

**Report to the Government**  
of  
**BRAZIL**  
on  
**FOREST DEVELOPMENT IN THE**  
**AMAZON VALLEY**



**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**

**ROME - OCTOBER - 1953**

REPORT  
to the  
GOVERNMENT OF BRAZIL  
on  
FOREST DEVELOPMENT IN THE AMAZON VALLEY

by  
R. Gachot, M.N. Gallant and K.P. McGrath

Rome  
October, 1953

	<u>Page</u>
III. WOOD-USING INDUSTRIES . . . . .	39
1. Sawmills . . . . .	39
(a) Supplies for sawmills . . . . .	42
(b) Sawmill equipment . . . . .	45
(c) Staff . . . . .	47
(d) Stacking and seasoning . . . . .	48
(e) Cost of production . . . . .	49
(f) Improving present conditions . . . . .	50
2. Rosewood Essence . . . . .	55
IV. TIMBER TRADE . . . . .	58
1. The market for timber in the Amazon . . . . .	58
2. Coastal markets of Brazil . . . . .	61
(a) Northeast ports . . . . .	61
(b) The Distrito Federal - Rio de Janeiro . . . . .	63
(c) São Paulo . . . . .	64
3. Foreign markets for Amazon timbers . . . . .	66
(a) La Plata markets . . . . .	66
(b) United States of America . . . . .	67
(c) Europe . . . . .	68
4. Prospects for an expanded industry . . . . .	70
APPENDICES	
A. Highlights of the Background Situation . . . . .	76
B. Economic Situation . . . . .	97
C. Commercial Species of the Amazon . . . . .	114
D. Observations about Growing Stock . . . . .	117
E. Timber Trade . . . . .	120
F. Timber Prices . . . . .	130
G. Grading Rules . . . . .	142

## CONTENTS

	<u>Page</u>
INTRODUCTION . . . . .	2
MAJOR RECOMMENDATIONS . . . . .	6
FOREST DEVELOPMENT AND ITS PROBLEMS . . . . .	8
I. FACTS ABOUT THE FOREST . . . . .	8
1. Extent and composition . . . . .	8
2. Drain . . . . .	9
II. LOGGING INDUSTRIES . . . . .	13
1. Types of logging areas . . . . .	13
(a) The Igapo regions . . . . .	14
(b) The Varzea regions . . . . .	17
(c) Tertiary areas bordering the rivers . . . . .	18
(d) Quaternary sands bordering the rivers . . . . .	20
(e) Terra firma bordered by Varzea . . . . .	21
(f) Volcanic highlands . . . . .	23
2. Costs of operations . . . . .	27
3. Methods of working . . . . .	28
(a) Logs . . . . .	28
(i) Cutting . . . . .	28
(ii) Track making . . . . .	28
(iii) Log extraction to water . . . . .	28
(iv) River floating . . . . .	29
(b) Railway sleepers . . . . .	31
(c) Pau Rosa working . . . . .	32
(d) Firewood . . . . .	34
4. Wastage in the forest . . . . .	35
(a) Felling . . . . .	35
(b) Extraction methods . . . . .	35
(c) Insect attack . . . . .	36
(d) Other sources of injury and loss . . . . .	36
5. Methods of Measurement . . . . .	37

The FAO Forestry Mission which was appointed at the request of the Government of Brazil has pleasure in presenting the attached Report.

Our instructions were:

"TO ADVISE THE GOVERNMENT ON FOREST INDUSTRY - SAWMILLING OPERATIONS, KILN DRYING, AND TRAINING OF PERSONNEL; ON THE MODERNIZATION OF LOGGING METHODS AND UTILIZATION OF WATERWAYS FOR WATER LOGGING; ON MARKETING AND DISTRIBUTION OF TIMBER."

The Mission spent twelve months in Brazil, mostly in the Amazon Valley, and had every opportunity not only to consult both government officials and private persons but also to travel extensively through the Amazon Valley and other parts of Brazil, to neighboring countries, and to countries which are potential importers of Amazon timbers.

On all sides we experienced keen interest in the work of the Mission throughout its stay in Brazil, and we are greatly indebted for all the help that we received. We regret that individual acknowledgements are impossible.

After our return to Rome in January 1953, we prepared the attached report in consultation with members of the staff of FAO. A preliminary draft had earlier been discussed with officials in Rio de Janeiro.

The Report presented herewith is the result of our initial appraisal of conditions and possibilities in the Amazon Valley. It is in a way an interim report only, in that the detailed implementation of our proposals and recommendations remain to be worked out by subsequent missions. With this qualification it is now respectfully submitted.

Rome, 1953.

R. Gachot  
M.N. Gallant  
K.P. McGrath

FAO/53/10/8283

## INTRODUCTION

The Amazon is an area which has suffered greatly from ill-informed journalism and the creation of the "green hell" legend. It is equally ill-described as a potential "bread basket of the world". It is in truth an area of poor soils and, on tropical standards, of poor forest quality. Apart from the limited "Varzea" areas there is little prospect over the remaining perhaps 99% of the area of the traditional type of colonization based on agricultural production.

On the favorable side, however, the magnificent system of waterways, the general ease of topography, and the open nature of the jungle present less difficulty to log extraction than probably any other extensive tropical forest in the world. There is no technical reason why the forests should not be exploited to the limit of available markets; and modern methods of extraction and industrialization could so reduce the cost of Amazon lumber and other types of wood products that a very much greater market would undoubtedly be opened than even the quite considerable one that is available today. The forests are of enormous extent and despite the low yield per unit of area, the amount of utilizable timber aggregated over the vast area is undoubtedly of staggering proportions, and given an unlimited market, then an enormous timber industry could be visualized on the basis of forest productive capacity.

At the moment, however, the only reliable market is the Brazilian market. The general supply position to the Brazilian market is now such that it is a matter of urgency for measures to be taken in the Amazon to ensure the supply of the timber required for continuing Brazilian development. Exactly what the internal market will require in the immediate future is unknown. But it is beyond doubt that it can absorb and at correct prices will have definite need of all that an Amazonian industry expanded at a practicable rate can produce in the foreseeable future. Having in view the general market condition and what has to be done to achieve such an objective, we believe that it is a sound and practical target to aim at a threefold increase of production from the Amazonian forests during the next ten-year period.

Given an expanded industry developed on sound lines, it is certain that overseas markets will become increasingly available for regular deliveries of standard grades of well-produced and conditioned lumber. How far this market will develop will to a large extent depend on the costs of the produce of the realized objective. Although lowered costs should be conducive to foreign merchantability, it nevertheless seems unlikely that international trade will in the foreseeable future be other than of secondary interest to that of the Brazilian market itself.

A threefold increase would establish an industry still without any relation to the capacity of the forest. But the achievement of even this target starting from the difficult basis of today's conditions in the Amazon, will itself be a really big task.

A development of this order will require the establishment of a new economy. Three centuries of a "collection" economy and a trading psychology has produced a set of conditions unsympathetic to the founding of a sound industrial basis. The Amazon's  $3\frac{1}{2}$  million square kilometers produce less than half of the food-stuffs consumed by a mere two million people; and the people are now so inadequately fed that malnutrition and under-nourishment, and not endemic disease, is the major medical problem. The habits and philosophies of all of the peoples who populate the basin are alien to a permanent and substantial economy. Little contribution to a threefold increase can come from the present so-called industry - for it is no more than another unit of the collection economy, conducted not by technicians but by traders. It can be assisted in a way which is essential to its economy, but little is possible to increase its productivity. An increase of the magnitude visualized can come only from a completely new industry.

Starting from the present basis the development of a new industry capable of increasing production threefold in a period of ten years will be a truly worthy achievement. But we believe it to be a real target and one possible of attainment. To attempt anything bigger, despite that markets might be assessed at greater capacity, is to start to explore the realm of phantasy and to founder any plan on unreality and lack of appreciation of Amazon conditions.

Towards such an objective the first task is to develop existing industry to the maximum of its possible efficiency. This would at the same time clear most of the ground for the establishment of new industry. For the needs of existing industry are common to those of new projects - an assured, reliable and cheaper log supply is essential to any industry established or projected. The removal of procedural difficulties which hamper existing industry and would similarly fetter a new one; the local availability of operatives trained to exploitation or industrial techniques; these and other problems on which the details of the subsequent recommendations are based are common ground to the existing or any projected industry.

Whatever might be achieved in the economy of the existing industry, little is possible to increase its production, because it suffers from capital establishment so basically opposed to modern flow production, its machinery is so inadequate and incorrect in type and its "trader" management so incompetent that it could make little contribution in volume to anything in the nature of a threefold increase.

The remainder, and bulk, of the increased output must come from new establishments and new investment requires additional justifications. It demands not the mere demonstration of exploitation techniques but the tabulation of data on forest yield and detailed mapping - desirable at the same time for existing exploitation but essential to organized extraction planning. It can already be assured of its market in type, but apart from a few species already accepted in the market investment would require detailed information on the possibility of other species meeting the requirements of the market. And above all a new industry would require a new colonization of people provided for locally in food, housing, medical services and amenities, which alone can make them dependable and stable members of an industrial enterprise. The exploitation and industrial techniques they would use would not be new; merely the standard methods well developed elsewhere with minor adaption to Amazonian use. But the methods would need to be demonstrated and operators to be trained.

In short the only justification for new industrial investment will be the demonstration that the timber is there in the Amazon Valley in sufficient accessible volume; that it can be got out reliably and economically, and delivered to centers strategically favorable to the establishment of industry; that colonization on modern lines is practicable; that taxation will be equitable and the method of collection not unduly burdensome; and that the Government is sympathetic to and desirous of establishing the conditions which will be attractive to a new development and favorable to investment.

Whatever inducements are necessary to attract the investment necessary to the ten-year objective of increased output should receive sympathetic consideration. The Amazon yields 1% of the National Revenue of Brazil and receives 3%. It can be made a self-supporting area if soundly developed and sympathetically administered over a ten-year period. And only by forest development can it be eventually rendered solvent and converted from a fiscal burden to the South, into the internal market for national products which is universally the basis of sound internal economy. In addition to the stimulus that should be given to the existing timber industry from the measures proposed in this report of the Mission, assistance to other subsidiary but nevertheless significant Amazonian industries is also essential. Of particular note are the Rosewood oil industry and firewood supplies. The former is, in fact, facing extinction unless its industry is rationalized and its raw material supply cheapened and made more readily and reliably available; and in the center of one of the largest of the world's forests, the local authorities are turning to oil, of which there is no national source of supply to replace firewood which they can no longer obtain in sufficient quantity to avoid a continually rationed and uncertain supply of urban electricity.



With the modernization of existing wood utilization and the attainment of a new industry and a new economic outlook, new horizons will be revealed. Alongside the tangible reality of the ten-year expansion which has been proposed, the possibility of much greater subsequent development has not been lost sight of in the Mission's investigations over the past year. But the lack of basic information has precluded any possibility of a real estimate of this potential at this time. To obtain the necessary data it is essential now to initiate concurrent enquiries which will become increasingly necessary as the success of the ten year plan materializes. Already the possibilities of pulp and paper making have received preliminary investigation: a Brazilian shortage in locally produced pulp offers an internal market and the Amazon has a real potential to supply the deficiency. Again, nitrogenous fertilizer for Brazil, which is now obtained at very high prices from Chile, could undoubtedly be obtained by chemical conversion of wood and at lower costs from the Amazon.

But these and similar possibilities must in practice be contingent on the progress achieved towards the initial ten-year objective and should be developed only at the pace that its advancement justifies. To go faster is again to waste money and effort. For unless the new economy can be established on the basis of traditional wood utilization, no other methods which require the same basis, but a higher degree of technical skill, can hold any real possibilities.

This then is the general background for the conclusions which the Mission reached and for the recommendations which it has put forward.

### MAJOR RECOMMENDATIONS

From its general survey of market prospects, the Mission has concluded that a threefold increase of production in the Amazon Valley could be absorbed in products of the type at present produced (sawn wood, hewn sleepers, boxes, etc.) and of new types that have excellent prospects (plywood, veneers, mosaic and end-matched flooring, wire-staple boxes, etc.). It believes that the attainment of such an increase, in view of the urgent desire of the Government of Brazil to develop the resources of the Amazon, is a realizable objective and it recommends that this should be the target to be reached in the ensuing ten-year period.

To permit realization of this objective, proposals which fall into two classes are put forward:

#### Proposals which will lead to immediate progress on a practical level

1. The methods which the Mission considers would lead to the solution of the supply problem must be demonstrated in the field, together with methods for the "spot" production of lumber and sleepers: pilot demonstrations must be given at strategic locations of modern logging methods and the operation of mobile sawmills.
2. Concurrently with these demonstrations, a permanent center should be set up at Fordlandia for the training of sawmill and logging operatives. This center should comprise initially a pilot logging station; a small sawmilling and saw care-and-conditioning school; and a workshop for machinery maintenance.
3. Measures suggested by the Mission as capable of ameliorating the troubles of the Rosewood oil industry should be set in train.
4. The Mission's proposals with regard to assuring a continuous and economical supply of firewood to electricity undertakings should be put into practice.
5. The Mission's recommendations which would permit industry to obtain equipment with greater facility, as being essential to existing and projected establishments alike, should be given effect.

#### Proposals which should be initiated forthwith but whose effectiveness will only become apparent over the long-term

6. The Government is requested to give earnest consideration to the Mission's recommendations in regard to adequate shipping space for timber and equitable freight rates; the simplification and rationalisation of modes of taxation; to the maintenance

of a steady export policy; and at the same time to the Mission's proposals relevant to monetary exchange control, and to the development of market publicity.

7. An air survey interpretation and assessment service should be established.
8. Owing to the basic necessity of establishing clearly the conditions of land tenure throughout the Amazon Valley, the services of a lawyer skilled in the legal aspects of Brazilian land law should be retained for this work.
9. The whole question of colonization and agricultural techniques for integration with new industrial establishments should be investigated without delay. The Comissão de Valorização de Amazonia should co-ordinate the work of all agencies concerned with Amazon development.
10. The Mission's proposals in regard to research on several basic and practical problems - techniques for peeling, drying, storage, grading, etc. of timber - should be implemented.
11. To prepare the way for a possible widening of the production target as the success of the initial ten-year project may later warrant, the Mission recommends that the local supply to the major markets within Brazil which are available to Amazon timbers should be thoroughly investigated, so as to permit a reliable assessment of the future needs from Amazonia of the domestic markets.
12. Finally, the Mission recommends that detailed attention be given to the administration requirements for promoting and controlling the development which it proposed, based on a clearly formulated forest policy.

The Mission's recommendations which are aimed at the establishment of a sound, substantial and traditional type of conversion industry in the Amazon Valley, are equally fundamental to any other type of wood utilization, and could prepare the way for new developments that might later become feasible. For instance, the development of chemical utilization at a later date is visualized, and, to initiate investigation of this type of possibility, an area should be selected for detailed study in the Territory of Amapa, and research into the pulping possibilities of its raw material resources is recommended.

FOREST DEVELOPMENT AND ITS PROBLEMS

FACTS ABOUT THE FOREST

Extent and composition

The Amazon forest may be described by A. Ducke's definition as "rain forest coincidental with the habitat of the genus Hevea". Within the borders of Brazil it covers the States of Amazonas and Pará; the territories of Acre, Guaporé, Rio Branco and Amapá; the northern part of Mato Grosso; and a narrow strip of Maranhão.

This vast forest area, extending over roughly 40% of the country, is still little known. Most progress has been made with studies in the field of systematic botany; many species have been described and identified but the inventory is still far from accurate. J. Huber, for instance, estimated the number of tree species making up the Pará forest at 1,500, while A. Ducke reduced the number to 600.

Likewise, geobotanical information is too slight for a clear definition of subdivisions.

Forest formations of four types can be distinguished on the basis of the extent of existing or available water:

- (a) coastal mangrove with characteristic flora;
- (b) 'Varzea' formations;
- (c) 'Igapo' formations;
- (d) 'terra firma' formations varying with climatic conditions (particularly rainfall): dense forest, dry forest and savannah woodland. Over 95% of the Amazonian forest is dense forest.

A practical description of these formations is given in appendix A.

Generally speaking, the tree flora of the dense Amazon forest, because of low soil fertility, has an average height which is less than, for example, the African average; comparable vegetation to the latter is only to be found in stands on soil of volcanic origin.

Since present available data on the subject are limited, it is clearly not possible to speak about forest stand composition. All we have is information on the area covered by a few species of special commercial value.

The aguano (*Swietenia macrophylla*), for example, is known to grow on a belt that covers the upper basins of the Juruá and the Purús, and the Madeira, Tapajoz, Xingú and Tocantins basins above the waterfalls or rapids where they enter Tertiary deposits. It has also been noted that pau rosa likes the sandy soils of 'terra firma' on both sides of the Amazon above the mouth of the Tapajoz and below the mouth of the Purús. The cedro seems to be common throughout the Brazilian Amazon, except at its northeastern and eastern extremities. Finally, a little is known about the distribution of the species of the genus *Manilkara* and of the main legumes.

It is not difficult to appreciate the fact that, because of the vastness of the area, the assembling of all the data necessary for a true knowledge of the forest would be a herculean task. It would only seem possible to make limited inventories of regions selected for economic reasons.

The list of forest species given in appendix C includes the main species utilized either for sawn wood or for by-products such as oleaginous fruits, latex, resins, and the like. The list of species that enter into trade is very much shorter. It comprises as regards saw-timber:

- from Amazonas: Aguano, Andiroba (Brazil nut tree), Assacu, Cedro (cedar), Jacareuba, and miscellaneous Louros (laurels) (mainly 'Inamhuí'), Ucuuba;
- from Pará: Andiroba, Cupiuba, Freiço (ash), Louros (laurel), Macacauba, Massaranduba, Sucupira, and, to a lesser extent, Aguano (a little is felled along the Tocantins), Araracangua, Cedro (a little in the Santarém area), Marupa, Pau amarelo.

#### DRAIN

The following information must be regarded as approximate. The production figures are, on the whole, below true figures because a part of the products, particularly those consumed locally, cannot be checked.

#### LUMBER

The lumber figures are those given by Dr. I. Kissin for 1951 in a paper entitled 'A situação madeira da Amazônia' (The Amazon Timber Situation). They comprise volumes of logs sawn in the Amazon saw mills or exported as logs.

	<u>Solid volume</u>
State of Amazonas and adjoining territories	120,000 m <sup>3</sup>
State of Pará and Amapá territory	175,000 "

It will be noted that the log volumes are measured in the State of Pará by the Francon system (78.5% of solid volume) and by a variant of this system in the State of Amazonas (60 - 65% of log volume according to the shape and size of the logs).

This takes no account of sawn wood utilized directly by the rural populations for their own needs. Estimation is difficult, but I. Kissin has suggested 90,000 m<sup>3</sup> for Amazonas and 140,000 m<sup>3</sup> for Pará.

The figures given for marketed timber come fairly close to information independently obtained by the Mission, except as regards the Pará output which seems to be less by 15 to 20%. In any event, the most striking fact is the low output by comparison with the extent of accessible resources.

Fuelwood and wood charcoal

Figures for these are few and incomplete and the only information obtained relates to 1947.

	<u>Fuelwood</u>		<u>Wood charcoal</u>	
	Cubic metres	Cr\$	Kilograms	Cr\$
Guapore	44,469	1,303,022	70,753	117,843
Acre	205,894	11,185,820	162,300	201,000
Amazonas	123,952	5,627,979	11,490,651	13,781,090
Rio Branco	5,120	363,520	-	-
Pará	284,062	4,624,097	2,764,627	1,558,952

This obviously only refers to marketed production. Fuelwood is industrially utilized by the railways, the river boats, thermo-electric stations and a certain number of other industries.

It will be noted that the steamboat is gradually giving way to the motorboat. In like manner, the trend in thermo-electric stations is away from fuelwood. Here, the arguments in favour of the use of Diesel oil are the difficulty experienced in obtaining supplies of wood and the disappointments due to the poor quality and high moisture content of shipments; arguments, however, which do not appear very convincing.

Charcoal is only used for domestic purposes, mainly in large urban centers in the neighbourhood of which charcoal burning is done on a craft basis. The wood used in the process comes mainly from clearings for cultivation.

Railroad sleepers (ties)

The output of railroad sleepers (ties) is sufficient for the needs of the Amazon railways and for export to southern Brazil and abroad.

The local railways: the line from Madeira to Mamoré in the territory of Guaporé, the Bragança line and the Tocantins line in Pará, annually require 50,000, 50,000 and 15,000 ties respectively. In all, therefore, 115,000 ties or 8,000 m<sup>3</sup> of wood must be needed annually for local consumption. It should be added that such quantities are not regularly produced. The Guaporé ties are cut from 'Itauba' and the Pará ties from 'Jarana' and 'Massaranduba'.

Timber for export comes exclusively from the Islands (State of Pará). After experiencing great prosperity between 1927 and 1930, when exports ranged from 500,000 to 770,000 ties a year, output declined; the reason is that the sleepers are made from many species of very uneven quality. In 1951 some 8,000 m<sup>3</sup> of ties were exported to southern Brazil.

Secondary products

The tables below clearly bring out the extent to which forest utilisation in the Amazon Valley is extractive.

Fruit and oil seed

The most important product of this sort harvested is the Pará nut from Bertholletia excelsa. Production for 1947 - 1949 was as follows:

	<u>1947</u>		<u>1948</u>		<u>1949</u>	
	Weight in M.T.	Value in 1,000 Cr\$	Weight in M.T.	Value in 1,000 Cr\$	Weight in M.T.	Value in 1,000 Cr\$
Amapá	626	2,990	524	2,311	911	3,301
Pará	13,760	8,392	11,646	51,974	27,566	29,185
Amazonas	9,575	8,900	13,268	39,318	29,188	42,787
Rio Branco	721	369	1,081	1,541	833	2,444
Guaporé	385	182	654	1,299	566	1,809
Acre	3,000	1,191	3,884	10,000	1,901	6,989

Other oleaginous fruits are cropped but to a much lesser extent: andiroba, cumaru, ucuuba and, of the palms, babaçu and murumuru.

Latex

The most important of the products of the forest currently is the woodland rubber crop, as will be seen from the following table:

	<u>1947</u>		<u>1948</u>		<u>1949</u>	
	Weight in M.T.	Value in 1,000 Cr\$	Weight in M.T.	Value in 1,000 Cr\$	Weight in M.T.	Value in 1,000 Cr\$
Amapá	450	4,922	401	4,213	453	4,833
Pará	7,983	87,717	7,161	65,528	5,852	57,086
Amazonas	10,195	122,906	6,027	73,992	7,101	85,715
Rio Branco	77	1,339	73	1,031	18	238
Guaporé	4,541	76,729	3,381	45,085	4,119	70,646
Acre	8,000	100,000	9,379	118,903	9,113	111,060

The latex harvested from other woodland tree species such as massaranduba and sorveira is economically of much less importance.

Essential oils

The only essential-oil industry of any size is the extraction of rosewood essence.

The 1950 output appears to have been the largest since the industry started.

<u>Source</u>	<u>Quantity in M.T.</u>
Amazonas	551
Pará	38
	<u>589</u>

Some idea of the average output can be gleaned from the quantities exported from 1945 to 1951 which, as regards the Amazon as a whole, were :

	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>
M.T.	103	326	228	61	288	326	449



### LOGGING INDUSTRIES

The rivers are the highways of Amazonia and the sawmills have been located to draw their supplies in rafts from upstream. But arising from the fact that no power other than manpower exists for the extraction of logs from the stump to the watercourse, log supply is disorganized, uncertain and costly. In the first place, logging operations are necessarily restricted to the frontages bordering the watercourses. In consequence the species established on the market are not necessarily those of the greatest utility but rather such as are found close to the rivers. And the quality of the logs which reach the mill is determined not by milling utility but by the ease or difficulty which they offer to muscle-powered extraction.

Another and most important result of the fact that yards by land are of greater consequence than miles by water is that mills, particularly in the inland region of Belem, lose all geographic relationship to their areas of supply and, with logging operations scattered over vast distances along the rivers, difficulties of administration and organization are accentuated. The picture is thus not really one of "Forest exploitation" - the real forest of the Amazon, both in quality and quantity, lies on the vast waterless planalto and this is practically untouched.

The general principle by which manpower is used to extract timber is much the same throughout the Amazon and variations in practice are mere modifications necessitated by peculiarities of topography or forest type which may differ with locality. Thus in the most typical case, the trees are felled by axes and worked into logs of 4 meters length, and rolled to the water where they are tied into rafts with wire rope or vines and then towed by launch to the mill. To permit the logs to be rolled, a track is cut six meters wide and as straight as possible, and is provided with three parallel lines of continuous skids of round timber 15-23 cm thick which are laid on the ground for the full length of the track. The logs are manoeuvred on to the skids, and with or without the use of levers are then rolled on the skids to the water. In general the distance over which the logs are rolled is not great but in special circumstances it may entail 2000 meters or more. However, since the general picture of the Amazon area is of a river pattern of roughly parallel tributaries 150 - 300 km apart, with largely waterless country between and with the best forest development on the higher country of the interior, it is apparent that the method used is not only primitive and inefficient but is incapable of tapping the real timber wealth of the Amazon.

#### Types of Logging areas

For descriptive purposes the "logging types" of the Amazon may be considered as :

1. The Igapo regions, i.e. the area covered by clear waters during the annual floods;
2. The Varzea regions, or areas similarly covered annually by "white" waters;
3. Tertiary areas bordering the rivers;
4. Quaternary sands bordering the rivers, and with tertiary high land behind within economic range;
5. Terra firma separated from the rivers by Varzea;
6. Volcanic high lands cut through by the main rivers but situated above cachoeiras.

It will be readily apparent that it is impossible to cover all the variations within such a subdivision which might be experienced over such a vast area as the Amazon. But the minor variations are of no more than academic interest at present. The determination of methods adequate to efficient modern extraction on the above types in their typical form will make an enormous amount of timber available which could not be exhausted in any period of present interest.

#### The Igapo regions

In their most typical form these areas are characteristic of the "island region" of Belem, i.e. in the river estuary which is one of the major exploitation areas of the present industry.

As described in Appendix A, the main formation of Igapo results from the flood rise in the main river, which backs up the clear water runoff of the immediate vicinity and spreads it out over the flat lands adjacent to the creeks down which it normally flows. As the floods recede the water is somewhat less clear, for it may now carry off some of the finer fractions of the soils it has covered and in so doing, leaves depressions behind which develop into swamps and marshes. Since it is formed by the erosion of the depression areas, rather than by the deposition of banks as is the typical formation of the Varzea swamps, the Igapo gives rise to a type of forest which is noticeably different; and the pattern of the swampy soils is quite irregular.

From the aspect of logging engineering the Igapo forests have these characteristics :

1. In addition to forming real swamps devoid of tree vegetation, the excessive and more or less continuous water otherwise gives rise to a stunted shiny-leaved hydrophilous vegetation which is somewhat difficult to penetrate and costly to clear. The type carries little timber but it has to be traversed by manpower extraction of the timber behind it, which seeks the most direct route to the floating waters of the creeks. The cost of clearing the typical 6-meters wide track for rolling logs in this type of forest is excessive.

In seeking the minimum combined cost of track preparation plus extraction, the cabocle (see Appendix A - Population) has in consequence abandoned wide-track hand rolling in favor of a narrow track over which the logs are bodily carried or skidded lengthwise on rollers transverse to the track. The logs are nosed (large logs may be squared as well) and power is applied to saplings checked in across the top length of the log. Commonly 8 - 20 men are required to extract a log in this way.

2. The typical Igapo forest would not carry tractors for any part of the year. There are of course the banks surrounding the depressions - only a matter of some 1 - 2 feet above the bottoms of the depressions - which dry out and harden sufficiently to carry machinery during perhaps August - September - October and part of November. But the pattern of the depressions is so irregular and inspection is so impeded by the undergrowth that it would be very difficult to pick out in advance the main tracks to be used to cross the Igapo. It would be impossible to wind through the area completely on high land but thorough inspection could minimize the length of corduroy or other preparation by which the banks could be connected.

The banks within the Igapo carry taller vegetation than the swamps and perhaps the bank pattern could be mapped in advance of operation with the assistance of air survey interpretation. This remains to be investigated, however, and it is doubtful whether present techniques have yet been developed anywhere to pick up such minor variations on air survey photos of any normal scale.

To log through this country by mechanical means, timber trucks are not practicable, and the mobile winch rather than the tractor would offer the greatest possibilities. For maximum utility the winch would need to be mounted on a 4 x 4 or 6 x 6 truck to permit it to enter the forest where necessary, but its major use would be to pull from the barge which would transport it up the creeks. The barge would require to be of the minimum dimension necessary to transport the truck, for the creeks are narrow and characterized by hairpin bends. To pull direct from the barge would occasion little difficulty of location, anchorage, etc., but the distance the barge could penetrate to attempt to get opposite a timber dump within the forest would vary from creek to creek. By this

system a tractor or another mobile winch would be employed on the firm lands behind the Igapo to assemble the logs in dumps for their subsequent removal to the creek. Where the Igapo is narrow, the one mobile winch on the firm land could in theory perform the additional job of hauling the logs to the water but as generally more than 1,000 metres are involved, this would usually not be practicable.

Alternatively, it is sometimes possible to avoid the Igapo forest altogether by penetrating up the creek until the Igapo disappears and firm land borders the creek. This is the general course to be adopted where Varzea separates firm land from the main watercourses, but the creeks are generally smaller in the Igapo region and it is not often possible to penetrate via the creeks to sufficient distance. Where it is possible, however, the solution is merely to operate mechanical equipment on the firm land direct to the creek.

It should be recognized, however, that any necessity to operate in the Igapo at all is due entirely to the inability of hand extraction methods to penetrate the forests for any real depth from the river - or from the mill itself located on the river. Thus although high quality stands are known to exist beyond the limits of the area worked in the immediate vicinity of the mills themselves, and where the intervening country is entirely suitable for mechanical extraction, the mills nevertheless continue to draw their supplies from perhaps 150 kilometers (100 miles) further along the river within the Igapo area. For example, the mill at Antonio Lemos draws much of its supply from Igarapé Miri.

The existing mills which the Igapo problem now affects can readily be supplied by non-complicated direct haulage to mill or by direct haulage from high land to water, at points considerably closer than the present supply areas. Extension of sawmilling would essentially not have to be limited by the possibilities of hand labor extraction but would have to be based on mechanization as a link between quality stands on firm land and proximity to water.

The Igapo extraction problem presents itself merely as a consequence of present methods and becomes of little more than academic interest once mechanization is visualized. But if in isolated circumstances it has to be faced, the mobile winch offers the best solution. However, for efficient application to any particular area unit, it would be essential to get as much detailed advance information of the terrain as was economically possible - viz. a map locating the timber stand and the creek system and, if possible, the swamp depressions and the banks - as preliminary to detailed examination of the area and the marking out of the best extraction routes.

### The Varzea region

Though in many outward respects similar to the Igapo, the Varzea is significantly different in its mode of formation and as a result, in the type of forest it carries.

The Varzeas result directly from the spreading of the waters of the "white" rivers out over the adjacent flat lands during the flood season. As the movement of the water slows down away from the effect of the river current, it deposits silt and both its mode of deposition and the subsequent effect of the withdrawal of the waters may result in alternate very low banks and hollows. The effect of the differences in the depositions is clearly noticeable from the air in the characteristic vegetation loop patterns.

But the depressions are not closed to the withdrawal of the waters and do not constitute swamps of the Igapo type. In consequence the forest type is somewhat tropophilous and yields an important amount of timber to the present industry. With recession of the flood waters the Varzea quickly hardens and would carry tractors and other suitable conventional logging equipment for perhaps 5 - 6 months of the year with properly planned extraction.

The Varzea types present the possibility of felling the trees and preparing the logs in advance of the flood period when they can be floated off into the main streams. Where the Varzea is very wide - and it may be 80 - 160 kilometers (50 to 100 miles) in parts along the main Amazon - or the timber is very sparse, this method has obvious advantages and appears to have been commonly practised in the past. However, the present tendency is to concentrate on better stands in close proximity to water and to carry out the whole extraction operations in the dry season which is more favorable to organized gang work. Since the Varzea forests are better developed and much more easily penetrated and cleared than those of the Igapo, the extraction system is typically the 6 meter-wide track and hand rolling.

A particular difficulty is experienced with the hand-rolling method in the true Varzea, because of the dyke which invariably is deposited along the bank of the river. It may be several feet in height and forms a substantial obstacle. The Mission was informed that hand winches have been tried to ease the situation but the exact techniques employed are not known. They have certainly not proved satisfactory and the dyke is normally surmounted by rolling and chocking the logs bit by bit up the skids. This necessitates a concentrated labor force at the end of the extraction route, however, which presents a serious problem in cost and organization.

To mechanize extraction from the Varzea by conventional tractor logging does not appear to involve any serious difficulty for 5-6 months of the year. In the wet months it would still be possible, if it were deemed essential, to work from the type of barge winch suggested for the Igapo.

However, there appears to be no necessity to introduce mechanization to the Varzea as a major method of supplying mills. The Varzea carries practically no timber species which are not at least as abundantly available and of better development on the Terra Firma, and the bulk of the Amazon Valley is Terra Firma which is generally much more suitable to mechanization. (The only important exception to this generalization noted by the Mission was Jacareuba which appeared to be restricted to the Varzea areas. Though more perfect knowledge might reveal additional species limited to the Varzea, it is extremely doubtful that their qualities would demand that they be given such priority over the Terra Firma timbers as to necessitate year-round working. Jacareuba appears to occur in fairly concentrated stands and working with machinery exclusively in Varzea for almost half the year would undoubtedly yield as much of this fine timber, or any other exclusively Varzea tree, as the market could absorb.)

#### Tertiary areas bordering the rivers

Typical conditions are found in the Santarem region, and these areas promise the most suitable general type for non-complicated conventional extraction by truck and tractor. Since hand-rolling methods could be used only along the borders of the water, while the area is a "high-yielder" of cedro and has presented no serious difficulty, it is in this region only that trucks are the general means of conveying logs from the forest.

However, the trucks employed are general purpose 3-ton table-top transports rather than "timber lorries" and are not the types most favored elsewhere for log timber transport. They have no power-driven loading winches, and since the country is so open and easy of access (as is all the Tertiary), the method is to drive direct to stump and roll the logs aboard by manpower.

No reliable information is available as to costs of working these trucks and the work is so disorganized that it is impossible to arrive at any estimate of the actual cost of extraction related to mileage, or to get any practical idea of the extent to which either the present or more suitable plant might be held up by the weather.

The most significant information obtained was confirmation of the cruzeiro per meter cost of road clearing, which is normal for up to 6 meters in width throughout the Tertiary series. The complementary information, on yield in timber per unit of area served by the roading, was entirely lacking.

Tractors could undoubtedly operate with complete satisfaction for by far the greater part of the year on the Tertiary plain. And the soils are not sufficiently abrasive as to suggest undue difficulty with track parts, if maintenance is thorough. But a final evaluation of their potential usefulness is again impossible until some knowledge of the yield is gained. Road construction is so cheap that it is probable in stands of such scattered nature that skidding would occupy a place very secondary to that of the truck. Under proper job management, ground skidding would probably be restricted to assembly of logs into unit loads for the trucks; but, in addition, tractors would be useful as an insurance against the intermittent inability of manpower to keep roading sufficiently advanced, and against the inevitable inability of the trucks to get out to the main extraction routes from time to time during wet weather.

