forest—areas which are not to be managed immediately but on which the forests might otherwise be destroyed and the land damaged in the meantime.

Wood production is not the only reason for managing or reserving forests. The reconnaissance will also recognize areas of present or potential value for watershed protection and flood and erosion control. Such areas should be reserved immediately to prevent their deterioration. An important function of this primary classification will be to recognize areas that have such critical watershed value that even managed timber exploitation must be forbidden or severely restricted. These areas will be an important part of the country's permanent forest reserves but not a part of the resources managed for wood production.

The forests can next be divided into two classes: those to be developed first and those whose development can safely be postponed. Within the group to be developed first, the most promising areas can then be selected and surveyed more intensively. These surveys must be sufficiently accurate and detailed to provide a basis for development and management. In some countries this will have to include a survey of the land to establish boundary lines and to mark the legal property limits on the ground.

The general order of selection should be as follows: (1) areas where the forest plays an outstanding protection role, (2) areas where settlement or exploitation is imminent, (3) areas already under exploitation, and (4) areas where exploitation and the establishment of new forest industries are planned for the near future. In this manner the areas of greatest apparent immediate potential can be recognized and a programme started to develop the forests in them. Current management should be concentrated on these areas but the surveys should continue on additional areas to anticipate the expansion of the forests under management.

The programme of development for the selected areas should proceed in the following general order of priority: (1) establish the area clearly on the ground through appropriate demarcation; (2) develop a transport system or improve the existing one to make the area adequately accessible; (3) develop a system of fire protection (in areas where fire is a problem); (4) develop a system of exploitation which will realize the maximum present return from the forest that is compatible with satisfactory regeneration and the continued productivity of the growing stock; (5) develop marketing channels or local industries to utilize as completely as possible the yield from the forests; (6) develop a programme to increase or maintain the productivity of the areas through planting and silvicultural practices.

Obviously this is no more than a general pattern of development. The areas which should receive priority will vary greatly in their characteristics not only between countries but within the same country. They may consist of previously unexploited forest, entirely in public ownership, but lacking in transport, or they may contain forests which have been in use for many years and which may require extensive reforestation, largely in private ownership, but with reasonably good transport. Development will have to be patterned to the conditions that exist.

Primary responsibility for initiating management of the forest resources will have to reside in the Governments. But private initiative should be encouraged and utilized. Since forest management must be closely linked to the industries using wood, it will often be efficient for private industrial concerns to operate the forests, either owning the land themselves or under concession from the Government. However, the history of private exploitation of forests in Latin America is one of destruction rather than development. The forests are too important to the future of the region to allow them to be destructively exploited for short-run gain. In the interests of the public, the Governments must exert much stricter control over the exploitation of public forest land than they have in the past.

Because of the variety of conditions which exist in the forests and the fact that these countries will change materially during the next twenty-five years, programmes to develop the forest resources should be kept flexible. It will take imagination, ingenuity and adaptability on the part of the responsible personnel to manage these resources effectively. Success will depend on the people and organizations involved and it would not be wise to hamper them by trying to prescribe the form of management by law.

In brief, the first need in all countries is a reconnaissance of the forest resources and a plan of priorities for their development; the second is a continuing programme of more detailed surveys to guide the selection of areas for development and their management, and the third is an organization capable of administering a programme which will gradually extend management to the forests of the country.

Ownership problems

The owner of a piece of property always influences what can be done with it. Regardless of whether that owner is a state or a private individual, what he does with the property depends on how that use coincides with his other interests. The extent to which the activities described in the previous sections will be carried out depends heavily on who owns the forest resources.

It is estimated that a little over half of the accessible forest lands in Latin America are publicly owned. Since less than half of the total forest area is classified as accessible and since most of the inaccessible land is

probably publicly owned, the public may own as much as 80 per cent of the total forest land resource. The accessible lands have the most immediate possibilities for development, however, so private ownership is significant for the future. Little information is available about any of these owners, their attitude towards their forest property, or their plans for its use. However, the general problems are evident and worth discussing.

Timber growing is a more extensive type of operation than the production of agricultural crops. Income per hectare is usually low compared to such crops, though there are some places in the world—such as Italy and the Near East—where tree plantations are more remunerative than agriculture. However, the annual input of labour and equipment per hectare is also low. The total net annual income from growing timber as a crop may be as large as from any agricultural enterprise, but the amount of land required to produce that income is usually much larger. Timber growing on a small scale is generally not attractive unless it can be combined with agriculture or some other activity which will provide employment for the necessary labour and capital during that part of the year when it is not needed in the forest. The disadvantages to the small land owner of growing timber on a small scale are so great that well-managed small forest properties are found in only a few places in the world.

Timber growing is an activity in which, over a considerable range of size, the larger the property under management, the smaller is the average cost per cubic metre of wood produced. There are a number of reasons for this. Supervisory and technical personnel are needed to manage a forest regardless of its size. A forest engineer, for example, can provide adequate technical supervision for perhaps 100,000 hectares. A forest property smaller than this will have higher supervision costs or inadequate supervision. The minimum equipment for effective fire suppression is adequate to protect a sizable area, but the same investment will be needed to protect a smaller area. Tractors, trucks and other logging equipment represent a large investment with high fixed costs for interest and depreciation. If the amount of timber harvested from a property is enough to keep this equipment operating full time, the cost per cubic metre of wood extracted will be lower than on a smaller property where the equipment is idle part of the time.

The investment required to build the necessary transport facilities for the efficient management of forest lands is quite large. Small landowners will ordinarily not have access to the amount of capital required for such investments. Considerable capital is also required to reforest idle lands, to improve degraded or low-quality stands, and to wait substantial periods of time for a second harvest from the land. Such investments may be profitable and possible on a large scale, whereas the necessary investors could not be found for a small operation.

A possible solution to these problems where the forest land is divided up in small holdings is some form of co-operative enterprise. Forest co-operatives have been especially successful in the Scandinavian countries, but also exist in many other parts of the world. By pooling their resources in a co-operative undertaking, small owners can often achieve many of the economies of scale enjoyed by larger owners.

All of this indicates that for efficient and economical management the forest resource should be controlled in large units. This is not a serious problem on the land in public ownership, but in the case of privately owned land it may conflict with other social objectives.

Land reform as visualized in Latin America includes the breaking up of large landholdings for distribution among a number of small holders. In many areas where these properties may be divided considerable land suitable only for forest is intermingled with the land suited to cultivation or pasture. This forest land could be useful to the prospective small holders as a source of fuel, posts, and other products for home use as well as possible wood to sell. However, the history of forest use by small owners in Latin America and other parts of the world does not give much hope that these new owners will manage their land in the most productive manner. Fragmentation of properties now large enough for efficient forest management will almost inevitably result in lower productivity on that land. Even if the forest has been mismanaged under the large ownership, the possibilities of bringing it under better management in the future are better in the large unit than if it is broken up into small holdings.

This should not be used as an argument against the sub-division of large properties, if it is justifiable on other grounds. But land reform programmes should take into account the nature of forest property and fragment forest holdings with a clear understanding of the problems they are creating for the rational use of those forests. It is essential that each parcel contain enough non-forest land to enable the new owner to earn a living without having to make some uneconomic use of his forest. Where possible, the forest should be excluded from the land parcelled out, and blocked up into economic units for operation by the Government or by a co-operative. When forest land is parcelled out, it should be recognized that the new owners will need more than the land if they are to manage it in a productive manner.

Since sizable areas are still undeveloped in most Latin American countries, settlement will be a logical and active programme for many years. Forest development and settlement should be compatible in these new areas. People are needed to work in the forests and the settlers can benefit from a chance to earn money in addition to what they produce on their own lands. But, as in land reform, it is essential that the settlers be placed on land really suited to agriculture and not put in the position of trying to farm land suited only to forest. The permanent forest land should be kept in large units and managed for timber production wherever possible. If the timberland can be blocked up sufficiently it might be managed as a community forest for the mutual benefit of the settlers. Small lots of timberland interspersed with cropland and pasture, windbreaks, and similar areas could not be controlled efficiently by a public forestry agency. But the public can make efforts to encourage the new owners to take care of such forested parts of their properties.

The present pattern of landholding in Latin America plus the results of land reform and settlement will mean that considerable forest land will be divided up into ownerships too small for rational management. These small holdings could contribute a substantial amount of wood to the economy even though managed less efficiently than larger holdings. But the owners would need help and guidance to accomplish this end and the only apparent source of such help is the Government.

In the long-run, Latin American Governments should develop programmes to improve the management of small forest properties. One source of such help to the small owners will be the large number of agricultural extension experts who will be trained to follow through on the land-reform programmes. All these extension experts should receive some minimum amount of training in forestry as a part of their agricultural education. If all the agricultural colleges would include some forestry in their curriculum, the extension specialists would all be able to answer the easy questions of their constituents about the forests and would know where to go for help on the difficult questions.

A substantial part of the privately-owned forest land in Latin America is in large holdings. Some few of these owners have done a good job of managing their forests for permanent production, but the vast majority have merely extracted what they could from them. Unfortunately public and private interests do not necessarily coincide when it comes to forest use. The public is interested in continuing production of wood on a permanent basis; the private owner is usually interested in the largest possible immediate revenue. It is difficult for an individual private owner to take the very long-range view that is necessary to proper forest management. A corporation or a wood-using industry which must have a continuing source of raw material is more likely to do this than an individual. The Governments will have to insist that such private lands be handled in a way that will not threaten the welfare of future generations. This will involve education, assistance, and in the last resort regulation. But in no case can the Governments wait much longer before starting to influence by one means or another what is done with these important privately-owned forest resources.

Problems of administration and organization

The productive capacity of the Latin American forest resources is potentially high, but many difficulties stand in the way. It will take organized effort to promote and carry through the activities needed to raise productivity. These activities will be numerous and diversified and most of them will have to be continued permanently. If they are to complement each other and fit together into a national programme of forest development, they must be competently administered. The relative success of the Latin American countries in obtaining the optimum benefit from their forest resources will depend heavily on the organizations they develop to promote and administer the forestry activities.

The Governments will have to assume the major responsibility for developing the forest resources. However, the economies of most of these countries are largely based on private enterprise and private organizations have proved capable of administering forest resources efficiently in other parts of the world. A combination of private and public efforts seems the logical pattern and the one that may be expected in most countries. Private enterprise can play an important role in the development of Latin America's forest resources and should be encouraged to the extent that it proves its ability to operate without prejudicing the public interest.

Public forestry agencies

Every Latin American country has at the national level some kind of agency nominally charged with responsibility for the forest resources. These agencies are everywhere inadequate for the job in hand. In a few countries they are reasonably well staffed and active; in most others they exist largely on paper or consist of a handful of employees.

One obvious problem for these public agencies lies in their inadequate budgets. The kind of programme needed to develop Latin American forest resources will require fairly large expenditures and investments on a continuous basis. If these nations are to reap the benefits which their forests are potentially capable of producing, they must devote more than a token amount of the national budget to forest development. However, the appropriation of larger sums for the forestry agencies will not by itself make them effective. Other serious problems hinder the development of satisfactory public forestry agencies. More adequate financing will aid in solving most of these problems, but too much money immediately might be more of a handicap than a benefit. A desirable financial programme would provide immediately the minimum budget that the existing agency can use efficiently and would provide substantial annual increases in this budget as the agency builds up the needed organization and develops effective programmes.

The most serious problem in the development of effective Latin American forestry organizations is the scarcity of adequately educated personnel. This problem really exists at three different levels of personnel, which will be discussed separately.

First is the professional level—that of the forester or forest engineer. The management and administration of forest resources is a field of professional activity distinct from any other. It requires a firm basic understanding of biology and ecology and the possibilities of manipulating forest growth. It requires technological knowledge of wood as a product. It requires engineering knowledge adequate to harvest and transport products of tremendous weight and bulk in remote and inaccessible places. It requires an understanding of economic relationships and of how to analyse problems in terms of their economic significance. More important than these, perhaps, it requires the ability to think, plan, and operate in terms of extensive areas (hundreds of thousands of hectares) and long periods of time (from twenty years to a century or more). As a result of their specialized education and experience, professional foresters are better prepared to handle the complex problems of renewable natural resources than are people of any other training.

The number of professional foresters in Latin America is small. Only in recent years have the universities begun to offer professional training in this field. Mexico has had a school of forestry for twenty-five years and has more professional foresters than any other Latin American country. Chile, Colombia and Venezuela have had forestry schools for ten years and the Inter-American Institute of Agricultural Sciences in Costa Rica has offered advanced work in forestry for about the same period. Argentina and Brazil have just started new forestry schools. In the other countries universities offer nothing more than a single course in silviculture as a part of the agriculture programme. Many of the professional foresters now active in Latin America received their education abroad; some are foreigners who came to Latin America to work, others are natives who went abroad to study. Nearly all the Latin American foresters are specialists in

silviculture or engineering; few of them have the economic training required by most decisions in research, administration, management, utilization and industrial development.

Because professional foresters were not available (and still are not in many countries), most of the public forestry agencies have been staffed with people of other professions—most commonly agricultural engineers. Some of these people have been genuinely interested in forestry, have learned through study and experience, and have done a capable job. Unfortunately others have lacked this interest and have done their jobs routinely and without imagination, or in the worst cases have held their positions simply through political patronage.

The mere fact that a man is a professional forester is no guarantee that he will be competent and successful. But experience in other countries indicates that an agency staffed with people of a common educational background and professional interest is most likely to develop an *esprit de corps* and a well-integrated programme. The task of developing the forest resources of Latin America will require agencies of this kind; with spirit, enthusiasm, and a devotion to their professional responsibilities. Since the development of such agencies depends on a supply of professional foresters, it is urgent that the facilities for educating such professional people be improved and expanded.

Forestry schools are now operating in all the larger countries but they have difficulty obtaining experienced teachers and adequate finances. The number of schools should therefore be increased cautiously. Unless the demand for trained foresters will justify a teaching staff adequate to provide good instruction in all the needed disciplines it would be better to expand and improve the existing schools than to start new ones. The existing schools already accept students from other Latin American countries. During the immediate future, it would probably be better for the countries without schools to arrange to send their nationals to these existing schools rather than to try to establish their own.

The most serious scarcity of forestry personnel is at the top administrative level. As in any other organization or field of activity, the accomplishments of the public forestry agencies will depend largely on the leadership they receive from their directors and administrators. The professional foresters in Latin America as a group are young and inexperienced; the great bulk of them have been out of the universities less than ten years. The selection of people for administrative positions is therefore a serious problem and one to which there is no easy solution. A gradual growth of the forestry agencies is desirable so that the most promising individuals can be given progressively more responsible assignments as their personal ability develops.

Finally, there is a scarcity of trained people to work at a subprofessional or intermediate level. Many important jobs in the execution of forestry programmes do not require a full professional education. The professional is needed in the policy, planning, and higher administrative positions. But non-professional men with adequate technical training working under the direction of professional foresters can supervise and carry out most of the other work. This type of trained technician is almost non-existent in Latin America. Several countries have recently set up schools to train such technicians in one or two years, but more are needed. Since it requires five years of university training to produce a professional forester, and these people are in such short supply today, it is wasteful to use professional men on jobs which can be competently handled by technicians. In contrast with the professional schools of forestry, it would probably be desirable to have a school for forestry technicians in almost every country. Such domestic schools could train technicians to handle the problems which occur in their own country and not attempt to train them for broader service.

Besides finances and personnel, still other problems handicap the public forestry agencies. In most countries the forestry agency is set up in the Ministry of Agriculture, which in general is a logical arrangement. In many countries, however, it does not have the status of a sub-ministry or major department. Where forestry is only a minor division within a department that is concerned with other problems (usually extraneous to forestry), the lines of communication between the forestry agency and the Minister of Agriculture or other major policy-making officials are too long to be efficient. The officials in between are primarily interested in some other aspect of agriculture and it is too much to expect them to be enthusiastic and active in carrying forestry problems to their superiors and fighting energetically for forestry interests.

The forest resources are sufficiently important in most Latin American countries to warrant major administrative status. This has already been achieved in some countries, sometimes with forestry and other compatible programmes brought together in a renewable natural resources agency. It must be done in the other countries if they hope to develop their forest resources energetically. The director of the forestry agency needs enough authority to develop a strong programme and to deal independently with other agencies. This he can only have if his position in the administration is sufficiently high to give him direct access to the policy-making officials.