Such uses presuppose large operations, however, for under normal conditions of haulage distances (say 0 - 50 km) one D7 caterpillar tractor would keep a small fleet of trucks working. The number of large dimension logs available suggests a tractor of this size, but for smaller general operations, more general reliance on the winch would nevertheless justify the use of a tractor of as low as 40 H.P.

As an alternative to the tractor, however, the use of the mobile winch or yarder has particular relevance to the Amazon under present day conditions. Its advantages are above all the very much lower capital cost and secondly the considerably reduced risk of expensive repairs being necessitated by faulty maintenance. Such practical difficulties as getting the rope out under conditions of scattered timber, etc., suggest the tractor in preference to the winch where large and efficient working is envisaged, but present operations are as yet far from that condition. The greater mobility of the mobile winch, the fact that it is stationary in operation and workable all the year round are very real advantages to unskilled operators.

#### Quaternary sands bordering the rivers

The outstanding characteristic of the Quaternary series from the viewpoint of extraction is the general sandy nature of the top soil, which may often approach a pure and deep sand. And also, the yield of timber is materially less than is obtainable from the Tertiary levels.

As such the type poses the problem that tractor distances would be considerably increased at the same time that the abrasion of the track wearing parts became the critical factor in economic operation. Further, since wet weather is more favorable to truck operations under such conditions and dry weather may even halt trucking, tractor operation would be at a maximum in dry weather when the greatest wear and tear on tracks is to be expected.

The roads operated on would be quite suitable for timber lorries of more appropriate types. As cleared for a cruzeiro per meter, they were aligned to miss any large trees and construction entailed merely cutting forest at and below ground level. Some flattening of uneven surfaces was carried out by hand tools but no grubbing of stumps or roots was practiced. A little more attention to this latter is warranted, but in general the type of road provided is as would be recommended for sparse stands of the Amazon type.

At the present cost of manual clearing there is fortunately no necessity to contemplate mechanical clearing and invite the risk of tractor breakdowns, which is inherent in such work and which would be of serious consequence under Amazonian conditions. But it is certain that the yield will be low, and any proposals for improved working must be based on operating on rudimentary low-cost roads with the truck type most appropriate to the conditions of road and climate.

The Tertiary soil types are grey and yellow clays, with sufficient sand to border on loamy clays; they dry out very hard but are correspondingly sticky when wet. Though they will continue to support a load when saturated, after being compacted by dry weather working, it is important to avoid cutting them up unnecessarily when wet. When graded, they pack down well and if also well beaten down in dry weather, will continue to give good service in the wet. Grading presupposes grubbing as a substitute for mere clearing, however, and the consequence would very materially increase roading costs. As with all unsurfaced road operation, only experience can suggest the extent to which there should be complete cessation of haulage in wet weather in preference to continuing at a reduced output, but this experience is lacking at present. The usual practice of the inexperienced now is to continue to work as long as and wherever it is just possible, and also this is distinctly disadvantageous to the operator, the practice did at least give the members of the Mission the opportunity to view the soils at their worst for haulage. There was no evidence to suggest that suitable trucks would meet with any greater seasonal dislocation than is usual in the tropics.

While experience of actual truck operations permitted the Mission to evaluate some specific mechanization possibilities under Amazonian conditions, it was not possible to judge much from what was seen of tractors in the area. Only a very few tractors intrude on the otherwise universal practice of manpowered extraction, and they are either of incorrect type or are inexpertly operated. Even in Peru where the reputation of one logging company suggested that reliable data should be available, it was found that there was no knowledge of the limitations of economic tractor operation or of the necessities of maintenance under the particular conditions of operation.



Again the mobile winch commends itself and though there would be a very large area of Quaternary soils suitable to skilled tractor operations, it is probable that the majority of the Quaternary would otherwise be very expensive to work with tractors and would thus favor the winch.

However, consideration of logging difficulties on the sandy Quaternary soils is, in general, of little practical importance. They are poorly supplied with timber and once mechanical means of extraction are available elsewhere, the necessity for seeking timber here largely disappears.

Where they form a band between the river and the Tertiary, as for instance below Santarem, they offer the possibility of wet weather working which would be of very considerably practical advantage in association with operations based primarily on Tertiary series. The advantage, however, rests on their yield, and beyond recognizing that this is low, it is impossible to anticipate whether operations would be worthwhile or not.

On the debit side is that, in separating the Tertiary from the river, they may provide a difficulty so far as haulage is concerned at the time when Tertiary operations are in full swing in the dry season. In general, however, they would have to be crossed by one or only a very few main extraction routes on any job, and if necessary could be made fit for traffic by the application of bark, etc., as is the practice elsewhere with similar sands.

Where the Quaternary series is being worked at present, the method practised is wide-track hand-rolling to water but it is doubtful whether this extraction covers any great percentage of present total supplies to mills. The series does not yield high volume and is generally fronted by Varzea, which because of its contiguity with the water, is the type receiving more attention.

#### Terra Firma bordered by Varzea

This is by far the most important "area-type" in the Amazon, though as regards immediate mechanization of logging, it is probably of secondary interest to the localities where the Tertiary series of the Terra Firma runs right to the water and consequently presents the least complications for the introduction of mechanical operations. Some of this type is being worked at present where the Varzea frontage is narrow, and the method employed is wide-track hand-rolling.

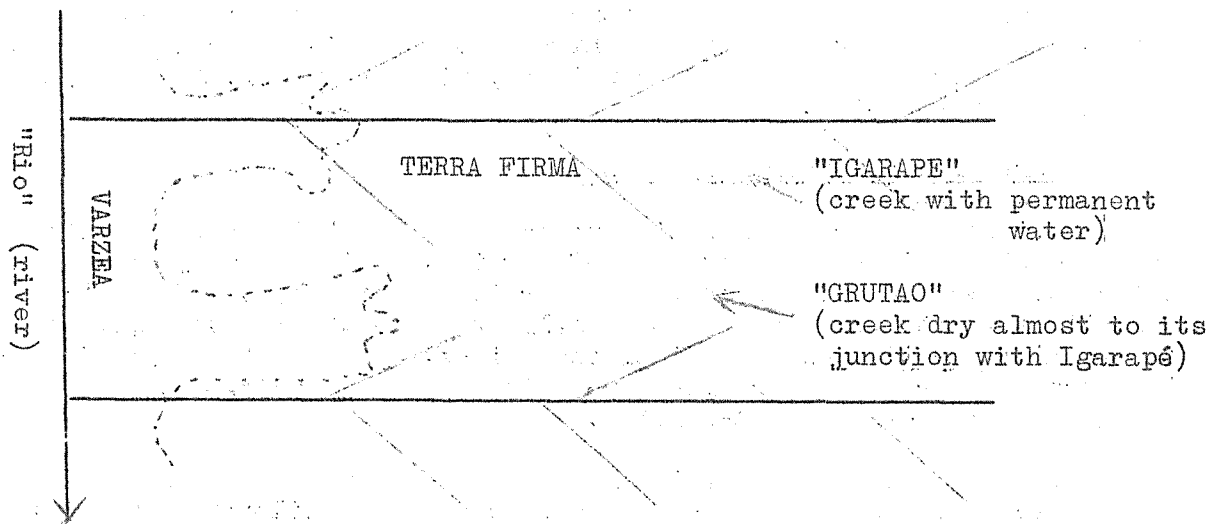
On first examination this type appears the most difficult for mechanical extraction for the Varzea may vary up to many kilometers in width. In consequence, though the Terra Firma itself may carry logging machinery for most of the year, the Varzea is either flooded or too wet to be traversed by trucks for at least half the year and, in any case, its width may too

greatly increase haulage distance and make extraction to water of Terra Firma timber via the Varzea too costly.

The possibility of concentrating operations on the Varzea during the dry season, and to deliver logs to the back of the Varzea from the Terra Firma in advance of the floods which will subsequently float them off, is only a partial solution. First it diverts work from the better stands of the high lands for more than half the working year; secondly, it may require the logs to be delivered from Terra Firma to well within the Varzea to ensure that they will float, and this operation may have to be halted as soon as the Varzea becomes covered by water. Further, it practically restricts working on the Terra Firma to logs which are either floatable or easily supported with suitably buoyant species, if these are available. Finally, and of greater importance, work could not recommence after the waters began to recede until the Varzea had again hardened.

The solution of the difficulty appears to be to deliver direct from the Terra Firma to permanent water. There are no maps available which place the exact position of the creeks, but at least the areas examined by the Mission bore out the generalization that there are in fact major permanent water creeks at sufficiently close intervals which could be used as water access. In the major Varzea-margined rivers, the Varzea generally penetrates along these tributary creeks but of insufficient distance to cause any problem.

The general position could be diagrammatically illustrated as follows :



(NOTE : the above distinction between the Igarapé and Grutao is arbitrary. There is no consistent definition throughout the Amazon but the above is accepted in some localities and is acceptable for descriptive purposes.) Road transport to the Igarapé above its Varzea section suggests no problems. But though the Varzea problem is narrowed by delivery to the Igarapé, it is not eliminated. However, operations can be concentrated in proximity to the Varzea in the period of the low waters to alternate with extraction higher up as the floods commence to rise, leaving the still higher operations for possible utilization of the Grutaos should they run in the wet season.

Knowledge of how far this is generally practicable requires topographical information which again is not at present available. That it is largely practicable can be accepted, but it must be stressed that for planned extraction it is essential for detailed topographical information of Varzea limits and creek locations and the positions of concentrations of timber to be mapped, and estimates of volumes to be similarly available.

#### Volcanic highlands

This area, the Mahagony belt, is also the type where there is the best tree development. The soils are deep red loams and on the southwest (Guaparé) section form a practically continuous belt with those areas which have been taken up by São Paulo interests, to beyond Cuiaba, for future coffee growing extension.

Because only mahagony and cedar could command sufficient market price to cover the cost of transport, the area has been exploited ( and only then sporadically) for these species alone, and since cedar is more readily obtainable elsewhere, its extraction on the Volcanics is merely incidental to mahagony working. The mahagony which has carried the trade since its establishment in Manaus in the 1930's, has been obtained generally from the lower edges of the belt below the cachoeiras. With the extinction of trees in proximity to the rivers, the costs of extraction have risen rapidly as the cachoeiras have to be contented with, and are now too high to be profitable. It is certain that mechanical extraction could progress further inland behind the old workings and win a lot of mahagony still below the cachoeiras. But the areas which are most promising are fronted by rivers (e.g. the higher reaches of the Furno) carrying little water and/or badly silted and obstructed by trees, etc., that are commonly uprooted and washed down all the Amazon waterways; the cost of rendering the rivers suitable for floatation might be prohibitive. The technical aspects of extraction here offer no problems, but the economic possibilities depend on the assessment of the mahagony available and the cost of its extraction including attention to the rivers. The possibilities can only be assessed after air survey followed by detailed investigations of the more promising areas revealed in the process of photo interpretation.

It is as well to observe, however, that mahogany does not occur within 2,000 river miles (3,000 km) of the milling center of Manaus. The mahogany belt approaches closer to the main Amazon as it is followed eastwards, but most of it lies substantially above cachoreias, even in the Tocantins and at Guama where it is at the backdoor of Belem, though yet unexploited.

In all the mahogany region the country is as flat as elsewhere, despite the increased general elevation; the forest is even more open and access is practically unencumbered by vines or undergrowth. In general the belt carries practically all the most valuable woods of the Amazon and at their best development. There is nothing to justify exploitation of species other than mahogany from the high rivers just for the benefit of the present milling industry located far below, but on the other hand there seems to be no sound reason why mahogany alone should not be exploited, even though single-species extraction or "creaming" is not generally desirable from the point of view of forest policy.

Within the belt, mahogany starts to occur typically about five kilometers or so back from the main rivers and permanent watercourses, and then runs back in a more or less continuous stand over the watersheds, perhaps for upwards of 150 kilometers before it again disappears, approaching the next major watercourse. Grutaos run back for many kilometers into the mahogany stands and the tree seems to reach its best development on the sides of the watersheds between Grutaos. The distance from permanent water is thus always very considerable for hand-rolling methods, and the tree's best development occurs at many kilometers from water.

Indeed, unless the Grutao promised the likelihood of water-assisted extraction, hand-rolling extraction of mahogany would generally be out of the question; but local rain causes the otherwise dry gullies to rise suddenly - and as suddenly to fall when the rain is finished - and a Grutao may typically carry water for a day perhaps 2 - 5 times during a wet season. Present methods of extraction are based on the hope that these sudden spates will bring the logs out via the Grutao.

The logs may be rolled from 0 - 2,000 meters to the Grutao in advance of the wet season, where they await the arrival of water. The logs are large and may require up to ten men to get them to the Grutao. The greatest difficulty is to arrange that manpower shall be available at the logs when the water comes down, for logs will be scattered awaiting water in several widely separated Grutaos at one time. The water may arrive at night and since the flow is of short duration, the men must work whenever the occasion necessitates.

The Grutao typically has a bed only 1 - 3 meters (3 - 10 feet) wide and 0.5 - 1.5 meter (2 - 5 feet) deep, but this generally rests in the bottom of a flood depression, perhaps 6 meters (20 feet) wide overall and some 1.5 meters (5 feet) below the general level of the plain. The Grutao is in addition extremely crooked and progresses in hairpin bends and loops which it is difficult for even a 4 meters (14 ft.) log to get around unless the whole depression is flooded. Man-handling is consequently essential to get the logs down the 5 - 8 kilometers necessary to reach the easier waters of the Igarapé; but not until the logs get to the river itself can they progress without manpower assistance. In the Igarapé, overhanging trees are continually being loosened at the roots in the soft soil during the wet season and they fall and block the way and have to be cut off, frequently below water level, to reopen the route. Generally, it takes more than one flooding of the Grutao to get the logs to the Igarapé and the gang cease work when the water drops, and await the next "eschanté" or rise. It is only to be anticipated that logs delivered to the Grutao have a good chance of remaining there through lack of synchronization - manpower availability with the short-lived run of the Grutao. Again, they may progress one or two stages towards the Igarapé and no further. Despite all the other difficulties - with cachoeiras, etc. - it is this wastage of labor which is primarily responsible for the high cost of mahogany extraction.\*

It is noteworthy that when floating conditions are difficult in the Grutao, it is the biggest (and best) logs which have the greatest chance of remaining behind in the forest.

On delivery to the river the logs may be temporarily tied together with vines and paddled to the cachoeiras, after which they may be passed over singly or in groups. If the next cachoeira is any considerable distance, the logs may again be collected and tied together. If the river is running strongly the logs may require no directing, or they may need to be directed to the correct entry to the cachoeira with the assistance of an outboard motorboat. In a fast-running stream it is inadvisable to allow the logs to travel during the period when the water is rising, for they stand a good chance of being carried off the river at a bend and stranded well within the forest. When the drop over the cachoeira is considerable, it is necessary to restrict rafting to the early and late stages of the flood, so as to avoid damage to the logs during the height of the flood when the stream may become a veritable torrent.

---

\* It may be remarked that somewhat similar difficulties are experienced in getting Teak logs down to floating streams in Burma, but here elephants are used to supplement manpower in getting logs moving down the side streams in spate.

Once delivered to clear water below the cachoeiras, the logs are formed into permanent triangular rafts and towed to Manaus by motor launch, an operation normally taking about 7 - 14 days.

The mechanization of mahogany logging involves no particular technical problem but offers an economic problem of some magnitude. Logs can be delivered to the rivers by conventional truck and tractor haulage at low cost. But any properly organized working at this end necessitates that, once the water levels permit, it should be mere routine to clear the log ponds through the cachoeiras to the unencumbered waters below, in unit rafts of say 5 or more logs, which can be quickly united into larger rafts between cachoeiras and similarly linked at the point where the towing launch takes over. This involves possibly very considerable capital outlay to put the cachoeiras in a condition that would permit the necessary organized and directed progress of the logs. Generally the work would involve blasting rocks, building temporary log walls to divert all the river flow over one exit, construction of artificial spillways to act as log flumes, etc. etc. (In one typical example a rough calculation of the cost of work necessary for reasonably easy five-log raft egress was approximately U.S.\$50,000, if carried out by modern machinery and skilled manpower.)

The justification for expenditure of this nature can only be the high potential value of the stand of timber that would be made accessible; but this presupposes careful assessment and survey of the timber resources, and estimates of extraction costs.

An additional and very practical difficulty to working in all the mahogany region is the Indian problem, particularly in the interior between major tributary streams where the real belt of mahogany exists untapped. Hostility on the part of Indian tribes might perhaps not be found in practice to assume any serious proportions, but that this optimism might prove unjustified would initially have to be provided against, before men and machinery were moved in.

Finally the difficulty of providing supplies to a modern logging organization above a series of widely separated cachoeiras is a very real one. In the case of the occasional large rubber collecting settlements which at present exist, the depth of water above the rocks and rapids may permit no more than four months of reasonably unimpeded access during which a whole year's supplies have to be taken up: access, which is a matter of days only when the river levels permit power-driven flat-bottom barges of perhaps 50 tons capacity, may take as many weeks for outboard-motored canoes in the period of low waters. To a large extent this could be avoided by the clearing and cutting of trees and debris which prevent utilization of the deeper parts of the rivers, but at the best, river access in the dry season when timber work would be at its height, would always be an

extremely unreliable business. The possibility of air traffic by small charter amphibians to the suitable points which do exist on the high reaches of practically all rivers would be entertainable, but its practicability would depend on the magnitude of operations and on specific locality factors.

In all its phases the problem of mahogany working necessitates complete modernization of extraction methods and processes, and the advance investment of capital, and this cannot be entertained until certainty is reached that sufficient timber exists in a particular catchment area to justify the initial outlay necessary to tap it. The preliminary requirement is consequently, as almost everywhere in the Amazon, the creation of a survey and assessment service.

### Costs of operations

There is little to be gained in examining the costs of the present methods of working in any detail, for these methods inevitably entail disorganized working and unproductive labor. The costs of the individual processes are low for the type of work involved, but the amount of time lost through the necessity of awaiting suitable water levels for extraction within the forest, and the amount of work done to logs to get them only part way to the mill, are the real contributing factors to the overall high costs. In addition, the financing of operations involves an excessive number of intermediaries, all of whom take part of the final payment by the millers and in the process not only enhance the costs critically but leave very little for the cabocle upon whose labor production ultimately depends.\*

The general log trade is similar to that of all other forest collections—a trader barter his goods for logs which one of his customers arranges to supply, but often through an intermediary who may similarly pass on the order. As many as five such intermediaries have been noted between the forest worker and the sawmill. In the "island region" of Belem dealings are normally more direct and generally concern the miller, the itinerant trader, the property owner, the bush organizer and the men. In the Manaus area the major mills have formed an association or "Impresa madeireira" which employs log buyers to obtain mahogany and cedar (but these species only) which on delivery to Manaus are allocated to the individual group members. The buyers eliminate the barter-trader and, unlike him, devote all their attention to log buying; otherwise the set-up is unchanged. In some cases (e.g. at Porto Velho and at Santarem) all intermediaries are eliminated and millers "fish" their supplies from the trees, uprooted in the floods, which float down the river past the mill.

The present working costs are of decided interest in that they reflect indirectly the working capabilities of the native workers, and as such are very encouraging evidence of what might be expected of them under efficient methods of management.

---

\* For timber prices see Appendix F.

## Methods of working

### Logs

Cutting. In general the cutting gangs divide the general work of felling, barking and cross cutting amongst themselves in groups each responsible for one operation. (Barking is not general and is practised only to assist hand-rolling.) In most instances all of the work is done by axe, and is of a very rudimentary kind. A saw may be used for cross-cutting - again a very poor type, heavy and overlong pigtooth, and generally poorly sharpened.

The output in prepared logs per 8-hour day varies from  $2\frac{1}{2}$  cubic meters in the smaller timber of the Varzea and Igapo to 5 cubic meters in for instance mahogany and cedar - a very satisfactory output in view of the poor tools employed.

Track-making. Track preparation varies somewhat, but on Terra Firma the general average per man-day is about 15-25 meters of completed track six meters wide and provided with three lines of skids. In Varzea the output is less due to the pot-holed nature of the terrain which necessitates extra work in placing the skids. On an average, a man produces about 10 - 20 meters of track in Varzea. In Igapo the undergrowth and swampiness is such that the three meter wide track cut to allow the logs to be carried out lengthwise is constructed at the rate of only 5 - 10 meters per man day.

Log extraction to water. The cost of rolling logs shows extreme variation from place to place. It is affected by the existence of any slight grade, favorable or otherwise; the occurrence of flat sides on logs, necessity to manoeuver logs to get them on the skids or to negotiate a bend between trees; the relation between manpower available and log volume, etc. The variations noted by the Mission were between the limits of 200 to 2000 meters per man-day per cubic meter of log. It is impossible to provide an average figure with any reliability, but for what it is worth, a figure of 1200 meters is suggested.

To move logs lengthwise, in Igapo, which is probably the only type where the practice is general, the output is about 50 meters per man-day per cubic meter. In rolling the larger logs lengthwise on skids, the output is approximately the same. The method requires much greater manpower to move the logs at all than does rolling, where levers can be more effectively employed. When water is available in the Grutao, a man may move a cubic meter of mahogany about 2000 to 5000 meters depending on the conditions along the gully.



It is difficult to transfer these figures into terms of cost because it is not possible to average the yield of timber per unit of track length, and the earnings of the men is an extremely variable figure. In the mahogany region a track may yield 5 - 6 cubic meters of log per track of average length, viz. 500 meters. In the Igapo the figure is perhaps only a quarter of this yield. Firm land Varzea would give a figure between the two. In adopting the lengthwise technique for Igapo extraction as against the lateral rolling otherwise generally practised, the cabocle has decided, in view of the forest's poor yield per unit length of track prepared, in favor of reduced track cost with consequent high haulage cost.

It can be accepted that under prevailing conditions a cabocle receives merely the possibilities of existence in return for his labor. From a wage of "20 cruzeiros per day plus food" he is usually required to purchase "luxuries" (clothes, and perfume, hair oils, etc. in which he delights) but also of necessities, extra food and medicines (particularly malaria tablets), for all of which he must pay the highest price. The most important part of his employer's profit may consequently derive not so much from the proceeds of timber extraction as from securing to himself the full value of the workers' output in return for a bare subsistence.

For men working in the Upper Jurua region, - a traditional mahogany-cedar area unhampered by cachoeiras, - one authority (Kissin) has suggested an output of 25 - 35 cubic meters as an average man production for an 8 - 9 months' season. As typical of production in the state of Pará, he suggests 60 - 100 meters of logs in one month from a team of 8 men. It will be apparent that, despite the difficulty of arriving at average figures and the great variation from place to place, an output of this order, though favorable by comparison with other countries, can be lined up with the figures suggested for the individual processes only by recognising that the majority of the worker's time is dissipated in non-productive labor or wasted.

River floating. The methods actually practised on the river are in general quite acceptable. They could be materially improved in regard to types of rafting dogs used and general fastenings, etc., but for the present there need be no major concern on this score. Complete modernization of rafting techniques and any radical change in towing practices generally would require that the whole industry be properly organized and that communications be regularized between the forest and the launch depots.

Rafting costs, as such, are exorbitant, but their reduction can come about only as a result of better organization and reliability of log deliveries from the forest to the river. At present launches spend a large amount of their time waiting around for rafts to be ready and finally when at last required, are frequently unavailable themselves. Further, there is little relation between the raft size and the type of launch used, and

there are no launches designed specifically for towing. High as they are, rafting costs are not the operative reason for the high cost of logs to the mill; the big cost, and the one most capable of big reduction, is incurred between the stump and the river.

For the long towage common in the upper rivers, flat booms of rectangular shape are common but still the general practice is to assemble triangular rafts, i.e. with the boom sticks connecting in front to serve as nose-sticks and fanning out to the rear, each log being wedged into the "V" made by the fanning out of the pair of logs in front of it. The whole is tied together with swiftners wire roped to the logs beneath by ring dogs.

For short tows, and where floaters are used to buoy up sinkers, the booms are normally rectangular and tied across with swiftners. In addition to floaters of millable species, palms of various species (Aninga, Burity, etc.) are frequently tied to the logs with vines, and the cabocle has a very clear idea of the number of pieces required to float each species, e.g. Sucupira requires about 75 pieces of Burity per cubic meter, Massaranduba 110, etc. Although these pieces are readily available on site where they are needed, it will be evident that there is a very considerable amount of work involved in cutting and attaching the number required. In general the small Burity is used only to get individual logs down the Igarapé to the raft assembly point, where large palms, 30 - 45 centimeters' (12 - 18 inches) diameter, replace them.

Where the trade is interested only in logs that are sinkers, e.g. in the island region of Belem, it is usual for the mills to use their own inboard steel barges to transport the logs. Where the logs are all floaters, it is common to build "rosaries" or rafts of logs each transverse to the direction of towage and strung along the tow rope by ring dogs at the log centers.

On arrival at the mills the logs are generally contained in boom grounds or, if non-floaters, are sunk close to the river bank to be recovered by winching from a barge if required, or allowed to await the fall in river level which leaves them high and dry.

It is not possible to put forward any firm ideas at this stage on desirable modifications in raft construction techniques until mechanical logging methods have established a real relationship between industry and its rational sources of supply. But it is evident that for more thorough forest utilization and consequent reduction of extraction costs (to water), much more attention will need to be given to non-floating species (e.g. Massaranduba) which are being only occasionally utilized today. No estimate is of course available of the proportion of floaters to non-floaters

in the forests of the Amazon, but it is certain that non-floaters make up a very appreciable percentage of the usable growing stock. It would seem that in the future river towage will have to deal with rafts of bundles of logs, each a timber truck load of mixed sinkers and (sufficient) floaters, which will be assembled as units of tow lots, in the manner practised on the west coast of Canada (with, of course, substantially more floaters). This matter, and research into the pre-girdling of sinker species of trees, etc. will however not be of immediate concern until the logging industry as a whole has been rationalized. The best possible way of bringing down towing costs is to introduce organization into the logging industry as a result of attention in the forest.

Apart from stating the actual costs incurred by the mills for rafting (see later), it is not possible on present information to relate costs to operations.

Railway sleepers. Sleepers produced are of a type which would generally be condemned by engineers wherever it was possible to avoid using them, viz. heart-centered pieces cut from immature pole trees.

A wide list of species is acceptable by the hungry external markets supplied (see Appendix C), and pole trees (approximately 50 inches - 125 centimeter girth over bark at breast height) are felled for the purpose, generally in the Varzea country in very close proximity to water. The method is to fell and line dress at the stump to the specified dimension, the whole of the work being carried out with the felling axe.

The man production is about 1 - 1.5 sleepers per month, because generally the work is done only as a part-time occupation concurrent with other work. But when men are employed full-time on sleeper cutting, typical production is :

2 men fell and prepare approximately 100 sleepers per month;

5 men transport the 100 sleepers from stump to a point for raft construction in 5 days. The sleepers are assembled in bundles which are then rolled to the creek on round saplings placed transverse to the track;

5 men assemble the bundles into rafts supported by Aninga or other floaters, and deliver at the rate of 100 in 2 days to the depots where they are purchased by the trader.

5 men take 1 day to stack the 100 sleepers at the depot. The sleepers are purchased at 20 cruzeiros each at the depot and the gang's earnings are consequently about 25 cruzeiros per man-day.

The sleepers are in the main cut to the size required by the Brazil Central Railway, i.e. 24 x 17 x 280 centimeters. Foreign export orders are of smaller dimension but are usually obtained by the recutting of the larger sleeper at the depots. Sleepers (20 x 18 x 200 centimeters) are also produced for the Braganca railway by similar methods but are purchased at Cr.\$28.00 per sleeper on the line and are generally of two species only, Massaranduba and Jarana. Similarly the Tocantins Railway purchases Massaranduba sleepers (180 x 18 x 16 centimeters) at Cr.\$16.00 per sleeper and the Guaparé line purchases sleepers on the line. In these latter cases water transport is not usually involved and donkeys are generally employed for delivery.

The most evident requirement here is to achieve the cutting of sleepers "on the back" and from mature (preferably hollow) trees of the most satisfactory species. From every view point of forest management, sleeper production should be a salvage operation integrated with general logging. In a similar measure, other railway and general construction timbers e.g. girders, etc. should be combined with mill-long cutting wherever the market offers opportunity. The latter to a large extent depends on the price at which these pieces could be made available under modern working conditions.

To permit such an integration it is necessary that the men be trained in the use of modern handtools - broadaxe, etc. - and in the methods of producing sleepers on the back from big logs; and secondly, a market is available for sawn sleepers produced at mobile sleeper mills of the special type required for this work.

#### Pau Rosa working

Since pau rosa extraction is greater in volume than that of any other single species, it is a matter of prime importance. From the extraction viewpoint there is the complication that whereas the boles are utilizable for oil extraction, the branches are considered to give by far the highest yield. In this regard it must be observed that no scientific work has been done to give a quantitative idea of the effect on oil yield and linolol content of the variables - size of tree, position in the tree, time of felling, delay in extraction, etc. - as well as of the factory processes involved. It seems certain, however, that any improvement in production methods would have to visualize extraction of both bole and branchwood, and it is not impossible that stumps and roots could also be of value. It seems more than probable also that speedy extraction after felling is essential to high oil yield.

In the general organization of the industry, a gang of men is engaged by an oil extraction plant to produce its requirement of raw material, either as its direct employees, or on piecework. The gang fells the trees

by axe and reduces bole and branches to lengths of 90 centimeters entirely by axe. (The waste in precious chips by such methods, particularly in large trees, can be readily appreciated.) Generally these pieces are then loaded on a table-top truck and delivered direct to the mill or to a barge on the river or Igarapé. In the main, supplies go direct to the chippers at the factory and such stocks as may accumulate are easily accommodated under the factory roof.

Recovery in oil is about 1% of the intake of wood by weight, and in a typical example 40 bush workers were required for 8 months of the year to maintain the plant in year-round production at 1,800 kilograms of oil per month. Of these, 5 were engaged in locating the trees, which are widely separated in the forest; 30 in felling and preparing the pieces, constructing access tracks, and loading the trucks, etc.; and 5 in operating the two haulage trucks. Cutting was carried out from July to September and extraction direct to mill mainly during October to February although some supplies were obtained from deliveries to the Igarapés during March to June. This work was on a direct employment basis and the cost to the plant Cr.\$450.00 per ton (1,000 kilograms) delivered in the factory; piece-work deliveries would have been very considerably dearer.

The Mission is hesitant to suggest measures for the general improvement of extraction methods in the pau rosa industry since their introduction would be conditional on there being a secure future for the oil industry itself and on proof of the industry's capacity to sustain itself either by sufficiency of trees in the forest or in commerce. These aspects are dealt with elsewhere in this report. For the improvement of the existing industry, however, assuming it cannot be integrated in general purpose logging, some necessities are :

1. mechanization of logging on modern lines to permit delivery of logs to the plant, to be crosscut there by power saws;
2. employment of chain saws to fell and crosscut in the bush, and of small chain saws to cut the branchwood.

But even more significant, improvement could come from :

3. attempt to avoid the major cost of present operations by incorporating extraction in general purpose logging and thus obviate the excessive roading charges which are a corollary to obtaining single trees at very widely scattered intervals through the forest;
4. trials of portable chippers at the stump to permit the branchwood and other small pieces (perhaps slabs of stumps, roots, etc.) to be chipped and bulk-handled direct to trucks for delivery to the plant hoppers.

### Firewood

Elsewhere in this report the present general tendency of electricity authorities to substitute oil burning for firewood is mentioned. There is no purpose at present in considering this question in detail beyond the general conclusion that it is the difficulty of organizing supplies to a stationary undertaking, as compared with the mobile craft taking supplies as it finds them along the river (river craft are still substantially wood burners) which has given rise to this tendency to oil - together with the high costs of firewood which are eliminating the former price advantage over other fuels.

The method practised is for gangs to fell 30 - 45 centimeters diameter pole trees in the jungle, crosscut them by axe into meter lengths which are then carried out to a riverside point where two men split them into pieces of about 45 centimeters triangular cross sectional area. The pieces are then stacked in heaps for purchase by the passing rivercrafts. An average production is about 200 - 250 pieces per man-day, less such time as may be required to assist or totally load the wood on the vessels.

In the case of stationary plants dependent on wood fuel, the increasing distance of sources of supply, through lack of silviculture to restore cut-over areas, has made the freight rates excessive. Since control of these undertakings passed from foreign to local hands, the economic status of the authorities concerned has progressively deteriorated. Thus at Belem the tramways have fallen into disuse, as also have some of the river craft of the authority, which were previously available. At present no attempt is made to organize firewood supplies in the forest, beyond merely providing a market for such supplies as are made available by part-time and unreliable operation of private cutters.

The means which suggest themselves for amelioration of the firewood supply position are :

1. selection and reservation of the closest available areas carrying suitable forest;
2. organization of operations as a basic and integral part of the production of power, and not as an external subsidiary to the main purpose;
3. modernization of cutting methods to ensure maximum production by available manpower - in particular use of modern axes and hand tools generally, and powersaws;
4. full-time engagement of suitable trucks for delivery either direct to plants, or to points for gravity feeding to barges;

5. experiments with portable hoppers in the forest for bulk-handling, wherever necessitated, up to final point of delivery into hoppers at the plant.

#### Wastage in the forest

The waste of utilizable timber at a stage when it has already occasioned some, and often considerable, preparatory attention is one of the most important direct causes of high extraction costs. The abandonment of large girth mahogany logs in a dry Grutao, almost within sight of deep water, is an outstanding example, but considerable wastage occurs at every stage of exploitation.

#### Felling

Felling without use of the saw is responsible for big waste in timber and manpower. Inability to direct the fall (as by saw and wedges) results in trees being hung up, bridged and broken, drawn and split butts, high stumps, etc. In cross-cutting by axes, though skillfully done, a foot of length is normally lost at each cut. In Pau Rosa exploitation where the bole is cut into short lengths, as much as a ton of wood wasted in a single tree from this cause alone has been noted.

#### Extraction methods

Since only cylindrical logs can be rolled without undue difficulty, stumps are high and solid buttressed, trees are generally long-butted to avoid the difficult section. In the case of figured timbers, this generally discards the only figured part of the tree and is probably the reason for the very low percentage of highly valuable figured mahogany emerging from the Amazon. For the same reason flat-sided logs are discarded, and logs are cut well back from branches, again discarding the valuable figured section. Crooked sections of trees stay in the bush for similar reasons. Since logs are paid for excluding defects, a faulty heart of an otherwise first-class log normally condemns it to waste. Attempts are sometimes made to salvage high-priced timbers like cedar by squaring out baulks by axe or pitsaw, but the yield noted was generally only about 30% of what would have been obtained had the reason for the salvage been avoided in the first place.

Spot estimates made in all workings visited, originating from all the foregoing causes, put the waste avoidable by using other methods at between 20 - 30% of the timber rolled from the stump.

Where water-flow in Grutaos is necessary to extraction, the losses noted were very high; depending on the season they are normally 30 - 50%

of the logs prepared - e.g. 1300 logs abandoned out of 3400; approximately 1000 admitted abandoned from 3000; and in one instance, only 100 out of 600 logs left the forest. In the 1952 season, it is considered that in many areas only 50% of the logs obtained sufficient depth and quantity of Grutao water. Such losses are inevitable with present methods of working when the timber species does not generally occur within some miles of permanent water. It is the normal practice, where manpower is available, to renew attempts in the next season to extract logs left behind in this way. Millers consider that "carry-over" logs have deteriorated 25%, however, and reduce payment accordingly or purchase only at "refuse" prices.

#### Insect attack

Although pinhole attack is often severe in the dry months, it is generally not of the seriousness usual under tropical conditions. Some species, e.g. the louros, are quickly attacked after felling when bark has been damaged or removed, but the severity of attack is affected by the degree of exposure to sunlight. Thus mahogany logs inspected in the beds of dry Grutaos where they had lain for three years under conditions of almost complete protection from direct sunlight, were only sporadically attacked by shorthole borers which had scarcely penetrated beyond the sap. However, the log delay between felling and delivery which is inevitable with present methods, involves quite considerable insect damage to practically every log.

Termite nests are commonplace throughout the forest. They are of the tree-dwelling type and their attentions, in the natural forest, appear to be confined to trees also affected by fungus. They were only rarely observed in logs cut for extraction. (In rubber and other plantations, however, termite nests were evident on most trees and seemed to have no relation to the health of the tree.)

In summary, it may be accepted that insect attack is not serious under present conditions of scattered felling. But conditions would be ripe for normally severe tropical damage if a modern system of cutting of all possible merchantable species were introduced.

#### Other sources of injury and loss

The Amazon is an area of light winds and there is no evidence of wind damage over the life time of the existing forest - e.g. dense vine and undergrowth as a stage in the recovery from cyclones is not observable.

The rain forest is universally too wet to carry fires, but the Amazon savannahs are in all probability the result of continued fires following deforestation and shifting cultivation by the Indian tribes, which gradually eat into the edges of the jungle and annually extend the savannah areas.



Although fire risk would never be serious, it would nevertheless have to be seriously considered in connection with any plantation work.

Disease in the natural forests is merely one of the balancing factors in the ecological climax and as such is of no importance except to overmature trees. Thus in big cedar a fungus infected butt is generally encountered, but in all species the degree of infection varies with natural durability and habit. Again, however, experience of rubber planting and such plantation trials of timber trees as have been established, indicate how important epidemic disease (and insect-attack) may become once the natural balance is upset.

#### Methods of measurement

In general the intention of measurement is to use the quarter girth FRANCON formula. But the method of measuring logs to provide the basic data varies considerably over the area. In the region of Belem, the measurements made are at length and center girth under bark, as required for application of Francon tables. But deductions made for defects follow no order other than inclination of individual sawmillers - as affected by his natural honesty or the condition of his log supply.

At Manaus, however, the Francon tables used are based on mid-diameter and length. But in practice, the figure applied as "mid-diameter" by the Manaus sawmillers is the smallest diameter at the small end under bark less 4 centimeters. In general this means that logs in rafts are "diametered" merely by hooking a rule to the under end of the log as it floats (small diameter vertical) and reading its top correspondence with the surface of the log in the water. The zero of the rule commences 4 centimeters from the end. But with logs fluted at the butt the measurement actually made is not as expressed - "small end smallest way" - but "smallest way at either end", viz. the diameter used is the smallest figure obtainable across the center at either end of the log, between the closest opposite approach of the fluted outline.

When logs are purchased by intermediaries in the forest, the same measure is used, but it is common for the 4 centimeter "deduction for sap" to be increased to as much as 10 centimeters.

Export logs, which are cylindrical and of high quality, are measured as required by overseas buyers e.g. true Francon to Europe, and Doyles Board-foot rule (on diameter basis, the mean of the smallest and greatest diameter at both ends) is applied for sales to the United States.

It is evident that such measurement practices cannot but add to wastage in the bush. The cabocle is not so much concerned with the milling utility of a log, but he is certainly concerned to avoid sending in logs which

give opportunity for inadequate measurement or excessive deduction.

Members of the Mission attempted to derive an estimate of the overall effect of this method of measurement in reducing the true content of the logs, but without success. Each log purchased by the Impresa Madereira buyers is stamped with a number as it is accepted in the high rivers, and its measurements are recorded against the dimensions of the log. But it was completely impossible to reconcile the logs with the lists - not so much because of the method of measurement but because of inaccuracy in the records. Large and small symmetrical logs frequently showed measurements of length and diameter which could not have been obtained by any method of measurement. However, on the evidence gathered it was concluded the "Manaus Measure" was probably 35 - 40% below True Cubic, and it will at once be apparent with such unreliable methods of measurement that it is impossible to derive the true cost of raw material to the mills, as well as the true percentage recovery of saleable material obtained. Frequently high "recoveries" appear to be obtained from poor logs, well above what is obtained from good logs - obviously not true in fact, but merely the result of mathematics applied to incorrect data.

The method of measurement is evidently designed to obtain - by reducing the volume received - some relief from the excessive taxation applied to log purchasees generally and particularly to high-priced purchases. But it is obvious that a unified and correct method of measurement is essential, and a standard should be determined and enforced. However, this cannot come about without a reduction of taxation rates and these should similarly be revised to apply as a residual royalty of log value in mill after deduction of costs of extraction. In its present application to "pauta value" of logs, taxation practically represents a percentage on cost, and it bears no real relation to true market value. Not only are State or Municipal revenues depressed through under collection on logs of high value generally obtainable close to the mills, but the increasing incidence of taxation as haulage costs increase is the final factor which determines merchantability. It is not difficult to appreciate that if correct measurement methods were applied at the current rates of taxation, the present Mahogany industry which is already in a precarious position would at once be out of business.

### WOOD-USING INDUSTRIES

The primary wood-using industries are today confined to sawmilling and the extraction of rosewood essence, the latter being worthy of mention because of the amount of logging and export to which it gives rise. (\*) In 1950 the value of rosewood essence exports from the port of Manaus was about seven times that of sawn wood exports and equalled around 10% of all exports.

What little industry there is of a secondary nature produces only for local consumption. The main one is boxmaking, generally carried on in poorly equipped workshops attached to sawmills. In passing, it should be mentioned that a firm in Manaus has tried building prefabricated houses.

#### Sawmills

There are some 89 sawmills in the Brazilian Amazon located in the various administrative divisions as follows :

Acre Territory	2
Guaporé Territory	4
Rio Branco Territory	2
Amapá Territory	1
State of Amazonas	20
State of Pará	60

These plants vary considerably in structure and size, from the rudimentary sawmill with its bucket wheel driving one old-fashioned saw to the one with modern equipment. In like manner, volume varies from the insignificant up to 10,000 cubic meters a year; there are, however, at most 15 sawmills with an annual output of over 2,000 cubic meters.

The following survey only takes into account the larger sawmills, simply because of the impossibility of obtaining reliable information regarding the others and from the desire not to complicate the report unnecessarily. This rules out the sawmills in the Federal Territories. It is paradoxical that these territories, situated in regions where logs are produced, are all lumber importers.

(\*) - See Appendix E - Timber Trade

State of Amazonas

In the State of Amazonas, the sawmills all lie along the main valley, the two principal centers being Manaus and Itacoatiara which account for 80% and 15% of the total output respectively. More than that, 5 sawmills at Manaus and 2 at Itacoatiara are responsible for almost 9/10 of the sawn timber produced in these two centers. They are:

<u>Manaus</u>	<u>Estimated 1951 Output</u>
Rodolfo (Industrias 1 B. Sabba S.A.) .....	10,000 m <sup>3</sup>
Colonia Oliveira Machado (Bereira et Cia) .....	9,500 "
Hore (Hore e Cia) .....	4,500 "
Manacapuru (Manacapuru Ind. Ltda) .....	4,000 "
Amazonas (Com. e Indust. de Madeiras de Amazonas) .....	2,700 "

Itacoatiara

S. Antonio (Araujo Costa e Cia) .....	4,000 m <sup>3</sup>
Amazonas (E. Chenivesse) .....	3,000 "

State of Pará

The State of Pará may be divided into four areas, as regards sawmill installations, namely, going from east to west:

- 1) The Belém-Bragança area, with 25 sawmills, 5 of which have a substantial output. They supply local needs.
- 2) The Rio Guama, Acará and Lower Tocantins area, with 16 sawmills, only one of which is worthy of note and all producing for local consumption (mainly Belém town).
- 3) The estuary islands area, with 11 sawmills producing for export, the main output coming from four of them.
- 4) The Lower Amazon area, with 10 smallish mills, one of them having been recently established by a Manaus industrialist and beginning to produce for export.

The major sawmills are listed below:

<u>Belém-Bragança area</u>	<u>Estimated annual output (1951)</u>
<u>Belém</u>	
Una (F.L. de Souza e Cia)	2,500 m <sup>3</sup>
Guamá (Indust. Guama Ltda)	2,000 to 2,500 "
S. José de Ribomar	1,500 to 1,800 "
Guajira (A. Mesquita e Cia)	1,500 to 1,800 "
<u>Vigia</u>	
Bastos	not known
 <u>Rio Guamã area</u>	
Boa Vista (Carlos Santiago e Cia)	not known
 <u>Estuary islands area</u>	
<u>Breves</u>	
Breves Industrial S.A.	3,000 m <sup>3</sup>
<u>Antonio Lemos</u>	
Mancel Pedro e Cia	5,000 "
<u>S. Miguel dos Macacos</u>	
Cia Atlantica de Madeiras	1,500 to 1,800 "
<u>Curralinho</u>	
Francisco Maria Bordalo	2,500 "

These production figures may well be inaccurate, for it is more difficult to obtain exact information in Pará than in the Amazonas, where,

at least, figures are obtainable for the volume of logs sawn annually.

The above list includes only the sawmills which appear to have the highest output and the largest amount of invested capital. Of smaller plants not included there are one or two which in the near future will probably produce more than some of those now regarded (somewhat arbitrarily) as relatively important.

In any discussion of the Amazon sawmilling industry, it is necessary to observe at the outset, that there is a decided contrast between conditions in Pará and Amazonas, owing primarily to the fact that the raw material is much more expensive in the State of Amazonas and because the local market is more important in the more densely populated State of Pará.

#### Supplies for Sawmills

Taking the 1951 log output, it is noted that of some 115,000 cubic meters of logs supplied by the forests of the Amazonas and adjoining territories to the Amazonas sawmills:

1) - Louro inamhui accounted for 24%, cedar 19%, assacu 16%, jacareuba 15%, aguano 9% only, andiroba 6% and miscellaneous species (including ucuuba) 11%.

2) - Some 60% of the logs come from the Upper Solimões, Upper Juruá and Upper Purús basins, that is to say, a distance of 1,500 to 2,500 kilometres.

Averages having been calculated on some 35,000 logs, the average volumes and dimensions per species have been estimated as follows:

	<u>Average volume</u> Francon measurement Manaus type	<u>Average solid</u> <u>volume</u>	<u>Average diameter</u> <u>at middle</u>
Aguano	1,530 m <sup>3</sup>	2,300 m <sup>3</sup>	80 cm.
Assacu	1,340 "	2,200 "	75 -- 80 "
Jacareuba	1,217 "	1,950 "	75 "
Louro Inamhui	1,092 "	1,750 "	70 "
Cedro	1,020 "	1,600 "	65 "
Andiroba	0,699 "	1,200 "	55 -- 60 "
Ucuuba	0,694 "	1,200 "	55 -- 60 "
Louro Preto	0,687	1,100 "	50 -- 55 "

A noteworthy point is that the small dimensions of the logs are reflected not only in the amount of lumber obtained, but also in the rate of output, particularly in sawmills equipped with large "head bandsaws". For example, the intake per hour of a head bandsaw at a large Manaus sawmill is 2.75 cubic meters of aguano (sawlog volume calculated on Manaus basis) as against 1.9 cubic meters of andiroba.

Again, as regards logs from the upper tributaries, the chaotic state of transport exposes them for many months (sometimes for a year) to destructive agents and insect damage is considerable. This is aggravated by a system of seasonal supplies from such tributaries which forces the sawmiller to hold over stocks from one year to another.

Practically speaking, all the logs felled are fed to the local sawmills. Prices at Manaus have soared since 1947 (by 50% as regards ucuuba, and as much as 150% as regards aguano), and in 1951 reached the following proportions:

The "Empresa Madeireira", formed by four large Manaus and Itacoatiara sawmills supplies its members with aguano and cedro from the Juruá and Purús areas. Selling prices in 1951 (log volumes measured in the Manaus manner) are listed below:

	<u>1st grade</u> Cr.\$/m <sup>3</sup>	<u>2nd grade</u> Cr.\$/m <sup>3</sup>	<u>3rd grade</u> Cr.\$/m <sup>3</sup>	<u>Rejects</u> Cr.\$/m <sup>3</sup>	<u>Average Price</u> Cr.\$/m <sup>3</sup>	
"AGUANO"	(Purchase price	750	600	450	100 - 150	500
	(Cost of transport					362
	(5% commission					43
						<u>Total: 905</u>
"CEDRO"	(Purchase price	330	275	-	40 - 100	266
	(Cost of transport					362
	(5% commission					32
						<u>Total: 660</u>

One sawmiller not in the Empresa group paid an average of 800 Cr.\$ per m<sup>3</sup> for aguano and 550 Cr.\$ per m<sup>3</sup> for cedro from the same sources, but the quality, on the average, appears to have been inferior. Cedar from the Upper Solimoes would appear to cost 550 Cr.\$ per m<sup>3</sup>. Prices for other species run:

	<u>Average purchase price</u> Cr.\$/m <sup>3</sup>	<u>Cost of transport according to source</u> Cr.\$/m <sup>3</sup>	<u>Average price at sawmill</u> Cr.\$/m <sup>3</sup>
Andiroba	120	60 - 180	240
Louro Inamhui	120	60 - 180	260
Louros (diverse)	110	60 - 180	230
Jacareuba	110	60 - 180	220
Assacú	80	60 - 180	200
Miscellaneous	60 - 70	60 - 120	150

The main sawmills in the State of Pará obtain their supplies somewhat differently; for one thing, such supplies are not seasonal, and the average hauling distances are shorter, the logs coming from the Acara and Iguarape Miry areas, and from the municipal districts in the Island area (eastern sector); for another, part of the forest output is exported as logs (27% of exports in 1949) and thus the sawmills are deprived of a large part of the first-grade logs.

The logs seem on the average smaller in Amazonas. It was not possible to obtain a sufficient number of measurements to draw reliable conclusions but, except for sucupira and louro vermelho, there would seem to be no species with average log diameters at the mill of as much as 60 cm.

Nor can even an approximate notion be obtained of the quantities of logs of each species delivered annually to the mills, although the 1949 deliveries to the sawmills on the Islands were: massaranduba 31%, sucupira 25%, freijo 12%, cupiuba 5%, laurel and cedar 4%, macacauba and quaruba 3%, sundry 13%.

It is estimated that the cost of logs delivered to a sawmill depot works out as follows (volumes calculated by the straight Francon method):



	<u>Average price</u> Crs./m <sup>3</sup>	<u>Cost of Transport</u> Crs./m <sup>3</sup>
Sucupira	200 - 280	) From 30 to 100 Crs./m <sup>3</sup> according to sawmill and source of logs.
Massaranduba	150 - 240	
Freijo	280	
Cupiuba	110 - 160	
Louro Vermelho	120 - 140	
Cedro	300	
Macacauba	300 - 350	
Quaruba	80 - 120	
Andiroba	90 - 150	
Madeiras brancas	60 - 70	

Sawmill equipment

An attempt will be made, not to consider each case individually, but only to bring out the broad features of the whole situation. The major sawmills at Belem and Manaus and in some of the Island areas are quite old and have grown, little by little, with the general expansion of the market. In some cases old equipment has been sold and more modern gear purchased but scarcely any extension of premises has been possible and the machinery layout has suffered accordingly. At times, new equipment has been added to old, with a consequent incredible and haphazard conglomeration of machines. One typical example is a sawmill with an average daily output of 20 cubic meters of sawn wood produced by 120 workers and the following equipment:

Power: 4 boilers and 5 steam engines.

Logs conveyed to head saw by small trucks on rails.

3 rows, or more accurately, 3 groups of principal machinery.

- a) Head saw: 1 reciprocating (gang) saw (capacity 1 meter)
- Rip saw : One 110 cm flywheel band saw

b) Head saws: two 68-inch (270 centimeters) circular saws and one reciprocating saw with frame (gang saw used in gang mill) (capacity 1m.)

Rip saws : 2 reciprocating saws (55 and 70 centimeter capacity).

c) One 5 ft. 6 (165 centimeters) flywheel band saw used as head saw and rip saw, for making ceiling laths. In addition, a group of circular saws, planing machines and moulding machines for the manufacture of parquet floor blocks.

#### Power

The large Amazon sawmills use boilers and steam engines. This is mostly old machinery removed from dismantled boats. Frequently the power produced is insufficient and has to be supplemented by internal combustion engines, or electric motors using town current. Some mills get along not too badly on an inadequate power supply.

The driving force in the small sawmills is still the steam engine or even the water mill, although the trend is towards their replacement by Diesel engines. This trend is, no doubt, due to the difficulty of obtaining boilers or steam engines in the country, except at prohibitive prices. As an example, one offer observed of a boiler for a 200 h.p. steam engine, including installation, amounted to 650 Cr.\$.

The drive is usually by overhead or underground belting. Seldom is a machine driven by its own electric motor.

#### Conveyance of logs and handling on head saw carriage

As the sawmills are situated alongside rivers, the most popular method of conveying logs is by a trolley moving on an inclined plane and drawn by a steam winch. This arrangement is most convenient for the existing plants; there are but few exceptions, these being a travelling crane, a steam crane on rails and, finally, small hand trucks with a system of platform loading.

The logs are handled during sawing mainly with use of tackle and hooks, but also by hand. The two chief Itacoatiara sawmills have a "loader" and a "steam nigger".

#### Principal machinery.

The head saws in the main Amazonas mills are European or American band saws, whereas in Pará they are usually circular (with inserted teeth) or reciprocating saws but seldom band saws.

Rip saws are little and badly used in the State of Amazonas, while their use is more frequent in the State of Pará where there are reciprocating saws and, on occasion, band saws. The edgers have multiple circular blades (as is most frequently the case in Amazonas) or simple circular saws. The trimming equipment, used everywhere, is of the pendulum type. It is not possible, within the compass of this report, to pass judgement on the equipment being used; that would require examination of each individual case. There are, however, certain general defects: the manner of using band saws is poor as far as efficient production is concerned, particularly where the logs are of smaller diameter. In many cases, the addition of a rip saw would substantially improve output. Unfortunately, in most cases there is no room for such additional machinery.

The widespread use of the inserted-tooth circular saw in the Belem area (and that very often for sawing softwoods for boxes) gives rise to enormous wastage of wood.

Leaving aside the overcrowding of machinery, so detrimental to output, its extremely haphazard arrangement must be emphasized. The layout could frequently be improved, insofar as belt drive arrangements do not impede such efficient re-organization.

#### Care and sharpening of blades.

It is in this matter that the most serious defects are to be found. With but rare exceptions the band saw blades are not tensioned at all or badly, and the circular or gang saw blades never; sharpening and setting are done without method. One reason is either complete absence or inadequate equipment of sawdoctors' shops. As far as could be ascertained, there is only one automatic sharpener for the large diameter (72") circular saw in the whole of Amazonia. The other reason is a shortage of skilled labor.

#### Staff

With but few exceptions, the owners and managers of enterprises are business men and administrators with no particular technical knowledge of their industry.

At the same time and, it might almost be said, as a corollary,

there are practically no skilled machine operators or mechanics for machine maintenance, and still fewer sawdoctors. As a result of the workers' inexperience and the bad layout of plant, sawmills generally employ labor out of proportion to output. Yield for an eight-hour man day is somewhere between one-quarter and one-third of a cubic meter. The average daily wage is between 30 to 35 cruzeiros at Manaus and from 25 to 30 in the Belem region; but in estimating labor cost, these figures have to be increased by at least 50% to allow for payments in respect of Sundays and holidays (69 in the year), medical care, workers' accident insurance and miscellaneous items.

#### Stacking and seasoning

Air seasoning and, a fortiori, artificial seasoning is not practised in the Amazon. At most a 5 to 15-day "sweating" period is allowed according to the season before stacking, pending shipment or before utilization in the sawmill annex. In this cursory drying it is the custom to stand the sawn wood vertically on end by the mill, in the open and in the sun. The area and manpower required for this operation and subsequent stacking in a sawmill with an average output can be well imagined. Sudden exposure of saturated sawn wood to the sun, and to the alternation of rain and sun, has remarkably little effect on even wide planks of cedar and aguano, and in general produces very much less degrade than would be expected. Seasoning degrade is nevertheless of importance and particularly so with the denser species.

#### Output

Output varies greatly of course - from one species to another - according to the size and the average shape of the logs. The sawn wood output from aguano in the State of Amazonas averages 45-50% of the solid volume, from assacu, jacacuba and leuro inamhui 40-45%, from cedar 40% and from other species 35-40%. Output is not so high in the State of Pará because of the lower average size of the logs and of the different equipment of the mills. This is offset in part, however, by marketing facilities for smaller timber. The average output thus works out at 35-40%, with a maximum of 50% in the case of sucupira and a minimum of 30% in that of some whitewoods used for boxmaking.

The waste would therefore appear to be substantial and not fully utilized for heating boilers. Sawdust, for example, is never used for anything but packing and "banking".

Cost of production

Cost of production clearly varies considerably from one factory to another; besides, it is difficult to get information on the subject. The production cost of a cubic meter of sawn wood at Manaus, however, would appear to be in the neighborhood of, on an average, 350 cruzeiros. The following is an example of the breakdown of such cost:

Operational costs - Employees and workmen	58%
Maintenance and repair	11%
Miscellaneous expenditure	6%
Overhead	25%

The impact of labor on production cost is noteworthy.

From the little information available in the State of Pará, it appears that production cost is very much less, at 250 cruzeiros per cubic meter sawn.

On the basis of estimates, whose shortcomings are appreciated, one arrives at a very high cost of producing sawn wood. For instance, in relation to aguano (mahogany) lumber production at Manaus for export is as follows:

Purchase price in rafts	500	per m <sup>3</sup> - Manaus measure
Transport to mill	362	"
Commission to buyers (5%)	43	"
Losses in rafts and in storage 5%	45	"
Interest on advances for 6 mos. at 15%	12	"
Pauta tax	<u>210</u>	"
Total log cost in mill	1,172	
Wastage (at 47 $\frac{1}{2}$ % recovery of true)	473	
Sawing cost	350	
Stevedoring and harbour Board	80	
Export tax	<u>130</u>	
Total:	2,205	Cr. per m <sup>3</sup> F.O.B. to U.S.A.

The selling price of this mahogany is around U.S. \$180 per 1000 board feet = \$76.32 per cubic meter or at official rates of exchange around 1,368 Cr. per cubic meter. This explains why some sawmillers are giving up aguano as unsaleable in its only market, the United States, if the transaction has to be carried out at the official rate of exchange. This remark applies, to a lesser degree, to lumber as a whole.

#### Improving present conditions

Improvement in the present conditions of the lumber industry, therefore, depends on a lowering of prices and on improvement in quality, which can be obtained by:

- 1) Reducing the price of the raw material, which represents 55 to 70 per cent (or even 75 per cent in the case of aguano) of the cost of the sawn product. Solutions for logging and transport problems have been suggested elsewhere. Stress should be laid on the importance of establishing in existing logging areas mobile plants able to make use of large logs which, because of defects, are not worth long-distance transport, and of small diameter logs which yield little lumber at great expense. Such plants could also industrialize the production of railway sleepers (crossties) for which there is a good market. The rise of the present handicrafts industry is hampered by labor requirements and limited by the expense of the unnecessary middlemen between the native producer (cabocle) and the user. To attain the two proposed objectives, two types of equipment are needed: one to saw large logs (60 centimeters and over in diameter), and the other to handle small logs. There are many types of such mobile equipment, but none can handle all species. It, therefore, seems logical to propose that demonstrations be given which, besides having a definite utility value in the Amazon as a means of diffusing information, will also determine the optimum conditions for the use of such equipment.
- 2) Training staff for the various sawmilling operations. The shortage of skilled operatives is particularly felt in the case of blade care and sharpening-machine output and lumber quality suffer accordingly. But the other laborers doing specific tasks, whether sawing, grading lumber or stocking it, are equally lacking in technical know-how. Some apprenticeship schools in southern Brazil (Senai) have tool-sharpening workshops, but that does not seem to be enough. For one thing, the training is confined to one category of worker; for another, there is advantage in providing apprentices

with the same working conditions as their future work will entail. The training center must therefore be a real sawmill of modest dimensions but with such equipment as the apprentice will most often be called upon to use. With training in three-to six-month courses, the sawmill can, with advantage, operate at an industrial pace for a few days towards the end of the course, for this will give the apprentices a notion of what an efficient plant can turn out.

Such a center should logically operate in conjunction with a similar logging training center. A repair shop for the maintenance of equipment (common to both centers) should be available. That would afford an opportunity for training sawmill mechanics. In small sawmills, particularly, machine maintenance leaves as much to be desired as does the care of blades.

- 3) Improving equipment and rationalizing the layout of machinery in sawmills. Admittedly, this latter objective will be difficult to achieve. Most plants are old; in towns, sawmills occupy small premises and the buildings are so arranged that any attempt to alter the installation would be as costly as erecting a new plant. On the other hand, the replacement of a worn-out machine, the acquisition of new equipment, and even the purchase of essential spare parts (bearings, cutter heads, etc.) that the sawyer feels he needs, frequently proves impossible. The necessary equipment is sometimes not made in Brazil and an import license is required which has proved difficult to obtain. In other cases the purchase of a machine is postponed or the idea abandoned for want of funds. Bank credit is available but stiff conditions discourage the borrower.

It must be recognized that the import license services, as well as the banks, have no idea of the improvement that a contemplated purchase might bring to the industry; the applicant himself sometimes has only a poor idea. The situation would, to some extent, appear capable of remedy by the establishment of an advisory body to counsel the wood industry and give technical advice to credit institutions. What has been said about sawmill equipment is equally applicable to the secondary industries, such as boxmaking, that may soon find wider markets.

The future development of the whole forest industry in the Amazon basin, including sawing, implies the establishment of new mills, with production capacity in keeping with possible markets and accessible

forest resources. The nature and quantity of the products which the forest can at a given point make available to industry, must be ascertained by the surveys previously stressed as being essential. Marketing possibilities, depending on the prices and quality of the products, are pointed out later. The industrial techniques for utilizing these resources and producing under requisite conditions, must be specified and guided.

For example, the seasoning of sawn timber raises economic and technical problems peculiar to Amazon timber. Artificial seasoning of any particular species can only be recommended when its characteristics have been ascertained and when practical tests have shown the cost of the operation to be acceptable.

As regards wood peeling, while it is known how cedro, assacu or quaruba behave, very little is known regarding the potential uses of other species.

Examples could be multiplied, but it is sufficiently realized already that research needs to be directed toward practical applications while forest resources are being surveyed. This does not at all imply that a new industry cannot start before the results of the research work, as a whole, are known, any more than it would be considered necessary to await the result of a complete survey of the Amazon forests.

In this age of extraordinary technical advance, solution of the problem of economic extraction and utilization of tropical forests at once suggests the minimization of the significance of species diversity by the attempt to categorise the forest as a mere storehouse of cellulose as a basis for chemical industry. It is a solution which suggests itself in Amazonia even more readily than in other typical forests of the world because of the extremely low percentage of the total wood volume per logging unit area which is available in species and type readily merchantable by traditional methods of conversion. But in addition, the open nature of the so-called "jungle", the general ease of access and of topography and the magnificent system of arterial waterways offer great promise to the assembly of wood material in considerable volume at key industrial centers. If chemical conversion is feasible the Amazon could offer an inexhaustible supply of cheap intake.

At the moment, research is proceeding in several parts of the world on the technology of processing wood chips of mixed hardwood species. It is known to be generally possible, technically, to produce pulp from some degree of physical and chemical diversity in the components of a mixed intake. But the practical implementation of mixed pulping processes is determined by the specific character of the intake, and is still in its infancy. At the present stage of knowledge even initial consideration



of a proposal necessitates basic and detailed knowledge of the particular characteristics of the intake components.

The approach to a consideration of this nature involves the initial selection of a forest of sufficient extent which offers suitability in quality and extraction possibility, and which at the same time is geographically in accessible relation to pulp markets and to sources of cheap power and of copious supply of suitable water.

The hydroelectric potential of the Territory of Amapa, what is already known of the quality of the available forests, and its geographical and other advantages have suggested the region of Mazagao as the most promising in Amazonia for pulp possibilities and two areas of forest have been initially determined as warranting the necessary detailed study.

The various stages in the development of such a project would be time-consuming, for unlike the establishment of a plant in a softwood area, this would entail in addition to research on the material characteristics, practical solution of a multitude of problems in plant design. For after all, the particular implementation of what is essentially a new branch of Technology would necessarily require to pioneer its own conformity with its circumstances and would profit only in fundamental principle from similar projects elsewhere.

Before the construction of the plant could proceed it would necessarily have to progress through the following phases:

1. Forest assessment of available volume by species.
2. A) Investigation of the pulping characteristic of at least the major (volume) components of the stand.  
B) Research into the techniques and extent to which the intake materials could be mixed, in their relation to processing economy and the effect on output volume and quality.
3. Pilot demonstration of the practice of decided techniques, and the development of a basis of practice adequate to design of a commercial plant and an estimate of its economy.
4. Economic forecast of the operation of a plant, and finally,
5. Construction of plant - and of housing etc., and of all the subsidiary undertakings essential to the safe and continued operation of the plant itself.

Research listed in category two can be carried out in existing specialized laboratories in Brazil and abroad, but each of the others is essentially of local concern.

From another standpoint, the opening up to production of large forest stands would give rise to conservation problems involving the application of silvicultural rules. It appears that nothing is yet known concerning the conditions of growth and the behaviour of the Amazon forest species. In this connection, attention is drawn to the particular value of some species of the genus Cecropia, covered by the vernacular name of imbauba, and belonging to second-growth forest formations. From such, a newsprint of excellent quality has been produced, but, in the present state of knowledge, the supply is too uncertain in the Brazilian Amazon to enable a pulp industry to be based on this raw material. Nevertheless, contrary to what is happening with the African musanga, the hope of propagation and regeneration is sufficiently encouraging to justify a study.

Finally, the methods of supervising production are at no stage sufficient to enable its evolution and trends to be followed: available statistics on the quantities produced and the origin and nature of the products are at present incomplete and inaccurate. Reorganization is required.

Whether it be forest inventories or the foregoing considerations that are concerned, what is really being proposed by the Mission is the principle of a forest policy embodied in an Amazon forest law and applied by an Amazon Forest Service. The forestry regulations to be included in the Forest Code (Decree 23,793 of 23 January 1934) must lay down practical rules to be applied to the particular case of the Amazon. The Forest Service, that can only grow with the expansion of the forest industry, must participate in this development, including in its activities the classic fields of silviculture, "engineering" in forest utilization and industries, applied research and forest protection. It is, of course, first necessary to study how such a service should be organized administratively in relation to the Federal Forest Service and the Agriculture Departments of the States and Territories concerned.

In view of the time needed for the specialized training of the officials who would be responsible for such a Service, the latter cannot be expected to be established for some years. Certain steps must, however, be taken immediately; for example, inventory taking in selected zones may well provoke a flood of applications for concessions in public domain forests and that for speculative purposes. Such a move might well ruin all prospect of development to which the inventories had opened the way. Legislation applying to such zones must at an early stage be

promulgated and enforced. Again, as regards ground surveys and the observations on the growth and behaviour of commercially valuable species, it would be desirable that teams of Brazilian technicians immediately proceed with such work and that they be members of the bodies capable of advising the Amazon wood industry. Pending incorporation in a future Amazonian Forest Service, such partial services should work in close collaboration with the FAO Forestry Mission, essentially to preserve a uniform approach towards the objective in view.

#### Rosewood essence

This industry is concerned with the extraction, by distillation, of the essential oil in the secretory cells of a laurel, Aniba rosaeodora var. amazonica A. Ducke. This essence is used in perfume-making in the same way as the essences of lavender and bergamot, linaloöl being the constituent sought. Rosewood essence, however, is less in demand than the other two. There are distillation plants in the Aniba rosaeodora range on both sides of the Amazon in two belts parallel to the river, bounded roughly on the east by the Santarem region and the west by the Manaus region. They are small and number 51 in all, the majority being located in the municipalities of Maues, Parintina, Itacoatiara and Manaus (State of Amazonas).

Although the pau rosa (Aniba rosaeodora) grows in the dense forest along with other useful forest species, it is seldom felled in any general logging operation. That is understandable when it is considered that the annual fellings of pau rosa range from 10,000 to 50,000 tons in an area of low logging activity. Since it is a species scattered through the stands, it can be imagined how the stands may become rapidly exhausted and that the cost of the raw material is high. The wood reaches the factory in ripped billets 75 centimeters to 1.50 meters long, or large and small branches of similar length. The price varies between 400 and 600 cruzeiros per metric ton, the usual being 450-500 cruzeiros. Frequently supplies are seasonal, because transportation is only possible when the rivers are high. Thus, some of the factories work for only a part of the year.

The distillery is a very simple set-up: a steam engine furnishes the power to drive a cutter and provide vapor for distillation.

The cutter produces chips from 3 to 5 millimeters thick.

Three to six retorts with coils are used for extraction of the essential oil and condensation of the vapor. The rosewood essence separates out by gravity.

All the operations: splitting of the wood so that the small

capacity cutters can take it; loading and unloading of the retorts and removal of waste, is done by hand. Thus, a 4-retort factory employs some 40 men.

There is no control over the distillation process and this empirical procedure adversely affects the rate of production of the retorts and the quality of the product. The quantity of essence produced per metric ton of wood is between 7.5 and 9 kilograms.

The following example from a Manaus factory gives some idea of the cost prices f.o.b. of a kilogram of essence:

	<u>Cr.\$</u>	<u>%</u>
Cost of raw material	58	41.5
Cost of distillation (labor 55%, other operational outlay 25%, overhead 20%)	32	23
Duties and taxes	40	28.5
Loading on board	10	7
	<hr/>	<hr/>
Totals:	140	100

The f.o.b. price, without the use of differential exchange rates, works out at 160 cruzeiros and is regarded as high on foreign markets. Although Amazon producers have experienced better prices, it should not be forgotten that this is not a basic commodity, that it has to face competition from similar and more popular products, and that a new product may any day threaten the industry (as an example, the introduction of "ho-oil" produced by the Japanese in Formosa). The industry has obvious need of modernization and must aim at lower prices, if it is to be kept from foundering.

The excessively high cost of the raw material can be very considerably reduced by using modern logging techniques and linking the industry with the production of lumber. A more long-term view would envisage the utilization of artificial stands, but this implies a knowledge of pau rosa silviculture that at the moment does not exist. A quite feasible reduction of 50% in the price of the wood would lower the f.o.b. price of the essence by 20%.