In some countries responsibility for the forest resources is divided among several agencies. Forestry departments may exist in the Ministry of Agriculture, the Ministry of Settlement or Lands, and in the development authority. Responsibility for the public lands may rest in one agency and responsibility for control of timber extraction in another. In the present state of forestry development, and in view of the limited resources available for such work in most countries, it appears preferable to consolidate all forestry activities in one agency. Because of the key position of industrial facilities in determining the productive capacity of the forest resources, it would be desirable that responsibility for the development of wood-using industries be assigned to this same agency.

Private forestry organizations

The area of forest actually owned and managed by private companies will probably never be relatively large in Latin America. But practically all the harvesting, transport and processing of the timber is likely to be done by private enterprise. These private companies will have to operate under various degrees of government restriction and control. In order to operate profitably under these conditions, the companies will have to be better organized and administered than the average company now operating. It seems reasonable to expect that the future companies will be larger and will have more capital at their disposal.

These companies will have the same personnel problems as the public agencies. They also will be affected by the shortage of professional foresters and sub-professional technicians. They will have a similar problem of competent people for the top executive positions, since there are few Latin Americans with experience in the management of large forest properties and of extensive logging and processing operations. In addition they will have the problem of skilled labour, since it may be taken for granted that harvesting, transport, and processing operations will be mechanized and modernized. Some kind of programme will be needed to train operators for mechanical equipment and to provide foremen competent to run mechanized operations.

SUMMARY

The situation of Latin America with regard to forest resources and prospective future requirements for wood products can be summarized briefly. Consumption of wood may be expected to increase rapidly in all these countries during the next twenty-five years, providing that wood is available to the consumers. The forest resources of Latin America are adequate to cover these future requirements on a regional basis, providing that the necessary steps are taken to increase their productive capacity. If sufficient effort is put into developing the forest resources, they are potentially adequate to also provide a surplus for export from the region. However, Latin America has done little up to the present time to develop them, and the productive capacity of the forest resources is declining in most countries. If Latin America is even to cover its own domestic requirements for wood in the future, positive action must be taken immediately to start developing the forest resources with a view to rapid expansion in the near future.

This positive action should consist of a survey and classification of the forests in each country; the assignment of priorities for development to various sections of the forests; the development of transport, fire protection, and planned harvesting in the areas of high priority; and the extension of silvicultural management to forests in these same areas. Also needed immediately is increased effort to find economic ways of using the species which are currently unused or have only limited use and the development of industrial capacity in balance with the potential productive capacity of the forest resources.

Such a positive programme can be carried out only if someone is made responsible for its activation and is given the technical personnel, information, and finances needed for success. Each country should develop a strong, well-staffed government forestry agency and should give that agency clear responsibility and authority to develop the forest resources of the country. In order to provide the needed personnel, the existing Latin American forestry schools should be strengthened and increased in size; well-qualified students should be encouraged to enter these schools; and a programme should be developed to send to them a substantial number of students from the countries which do not have schools of their own. Sub-professional schools to train forestry technicians should be developed in each country or should be made available to students from the smaller countries which feel unable to establish their own. Finally, the existing research organizations should be strengthened and expanded and a co-ordinated programme of research developed on the silviculture of Latin American forests and the properties and utilization of Latin American woods.

Chapter 9. Requirements and industrial capacity

During the next twenty-five years, the domestic consumption of individual wood products in Latin America will increase from two to six times over what it is today, if these products remain as available as they now are and if their prices do not rise in relation to those of competing materials. Chapter 8 demonstrated that the potential productive capacity of the Latin American forest resources is much larger than the amounts of wood that will be required to supply this greatly expanded domestic consumption. The region thus has the potential to be an exporter of wood products. But regardless of how much wood the forests are potentially capable of growing, their productivity is limited to the amount that can be extracted and manufactured into useful products. The actual productive capacity of a country's forest resources depends partly on the manufacturing capacity of that country's wood-using industries. Latin America's wood-using industries will therefore have much to do with whether the region becomes a major exporter of wood products or is not even able to cover its own domestic requirements for such products in the future.

The Latin American countries have been producing domestically most of the wood products they have used with the exception of pulp and paper. The capacity of the forest products industries (other than pulp and paper) on a regional basis is therefore at least as large as the present consumption. The fact that some plants are idle and others are not operating to full capacity indicates that the total capacity of the existing industry actually exceeds present consumption.

But consumption depends on what is available to the consumers and on the prices they must pay. Wood-products consumption is low in Latin America compared with other parts of the world. This is at least partly due to the high costs and poor quality of many of the products. If the existing industry produced better quality products and sold them at lower prices, present consumption would be higher. Most Latin American countries also impose restrictions of one kind or another on imports of wood products. If the domestic industry were able to provide all the wood products the people wished to consume at prices they were willing to pay, there would be no need for such import restrictions. Thus the potential demand for wood products in the Latin American countries is certainly larger than the present consumption would indicate. The amount consumed is restricted by the supply made available: by the limited or even non-existent domestic production of some products, by the high cost and poor quality of the domestic production of others, and by the exclusion or high cost of imported products as a result of tariffs and other trade restrictions. The manufacturing capacity of the Latin American wood-

products industry is generally not adequate to take care of the potential demand for these products.

The capacity of an industry cannot be measured completely in terms of cubic metres or tons of output. The quality of the products and the price at which they can be offered on the market are also important characteristics. Capacity must be expressed in terms of a product of specified quality and a reasonable price. It is in these respects that the present capacity of the Latin American wood products industry is deficient.

Most of the wood that people use must pass through a manufacturing process on its way from the forest to the ultimate consumer. The amount that the people of a country can use depends on what the wood-products industry can produce, regardless of how abundant the country's forests may be. And regardless of how productive a country's forest resources may be, the amount of benefit that the country can derive from those resources depends on what the country's industry can manufacture from this raw material and sell at a price that will cover its costs. The harvesting and processing stage thus places limits on both the exploitation of the forests and the consumption of wood products. The wood-processing industries occupy a very strategic position in the development of the potential productive capacity of Latin America's forest resources.

In view of this, the suggested under-capacity of the existing industry poses a serious problem. If the full economic potential of the forests as a productive resource and of wood products as contributors to a higher income and standard of living are to be realized, it will not suffice to duplicate or triplicate the existing industrial structure. The needed industrial expansion should be accompanied by lower cost and higher quality of the product. Wood is an extremely versatile material whose potentialities have been little exploited in Latin America. If the wood-processing industry develops with efficiency and imagination, the future requirements presented in this report may well prove to be decided under-estimations.

Nature of the wood-products industries

Industry, as the link between the forest resource and the consumers of wood products, has two aspects. From the forest's viewpoint, industry is the consumer of wood; from the consumer's viewpoint, it is the source of supply. The domestic industry of any country should therefore play two roles. It should help the country realize the optimum benefit from its forest resources by developing means of processing the wood grown and by promoting the sale of the resulting products. And it should help meet the people's need for wood products by producing as many as possible with wood from the domestic forests.

The wood-products industry should expand in all Latin American countries. The particular kinds of products to be manufactured and the amount of expansion in each will differ from country to country, depending on their resources and requirements. But industrial development in every country should be planned with the joint purpose of satisfying domestic requirements and utilizing as completely as possible the productive potential of the forest resource.

Covering domestic requirements

Domestic requirements for wood products may be met in three ways: through domestic production, through imports, and through the substitution of other products. (Substitution may not sound like a way to cover requirements, but these requirements are not for sawnwood or any other product; they are for housing, furniture, packaging, and other end uses. Part of the additional material needed for construction may be fibreboard in place of sawnwood and part of that for packaging may be paperboard.) The future increase in requirements may be covered by any combination of these. There is another possible policy with regard to domestic requirements, and that is to do without. Various countries have done this in the past with some products, such as newsprint or fibreboard. But a policy of doing without is hardly logical in a region that has vast forest resources and is striving to make substantial strides forward in economic development. The Latin American countries can cover their future requirements by the three methods mentioned above and contribute to economic development in the process.

All the countries can increase domestic production of the wood products they now make. In some countries this will mean mainly an increase in the manufacturing capacity of the industry, as is the case with fibreboard and paper in Chile. In other countries it will also require an increase in the amount of wood being grown in the forests, as is the case with pine sawnwood in Brazil. Some countries will not be able to increase their domestic production of certain products very much because of limited potential forest capacity. Others may not be able to increase domestic production enough to cover all their prospective requirements, but can increase it enough to cover a substantial part of them. Many countries can start domestic production of products that they have not used very much in the past because they had to be imported, as Peru is now proposing to do with particle-board.

Few countries will be able to cover their increasing requirements by merely cutting more of the same species and processing them in the same way. The forest resources—even assuming they are managed—will not be adequate for this in most countries. Industry's job will be to use the forests that are available as effectively as possible. Species which have not been used in the past can serve in certain uses if properly processed. Species now put to inferior uses can serve more demanding purposes if processed better. More careful processing can increase the proportion of the better grades of material recovered from the same kinds of trees and logs. Waste can be reduced and more usable material recovered from the same amount of roundwood. But all of this implies a different and more efficient kind of manufacturing plant from those currently producing.

A potent opportunity to expand domestic production on the same forest resource base lies in the preservative treatment of timber. Particularly in the tropical countries, many species of wood are not used because they are so readily destroyed by decay and insects. Chemical treatment can make many of them as durable, and perhaps more durable, than the species now used. Preservative treatment can greatly expand the supply of material suitable for poles, posts, sleepers, and similar products in all parts of the region. Since few treating plants now exist in Latin America this will require the development of a new industry or an addition to existing industry in most countries.

Substitution of different products can help materially to cover domestic requirements in Latin America. Pre-

viously unused species when processed better or treated with preservatives may substitute for species now in use. The wood-based sheet materials are excellent substitutes for sawnwood. The Brazilian plywood manufacturers have developed and promoted a special plywood for use in concrete forms, which are made of sawnwood in most other Latin American countries. A Chilean company is experimenting with fibreboard for the same purpose. Part of the future requirements for furniture will undoubtedly be met with plywood in place of sawnwood. Plywood is relatively demanding in its raw material, so a country with insufficient species suitable for sawnwood and plywood may substitute particle-board, which can be made of poorer species. Paperboard is an effective substitute for sawnwood in packaging. It has almost completely replaced sawnwood in this use in the United States and a similar substitution may be expected in Latin America as the production of paperboard is increased. This substitution of one kind of wood product for another will require the development of new industries in most countries, and this development must be carefully planned if it is to accomplish its desired purpose. These problems of development will be discussed at some length later in this chapter.

Most of the Latin American countries are already importing part of the wood products they need for domestic consumption. It seems likely that imports will continue to play an important role in covering future requirements. But the present pattern of importations is not necessarily a logical one. With about one-fourth of the world's forest land—and part of this extremely productive—Latin America should be an exporting rather than an importing region. At present the region is actually a net exporter of wood products other than pulp, paper and plywood. These particular products require more elaborate manufacturing facilities than the other wood products. It is the shortage of such processing facilities, rather than a lack of forest resources, that causes Latin America to import these products. With the construction of new plants in recent years, Colombia has ceased to import plywood and Chile has become an exporter in place of an importer of newsprint. Similar industrial development is, and should be, taking place in other countries. It is not logical that Latin America as a region should depend on external imports to take care of its future requirements.

Within the region, the situation is somewhat different. Not all of the countries are equally endowed with forest resources and the kinds of forests they have vary considerably from one country to another. Some of the Latin American countries are very small and their individual domestic markets will not support a manufacturing plant of economical size for some wood products. It seems reasonable that the countries should complement each other. This is the idea of the common market. If such an integrated development is to be successful, every country cannot attempt to be self-sufficient in production.

However, the case of wood products is not a simple one. All the Latin American countries have some forest resources. Because of the favourable climate and growing conditions, even a country like Uruguay, which has only limited natural forests, could produce a considerable volume of wood in plantations of eucalyptus, pine, or other fast-growing species on land which is not highly productive in other uses. Especially in South America, the only feasible international routes are long roads; other transport facilities are poor, and imported products will have a high transport cost. Labour is plentiful in all Latin America, and other valuable productive activities will not usually have to be sacrificed in order to divert men into the timber industries. All these points argue for domestic production in place of imports. There is obviously a need for international co-operation in planning the development of the forest resources and industries after the general pattern of the Central American Integration Programme. Each country should make the most of its own resources, but in many cases industrial development can only proceed logically if several countries work together.

Realizing the productive potential of the forests

The possession of forest resources gives a country the potential ability to increase its domestic product, because they can be the base for production of goods for both domestic consumption and trade with other countries. This can only be accomplished through an industry capable of harvesting and processing the forest products. If the manufacturing industry of the country is not adequate to utilize the full productive potential of the forests, the country cannot take advantage of the possibilities offered by its forest resources. But the industry can only expand its output if it can find markets for the additional products. The ultimate controlling factor is therefore the extent of the available markets. But these markets must be discovered or developed by the manufacturing sector of the industry, since the timber-growing sector produces only raw material. The basic problem of realizing the productive potential of the forest resources is therefore one of developing markets for the products that can be made with the wood from those forests.

Markets for the output of the wood-products industry may be broadened in five ways: through the expansion of domestic consumption of wood in its traditional uses, through the substitution of domestic wood products for imported products, through the development of new domestic uses of wood products, through the substitution of domestic wood products for other domestic products, and through the export of domestic wood products.

The domestic consumption of wood in its traditional uses may be expected to increase gradually in all the Latin American countries with increasing population and income. The actual amount of the increase, however, can be influenced by the manufacturers of wood products. People will be encouraged to use more wood for these purposes if the price is lowered, or at least not raised, and if the quality is improved. Better service and more active selling and advertising would probably also increase consumption in most of these countries.

Imports of wood products are not large in most Latin American countries with the exception of pulp and paper. Where the country has adequate forests, however, it may be possible to replace practically all imports with domestic production. If these products can be made cheaper domestically, the amount consumed may be even larger than what has been imported in the past.

Latin Americans are not large consumers of wood compared to Europeans and North Americans. Wood must be used in many ways in those regions in which

it is not used in Latin America. It is possible, therefore, that new uses of wood can be introduced in the Latin American countries. The best possibilities probably lie in the pulp and paper field. Although almost all paper products are sold in Latin America, the consumption of many is so limited that they would represent practically new products to the mass of the consumers.

Numerous opportunities exist for the substitution of wood products for domestic products of other materials. An example is the substitution of creosoted eucalyptus poles for concrete telephone poles in parts of Brazil. There are many possibilities in the construction industry where wood is not widely used today. Properly designed houses of preservatively treated wood may be cheaper and faster to construct than those of traditional materials.

Finally, there are possibilities of producing and exporting various products to other Latin American countries or the rest of the world. The exports of newsprint from Chile, lumber from Paraguay, and plywood from Mexico are examples of what might be done. A quality product is essential in the export market, where competition from other countries is severe. This will generally require new and efficient installations which, however, may produce for domestic consumption as well as export.

Development of the wood-products industries

In every Latin American country there exists some industry processing forest products. In some countries the existing industry is very primitive; in others, parts of it at least are quite modern and efficient. What role should this wood-products industry play in the general economic development of these countries and how should it be assigned to that role?

The total output of the wood-products industries as a group should increase in the future in all Latin American countries. This increase can come about through expansion of the existing industry (adding more plants and increasing the size of the existing ones), through improvement of the existing industry (modernization of equipment and processes), and through the establishment of new industries. How much of the development effort should be devoted to each of these ways of increasing output?

The industry of any country should first be considered in the light of domestic requirements for wood products. This market exists and can be expected to expand in the future as population and income increase. It will require a minimum of market development; transport and other costs should be less than in any other market; and competition from foreign producers will also be less effective. These are the reasons that the inefficient existing industry has been able to survive. However, the limited resources available for economic development should not be squandered on inefficient means of production.

The existing industry is very unproductive in many places. It is estimated that 100,000 cubic metres of sawnwood are produced annually by handsawing in Colombia. This is a form of production that cannot be improved but only replaced by mechanized processes. British Honduras (Belize) claims 29 sawmills but almost all of the sawnwood is produced by the mills of one large company. Only 100 of the 800 Chilean sawmills are classified as permanent. Throughout the region, most of the sawmills are small, poorly equipped, and underpowered. The best of these mills can be improved with new or additional machinery to a point where they are reasonably efficient. The rest of them are probably hopeless. The larger and more modern mills are better prospects for improvement and expansion in size. The manufacturing plants for other products such as plywood, sheet materials, and paper are generally larger and better designed and equipped than the sawmills. Some, like the fibreboard mill in Chile, are built in such a way that additional machines can eventually be installed to expand output. Wherever the existing industry—or part of it—is reasonably efficient, the best way to take care of increasing domestic consumption is probably through improving these existing plants and increasing their size. Where the domestic industry is very inefficient, it will be necessary to establish new mills and these should be of modern design and efficient size.