Again, if the factories were regrouped and modernized, far fewer workers would be necessary, output and quality would be improved and waste could be utilized. An annual output of 250 tons of essence would concentrate a refuse volume of 20,000 tons of chips whose availability might well serve as a basis for the future development of a new industry.

The present trend is to expand production which, in 1950, reached the record figure for the Amazon of 590 metric tons. It has been only with some difficulty—and with the help of differential exchange rates — that the product has been marketed at the lower price of US \$3.5 a pound.

Apart from the risk of marketing difficulties, this expansion of output may have other consequences, the most serious of which would be the disappearance of the industry for want of raw material. Nothing is known of the possible volume of pau rosa that may be available in the Amazon; nor is anything known of the manner in which it reproduces. At most, one or two observations have been made; it is known that in general large numbers of seedlings spring up where a tree has been felled, and that the stumps sprout. But there is no certain knowledge of the pau rosa's rate of growth, of what happens to the seedlings or of how long the shoots live. These are points for research, to which could usefully be added others such as the essential oil content at various ages and in different parts of the tree, and the optimum conditions for distillation.

Finally, to limit the dangers of overproduction there is some attraction in the suggestion that has been made to go beyond distillation and obtain, in addition to linalol, acetates and terpene compounds for which there are wider markets. No information can be offered at the moment as to market prospects for such possibilities from the Amazon.

\*\*\*\*\*

### TIMBER TRADE

#### The market for timber in the Amazon

It is not possible to make a close estimate of consumption of timber within the Amazon Valley. Statistics for domestic or non-trade production are entirely lacking. One source puts it at 230,000 cubic meters round - 90,000 cubic meters for Amazonas and neighbouring territories and 140,000 cubic meters for Pará and Amapá. But this is no more than a guess and there is no means of assessing its accuracy.

It is also very difficult to arrive at a reasonable estimate of internal consumption of trade timber. Official production figures appear to be incomplete. Information is lacking as to initial and final stocks for any given period, while production and export figures vary considerably from year to year. There is a mild basis of observation in the assumption that internal consumption amounts to rather more than half, say 60%, of trade production.

On this assumption it may be deduced that, of recent years, the average trade production was 212,000 cubic meters round, of which 121,000 cubic meters were consumed internally. Add non-trade production, and total domestic consumption becomes around 321,000 cubic meters or 0.18 cubic meters of round timber per caput per annum. In Manaus, the per caput consumption has been put at 0.14 cubic meters of sawn timber, in Belem at 0.12 cubic meters.

These figures are not put forward with any confidence but merely to suggest the inference that in both the villages and the towns, but particularly so in the villages, internal consumption in the Amazon valley is light, surprisingly so when regards is had to the vastness and accessibility of the forests. Compare per capita figures for developed countries - 220 board feet or 0.52 cubic metres of sawn timber for the United States in 1949 and 0.28 cubic metres of sawn timber in the United Kingdom prior to the war.

Outside the main towns of the Amazon, the standard of housing is very poor; in places, it is unnecessarily primitive. There is a lack of what would be termed in more developed centres essential furniture. The majority of huts have a crude framework of poles, a rough raised floor where the ground is subject to inundation. The hammock dispenses with the bed and as often as not, empty boxes serve as the sole seating accommodation. In most villages housing is decrepit and badly in need of repair and furniture is confined to the barest essentials.

In the towns, in the poorer house, it is much the same. Jetties and raised paths of wood, which are a feature of the Amazon and which take up so much timber, are often in a sad state of repair. Too many of the boats and launches have passed their best days.

There is an acute timber shortage in the towns and villages of the Territories of Acre, Guaporé and Rio Branco. Local sawmills are small and inefficient and do not meet the demand for sawn timber. The volume of pit-sawing, in general is entirely inadequate. Despite the excellent water system, the virtual absence of wheeled traffic presents distributional problems, for over the year, the immediate vicinity of the banks of the rivers and igarapés that are close to the towns and villages have been cleaned of useful timber. Without wheeled traffic, the deeper penetration of the forest for timber is an undertaking that is not entered into lightly. As an instance, the Porto Velho saw mill exists on timber "fished" from the river, for there is no organized extraction to keep it supplied with logs. The Upper Amazon Territories buy from Manaus and Pará as also from river sawmills. The price of the timber is, however, prohibitive except to public institutions and the comparatively wealthy.

There is also a timber shortage in the Territory of Amapá, which draws supplies from the Pará Islands. Here we have the case of a local sawmill, at Matapi, being unable to dispose of its production effectively, despite the scarcity in Macapá, because of cheap hand sawn supplies from the Islands.

In Belem, local sawmills do not produce sufficient timber for the town. Much sawn and rough hewn timber, often of poor quality, comes in from the Islands and the Braganza area through the Baía to the twenty or so Estâncias for retail sale. The Baía sells 20,000 cubic meters or more of sawn or hewn timber each year. Much of this timber, along with direct imports, is taken up by the Estâncias, where resawing and planing facilities are available. A number of the Belem sawmills are primarily engaged in the production of indifferent grade boxes for local consumption. One sawmill devotes its main energies to lorry and coach body building. The main consumption of timber in Belem is non the less in the building and furniture trades. In the buildings, the commonest timbers are massaranduba for beams, pau amarello and succupira for floors and marupa for ceilings. The better class furniture is mainly of macacauba with cedar lining. Freijo too is popular. Plywood, from the South of Brazil, is slowly gaining ground.

Half the production of the major sawmills of Manaus and the whole of the production of the smaller sawmills is taken up in local sales or in sales outside the town, to the upper rivers etc. The quantity available for local consumption depends to a great extent on the state of the export market. When that market is bad, as in the latter part of 1952, accumulation of shorts presents a serious problem to the major sawmills. The poorly designed mills become congested and production suffers. Timber deteriorates under the crude stacking arrangements that are common. In such a market, even the much prized cedar goes into box production. An interesting development is the manufacture of prefabricated houses by one of the larger sawmills, but the price asked appears prohibitive - 15,000 Cr\$ at Manaus per unit and 28,000 Cr\$ erected at Porto Velho.

Furniture production is on the increase in Manaus. Mahogany and Cedar are used for the better articles, the Louros for the cheaper. The prices paid for timber by the furniture factories seemed to be very high. It is not surprising, therefore, that there has been a marked increase in the use of plywood for furniture of recent years. Sales by one importer have increased from 20 centos in 1949 to 150 centos in 1951 and 100 centos during the first five months of 1952.

In Itacatiara, unlike Manaus, there is a poor local offtake from the sawmills, which are as a consequence invariably in more serious difficulties than the Manaus sawmills, when there is a decline in the export market.

There are three short lengths of local railway that call for sleepers. For the present, there appear to be adequate supplies available from forests in close proximity to the lines. The Madeira-Mamore railway uses itanba exclusively, the Tocantins railway massaranduba and the Braganza railway a mixture of jaraná, massaranduba and other timbers, with jaraná predominating.

Production of sleepers for export is unlikely to affect these supplies, as export sleepers are produced from forest areas that do not serve the local railways. It is of interest that the local railways do not make use of a great mixture of sleeper species, such as are exported. (see Chapter II. 3(b))

The greater part of log supplies from the Amazon goes to the Island sawmills, to Manaus and to Belem. And rightly so, for the concentrated local timber markets existing in Belem and Manaus are a pre-requisite for a healthy export trade. The local markets do not have to meet high ocean freights, export taxes and harbour dues and can therefore afford to be less exacting as regards quality. Not that this should constitute any justification for the irregular sawing and poor condition of so much of the timber that is on offer locally. Proper sawing in machines that run true and with saws that are correctly set and tensioned, and care in storage prior to sale, yields more attractive produce and cheapens the cost of production.

If an expanded timber industry is aimed at for the Amazon, the maximum development of the local market for timber produced in sawmills cutting for export is an essential. It would be unwise to locate any new sawmills having the export market as a primary objective in a centre - no matter how rich the surrounding forests - where the poorer grades cannot be absorbed locally or where the cost of transport to main consumption point prices the timber too high; nor should the need to dispose of poorer grades from export mills act as a break to the development of sawmill centres in distant parts of the Amazon where the objective is local supply.

The most pertinent facts about the timber position in the Amazon are the serious shortage of sawn timber in the remote areas and the excessive price of timber throughout the valley, a price that is beyond the average local purse.



In the remoter areas, the solution is undoubtedly installation of small portable units in centres of exploitation that are as close as possible to the demand. Elsewhere, production costs must somehow be brought down in the interest both of the local and of the export market. This lowering of production costs can be effected, as has been said in an earlier chapter, by rationalized extraction, with a more direct linkage between sawmill and forest and with fewer middle men by improved sawmilling facilities, and by a steady supply of labour that is rendered contented and may be cheaper by making a greater variety of food stuffs available at prices that labour can afford to pay.

Can the local market be developed materially? Three to four times the present consumption could probably be absorbed with ease, if prices were correct and if the industry were located so as to ensure proper distribution. A good deal devolves on the effectiveness of the Organization for the Development of the Amazon that has been or is shortly to be set up by the Government of Brazil. If objectives are reached, there should be a greater area under cultivation in the Amazon and a greater variety of and cheaper foodstuffs, an accelerated rate of increase of the population and a marked improvement in living standards. A regular supply of forest and sawmill labour should result, a supply that must somehow be safeguarded from enticement by other activities that may appear more remunerative.

#### Coastal markets of Brazil Northeast ports

The most important export market for Amazon timbers lies along the coast from Fortaleza to Recife. During the period 1939/1950, Fortaleza, Natal and Recife between them took up 68.9% of the coastal exports from Para and 40.9% of the total exports, home and abroad. During the same period Fortaleza took up 32.7% of the coastal exports from Amazonas; very little timber went from Amazonas to Natal and Recife. The trade ascribes this among other reasons, to the shortage of shipping space. As an instance, an order placed with Manaus in December 1951 had still to be shipped in September 1952.

During 1951, Amazon timber represented 76.5% of total timber imports to Ceara. There is very little competition in Ceara from hardwoods from other sources. Minor quantities reach the ports from the interior and minor quantities only come up from Espirito Santo and Bahia. Parana Pine is the only other timber to enter in any quantity. The same state of affairs exists in Rio Grande do Norte, where 56.9% of total imports during 1951 were from the Amazon. In Pernambuco, where Amazon imports during 1951 represented 30.7% of the total imports by sea, considerable quantities of hardwoods reached Recife by road and rail. Exact figures are not available, but the tonnage entering by road and rail must have exceeded tonnage coming in by sea from the Amazon.

The Northeastern States appear to be developing rapidly. Between 1940 and 1950, Recife recorded a population increase of 65.3% and Fortaleza of 55.4%. Eight new houses are being completed daily in Recife, three in Fortaleza and 1.5 in Natal. Industry is developing, particularly in Recife, where new workshops and factories are springing up to meet the rapidly increasing demand for the produce of Pernambuco.

If the development of the region continues at the present pace, then the prospects for an increase in the consumption of Amazon timbers are excellent. There would be an immediate and material increase if more shipping space were made available and if prices were eased. Competition may develop from Bahia. As an instance hand sawn or hewn cedar planks travel 1250 kilometers by road from the South of Bahia to sell at sawmill in Fortaleza for Cr. 2,000 per cubic meter as against Cedar at Cr. 2,500 per cubic meter c.i.f. to which must be added Cr. 200 per cubic meter for delivery from wharf to sawmill. It is true that the specification of the Bahian cedar is inferior, but it is improving and as for the quality of the timber, there is little to choose between it and cedar from the Amazon.

There are some interesting possibilities for widening the scope of timber sales from the Amazon to these Northeastern ports. The consumption of plywood is on the increase and cedar plywood is much in favour. In Recife alone, given a wide range of thicknesses, 100 cubic meters of cedar plywood could be absorbed monthly and there are sale prospects in all ports, from Fortaleza down to Rio. Cedar plywood from the Southern States is poor in quality and is said to be in short supply. There are plywood factories in Bahia and Espirito Santo, but there is difficulty in maintaining the supply of cedar peeler logs. For instance, it is a 400 kilometer road haul for cedar logs to the Ituberá factory. CIF. prices for 3 millimeter cedar plywood in 1952 were Cr. 36 per square meter in Fortaleza and Natal, Cr. 30 per square meter in Recife and Cr. 25 per square meter in Salvador. At these prices, it should be possible to set up a remunerative plywood industry, based on cedar, in the Amazon.

There is a comparatively heavy consumption of boxes in Recife and Fortaleza. At present, pine shooks are used almost exclusively. Pará boxes are not liked as they are said to be badly processed and badly dried, while the Belem manufacturer for his part has little interest in export for he has no difficulty in disposing of his full production locally at profitable rates.

But the prices paid for box shooks in the Northeast should be of interest to the Amazon and it should be possible with proper manufacture, to match the quality of the box woods in use from the Madeira brancas of Pará.

There is a limited scope for Pará sleepers in the Northeast. Only in the Rio Grande do Norte is there a difficulty in sleeper supply, where very poor quality sleepers come in by lorry from Ceara. In 1953, it is estimated that about 90,000 sleepers will be needed and that the price from Ceara is likely to be Cr. 45 per sleeper. At this price, Pará should be able to supply without difficulty sleepers of the dimensions required - 180 x 18 x 14 centimeters - and in much superior quality.

Finally, there is the possibility of substituting cheaper Pará timbers for Parana Pine. A good deal of third class pine is used for cement shuttering. In Natal and Fortaleza, the CIF price paid corresponds to Cr. 1,147 per cubic meter and in Recife Cr. 1,062 per cubic meter. Sawn material from the Madeira brancas of Pará can be produced at Cr. 600/650 per cubic meter f.o.b. Add freight from the Islands - to Fortaleza Cr. 185 per cubic meter, to Natal Cr. 219 and to Recife Cr. 261 - and it appears that a reasonable margin is offered by the prices for third class pine.

#### The Distrito Federal - Rio de Janeiro

Of a total hardwood import into Rio de Janeiro during 1949 of 179,992 cubic meters, the Amazon contributed 4,851 tons.

Rio de Janeiro's main hardwood supplies come from the Rio Doce forests. In 1950, 108,341 tons were furnished to Rio de Janeiro from those forests, while the Amazon furnished 3,265 tons.

Development in Rio de Janeiro has been fairly rapid and is continuing. Between 1940 and 1950, there was a population increase of 37%. Each month, more than 600 new buildings are being erected. The demand for timber must be increasing. But it is said of the Rio Doce forests that they are drying up as a source of supply, and that they have an economic life of less than 30 years at the present rate of cutting. Peroba do Campos forests that were once 50 kilometers from the sawmill centre of Colatina are now 150 kilometers distant by road. Log costs are mounting. Peroba do Campos logs are costing Cr. 500 per cubic meter at source in Espirito Santo, Cr. 750 at Colatina and Cr. 1,000 at sawmill in Vitoria. Peroba do Campos logs from Bahia arrive by road in Vitoria at Cr. 850/900 per cubic meter. Compare the cost of logs in the Amazon - Cr. 490 per cubic meter for cedro into Manaus, Cr. 320 per cubic meter for Succupira and Cr. 130 per cubic meter for andiroba into Pará sawmill.

It is puzzling that the Amazon does not make a greater contribution to Rio de Janeiro hardwood supplies. Given the shipping space, there seems no reason why Amazon exports to Rio de Janeiro cannot even now be stepped up materially. Freijo and Succupira, which are well liked, are in short supply. There is a prejudice against andiroba and jacareuba, while louro inhamuy does not sell readily; good sales propaganda could probably help here. Mahogany is almost unknown and it would surely be good policy to create more interest in the timber inside Brazil. Of 15,396 tons of cedar imported into Rio de Janeiro D.F. in 1951, 9,676 tons come from Bahia, 3,986 tons from the Amazon and the rest from the South, mainly from Santa Caterina. In general, the Santa Caterina Cedar is much inferior to cedar from the Amazon. Bahian Cedar is mostly in the form of hewn baulks, 2 meters long; some is of fair quality handsawn planks, but still short. The CIF. prices for the planks from Bahia is Cr. 2000 per cubic meter as against Cr. 2820 for 1st class and Cr. 2620 per 2nd class Manaus planks, Cr. 2,300 for Parana cedar planks and Cr. 1,700 for planks from Santa Caterina. The trade feels that if Manaus Cedar prices were eased, there are prospects for greatly expanded sales.

The impression cannot be avoided that proper advantage is not being taken of the immediate prospects offered by the Rio de Janeiro market. As to the future, the prospects for Amazon timbers should improve still further in view of the failing resources of the Rio Doce forests.

As regards sleepers, the E.F. Central do Brasil is increasing its demands on Pará. 400,000 were ordered from Pará in 1952. The E.F.C.B. is also purchasing from Bahia, Santa Caterina and Espirito Santo. Bahian sleepers reach Rio at Cr. 85 each as against Cr. 98 from Pará. The Pará sleeper is estimated to have a 10-year life and to be inferior to the Sertao sleeper. But with more organization, with production of sleepers from more mature trees than is the case at present, the standard of Pará sleepers can be improved considerably. And if Pará wishes to retain her market for sleepers, measures for improvement of the quality of production merit serious attention.

Other points of interest in connection with the Rio Market, which apply equally to the timber markets south of Rio, are (1) that cedar plywood from the Amazon would be well received because of the inferior quality of the southern cedar plywood and (2) that because of the proximity of Parana Pine supplies, there is little possibility of placing Pará timbers for box shooks and for cement shuttering.

#### Sao Paulo

Very little Amazon timber is taken by those parts of the Brazil coast that have not already been touched on above. Bahia and Espirito Santo have adequate local hardwood supplies and the same applies to the States from Parana south. Sale prospects for Amazon timbers are poor in these regions, though minor quantities of speciality woods or of peeler logs of good specification may be absorbed from time to time.

Sao Paulo is in different case. Present absorption of Amazon timber is unimportant both in relation to Amazon supplies available and to total hardwood consumption in Sao Paulo. In 1947, Sao Paulo purchased 813 tons from the Amazon, in 1948, 753 tons. Compare this with the INP 1951 figure for imports into Sao Paulo of timbers other than pine and which are presumably all hardwoods - 443, 145 tons.

Sao Paulo obtains the bulk of its hardwood supplies by road and rail. Of the 1951 figure - 443, 145 tons - only 60,895 tons entered through the port of Santos. Peroba rosa is the main species entering by road. It derives from agricultural clearings, mainly for coffee planting. The logs are disposed of to extraction agencies and transport concerns for nominal prices, because felling is primarily an agricultural operation and the farmer wishes to have his land cleared of trees as quickly as possible. The Peroba rosa stands are growing more and more distant and it is the extension and improvements

to the main road systems that have enabled it to reach Sao Paulo at present price levels. As an instance of the recession of the timber stands - Peroba rosa was located 6 kilometers from Londrina in 1941, by 1947/48 the distance had increased to 20 kilometers; now the nearest stands are 150 kilometers from Londrina. Lorry distances from forest to sawmill are now 200 kilometers in many places. It was the general opinion of the trade that economic supplies of Peroba rosa would be exhausted in 10 years.

As for entry by sea, the Rio Doce forests contribute little more than the Amazon. In 1950, Bahia supplied 937 tons. In 1951, Espirito Santo supplied 262 tons. 98% or more of Sao Paulo's sea imports of hardwoods must therefore have come from the South. Of the Southern forests, it is said that cedar from North Parana is nearing exhaustion. Canella, imbuia and cedar supplies from the other states, though in no immediate danger, are said to be growing scarcer. It does not appear that the Southern States can do much to meet the impending hardwood shortage that will arise from the failure of Peroba rosa supplies.

The timber position in Sao Paulo is clearly reflected in prices now being paid. Taking floor boards as an instance; by March 1952, the price had risen 975% since 1939, as against price increases varying from 280% to 584% for seven other essential building materials. Cedro logs from North Parana sell in Sao Paulo for Cr. 1,800 to Cr. 1,900 per cubic meter. At the Lapa railway yard, the price has been as high as Cr. 2,500 per cubic meter. Peroba rosa and ipe logs vary from Cr. 800 to Cr. 1,200 per cubic meter. At Lapa, imbuia logs cost Cr. 3,000 per cubic meter, jequetiba logs Cr. 1,300 per cubic meter and arariba logs Cr. 2,300 per cubic meter.

Development in Sao Paulo has been phenomenal of recent years. Between 1940 and 1950 there was a population increase of 68% and this rate of increase is being maintained, if not exceeded. During the same period, industrial production in the State of Sao Paulo increased by 800% in value. More than 800 new buildings are being completed monthly. Development on this scale calls for ever increasing supplies of timber. With local supplies dwindling rapidly, with the Southern forests unlikely to expand hardwood production and with the Rio Doce forests fully engaged in the Rio market, the prospects for materially increasing deliveries of hardwood to Sao Paulo from the Amazon seem to be very good indeed. There is a promising field in Sao Paulo for active publicity on behalf of Amazon timbers.

The only immediate prospect for sale of Pará sleepers in the Sao Paulo area is to the E F Santos-Jundiai. The Paulista railway, which needs 250,000 sleepers annually, draws its supplies from the Sertao. The Sertao sleepers - aroeira, faveira, etc. - are excellent and superior to the average Pará sleeper, but they are getting scarce. The Paulista railway propose to treat 50,000 eucalypt sleepers annually to fill the gap and there is also talk of an extension of line which will tap new sources of supply. From a rough costing of the preserved eucalypt sleeper, the Pará sleeper may prove the cheaper proposition.

The Santos-Jundiaí Railway now looks to Pará as an essential source of sleeper supply. Its needs are 40,000 B.G. sleepers annually. In 1952, purchase from Pará was resumed after an interval of 23 years. The first deliveries were unfortunate. About 30% only of the sleepers sent were of the species prescribed. While the sleepers were well cut, they were excessively sappy and with many bad splits despite profuse clamping. Of 7,673 sleepers inspected by the Railway authorities, only 217 were given a 1st class life of 15 years, 2,748 were classified as 2nd class with a life of 4-8 years, and the rest were rejects with an estimated life of 1-3 years. Clearly, if Pará wishes to maintain its position in the sleeper market it must do better than this.

### The foreign markets for Amazon timbers

#### La Plata markets

Uruguay is largely dependent on imports for its supplies of timber. About 60,000 tons of logs or roughly half the total imports are of hardwoods. The Misiones forests of Paraguay and Brazil supply these hardwoods. The logs are in general of indifferent quality and specification and prices paid are high relative to the grade supplied. C.I.F. Montevideo louro preto per 1000 board feet sells for US\$ 230 and incienso (Cabriuva) for US\$ 260. The price of Misiones lapacho (Ipe) and cedar is 350 to 360 pesos per 1000 board feet c.i.f. Montevideo.

Pará cedar is quoted at 320 pesos per 1000 board feet c.i.f. Montevideo. Pará louro vermelho and andiroba are quoted at US\$ 83/85 per cubic meter (rough equivalent to US\$ 190 per 1000 board feet. When comparing prices, account must be taken of the difference in systems of measurement - Misiones logs are given a 4-inch allowance off the mid-girth. Bearing this in mind and the superior specification and quality of the normal run of Amazon hardwood logs, the Amazon timber appears to be the better proposition.

Another import of importance to Uruguay is the 1.8 million fence posts purchased annually. The greater part come from Paraguay, from where Curupai posts 2.2 meters long by 10 centimeters diameter are sold at US\$ 1.7 each c.i.f. Montevideo. Amazon acapu posts of these dimensions, but of superior quality, fetch US\$ 1.85 each.

Freight shortage appears to be the main obstacle to an expanded market from the Amazon. It is difficult to estimate the potential absorption by this market. In 1950, 192 tons of logs were taken up. Acapu and mahogany are listed. In 1951, nothing was sent from the Amazon. An order placed in August 1951 for 255 cubic meters of logs and 240 tons of acapu posts was due to arrive in Montevideo towards the end of October 1952. The purchase was of andiroba, louro vermelho, pan marfim and quaruba logs and of Succupira and massaranduba beams. It should be possible to sell larger quantities than these, if shipping

facilities were available and in this connection the Delta line manager for South America indicated that he could divert a ship to the Islands for a regular 500 tons. Transshipment at Rio is apparently out of the question on the grounds of expense and because the timber is subjected to much damage from exposure on wharf and careless handling.

The plywood industry of Montevideo seemed quite interested in Amazon cedar logs, when it was pointed out that the specification of these logs was much superior of those from Misiones and from Santa Caterina. Amazon logs were thought to be on the short side and it was considered doubtful that, in view of the shipping delays, the logs would arrive in Montevideo in fresh enough a condition. Nevertheless, a visit to Belem and Manaus was contemplated to see if it were possible to arrange supplies.

In Argentina, the position is much the same as for Uruguay relative to Amazon timber imports, with the added complication that general imports from Brazil are dependent on the volume of cereals moved from Argentina to Brazil. Prices for Misiones hardwoods in Buenos Aires are similar to those ruling in Montevideo, so that price cannot be the stumbling block as far as sale of Amazon hardwoods is concerned. In 1950, the Amazon sent 300 cubic meters of logs to Argentina (cedar and andiroba). During 1951, 200 cubic meters of andiroba logs were shipped. Given better freight facilities, these figures could undoubtedly be improved on, though to what extent it is difficult to estimate.

In general, while much more might be achieved by the Amazon in the La Plata markets, the scope is probably limited in view of the more strategically placed Misiones supplies.

#### United States of America

Whatever prospects there may be for marketing Amazon timbers in the United States lie in the Northeast, with New York as a principal centre of import. During 1950 Amazon shipments were 8301 cubic meters (7,915 cubic meters of mahogany, of which 85% was sawn timber). A similar quantity was shipped in 1951, with mahogany again dominant, but with larger sales of sawn assacu, cedar and andiroba.

Amazon mahogany is considered a poorer proposition than Central American mahogany, which shows more figure, or than African mahogany, which is much cheaper. (Amazon mahogany shipped is less than 3% of total mahogany shipments to the United States). The Brazil mahogany nevertheless benefits from the considerable publicity that is given to the use of mahogany in general by the trade in the United States.

There is no enthusiasm for Amazon cedar because of irregularity in colour and the danger of resin exudation. As for the other timbers, the quantities on offer are too small and too irregular for the mass production methods that are so common in the wood-using industries of the United States. The Philippines, with West Africa a poor second, are the main overseas hardwood sources and they furnish more of the lighter species that are in demand and at easier prices. For Amazon timber, freight and yarding is estimated at US\$ 90 to 100, which gives little scope for competition with national hardwoods.

The American timber market is a difficult one in which to obtain a foothold. It is less centralized and more individualistic than in North Europe and there are strong prejudices to overcome. But it is a big market and worth cultivating. If Amazon production were stepped up, and steady, appreciable and cheaper supplies assured, there is little doubt that American trade would show a much greater interest in what was on offer. An uniform production of cedar plywood at the right price would be certain to command attention and there is always scope for decorative veneers.

### Europe

United Kingdom. Amazon exports to the United Kingdom, mainly in the form of sawn timber, were 10,148 cubic meters in 1950 and about the same quantity in 1951. The main interest is in the Meliaceae and in the lighter weight timbers - mahogany, cedar, assacu, freijo, quaruba, the louros, ucuúba and jacareuba.

Owing to the limitation in softwood imports since the war, a limitation imposed largely by currency difficulties, attention has been given to the substitution of softwoods by hardwoods of light to medium density. Amazon timbers of this description that are on offer are limited to about ten species. These timbers have had ample opportunity of entering the market on a permanent basis but have, in general, lost ground for a number of reasons. First, the quantities on offer have been too small and too irregular. Price has been too high relative and too irregular. Price has been too high relative to African and Far Eastern timbers. In view of the difficulty in obtaining refunds against genuine claims, the insistence on a 100% letter of credit has been burdensome. Agents are dissatisfied with the inability to include their commissions in the selling price, which is apparently due to the Bank of Brazil's refusal to permit these commissions to be remitted. Finally, there is a general dissatisfaction with the quality of timber now being shipped. The quality is said to have deteriorated since the initial post-war shipments and there is now too high a percentage of poor-grained wormy stock.

The crucial fact about the timber market - in the United Kingdom - and in this respect all the Northern European timber markets have followed suit - is that a pronounced buyers' market developed in 1952, as a result of which West African and Far Eastern timber prices fell heavily, leaving the Amazon timbers, which were tied to official exchange rates, above world price levels.



The drop in freights from Manaus on sawn stock has been unable to bridge the gap.

Licensing for non-sterling hardwood imports have now been resumed and a fresh opportunity is offered to Amazon timbers, if the recently enacted freeing of the exchange in Brazil will permit an easing of prices in terms of sterling. It was indicated to a member of the mission in London and Liverpool, that the top price for FAS Mahogany that was of interest was 21/- per cft. f.o.b. Assacu can be marketed, but at not more than 14/- per cft. c.i.f. which presumably includes the 10% duty payable on Amazon timbers. Cedar at the present price of 17/- per cft. f.o.b. Amazon port is thought too high (Khaya from Africa is being purchased at 17/6d per cft. c.i.f.). Probably the correct price for cedar is 14/6 to 15/- per cft. f.o.b. While brokers and merchants show a lively interest in prospects of more Amazon timber becoming available, they appear indifferent to andiroba, Succupira, massaranduba, jacareuba and ucuúba at current prices.

The UK market is the key market in Europe. It is the largest importing centre for hardwoods in the world. With proper prices and regular supplies, there are fair prospects of expanding Amazon sales. Steady publicity is needed to keep the merits of Amazon timbers before the trade and the public. In this the Trade Press will cooperate, if the material furnished is interesting and accurately informed.

Germany. The German interest in Amazon timbers revived only in 1950, but little business was done. There is a record of 73 cubic meters being shipped, all of massaranduba logs. In 1951, Amazon shipments were stepped up to about 3680 tons (4,200 cubic meters or more), all in the form of round logs. Quaruba was the principal species, accounting for about 75% of the total. Lesser quantities were shipped of louro vermelho and assacu. Of other species, including massaranduba, the shipments made were unimportant. Much of the quaruba eventually found its way into the United Kingdom in the form of plywood. Purchase of quaruba from the Amazona by Germany fell away during 1952, when the United Kingdom shut down on plywood imports and when the price of okumé and other West African peeler logs declined.

Germany, as the second largest center for imported hardwoods in Europe, is a market well worth cultivating. But it must be appreciated that Amazon timbers are likely to remain secondary to West African timbers unless the Amazon prices are much lower than at present. Germany's interest is purely in logs for local conversion and for peeling and West African logs can be purchased in markedly superior specification. During 1951, Amazon shipments represented less than 2% of total hardwood shipments into Germany from tropical countries.

There is an interest in Hamburg in the use of tropical hardwoods for sleepers. Pará might participate in any future supply, but only if the quality of production is very much improved.

Portugal. During 1951, Portugal imported 16,779 tons of hardwoods from Brazil, of which about 95% was in log form. The bulk came from the Amazon, for there is a record for the first 11 months of 1951 of the shipment of 10,318 cubic meters (Amazon shipments to Portugal in 1950 were 7,814 cubic meters).

The whole range of Pará commercial species play a part in this trade. (Amazona's shipments are negligible). In order of quantities, the principal species shipped were macacaúba, succupira, andiroba, quaruba, massaranduba, and louro vermelho.

Brazil contributes more than 60% of Portugal's hardwood imports. The Portuguese West African territories account for the bulk of the remainder.

Portugal is a traditional market for Amazon timbers, which are well liked and firmly established through very long usage. Macacauba is highly esteemed, while andiroba, freijo and succupira are rated high, though succupira is a bit dark in colour for the fashion in furniture. The market for massarandabu is said to be declining, because of new methods of construction and the passing of the wooden cart wheel. Nonetheless, there is danger from Portuguese Colonial production, which has developed considerably since the war. Brazil timbers pay an entry duty, whereas Colonial timber comes in free. Hitherto a good deal of the Colonial imports particularly Tola and Undianuno (Khaya spp.) has been re-exported in the form of plywood. But the decline in the UK hardwood and plywood market in 1952 has curtailed sales and for the first time on record, Colonial Portuguese hardwoods in 1952 were priced substantially lower than corresponding Amazon hardwoods in the Lisbon market.

The general impression formed of the market for Amazon timbers in Portugal is that it is static. Despite the competition of Portuguese Colonial production, it is unlikely that much headway will be made against Amazon hardwoods, if the new Brazilian Exchange laws cause an easement of Amazon timber prices. The bulk of Amazon timber exports is handled by Portuguese traders and this will ensure steady marketing. But there appears to be little prospect of materially expanding the consumption of Amazon timbers in so limited a market as Portugal.

One point of interest. Plywood prices for waterproof bonded material to the United Kingdom are - £99 per cubic meter for Tola 3 millimeter plywood f.o.b. Lisbon. To the United States - 3 millimeter Tola plywood costs US\$ 266 per cubic meter and Undianuno (Khaya) 25% more. At these prices, with a free rate for the cruzeiro, cedar plywood from the Amazon could compete. A good grade of cedar plywood in both markets would command interest, if the price were competitive.

#### Prospects for an expanded industry

The Mission was concerned primarily with determining how far an expanded timber production in the Amazon could be effectively marketed and distributed.

With this view, a study was made of the market for Amazon timbers inside and outside Brazil in order to assess what trading difficulties were being experienced, to ascertain how far they could be resolved, and to form an opinion on the prospects for a material increase in the quantities consumed. It will be appreciated that with so many uncertain factors operating - the trend of population; the rate of improvement in living standards; the degree of industrial expansion; the competition in foreign markets from a host of other timbers and substitute materials from widely dispersed sources - the determination of precisely how far consumption could be increased in any one market was not a practical issue.

One aspect that could not fail to impress at a very early stage of the investigation was that for so huge an area of forest as is to be found in the Amazon, an area half the size of the United States and for the greater part accessible on account of its superb system of water ways, the production of timber is a mere trickle. It is estimated that the average annual trade production of timber in the Amazon is 212,000 cubic meters (Francon) to which may be added a domestic consumption of 230,000 cubic meters. Compare this with production elsewhere in the equatorial forest belt. From British Guiana and Surinam together, with a forest area less than one tenth of the Amazon, and with only one quarter of this area classified as accessible, the trade production of timber is about 213,000 cubic meters (Francon). In Nigeria and the Cameroons, with a forest area less than one seventh that of the Amazon and with less than 2.5% classified as accessible, the trade production of timber is about 390,000 cubic meters (Francon). From the French Cameroon, with one tenth of the area of forest to be found in the Amazon, less than 8% of which is classified as accessible, the production in 1950 was about 200,000 cubic meters (Francon). Many similar examples could be added, from East Africa and the Far East.

It is quite certain that very much more timber could be produced from the Amazon than at present. Suppose the objective were set at three to four times the present rate of production - this could be achieved without difficulty and if correctly organized, without endangering a steady supply of timber from the more accessible areas. From what was observed, the terrain does not offer serious obstacles to extraction by mechanical measures, and this would permit exploitation at a greater distance from floating stream than is now the case.

A three- to four-fold expansion should therefore be achieved without dispersion of effort, in a few well-defined and promising centers of production, where it should be possible for the authorities to exercise a reasonable measure of control. It is a practical objective in that it should be possible to carry out within a reasonable period the survey and stocktaking required, that is an essential preliminary to organized extraction. If there is a difficulty, it is in the provision of an adequate quantity of qualified labour. But this will presumably be one of the main objectives of the Brazil Government's scheme for general development in the Amazon. The quantity of

of labour required can be minimised by adoption of efficient extraction processes; as for the quality, that can be provided for by training and instruction.

How long should an expansion of this magnitude take to develop? The Mission has thought in terms of ten years because the rate of expansion must keep pace with the progress of survey and stocktaking and with the growth of a competent control organization. It must keep pace with the expansion of the labour force and, most important, it must not go ahead of the rate of market expansion, which will devolve largely on the rate of increase of population in the Amazon valley and in Brazil in general, on improvements that can be effected to the standard of living in the Amazon and elsewhere in Brazil, on the growth of industrialization in Brazil, and on the results of intensified sales propaganda in foreign countries.

It must be recognized that the main scope for an increase in the consumption of Amazon timber lies within Brazil itself. As a natural corollary to an expansion in production to meet internal demands, more timber will become available for offer abroad and this will in turn stimulate foreign markets to greater activity in the sale of Amazon timbers.

A P P E N D I C E S

HIGHLIGHTS OF THE BACKGROUND SITUATION

The Area

Extent

For practical purposes the "area" covered by this report includes the following States and Federal Territories:

Federal Territory of Guapore	--	area	254,163 Km <sup>2</sup>	or	2.98%	of Brazil
"	"	of Acre	153,170 "	"	1.80%	" "
State of Amazonas	--	"	1,595,818 "	"	18.74%	" "
Federal Territory of Rio Branco	--	"	214,316 "	"	2.52%	" "
State of Pará	--	"	1,216,726 "	"	14.29%	" "
Federal Territory of Amapa	--	"	137,419 "	"	1.61%	" "
<b>Total:</b>			<b>3,571,612</b>		<b>41.94%</b>	<b>of Brazil</b>

It is located squarely astride the Equator within the following extremes:

North	5°	16'	19"	N
South	13°	41'	30"	S
East	46°	06'	30"	E
West	73°	59'	32"	W

Geology and topography

The geology and topography of the area are of interest to this report only in relation to their effects on timber extraction and general access, soil type formations and colonization possibilities; they are considered here from these aspects.

The Amazon "plane" may be regarded as two gently sloping surfaces abutting along a somewhat east-west junction corresponding to the track of the main Amazon-Solimoes River, and stretching out on either side to attain eventually a proximity to the elevations of the chain of small peaks and plateaux which bound it to the North and to a much less continuous extent to the South, well into the center of Brazil. On the west the plain continues into Bolivia and Peru to the foothills of the Andes. Of the total area 42.2% or a million and a half square kilometers has an elevation between 0 and 100 metres and a further million (28.7%) is less than 200. The general flatness of the area is its most important characteristic. Manaus, some 1500 kilometers (972 miles) up the river is only 30 metres (100 feet) above sea level and on both sides the rise in elevation is imperceptible.

The land comes away from the flat volcanic crystallines which originally bordered a pre-Tertiary sea to contact the Tertiary deposits exposed as a result of the general uplift and folding which affected the world in that era and expelled the sea waters. The continuation from one series to the other is unbroken in profile and the junction of the series is not topographically discernable. The general picture is of a parent plain of volcanics overlain by a vast spatula of Tertiary sandstones fanning out to cover a huge area west of Manaus and into Peru and Colombia, and being narrowed in between Manaus and the mouth of the river. Later processes have modified the picture by the action of surface run-off carving out a pattern of widely-separated broad flat valleys through which the streams wander, slowly changing course, and in their annual floodings building a quaternary deposit over the valley flats. An enormous amount of silt is torn off the Andes and the banks of most of the rivers, particularly in their high courses, to be deposited as the river current slows down east of Manaus. It is estimated, for example, that over 600 million tons of material in suspension passes Obidos annually. In consequence it has been responsible for the formation of two levels on the previously eroded tertiary deposits, - an old quaternary layer above the present levels of river floods, and a recent level being built annually by the floods which cover it.

The old quaternary is at its greatest development in the river estuary or "island region" of Belem. The area flooded annually is of enormous extent along the main river valley and according to whether the particular area is receiving annual deposition of silt or is merely covered by clear water without material in suspension, the flooded areas are known as Varzea and Igapo respectively, and propose different problems of access, different forests and different land utilization possibilities. In local parlance the firm lands above flood level is called "Terra Firma" irrespective of the geological series it belongs to.

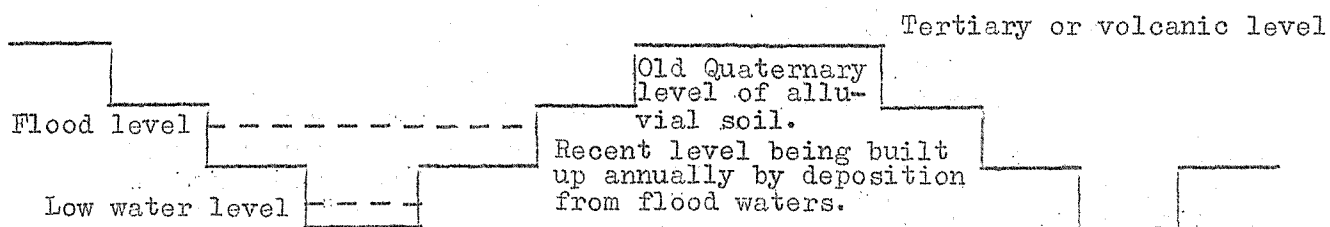
What has been generally categorized as Volcanic above is to the largest extent Archaic - gneisses and granites. But between the Tertiary sandstones and the Archaic are rocks of intermediate age - Palaeozoic - whose complete occurrence is as yet unmapped but which occur as strips paralleling the river axis along the Manaus - Belem sections, on both sides. First appears a strip of Carboniferous, then the Devonian, the Silurian, and finally what is probably Algonkian borders the Archaic.

As the rivers pass over the junction of the volcanic to the softer sand-stones, they spill over in rapids or small waterfalls which are known collectively as "cachoeiras". In this connection it is of interest that the Amazon-Solemoes axis is somewhat closer to the Northern watershed - and to the junction of the volcanics with the sandstones - than to the South. In consequence since the watersheds to North and South are of almost equal elevation, water travels in a much more leisurely fashion to the river from the South fall than from the North. As a result:

1. Shipping may continue from the Amazon up any of the Southern tributaries for a very considerable distance (e.g. to Porto Velho) before it encounters the shallows of the rapids, and there is a big belt of country on the South side from which timber may be rafted, below any difficulty from rapids. And even for timber above the rapids on the south side (as is practically all the Mahogany belt), there is nothing like the difficulty in river floating that the very considerable falls on the North side constitute.

2. Though on the North the general fall is almost imperceptible, the drop from the level of the volcanics to Amazon level is relatively close to the main river, and instead of mere rapids, the crossing of the junction of the two series produces real waterfalls. It is only on this side that there is any immediately utilizable hydroelectric potential, and this is of major interest in the Territory of Amapa in all the tributaries from the Rio Jari to the coast, and in the rivers running directly to the Atlantic north of the mouth of the Amazon. There are possible exceptions of material local importance, e.g. in the vicinity of Santarem, but in general the sluggish progress of the Southern tributaries is interrupted only by scattered chains of rapids whose potential could be availed of only at a high capital cost.

A general diagrammatic section of what would result from formation processes would be something of the following type:



However, as will be shown later, this simplified illustration is generally varied somewhat, and often importantly, by the detailed formation processes in any particular locality.

Generally the difference in elevation between the recent and old quaternary levels is a few feet only, but the rise to the Tertiary "Planalto" is a matter of some 60 meters (200 feet) which may be quite abrupt but, more usually, a series of eroded levels separates the two. In being covered by flood at some period of the year and dry for the remainder, the extent of the recent level has a most important effect on access possibilities. It is of its widest extent within the greatest expanse of the old Quaternary. The closer vicinity is to the volcanics, the less the Recent, and when quite within the Volcanic series, it is of little practical consequence to access considerations. It is important to observe therefore that along the Tapajos and down past Santarem the volcanics approach the river, and Terra Firma closely borders the river until approaching the Xingu it once



again recedes from the river. Between Parentins and Obidos the Terra Firma is so close to the river on the South as to push it into a bend to the North, towards the Volcanics on that fall, and at Obidos the river is contained in a single course, for the only time, between the Terra Firma bluffs on either side.

In contrast to the irregularity of the flood plains at the river mouth, within the wide expanse of the Quaternary series and in the area immediately east of Manaus, to the west of Manaus it is a much more regular and clearly defined border to all the rivers until well into the Volcanic region. Its extent above Manaus has not been mapped but it is probably very much greater than the 1% of the total area east of Manaus flooded annually in this section.

### Climate

The Amazon region runs true to the general conditions of the world's equatorial regions as regards temperatures, - dry bulb temperatures are only moderately high and are not of themselves sufficient to cause discomfort. But there is little variation in the daily or annual range of dry bulb readings. The warmest weather is generally in the low rainfall period and the coolest in the wet season. But the range is slight. At Belem with a mean of 25.9°C the range is only 1.4°C between the hottest and coolest months and at Manaus it is only 0.3°C greater. The daily range is greater but still only moderate. Near the coast the average maximum is about 30°C, with absolute maximum rarely above 32.2° and the minima averaging 22°-24°C seldom drop below 21°C. Further inland the disparity is greater with absolute maxima above 35°C and minima of 15°C and a general range of 8°-11°C occurs between day and night.

Similarly, wet bulb readings are maintained, - but in the very high range. The humidity increases gradually from the coast inland and at Manaus the relative humidity for August, the driest month, is 74%. For the whole area the annual relative humidity averages about 80%.

But the almost universal availability of a pleasant breeze is most important in relation to human comfort in the Amazon and one whose effect is incapable of sufficient expression in the statistical attempt to characterize the Amazonian climate. The area is one of light winds and occasional calms, or general trade winds. High winds are practically unknown, and no tropical cyclones invade the area. For nine months of the year the NE tradewind is directed squarely offshore and blows right up the valley, and the more unpleasant season (July - October) inland in the area is associated with the establishment of the doldrum trough north of the area, in consequence of which the winds do not blow directly inland. The decided contrast between the rather pleasant, if tropical, climate of Belem and the sticky unpleasantness of Manaus, despite its cooler nights, is understandable more in terms of the breeze than by the somewhat minor difference in temperature readings.

No one center will typify the Amazon, but it is not misleading to suggest Santarem as typical of conditions applicable to a large area most favored for colonization. The highest temperature ever recorded here is 35.6°C, the lowest 18.5°C. The mean annual temperature is 25.6°C and the means of the hottest and coolest months only 1.5°C separated. The mean annual humidity is always in the eighties and the daily mean varies throughout the year from about 75% to about 90%. But the noticeable amelioration of the almost ever-present sea breeze is not measurable by available statistics.

The area is one of abundant and distributed rainfall amounting to perhaps 2030 mm (80") for the area as a whole. The annual isohyets show a belt of below average precipitation running north along the Xingu to the Amazon and then bending west of North along the border of Pará State and Rio Branco into British Guiana. In this belt the annual rainfall may drop to 1525 mm (60"). On either side, a wetter belt covers a crescent on the East, which includes most of Amapa and all the island of Marajó, and then swings away to the coast at San Luiz, while on the west the wetter belt is bordered by the Negro and the Tapajos and extends inland beyond the borders of Colombia, Peru and Bolivia. Within the latter belt are two centers of very high rainfall, one in the NW corner and one on the Rio Coruru which together with a lesser crescent on the coastal strip constitute the three zones which experience rainfalls of over 100".

Despite the central depression the track of the rain is in an east-west face which moves up from the south delivering its maximum effects at a progressively later time as it slowly moves northward. Thus the belt across Guapore and East to the coast receives maximum wet season effects in December-February, along the Amazon in mid-February to mid-May and finally the northward progression of the rain-producing conditions crosses the Northern border between mid-July to mid-October. The complementary driest months are similarly June-August in the south, mid-July to mid-October along the river and January-March on the Northern border. However, it is necessary to observe that despite the marked alternation there is sufficient rain throughout the year for the bulk of the area to conform to Koppen's Af classification. Only in the N-S low-rainfall belt through the interior is the rainfall so low that its reliability in the dryer months of any year is occasion for concern.

The climatic conditions are completely favorable to luxuriant vegetation. That it is not luxuriant, on rain forest standards, is due to the poverty of the soil. That the area is not peopled by a dense native population is again due not to its climate but to other factors not least of which is the poverty of the soil. It is not a climate of the type favored by the most advanced races of human beings, but it is nevertheless not one which offers these same peoples any great difficulty of adaptation. There is, in effect, no climatic bar to the satisfactory colonization of the Amazon by suitable immigrants.

### Hydrology

The principle characteristic of the stream flow of the Amazon and its larger tributaries is the fact that each year they rise to an annual floodcrest and then recede to a period of minimum flow. As an average the cycle starts at dead low in September-October, the rivers start to rise in November and continue to rise to a top level in May after which they start to recede again. The recent Quaternary level in such a cycle, is flooded generally from early February until towards the end of July. The difference in highest and lowest levels is generally very great. At Porto Velho for example the average is 13 meters (42 feet) between recorded extremes of 16 meters (53 feet) and 10 meters (33 feet). At Manaus the average is 10 meters (33 feet) and the recorded extremes 14 meters (46 feet) and 5.5 meters (18 feet). Below Manaus the waters spread out over a vast area and the annual variation in height is considerably less than it is on the Jurua Purus and Madeira rivers. At the mouth of the Xingu it is only 2.4 meters (8 feet) and from there on the tidal effect is responsible for arresting the downstream differences in level.

In any particular river the rise to maximum height is generally a downstream progression but this is not true of the Amazon itself, probably because of the fact that the inflow of water from the North bank is materially later than from the South which first experiences the onset of the wet season. At Porto Velho the crest of the readings is experienced generally between the 20 - 30 March. At Iquitos 10 - 15 May. At Jaracua, on the upper Negro the crest occurs in June. On the Amazon the effect of this difference of flood time over the basin gives maximum floods at Iquitos 10 - 15 May, Esperanca 20 kilometers and travelling at 30 kilometres (18 miles) per day top flood can be expected at Jefe about June 20th. However, at Manaus top flood is on the average on 22 June. But Santarem's top flood (18 May) is a month past by that time. Obidos' peak is 2 days after Santarem's and Parentins' a further 3 days later. On the other side, the top flood at Porto do Moz and Arumanduba occurs in late April.

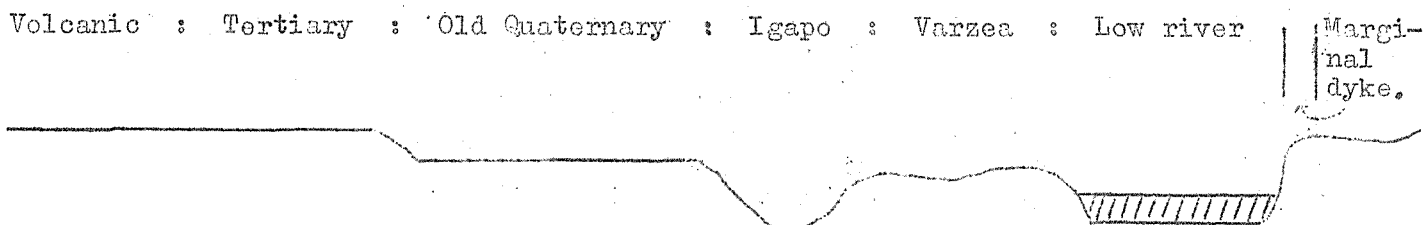
The tidal effect at the river mouth offers some assistance to river transport upstream and is of major benefit to the island region. But though tidal effects are noticeable even beyond Santarem as far as Boim on the Tapajos, the flow is always outward beyond Maraca.

The lower courses of the major tributaries of the Amazon itself are, in truth, a system of lakes and paranas, and interlocking interlacing watercourses spread over a vast width, with the mother river winding between them. And in addition to direct discharge to the main river the tributary streams frequently enter a network of lakes or deltas which may themselves be interlaced with those of the adjoining tributaries before their waters finally reach the river proper. It would be possible, for example, to travel by launch from Parenteis to Fanta Boa and cross the main river once only in what is, by the most direct route, 1240 kilometers (774 miles).

In the lower rivers the rise of the floods may inundate all the intervening land and give rise to enormous areas of Varzea. Further up the rivers the "Varzea" or land actually inundated decreases but there may still be a wide belt of low flat Quaternary land bordering the rivers through which wind an anastomosing system of depressions and dry water courses which will be flushed by backwaters of the main stream in the flood period. As such then, these flood courses may in the wet season provide the assistance of water access to somewhat within the forest. However, these courses, as distinct from major "Igarapés", run, at most, merely to the foot of the planalto and in the dry period constitute a problem in land transport to the main stream. When they do carry water, they are at best a very indirect means of progress. The backwaters which flush them enter the system by so many devious routes that there is no reliability in the direction of the currents along any one route. Thus progress is now with the assistance of the current, now against it, and the direction changes at each junction and each entry to a swamp. The utilization of this watercourse system thus may enormously increase the distance to be manoeuvred, and requires intimate local knowledge to ensure that eventual delivery is to the desired vicinity.

The rivers of the Amazon are of three types classified according to the amount of silt they carry as "white" (e.g. the Amazon or the Madeira) "clear" (e.g. the Tapajos) and "black" (e.g. the Negro or Cururu). In different sections the one river may correspond to each of the three types. Where the white waters back out over the flood plain and in losing velocity deposit suspended material, the resultant is "Varzea" proper and a characteristic forest type. The "clear" rivers carry almost no suspended material and characteristically run slowly between terra firma banks on either side and have no flood plain. The "black" waters are almost as transparent but are stained with minute particles carried. When they overflow back out over the adjoining flood plain, they give rise to a different set of conditions to those of "Varzea" and to a different class of "Igapo" forest. From only a slightly different process igapo is formed also along the "white" rivers either by the progress inland of waters which have already lost their suspended material closer to the river, or by the blocking inland of local runoff of the black or clear type whose egress is prevented by the rise of the main river.

Thus in contrast to the simplified illustration of the typical section previously given, the more complete picture, from the aspect of forest type and access problem is as follows:



(As previously suggested depending on the particular characteristics of the locality, any of the belts bordering the river may be absent).

It is of importance that whereas the Varzea is being built up by deposition and may carry swamps of water trapped by the formation of banks, swamps are much more characteristic of the Igapo where the depressions are formed by erosion of the surface as the flood waters recede.

#### Soils.

The existence of a so-called "luxuriant" rain forest vegetation is the origin of a very considerable and misleading literature on Amazon agricultural potential. For it has not been recognized that a rain forest is primarily the creation of the climate, that it lives mainly on its own wastes and once established is largely self-sustaining. Its major requirement of the soil is continuous moisture and it makes very little chemical demands on the soil, and almost none on the upper horizons which agriculture would utilize.

The most significant evidence as to the possible value of the soil is provided by laterization which in a general way attacks all the soils of the Terra Firma. There is considerable doubt as to whether the exact chemical process is truly one of laterization or of tropical podsolization but for practical purposes the end effect is the same - with leaching of the soluble bases, the soil is finally composed of variable proportions of hydroxides of iron and aluminum, and in their most advanced condition they are able to offer no element assimilable by plants. As Gourou states:

"The laterites (of the tropics) are strictly infertile.... they contain no soluble products, no nitrogen, no potash, no lime, no phosphoric acid, no humus. Also in most of the laterite because of its compact texture and its impermeability it is hostile to vegetation. The lateritic crusts.... are absolutely useless."

That the Amazonian soils have not proceeded to this final condition is due to the forest cover which protects the soil from the conditions necessary for advanced laterization - absence of humus, open exposure to precipitation, marked alternation of wet and dry soil moisture conditions, high soil temperatures. But the evidence of this type of soil alteration is available over the whole region - the general appearance of concretations of hydroxides of iron and aluminum giving to the formation a layer or layers of concretations or encrustations, - or at least their forerunner, the formation of spotted nodules in layers below the surface. As would be expected under these conditions, such scattered sampling as has been carried out reveals that the soils are acid and extremely poor in exchangeable bases.

In this respect, however, the soils of the Varzea regions are unique in the Amazon in that they are not attacked by laterization, and being provided annually by depositions from the "white" waters their fertility is greatly favored to inundated cultures. The Varzeas offer the only areas naturally favorable to sustained agriculture in the Amazon, but control of the water required to permit that they be utilized to full advantage, and the difficulty of mechanized working, present real difficulties to modern methods of producing the type of foods the Amazon requires.

On the Terra Firmas agriculture has been practicable only by shifting regularly to new areas. Generally 1 - 3 crops are all that is possible but rare instances of six crops of manioc have been observed. In the Brajanca region, traditionally Belem's local supplier, increasing population has shortened the rotation under which land has to be re-utilized to the point that, through exposure, they are now in a state of advanced laterization. But if properly organized there is no reason, except economic, why shifting cultivation on long-term rotations should not be practicable. Otherwise the Terra Firma soils could not provide, for permanent agriculture, more than the physical vehicle for applied chemical plant foods and for such a purpose this physical condition is quite good. The conditions which initiate laterization do not at the same time permit the complete leaching of the finer fractions to any great depth. The top horizons of the Tertiary and older soils is a somewhat loamy clay of fair tilth. The Quaternary soils, having been built of the deposition of the Tertiary runoff are more definitely horizoned into a loose sand overlying clay loam above a clay. But manipulation of this chemical condition would require very skillful application of fertilisers, both to provide the necessary plant foods and, at the same time prevent their eventual degeneration under exposure. The richer volcanic soils offer greater - if more remote in location - possibilities of continued agriculture on the firm lands, but these similarly are affected by laterization processes, and experience of lixivation and erosion following deforestation of somewhat similar soils of the Rio Paraiba do sul, the Paulista plateau, Rio Doce, etc., to the point of loss of all fertility, does not induce optimism here.

Population.

The 1950 census puts the population (excluding Indians) as follows:

Guapore	37,438	or	.07%	of all Brazil	or	.15	per km <sup>2</sup>
Acre	116,124	or	.22%	" " " "	" "	.76	" "
Amazonas	530,920	or	1.01%	" " " "	" "	.33	" "
Rio Branco	17,623	or	.03%	" " " "	" "	.08	" "
Pará	1,142,846	or	2.17%	" " " "	" "	.96	" "
Amapa	38,374	or	.07%	" " " "	" "	.29	" "
Totals	1,883,345	or	3.57%	of all Brazil	or	.56	per km <sup>2</sup>

The latest statistics available as to type, are those of the 1940 Census which indicated the following position:

Total population:	1,462,420
Masculine	- 51%
Feminine	- 49%
White	- 41.2%
Black	- 9.8%
Yellow	- .2%
Brown	- 49.5%
Undeclared	.3%

The progress of population over the last 80 years has been:

1872	total	332,847	or	3.29%	of all Brazil at that date.
1890	"	476,370	or	3.32%	" " " " " "
1900	"	695,112	or	4.01%	" " " " " "
1920	"	1,439,052	or	4.70%	" " " " " "
1940	"	1,462,420	or	3.55%	" " " " " "
1950	"	1,883,325	or	3.57%	" " " " " "

The influence of the major and minor rubber booms in the Amazon are clearly evidenced in these figures.

The number of cities and villages established in the area as at the 1950 census was:

Total	0-5000	5-10,000	10-20,000	20-50,000	50-100,000	100-200,000	over
Guaporé	9	8	-	1	-	-	-
Acre	9	8	1	-	-	-	-
Amazonas	54	51	2	-	-	1	-
Rio Branco	1	-	1	-	-	-	-
Pará	159	151	6	1	-	-	1
Amapa	10	9	-	1	-	-	-

and the population represented was:

Guaporé	3,944	-	10,205	-	-	-	-
Acre	12,195	9,592	-	-	-	-	-
Amazonas	38,177	11,218	-	-	-	110,678	-
Rio Branco	-	5,125	-	-	-	-	-
Pará	117,786	37,397	14,604	-	-	-	230,181
Amapa	3,920	-	10,094	-	-	-	-
Totals	176,022	63,332	34,093	-	-	110,678	230,181
% of Popula.	9%	3%	2%	-	-	6%	12%

The total people living in cities or villages is consequently 615,116 or 32% of the total population, the remaining 1,268,229 or 68% of the population being scattered as single families or very small groups along the rivers.

The population of the state and Federal Territory capitals and the largest other cities were as follows:

Belem (capital of Pará)	230,181	7th city of Brazil
Manaus (capital of Amazonas)	110,678	12th " " "
Santarem	14,604	145th " " "
Porto Velho (capital of Guaporé)	10,205	
Macapa ( " " Amapa)	10,094	
Rio Branco ( " " Acre)	9,592	
Boa Vista ( " " Rio Branco)	5,125	

Since that date the populations of Santarem and Macapa have increased substantially, the latter by 50%.

The distribution of the population according to age was:

	Total	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
Acre	79,768	25,010	17,591	13,373	8,146	7,564	5,635
Amazonas	438,008	134,871	104,142	79,214	51,068	34,165	21,090
Pará	944,644	272,933	215,913	171,481	121,044	80,226	47,696
Totals	1,462,420	432,814	337,646	264,068	180,258	121,955	74,421
	60 - 69	70 - 79	80 - 89	90 - 100	100 +	Unknown	
Acre	1,844	473	87	18	10	17	
Amazonas	9,042	2,871	763	167	46	569	
Pará	22,404	7,838	2,500	800	144	1,665	
Totals	33,290	11,182	3,350	985	200	2,251	

The outstanding characteristic of the people of Amazonia is the persistence of the identity of its constituent groups. Each became established in the basin under the influence of particular amenity to its most determined characteristic, and three centuries have produced merely a more pronounced harmony of each group in its original character with its Amazonian environment. But none of the groups is of a type which would conduce to sound colonial development and none constitute a basis on which a new order could be built. Indeed, though some measure of their incorporation in a new approach to the utilization of the area is possible, the development would require new peoples from other parts of Brazil and elsewhere, and would be largely independent of the present Amazonians, if not even despite them.

Essentially the Amazon is "occupied" by peoples having their origins in the Northeast - either in the sugar lands or in the subsequent cattle country of the periodically drought-stricken region. Whatever the history of the long Brazilian conflict between liberalism and the semi-feudal society of the country's early beginnings, the Northeast was the final stronghold of the resistance to the upsurge of liberalism centered further in the South. In receiving its inhabitants from such a background, the Amazon obtained at once the establishment of a set of social values which because of its own conditions of climate productivity and vast expanses, has since been little influenced.

The "trader" is King of the Amazon - as he was, elsewhere, in Brazil's early beginnings. In bartering goods for the products of the forests assembled by the "cabocles" scattered along the margins of the vast waterways, the trader established a collection economy in which his own pre-eminence is completely secure and in which his mercantile outlook is paramount. Under such domination no more than a speculative economy is possible, and thoroughly adjusted to the conditions, despite the alternations of boom and collapse, the trader's dispersion of interest over rubber and nuts, timber, oil, minerals, and not least, monetary exchange, has kept him steadily in control of the financial sources of increasing local prestige and substance.



Essentially town dwellers the "white" 41% of the population peoples the Public Service, Banking Trade and Commerce. The white looks to achieve by wealth, power, or position a place of prestige in the community. The advantages of higher education are practically restricted to the whites, but its cultural benefits are applied primarily to the attainment of social prestige. Thus while he applies himself to Medicine, Architecture and Law, the field of Mechanical and Civil Engineering is neglected. Manual work is abhorrent to his general character. With its roots in feudal-like beginnings the relation of patron and dependent has persisted in the reciprocal recognition of trader and cabocle with the invariable corollary that the white trader has it in his power to maintain the dependence economically. Whatever the volume of the cabocle's collections, the equating power of price of the trader's goods derives for the primary producer the barest necessities of existence.

With the ability of the few to obtain at low cost the output of the many it is natural that very considerable fortunes are amassed and as a result, that political power is concentrated in the hands of the few to whom maintenance of the existing order is individually essential. And an underpaid and ineffective Public Service has subscribed to rather than resisted the entrenchment of the powerful few in a position to control general Amazonian development.

The negro, or substantially pure negro, is the wage laborer of the Amazon. He is a completely satisfactory reliable manual worker and possesses a very high degree of skill in performing routine work. In admixture with white blood, however, his desire is generally to leave the ranks of manual workers and if possible seek a position of some social esteem. Most of the artisans and mechanical workers come from this class. In carrying out routine maintenace to which they have been trained they are quite reliable, but when facing a problem outside their previous experience, their attention generally creates a major failure from the minor cause. To a large extent this tendency springs from lack of basic technical education. But when educational facilities are available, again its attraction is the prestige it may provide and its goal the position of overseeing ability to avoid contact with manual work.

The cabocle, 49% of the population, is the basic foundation of the collection economy. He is essentially a man of the river and forest. He is nomadic and not disposed to agricultural practice, and no attraction as, for example, was offered him in the Ford plantations could either anchor him or buy his continued performance of plantation work. Education, far from securing him to the land, at once tempts him to the city.

He has very real innate ability but little opportunity to develop it. He has only rarely been shown how to work or the correct tools to use, and when he is, he adopts new methods, at least in his old crafts, only slowly and with psychological difficulty. But he has great personal skill as a hunter and with river craft. His output in work is high despite that his tools are the most primitive. He has a natural mechanical bent

and works excellently and interestedly with factory machinery. But he maintains nothing and without proper supervision quickly destroys any machinery in his care. Yet when thoroughly trained to normal maintenance he can keep a motor launch or a telephone exchange working well. But given a break-down beyond his previous experience, and like the negro, his attempted repair generally produces serious trouble.

He is obedient to orders and in accepting the relation of dependent to patron is incredibly loyal to the trader, or other employer in an association economically loaded against him. He has a natural courtesy and keen appreciation of any assistance he receives. He is a willing worker and no physical effort is too great for him to attempt. But his continued satisfactoriness as a worker requires both that the type of work be compatible with his temperament and that he feels himself completely independent to perform it in his own way and, largely, in his own time; whatever his relation to his employer, in fact, only with great difficulty could he continue an engagement in which he was made to feel subservient.

Timber work appeals to him in the forest, on the river or in the sawmill. In the mill routine work with logs, lumber and machinery attracts him. In the forest the diversity of work in his native element makes work akin to the carefree picnic existence of his natural inclination.

The cabocle's most serious failing is his unreliability. Once his financial condition permits his nomadic instinct to find expression, he perceives little obligation to his present employment whatever its urgency. An engagement entered into with good intention can easily be diverted from performance; and though essentially honest, when the urgency of freedom of action drives, he will secure the initial advantages of an engagement which he may have little or no intention of honoring. In contrast, the women are excellent and reliable workers and if socially emancipated and freed from household chores and their ubiquitous offspring, would undoubtedly make excellent factory workers.

The wide dispersion of cabocle population along the rivers leaves little opportunity for education, hospitalization, or other social amenity. The cabocle lives on what he can shoot, catch or collect in the forest plus the ubiquitous manioc and sporadic planting of bananas and pineapples. He can live in plenty from the natural products of the land and his housing requirements in such a climate are readily obtained from the timbers and palms of the forest. But he has some predilection for other foods, particularly canned goods, and for these and all his other requirements he is almost perpetually in debt to the trader.

No exact estimate of the last population group, the Indians, has been made but the best estimate places their number at 10,000.

Settlement along the margins of the main rivers and tributary streams had the effect of driving the native Indians either to the headwaters where effective settlement has not penetrated, or to the planalto between the major streams. They belong to many tribes some of which are docile but in the main they are hostile - either naturally so or as a result of atrocities committed on them in the frantic urgency of the rubber boom of the early years of the century.

The official Government attitude to the Indians is extremely sympathetic and laws relating to the interaction of Brazilians and Indians weigh very heavily in the latter's favor. Despite this, "civilization" has contrived its own very realistic measures to control any Indian menace.

Though they are a danger to unaccompanied explorers in the jungle, the Indians will not usually attack groups of men. But tribes of exceptional ferocity, e.g. the Tupi or the Gê Indians, cannot be relied on to subscribe to this generalization. On the Tocantins river, for example, it is almost an annual event for the Tupi to come down from the interior in the dry season when food is scarce and "shoot up" the Government train which cuts them off from the river and its fishing. But, unless familiar with the phenomenon, a machine of any kind (e.g. a tractor) readily terrifies the Indians and rids the area of their presence.

Nevertheless, it is of interest that the whole of the Mahogany belt is peopled by Indians and any real extraction industry there would have to take serious precautions to ensure the safety of both personnel and equipment. Otherwise, Indians are of no consequence in the areas at present being worked, and there is a considerable area available for extension where there is no Indian problem.

#### Health

Though Malaria is by far the greatest "killer" in the Amazon, the major health problem is one of nutrition and sanitation.

Malaria has made several spectacular outbreaks in the Amazon (notably on the infamous "life per sleeper" Guaporé railway), but it is neither so great a hazard as elsewhere in the tropics nor is it generally as easily controlled. Of 30 species of anopheline mosquitoes in the Amazon, only two carry malaria, and one of these breeding only in saline waters, is not only restricted to a small area on the coast but has been completely controlled.

*A. darlinjii* is the Amazonian malarial vector but research has demonstrated:

1. It is only rarely contaminated.
2. It is not a house type and enters the house almost only at night.
3. Its appetite is not restricted to human blood but feeds on dogs, chickens, horses, etc.
4. It needs pure clear water substantially open to the sun.
5. Within the house, it rarely rises more than 3 meters from the floor and DDT sprays to control it have no real need to cover more than the walls.

With complete knowledge of conditions which make for the occurrence of the vector and of the ready means of control, it can be stated that malaria is no longer a problem except where, by reason of the scattering of population, effective control is difficult to implement.

However, other tropical diseases are well known and in particular hookworm, amoebic dysentery, bacillar dysentery and intestinal worms. These diseases affect a very large percentage of the population and though not themselves the reason for the death rate, they cause much suffering and misery, and reduce resistance to such a point that death from other causes is inevitable. There are in addition various ulcers, etc. which cause distress but the incidence of all of these is of minor importance. Filaria, and its final stages, elephantiasis, have previously been serious but their culex vector has been practically eliminated in the process of malarial control. Otherwise the diseases of most importance are similarly those of the temperate regions - syphilis, respiratory diseases, etc.

There are no endemic diseases which are of serious consequence, and the problem of health in the Amazon is one of education, hygiene, nutrition, medical attention and health organization. Several Government Health Services (S.E.S.P., Malarial Service, etc.) exist and have shown excellent results when allowed to operate without political interference. The health of the poorer people is very much better in the interior than in the cities, for the forests offer a better and more nutritious variety of foods than the city dweller can afford to purchase. But medical service for normal illnesses is something only the rich can afford and hospitalization is beyond the capacity of the laborer.

There is no evidence to suggest that a colonization based on modern lines would be confronted by any serious problems in health. The Amazon cannot be regarded as one of the natural malaria-dangerous areas, and on all counts it is more accurately designated as one of the most healthy tropical areas of the world, despite a present average expectation of life of only 39 years.