Part of the domestic consumption of some products has been supplied through imports. Where it is economically possible, substituting domestic production for imports by establishing new industries would be advantageous. Diversification of production lends stability to the economy and this will justify establishing different industries to supply domestic consumption even in countries which can export certain products advantageously.

Domestic requirements for the traditional products may not be sufficient in quantity and kind to utilize the productive capacity of a country's forests. So industry should next be considered with a view to making optimum use of the forest resources. What raw materials can the forests produce that will not be needed for increasing domestic consumption of traditional products?

The condition of the existing industry must also be considered at this point. The Mexican plywood industry has the capacity to produce 100,000 cubic metres of plywood per year, but in 1958 it actually produced only 31,000. The limiting factor was markets. It is estimated that the Argentine plywood mills could increase their output by at least 30 per cent without adding any new equipment. In both these countries there is excess productive capacity, in the forest resource as well as in the concomitant processing facilities, for the present market. The problem is to find additional market outlets so that the productive capacity can be utilized, and this Mexico is trying to do abroad. Similar excess capacity exists in numerous countries for some of the wood products. Expanding production will require little investment in these countries but will require efforts in market development.

The best opportunities for disposing of products made from this surplus raw material are probably within the country itself. New products may be introduced that have not been used before in the country or that are capable of competing with and displacing other products in domestic use. If a country has some particularly valuable resource and the necessary conditions for low-cost production, it may be able to sell its products in the international market. Because this market is so demanding of quality and low price, existing plants will have to be improved and made much more efficient, or else new and modern plants will have to be built to concentrate on production for export.

No general recommendation can be made about developing the wood-products industry that will hold good in all countries. Each country must try to plan

the development of its own industry in terms of the potential productive capacity of its own forests, its prospective future requirements for wood products, and its situation with regard to competition in the world market. The development of a wood-using industry in a country must be integrated with the development of its forest resources and the rest of the economy. The wood-products industry is likely to be the dominant one in few, if any, of the Latin American countries, but it should be a major industry in many of them.

Problems in developing the wood-using industry

The development of the forest-product industries of Latin America to a position commensurate with the importance of the forest resources and of wood in the economy of the region will face some serious problems. An understanding of them is basic to any attempt to plan for industrial development.

Inadequate knowledge of resources

Industrial development must be closely related to the potential productive capacity of the forest resources. Industries must be designed to make the most of that potential capacity but at the same time avoid the tragic situation of more manufacturing facilities than the forests can support. The necessary basis for this is reliable information about the volumes, species composition, growth, and quality of the country's forest resources. Mexico, Brazil, and a few other countries are making reconnaissance surveys of part of their forests and all the other countries should be doing the same. On the basis of such reconnaissance, the most promising areas can be selected and inventoried in more detail as a preliminary to planning industrial development. This problem of obtaining more information about the forest resources is discussed at greater length in chapters 8 and 11.

Estimating present and potential markets

Information on the consumption of wood products in Latin America is very scanty. The figures presented in this report are the best that could be assembled, but in many cases are based only on estimates. In some countries well-informed people differed considerably in their estimates of consumption of certain products. This indicates a great need for better statistics on the use of wood products. They should be based on reliable reports or sampling and collected on a continuing basis so that trends can be detected and future developments predicted. Without such statistics, industries must be planned in the dark and serious mistakes are possible.

In addition to better statistics on current and past consumption, economic studies are needed to forecast likely future developments. General studies of this nature are being made by the Economic Commission for Latin America and by various of the national planning and development boards. There is a need, however, for more detailed studies of fields such as construction, for example, which would help to recognize opportunities for the development of new wood-using industries or for the modification or expansion of existing industries.

The scale and pattern of wood-using industries

The existing wood-using industries in Latin America include plants of all sizes and patterns of organization. Part of the inefficiency of these industries stems from the fact that the plants are not of the proper size or design for the conditions under which they are working. It is imperative that these deficiencies of the existing industry be corrected in new installations and in the changing or expansion of the plants now operating.

Certain limiting factors determine whether an industry can be established and survive at all in a particular country. For each wood product there is a minimum size of plant in which a satisfactory product can be made economically. Most of them can be made in smaller plants—and it is done—but the quality of the product is generally inferior and the average cost per unit much higher. The necessary machinery and technology set a physical limit to plant size, and this is often very large in industries such as pulp and paper. The minimum economical plant to manufacture mechanical pulp needs a capacity of about 50 tons daily and for chemical pulp it may be as high as 200 tons a day. For sawnwood an efficient mill should produce at least 70 cubic metres per day.

There is usually also a minimum output which must be maintained or exceeded if the plant is to be economical. Certain industries typically work more than one shift a day, or seven days a week, or must be assured of working all year round. Such schedules indicate that a minimum annual output is needed to keep costs at acceptable levels. For mechanical pulp this minimum is in the neighbourhood of 15,000 tons per year, and for chemical pulp about 60,000 tons.

For a new industry to operate a plant of the minimum economic size and output in a country, it must be assured of two things: an adequate supply of raw material on a continuous basis to keep the plant operating, and adequate markets to absorb the total output on a continuous basis and at satisfactory prices. Without both of these, the industry is doomed to eventual failure.

The more critical of these in Latin America is probably an adequate market. With few exceptions, these countries are small. Potential consumption is even less than the populations indicate because income is low and its distribution is such that a large proportion of the people are not potential consumers for a new product. The minimum output of a plant to manufacture fibreboard or paper, for example, is likely to exceed the possible domestic consumption in a number of Latin American countries. Such a plant is an economic impossibility for some of the countries unless domestic consumption can be increased, the excess over domestic needs can be exported profitably to other countries, or the plant is heavily subsidized by the Government. Domestic markets will grow with time in these countries as their populations and incomes increase and eventually it will be possible to establish industries where they are not economically feasible today.

The limited market problem may not be serious if an industry can produce for more than one country. However, in a region with abundant forest resources and idle people, such as Latin America, every country will be desirous of developing domestic production. As populations and incomes grow, the domestic consumption in many countries will become large enough to support domestic manufacture of a product previously imported. A country which develops an industry with the idea of selling products to other countries as well as its own people, may therefore find itself faced with growing competition abroad. The larger the minimum feasible plant, the less likely is

such competition to develop. If the minimum size is large enough to mean that exports are necessary to dispose of all the output, the first country to develop production of this particular product may eliminate the possibility of other small countries entering this same field. Potential competition for some products will also be limited by the fact that all countries will not have forest resources adequate to provide the minimum amount of raw material needed to support a plant of economic size.

The minimum-sized plant for many products requires a large input of raw material. The 200-ton daily capacity chemical-pulp mill mentioned above requires over 400,000 cubic metres of pulpwood annually for minimum production. An efficient plywood or fibreboard plant will need about 20,000 cubic metres of logs each year. Such an industry can only operate where there are adequate forest resources to support it. Many countries have limited amounts of certain species or types of trees but not enough to supply an industry. Unless it is profitable to export the raw material to another country where the industry exists, it may be necessary to put this material to some inferior use. Veneer quality logs are made into sawnwood, and even into posts and fuelwood, because there are not enough of them to supply a veneer mill.

In order to justify the establishment of an industry the forest resource must be able to furnish the required quantity of logs on a continuous basis. The productive capacity of the forest must, therefore, be at least equal to the minimum required needs of the industry. Plants have been established where the productive capacity of the forest was not adequate. They were supplied by a progressive liquidation of the forest growing stock. Eventually the timber was exhausted and the plant was forced to shut down. Such a temporary splurge of activity which ends with destruction of the forest resource and collapse of the industry has little to recommend it. The development of forests and industry must be planned on a long-term basis. A country will be better off in the long run to put its forests to some less profitable current use if it will continue to produce returns indefinitely.

In some cases it is justifiable to establish an industry which it is known will eventually exhaust its raw material supply. Where extensive areas are being cleared for agriculture or other use, the amount of material and the period over which it will be liquidated may justify installing a sawmill on a temporary basis. In parts of Latin America, timber of the species, size, and quality found in the virgin forests will never be grown under management because of the time required. After the original harvest, these areas will be converted —either naturally or by the deliberate efforts of their managers—to forests of a different kind. These new forests will probably not produce wood suitable for the kind of plant set up to process the old-growth timber. From the viewpoint of the forest resource a temporary industry is desirable here if it can be justified from the investors' viewpoint. The wood-product industries differ in their suitability for temporary or short-period operation. When the minimum investment is not large and can be amortized over a fairly short period, as in a sawmill, temporary operation may be feasible. Where the minimum investment is very large, as in the pulp and paper industry, permanent or long-period operation must be in prospect to justify the establishment of a plant.

The minimum-size requirement has limited development of certain wood-product industries in Latin America, and will probably continue to do so, but there are prospects for overcoming these limits. On the raw material supply side, there are two possibilities. The productive capacity of the forests may be increased through management to a level where they can support a particular kind of industry. Extensive pine plantations have now enabled Chile to develop a paper industry which was impossible twenty years ago because of the lack of raw material. The other possibility is to develop new processing techniques with which the industry can use the kinds of wood that are now available in sufficient quantity. Satisfactory new processes for pulping mixtures of tropical hardwoods make it feasible now to establish pulp mills in Colombia and Mexico in places where the existing forests were previously unusable for this product.

The development of a common market in Latin America will make it possible to establish certain industries in countries which have the necessary forest resources but up to now have lacked a sufficient market. The Central American Integration Programme will be of particular help in this respect, since none of these small countries individually provide much of a domestic market.

In addition to problems of size, the Latin American wood-using industry also has serious problems in the organization of the production itself. The harvesting of wood and its manufacture into products is an extremely wasteful process in Latin America. Only part of the trees in the forest are felled; only part of each tree is removed from the forest; only part of each log is recovered in the mill. At each stage, much of the output is actually waste and not useful. But it costs just as much to transport the part of the log which ends up in waste as it does the part which becomes a final product. There are real opportunities to reduce costs by more complete utilization and, as mentioned in chapter 8, this will also increase forest productivity.

One approach to this problem is through integrated manufacture of different products. A combination of a veneer mill, a sawmill, and a pulp mill could extract more material and also more value from the average mixed Latin American forest. Much of the waste from veneer and lumber manufacture is usable in making particle board and pulp. A Chilean plywood company, for example, makes particle-board out of the waste from its veneer and plywood plants and uses this board as core stock in some of the sheet materials it produces. Integration of processing can reduce the overhead costs of supervision, maintenance, and general administration, and is one way of making full use of the limited quantity of skilled personnel and equipment.

Wood is a versatile raw material. The number of different products that can be made from it and the variation in the demands of the industries which make these products allow for flexibility in utilization. If the development of the forest resources and of the industries to process the wood they produce are planned together, each country will be able to work out a pattern that will allow it to make the most of its potential productive capacity and markets.

The shortage of technical skills

Industrial expansion in Latin America is handicapped by the shortage of skilled workers. The poor

quality of the product of the existing industry is at least partly due to the people employed in its manufacture. Latin Americans are capable of becoming skilled workers but there has been little opportunity to develop industrial skills and to work as part of an efficient industrial organization in Latin America up to now. If industry is to expand rapidly in these countries, it will be necessary to take steps to provide people with the necessary technical skills.

New industry has met this shortage in some countries by importing skilled workers. In some cases these foreign workers have not only operated the plant but have also trained local people to replace them. Some companies have set up programmes to develop their own skilled workers through in-service training. An approach of this kind will probably be necessary in the development of pulp and paper and wood-based sheet materials industries. There are few existing plants to serve as sources of skilled workers for these industries and even in the future there will not be many in any one country. The companies will probably have to train their own workers for the special jobs involved.

In the larger countries it would be advantageous to set up schools to train industrial foremen and skilled workers. Many of the skills required in the wood-using industries are similar to those needed in other industries and such schools might be designed to provide people for industry in general. Arrangements should be made to send people from the smaller countries to these schools for training. A limited number of international schools might also be established to give training in particular skills required by the wood-using industries.

The number of highly-skilled jobs is relatively small in the lumber industry and the harvesting of forest products. The need appears to be more for careful and efficient operation. The labour problem can probably be largely solved through well-planned organization of the processing, work simplification techniques, and strict supervision of the activities. The shortage of these industries lies in experienced foremen and other supervisory personnel. The companies will have to develop these through incentives in the form of salaries and promotion and through insistence on high standards of performance.

In addition to skilled workers and foremen, there is a need for technicians. Most of the existing forestry schools offer some training in wood technology and this might logically be expanded as a function of these schools. The pulp and paper industry demands more of its technicians than the other wood-using industries. It will be able to obtain some of the people it needs from the engineering schools of the local universities, but a regional school to prepare technicians for this industry would be very useful. For the immediate future, foreign technicians will probably have to be brought in if the industries are to expand rapidly. In preparation for the longer run, selected students should be sent to Europe or North America to study and obtain experience and then to return to work in their own countries.

The most difficult shortage to remedy is probably in management personnel. Really capable managers cannot be produced in a short time. An effective arrangement is joint ownership of an industry with a foreign firm which will provide experienced managers during the initial period of operation. Another possibility, of course, is to hire outstanding people from abroad to manage the plant. Both of these are stopgaps and the real need is to develop capable Latin Americans to manage their own industries.

Problems of mechanization

A large part of the existing wood-processing industry is inefficient and wasteful. It must be improved if it is to help meet the increasing requirements for wood products and realize more of the forest potential. This can be done by modernizing and mechanizing the existing operations and by establishing new plants of modern design and efficient size. Both of these actions will cause some problems for both the industry and society as a whole.

The effect of modernizing and mechanizing the existing plants will be to substitute machinery for labour. Harvesting and primary processing as they are now done use a very high proportion of manual labour. With modern machinery, the same work can be accomplished with a fraction of the people now employed. If the most modern equipment and techniques were introduced at once, the displacement of labour would be very large. One man with a power chain saw can probably fell and make into logs as many trees as ten men working only with axes. One man with a fork-lift truck can move and stack more lumber in a day than many men carrying each board by hand. It is possible that complete modernization would eliminate jobs for more than half of the people in the industry.

Since underemployment is common in Latin America today, one major problem is to increase the amount of productive employment. Modernization and mechanization of the wood-using industry appears to be a move in the wrong direction. But two factors carry weight on the other side. If the wood-using industry is to expand its output and sales—and particularly if it is going to expand in the export market—it must raise the quality of its product and at the same time produce it as cheaply as possible. Through modernization the total output of the industry may be increased and this will provide jobs for part of the displaced workers. In addition, if Latin America develops as it should, the present surplus of labour will gradually be absorbed in productive activities. Rising living standards and a growing cohesion of labour will inevitably bring higher wages and labour will no longer be the cheap factor of production that it now is. In the long run, mechanization will be desirable, and it is only its immediate effects that may cause problems.

Modernization will be most effective in the major installations of the manufacturing plants. These main machines more or less control the output and quality that the plants can produce. The heavy capital items should therefore be as modern and efficient as possible. Since these heavy machines also have a long average life time, it is important not to install types which will soon become obsolete and thus condemn the plant to many years of inefficient future operation. This is a strong argument against used equipment for these major installations. The place to start modernization and mechanization is in the key operations of the industry.

The secondary and supplementary operations can be modernized and mechanized later as capital becomes available, labour becomes more expensive, or there are opportunities to obtain the necessary equipment at reasonable prices. In order to take full advantage of this, the plant or operation must be designed around

the modern key machines in such a way that the supplementary operations can be modernized gradually without rebuilding the whole plant. Since the bulk of the labour is employed in these supplementary operations, such as preparing raw material, movement of materials within the plant, supplementary finishing operations, and storage and shipping, modernization of the major installations will not have a serious immediate impact on employment.

The mechanization of secondary operations should concentrate first on those which have a serious influence on quality of the product or which are potential bottlenecks in the product flow within the operation. Ultimately, the aim of mechanization should be to make work easier and less arduous for the workmen. But for the immediate future it is more important to provide work for everyone. A limited amount of capital might therefore better go into modernizing the headrig and resaws of a sawmill so as to increase output and require many men to stack lumber by hand than into fork-lift trucks with which a pair of men can stack the more restricted output of the whole mill. By concentrating investment in modernization and mechanization on the key installations of the industry, it will be possible to increase total output, raise the quality of the product, and very likely provide increased employment with a much smaller amount of capital than would be required to completely modernize the entire industry.

New plants of modern design will provide serious competition for the existing industry. They are likely to be built before the market has expanded enough to absorb all of their output and will therefore compete for the present industry's markets. What will happen then to the least efficient existing producers? In the long run it would be desirable for these inefficient producers to go out of business. But at the time when they are forced out, the repercussions can be serious for the owners, employees, and communities.

If the existing industry contains only a few plants, as is common in many small countries, the bankrupting of one firm may leave a more efficient industry but one that cannot cover the domestic requirements for its product. The opposite could also happen. The existing industry may resist the entry of a new firm by modernizing their own plants in order to compete and the result may be over-capacity for the existing markets.

The wood-products industries have good future prospects in Latin America. Consumption of wood products will increase substantially and may increase very rapidly for some products like paperboard and particleboard. Little real effort has been made to promote the use of wood products or to switch consumers to them from other materials. The existing industry is mostly inefficient, has high costs, produces an inferior product, and should not be serious competition for an active firm with modern equipment. All this indicates good opportunities for profitable investment in the wood-using industries, which in turn leads to the possibility that too many firms may try to enter the business.

If the wood needs of the plants which are established exceed the productive capacity of the forests in a country, a serious situation will exist. Should all operate to capacity, the forests will be destroyed by overcutting, and the industry will eventually collapse. If the government prevents this by restricting the annual harvest to the amount of wood grown, some or all of the plants will not get enough raw materials to operate to capacity. Their costs (and selling prices) will all be higher than necessary because of the excess capacity and consequent high fixed costs, or some firms will be unable to compete and will go out of business. In the latter case, resources will have been wasted that could have been used to manufacture other products. (It is not always possible to convert a plant built to manufacture one product into an efficient plant to make something else.)

The development of the wood-using industries must be planned and guided in each country to maintain a balance with resources and markets. Planning for industry should be in conjunction with planning the development and management of the country's forest resources.

Capital needs

The future requirements estimate made in chapter 6 indicate that if sawnwood and wood-based sheet materials are available and do not increase in relative price, the annual consumption of these products in Latin America will be about 11 million cubic metres more in 1975 than it was in the period 1956-59. The consumption of all pulp products will be higher by somewhat more than 5 million tons. The point has been made repeatedly in this report that Latin America has tremendous potential forest productivity and should cover these future requirements with domestic production. What would this mean in the way of investment in industrial expansion?

An accurate estimate of the cost of expanding production is difficult to make because of the great variety of forms that this expansion might take. But it is possible to indicate the magnitude of the amount of capital that will be needed by assuming that the present level of imports will be maintained; that all the additional material consumed will be produced within Latin America; and that all this addition will be produced in new, modern and reasonably efficient plants. Under these assumptions, the following investments in manufacturing facilities would have to be made between 1958 and 1975 to bring the productive capacity of the various industries up to the level of the 1975 requirements (in millions of U.S. dollars):

Sawnwood	330
Plywood	25
Fibreboard	60
Particle-board	30
Newsprint	640
Printing and writing papers	580
Other papers	870
Paperboard	700

This would mean a total investment of 3,235 million dollars, of which about 2,800 million would be in pulp and paper facilities and 440 million in facilities to make other wood products. The average annual investment during this period would have to be of the order of 190 million dollars in pulp and paper facilities and 25 million for other products.

Further investment would then be required between 1975 and 1985 to bring the total capacity up to the estimated 1985 requirements. The total investment needed during this second period would be about 4,400 million dollars, of which 3,900 million would be in pulp and paper facilities and 470 million dollars for other products. The average investment during this second

period would therefore have to rise to 440 million dollars per year for pulp and paper and 47 million dollars per year for other products. No claim for accuracy can be made for any of these investment estimates, but they give an idea of the over-all magnitude of the amount of capital that will be needed if domestic production in Latin America is to expand enough to cover the future requirements for wood products.

At first glance these estimated investments appear very large, and some comparative figures may help to put them in perspective. During the period 1956-58, the Latin American countries imported, from all sources, sawnwood and sheet materials to a value of 83 million dollars each year. The value of annual imports was thus over three times as large as the necessary annual investment to meet the increase in requirements by 1975. In 1959 the region imported approximately 280 million dollars worth of pulp and paper products, and thus spent a sum 50 per cent larger than the estimated necessary annual investment. A joint study of the Asia-Pacific region made by FAO and ECAFE estimated that the needed annual investment in manufacturing facilities in that region between now and 1975 would be of the order of 210 million dollars per year for pulp and paper and 44 million dollars for sawnwood and sheet materials. These estimates are about 10 and 75 per cent higher, respectively, than those given here for Latin America.

Where is the capital to come from if these additional facilities are to be installed? Part of it—and probably a fairly substantial amount—should come from within the countries themselves. Much of the additional production will be achieved, not as assumed here by the construction of completely new plants, but through the modernization and expansion of the existing industry. The owners will be able to finance at least a part of this out of earnings or from their own resources. The pulp and paper industry and the sheet materials industry should be specially attractive investments for domestic capital because of their growth prospects. These same industries appear to be logical investments for private foreign capital. Arrangements similar to those now common, in which ownership is shared between private foreign investors and domestic investors or Governments, will maintain the control of the industry in Latin America while utilizing foreign capital.

Direct Government-to-Government loans can be a factor here, and programmes such as the Alliance for Progress may be a logical source because of the close relationship of some of the wood processing industries to housing construction and other activities of an urgent social nature. The Export-Import Bank may be a source of loans for machinery and equipment imported from the United States, and the Development Loan Fund may help with specific development projects. The International Bank for Reconstruction and Development has made loans mainly for the development of sources of energy, but may also enter other fields. The International Finance Corporation invests in private enterprises requiring capital for expansion, and could be a logical source for such funds for existing wood-using industries. The Inter-American Development Bank is intended to help finance specific projects, including those which are part of a national or regional development programme, and thus may be a source of funds for new industries in previously undeveloped areas of Latin America. There appear to be many possible sources of the capital needed to expand production of wood products if an intelligent and vigorous effort is made to obtain it.

The need for pre-investment surveys

If capital is to be attracted—be it public or private, domestic or foreign—the potential investors will need a prospectus. Assembling the sort of information an investor needs before he can make a decision is a long and expensive undertaking. It will require reconnaissance surveys of the forests as sources of raw material and detailed inventories in selected areas. For some industries, such as paper, laboratory tests on the raw material and even pilot scale tests will be needed. Enquiries must be made about water, power, chemicals, and other prerequisites to operation of a plant. Marketing studies are needed. There are questions of selection of the process, decisions as to location and site, size and type of mill. Eventually more detailed feasibility studies must be made which can lead up to a final project.

The Governments themselves should carry out at least some of these studies or have them made by competent consultants. They have the primary responsibility for the conservation and proper management of the forest resources and can best assure this if they have their own data. If the Governments have this basic information available, they will be in a position to attract capital more quickly. With their own information the Governments are in a better position to choose between rival projects and to negotiate the final projects on equitable terms.

These preliminary studies are essentially pre-investment surveys, and if the Governments are serious about developing their forest industries, one of the most useful things they can do is to promote such surveys. They are expensive, but international assistance can be obtained for making them from the Special Fund of the United Nations, the Inter-American Development Bank, the Alliance for Progress, and other sources.

Future requirements and industry

The situation of the wood-using industries in Latin America can be briefly summarized as follows. The consumption of wood products will increase considerably in the next fifteen to twenty-five years, if they are available to the consumers. The forest resources of Latin America are in general adequate to furnish the raw material for these products if they are managed properly. New processes will have to be developed and previously unused species will have to be used in order to realize the productivity of the forests and to supply the future requirements, but this does not appear to present major technological difficulties.

A large part of the existing industry is poorly organized and equipped and will have to be improved materially or replaced by new and more efficient plants. New plants will also be needed to make products which have not been used much because they had to be imported or were produced on a small scale. There appears to be a need for considerable investment in improved and new wood-processing facilities in the near future.

The best opportunities seem to be in pulp and paper in the wood-based sheet materials, since the requirements for these products are expected to be

three times as large in 1975 as they are today. These are the very industries, however, in which the most severe limitations are imposed by the minimum size of plant and the requirements for capital and skilled labour. Installations to manufacture these products must be carefully planned, with consideration of the raw material supply and markets, if they are to be successful in the long run. The total number that can be economically justified in Latin America in the near future is not very large and time should be taken to locate them wisely.

Future prospects for the manufacture of sawnwood also appear promising. The volume of sawnwood used is much larger than that of other products and the 70 per cent increase in requirements expected by 1975 will represent a large additional volume. There appear to be good opportunities for investment in sawnwood production, with less severe restrictions than in the case of paper or board.

The wood products industries can be a permanent part of the Latin American economy because their raw material source can be maintained. But this is only possible if industry is kept in balance with the productivity of the forests. It is therefore important that the development of the forests and of the industries using wood be closely integrated. The expansion in industry needed to supply the expected future requirements will represent a large investment for the Latin American countries. It is imperative that immediate action be taken to protect and develop the forest resources as a firm and permanent base for this industrial expansion.

Chapter 10. Requirements, potential trade and production

The Latin American countries have covered part of their past consumption of wood products with imports and have found markets for part of their timber through exports. For some of the countries and for certain products, such as pulp and paper, this international trade has been quite important, even though it has involved only a small part of the total production and consumption of the region. Since the consumption of wood products will increase substantially in Latin America during the next twenty-five years, and since with proper management the productive capacity of the forests in certain countries can exceed even a greatly increased domestic demand, international trade in wood products should play a more significant role in the future development of Latin America than it has in the past.

The general problem of international trade

International trade takes place in a market that is larger and more complicated than the domestic market. Since all Latin American countries desire many things which they do not produce domestically, the general policy has been to encourage exports and to discourage imports. Imports are discouraged directly through tariffs and other restrictions and indirectly through the encouragement of domestic production by protection or subsidy. Import substitution as a general Latin American policy has led to domestic production of various wood products, such as plywood in Colombia and newsprint in Chile.

The encouragement of exports is more difficult. A country must first of all have adequate forest resources from which to draw raw material. Without adequate resources, the export trade can only be temporary, since the forests will eventually be exhausted. But raw materials such as logs are low-valued exports. So the country also needs a local industry to process these raw materials and to export higher-valued products. The products of a Latin American industry will have to compete on the world market with similar products from other countries. Many of these competitors are old, well-established, and efficient industries which can produce high-quality products and sell them at low prices. If Latin America is to export wood products, they must be competitive in both quality and price. The fact that Peru, for example, imports more plywood from Europe and more sawnwood from the United States than it does from all the rest of Latin America together is an indication of the kind of competition that must be faced.

It is possible to establish behind a protective tariff barrier a domestic industry which could not survive the competition of imports if it were not protected. Under more favourable circumstances it is possible to establish a domestic industry that can hold its own against imports in the domestic market without protection but cannot compete in foreign markets. Even more favourable circumstances are needed before a domestic industry can sell its products in the world market. Wood products industries of all three kinds exist in Latin America today.

Theoretically Latin America should produce those goods in which it has a comparative advantage and trade them for other goods that can be produced more advantageously in other countries. This is difficult to accomplish because of the unequal distribution of natural resources and people and the differences between countries in their stage of economic development and accumulation of capital. A country such as Venezuela, which has undeveloped forests and under-employed people, can gain immediate advantages by cutting off sawnwood imports and fostering a domestic sawmill industry. Once established, this industry may prove to be efficient and capable of producing sawnwood at least as cheaply as it could be imported. Eventually it may even be able to export. However, it may not be able to survive the first few years until it becomes established unless it is protected against outside competition or given some other kind of assistance. In a case like this, a protective tariff or other kinds of restrictions on competitive imports is justified temporarily until the industry becomes established.

It may well turn out, however, that a domestic industry established behind a protective trade barrier never reaches the point where it can produce as cheaply as its products can be imported. As the country develops, it will have other more productive uses for its labour and capital and will do better to import this product at lower prices than to continue trying to produce it domestically.

In the long run it will be to the advantage of Latin America to have unrestricted trade in wood products

between nations in the region rather than for each country to try to be self-sufficient. It will take time to achieve this. Until the forest resources have been developed and transport facilities have been improved, the countries cannot realize their full productive potential and it is not possible to determine the regional pattern of production that will be most efficient in the long run. Domestic production of various products is therefore desirable at present in many countries. But this domestic industry should not be perpetuated by trade protection if it eventually proves to be more economical to import the product from another country.

New domestic industry should be planned with care in those Latin American countries that have the potential to develop an export trade. A small and inefficient mill established in such a country may be absolutely unable to compete in the international market but at the same time may completely saturate the domestic market. Its limited capacity will absorb only a part of the potential productivity of the forest resources. But a new mill that is efficient enough to export and thus to utilize the surplus forest productivity may be impossible to establish later because the domestic market which it needs to round out its sales is completely occupied. The future industrial development of Latin America must always be planned in relation with the potential productive capacity of the forests.

The pattern of wood-products trade

The pattern of international trade which has developed in Latin America in the past is not necessarily the one which will be best for the future. But it indicates some of the problems and relationships that are involved in such trade and have to be taken into account in future.

There has been a tendency in the past to trade mostly with the countries that are nearest. In the period 1956-58, 70 per cent of the Latin American export of logs and sawnwood went to immediate neighbours of the exporting countries, that is, to countries that had a common boundary with the exporter. If the Caribbean islands are considered to have common boundaries with those countries bordering on the Caribbean sea, three-fourths of the exports went to immediate neighbours. Next after these neighbours, in general, came the most readily accessible other countries. Brazil sent three-fourths of its sawnwood and log exports to its immediate neighbours. The next largest amount went to Europe, which is actually more accessible than most other Latin American countries.

The extent of the market has been different in the past for the various wood products. Most limited is the market for logs. In 1956-58 the Latin American countries sent 83 per cent of their log exports to immediate neighbours. Only 15 per cent went outside the region (excluding Mexico's exports to its neighbour, the United States) and it seems safe to conclude that most of these were high-quality logs for veneer or special uses. The small exports of sleepers and posts also went mainly to neighbours. In special situations, however, these products apparently can be shipped to some distance, as were the sleepers from Brazil to Europe. Sawnwood and the wood-based sheet materials are shipped farther, but even with these products, over 70 per cent of the exports have gone to immediate neighbours. The short history of the Chilean newsprint trade suggests that pulp and paper products can be exported more widely than other wood products.

The reasons for this historical pattern are not absolutely clear. Did the countries sell mostly to their neighbours because this nearby market could absorb practically all their production and was more profitable because of the lower transport cost? Or were they limited in the amount they could sell to countries farther away because they could not compete with the close neighbours of those countries? Did Brazil, for example, sell only a small amount of coniferous sawnwood in Cuba because the more profitable markets in South-east South America and Europe absorbed practically all it was able to produce? Or would the Brazilians have increased their total exports if they had been able to take the Cuban market away from their competitors in Central America and the United States?

From a regional viewpoint, this is an important question. Was the amount of wood products exported during 1956-58 set by the amount which could be sold in the export markets or by the amount which was produced in excess of domestic consumption and therefore available for export? The fact that almost 30 per cent of the coniferous sawnwood imported by Latin America during that period came from outside the region indicates that the market was not saturated with Latin American sawnwood. The way in which Chilean newsprint exports have expanded year by year as production increased supports the idea that exports are limited by production. But the limiting factor is probably not the total physical production. It is the amount of production that will meet the quality standards, and can be sold at the price, set in the market by competing countries. Perhaps Brazil and Central America could have provided all the coniferous sawnwood imported by Cuba in those years, but were unable to provide it at the price quoted by the United States.

This discussion over-simplifies the situation, of course, because international trade is not a simple market situation in which price is the only controlling factor. There are problems of payment and exchange, unilateral agreements, restrictions and concessions, which alter or ignore the price relationships involved. Despite these other factors, it appears that Latin American countries can increase their export trade if they improve their competitive position.

The past import trade shows much the same pattern as that of the exports. During 1956-58 the imported logs came almost entirely from neighbouring countries. The same was true of the small amount of posts, since most of those imported from outside the region were drawn by Mexico from the United States. Eighty per cent of the sleeper imports came from neighbouring countries. But because of the large imports of Mexico and Cuba, about 90 per cent of all the imported sleepers originated in the United States. Sawnwood was drawn 70 per cent from other Latin American countries, with an additional 12 per cent by Mexico and Cuba from the United States. The Latin American countries went beyond their immediate neighbours for less than 20 per cent of their imports of all these products.