#### Education.

The Brazilian constitution proposes very embracing provisions for education at all levels. Education is a Federal concern but with 57% illiteracy the opportunity is provided to take advantage of any local assistance which might be offered. In the Amazon, primary education is provided in the cities, and attempted in the small villas, but it runs into practical difficulties of political interference, incapacity of teachers if available at all, and apathy of parents themselves illiterate. Although schooling is compulsory for children between 7 - 12 years, few register outside the cities, and of those who do, absenteeism is very high. And in addition, with 68% of the population living beyond villas and cities, the problem of effectively lifting the present rate of 39% of literacy is a very difficult one.

Opportunities of secondary and technical education exist in the cities but the standards appear to be extremely low and the schools unequipped to handle science subjects adequately.

So far Amazonia has no university but in both Manaus and Belem the independent faculties devoted to specific education are in process of agglomerating to achieve the establishment of a university in each city. Constitutionally universities may be established by the joining together under an autonomous administration at least three of these faculties, one of which shall be a faculty of Philosophy, Science, Letters and Education, and two of which shall be Faculties of Law, Engineering or Medicine. The bias to the Arts is noticeable and it is equally significant that the origin of the Manaus University will be the original faculties of Law and Medicine. There is no Forestry faculty in Brazil but some forestry may be taught in extension of Agriculture.

#### Religion

The 1940 statistics are the most recent obtainable and shows:

Catholics	98%	(Brazil figure 95%)
Protestants	1.1	
Spiritualists	.2	
Jews	.1	
Atheists	.1	
Undeclared	.5	

In joining together Negroes, Indians and Portuguese Catholics under the one creed, it is natural that the outward expression of the result, whatever its conformation to universal dogma and ritual, should have derived outward forms which are characteristic of its adherents. The original substitution of new forms for the voodooism of the Negroes' previous espousal, the similar coloring which the Indian brought to his new religion, and, above all, the Mohammedan colorings of the 400 years of Portugal's occupation by the Moors, have all left their indelible mark. The church has always been the center round which the towers have grown up. In the small villas the church fronts the square which is the forum of village life, and every small collection of houses has its chapel building. But the problem of dispersion of population proposes to church authorities the same problem as confronts civil services. Regular guidance by ordained priests is physically impossible and the direction of common worship falls to one of its prominent members and receives in consequence the full impact of personal and local expression of the means whereby intimate relationship with the Deity can best be maintained.

#### Language

The universal language of the Amazon, as of all Brazil, is Portuguese. The Indians each have their own dialects but the "Lingua geral" is a common understanding of all. The 1940 Census showed Amazonia to be peopled

99% by Brazilian nationals and there are no foreign minority groups, as might be met in South Brazil, where a foreign language has persisted.

Land tenure and land use

Land tenure

It is sufficient to the present purpose merely to indicate that it is quite impossible to determine where property rights exist, their limitations in the field, and the rights conferred by the tenure. It would be an essential basis for the establishment of any new forest industry, and is indeed necessary to existing industry, that this question be completely clarified. An extensive investigation involving the services of a lawyer thoroughly acquainted with the land laws of Brazil should be initiated without delay and its results implemented to the point that maps be available at all Municipal offices indicating with legal certainty the boundaries of each parcel of land in the Municipios. And further, action should follow to ensure that land required for developmental projects be available and not allowed to remain in a holding beyond its owner's needs or capacity to use.

Land use

The available figures for areas covered by the different forest types are lacking in many important respects. The Instituto Brasileiro de Geographia e Estatistica is in process of determining a reliable estimate of the various types State by State. Meantime on examination of all the information available the areas are of the following order:

Rain forest	3,321,000 km <sup>2</sup>	or 93%	of total	(332 million
Savannah	190,000 "	"	5%	" " hectares)
Steppe	15,000 "	"	1.5%	" "
Litorian vegetation	45,000 "	"	.5%	" "

The Savannah is located mainly in the territory of Amapa, on the island of Marajo, in Rio Branco and in patches along the main river. The steppe is primarily in Amapa.

To the greatest extent cattle raising is practised on the Savannahs particularly on Marajo island, but there is some cattle raising in the lake country bordering the main river. The estimate of animals as at 31 December 1948 was as follows:

	Cattle	Horses	Donkeys	Mules	Hogs	Poultry	Goats
Guaporé	3,980	290	30	410	7,300	1,360	800
Acre	30,310	2,470	280	7,720	56,480	21,020	4,570
Amazonas	126,540	7,990	2,460	3,280	93,930	15,270	8,370
Rio Branco	130,000	9,500	10	50	8,000	4,000	2,000
Para	830,370	116,040	3,320	12,680	387,490	48,820	44,450
Amapa	60,580	2,260	-	120	6,330	780	390

The pre-eminence of Para under each of these heads is noticeable and is not proportionately related either to area or population. The figures for all grazing and agricultural pursuits are in fact inversely related to preoccupation with rubber, and so also indeed is the general position of the individual state's prosperity.

There is no dairying industry in the Amazon and cattle are raised almost solely for meat production which in 1949 was as follows:

	No. slaughtered	Meat produced	Av. per beast	Av. per head of population
Guaporé	5,062	681 metric tons	135 kg.	18.4 kg.
Acre	6,536	954 " "	149 "	8.2 "
Amazonas	21,591	2,649 " "	123 "	5.0 "
Rio Branco	3,760	507 " "	135 "	28.1 "
Para	78,661	11,137 " "	143 "	9.8 "
Amapa	3,474	461 " "	132 "	12.1 "
Total:	119,084	16,389 m.t.	Average: 142 kg.	8.7 kg.
Average for Brazil:			158 kg.	18.3 kg.

The low consumption of locally raised beef in the Amazon, as compared with the Brazil average, which itself is very low for a primary producing country, is not offset by the average annual consumption of approximately 2.75 kilograms of other meat (pork, poultry and mutton) or by the importation of sundried meat from South Brazil or Bolivia. Meat is perennially short in the markets of the larger cities, but in the interior the lack is offset by chicken-raising and hunting. Fish are abundant in the Amazon but prices are high and other than dried fish are scarce.

The low output of meat per beast is worse than the Brazil figure would indicate for the cattle slaughtered are substantially older. The reason is not disease, for foot and mouth disease which affects southern and central Brazil is almost absent. Cattle of even cold country types (dairy breeds, Friesians, Jerseys etc.) do well if looked after, but the real difficulty is the poverty of the natural grasses. The breeds which are hardy on such a combination of feed and climate do not produce beef quickly. The solution of pasture improvement is as yet not entertainable, for cereal crops bring such high prices that it is uneconomic to grow grass artificially when the same country would feed protein to the people more efficiently.

#### Area cultivated

The total areas cultivated as of 1949 were:

Guaporé	301 hectares
Acre	10,975 "
Amazonas	7,399 "
Rio Branco	423 "
Para	111,840 "
Amapa	751 "
Total:	131,689 hectares or .04% of the total area

Since 1949 the acreages have remained steady in all cases except Amapa which has increased steadily from 174 hectares in 1944 and has more than maintained the increase since 1949.

The major crops of these cultivations are (in hectares):

	Guaporé	Acre	Amazonas	Rio Branco	Para	Amapa
Pineapples	13	211	110	2	115	16
Cotton	-	-	30	-	5,091	-
Peanuts	1	28	-	-	3	-
Rice	63	1,524	222	18	28,126	69
Bananas	46	668	551	16	731	19
Sweet Potato	3	98	166	2	276	29
Cocoa	-	14	2,150	-	8,641	16
Coffee	-	656	41	-	24	-
Sugar cane	17	1,334	532	-	5,825	5
Onions	15	-	10	-	531	1
Cocoanut	2	21	3	-	331	1
Fava bean	-	-	6	-	48	-
Black beans	21	1,184	774	20	4,651	49
Tobacco leaf	10	256	195	125	3,544	43
Maizes	7	84	125	-	371	1
Mamona	-	-	-	-	110	-
Manioc	61	2,294	1,869	150	34,377	36
Corn	61	2,729	791	90	19,901	93
Tomatoes	1	29	56	-	93	-

All of this production (other than tree crops) is by shifting cultivation and the figures well illustrate that only in Pará is the annual acreage under production of any consequence - though still not nearly sufficient to meet local needs. The Braganca (Quaternary) region is Belem's traditional supplier of agricultural produce, and is substantially the area of Pará's agriculture. In this region the necessity to shorten the rotation cycle which is the inevitable consequence with rising population has completely devastated the area, and a new region is now being opened up in the Guama valley. Bearing in mind the excellent climatic conditions a good picture of the combined poverty of soils and agricultural practice is given by the production per hectare of a few crops in the state of Pará:

Peanuts (in shell)	199 kg. per ha.	Rice (in husk)	1,065 kg. per ha.
Sweet potato	8,399 " " "	Sugar cane	29 " " "
Onions	1,629 " " "	Black beans	629 " " "
Manioc	9,989 " " "	Corn	882 " " "
Tomatoes	1,206 " " "		

The following data for 1948 are significant of the Amazonian's natural collection psychology and inaptitude for agriculture, and of the course the economy has taken in the hands of the trader. They concern production of the major foodstuffs in the states of Amazonas and territories of Guaporé and Acre, and imports brought into the port of Manaus from outside for consumption in these areas during 1948:



	Production	Net importation	Consumption
Manioc	71,227	-	71,227
Flour	-	9,970	9,970
Sugar cane	52,655	-	52,655
Sugar	-	8,163	8,163
Corn	4,741	623	5,364
Fruit	4,000 (approx.)	44	4,044
Rice	2,131	3,108	5,239
Beans	1,973	1,128	3,101
Sweet potatoes	1,559	-	1,559
English "	-	381	381
Coffee	279	2,114	2,393
Tomatoes	39	-	39
Peanuts	16	-	16
Onions	11	522	533
Milk (inc. tinned)	-	769	769
Jam	-	576	576
Butter	-	303	303
Drymeat	-	317	317
Oils	-	167	167
Cheese	-	17	17
Fish	-	4	4
Totals:	138,631	28,206	166,837

Discounting manioc which was traditionally the one cultivated crop of the Indians and sugar cane which like manioc is processed before consumption and gives a low recovery, it will be seen that almost two-thirds of these primary foodstuffs are imported (in addition to canned and other preserved and processed foods).

There is some local cry for more population in the Amazon and with each Ceara drought comes a new but decreasing dribble of refugees to the Amazon. Until the Amazon can feed itself there is perhaps more logic in the alternative trek to Rio which has put a million in slums in the Capital in the last ten years. For otherwise, whatever the earnings of a rubber-gather in, say, Guaporé, his net return cannot fail to dwindle to nothing when he has to deal with the trader for basic foods which have travelled 2,000 - 7,000 miles to his camp - dried meat from Bolivia; butter from Minas Gerais, Rio Grande do Sul and Sao Paulo; sugar from Pernambuco; rice and farinha from Belem; black beans from Rio Grande do Sul; coffee from Sao Paulo and Espirito Santo etc. etc. The general price for all those items in the high rivers of Guapore is Manaus price (itself high) plus 100%. But it is in such things as cloth and medicaments (Manaus prices plus 200 - 300%) etc. that the cabocle takes the greatest knock. In Guapore perfume (of type fixed price in Rio Cr. \$35.00) sells at 120; cotton blankets (60) sell for 250; shotgun cartridges (Cr.1) sell for \$4; Gin (30) sells for 200 etc. etc.

### Land use planning

So vast is the area and so few the people that there has not been the urgency to complete an inventory or to draw up the classification of land for sound use -- which traditionally comes not to plan development so much as to control extension of land despoilation after the evil has arisen. However, it is constitutionally provided that 3% of the National Revenue of Brazil shall be devoted to Amazon development, and to administer this vote a "Comissão de Valorização da Amazonia" is in process of establishment; which will presumably determine the lines of development and have it in its power to plan for sound land use. But very considerable studies have been made in the Amazon on many aspects connected with possible land use. Without the urgency of a pressing problem, however, they repose in libraries as little more than of academic interest. Until now each of the studies has followed the particular inclination of the worker and has had little reference to the development of an overall picture. As a result there has been much overlapping and misdirected investigation. To a lesser extent the same is true of all Brazil.

Recognizing the need for an integration of any new studies in a definite objective, the Instituto Brasileiro de Geographia e Estatística (I.B.G.E.) has set about the task of assembling what is known of Brazil and in what respect information is lacking. For this purpose the Institute has constituted a number of internal sections each charged with the responsibility of a defined Region, of which the Amazon is one such region. The first task of the Section is to assemble a bibliography of what has been done, secondly to examine, sift and summarize the various treatises, and finally to carry out field studies either to supply missing information or to confirm or otherwise the significant findings of previous workers. In this work it is intended to take the region section by section and give it the detailed study it warrants.

The Amazon section is staffed by competent Geographers, Geologists, Pedologists, etc. who have the full resources of the Statistical Branch at their disposal. They have in addition the cooperation of the Brazilian Air Force and of the State Governors to assist their field excursions and of the Air Survey Section of the Army and the photographs taken by the United States Air Force during the war. They labor under some personal difficulties which hamper continuity of their investigations, but nevertheless they are engaged in serious work which is of fundamental importance to determining sound use of the area. As such they function purely as an advisory organ and can be expected to play an important part in the decisions of the Comissão de Valorização da Amazonia when it is fully operative.

In two respects the organization seems decidedly weak, however; there is no skilled photo interpretation section to advise their field study sampling or to determine the reliability of any general inferences drawn from their field experiences, and secondly, there is no economic botanist or forester attached to the party who could give quantitative

worth to what must otherwise be descriptive findings. Since the Amazon's most extensive feature is its jungle cover, the evidences of its variation on air photos provides by far the most important symptom of the similar variation it is hoped to locate, study and map in the field, be it Botany, Geology, Soil or Topography, or any other physical character of the area.

As a necessary adjunct to such a study, a research institute to further the explanation of I.B.G.E. evidence, or to test its conclusions, is an essential. To an extent such an institution exists in the Instituto do Agriculture do Norte but here again is further instance of the lack of liaison or integration of allied organizations which is so extraordinarily evident throughout the Amazon. In its operation the Institute functions primarily as an Agricultural High School, but in its research activities its liaison is with the Banco do Credito da Amazonia, a semi-Government agency whose overall purpose is to sustain the rubber collecting industry.

The Institute is a well-staffed and well equipped body and has the benefit of an excellent library and ample demonstration areas - including inheritance of all the Ford achievements at Fortlandia and Belterra as well as in the vicinity of its Belem establishments and other areas, notably Cocal Grande.

In addition to its rubber research which functions under its aegis but otherwise appears almost independent of it, the Institute is engaged in several agricultural projects. But in this work there is lack of continuity and the field evidence suggests a succession of discontinued inconclusive projects. It is worthy of note that the rubber research alone has been carried out with the necessary technical skill and persistence, and is now considered to have achieved its purpose of developing a high-yielding disease-resistant strain of Hevea brasiliensis. (It is no less noteworthy that its sponsor, the B.C.A., is proceeding with its encouragement of farm planting of rubber in what would appear to be complete oblivion of the Belterra work, and in practising the old techniques unchanged, is bent on showing a result which can hardly be less tragic than were the original Ford plantings).

The immediate need in the Amazon is the selection of suitable areas and the economic assistance of the establishment of an agricultural industry capable of feeding the present inhabitants, to eliminate dependence on outside sources and the importance of the trader who organises food importation. Sufficient information already exists to permit that this objective be achieved without delay and tentative beginnings have already been made in the Guama valley, at Santarem, at Manacapuru etc.

The additional crops of raw material for export is of next importance, and this is being attended to with jute and rubber, minerals - e.g. manganese - as well as all the other extractive industries which receive the full time attention of the Amazonian.

But the "Amazon" is essentially the planalto and only with its widescale utilization will any degree of real occupation of the area ensue. The poverty of these soils eliminates serious consideration of their settlement on the traditional basis of agricultural colonization. But they carry what aggregates an enormous volume of timber and although geographers have not, as yet, seriously considered the possibility of forest industries as providing the cornerstone for colonization, they do provide such an opportunity and are in fact the only possibility on the basis of present standards of information.

As illustrated elsewhere in this report there exists a market already for a very considerable increase in timber production if production costs are lowered. That this presents no technical problem of any consequence is the conclusion of the investigations carried out by the FAO Mission during the past year. But the existing industry can make no significant contribution to increased production and this requires the establishment of a new industry on modern lines. And it has been shown that this entails the introduction of capital and personnel skilled in the performance of modern industrial techniques, as well as the training of what local labor is available for engagement in the new establishments.

Such an intention would need to be self-sustaining in every phase which could affect its continued operation or risk the expenditure in fixed assets involved. The problem is in consequence not merely one of building a new industry but of finding its best location, establishing reliability of supply, securing operators, and developing a local agriculture, health and medical services, education etc. etc.

In short, timber industrial development and colonization are inseparable complements to each other. To plan a development of this nature involves widening the I.B.G.E. enquiry, either under its aegis or otherwise, into a full resources survey; the development of a forest assessment and survey service, the determination of colonization techniques, agricultural instruction and research; the establishment of a forest service to direct and control the forest enterprise; the demonstration of logging techniques; education carried through to the technical level etc.; and the coordination of the whole under the Comissão. For such a project the fullest cooperation of all sources of technical advice and assistance would be essential and a confidence on the part of all concerned and particularly the Brazilian Government of the practicability and sound economy of the intention. That no proposal to date has provided such a foundation is largely responsible for the lack of any real impetus which would have welded interested parties into a coordinated planning of sound land usage.

ECONOMIC SITUATION

National income and budget

Federal Budget

Since 1938, estimates of revenue and expenditure have increased rapidly.

Instances are:

	Estimated receipts	Estimated expenditure	Surplus or deficit
		in Cr. \$ 1,000	
1938	3,823,623	3,875,227	-51,604
1942	4,988,756	5,626,077	-637,321
1946	11,010,148	9,281,790	+1,728,358
1950	18,775,228	22,290,417	-3,515,189

Budget estimates are seldom balanced.

Federal income and expenditure

There is generally a surplus of actual over-estimated income and expenditure at the end of the year. Where this is not the case, the deficits have been minor. Instances are:

	Actual Income	Difference with estimate	Actual expenditure	Difference with estimate	Net surplus or deficit
			in Cr. \$ 1,000		
1938	3,897,796	+56,146	4,735,434	+860,207	-855,665
1942	4,987,728	-1,028	6,343,206	+717,129	-1,355,478
1946	11,569,576	+559,428	14,202,544	+4,920,754	-2,632,968
1950	19,372,788	+597,560	23,669,854	+1,397,437	-4,297,066

The usual outcome each year is a net deficit. During the ten years, 1941 to 1950, there was a small net surplus in two years only, 1947 and 1948.

Using 1939 as a base, when income and expenditure are equated to 100, income rose from 109 in 1941 to 445 in 1950, while expenditure rose from 112 in 1941 to 488 in 1950.

The changing pattern of revenue is of interest. Details for 1941 and 1950 are:

	Receipts of Cr. \$ 1,000		Percentage of total revenue	
	1941	1950	1941	1950
Imports duties				
Port dues etc.	1,058,775	1,694,871	22.22	8.75
Excise Tax	1,185,495	6,409,818	24.88	33.09
Income Tax	537,082	5,581,581	11.27	28.81
Stamp Tax	337,776	1,900,428	7.09	9.81
Other Taxes	166	3,313	-	0.02
From				
State lands	43,059	237,296	0.90	1.22
Industry	389,551	741,410	8.18	3.83
Sundry Sources	198,501	1,986,228	4.17	10.25
Extraordinary	295,150	817,843	6.19	4.22
Special plans	719,529	-	15.10	-
<b>Total :</b>	<b>4,765,084</b>	<b>19,372,788</b>	<b>100.00</b>	<b>100.00</b>

Income tax shows the heaviest relative increase, followed by Excise tax and Stamp tax. Causes for the increase are the raising of taxation levels, the growth of industry and commerce and, indirectly, inflation.

Details of expenditure are:

	Expenditure in Cr. \$1,000		Percentage of total expenditure	
	1941	1950	1941	1950
Presidency etc.	80,977	3,072,827	1.49	12.98
National Congress etc.	-	442,929	-	1.97
Ministry of				
Aviation	10,091	1,697,839	0.19	7.17
Agriculture	127,579	1,066,354	2.35	4.51
Education and Public Health	323,140	2,497,474	5.94	10.55
Finance	1,454,837	4,575,930	26.75	19.33
War	932,971	3,005,917	17.15	12.70
Justice and External Affairs	189,285	1,011,949	6.48	4.28
Marine	352,375	1,635,622	6.48	6.91
Foreign Affairs	80,561	176,782	1.48	0.75
Labor, Industry and Commerce	178,046	760,186	3.27	3.21
Transport and Public Works	1,109,746	3,726,045	20.41	15.74
Special Plans	598,754	-	11.01	-
<b>Total</b>	<b>5,438,389</b>	<b>23,669,854</b>	<b>100.00</b>	<b>100.00</b>

Increase in expenditure is due mainly to inflationary causes but there have been many developments in the scope of certain Federal Activities. Noteworthy are the heavy expenditure increases against the following departments - Presidency and associated bodies, Ministry of Aviation, Ministry of Agriculture, Ministry of Education and Public Health, Ministry of Justice and External Affairs.

State and municipal budget

As was the case with Federal Estimates, the estimates for revenue and expenditure for the States and Municipalities have increased rapidly during recent years. Instances are:

Indices - 1939 = 100

	<u>1941</u>	<u>1945</u>	<u>1950</u>
		<u>Income</u>	
Federal	109	226	445
States	123	246	632
Municipalities	117	168	557
		<u>Expenditure</u>	
Federal	112	223	488
States	118	253	665
Municipalities	108	176	570

Contribution of the Northern States to Federal Income  
Percentage of total Federal Income

Contributed by	1948	1949	1950
Amazonas and Acre	0.32	0.31	0.30
Pará	0.66	0.61	0.57
Totals :	0.98	0.92	0.87

These figures are of interest in connection with the proposal to plough 3% of Federal Revenue into Amazon development.

To a base 1939 = 100, the indices of contributions of revenue to Federal Income for selected States are:

	1941	1945	1950
Amazona and Acre	148	297	437
Pará	117	225	285
Minas Geraio	137	385	818
Espirito Santo	118	311	685
Rio de Janeiro	130	284	519
São Paulo	117	250	557
Parana	129	352	795
Santa Caterina	102	297	596
Rio Grande de Sul	108	240	575
Goiás	143	468	882
Brazil	109	226	445

Recently, a law has been enacted "freeing" the exchange, but no details are yet to hand which would enable its significance to be assessed, other than that coffee sales will remain linked to the official exchange rate.

This uncertainty as to the exact value of the Cruzeiro and the frequent changes in procedure for valuation of the Cruzeiro has given rise to considerable trading difficulties. The trade in Amazon timber, in particular, has suffered severely.

#### National Debt

##### External Debt

The position at the end of 1945 and 1950 was:

	1945		1950	
<u>Federal Debt</u>		78,372,419		28,384,098
	US\$	118,380,285	US\$	88,137,985
	Paper Francs	272,908,462		-
	Gold Francs	229,185,500		-
<u>States Debt</u>		27,392,212		19,170,637
	US\$	86,392,800	US\$	57,078,800
	Paper Francs	225,138,125		-
	Florins	6,428,100	Florins	6,428,100

(The Northern States, Pará and Amazonas, liquidated their External Debts during 1946).

<u>Municipal Debt</u>	£	5,238,163	£	2,534,075
	US\$	14,575,250	US\$	8,878,750
	Paper Francs	21,520,000		-

(Manaus-Belem liquidated their Sterling debt in 1946. There is now no municipal foreign debt in the Northern States.)



Internal Debt

The position at the end of 1945 and 1950 was:

	Debt in:		Interest due in:	
	1945	1950	1945	1950
	Cr. 1000	Cr. 1000	Cr. 1000	Cr. 1000
Federal	7,895,263	10,439,288	489,377	588,218
State	6,272,538	12,399,566		
Amazonas	29,487	29,487		
Pará	4,261	27,588		
Municipal	548,244	1,018,964		
Manaus	3,207	3,207		
Belem	545	324		

Main Source of Income

May be judged from the following figures for 1950:

<u>Source</u>	<u>Value of Production</u> (Cr. \$ 1,000)
Mining	786,807
Vegetable extracts	1,613,955
Agriculture	51,177,150
Foodstuffs	12,903,206
Wine and other drinks	331,472
Vegetable and animal oils	1,506,136
Rubber	1,704,939
Paper	247,894
Hides	781,177
Textiles	7,759,872

These figures are from the Anuario Estadístico de Brazil, 1951. They give an adequate over-all picture of the Brazil position as a whole.

The importance of the timber industry may be gauged from the following figures prepared by the Statistical Department for the industrial survey very shortly to be published. They refer to the year 1949.

	<u>Value of Production</u> (Cr. \$ 1,000)
Timber extraction, Brazil	998,380
Sawmilling, Brazil	1,491,112
Total	<u>2,389,492</u>

The figures for the timber extraction and for sawmilling are independent. The value of timber reaching sawmills is not included in the figure for timber extraction.

Briefly the main regional occupations furnishing sources of income are:

Northern States	Rubber, Brazilnuts, oil from fruits and trees, timber and fish.
North-eastern States	Sugar, cotton, carnauba wax, babassu, coconuts, oiticica oil, salt and minerals.
Eastern States	Dairy produce, minerals including precious stones, coffee, cotton, cocoa, sugar, rice, tobacco, fruit, maize and timber.
Southern States	Coffee, cotton, wheat, rice, maize, tobacco, fruit, cattle raising and timber.
West Central States	Cattle raising and minerals, including precious stones.

In Pará Estatístico, issued by I.B.G.E. in 1951, the values of the main products of the State of Pará for the year 1950 are given as:

<u>Source</u>	<u>Value in Cr. \$ 1,000</u>
Raw cotton	5,373
Rice in husk	31,856
Cocoa	10,222
Sugar cane	9,285
Beans	2,693
Jute	30,002
Tobacco	17,101
Mandioca	44,263
Corn	8,766
Rubber	48,984
Balata	8,959
Macaranduba Gum	13,379
Brazil nuts	63,834
Mother of pearl	1,795
Diverse fibres	27,893
Bananas, Oranges	10,930
Timber	31,062
Pau Rosa oil	3,736
Sweet Potatoes	2,319
Hides and Skins	14,030

Elsewhere, the value of Pará timber production during 1949, is given as:

	<u>Value in Cr. \$ 1,000</u>
Extraction	17,623
Processed in Sawmills	15,432
	<u>33,055</u>

In the Anuario Estatístico de Brazil, 1951, the value of the main products of the state of Amazonas and the territories of Amapá, Guaporé, Açu and Rio Branco for the year 1950 are shown as:

	<u>Value in Cr. \$ 1,000</u>				
	Amazonas	Guaporé	Açu	Amapá	Rio Branco
Minerals	-	-	-	50	-
Rubber	111,775	83,239	94,872	7,911	2,076
Brazil nuts	35,412	3,958	5,120	6,384	1,223
Guarana	4,410	-	-	-	-
Jute	30,324	-	-	-	-
Piacaba	1,576	-	-	-	-
Pau Rosa oil	18,843	-	-	-	-
Abaucaxi	640	238	1,021	116	104
Cotton	21	-	-	-	-
Rice in husk	399	158	4,210	155	54
Bananas	3,503	312	2,607	256	60
Sweet potatoes	1,477	18	1,383	97	42
Cocoa	3,704	-	4	44	-
Coffee	138	-	3,091	-	-
Sugar	1,318	110	6,976	-	15
Beans	1,489	84	3,786	144	99
Tobacco	2,080	120	2,554	267	300
Oranges	1,202	36	1,162	112	10
Mandioca	12,576	309	18,543	3,304	145
Maize	1,143	148	4,947	266	130

No figures are available for Hides and Skins, a relatively important item. The figures for Pau Rosa oil for Amazonas is a personal estimate.

The value of timber production in Amazonas is shown elsewhere as Cr. 39,974,000. Separate figures are not available for the territories. Study of the above figures, though they are incomplete, will reveal - that the timber industry, important though it may be regionally, plays a relatively minor part in the over-all industrial set-up of Brazil (this is further exemplified by the fact that only 3.45% of the total industrial

population is engaged in the timber industry), that the timber industry of the Northern Region, with an estimated production value of approx. 73 million Cruzeiros, is unimportant relative to the over-all Brazilian timber industry, whose production is valued at approximately 2,389 million Cruzeiros, that the timber industry in the Northern Region ranks locally as of fourth importance, being surpassed by agriculture, the collection of rubber and the collection of Brazil nuts, in that order.

#### Transportation means in the Amazon Basin

The main river is navigable throughout its length in Brazil to the Peruvian border by deep sea steamer. Roads are few and are in general confined to short distances from the main towns, such as Belem, Manaus, Amapa, Porto Velho, Santarem, etc. There are air services connecting the principal towns, but the normal means of progression is by water, for which purpose there is a host of launches, tugs, sailing vessels and lesser craft.

Owing to rapids near to their junction with the main river, the tributaries flowing from the North are navigable by powered craft for relatively short distances only.

The tributaries flowing from the South have a greater volume of water. Indeed some of them are mighty rivers in themselves, such as the Tocantins, Xingu, Tapajos and Madeira. These Southern tributaries are navigable by fairly large powered craft for considerable distances, until rapids are encountered. Thus the Tocantins is navigable to Tucuri and the Madeira to Porto Velho.

Of railroads there are three. The Braganza Railway extends 294 kilometers, the Madeira-Mamore Railway 366 kilometers and the Tocantins Railway 117 kilometers. The Tocantins Railway in particular is a poor affair with an infrequent service. The Madeira-Mamore Railway serves to bypass the falls on the Madeira river and the Tocantins Railway, the falls on the Tocantins River.

#### Harbors in the Amazon Basin

There are no difficulties as far as harbors are concerned in the Amazon. The main river, the Delta and the larger tributaries are for all purposes inland seas where deep sea steamers can travel and anchor almost at will near either bank, where jetties are not provided.

There are two main ports where adequate loading and discharging facilities exist. They are Belem and Manaus, with a distance of 924 miles between them. A third is under construction at Macapa, to deal with the Manganese ore out-put of Amapa.

Lesser ports exist at Port Velho, Iacoatiari, Parantins, Obidos and Benjam in Constant on the border of Peru. The Booth line have a list of 18 ports in the Islands where timber can be loaded. They are Cabral, Fortaleza do Jarraraca, Cocal, Joazeiro, Mossoró, Brevés,

Jaburizinho, Sao Miguel dos Macacos, Jaburu do Jaime, Palacio de Eristal, Boiucu do Gabra, Boca do Terra, Bon Jardim do Maia, Liverpool, Mututi do Amerin, Sao Pedro, Antonio Lemos, Sao Luiz do Tajapuru. At almost all these ports the vessel is afloat at low waters though tied to the bank on jetty. There are numerous other points in the Island and along the river which offer similar facilities.

At Manaus there is always a minimum of 20 meters of water. It is of course a fresh water port. At Belem, where it is tidal, the depth varies from 3.5 to 10 meters or more though there is always at least 4 meters in the channel leading to the quays. This channel has 7 meters at high water neap tides and there is an alongside depth of 7 to 8 meters.

At Manaus there are floating docks extending 1313 meters, 15 cranes of 3 to 7 tons capacity and 19 warehouses with an effective area of 19,530 square meters.

At Belem, there are 1860 meters of masonry wharves, 23 cranes of 1.5 to 30 tons capacity and 15 warehouses with an effective area of 35,000 square meters. The port is served by a fleet of 73 lighters and tugs.

The following record for 1948 of entries of vessels to various Amazon ports will give an adequate picture of facilities for large vessels:

	<u>Number of vessels</u>		<u>Register tonnage</u>	
	<u>Brazilian</u>	<u>Foreign</u>	<u>Brazilian</u>	<u>Foreign</u>
<u>Guaporé</u> Porto Velho	81	-	13	-
<u>Acre</u> Purus Rio Branco	226	-	5	-
<u>Amazonas</u>				
Benjamin Constant	52	50	5	8
Itacoatiara	332	24	194	87
Manaus	466	40	144	102
Parentins	261	15	165	48
<u>Pará</u>				
Belem	495	279	460	956
Obidon	99	-	94	94
<u>Amapa</u>				
Macapa	320	-	11	-
Oiapoque	103	-	4	-
<u>Total for Amazon:</u>	2,875	408	1,108	1,295

Taxation duties and other charges on timber exported from the Amazon

This is a most complicated subject and it is difficult to obtain a clear picture of dues.

In Pará, all timber moved from the Municipality of Belem pays:

- 6.25% of the internal pauta
- 3.50% of the internal pauta (Production Tax)

In addition, timber exported abroad pays:

- 5.0% of the export pauta
- 3.5% of the commercial value of the timber

If the timber is exported to the South of Brazil, the 5% on the export pauta is waived, but the rest have to be paid.

Then there are the charges of the Instituto do Pinho:

- Cr. 2 per m<sup>3</sup> on sleepers
- Cr. 3 " " " sawn timber
- Cr. 4 " " " floor blocks and planed timber
- Cr. 5 " " " round logs

SNAPP then take:

- Cr. 9 plus 4% per 1,000 kgs. plus
- Cr. 5 per 1,000 kgs. as "energy" tax

Rural economy takes 0.10% of the commercial value

The Department of Agriculture collects the following extraction charges:

De Luxe timber	Cr. 14 per m <sup>3</sup> sawn,	Cr. 10 per m <sup>3</sup> round
Constructional timbers	Cr. 6 " " " ;	Cr. 5 " " "
Soft or very hard	Cr. 3 " " " ;	Cr. 3 " " "
Very light	Cr. 2 " " " ;	Cr. 2 " " "

Then there is a classification tax about Cr. 2.40 per m<sup>3</sup>.

Stamps and other documentary charges amount to Cr. 200 per shipment.

The customs broker (Despachante), whose services cannot be avoided, takes Cr. 2,000 per normal shipment.

There is a charge of Cr. 1.5 (approx.) per m<sup>3</sup> for the Federal Government, Cr. 1.5 (approx.) for m<sup>3</sup> for the State Government and Cr. 2 per m<sup>3</sup> for the Department of Agriculture which is additional to all the above.

In the Islands, the captain of the vessel and the river pilot between them receive Cr. 15 per m<sup>3</sup>.

In all, on sawn Madeiras Brancas exported abroad the duties taxes and charges add up to about Cr. 135 per m<sup>3</sup>.

An estimate by Dr. I. Kissin puts the charges per m<sup>3</sup> in Pará at:

	Succupira Cr.	Andiroba Cr.	Quaruba Cr.
Sawn timber for Brazil ports	130	190	90
" " " foreign "	150	220	100
Round logs " " "	110	170	70

Andiroba pays a special tax of Cr. 60 per m<sup>3</sup>. This is intended as a measure of conservation. In effect, Andiroba where possible, is moved across the State boundary prior to export to avoid the tax.

Cedro from public forest land pays a special tax.