Imports of plywood and veneers were different. Only one-third came from other Latin American countries and less than half from immediate neighbours, including the United States. Pulp and paper products were drawn from much greater distances, with only a small part originating in neighbouring countries.

This past history indicates that the Latin American countries have not found it necessary to go beyond their immediate neighbours for most of their imports

of logs, posts, sleepers, and sawnwood. This does not mean that they might not have imported more if the price and other terms of trade had been more favourable. But regardless of what controlled the total amount imported, they were able to get practically all of the logs and posts they wanted from neighbours and had to go farther afield for less than 20 per cent of their imports of sawnwood and sleepers.

The same was not true of plywood and veneers and pulp and paper. Less than half of the plywood and veneers which they decided to import could be obtained from neighbouring countries and only one-third of the total was available from other Latin American countries. There was domestic production of these products in all of the sub-regions, but it was not adequate to supply the needs of the importing countries. In many cases the inadequacy was not in quantity but in quality and price. Europe, Japan, and northern North America have offered quality products at prices which many potential Latin American exporters have been unable to match. The region should be able to supply most of its internal import needs but only after the domestic industry has improved its efficiency and the quality of its product.

Pulp and paper imports have been restricted to extra-regional sources by the lack of Latin American industrial capacity. The output of the region's pulp and paper industry has not been sufficient to cover consumption in its home countries and there has been nothing available to export. This situation is changing as more industry develops and some Latin American countries will soon be in a position to export some of these products, as Chile now is with newsprint. However, much of the new industrial capacity is being installed to supply domestic consumption as a substitute for imports. The total imports of pulp and paper from all sources are, therefore, likely to decline in the future although the imports from Latin American sources should increase.

The future development of wood-products trade

Consumption of wood products will increase substantially in all Latin American countries in the next twenty-five years. The first preoccupation of every country, therefore, must be how it is to cover its increased domestic consumption. In the majority of cases the most efficient first recourse will be to domestic production. All these countries are potentially capable of producing a part of their needs for sawnwood, posts, poles, sleepers, fuelwood, and similar products. The successful existing plantations of pines, eucalyptus, and other fast-growing species show that even the forest-poor countries can raise the productive capacity of their domestic forests. Processing facilities are also needed, however, and domestic production of products such as plywood, fibreboard, particle-board, and pulp and paper will be difficult in some countries.

For those countries which cannot efficiently meet all their requirements with domestic production, the second recourse should be to other Latin American countries. (This will include many countries which can be self-sufficient in some products, such as sawnwood, but not in others, such as plywood or paper.) If these countries are to work together on a regional basis for mutual economic development, import needs must be met to the greatest extent possible within the region. As some countries expand their productive facilities to cover domestic consumption they will find, as have Brazil, Chile, and Mexico, that an efficient industry may have a capacity in excess of domestic requirements. Capacity and urge to export will increase in the countries with large productive potential and they should find their best markets within the region. The development of a common market will aid in this intra-regional exchange of wood products.

A necessary prerequisite to this mutual supplying of requirements through intra-regional trade is the development of the productive capacity of the region's forest resources. Brazil and the Central American sub-region cannot continue indefinitely to supply the rest of the region with coniferous sawnwood unless they take prompt action to manage their forests on a permanent basis. Development of the forests is important in all countries if they hope to meet their own future domestic requirements. But it is doubly urgent in those countries which have the potential to be exporters because their forests are subject to an extra drain. It is not inconceivable that if a wood-rich country like Honduras were to strip its forest for export without any effort to keep them productive, and if a relatively wood-poor country like Uruguay were to manage its limited forest resources as intensively as possible, their roles might eventually be reversed, with the people of the former wood-rich country having to import wood for their domestic use while the formerly wood-poor country became reasonably self-sufficient.

If requirements could not be covered by domestic production or intra-regional imports, a third recourse might be to extra-regional sources of imports. Countries outside the region already supply a large part of the plywood and practically all of the pulp and paper. What are the possibilities that they might continue to do so? For a period as long as twenty-five years the prospects are not encouraging. To begin with, the Latin American requirements for home consumption will grow tremendously within that period. Plywood consumption in 1985 is expected to be three times what it was in 1958; paper consumption will be six times as large; and consumption of hitherto little-used products such as fibreboard and particle-board may be anywhere from twenty to a hundred times the volume used in 1958.

Consumption will be growing in the rest of the world too. Europe will gradually absorb more and more of the Scandinavian pulp and paper production. The United States is working hard to improve its forest resources out of concern for its own future domestic consumption. A United Nations study of timber prospects in Asia and the Far East has forecast a deficit of 22 million cubic metres of wood in that region in 1975. Latin America, with a fourth of the world's forest land and unusually favourable conditions for tree growth in many countries, should be a source of future supply for other regions and not dependent on them for its wood needs.

Rational planning for the long-run future in Latin America calls for substantial regional self-sufficiency in wood products. Imports from outside the region are necessary now and will be for some time to come. In fact, it may always be desirable to import limited amounts of special products. But the general goal should be a high degree of self-sufficiency on a regional basis and this should be accomplished within the next twenty-five years.

What are the implications of such a policy of self-sufficiency for trade within the region? It will mean,

first of all, that adequate forests and industries must be developed somewhere within the region to supply all the expanded future requirements of the whole region. The proportionate growth in all wood-products industries will have to be greater than the mere increase in total consumption would indicate. It will have to be large enough to replace the present imports and in addition to cover all of the future increase in consumption. The magnitude of the problem is indicated by the figures on pulp and paper. At present about one-third of the paper consumed in Latin America is imported from outside the region. But in addition about 40 per cent of the pulp used in making paper domestically also comes from outside the region. To achieve self-sufficiency by 1985, the region would have to increase the present pulping capacity by 70 per cent and the present paper-making capacity by 50 per cent and then increase this new total capacity six-fold in order to bring present production to the level of present consumption and to allow for future expansion.

Regional self-sufficiency in wood products also means that the countries with productive forest resources will have to develop them to meet requirements larger than those indicated by their own domestic consumption. In Paraguay, for example, it is estimated that domestic requirements for wood products other than fuel and paper will cause a drain on the country's forests of 260,000 cubic metres of roundwood annually by 1985. However, if Paraguay continues to provide the same proportion of the consumption of these products by Argentina and Uruguay as it did in 1956-58, the total drain on Paraguay's forests by 1985 will be over 900,000 cubic metres of roundwood each year, exclusive of fuel and pulpwood.

Despite the best efforts of the individual countries to develop their forests and industries in order to meet their domestic requirements, many of them will find it necessary or more economical to import part of what they consume from other countries. Intra-regional trade should therefore expand considerably. If this is to be a stable expansion, there must be integration in the development of the forest resources and industries of the various countries. Such kinds of integration are planned as a part of the development of the Latin American Free-Trade Area and the Central American Integration Programme. As far as the forests and wood-using industries are concerned, the integration efforts and arrangements to handle problems of payment and exchange are more important parts of these programmes than the removal of tariffs and other trade restrictions.

Would an attempt by Latin America to achieve regional self-sufficiency in wood products eliminate the possibility of trade with countries outside the region? In the long run this will depend on the total productive capacity that the region is able to develop. In the immediate future such external markets would be very helpful in absorbing the output of new and productive industries during the time when the domestic and regional markets are growing. Europe should provide a growing market for various Latin American products. The United States is rebuilding its forest resources and for some time to come will be interested in importing types of material that have become scarce domestically. The Far East is a potential market, depending on how it develops economically.

Some of the Latin American countries—like Brazil, the Guianas, and Honduras—have a very high potential productive capacity. Climatic and soil conditions are very favourable to tree growth in many parts of Latin America and it may be possible to grow trees cheaper here than in almost any other part of the world. If the forests, transport, and manufacturing facilities are developed with an emphasis on efficiency the region should have no difficulty competing in the world markets. Latin America should be able to cover its own domestic needs and still develop a substantial export trade in wood products.

Prospects for the sub-regions

The future pattern of trade among the Latin American countries depends on so many unknown factors—what the countries will do to develop their forests, the relative effort they will put into developing wood-using industries, the extent to which they will be able to integrate their economies, and many others—that a prediction of future trade would not have much meaning. However, the sub-regions have certain characteristics which will influence their future trade position and these indicate what the general pattern of intra-regional trade is likely to be.

The Caribbean islands have such limited forest resources in relation to their population that they will undoubtedly continue to be large importers of all wood products. South-east South America is not such a clear-cut case, but also appears certain to continue as an importer of many products. Population and income are not expected to increase as rapidly in this sub-region as in the others, but south-east South America already has a large population, hte highest average income in Latin America, and a high per capita consumption of wood products. Argentina and Paraguay have extensive forests but very limited amounts of coniferous species. Trade in wood products between the countries within the sub-region should increase but imports from outside countries will also be needed.

At the opposite extreme, Brazil will probably continue to be self-sufficient in most wood products. With tremendous forest resources and a fairly well-developed industry, it should continue to be a wood-product exporter. However, domestic consumption is expected to increase rapidly and Brazil has done very little to develop or even maintain its forests. Whether the country continues to be a major wood-product exporter will depend on what it does to realize its potential.

Central America presents a similar situation. The forest resources—which include extensive stands of conifers—are potentially adequate to cover the domestic requirements and support an export industry, but they have received little care up to now. The sub-region now imports most of the paper it uses, but may become a pulp and paper exporter in the near future if the much-discussed industrial development in Honduras becomes a reality. Considerable wood-product trade will develop between the countries within the sub-region as a part of the over-all Central American Integration Programme. The Central American sub-region should be a wood-product exporter in the future.

Mexico has varied forest resources, a reasonably well-developed industry, and a comparatively low per capita consumption of wood products. It seems likely that it will continue to be largely self-sufficient in the future, with a limited amount of export and import trade in certain individual products.

Northern South America has only begun to exploit its forest resources. Venezuela has imported a con-

siderable quantity of wood products in the past, but is now starting to develop its own extensive forests. The sub-region is now an exporter of products other than sawnwood and pulp and paper. Since it has virtually no coniferous species it will continue to import some of these products. However, with the successful pulping of hardwoods it is likely that these countries will move in the direction of self-sufficiency in paper. On balance, northern South America should be an exporting sub-region, although not completely self-sufficient in all products.

South-west South America has extensive forest resources, including both planted and natural conifers in Chile. Peru is beginning the difficult job of developing its trans-Andean forests and should supply more of its own needs than it has in the past. Chile has been an exporter at one time or another of almost all wood products and can be expected to increase its exports in the future. By inter-country trade this sub-region should be able to cover all of its own requirements. South-west South America should be an exporting sub-region in the future.

In brief, the Caribbean islands and south-east South America will continue to be significant wood-product importers. Brazil, Central America, and south-west South America will in time be virtually self-sufficient and will be important exporters of wood products. Northern South America will be predominantly an exporting sub-region but will continue to import certain products. Mexico will be largely self-sufficient and will carry on a certain amount of both export and import trade.

Requirements, potential trade and production

The international trade situation in Latin America may be summarized as follows. The region imports a substantial part of the pulp and paper it uses but is a net exporter of other wood products. Two of the sub-regions are heavy importers of wood products, two others are large exporters, and the remaining three are not far from a balance between exports and imports. Practically all the pulp and paper imports originate outside the region, but 70 per cent of the imports of other wood products come from other Latin American countries.

Consumption of wood products will increase greatly during the next twenty-five years, both in Latin America and in the rest of the world. There is not much likelihood that the increased Latin American consumption can be supplied by imports from outside the region, both because the Latin American countries will continue to be short of foreign exchange and because the outside countries will need their production for their own use or that of their close neighbours. The region must therefore think in terms of self-sufficiency in wood products.

The potential productive capacity of the forest resources of Latin America is much higher than the prospective future domestic requirements. The areas now in use have never been managed scientifically for wood production, and in addition there are extensive forest areas that have not been exploited at all. More important in the long run, however, is the fact that in many parts of the region the soil and climate favour very rapid tree growth. Latin American plantations of pine and eucalyptus produce annual yields per hectare that are fantastic when compared with yields in the northern temperate zone, where the bulk of the world's productive forests are concentrated. In view of its natural advantage Latin America should not be thinking merely in terms of self-sufficiency. It has the potential to play an important role in the future world supply of forest products. More than abundant land and favourable growing conditions will be needed, however, if the region is to occupy that role. New and efficient industrial capacity will have to be developed to make the kinds of products that the world will want. Transport and communications will have to be improved immensely to reduce costs and keep them at a minimum. The forests themselves will have to be changed and diversified to emphasize rapid production of the quality needed. The region will have to invest in raising the productive capacity of its forest resources. But such investments will pay off in the long run by making the region a major supply source for forest products.

Because the forest resources are not evenly distributed, it will be necessary for some countries to import part of their requirements from others. The pressure on the forests in the exporting countries will therefore be heavier than their own domestic requirements would indicate. Unfortunately, the forests in Latin America have received little attention in general and those in some of the potential exporting countries are being rapidly depleted at present. There are extensive areas of unexploited forests in Latin America today. But since future domestic requirements will have to be supplied largely from regional sources and since domestic consumption will increase in only twenty-five years to three or four times its present size, even these extensive forests will not last very long if they are exploited in the present wasteful fashion. It is imperative that steps be taken immediately to develop and maintain the forest resources of the whole region. But in those countries on which the region will depend for future exports, the task of resource development is an urgent obligation.

Chapter 11. Requirements, resources and policy

Previous chapters have considered Latin America's future requirements for wood products in the light of its forest resources, its wood-using industries, and its international trade. They have indicated that the region has adequate forest resources if they are developed and managed, that it needs an extensive and integrated development of new wood-using industries, and that trade between the nations can play an important role in the covering of future requirements for wood products. Mention has been made of various steps which should be undertaken in these different areas to assure the needed future supply. This chapter will attempt to bring all these diversified aspects together and to consider what policies are desirable for Latin America to establish and implement in its long-run regional interest.

Aims and problems of forest policy

Up to now, most of the countries have had no well-defined policy regarding the use of forests and forest land. While none of them have completely ignored their

forests, many have followed a policy of temporary expedient in response to current pressures. As a result, large areas remain completely undeveloped while others have been overcut and in some cases virtually devastated.

The base for the large increase in consumption, and the expansion of the industry to supply it, rests in the forests. Individual Latin American countries may help to supply each other's future needs, but the region as a whole cannot count on obtaining the wood products it needs from the rest of the world. Latin America has sufficient potential forest resource capacity to provide all the wood products it needs and even to help supply the rest of the world. But this can come about only if these resources are properly developed and managed. The length of time needed for forest development, even with quick-growing species, makes it imperative that action begin now if significant results are to be obtained before 1985.

Forest policy must recognize other values produced by the forest. Among these are the protection and stabilization of watersheds, and protection against floods, erosion, and wind. In addition there is the prospect of a growing need for forest recreation as the region develops and the people have more leisure and money.

The time has arrived when every Latin American country should have a rational policy for the use of its forest resources. The aim of that policy is simple to state: to assure that the forest resources are used in the way which will make an optimum contribution to the future development of the country. The elaboration of a policy that will accomplish this aim can also be stated simply. It is necessary to (1) determine the country's future needs for goods and services from the forests, (2) determine what forest resources the country has and what they are capable of producing, and (3) adapt the resources to the needs.

The third part of this policy—adapting the resources to the needs is too general as it stands to be an effective guide to action. Various complications will arise in trying to put it into effect. These must be recognized and understood because they will require a number of subsidiary policy decisions that will have much to do with the success or failure of the overall policy. The focal point of the complications lies in the aim of the forestry policy to assure that the forests make an *optimum* contribution to future development of the country. This is quite different from assuring that they make a maximum contribution or that they contribute some given quantity or value of product.

Despite the complications it causes, the word "optimum" is vital to a rational forestry policy. It means that the use of the forest resources must be considered in terms of its effect on the whole economy. It means that land and labour and capital should be devoted to the growing of forests only if they will contribute more to the well-being of the country in that use than they would in any other productive use. It thus discourages the practice of forestry for forestry's sake. But it also means that if resources will benefit the country more *in the long run* when devoted to managing the forests than they will in any other use, they should not be withheld from forestry on the grounds that they can produce more immediate benefits in other uses. In perhaps no other economic activity is it so essential always to take the long-run viewpoint as in the management and use of forest resources.

The next two sections will consider the major problems of developing a forestry policy that will coordinate with other efforts to improve the welfare of the country. Then the discussion will return to a more detailed consideration of the forestry policy itself.

Forestry and land-use policy

The total amount of land per capita is high in Latin America compared to many other parts of the world. But this must be discounted heavily because there are such large areas of desert, high mountain, arid plateau, and similar unproductive lands. Population pressure on the land is already heavy in particular areas and the number of people is growing so fast that it will soon become critical in other parts of the region.

Considerable areas of land in Latin America are not being used at all, or are used only lightly by a small indigenous population. But the more productive and useful lands are already in use and many of the presently unexploited lands will be suitable only for certain restricted uses. Latin America is not really a region of limitless land resources and cannot afford to continue to use what it has in a wasteful and unplanned way. This is generally recognized by the countries themselves and most of them are trying to make some provision for the rational use of their lands.

Considerable land in Latin America is suitable almost exclusively for forest. But another very large area which is naturally adapted to the growth of trees can be used for other purposes through proper management. An important part of every nation's land use programme is therefore concerned with existing and potential forest lands. Decisions must be made about the use of these forest lands, but these decisions can only be made rationally if the use of the rest of the nation's lands is also considered. Forest land policy must be an integral part of a general land policy.

Land use policy cannot be static anywhere, but in Latin America it must be particularly dynamic. With populations growing very rapidly, with settlement continuing to spread into previously unused lands, and with a growing pressure for more equal distribution of lands among the people, it will be necessary for land use to change materially with time. Many of these changes must involve forested land, and if they are left to chance and individual short-run initiative, they may not be in the long-run interest of the countries. It would therefore be wise to give to competent professional foresters the initiative for choosing the forested lands that should be reserved for the future. When some of these reserved forest lands are needed for agriculture or grazing in the future and when the necessary means exist to assure their proper maintenance in those uses, it will be possible to release them with their soils still in good condition, and to control the manner in which they are cleared.

Forestry and agricultural production

The rapid population growth and rising incomes in Latin America mean a constantly increasing demand for agricultural products. Food products in particular are likely to receive a high priority in the countries' plans. At first glance, the obvious way to increase agricultural production is to clear land now in forest and to devote it to crops or pasture. There appears to be a basic conflict between increasing agricultural production and increasing timber production.

This conflict is not as serious as it might appear. Expanding the area under cultivation or in pasture is not the only way to increase agricultural production. Yields per hectare are low in Latin America compared to those in Europe and northern North America. It may cost less to obtain additional agricultural products through more intensive use of the existing agricultural land than through the clearing and bringing into use of presently forested lands. If the potential future wood production which is sacrificed in converting the land to agricultural use is included among the costs, it becomes apparent that conversion of forest land is in many cases an expensive way of increasing agricultural production. In any event, the expansion of agriculture into additional lands can only postpone the technical revolution in Latin American agriculture—involving the use of more fertilizer, improved seed, and equipment—which is badly needed even now. Land use policy must consider the intensity of use as well as the area devoted to different uses.

From an agricultural viewpoint, forest land falls into four categories: (1) land definitely unsuited to agricultural use, even if cleared of timber, because it is too steep, too rough, very susceptible to erosion, has very shallow soil, or for many other reasons; (2) land definitely suited to agricultural use and which will be very productive if cleared of forest; (3) land usable for agriculture if restricted to certain uses and if the essential soil and water conservation practices are strictly followed, and (4) land suitable for a combination of grazing and timber production if the necessary restrictions on intensity of grazing use are observed.

The only problem presented by the first two categories is that of identification. Once identified, the land definitely unsuited to agricultural use should be kept permanently in forest. If it has already been cleared—as some has been in many countries—it should return to forest. Whether planting should be used to speed this reforestation will depend on how rapidly the land is deteriorating without a forest cover and the threat which it represents to other areas through erosion and uncontrolled runoff.

The land which is definitely suited to agricultural use can be cleared at any time it is needed. Whether it should be cleared in the first place, and whether once it has been cleared it should be kept in agricultural use or reforested, depends on which use will produce the greater net return with due regard to all social costs and returns. In the United States some land of this type is now being reforested because for the time being it is not needed in crop production. In Latin America, where there is no general shortage of agricultural land, plantations of fast-growing timber species will often yield a higher return on such good land than will agricultural crops or livestock.

Of the presently forested lands, a larger area probably falls into the third category—land usable for agriculture under strict limitations—than in the class that is definitely suited to agriculture. It is essential that the land use policy make adequate provision for distinguishing the one from the other and for assuring that the third category of land will be properly managed if it is cleared of forest. This kind of land will generally deteriorate rapidly in agricultural use if it is not properly handled. Large areas of such land have been so badly damaged that they now fall into the first category of land definitely unsuited to agricultural use. It should be a part of the land use policy to identify land of this category that has deteriorated to the point where it is no longer economic to rebuild it for agricultural use, and to allow it to return to forest cover before it deteriorates further. Whether presently forested land of this category should be cleared depends first on whether the potential value of the agricultural yields will justify the high cost that will be necessary to maintain its productivity. If it will not, the land should not be cleared because it will deteriorate under temporary and unprofitable agricultural use with the attendant sacrifice of possible timber yields and with the threat of necessary future reforestation costs. Even where investigation shows the possibility of economic agriculture production, care should be taken to prevent the destruction of the land by operators with a short-term view. If the pressure of demand for agricultural products forces the clearing of such land, the Government must take strong measures to assure its maintenance, or else face eventual disaster when these agricultural resources have been destroyed.

The fourth category of land should no more be cleared than the first. It differs from that first category only in the fact that grazing is possible (under proper limitations) without destroying the forest. This land can provide a certain amount of forage although it is not suitable for cleared pasture. The problems lie in distinguishing this type of forest from the first category which will not tolerate grazing, and in determining how heavy a grazing use is allowable. Usually neither of these steps is taken; livestock is generally permitted to run indiscriminately on all forest land and in uncontrolled numbers. Forests of the first category have been virtually destroyed or their productivity seriously reduced by grazing. Even forests of the fourth category which will tolerate grazing have been similarly degraded by excessive use.

In order to co-ordinate forest land use with agricultural land use, the forest lands must first be classified into those which may be cleared of forest cover and those which may not. The lands which may not be cleared must then be classified into those which may be grazed and those which may not. The lands which may be cleared and the forested lands which may be grazed are potentially available for agricultural use; the rest of the forest lands must be limited to strictly forestry uses. This does not mean that all of the potentially available lands should be used for agriculture. That will depend on how badly the country needs more agricultural land and on the relative returns from forestry and agricultural uses of those lands. Frequently they will be more productive in forest crops—and particularly in plantations—than they will be in agriculture. What it does mean is that lands suitable only for forestry should be kept out of agricultural use. It also means that lands of this type that have found their way into agricultural use should be returned to forest and kept there. Land which is suitable for restricted agricultural use but which has deteriorated because of unwise use should also return to forest, but may eventually be available for agriculture again if its condition improves sufficiently under the forest cover.

Shifting agriculture

Perhaps the most irrational use of forest land is in shifting agriculture. Small areas are cleared sufficiently to permit the planting of crops, usually with liberal use of fire and with little salvage of the timber.

These areas are cultivated in a primitive fashion with no attempt to prevent erosion or to preserve soil fertility. When the natural soil productivity has been exhausted after a few years and the yield falls off, the areas are abandoned and new ones are started in the same manner. This practice is common in many parts of Latin America and is particularly destructive in the tropics and in areas of heavy rainfall.

Shifting agriculture is not usually a planned rotation of a forest crop with other crops. The original soil fertility under the forest cover is taken as a free gift of nature to be extracted by destroying the forest. The return to forest after cultivation is ordinarily an accident so far as the user is concerned, since he merely abandons the land with no conscious effort to re-establish the forest cover. The emphasis is on the cultivated crop; when the process is repeated on the same area, the time under forest cover is looked upon as a fallow period and not a time to produce a usable crop of wood.

Shifting agriculture is basically a social problem in that it is practiced by a part of the population which lives under primitive conditions or with a desperate need to produce food somewhere. As Latin America develops, these people should be absorbed into more productive activities or given an opportunity to practice agriculture on lands suited to permanent use. Programmes of land reform, settlement, and industrial development can serve a dual purpose of bettering the living conditions of these people and increasing forest productivity through the gradual elimination of shifting cultivation.

Land settlement

Practically all the Latin American countries contain sizable undeveloped areas. These undeveloped areas are potential producers of agricultural forest, and of mineral products of one kind or another. However, at the present time they are uninhabited or occupied only by scattered groups of indigenous peoples. Most of the countries, therefore, have programmes aimed at the settlement of the most promising areas. Land settlement also offers one method of meeting the pressure for the distribution of more land to small owners.

Even where the main object of land settlement is to develop forest or mineral resources, the programmes usually include the opening up of new agricultural areas. The land settlement programmes have the advantage that they can plan their land use from the beginning and do not have to try to change an established but illogical existing pattern. The conversion of forest land should therefore proceed on a rational basis with only those lands being converted which show evidence of being suited to long-run agricultural use. This has not always been the case in the past, but there are signs that the land settlement authorities are aware of the problem and will try in the future to identify carefully and scientifically the forest areas which are suitable for agricultural use.

In some land settlement areas the forest will be the main resource to be exploited. The success and permanence of the settlement in such areas obviously depends entirely on the manner in which the forests are managed. However, the forests can also contribute to the economy of land settlement areas whose primary resource is mineral or agricultural. Land settlement is more likely to be successful if it has a diversified economic base. The forests should therefore be assigned a definite role in every land settlement programme which involves an area with forest resources of any value. If the exploitation of the forests is properly organized, the income from the virgin timber stands can bear part of the cost of land settlement without detracting from the long-run value of the forests to the colony.

Forestry and land protection

In all parts of the world there exist tragic examples of once-productive land which has been destroyed by the action of rain and wind. Much more numerous are examples of land whose productivity has been reduced by these agencies. Latin America will need all the land it has in the future and should be taking steps now to prevent its destruction or degradation.

Forests are especially effective in protecting land against rain and wind because of their height, their many-layered cover of leaves and surface litter, and their sub-surface root structure. The soil under a forest cover is porous and absorptive. As a result of these characteristics, most—and often all—of the rain which falls on a forest area infiltrates into the soil. Surface runoff is small or even non-existent. By contrast, the rain which falls on areas where the soil is bare or has only sparse vegetative cover mostly runs off over the surface and carries soil with it.

Uncontrolled runoff with its accompanying load of silt is doubly destructive. The area itself on which the runoff originates is gradually destroyed as its soil is eroded. But more important is the damage done to the other areas which receive the runoff. Crops and fertile land are scoured by the flood water or buried under a layer of debris. Stream channels, harbours, and dams are filled with silt. Highways, railroads, and towns are damaged by the high water and silt. Forest cover on the source of the runoff can eliminate or reduce to a minimum such damage.

Obviously forests cannot prevent the local destructive action of the rain which falls directly on agricultural fields or other open land. What they can prevent is damage to such lands from adjacent areas. Flood and erosion control is a many-sided operation. Some lands can be cultivated freely and will suffer practically no runoff or erosion. Other lands can be cultivated safely if various practices are followed to control runoff and stabilize the soil. Still other lands cannot safely be cultivated but can be used for pasture or other purposes for which a permanent grass cover is maintained. Finally there are lands that cannot be adequately protected against erosion in any of these uses and that should be kept in permanent forest.

From the viewpoint of protection we come back to the same classification of forest lands given earlier. Some lands must be maintained in permanent forest cover, although a part of them can also be used for grazing. Other lands may be used for agriculture, but on part of them the type of use must be severely restricted. The basic land policy problem is to recognize these classes of land and to limit their use to what they are suited for.

Forests and wind

In many places wind is also a destructive agent. The damage may consist of physical removal of the soil,

but more commonly it results from the drying action which reduces the moisture available for crops. Where wind is a problem, shelterbelts or windbreaks of trees often provide relief and greatly increase the productivity and stability of the land. Such windbreaks are common in parts of Latin America and could be used more extensively. If these belts or patches of trees are properly tended they can often produce fuel-wood, posts, and other wood products for domestic use without reducing their main protective function. In fact it is a general characteristic of forests that they are capable of producing multiple benefits if they are properly managed.

Forests and usable water

The previous discussion spoke of water as a destructive agent and of how forests might serve to control it. However, water is a vital commodity and the problem generally is how to obtain a better supply for domestic and industrial consumption, irrigation, generation of electricity, and other uses. The characteristics of forests fit them for an important role in this search for more and better water. The rain which falls on a forested area is prevented from running off over the surface and infiltrates into the soil. The trees themselves use part of this water, but most of it percolates through the soil, follows natural sub-surface channels, and eventually again appears on the surface in springs and streams. This maintains the sub-surface supplies which can be tapped through wells, and also feeds water gradually into the surface streams. The primary effect of the forest cover is thus to stabilize the yield of water, making it available throughout the year instead of in the form of alternating floods and droughts. An important secondary effect is the improvement of the quality of the water, which carries much less suspended material than does surface runoff.

In many places water will be a more important product of the forest than wood. The most urgent reason for reforesting as rapidly as possible those cleared lands in Latin America which are suitable in the long run only for forest is to obtain more and better water and to eliminate flood and erosion damage rather than to produce more wood. Fortunately, watershed protection can be accomplished by planting trees that will eventually produce wood of commercial value. In practically all cases protection, water yield, and wood production are compatible uses of the forest. Good land use therefore calls for getting the land suitable only for forest into permanent forest cover and maintaining it there.

Forest for recreation

In recent decades the use of forest for recreational purposes has been growing rapidly in many parts of the world. In addition to the tourist attraction of forest areas with special aesthetic, botanical and zoological interest, there is the strong appeal to local urban dwellers to enjoy holidays in more peaceful and natural surroundings. Latin America has many forests with the former type of interest, and their importance as income-producers could grow with the development of the tourist industry. With the increasing degree of urbanization and industrialization and the growth of incomes, demands for recreational services of a local nature will develop rapidly. It is usually in areas where forests are less abundant that the need for recreational areas becomes most pressing. Fortunately this use can often be provided simultaneously with many of the protective functions and even with timber production. It will normally prove easier to establish and maintain recreational areas while the need is growing and while forests are still available than to create them after the use pattern has been determined by other demands.

Forestry in land-use programmes

The previous discussion indicates that a significant part of the land-use problems of Latin America and of the programmes instituted to deal with those problems will in one way or another be involved with forest lands and forestry. The extent to which the Latin American countries will benefit from their forest resources in the future will depend heavily on how the forest lands are treated as a part of the total land-use development of these countries. The potential contribution of these forests to the future economic development and welfare of Latin America is too important to be left to the short-sighted judgement of disinterested owners and operators or to the casual decisions of ill-informed officials. It is imperative that the best available information be brought to bear on the use of these lands and that this use be oriented towards their optimum long-run contribution to the economy.

Forestry must be an integral part of the total land-use programme at both the planning and execution levels. Within the planning unit there should be a professionally competent forestry group to make sure that the necessary information about the forest lands is available for planning purposes. The group which draws up the land-use plans should include at least one professional forester who should have enough authority to prevent the undue subordination of forestry to other land uses by the representatives of those other uses. Land-use can only be properly planned jointly by a group of experts, each of whom is interested in fitting the object of his specialization into a rational over-all plan. At the execution level, forestry specialists will be needed in the vital land classification stage and in promoting proper management of the lands dedicated to forest. It is essential that agricultural, land-settlement, watershed-development, and similar programmes include in their directing body and staff people who are competent to give the necessary scientific study and management to the forest resources and to make sure that they have the relative status in the over-all programme that is warranted by the future importance to the country of these resources.

Forest management differs materially from agriculture because wood is produced by a combination of land and forest growing stock. Whereas wheat or cotton can be grown in one season starting from bare land, it is necessary to build up a stand of trees over a period of years before the production of useful wood can start. Because of this basic difference in the kind of crop, agricultural experts—no matter how well intentioned they may be—frequently underestimate the complexities of forest management and fail to understand its vital problems. It is imperative, therefore, that the knowledge of forestry experts be used in the development of rational land-use plans. The scarcity of such experts in Latin America poses a serious problem and a country like Brazil, with only a handful of professional foresters, will need help from outside for some years to come if it is to use its vast land area wisely.