The pauta values are nominal, though they vary from time to time with the state of the market. Some examples of values for the month of January 1952 are:

	<u>Internal</u> Cr. per m <sup>3</sup>	<u>Export</u> Cr. per m <sup>3</sup>
De luxe timbers - sawn	500	800
" " " - round	350	550
" " " - hewn	250	400
Sleepers	200	300
Box shooks	150	280

In Manaus the State and Municipal taxes during 1952 were:

- 6.6% of the pauta value as sales tax
- 6% of the pauta value as extraction tax

The port tax is Cr. 9 per ton elada. Timber is assessed at the rate of 1000 kilos per m<sup>3</sup> round and 850 kilos per m<sup>3</sup> sawn, with the following exceptions:

	Round logs	Saw and planed timber kgs. per m <sup>3</sup>
Pine	750	600
Cedar	750	650
Marupa, Assacu and Ucuuba	600	500
If from Amazonas State		950

Samples of Pauta values in Manaus for sawn timber during July 1952 are:

	<u>Cr. per m<sup>3</sup></u>
Andiroba	567
Cedro	1,138
Mahogany	998
Piquia	667
Louro inhamuy	717
Louro preto	671
Succupira	512
Assacu	575
Ucuuba	656
Massaranduba	513
Marupa	295

An estimate by Dr. I. Kissin puts the charges and taxes per m<sup>3</sup> of timber at Manaus at:

	Mahogany Cr.	Cedar per	Louro inhamuy m <sup>3</sup>	Assacu
Entry tax per m <sup>3</sup> round	210	200	30	20
Export tax per m <sup>3</sup> " (export abroad)	160	140	100	80
Tax per sawn m <sup>3</sup> (to Brazil ports)	90	70	70	50
" " " (" foreign ")	130	110	90	70

Timber traders in both Pará and Amazonas complain about the complicated taxation and their complaints appear to have ample justification. In Manaus there are complaints about the pauta rates, which have lagged behind the market movements at times and have constituted an obstacle to sales at remunerative prices.

#### Economic Relations with other countries

From 1946 onwards, trade agreements have been signed with the United Kingdom, France, Belgium, Finland, Czechoslovakia, Argentine, Uruguay, Chile, Paraguay and Bolivia. An agreement has recently been signed with West Germany. Agreements with the United Kingdom and some of the other countries mentioned above are due for revision or renewal.

The British Commonwealth and most of the countries in America, Europe (the U.S.S.R. is an exception) and the Middle East are listed as countries whose exports to Brazil pay minimum duties.

In 1950 Brazil had a favorable trade balance of over Cr. 4.5 billion. More recent figures are not available. But there are now deficits with certain countries, particularly the United Kingdom and West Germany, and this has given rise to trading difficulties.



During 1952 it was thought in many foreign countries that Brazil goods for export were priced above world market levels and this led to trade stagnation. It remains to be seen how far the recently enacted exchange laws will rectify the situation.

The whole of the foreign trade of Brazil, both export and import, is for practical purposes subject to licenses issued through the Export-Import Department of the Bank of Brazil. The objective is to safeguard stocks of foodstuffs, to encourage import of essentials and restrict imports of non-essentials and to safeguard national industry. In addition, the exchange regulations act as a restrictive measure in foreign trade.

The licensing procedure and the exchange regulations have acted as a serious deterrent to timber export abroad during 1952.

The pattern of foreign trade may be gauged from the following figures for 1950:

	<u>% of Total for Brazil</u>	
	<u>Exports</u>	<u>Imports</u>
Africa	1.40	0.96
North and Central America (of which U.S.A.)	56.15 (54.52)	45.43 (34.49)
South America (of which Argentine)	7.85 ( 5.63)	13.77 ( 9.99)
Asia	1.76	0.74
Europe (of which United Kingdom France Holland Sweden Benelux)	32.21 ( 8.33) ( 4.71) ( 2.41) ( 3.29) ( 2.54)	39.02 (12.33) ( 4.66) ( 2.29) ( 4.35) ( 5.77)

General import and export

The "direction" of imports and exports is given in the preceding paragraph. For the year 1950, imports and exports under main heads were:

	<u>Quantity in tons</u>	<u>Value in Cr.1,000</u>	<u>Remarks</u>
<u>Exports</u>			
Livestock	3	158	
Raw materials	2,242,556	5,943,099	Main items are hides, timber, oily seeds, vegetable oils, tobacco, minerals and cotton. Quantities are declining slightly, values more so.
Foodstuffs	1,559,298	18,675,860	Coffee is the principal item, accounting for approx. 16 billion Cruzeiros. Quantities are markedly on the decline with values rising. Other items are maize, mate, cocoa, sugar, rice, meat. In general, under this head, there has been a sharp decline in quantities exported with a heavy rise in values.
Manufactures	17,226	294,370	Cotton goods are the main item. Over the three years 1948-50, there was a sharp decline in quantity and value of cotton exported. There was a similar decline for the group as a whole.
Total Exports	<u>3,819,083</u>	<u>24,913,487</u>	Quantities declining with values rising.
<u>Imports</u>			
Livestock	23,136	173,968	There was a pronounced increase.
Raw materials	6,383,575	5,832,374	Quantities increasing more rapidly than over-all values. Main items are petrol, fuel, oils and lubricants, coal cement, and textiles, particularly jute and wool.
Foodstuffs	1,430,867	3,470,319	A slight increase in quantities with decline in over-all values. Wheat is the dominant single item followed by dried fish.
Manufactures	1,130,318	10,836,768	Quantities on the increase with over-all values falling. Most important are machinery metals, chemicals, textiles and paper.
Total Imports	<u>8,967,894</u>	<u>20,313,429</u>	Quantities increasing with values static.

One has the impression from the figures of Brazilian goods rising in value in face of a merked world decline in prices.

Imports have declined in volume, exports have risen. One inference is that this is caused by the rapid increase in population, which is giving rise to heavier demands on home production and for imported goods.

Timber exports in 1950 were 582,210 tons, valued at 701,967.000 Cruzeiros. This represents 15,25% by volume of total exports and 2.82% by value.

Existing planning for economic development

Existing plans for economic development are:

The SALTE plan

a five-year plan to cover the period 1949/53.

Estimated expenditure under the plan is:

	<u>Cr. Millions</u>	<u>% of Total</u>
Health	2,620	14.3
Foodstuffs	3,700	20.2
Transportation	8,030	43.9
Power	3,250	17.8
Interest	700	3.8
To be spent by Federal Government	<u>18,300</u>	<u>100.0</u>
To be spent by States, Municipalities and private corporations on power development	<u>7,422</u>	
Total:	<u>25,722</u>	

No information is to hand as to how far this plan has been implemented.

Against foodstuffs, an increase in production is aimed at.

Against transportation, the objectives are - railway construction and the re-equipment of the railways, the development of roads, the re-equipment and extension of ports, improvements to rivers and canals and the construction of an oil-pine line from Santos to São Paulo.

Against power, the objectives are - exploration for oil, construction of refineries, the purchase of tankers and the development of hydro-electric resources.

The Commission for the development of the Sao Francisco Valley

The official activities of this Commission include the development of power at the Paulo Alfonso falls, the improvement of navigability and the control of floods in the middle basin.

The Commission for the development of the Amazon Basin

This Commission has yet to be set up, though it is understood that the relevant legislation has now been enacted. The terms of the Commission are general development of the Amazon Basin, to which end 3% of the Federal revenues will be applied. Development of the forest resources of the Amazon will presumably figure largely in the over-all scheme.

Economic trends

The rapid increase in population is causing an ever-increasing demand on foodstuffs and consumer goods. To meet this agriculture and industry have been stepped up.

The area under cultivation (on main 29 cultures) increased from 14,960,628 hectares in 1944 to 17,775,073 hectares in 1950, while value of production has increased from 17.6 to 31.2 million Cruzeiros. With the single exception of cotton, where there has been a decline, all main cultures showed substantial production increases.

In the field of industry, Brazil's objective is self-sufficiency. The following figures will best demonstrate the rapid strides that are being made:

Indices of Brazil's Industrial Production to a Base 1946 = 100

Year	Heavy industry	Electric power	Textiles	Sugar and derivatives	General Production
1947	113.8	108.4	81.3	112.7	86.7
1948	133.9	120.5	93.1	130.7	111.2
1949	153.4	133.2	94.6	128.0	144.4
1950	190.4	140.5	99.7	138.3	121.4
1951 (estimated)	203.3	149.6	100.6	145.1	131.2

Most of the industrial production and the greatest development is to be seen in the South, particularly in the vicinity of Sao Paulo.

It remains to be seen whether these increases in agricultural and industrial production are adequate and whether they can be maintained. The record reveals that Brazil needs goods from abroad in ever-increasing quantities but that her surplus of production is not increasing accordingly and that the gap cannot be effectively spanned by maintaining a high

exchange rate that causes Brazilian goods to be priced materially above world market levels. The recently enacted revised exchange laws may ease the situation, but it has still to be demonstrated that there is an adequate surplus of production for the purposes of foreign trade.

Brazil needs foreign capital for expansion but has imposed conditions for operation of such capital that have proved unattractive. The drive for self-sufficiency in industry needs to be tempered by practical rather than political considerations. An instance is the drive for petroleum, which promises to consume more energy and capital than probable results can justify.

But taking all into account one cannot but be impressed by Brazil's very bright prospects for future development.

APPENDIX C

COMMERCIAL SPECIES OF THE AMAZON

Timbers of interest to the export market

Acapu, Aguano, Anani, Andiroba, Araracanga, Assacú, Cedro, Cumarú, Cupiuba, Freijo, Itauba, Jacaranda do Pará, Jacareuba, Jutai, Louro-inhamui, Louro vermelho, Macacauba, Mandioqueira, Marupá, Massaranduba, Muiracatiara, Muirapiranga, Pau Roxo, Pau D'Arco, Quaruba, Sapupira, Tatajuba, Ucuúba.

Twenty-nine species are listed here. Of these, eighteen are fairly well known to foreign trade. The remaining eleven, which have been underlined, would probably be of interest if fair and steady supplies could be made available.

Timbers suitable for box shooks

Amapá, Anani, Assacú, Bacuri, Carauba, Cedro, Guariuba, Mandioqueira, Marupá, Morototó, Quaruba, Sorua-Grande, Sumauma, Tauary, Ucuúba, Seringdeira.

Sleeper species (as listed by A. de Miranda Bastos)

<u>Abiurana</u>	<u>Itauba</u>	<u>Muirauúba</u>
<u>Acapu</u>	<u>Itaubarana</u>	<u>Pajurá</u>
<u>Acapurana</u>	<u>Jarana</u>	<u>Pracuuba</u>
<u>Acariquara</u>	<u>Jutai</u>	<u>Pau Darco</u>
<u>Acariuba</u>	<u>Jutai Porocora</u>	<u>Pau de Botó</u>
<u>Angelim</u>	<u>Louro Itauba</u>	<u>Pau Roxo</u>
<u>Angelim Pedra</u>	<u>Louro Limao</u>	<u>Piquiá</u>
<u>Arapari Vermelho</u>	<u>Louro Pimenta</u>	<u>Piquiarana</u>
<u>Araracanga</u>	<u>Louro Preto</u>	<u>Piranheira</u>
<u>Copaiba</u>	<u>Mangue Vermelho</u>	<u>Sucupira</u>
<u>Copaibarana</u>	<u>Massaranduba</u>	<u>Siriuba</u>
<u>Cumarú</u>	<u>Matá Matá</u>	<u>Tatujuba</u>
<u>Faveira de Rosca</u>	<u>Membi</u>	<u>Tento Amarelo</u>
<u>Comavel</u>	<u>Muirajussara</u>	<u>Uapá</u>
<u>Guajará</u>	<u>Muiratauí</u>	<u>Umiri</u>

Forty-six species are listed. Those underlined, 29 in all, are not included among the species given in the check-list below. In addition, four species are listed as suitable for sleepers, but whose use as such should be prohibited owing to their value as high grade furniture woods - they are, Angelim Rajabo, Macacauba, Muirapiranga, Pau Amarelo.

This great mixture of species is one of the difficulties in sleeper production in the Amazon. Identification becomes difficult and unsuitable species slip through. The export market for sleepers, in particular, will be very wary of this great multiplicity of species.

Timbers suitable for plywood

Anani, Assacú, Bacuri, Carauba, Cedro, Louro Vermelho, Mandioqueira, Marupá, Morototó, Quaruba, Sumauma, Tauary, Ucuíba.

Timbers for paper pulp

Caruaba, Mandioqueira, Marupá, Morototó, Sumauma, Ucuíba.

Timbers for high grade veneers

Aguano, Andiroba, Angelim Rajado, Jacaranda do Pará, Macacauba, Muiracatiara, Muira Piranga, Sapupira, Sucupira.

Timbers for flooring

Acapú, Aguano, Andiroba, Bacuri, Castanheiro, Camarú, Jutai, Louro-inhamui, Macacauba, Massaranduba, Muiracatiara, Pau Amarelo, Pau Roxo, Sapupira, Sucupira.

Timbers for ships' decks

Castanheiro, Itaúba, Louro inhamui, Louro vermelho, Piquiá rana, Tatajuba.

CHECK - LIST

Acapu	Vouacapoua americana	Leguminosae
Acapú - rana	Batesia floribunda	Leguminosae
Aguano	Swietenia macrophylla	Meliaceae
Amapá	Parahancornia amapa	Apocynaceae
Anani	Symponia globulifera	Guttiferae
Andiroba	Carapa guianensis	Meliaceae
Angelim	Rymenolobium excelsum	Leguminosae
Angelim Rajado	Marmaroxylon racemosum	Leguminosae
Araracanga	Aspidosperma desmanthum	Apocynaceae
Assacú	Eura crepitans	Euphorbiaceae
Axua	Sacoglottis guianensis	Humiriaceae
Bacuri	Platonia insignis	Guttiferae
Balsamo	Myroxylon peruiferum	Leguminosae
Carauba	Jacaranda copais	Bignoniaceae
Castanheiro	Bertholletia excelsa	Lecythidaceae
Cedro	Cedrele odorata	Meliaceae
Cedro - rana	Cedrelinga catanaeformis	Leguminosae
Copahiba Jutahy	Copaifera martii	Leguminosae
Cumarú	Coumarouna odorata	Leguminosae
Cupiuba	Goupia glabra	Celastraceae

Freijo	<i>Cordia coeloiana</i>	Boraginaceae
Guariuba	<i>Clarisia racemosa</i>	Moraceae
Itauba	<i>Mesilaurus itauba</i>	Lauraceae
Jacarandá do Pará	<i>Dalbergia spruceana</i>	Leguminosae
Jacareuba	<i>Calophyllum brasiliense</i>	Guttiferae
Jenipapo	<i>Genipa americana</i>	Rubiaceae
Jutai	<i>Hymenaea coubaril</i>	Leguminosae
Louro - inhamui	<i>Nectandra elaiophora</i>	Lauraceae
Louro - vermelho	<i>Ocotea rubra</i>	Lauraceae
Macacauba	<i>Platymiscium uleii</i>	Leguminosae
Mandioqueira	<i>Qualia</i> spp.	Vochysiaceae
Mara - gonçalo	<i>Hieronyma alchorneoides</i>	Euphorbiaceae
Marupé	<i>Simarouba amara</i>	Simarubaceae
Massaranduba	<i>Mimosa - Manilkara</i> spp.	Sapotaceae
Morototó	<i>Didymopanax morototoni</i>	Araliaceae
Muiracatiara	<i>Astronium graveolens</i>	Anacardiaceae
Muirapiranga	<i>Brosimum paraense</i>	Moraceae
Pau amarelo	<i>Euxylophora paraensis</i>	Rutaceae
Pau d'arco	<i>Tabebuia serratifolia</i>	Bignoniaceae
Pau Mulato	<i>Calycophyllum spruceanum</i>	Rubiaceae
Pau Mulato da Terra Firma	<i>Capirona decorticans</i>	Rubiaceae
Pau Roxo	<i>Peltogyne paniculata</i>	Leguminosae
Piquiá	<i>Caryocar villusum</i>	Caryocaraceae
Pracauba	<i>Mora paraensis</i>	Leguminosae
Queraba	<i>Vochysia</i> spp.	Vochysiaceae
Sapucaia	<i>Lecythis paraensis</i>	Lecythidaceae
Sapupira	<i>Diploptropis martiusii</i>	Leguminosae
Serva - grande	<i>Couma macrocarpa</i>	Apocynaceae
Sucupira	<i>Bowdichia nitida</i>	Leguminosae
Sumauma	<i>Ceiba pentandra</i>	Bambaceae
Tatajuba	<i>Bagassa guianensis</i>	Moraceae
Tauary	<i>Couratari tauari</i>	Lecythidaceae
Ucuíba	<i>Virola surinamensis</i>	Myristicaceae
Ucuíba - rana	<i>Iryanthera</i> spp.	Myristicaceae
Umiri	<i>Humiria floribunda</i>	Humiriaceae



OBSERVATIONS ABOUT GROWING STOCK

While considerable botanical survey has been carried out in the Amazon, remarkably little work has been done on the composition of the forests and on the determination of the growing stock.

Such information as has come to hand is given below:

- (i) A count of trees by Snr. Artur de Miranda Bastos in the forests of Santa Maria do Vila-Nova in the territory of Amapá produced the following results:

Per hectare - 767 trees 15 to 30 cm. diam. yielding	153.4 m <sup>3</sup> timber
124 " 30 cm. diam. and up "	246.3 " "
	<u>399.7</u> " "

In all, 46 species were enumerated. The most frequent of those with the heaviest timber yield were:

Acapu	(Vouacapoun Americana)	11 trees	12.9 m <sup>3</sup>	per hectare
Angelim	(Hymonolobium)	5 "	30.0 "	" "
Angelim Amarelo	(Hymonolobium)	4 "	18.5 "	" "
Caraipe	(Licãnia)	10 "	13.6 "	" "
Capiuba	(Goupia glabra)	6 "	12.4 "	" "
Matamata	(Eschweilern)	9 "	9.2 "	" "
Tachi preto	(Tachigalia)	5 "	9.4 "	" "
Tauari	(Couratari)	3 "	10.4 "	" "

Of the better known timber trees, other than those already included above, there were:

2 of Itauba, 5 of Louro amarelo, 3 of Louro Vermelho, one each of Massaranduba and Piquia, 2 each of Quaruba and Ucuúba.

- (ii) An estimate by Messrs. Black, Dobzhansky and Favan of the diversity and population density of trees in Amazon forests. Trees 10 centimeters in diameter and over were recorded in three plots of one hectare each.

On the Igapo forest plot (a second growth area), 546 trees were recorded, of which 430 were between 10 and 20 centimeters diameter while the total number of species recorded was 60.

On a terra-firma plot at Belem which was a relatively virgin area, 423 trees were counted, of which 228 were between 10 and 20 centimeters diameter while the total number of species recorded was 87.

On a third terrafirma plot at Jefe, where only trees of 20 centimeters diameter and over were recorded, 230 trees were found, comprising 79 different species.

The estimate is of little assistance in the determination of the growing stock. It is recorded here merely because so little is available on this subject.

In the Igapo area, of timber species, Andiroba and Matamata are recorded.

In the two terrafirma areas, the timber species met were: Ucuúba, Louros, Acapu, Andiroba, Quaruba, Cupiuba, Piquia, Morototo, Massaranduba, Matamata.

Ucuúba and Matamata were the most frequent species encountered in the Jefe plot, which is in Amazonas State.

(iii) There is a record of two counts made by Le Coínte, virgin jungle.

	Trees measured 3 feet from the ground on Paranova River above Guajara-Mirim	Between Kapury and Cobija in Acre
Below $7\frac{1}{2}$ " diameter	87	51
$7\frac{1}{2}$ -12" diameter	53	38
12-15" "	17	16
15-19" "	13	8
Over 19" "	10	12
Total per acre	180	125 *

\* There were less than 4 trees per acre  $27\frac{1}{2}$  inches and up in diameter

In view of the vastness of the area of the Amazon forests and the relatively minute area covered by these surveys, it would be dangerous to try to draw any authoritative conclusions as to the growing stock. The forests are undoubtedly "lighter" than those of the equatorial Far East or of Equatorial Africa. While one hears of comparatively gregarious forests of Andiroba, Succupira, Louros etc., the normal is a tremendous mixture with a light tonnage of marketable species.

In the Peruvian Amazon, which may be considered comparable to the forests of Upper Amazonas and Acre, surveys carried out over an area of more than 180 hectares of trees 18 inches in diameter at B.H., gave a yield of between 10,000 and 33,800 board feet per hectare, with an average of about 23,000 board feet per hectare. Of Mahogany, the volume varied from 1,009 to 3,640 board feet per hectare, where it occurred. Of cedar, the volume varied from 405 to 8,363 board feet per hectare.

In British Guiana, the volume per hectare of trees 16 inches and up in diameter at B.H. varies from 38 to 126 cubic meters, with the average around 80.

TIMBER TRADE

1. Internal trade and consumption in the Amazon

In Belem, sales are normally direct from saw mills, particularly of boxshocks, but there are a number of Estancias, which purchase timber from Island sawmills mainly or from sawmills in the Braganza region, and which sell retail in small lots to the public. Timber from the Island is imported and sold locally, by auction, at Amazon No. 11, where there is normally about 1,000 tons in stock, about half of it sawn and of very poor quality and half of it in the form of hewn planks and beams.

In Manaus and elsewhere in Amazonas, sales are almost exclusively direct from mill. Fair quantities are shipped from Manaus and other sawmills in Amazonas to the upper regions, to Acre, Guaporé and to the Rio Branco. This trade with the upper rivers is showing a tendency to increase.

No figures are available for the quantities of trade timber consumed within the Amazon. From information supplied at various sawmills, the impression formed was that 50 to 60% of such timber is consumed locally. On a personal estimate, the average annual trade production is 212,000 cubic metres (Francon), of which 121,000 cubic metres is consumed inside the Amazon.

Timber is consumed locally for house building, manufacture of furniture, box-shocks, ship-building, flooring, turnery, sleepers, railway wagon construction, lorry body and coach construction, etc.

In Manaus furniture factories, timber used include Cedar, Mahogany, Andiroba Massaranduba Louros, Angelim etc. Wherever possible plywood is used and the sale of imported plywood is increasing. High prices are paid for prime furniture stock.

In one furniture factory in Belem, Macacauba is used almost exclusively for exterior panels etc. with Cedar as a lining. Deck chairs are of Pau Amarello and vases are turned from Angelim, Violetta and local Jacaranda.

Boat construction in a typical yard was with an Itauba body, Piquiá rails and an Angelim keel. Decking was generally of Itauba or Piquiá.

On the Madeira-Mamore Railway, Itauba is almost used exclusively for sleepers. Massaranduba is not liked because of its tendency to split. On the Tocantins Railway, the sleepers are of Massaranduba and on the Braganza Railway of Massaranduba and Jarana.

One interesting local development in timber consumption is the manufacture in Manaus of pre-fabricated housing. The Manaus cost is Cr. 15,000 per unit, the cost of an assembled house near Porto Velho is Cr. 28,000.

For flooring, the traditional pattern is the yellow and dark brown one made by laying Pau Amaraello and Acapu side by side. Acapu supplies are running out and Succupira has largely replaced it. But almost all of the heavier hardwoods are used in the form of floor blocks.

The poorer quality Cedar and many of the lighter coloured and less dense hardwoods are used for ceilings.

Assacu is the main box-making wood of Manaus. In Belem, boxes are manufactured from the Madeiras Brancas, that is the softer woods, for there is a great mixture of colours.

Until recently, there was a small plywood mill in Belem with a capacity of not more than 2 cubic metres per day. It was a primitive mill with very ancient machines and it has now been sold for breaking up. Messrs. Sabba of Manaus have now in mind the erection of a plywood mill in Santarem with a capacity of about 25 cubic metres of plywood daily. The main species to be used is Cedar. The prospects for such a mill appear to be quite bright as much of the production should be exportable to the south of Brazil.

There is a small paper manufacturing factory in Belem, but it operates only on rags and scrap paper. To all intents and purposes all pulp and paper requirements of the Amazon are imported.

#### Firewood and charcoal

About 700,000 cubic metres of firewood and 15,000 tons of charcoal are produced annually for trade purposes. It is entirely consumed locally for domestic purposes in the towns, as railway fuel, as fuel for power houses, etc.

#### Other forest products

Of other forest products produced commercially, such as rubber sorva, balata, Brazil nuts, Pau Rosa oil, vegetable oils etc. for practical purposes the whole is exported either abroad or to other parts of Brazil.

## 2. Trade in forest produce to other parts of Brazil

### Timber

40 to 50% of the commercial timber production of the Amazon is either sent to other parts of Brazil or is exported to foreign countries.

### Amazonas

During the period 1938 - 49, about 114,000 tons of timber was exported from the States of Amazonas in all. Of this, 29,000 tons, or 25%, was sent to other parts of Brazil. During 1949, 6,004 cubic metres was shipped to Brazil ports, during 1950, 3,985 cubic metres. Shipments decreased still further in 1951.

The main buyer has been the Distrito Federal (that is the town of Rio de Janeiro) followed by Ceara, although of recent years Ceara purchases have outstripped those from the Distrito Federal. Relatively minor quantities have gone to Pernambuco, Rio Grande do Norte and Sao Paulo.

Species purchased by the various areas are:

Distrito Federal - Mainly Cedar and small quantities of Mahogany and Jacareuba.

Ceara - Cedar mainly with lesser quantities of Mahogany, Andiroba, Assacu, Louro inhamuy and other louros, etc.

Other States - Minor quantities of the whole range of commercial species on offer.

The main exporter from Amazonas is the Empresa Madereira, an association of the four leading sawmillers of Manaus and Itacatiara. The Empresa Madereira purchases Cedar and Mahogany logs as a joint venture from the Jurua and Purus rivers for sale to the four principals. Sales of timber to the South of Brazil are made by the Empresa Madereira on behalf of the four principals on the basis of a 6% commission, 4% of which is paid to agents located in places of sale. The Empresa Madereira has its agents at Fortaleza, Natal, Pernambuco and Rio de Janeiro. The organization gives the impression of being an effective one. It undoubtedly has the best cut and best quality timber from the Amazonas to offer for sale and it has secured the services of Agents of good commercial standing.

Over the period 1939-50, about 400,000 tons of timber was exported, of which 236,000 tons or 59% was sent to Brazil ports outside the Amazon. During 1950, 21,200 tons were shipped to Brazil ports, during 1951, 34,820 tons.

Pernambuco was the biggest buyer, followed by Ceara, Rio Grande do Norte, the Distrito Federal and the North Eastern ports other than those in Ceara, and Rio Grande do Norte. Bahia, Sao Paulo and Rio Grande do Sul buy minor quantities. The timbers most in demand are Succupira and Massaranduba followed by Freiyo, Cedro, the Louros, Cupiuba, Andiroba and Quaruba.

Succupira is highly esteemed throughout Brazil and finds its use in panelling, furniture, floorboards etc. Massaranduba is used for heavy construction, wherever strength is required and also sells as floor blocks. Freiyo is particularly well liked for furniture and more could be sold if it were available. Andiroba is well thought of in the North Eastern ports and in Recife laminated arches were seen that were made of this timber. In Rio, Andiroba is not liked, nor is Jacareuba, which is considered to show too much movement.

Sleepers are at present only shipped from Pará. 86,890 sleepers were shipped to Rio in 1952, the E.F. Central do Brazil expected to receive 400,000 from Pará and the E.F. Santos-Jundiai 40,000. Owing to the growing shortage of sleepers on the main Brazil Railway, there is a renewal of interest in Amazonian supplies. The great mixture of species supplied makes

for difficulty of inspection. Unsuitable woods get through and have caused harm to the reputation of the Amazon sleepers. Some 50 species have been listed as suitable, all heavy woods, the lightest with a density of 0.7. Sleepers are all axe hewn and almost invariably with boxed heart, so that they tend to split despite clamping. Excessively sappy pieces slip through because of the difficult inspection conditions in shallow water.

#### Para

The main timber exports from the State of Pará, are from sawmills in the Amazon Islands. Most of the timber shipped to Brazil ports is sawn stock, but Pernambuco takes some Succupira logs and the Distrito Federal takes both Succupira and Cedar logs.

#### General

The larger sawmills have their agents in every significant port. On the whole, these agents for Pará timbers do not appear to have the same high business standing as the agents of the Empresa Madeireira. This presumably is because the quantities of timber on offer from individual Pará sawmillers are insufficient to interest the larger business houses.

Price lists are issued from time to time by the Empresa Madeireira and by some of the Para mills, but in effect prices are fixed by negotiations. Normal sale conditions are as follows:

4% consumption tax to buyer's account.

90 days credit without discount or payment at sight with 3% discount.

For Rio Contracts -- delivery in 90 days subject to availability of freight on the Lloyd Brasileiro.

Payment is only too frequently delayed beyond the 90 days allowed in the contract. Claims are common and sellers have no great confidence in buyers in this respect. Freight down the coast is often difficult to procure, for timber has a category 3 priority and pays the poorest freight relative to its weight and bulk. For these reasons, millers prefer to sell to foreign markets even though the paper return may appear poorer.

Much of the timber shipped from Para and from the smaller Amazonas sawmills is unevenly sawn, which means a loss to seller, for measurement is of the smallest measurements that will give square cut timber. The usual grade supplied, No. 2 Common and better, with the best creamed for export, and with plenty of worm is an indifferent grade for long distance shipment. None the less, Amazon timbers are highly thought of in the Coastal markets. They appear highly priced and if prices were reduced, which should be possible with better organised extraction and milling there is little doubt that sales could be materially increased.

### Other forest products

Rubber goes to Brazil ports only. Also Guarana and the major part of Massaranduba latex (Balata) and Brazil Nut Oil. The bulk of the remaining minor Forest Products, including Pau Rosa, is shipped abroad.

### Foreign markets and supply

#### Amazonas

66,995 tons of timber was shipped abroad from the State of Amazonas during the period 1938-1948. 6,748 cubic metres was shipped in 1949, and in 1950, 12,752 cubic metres. There was a further increase of 10-12% over the 1950 figure for shipments during 1951. In 1952, there must have been a severe drop in shipments owing to the difficult market in Europe. No reliable figures have come to hand regarding the quantities shipped subsequent to 1950.

The United States was the main buyer and her interest lay almost entirely in Mahogany. Unimportant quantities were shipped, apparently on a trial basis of Cedar, Andiroba, Assacu and Louro Inhamuy.

The United Kingdom was the second heaviest buyer, though a long way behind the United States. Her interest has been in the whole range of commercial species. Mahogany, Cedar, Andiroba, Assacu, Jacareuba, Louro inhamuy and the other Louros, and Ucuúba.

Purchases by the other countries were minor, but covered almost the whole range of commercial species. The Argentine and Uruguay, Portugal, The Netherlands and Ireland were purchasers from time to time.

Portugal bought fair quantities prior to the war, but now appears to have lost interest in Amazonas timbers.

During the war, exports to Europe were practically extinguished. In 1950 the United Kingdom interest in Amazonas timbers revived and 4873 cubic metres was purchased. The market deteriorated towards the end of 1952.

#### Pará

From the State of Pará, 161,448 tons of timber was shipped abroad during the years 1939-50. There is a record of 18,578 tons shipped in 1949, 8,885 tons in 1950 and 19,717 tons in 1951. The market for Pará timbers has fluctuated considerably. In 1939, 64,947 tons were shipped which included a very heavy tonnage to Germany, presumably for stockpiling. Small tonnages were shipped to Europe during the war. 1947 represented a second peak for shipments, since when there has been an irregular decline.



Portugal has been the dominant buyer, except during 1939, when Germany was stock-piling. The United Kingdom is second on the list with about one fifth the purchase by Portugal. The United States, Argentine and Uruguay, Spain, the Netherlands, Ireland, Belgium, France and Italy purchased minor quantities from time to time. During 1952, Spain made a large purchase of railway sleepers.

Almost all the Macacaubá available has been purchased by Portugal, where the timber is highly esteemed for high grade furniture manufacture. Massaranduba, Succupira, Andiroba and the Louros were also purchased by Portugal in substantial quantities. A heavy purchase of Quaruba was made in 1950. There was a lesser interest in most of the other commercial timbers on offer from Pará. Portugal and countries other than the United States purchase timber from Pará mainly in the form of logs. The United States takes about half in sawn timber and the United Kingdom buys sawn timber almost exclusively, its interest being in medium weight, light colored hardwood, which can be used as a substitute for softwoods that are in short supply. Assacu, Freiço, Andiroba and the Louros have been in demand. Quaruba has reached the United Kingdom via Germany, after manufacture into plywoods.

United States purchases have been spasmodic and more or less on a trial basis. Germany is interested in peeler logs, such as Assacu and Quaruba. The trade with Germany received a setback in 1952 owing to a decline in UK imports and the drop in log prices from West Africa.

#### General

Lack of freight was a serious obstacle to sales to the Argentine and Uruguay. With the Argentine there have also been general trading difficulties with Brazil of recent years, though they appear to have been resolved during 1952. Owing to shortage of freight, shipments to Uruguay have been held up for a year or more after completion of contract. With more freight offering, sales from the Amazon could undoubtedly be expanded, for the Amazon timber can be procured in superior specification to the average run of timber from Missiones. New York and the North East Coast of the United States is the purchasing centre for Amazon timbers and the interest is almost exclusively in Mahogany. Other Amazon timbers experience a great difficulty in securing a foothold and are up against cheaper imports from Africa, Central America and the Philippines.

Liverpool and London are the main purchasing centers in the United Kingdom, and lively interest is maintained in Amazon timber supplies. Difficult exchange regulations and unreliable parcels have adversely affected a promising market. Sales to the United Kingdom fell away in 1952, when there was a general decline in timber imports, which gave impetus to the drop in African timber prices.

In general and as far as the United Kingdom, the United States and Europe are concerned, a greater interest would be shown in what was an offer from the Amazon, if larger and steadier quantities of reliably graded timber could be made available.

### Harbors and shipping facilities freight

Harbor facilities have already been commented on in some detail. Along the main river, in the Islands of the Amazon delta and for appreciable distances along the southern tributaries, deep sea steamers can ply with safety and can anchor in close proximity to where supplies are accumulated.

The Lloyd Brasileiro Line has a virtual monopoly on shipments from Manaus to Brazil ports. The trade in Manaus complains that the space offered by the Lloyd Brasileiro is inadequate. Timber is given a third, the lowest, priority by the shipping company and maximum quantities accepted are 300 cubic metres per passenger vessel and 600 cubic meters per cargo vessel. In practice, the space allotted per vessel is generally well below these limits. Timber is the lowest paying, slowest loading cargo and the Manaus agent for the Lloyd Brasileiro accepts it with marked reluctance.

Freights from Manaus are relatively high. The freight on sawn timber from Manaus to Rio de Janeiro is Cr. 293 + 60% or Cr. 468 per cubic meter. This is equivalent to 180 shillings per cubic meter (35 feet) at official exchange rates, as against 175 shillings less 10% for a ton of 40 cft. for the greater range of species for Europe. Manaus is served for shipments to the United States by the Moore - McCormac Lines Inc., the Booth Steamship Co. Ltd. and the Lamport and Holt Lines. To the United Kingdom and European ports, the Booth Steamship Co. plies regularly. Each year, 25 of these Conference Line ships call at Manaus and between them they can comfortably handle all the timber freight likely to be offered. There is no justification, therefore, for importers' complaints that there is difficulty about freight to Europe. Where there has been a hold up, it has been the shipper's fault, as often as not due to circumstances beyond his control such as when there is a heavy fall in the river level during the low water seasons - October to December.

The larger Moore - McCormac Line steamers have superior timber handling facilities than the Booth Line steamers. But all ships serving foreign ports are superior to the Lloyd Brasileiro in this respect.