Forestry and general economic policy

The preceding discussion centered around the land resource and the problems of whether certain parts of it should be used for forestry or for other purposes. It was pointed out that in many cases the choice should be based on which use will yield the greatest net return when properly handled. But little was said about what determines this net return besides the land itself. In other cases, it was said that the land should be used only for forest but nothing was specified about the type or intensity of such use. Other factors obviously are involved in these decisions beside the kind of land.

First is the demand for the potential products of the land. If there is no demand for the products, there is no justification in managing the land to produce them. If the amount of land is more than sufficient to produce the products demanded, part of it can be diverted to other uses or allowed to remain in unexploited forest if it is not suitable for other uses. But current demand is not the proper criterion. In Latin America, the population is growing very rapidly, and with rising average income the demand for wood products will increase substantially in the future. The income elasticity of demand for forest products is much higher than that for food, which means that as Latin American incomes rise in the future, the demand for wood products will increase more rapidly than the demand for agricultural food crops. The amount of land to be managed for forest must be related to this future demand. The future demand, however, will in turn depend on the future economic growth of the country. The choice between forest and other uses of land or of the proper intensity of management for forest land will be influenced materially by development in other sectors of the economy such as construction, mining, transport, etc.

In a few cases, such as fuelwood, there is a direct demand for wood from the forest. (Fuelwood is an important forest product in Latin America today and will continue to be in many of the countries.) But in most cases the demand will be for products which can be made from wood. This demand can only be met if there are manufacturing facilities to convert the wood into the desired products. If these facilities do not exist, there is really no demand for wood. There is no demand for pulpwood, for example, in most Latin American countries because there are no domestic pulp manufacturing plants. The value of the forests in those countries cannot be determined by the amount of pulpwood they grow or could grow. However, if new pulp mills are built, a domestic demand will develop for pulpwood and this product will have to be included in decisions about the management of the forest lands in those countries. The relation with industry is a close one and land and industries must be planned together.

A similar relationship exists with transport and with domestic and foreign trade. The best use and best intensity of use of the land are affected by everything which stands between the tree in the forest and the final consumer.

On the supply side there also are controlling factors. The management of forest land to produce wood requires labour and also professional and administrative personnel. Perhaps even more important at this stage in the development of Latin America, it requires capital. All these factors have other potential uses. The decision to grow timber on an area does not only involve dedicating a certain amount of land to that use but also diverting labour and capital from other uses into forestry. This problem is more complicated than that of the land itself because a certain amount of forest land is unsuited to any other use, but very little labour or capital, if any, is suitable only for use in forestry.

Forestry in economic development

All the Latin American nations are interested in economic development and are seeking ways of fostering it. Many have development or planning organizations working and some have prepared general development plans. What place should forestry have in this general development effort?

Economic development is largely a matter of increasing the productivity of the people of a country and of the resources they have to work with. It involves carrying production beyond the raw material stage and close to the final product. And it requires technology, trained workers, and capital. It is a complex process which must be accomplished gradually so that balance can be maintained among the various parts of the economy.

Latin America has a shortage of capital and skilled workers. But it has potentially valuable natural resources and it has people. The basic problem of economic development in Latin America is to make the most of its natural resources, although development must proceed along other lines too.

This has two implications for the forest resources of the Latin American countries: planning for economic development must give serious consideration to the forests as a base for such development, and forestry policy must be aimed at contributing to the general economic development of the country. This may sound like saying the same thing in two different ways. But in actual practice, the people who are doing the economic development planning are seldom the same people who are planning and promoting forestry policy.

Part of the function of economic development planning is to guide the allocation of labour and capital to the various sectors of the economy and forms of production. Another part is to assure that the various productive activities complement each other and provide the necessary support for each other. The problems of how much of the land which is potentially usable for other purposes should be kept in forestry and of how intensively the forest land should be managed are thus a part of the over-all problem of planning for economic development. If forests are to make their optimum contribution they must be assigned the necessary management to produce on a continuous basis the products needed to support development in other parts of the economy. But also they must be studied carefully from the viewpoint of forming the base of a new development for domestic consumption or export.

Economic development is a long-term proposition and it must consider the forest resources as a permanent producer. Mature, unexploited forests can yield larger volumes of wood immediately in the first cut than they can produce on a sustained basis. The liquidation of this existing timber may be a source of capital for development purposes. But first priority on the use of this capital should be given to the development

of the forest resource itself through the construction of roads, reforestation of idle lands, improvement and protection of the growing stock, and similar activities to build up and maintain the resource. If this is not done, the forest may be stripped to provide funds for other purposes, the long-run benefits from the forest resources sacrificed in the process, and the future benefits to the country from all resources reduced as a result. However, if the funds that can be derived from the exploitation of Latin America's virgin forests are ploughed back into forest improvement, the development of these forest resources can be largely self-financing. It will be necessary to borrow funds temporarily for the construction of access roads and other facilities necessary for exploitation, but these loans can then be repaid out of the proceeds from the timber. This possibility of auto-financing of development is a tremendous asset of the forest resources and every Government should establish a definite policy to take the maximum advantage of it.

Planning for economic development in all Latin American countries should give specific attention to deriving the optimum benefit from the forest resources. Because of the complex technical problems posed by the proper management and utilization of the great variety of little-understood forests which exist in Latin America, the planning of the use of these forest resources must be in the hands of competent forestry experts. The present shortage of such qualified people in Latin America is a serious problem and it would not be wise to scatter the few there are among a number of agencies. (There are not more than 650 professional foresters in all Latin America at present although the need for such experts is estimated at 5,000. Mexico, with 450 foresters, is the only Latin American country that is even reasonably supplied with such technicians.) The desired result can probably be achieved by very close liaison between the agency charged with administration of the forest resources and the economic planning group. The most important need is that the economic development policy of the country include a clear recognition of the significance of the forest resources and provision for their development.

Forestry and industrial development

As part of its effort to develop and progress economically, Latin America is placing considerable emphasis on industrialization. The amount and type of industry which has been developed so far varies a great deal from one country to another and from one part of a country to another. More industry would be desirable in the presently under-industrialized areas, and wood-processing plants offer one possibility for such expansion.

From the viewpoint of the forest resources, the wood products industries are of critical importance. Wood as it comes from the forest is usually a raw material that has value only because it can be converted into other products. Through processing and manufacture, the output of the forest is made into goods which consumers want or which can be used in other productive activities. Without processing facilities, the forests have much less value and in some cases are practically valueless. Industrial expansion and forest development are thus logical complementary undertakings.

Where formerly unused forest areas are to be opened up or where a new type of wood-product industry is to be installed, investment will be necessary in both the forest and the industrial plant. Usually transport facilities will also have to be developed. Such an investment is hard to justify unless the forest resources are capable of supporting a long-time operation. Properly managed forests can be a permanent source of raw material if the demands of the industry do not exceed the capacity of the lands. And a properly planned industrial complex can provide profitable outlets for all of the timber produced in an area. Such a happy combination is not likely to occur by chance. Close integration of the development of industries and forests is essential if the Latin American countries are to realize the possible long-run benefits from their forest resources.

Industrial development serves to provide domestically the goods which the people of the country want and which are needed in other economic activity. It also serves to provide productive employment for the people of the country. From this point of view, each country should channel development into those types of industry that will produce goods of greatest domestic value and provide the most productive forms of employment. Industrial development should be an integral part of general economic development. But when a country has potentially valuable natural resources, economic development may be best served by making the most of those resources.

The amount of investment and effort that should be put into wood-using industries must be determined in relation to the other industrial possibilities of the country. The development of these industries would therefore appear to be a logical responsibility of an organization charged with general industrial or economic development. However, the forest resources of most Latin American countries are potentially too important for the future to risk the possibility of their development being handicapped by an over-conservative or short-sighted development of the wood-using industries. It would be desirable to have some one government agency responsible for the joint development of the forest resources and the wood-using industries based on them. If such an arrangement is impossible, some form of very close co-operation is essential between the agencies charged with the development of the forests and of industries. This might consist of joint study and approval of new development undertakings in forestry and wood products.

Social implications of forestry

A basic policy of all of the Latin American nations is constantly to raise the standard of living and increase the general welfare of their people. Successful economic development will further this policy in a general way. But there are specific ways in which forestry and the development of the forest resources can contribute to this policy that are worth separate mention.

Huge housing deficits exist in Latin America today. Millions of people live in temporary, overcrowded, and sub-standard types of dwellings. In most countries this situation has been getting worse instead of better. With its population increasing at such a rapid rate, Latin America faces a serious housing problem for many years to come. The only way to make significant progress in overcoming this problem is to construct a large number of dwelling units each year. With all the other demands on Latin America's capital resources, it is obvious that these dwellings will have to be built at a minimum cost.

Wood products are very adaptable for construction purposes and with proper preservative treatment are suitable for use even in the tropics. Most of the countries have forests waiting for exploitation, which could provide large quantities of wood for construction purposes in the immediate future. Properly managed, these forests could supply the wood for a continuing housing programme in the future. But the problem is not a simple one of cutting trees and building houses. The costs of extracting the timber and processing it must be reduced below present levels. The products must be improved in quality and made more durable. Designs must be developed that will take advantage of the properties of wood products to permit more rapid construction and at lower cost. But none of these difficulties are insuperable. It is urgent that the Latin American countries increase their efforts in the housing field immediately. Part of this increased effort should go into developing ways of using the timber resources to a greater extent for this purpose than they have in the past.

Under-employment is a serious problem throughout Latin America. Many people work only part-time or engage in activities of very low productivity. An integrated development of the forests and wood-using industries will require the services of many men in forest management, logging, transport, and processing. Much of this employment will be available in sections of the countries where other employment opportunities are limited. In co-ordination with agriculture, forest land management and wood processing can provide an employment base for rural communities. This aspect should receive serious consideration in the selection of forests to be managed, location of wood-product industries, and similar planning decisions.

Decentralization of development would be desirable in most Latin American countries. At present industry tends to settle around the main cities because these are the only ones that have services. People from the rural areas have been migrating to these cities in search of work. The numbers of people involved have created serious problems of housing, education, sanitation, and employment. Since the forests are at a distance from these centres of population, wood-using industries based on the forests might serve as new poles of development and thus foster decentralization.

Latin America still has a high illiteracy rate and many people receive very little education. Improvement and extension of education is a major undertaking in every country. Printing and writing papers are essential to modern education and their use by the adult population is bound to expand as more people receive the benefits of education. The forests can provide the raw material for domestic production of these cultural papers.

A rising standard of living will mean more use by everyone of furniture, paper articles, and other products of wood which in the past have been used in the main only by the wealthier people. Or, to put it the other way round, the development of the forest resources will contribute to the rising standard of living by providing the raw material for these products that the people will want to use.

A GENERAL FOREST POLICY

In the first part of this chapter it was stated that a rational forestry policy should provide for three actions: the determination of the future needs for forest goods and services, the determination of the potential productivity of the forest resources, and the adaptation of the resources to the needs. An attempt will now be made to describe these three parts of the policy more explicitly.

Determining the needs—a statistical service

If the basic purpose of a forestry policy is to serve the interests of the country, it is obvious that the policy will depend on what the country needs from its forest resources. The best basis for determining this is reliable statistics on the use of goods and services that the country's forests might produce.

In preparing this report, all available statistical information on the production, consumption, and trade of forest products was assembled for each country. The results were discouraging. Some information on imports and exports was available for most countries, but it was often incomplete, poorly classified, and did not agree with equivalent figures in the records of the other party to the trade. Information on production was available in some countries for some wood products, but in other countries there are no statistics at all on production. Where production statistics do exist they are often only partial, being limited to removals from state forests or removals under permit or licence. All the countries recognize that such "recorded" production figures under-estimate the actual production. In the case of fuelwood, recorded production in some countries is estimated to be no more than 10 per cent of the total. Information on consumption by end uses, such as construction and furniture, was almost universally non-existent. In some countries scattered figures were available on the consumption of sleepers, telephone poles, and similar products. The figures presented in chapter 5 of this report are based largely on estimates of well-informed people in the various countries.

An essential part of the forestry policy of each country should be to establish immediately some arrangement for gathering, compiling, and publishing on a continuous basis complete and reliable statistics on wood products. These should include the quantity of timber removed from the forests; the production, imports, and exports of individual wood products; and the quantity of wood products consumed in the major end uses, such as construction, furniture, packaging, mining, transportation, etc.

There is a pressing need for better statistical information of all kinds in Latin America. Most of the countries are presently trying to improve their statistical services. It may be possible, therefore, to obtain the needed wood-products statistics as part of the improved general statistics. However, this information is so vital to the rational management of the countries' forest resources that the agency charged with the development of those resources should have its own statistical service. This forest-statistic unit should collaborate closely with the general statistical services to help in improving their data and should supplement it by collecting itself information not satisfactorily covered by the general statistics.

The immediate need is to start collecting and compiling systematically statistics on current wood-product activities. Once this is firmly established, the forest-statistics unit should follow the development of pro-

duction and consumption and should make this information available currently to industry, planning groups, and other interested parties. Eventually the statistics unit should start to prepare forecasts of future consumption as a guide for forest management and industrial development. Such forecasts should be more accurate and detailed than those presented in this report because they will have a much more reliable statistical base.

Information is also needed on the consumption of water, the demand for areas for recreational use, and the need for protection from floods and erosion. The statistics unit should be responsible for collecting information on the need for these forest services as well as on wood.

This proposed forest-statistics unit need not be large in any of the countries. But it should be headed by a competent person, should be encouraged to develop its own methods of obtaining the needed information, and should be brought actively into planning and administration to keep it from lapsing into routine "figure gathering".

Determining the potential productivity—an inventory service

If a country wants to make the optimum use of its forest resources, it is clear that it must know what those resources are and what they are capable of producing. Without this information policy makers must operate on a basis of conjecture and personal opinion. Decisions must be made, opinions are often mistaken or distorted, and the result may be tremendous losses to the country in the long run.

In preparing this report, all available information on forest areas, types of forest, growing stock volumes, and annual growth and drain was assembled for each country. The results presented in chapter 3 give a general picture of the forest resources in each country. Estimates of area are probably reasonably accurate but information on existing volumes, growth and drain and protection value are almost completely lacking. It is evident that none of the countries has the kind of information about its forest resources that is needed for rational planning. Survey work is currently under way in some of the countries to obtain this information but in most of them it has only started.

Each country should establish immediately a programme of inventory for its forest resources. Such inventories were very expensive in the past but present aerial photogrammetric techniques have brought the cost within reason. In proportion to the value of the resources to be surveyed, the cost is not large. No development is possible without investment and the primary investment in the development of the forest must be in a basic inventory which will serve to guide that development.

The first need is for a reconnaissance survey to determine the location and general characteristics of the forests; the areas of different types in various parts of the country; the general condition of the forests in various areas, and the relation of the forest lands to transport, population, and agricultural developments. Preferably this reconnaissance should cover the whole country as soon as possible, since it will be the basis on which areas will be selected for more intensive inventory. The intensity of reconnaissance surveys can vary and the needed information about areas where development is likely only in the remote future can be obtained with simple and inexpensive procedures. Reconnaissance work should start in the parts of the country where the forests are considered to be most desirable for immediate development. Results for these areas should be made available for use as they are obtained and while the reconnaissance is still continuing in other areas.

Following the reconnaissance should come a more intensive inventory of selected areas to permit delineation on the ground and the development of plans for exploitation and management for wood production or protection. It will be desirable to start this more intensive work on obviously important areas while the reconnaissance is still proceeding on other areas. The intensive inventories should constitute a fairly long-term programme and may not be extended to certain remote and low-value areas for many years.

Because of the specialized requirements of inventory work, and particularly the use of photogrammetry, the responsibility for this programme should be assigned to a special inventory unit. This unit should take advantage of any opportunities to co-operate in, or obtain useful maps, photographs, or other information from, similar programmes for agricultural, geological, or military purposes. However, the needs of the forest inventory are such that there is no chance of obtaining everything needed as part of another programme and the agency responsible for developing the forest resources will have to have its own field programme.

The inventory unit should be headed and staffed by competent people and should have major administrative status in the forestry agency. It should be planned from the first as a permanent unit, since the inventories will have to be maintained and since this unit should eventually play an important role in planning and management of the forests. The responsibilities of the inventory unit should be broadly defined and its programme should not be specified rigidly. It is almost impossible to specify in advance the extent and intensity of coverage that will eventually be desirable and the procedures which should be followed. The programme of the inventory unit must evolve as part of the over-all programme of forest development. The most fruitful policy will be to establish such a unit with adequate staff and budget and to assign it the responsibility for providing information on a continuing basis about the forest resources of the nation, leaving the details of its operation to subsequent decisions by the administrators of the forest development agency.

Adapting resources to needs—forest administration

The preceding sections have stated that the forestry policy of a country should first be to find out what the nation needs from its forests and what resources there are to meet those needs. The rest of the policy should concern actions that will be in the public interest in view of these needs and resources.

If the development of the forests is not to be completely haphazard, the first step must be to define the areas that will be considered a part of the national forest resource and which should be developed for the future benefit of the nation. As rapidly as the results of the reconnaissance survey become available, the areas which are suitable for permanent forest use should be identified. Where these lands are already publicly-owned, they should be legally reserved for forestry use, their boundaries should be established on the ground,

and they should be assigned to the public forestry agency for administration as public forests. The setting of the boundaries should not be arbitrary, but should be done in collaboration with adjoining landowners and representatives of other land uses. Once a public forest has been established and its boundaries marked on the ground, the alienation of lands within those boundaries to other uses or other owners should be permissible only upon proof that this would be in the public interest, and after study and approval by the forest agency.

The establishment of public forests and the marking of their boundaries on the ground should not necessarily imply that they are to be exploited or put under management immediately. The purpose of this establishment and demarcation should be to reserve these areas for future use and to protect them from unwise use in the meantime. None of the Latin American countries will have sufficient personnel and funds to put all their public forests under management immediately. They will have to start with the most urgent or potentially most productive areas and extend management gradually to the rest of the lands. But a policy of selection and demarcation of public forests as soon as sufficient information becomes available to permit it to be done logically will permit an immediate start anl fairly rapid progress in defining the forest resource which the country will have for use in future development.

When areas identified as suitable for permanent forest use are already in private ownership, they should be recognized as areas of possible public influence and control though not necessarily of public operation. In special cases, where they are important for protection against floods or erosion, such privately-owned areas might be reserved exclusively for forestry purposes by legal limitations placed on their use. But usually these areas will have to be considered as a somewhat less definite part of the national forest resources than the public forests.

The national policy concerning the administration of the forest resources should, therefore, be first to identify the areas suitable for permanent dedication to forestry and where possible to give them legal status as state forests. Subsequent policy should then be to put these selected areas under permanent forest management as rapidly as the needs of the country and the available resources permit. The policy concerning management should be general and flexible. It should not attempt to stipulate specific activities or arrangements but should assign the responsibility for such current policy decisions to the persons placed in charge of the forestry programmes.

A general policy regarding the priority to be followed in applying management to the various areas is probably desirable, however, because of the limited resources that will be available for such work. A logical order of priority is the following: (1) areas where forest cover is very important for the protection of watersheds and the prevention of erosion and floods, (2) areas where land settlement or exploitation are imminent, in order that they may start off on a proper basis, (3) areas already under exploitation and (4) areas where exploitation or land settlement are planned for the future. Such an order of priority should not be stipulated too rigidly, however, because it may be possible to accomplish a great deal in some areas already under exploitation with only a limited amount of inspection and technical assistance if the people operating in those areas are co-operative and interested in maintaining the forest resources.

Throughout the preceding discussion of policy repeated reference has been made to a "public forestry agency". It is clear that some such agency will be the key to the success of the policies which have been proposed. There is little point in deciding on and announcing policies unless some provision is made for implementing them. But in the case of forest resources the public agency will have to do more than just carry out policies assigned to it.

The discussion in the last four chapters has emphasized the very complex nature of the forest resource problem in Latin America. The lack of reliable information about the forests and the consumption of wood products, the lack of knowledge about silviculture and the properties and processing of Latin American woods, and the uncertainty about future economic and agricultural development all combine to form an environment of extreme uncertainty in which to try to spell out a "best" policy for the development of the forest resources. It seems obvious that such a policy can only evolve gradually as more information accumulates and as the general direction of Latin American development becomes clearer. The only logical policy for the management of Latin American forests today is one of flexibility. But this requires the delegation of responsibility to the administering agency constantly to guide management into what appears to be the most promising course of action.

If the policies already proposed are ever to be carried out, they must be supplemented in each country by another basic policy: to develop a strong, professionally competent, and independent forestry agency capable of carrying the responsibility for the optimum development of the nation's forest resources. This agency should have complete responsibility. The limited professional and financial resources now available should not be dispersed thinly among various agencies but should be concentrated in one organization.

The public forestry agency will not be able to accomplish what it should unless it has sufficient status in the administrative organization of the government to be able to influence over-all policies. As was pointed out earlier, the use of the forest resources will affect and be affected by many other activities such as agricultural development, land settlement, industrial development, and improvement of transport. Often it will be possible to promote the aims of forest development jointly with these other programmes. Sometimes their aims will conflict and will have to be resolved in the public interest. The administrator of the forestry agency must be in a position to influence those other programmes and to defend effectively the place of forest resources in the over-all development effort.

The forest resources have sufficient potential importance for the future of the Latin American countries to justify major administrative status for the agency responsible for their development. Some countries might well consider a separate Ministry of Forestry, especially if they are willing to give that Ministry responsibility for development of the wood-using industry as well as the forests. This is the ideal arrangement for a country whose forests should play a major role in future economic development, because it will practically guarantee that the wood-using industries are developed

in the way that will make the most of the potential productive capacity of the forests. In other countries a Ministry of Renewable Natural Resources would be logical, with forestry as a sub-ministry. Various combinations are possible, and each country will have to develop its own pattern, but in no case should the forestry agency be less than a sub-ministry or a major department in a Ministry concerned with similar resources or problems. The head of the forestry agency should have direct access to the major policy making officials of the Government, since issues will arise which only those officials can resolve. If there is to be balance in the over-all development of the country, forestry must have equal status with agriculture, land settlement, and other activities with which it must be integrated and with which conflicts are likely to develop.

It was suggested earlier that forestry should be represented in the planning and implementation of general land use, land settlement, watershed development, and industrial development programmes. The scarcity of qualified personnel will make this a difficult problem in many countries. It will be preferable, therefore, to assign to the forestry agency the responsibility for co-operating in and co-ordinating with those other programmes and to leave the details of how this is to be done to the administrator of that agency.

It is clear that the policy suggested here of delegating the responsibility for the development of the nation's forest resources to a strong public forestry agency with adequate authority and complete backing by the national administration will depend for its success on the men who head and form the staff of that agency. Resources are not developed by passing laws or by issuing proclamations. The experience of other countries shows that the forests have only been developed as a result of the continuing efforts of many dedicated men working with imagination, persistence, and a long-range view.

An important part of the forestry policy of a nation should, therefore, be to encourage the development of a corps of professional foresters dedicated to the development of the country's forests. This policy can be implemented through the improvement of educational facilities for professional foresters and through the provision of scholarships for study abroad by those countries unable to support a domestic forestry school. Additional incentives should be provided in the form of attractive salaries, recognition of professional status, and rapid promotion to responsible positions to attract capable young men into the forestry field.

Government and private enterprise

Private enterprise occupies an important place in the economy of Latin America. Unfortunately, with few exceptions the private exploitation of Latin America's forests has been destructive rather than constructive. There are inevitable conflicts between the short-term private interests and the long-term public interest. In the past the public interest in the forest resources has often not been recognized in Latin America or, if it has been recognized, the means or the will to enforce it have been lacking. The Latin American countries must start to resolve such conflicts in favour of their long-term public interest. This does not mean that the Governments should operate all forests and wood-using industries. But it does mean that the Governments must exert some control over the use of the forests if they are to be developed as they should be.

Industrial plantations are profitable in many parts of Latin America and will become more profitable as time goes on. Private capital has been readily forthcoming for plantations of quick-growing species in Argentina, Brazil, Chile, and other countries. It appears that private capital will continue to be available for such investments in the future. But this does not mean that industrial planting should be reserved exclusively for private enterprise. All the Latin American Governments will be managing extensive public forests in the future. The goal of this management should be to produce a maximum return in services and income to the public. The public agencies should therefore be encouraged to put part of their effort into profitable, fast-growing industrial plantations.

The problem of developing the forest resources is so large that all the help possible will be needed. A reasonable policy, therefore, is to encourage anyone who is willing to make an effort to manage his lands well or to harvest timber properly. The Government should try to guide the management of private lands in the right direction but should not attempt to establish a strict centralized control over their operation. The case of public lands is different. Here the Government has an obligation to ensure their proper management. Most harvesting will continue to be a private activity, but should be conducted under government control and supervision. In some cases it will be desirable to lease such lands to private owners for long periods, but this should be done with strict stipulations as to the use of those lands and a threat of forfeiture if the private owner fails to handle them properly.

A Latin American forestry policy

In its own long-run interests each Latin American country should formulate immediately a definite policy regarding its forest resources. This policy should be quite simple and general. The elaboration of details will serve no useful purpose at present and may even retard the work to be done. A nation will have taken a great step forward if it can decide that its national policy should be to:

1. Recognize publicly that the forest resources are of major long-run importance to the country and that immediate steps must be taken to protect and develop them;

2. Establish a strong public forestry agency at a high administrative level and give that agency full authorization and an adequate budget to develop the forest resources of the country;

3. Mark on the ground and reserve as public forests those areas of publicly-owned land which are at present most valuable for forestry uses, as rapidly as they can be identified;

4. Extend management and development to the public forests, in the order of their value for protection or wood-production, as available personnel and funds permit;

5. Assist, guide, and if necessary control, private owners and operators to the extent needed to ensure satisfactory protection and management of privately-owned forest lands;

6. Promote the development of a wood products industry which is in balance with the long-run productive potential of the forest resources.

Some of the countries already have a national policy which comprises most of these points, and need only to round it out and to accelerate its implementation. Others have no clearly defined policy at all and are seriously handicapped in developing their resources. Every country will benefit by deciding clearly what its policy should be regarding its forest resources. Only then can it really start to make the best use of them.

What are the priorities?

The present need in Latin America is immediate decisive action to develop the forest resources. Continuing study and investigation will be needed, but the major problems are well enough understood for the Governments to take effective action now.

The following actions are presented in the order of their importance and urgency. Some countries are well on the way to doing what is recommended here, and this may serve mainly as a check list for assessing and expanding their activities. Other countries have made little more than a start and will find here a guide for expanding their activities rapidly.

1. *Establish a strong national forestry agency.* Plans are worthless unless there is an organization to put them into effect. Laws are futile unless there is someone capable of enforcing them. An efficient and capable organization is an absolute prerequisite for any kind of effective programme. Building and staffing such an organization should take precedence over both plans and laws. If it is properly set up and manned, it will start immediately to find ways of attacking the major problems. Few Latin American countries now have a national forestry agency of this calibre.

2. *Establish a programme to provide qualified forestry personnel for Government and industry.* The effectiveness of any organization or programme depends absolutely on the people who work in it. No country can establish a strong forestry agency or develop government and industrial forestry programmes on a sound basis without qualified professional and technical personnel. Such people are scarce in Latin America and it is imperative that steps be taken at once to increase their number substantially. The existing professional forestry school should be strengthened and expanded. New schools should be established to train people for position at the subprofessional or technician level. The nations which cannot establish their own schools should make arrangements with other countries for the education of their nationals and should set up a definite programme to recruit students, finance their education abroad, and assure them of employment at home after they complete their education.

3. *Start an action programme in forestry at once.* It is essential to the development of a strong forestry agency that this organization have under way a programme of action from the start. Resources are not developed by talk or by drawing plans and shuffling papers in offices in the capital. Even a young and undermanned organization can start effective work in reforestation, fire control, or advice on cutting practices. More important than the immediate results accomplished will be the development of an organization and personnel capable of putting programmes into effect in the field. Without these, the planning and promotion activities recommended below are likely to be ineffective and perhaps even impossible to utilize. The major problems are well enough known for action on them to be started at once. The results of the planning and promotion activities can then be fed into a going action programme as they become available.

4. *Establish a programme to plan and promote the development of the forest resources and industries.* In order to develop its forest resources effectively in the long run for domestic consumption and possible export, a country must plan that development carefully and promote it in a logical manner. This cannot be done all at once. It will take time to collect the necessary information, to prepare rational plans, and to devise means of putting them into effect. But action cannot be postponed for years awaiting the development of complete and perfect plans. The programme must be designed to produce partial plans which can be translated into action as rapidly as they are developed, and to gradually build these into an over-all plan for the country. It must therefore be a continuing programme for many years and perhaps permanently. The planning and action programmes should proceed simultaneously and with close co-ordination.

Three related activities must be undertaken in this programme. They are equally essential, should be carried on at the same time, and must be closely co-ordinated.

(a) *An inventory of forest resources and existing industrial capacity.* Without knowledge of a country's resources, it is impossible to plan or promote development. This inventory will provide the basic information on the potential productive capacity for the country's forest-based industry. It should include areas suitable for reforestation as well as promising areas of existing forests.

(b) *A study of the need for products and services of the forests.* A nation's primary responsibility in managing its resources is to serve the needs of its people. Little reliable information is now available in any Latin American country on the potential domestic demand for the great variety of forest products. Such information is essential as a guide for developing both forests and industries. This study should include the need for erosion control, watershed protection and recreation areas.

(c) *A programme to promote the expansion of the wood-using industries and of domestic and foreign markets.* If the Latin American countries are to develop rapidly and efficiently, the growth of industries and markets cannot be left to chance. Investigation should begin immediately on the possibilities and problems of expanding the existing industry, developing new industries, and developing new markets. The information produced by the inventory of resources and study of needs should be used, as soon as it becomes available, to promote integrated development.

5. *Establish a programme of applied research on forest resource and industry development.* Most of the basic knowledge needed to manage Latin American forests and process Latin American woods is now available from research done elsewhere. The problems actually encountered in these countries should be studied in the light of this existing knowledge and any gaps should then be filled by applied research and experimentation. At this stage in Latin American development less is known about the economic problems than about the technological ones, and emphasis should be placed on finding out how to achieve a maximum

of development with the limited financial resources available.

Forestry and regional development

The Latin American countries have common problems and aspirations. They are trying to cope with many of these on a regional rather than an individual basis. Developing the forest resources and industries fits logically into such a scheme of regional cooperation. All the countries are not equally gifted with forests, and they can complement each other in the production of different products. The domestic markets are too small in many of them for an efficient national industry in all wood products. Widening the possible sales area through a common market can make such industries possible. Professional education and research are expensive undertakings for small countries, but are possible if they pool their resources. Regional cooperation can greatly facilitate the development of the forest resources. At the same time these resources and the industries based on them can contribute materially to the economic development of the region. Latin America stands at the threshold of an era of rapid growth. The forests can and should play an important role in this future regional development.

GENERAL NOTES

The basic data in this study have been supplied to FAO and ECLA by official agencies of the Latin American countries. In some cases, however, it was known that the officially accepted figures were not comprehensive. These figures were therefore replaced, where appropriate, by alternative figures obtained by correspondents specially commissioned to assist in the study.

When insufficient data were available to determine the consumption of a given item in a particular country, estimates were prepared in the light of what was known about consumption in countries with similar characteristics.

The figures for wood used in rayon manufacture were excluded for lack of information. The volume which they represent within the total for roundwood is negligible (less than 1 per cent).

The statistics of foreign trade in forest products quoted in the study exclude wood manufactures (furniture, cabinet-making, prefabricated houses, etc.), rayon and other pulp products, and paper and board manufactures.

In determining roundwood consumption in paper and board manufacture, the composition of fibrous material used in the different countries and years covered by this study was calculated separately. In those countries where the only raw material used was wood the conversion factors were applied directly.

CONVERTING FACTORS

Processed wood

	m^3 *roundwood equivalent*
1 m^3 sawnwood and hewnwood	2.00
1 m^3 sleepers	2.75
1 m^3 plywood	2.50
1 m^3 veneers	2.00
1 m^3 particle-board	1.60
1 m^3 fibreboard	1.60
1 metric ton charcoal	7.00

Pulp and paper

		m^3 *roundwood equivalent*
1 metric ton of:	mechanical wood pulp	2.40
	chemical wood pulp	4.70
	semi-chemical wood pulp	3.80
	newsprint paper	2.80
	paper other than newsprint	3.40
	paperboard	1.70

Weights

		Kilogrammes
1 m^3 of:	coniferous sawlogs	650
	broadleaved sawlogs	975
	coniferous sawnwood	520
	broadleaved sawnwood	730
	coniferous plywood	500
	broadleaved plywood	650
	coniferous sleepers	620
	broadleaved sleepers	900

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