Freight on sawn timber from Manaus to the United States is US \$32.5 for Mahogany and US \$28 for other timber per ton of 40 cft. The freights to Europe are lower at 175/- less 10% per ton.

Pará is served by three national lines for shipments to Brazil ports—the Lloyd Brasileiro, the Companhia Nacional de Navegação Costeira and the Transmaritima Commercial S.A. While the position does not appear to be as acute as in Manaus, space for timber is frequently in short supply.

Freight from Belem to Rio on sawn timber is Cr. 209 + 60% or Cr. 324 per cubic meter. From the Islands, there is a surcharge of 5%. I was informed in Rio that the freight on sleepers was Cr. 53.75 per piece, from which it would appear that sleepers pay at the round log freight of Cr. 451 per cubic meter geometric. The Moore-line McCormac Line offered to move these sleepers at Cr. 28. each, but national lines have a monopoly of the coastal trade. In view of the chronic space shortage on these national lines, it would appear a sensible arrangement to permit foreign lines to transport sleepers at cheaper rates.

For shipment of timber to the United States, Pará is served by the Booth Steamship Co., Ltd., the Moore Line, McCormac Lines inc., and the Lamport and Holt Line; while to the United Kingdom and European ports, the companies that ply regularly are the Booth Steamship Co., Ltd., the Norska-Syd Amerika Linje and the Norddeutscher Lloyd.

There appears to be no shortage of space offering for Europe. Indeed, with ships during 1952 leaving the Amazon lightly laden, there has been keen competition to take whatever the Islands could offer. Freight rates on sawn timber to Europe both from Manaus and Belem were reduced by 10% in the latter part of 1952. This brings them below the West African freights. Instances of Pará freights for sawn timber are - to the United States, US \$28 per 40 cft., to North European ports, 135/- less 10% per 40 cft. for the greater range of species from Belem and 155/- less 10% from the Islands. Importers in Fortaleza and other North Eastern ports were critical of the Lloyd Brasileiro discharging arrangements. At Fortaleza, timber is put on lorry at shipside and dumped in an open store near the town centre. The handling is very rough and causes a good deal of damage, in addition to which there is deterioration from exposure while the timber awaits measurements, which has to be carried out before the purchaser can remove it.

Shipping companies find justification for their higher freight rates from the Islands on the grounds of the slowness of loading from stream, or from an indifferent jetty. A typical journey is that of the ss. "Cape Sable", which sailed from Belem to the Islands on 29 November 1947 at 9 a.m. and returned to Belem on 23 December at 4 p.m. During this period of 25 days, she loaded 2817.5 tons, calling twice at Jarracaca, twice at Breves and once each at Cocal Jaburazinho and Sao Miguel dos Macacos.

For local shipments of timber within the Amazon, the SHAPP river steamers, tugs and barges, sailing vessels, etc. are used.

#### Entry taxes, export taxes and harbor dues

These have already been set out above in such detail as available. The taxation system is complicated and could with advantage be simplified. The incidence of taxation in Manaus relative to log production costs is uneven for the different species and severe in cases. Instances are as follows:

	<u>Mahogany</u>	<u>Cedar</u>	<u>Louro inhamuy</u>	<u>Assacu</u>
	(Cr. per cubic meter)			
Rough cost of log at mill for Brazil ports round log export	860	540	265	165
Entry Tax	210	200	30	20
% Entry tax/log cost	24.5	37.0	11.3	12.1
For Foreign ports round log export				
Entry and export tax	370	340	130	100
% Taxes/log cost	43.0	53.5	47.3	58.8
For Brazil ports sawn timber				
Entry and export tax	280	235	65	45
% Tax/log cost	32.6	43.5	24.5	27.3
For Foreign ports sawn timber				
Entry and export tax	310	255	75	55
% Taxes/log cost	36.0	47.2	26.8	33.3

Entry tax is paid only on timber produced in the State of Amazonas. Much of the Mahogany and Cedar which come from the Territories is therefore exempt.

Taxation on Cedar seems severe and still more so the taxation on Assacu in log form. Taxation on Louro Inhamuy and Assacu whether in log form or sawn must have been very much higher than profits during 1951/52 and must have made trading in these timbers very difficult indeed.

In Pará, the incidence of taxation relative to log cost was:

	<u>Succupira</u>	<u>Andirobá</u>	<u>Quaruba</u>
	(Cr. per cubic meter)		
Rough cost of log at mill For Brazil ports round log export	320	130	150
Taxes		Nil	
For Foreign ports round log export			
Taxes	110	170	70
% Tax/log cost	34.4	130.8	46.7
For Brazil ports sawn timber			
Taxes	130	190	90
% Tax/log cost	40.6	146.1	60.0
For Foreign ports sawn timber			
Taxes	150	220	100
% Tax/log cost	46.9	169.9	66.6

The heavy tax on Andiroba is intended as a measure of preservation. In effect, there is avoidance of tax by declaring an extraction point outside the Pará State (a similar state of affairs probably occurs in Manaus for Mahogany and Cedar). Taxation in Quaruba logs, the form in which it is wanted abroad, seems high relative to sale prices.

If larger quantities of timber are to be sold abroad, then it may be necessary to lighten the incidence of taxation in order to encourage extraction.

TIMBER PRICES

Purchase price of round logs by the Island sawmills

It is very difficult, if not impossible, to arrive at an average figure for each species. Logs are collected at widely dispersed points. Each sawmill has its preserves and is never anxious to broadcast its results. The figures below are confusing. Some are possibly unreliable, but the degree of reliability cannot be assessed.

The prices are per cubic meter for a normal Francon measurement and are of course in Cruzeiros. They are for logs for delivery to sawmills located at the places named at the head of the table. They are for logs 1.4 meters in mid-girth and up and of 3.5-5 meters in length unless otherwise stated.

	<u>Breves</u>	<u>Curalinha</u>	<u>Piria</u>	<u>Iracema</u>	<u>San Miguel Dos Macacos</u>	<u>Jaberu- Zinho</u>	<u>Matapi</u>
Succupira	250	280/300	250	220	200	180	150
Cupiuba	140	140		120	160		
Macacauba	350	350				300	150
Araracanga	140	200					
Massaranduba	240		150	160*	200		
Andiroba	120	150	100/150		100	90	80
Quaruba	120	150				80	
Louro Vermelho	180			250*	120		
Marupa	120	150				80	
Pau Amarella		400		300			
Pau Rozo				200			
Cedro				300			150
Freiijo				280			
Assacu				180*			180*
Piquia						250	
Acapã						160	
Jacareuba							80

Breves log transport to mills costs Cr. 25-40 per cubic meter  
 Piria " " " " " Cr. 50 " " "  
 Iracema " " " " " Cr. 30 " " "

\* Iracema Louro Vermelho price is for logs 1.8 meters up in girth. Poorer logs are purchased at Cr. 125. Massaranduba price is also for logs 1.8 meters up, with a cut of 10% for logs 1.7 to 1.8 meters girth. For Assacu, 5% more is paid for logs 1.8 meters up.

Massaranduba beams or squares (hewn) are purchased by the Curalinha sawmill for Cr. 350 per cubic meter (Francon).

Purchase price for round logs in the Upper Amazon

The prices given below are as reported by the Empresa Maderreira. The prices are per cubic meter Manaus measure at the point of collection by the sawmills. Under the Manaus system of measurement, the diameter used is the shortest at the small end less 4 centimeters. The volume is then calculated by the Francon system.

	1947/48	1948/49	1949/50	1950/51
Price per cubic meter in cruzeiros				
Mahogany	300	500	500	750
Cedar	200	250	300	330
Jacareuba	80	100	120	130
Andiroba	100	120	140	170
Louros	80	100	120	130
Assacu	40	40	60	80
Ucuúba	40	40	60	60

Cost of Transport  
to Manaus sawmills

From the upper rivers

Mahogany and Cedar	175	277	324	362
-----------------------	-----	-----	-----	-----

The steep rise in cost of logs at sawmill is noteworthy. The prices for Mahogany and Cedar above are for 1st class logs. The full range of Empresa Maderreira prices in 1950/51 was:

Quality	Cr. per cubic meter			Cr. per log
	1st	2nd	3rd	Refuse
Mahogany	750	600	450	100/150
Cedar	330	275	100	40

Average Price 1950/51

Mahogany	501
Cedar	266

To arrive at cost of logs delivered sawmill, 5% must be added; this being the Empresa Madereira commission.

Sale price for log shipment from Pará, 1952

Brazil ports

Succupira Cr. 1,300 c.i.f. Recife per m<sup>3</sup>  
Cr. 1400/1500 c.i.f. Rio per m<sup>3</sup> \* Girth 160 cm. and up.  
Massaranduba Cr. 1250 c.i.f. Recife per m<sup>3</sup>  
Louro Inhamuy Cr. 1,100 c.i.f. Recife per m<sup>3</sup>  
Andiroba Cr. 1,300 c.i.f. Recife per m<sup>3</sup>

The movements to Brazil ports are unimportant.

Foreign ports

Portugal

Per cubic meter Francon f.o.b. Andiroba	US\$	27.20	or	Cr.	650
Succupira	"	31.00	"	"	700
Macacauba	"	40.00	"	"	900
Araracanga	"	30.00	"	"	

Sale price for log shipments f.o.b. Manaus, Feb. 1952

Brazil ports

Cedar	Cr.	1,350	per	m <sup>3</sup>
Louro Inhamuy	Cr.	650	"	"

There is little movement of logs to Brazil ports

Foreign ports

Mahogany for USA -	Cr.	700	per	m <sup>3</sup>
" paid for by Astoria				
per 1,000 board feet (in 1951) 1st class -	US\$	120		
2nd " -	US\$	100		

Louro Inhamuy for UK	Cr.	400	per	m <sup>3</sup>
Macacauba " "	Cr.	400	"	"

Minimum export prices per cubic meter f.o.b. prescribed by Instituto Nacional do Pinho for round log shipment from Pará

These minima have been in operation since 1950.



Andiroba	Cr. 500	in practice, these minima
Macacauba	Cr. 735	
Succupira	Cr. 570	are almost invariably exceeded
Pau Amarelo	Cr. 800	
Freijo	Cr. 735	
Cedar	Cr. 735	
Quaruba	Cr. 500	
Louro	Cr. 500	

Sale prices for sawn timber

Local sales, within the Amazon 1952

Belem Estancia de Maio

Ceilings, soft species, 12 pieces  $4\frac{1}{2}m \times \frac{1}{2}''$  - Cr. 180/200  
Hardwood planks - Cupiuba, Pau Amarelo, Massaranduba, etc.  $4\frac{1}{2}'' \times 8'' \times 1''$   
(approx.) - Cr. 280 per dozen.

Prices in the estancias vary from summer to winter. They are about Cr. 25/30 more in summer than in winter.

Serraria Quajora

Brazil nuts box (contains two tins) - Cr. 12 for the shooks and  
Cr. 14 for the box.

The sawmill purchases timber from the Islands for conversion into boxes at the rate of Cr. 40 for 12 pieces  $3m \times \frac{1}{2}'' \times 6/8''$ .

Serraria Palai - at Castenhal in Braganza

Sells timber delivery Belem per  $m^3$  (sawn)

Sapucaia (the main species)	Cr. 800	Angelim	800
Piquia	Cr. 1000	Quaruba	500
Succupira	Cr. 800	Macacauba	1000
Acapu	Cr. 1000	Cupiuba	600
Freijo	Cr. 1000	Louro	600

(this sawmill also cuts AXUA PAU SANTO, PAU DARCO, and JARANA)

Serraria Guama

Shell Max manufactured boxes - Cr. 12 per box.

Boards for walls -  $12' \times 8'' \times \frac{1}{2}''$  (actual length 15')  
Cr. 100 per dozen  
which is roughly Cr. 525 per  $m^3$ .

Manaus January 1951 (This price list held for most of 1952)

	Cedar	Louro	Inhamuy	Jacareuba	Assacu	Ucuúba		
	"	"	Amarelo			and		
	"	"	Preto			Madeiras		
	"	"	Andiroba			Brancas		
Price in Cr. per palm l length								
	Sawn	Planed	Sawn	Planed	Sawn	Planed	Sawn	Sawn
Boards 6 x 1	1.80	2.05	1.32	1.57	1.08	1.33	0.72	0.60
8 x 1	2.40	2.65	1.76	2.00	1.44	1.70	0.96	0.80
9 x 1	2.70	2.95	1.98	2.20	1.62	1.87	1.08	0.90
per extra inch width	0.30		0.22		0.18		0.12	
Furniture 3 x 2	1.80	2.15	1.32	1.67	1.08			
Blanks 4 x 2	2.40	2.75	1.76	2.11	1.44			

There is a surcharge of Cr. 0.05 per palm length for tongue and grooving. For timber above 4m length or 10" width, price has to be negotiated. For thicknesses under 1" -

90%	of price for 1" for 3/4"
80%	" " " " " 5/8"
75%	" " " " " 1/2"

Refuse is sold by negotiation, with a minimum price of Cr. 120 per dozen boards of normal length.

Price of shorts is for negotiation.

The price for sawn timber in the above table corresponds roughly to:

Cr. 1,926	for Cedar
Cr. 1,478	" Louros and Andiroba
Cr. 1,210	" Jacareuba
Cr. 806	" Assacu
Cr. 672	" Ucuúba and Madeiras Brancas

These are prices reigning in the main Manaus sawmills. It will be seen that they are very high, almost as high for Cedar as the f.o.b. price to Brazil ports, higher for the Louros, Andiroba and Jacareuba, and at about the same level for other timbers. It is not surprising, therefore, that Porto Velho as an instance prefers to purchase from Pará rather than from Manaus, though Manaus is very much closer.

Manaus

The following are examples of prices for boxes of Madeiras Brancas:

<u>Inside Measurements</u>	<u>Type</u>	<u>Cruzeiros</u>
52 x 36 x 22	000	10.6
70 x 44 x 24	0	16.2
90 x 56 x 39	5	30.0
80 x 60 x 40	Special	29.0
95 x 40 x 30	Guarana	22.0
83 x 54 x 40	Timbo	27.5
90 x 56 x 39	Chicle	30.0
55 $\frac{1}{2}$ x 27 x 38 $\frac{1}{2}$	Castanha	13.2

Sawn Timber Boxes (unplaned)

86 x 61 x 41	Crude Sorva	32.30
48 x 24 x 36	Kerosene	10.50
	shooks	9.0

These prices correspond roughly to Cr. 1,400 per cubic meter for timber in the made boxes and Cr. 1,200 per cubic meter for the shooks. The business must be quite a profitable one with planed Madeira Brancas selling at about Cr. 750 per cubic meter retail from the major sawmills.

Porto Velho

Examples of prices for timber during 1952 ex-sawmill at Porto Velho are:

		<u>In Cruzeiros per meter length</u>
Furniture blanks	2 x 2	4.5 or 1,800 per m <sup>3</sup>
	3 x 4	12.5 " 1,670 " "
	3 x 6	19.2 " 1,700 " "
Boards	$\frac{1}{2}$ x 6	4.5 or 2,400 per m <sup>3</sup>
	$\frac{3}{4}$ x 8	5.5 " 2,200 " "
	$\frac{1}{2}$ x 10	7.5 " 2,400 " "
	$\frac{3}{4}$ x 12	9.0 " 2,000 " "
	1 x 6	6.0 " 1,333 " "
	1 x 8	9.0 " 1,800 " "
	1 x 10	10.5 " 1,680 " "
	1 x 12	12.5 " 1,670 " "
	2 x 8	12.5 " 1,250 " "
	2 x 10	14.0 " 1,120 " "
	2 x 12	18.0 " 1,066 " "
	2 x 6	12.5 " 1,667 " "
2 x 12	27.0 " 1,800 " "	

In Cruzeiros per meter length

Planks	3 x 8	27.0 or 1,800 per m <sup>3</sup>
	4 x 4	18.0 " 1,800 " "
	4 x 8	27.0 " 1,350 " "
	4 x 12	36.0 " 1,200 " "

Half inch ceilings are sold at Cr. 40.0 per m<sup>2</sup>.  
 One inch floorboards are sold at Cr. 60.0 per m<sup>2</sup>.  
 The pricing seems curious. It is high for the grade of timber supplied.

Sawn timber prices for export to Brazil ports

Belem Prices from the Islands, 1952.

	<u>F O B</u>	<u>C I P</u>	<u>C I F</u>
	<u>Islands</u>	<u>Bahia</u>	<u>Rio de Janeiro</u>
	<u>in Cruzeiros per cubic meter</u>		

Sawn planks 3/4" x 6/12" x 3m up

Pau Roze	2,000		
Succupira	1,500	1,600	1,700
Andiroba	1,250	1,400	1,500
Cupiuba	1,250	1,350	1,450
Louro Vermelho	1,300	1,400	1,500
Quaruba	1,200	1,150	1,250
Massaranduba - 3/5m	1,500	1,600	1,700
		1,700	1,800
		1,850	1,950

Battens - 2 x 1 - 2 x 1 1/2 - 2 1/2 x 2 - 2 1/2 x 3 - by 3m up

Massaranduba	1,650	1,750
Other hardwoods	1,350	1,450
	<u>C I F</u>	<u>C I F</u>
	<u>Bahia</u>	<u>Rio de Janeiro</u>
	<u>In Cruzeiros per cubic meter</u>	

Sawn Boards - 1", 1 1/2", 2" x 6" to 12" x 3m up

Cupiuba and Louro	1,500	1,700
Andiroba	1,550	1,650

	C I F	C I F
	Bahia	Rio de Janeiro
	In Cruzeiros per cubic meter	
<u>Hewn Beams or Squares - 0,2 x 0,2 - 0,25 x 0,25 and up</u>		
Massaranduba - 5/8 m	1,450	1,550
and Succupira 8/10 m	1,550	1,650
10/12 m	1,700	1,800
<u>Flooring - 4" x 1" x 3 m up</u>	<u>Per m<sup>2</sup></u>	<u>Per m<sup>2</sup></u>
Succupira	70	80
Andiroba	65	75
Cupiuba and Araracanga	60	70
<u>Floorblocks - planed - 0,21 x 0,07 or 0,24 x 0,08</u>		
Succupira	70	
Macacauba and Araracanga	65	

Other sizes for negotiations

MANAUS

F O B price list for timber for Rio de Janeiro, April 1952.

	Per m <sup>3</sup>	F O B Manaus
Cedar		
<u>Planks 1st.</u> 0.75/0.10 by 0.15		
up by 2 m up 25% of 0.15 to 0.19	2,300	
and 75% of 0.20 up		
<u>2nd.</u> 0.75/0.10 by 0.15		
up by 2 m up without limitation	2,100	
of widths		
<u>Boards 1st.</u> 0.15 up with 25%		
0.15 to 0.19 and 75% of 0.20 up	2,200	
<u>2nd.</u> 0.15 up without		
limitation of widths	2,000	
<u>Scantlings 1st.</u> 0.032/0.038 by 4"	2,200	
2nd. 0.075/0.10 by 4"	2,300	
Shorts 1m. to 1.90 m	1,700	
Logs - usual dimensions	1,350	

FAO 53/10/8283

Per m<sup>3</sup> F O B Manaus

Louro Inhamuy

Planks - 0.20 up	1,200
Boards - 0.15 up	1,100
Logs - usual dimensions	650

Andiroba

Planks and boards - 0.15 up	1,200
-----------------------------	-------

Jacareuba

Planks - 0.075/0.10 by 0.15 up by 2 m up with guarantee of 25% of 0.15/0.19 and 75% of 0.20 up	1,100
--	-------

---

Prices for 1951 were about Cr. 100 per cubic meter less for Cedar and the same as 1952 for other species.

PARA

Minimum FOB export prices prescribed for Pará ports by the I.N.P. for sawn timber.

Cruzeiros per cubic meter

	<u>Planks</u>	<u>Boards</u>	<u>Beams</u>
Andiroba	800	900	
Macacauba	1,200	1,500	
Succupira	1,100	1,300	645
Pau Amarelo	1,500	1,500	
Freijo	1,300	1,300	
Quaruba	700		
Louro	700		
Massaranduba			645

---

This list has been in operation since 1950. In practice, prices are well above these levels.

The following list compiled for Fortaleza is of interest in that it shows the margin on resale and the price of certain items which are competitive with Amazon timbers.

CIF Fortaleza Price to consumer  
Cruzeiros per cubic meter

Planks and squares

Massaranduba 6 x 3 or 6 up by 4 m up	}	1,200	2,000/2,200
Cupiuba 6 x 3 or 8 x 2 etc. by 3 - 4,5 m			

Boards

Cedro 6" by 2 m up	2,200/2,400	3,500/4,000
Freijo 8" by 2 m up	1,800	2,800/3,000
Pinho 12" (30% 9") by 1" by 13" - 18 ft. 3rd quality	3.5 per m. run 2.7 per m. run	18 per m <sub>2</sub> run 40 per m <sup>2</sup>
Louro Inhamuy 1" x 6" x 2 m up and Andiroba	1,470	2,300/2,400
Quaruba 1" x 8" x 3 m up	1,000	Cr. 45 per m <sup>2</sup>
Assacu 1" x 8" x 3 m up	1,100	Cr. 45 " "

Floor blocks

Succupira and Pau Amarello	Cr. 60 per m <sup>2</sup>	Cr. 75 per m <sup>2</sup>
Imbuia and Peroba	" 50 " "	" 60/70 per m <sup>2</sup>
Angico and Pau Darco		" 65 per m <sup>2</sup>

Prices for timber exported abroad

Pará to U.K. 1952

<u>Sawn Timbers</u>	Andiroba 10/- per c.ft. FOB
	Quaruba 9/- " " "

Pará to Portugal 1952

<u>Logs</u>	Andiroba US\$ 27.20 per m <sup>3</sup> Francon FOB
	Succupira " 31.00 " " " "
	Macacauba " 40.00 " " " "
	Araracanga " 35.09 " " " "

Massaranduba beams

3 $\frac{1}{2}$  up x 10" x 10" up US\$ 30.00 per m<sup>3</sup> Francon F.o.b.

Pará to Uruguay 1951-52

<u>Logs</u>	Andiroba	US\$ 42.00 per m <sup>3</sup> Francon f.o.b.
	Louro Vermelho	" 40.00 " " " "
	Pau Marfin	" 40.00 " " " "
	Quaruba	" 35.00 " " " "

<u>Beams</u>	Succupira	" 46.00 " " " "
	Massarandabu	" 46.00 " " " "

<u>Foles</u>	Acapu	" 1.2 each (about 50 to the ton)
--------------	-------	----------------------------------

Highest prices are obtainable from Uruguay, but shipping is very scarce.

Manaus for USA and UK 1951-1952

Sawn Timber

	1951 shillings	1952 per c.ft.	1951 f.o.b. US\$	1952 per 1000 board feet f.o.b.
Mahogany	21/4	18/-	190	180
Cedar	16/-	13/-	130	130
Jacareuba	10/8	9/6		
Louros	10/8	9/6		
Andiroba	10/8	9/6		
Assacu	11/-	9/8		
Ucuúba	9/6	9/-		

Cedar was quoted at 17/- c.ft. late in 1952 in the London market but there were no sales.

Mahogany logs to USA per 1000 board feet f.o.b.

1st class - US\$ 120  
2nd " " " 100



Prices for box woods in the Northeast ports

Fortaleza. Soap boxes about 7 cubic decimeters in volume, roughly the size that holds two kerosine tins. - Parana Pine shooks cost Cr. 13 per box to consumer. Pine boxes can be used four times as against twice for Para boxes, which are badly dried and processed. Assacu shooks sent have stuck together. With Paper manufacture, there is scope for sale of 2,400 cubic meters shooks annually from Para in Fortaleza.

Natal. Rio Grande do Norte imports only about 62 cubic meters of Pine shooks a year.

Price about Cr. 1000 per cubic meter c.i.f. for the shooks.

A few consignments of box shooks from Pará were received in 1952.

Recife. Prices of Parana Pine box shooks (planed one side) cif are:

	Type I	Type 4	Type 5	Type 5 (new)	Type 12
	Dimensions in millimeters				
sides tops and bottoms	500x310x10	600x225x15	790x205x15	380x190x17	530x360x12
ends	500x270x10	600x225x15	790x405x15	430x190x10	530x270x12
	310x250x20	340x225x20	375x205x20	430x400x10	360x250x20
CIF Recife	Cr.18.20	Cr. 28	Cr. 25.70	Cr. 14.70	Cr. 20.20

Quotation

delivery at

Belem Harbour Cr. 9      Cr. 12      Cr. 16      Cr. 10

In addition Belem sawmill offered for delivery Belem harbour -

Standard type kerosene and Gasoline box - Cr.- 11  
 " " soap box for 50 kilogram - Cr.- 11.50

Total quantity box shooks required annually at Recife is roughly 14 - 15,000 cubic meters.

An agent of a Belem sawmill secured orders for one million Cruzeiros worth of box shooks from Pará for delivery to Recife. Species that were accepted - Amapa, Cajueiro, Mututi, Atana and Assacu. (Amapa and cajereiro are considered the best for box shooks). The orders had to be turned down as Pará was unable to supply sawn and seasoned material.

GRADING RULES

In the larger Manaus sawmills, the grading rules of the U.S. National Hardwood Association are applied to Mahogany and sometimes to Cedar and other timbers. Otherwise there are no set rules that are applied in Amazonas and Para.

Timber shipped from Manaus to the U.S.A., mainly Mahogany, is No.1 Common or better. Cedar and other shipments to South Brazil are more or less No.2 Common or better though no precise grade is specified in contracts. One of the mills ships a grade of Cedar to the South that is No.1 Common and better and free of worm.

In the Pereira sawmill in Manaus planks and boards from the headsaw have their sawcuts marked in chalk and the pieces graded prior to further sawing. This is done because sawyers on the smaller branches are considered unreliable.

In one of the lesser Manaus mills, it was explained that when grading for U.K. shipments 1st class timber was clear two sides and 2nd class clear one side and the other 60% clear, with pin hole acceptable.

The usual contract with the U.K. calls for "Prime Export Quality - well and evenly sawn - practically free from worm", or for "Well Manufactured timber in good shipping dry condition, free of live worm, beetleless and of serious wormholes". Disposal of wormy grades is always a problem, but it appears that the export market is tolerant to the extent of 5% per shipment, provided the attack in individual pieces is not too severe. The South Brazil market is more tolerant still of worm attack, though it serves as a frequent cause for complaints.

There are facilities for commercial inspection in Manaus, though they are seldom resorted to. In practice, the only commercial inspections carried out are for U.S.A. Mahogany shipments, where purchase is made from a lesser sawmill.

In Pará, there appears to be no one acceptable or willing to carry out commercial surveys. The virtual absence of commercial survey facilities undoubtedly deters new foreign buyers from entering the market. The alternatives to commercial survey are (1) for the buyer to send a representative to see the timber before shipment, which is ordinarily too expensive a procedure because of the relative smallness of the parcels, (2) to pass at Buyers' and which is generally unacceptable to shippers and (3) to deal only with shippers of impeccable reputation, which leaves a very limited field for operation.

There is a form of State and Federal timber inspection for timber exports both in Amazonas and in Pará. In Amazonas, it is quite nominal and timber is seldom seen prior to shipment though about Cr.5 per cubic metre is collected in survey fees. In Pará, government inspectors are to be found wherever a timber shipment is made, but the emphasis is on species and quantity. A white certificate is issued for timber as against the yellow certificate for merchandise for which Government grades have been prescribed such as for rubber. (A pro-forma of the certificate is reproduced as Appendix).

Rules have now been drafted for the classification of timber in Pará by State and Federal inspectors. These rules are to be submitted to the Federal Government for approval (they are reproduced as Appendix VI).

Four groups of timber are defined and four grades in each group. The groups are:

1. Sawn and processed timber.
2. Round or rough hewn timber.
3. Squares or beams.
4. Sleepers.

The grades are to all intents and purposes identical for each group and may be summarised thus:

- Grade 1 - flawless timber
- Grade 2 - 70% flawless (one flawless side for sawn timber)
- Grade 3 - well out timber with more defects than in the previous grade.
- Grade 4 - refuse quality that does not fit into Grade 3.

There is a definition of the defects used when describing the grades and this is followed by a list of 75 Pará species (only the common names are given to which the grading rules are meant to apply).

As drafted, the rules are an advance, but they appear a little impractical for precise application and may well give rise to dispute in interpretation. Grade 1 is too perfect and Grade 3 is ill-defined in regard to the degree of defectiveness permissible.

The Railway Authorities in Brazil and elsewhere have of course laid down specifications for sleepers. In general, tolerance and permissible defectiveness are adequately defined. I was unable to secure a copy of sleeper specifications while in Pará, the dealers did not appear to possess copies. This is a fair reflection on the importance that the Pará sleeper merchant attaches to specifications. (See Appendix for sleeper specifications called for by the N.F. Central do Brazil).

The procedure for sleeper inspection is for the Belem merchant to make a preliminary selection. Then the buyers inspector passes the sleepers put up to him. The N.F. Central do Brazil maintain a staff of four inspectors in Belem. The Spanish Railway Authorities send a man to Pará during the sleeper shipping season. In addition the State and Federal inspectors play a part for they have to issue certificates prior to shipment. This multiplicity of inspection adds to the cost of the sleepers.

#### Extent to which Dimensions are Standardised

For flooring, floor blocks, ceilings, blanks for furniture legs and, of course, for sleepers, dimensions are reasonably standardised. Otherwise there is no sign of standardisation, which must be difficult of accomplishment with so dispersed a market.

All Pará and most Amazonas sawmillers dislike cutting thicknesses in parts of an inch less than  $\frac{1}{2}$ ". Indeed, their preference is to cut in multiples of 1". The reason is that their machines cannot cut sufficiently accurately.

#### DRAFT GRADING RULES FOR THE STATE OF PARÁ

Rules for the grading of Timber in the State of Pará (being the translation of a draft to be submitted to the Federal Government for approval by the Serviço de Classificações e Fiscalização de Productos of the Departamento de Produção, Belem).

The classification of sawn or planed timber, round or hewn logs, beams and sleepers will be regulated by Four Groups and Three Grades plus a Refuse Grade, in accordance with the prescription of Articles 5, 6 and 7 of the Regulation approved by Decree No. 5,739 of 29 May 1940.

Art. 1 All timber exported from the State of Pará must comply with the specifications laid down in this regulation.

Art. 2 For the purpose of Art. 1, Four Groups and Three Grades plus a Refuse Grade are prescribed as follows:

Group 1 Sawn and Planed Timber.

Includes all kinds of sawn and planed timber such as planks, boards, scantlings, battens, furniture blanks, mouldings, floor blocks, ceilings, etc.

Group 2 Round and hewn timber.

Includes logs, hewn logs, posts, etc.

Group 3 Beams.

Includes beams 0.25 to 0.50 cm., 0.15 to 0.20 cm. and 0.10 to 0.15 cm.

Group 4 Sleepers and Crossing Sleepers.

Includes sleepers 1.5 to 2.9 cm. and Crossing Sleepers 3.0 to 5.5 m.

Grades 1, 2 and 3 and Refuse

Group 1 - Sawn and planed timber.

Art. 3 Grade 1

Dry timber, clear on both faces, of natural colour; correctly sawn to exact dimensions and with square edges; without larval galleries; without mould or fungal stain; without stain caused by chemical, physical or any other agency; without defects such as checks, cup spring, inbark, worm hole, sap fermentation, powdering, wane or bark, resin pockets, splits and irregular sawing.

Art. 4 Grade 2 timber must satisfy the characteristics of Grade 1 on one face.

Art. 5 Grade 3

Dry timber, with knots or larval galleries, with fungal or other stains, with sap fermentation, with wane and bark in greater proportion than in higher grades, with cracks on one face and flaws on both faces, but of natural colour, correct sawing to exact dimensions and with square edges.

Art. 6 Timber that does not reach the standards set for Grade 3, will be classified Below Grade or Refuse.

Hown and Round Logs and Posts

Art. 7 Grade I

Dry timber, clean throughout, cylindrical, with good taper, without knots or larval galleries, without mould or stain caused by physical or chemical agency, without checks, inbark, sap fermentation, powdering, worm holes, plugs, flutes, crookedness and other characteristic defects.

Art. 8 Grade 2 timber must satisfy the characteristics of Grade I in respect of 70% and 30% may have defects.

Art. 9 Grade 3

Dry timber, with knots and larval galleries, with mould and stains, with sap fermentations, with cracks and splits in greater proportion than in higher grades with splits and cracks in one end and flaws in both ends, with plugs and flutes, but of natural colour and correctly cylindrical.

Art. 10 Timber that does not reach the standards set for Grade 3 will be classified Below Grade or Refuse.

Beams

Art. 11 Grade 1

Clean timber of natural colour, rectangular in form without knots, larval galleries, mould or stain due to physical or chemical agency, without checks, sap fermentation, powdering, worm holes, plugs or other characteristic defects.

Art. 12 Grade 2 timber must satisfy Grade 1 in respect of 70% and 30% may be defective.

Art. 13 Grade 3

With knots, larval galleries, mould and stains, with sap fermentation, with cracks in greater proportion than in higher grades, with splits on the ends, with plugs, but of natural colour and correct rectangularity.

Art. 14 Grade 4 Timber below Grade 3 will be classified as Below Grade or Refuse.

Sleepers and Crossing Sleepers

Art.15 Grade 1

Dry timber, clean on all faces, of natural colour, sawn or axed, of exact dimensions, with rigorously square corners, without knots, larval galleries, fungal stain or mould or stain from physical or chemical agencies, without defects such as - cracks, cup, spring or warp, worm holes, sap stain, powdering, bark or wane, resinous pockets, splits or cracks or other characteristic defects.

Art.16 Grade 2 70% of the timber to be of Grade 1 and 30% to be with defects.

Art.17 Grade 3

Timber with knots, larval galleries, mould and stain, sap stain and cracks in greater degree than for the previous grades, with splits at the tops, with plugs but of natural colour and rectangular in shape.

Art.18 Timber below Grade 3 will be called Below Grade or Refuse.

Art.19 Technical terms and expressions used in describing the grades are defined thus -

- (1) Defects Deficiencies on the surface and in the interior of timber which affect its resistance, durability and manner of application.
- (2) Blemishes are deficiencies not classified as defects affecting only the look of the timber and that do not affect its resistance or durability, though they may limit its application.
- (3) Dry Timber Is that which has lost the maximum humidity permitted by natural methods of drying or kilns for that purpose.
- (4) Clear Timber Is without oil stains (from machinery), rust stains, earth and other stains which are not characteristic of the species.
- (5) Natural colour Is the characteristic colour of the timber and its varieties.

- (6) Sawn Timber Timber whether mechanically or manually sawn.
- (7) Exact dimension Dimensions perfectly identical in all senses and for each category of the parcel.
- (8) Knot The nucleus in the tree where branches exist, which provides timber of different colour to the remainder in sawn timber and appears like an insertion into the timber. Knots may be loose or tight.
- (9) Larval galleries are holes produced in timber by the larvae of certain wood-eating insects and also predatory insects which cross from side to side.
- (10) Mould Is the first stage of disintegration producing a powdering which commonly manifests itself by a discolouration or whitening of the timber, caused by fungal development.
- (11) Splits Are cracks in the ends of a piece of timber, caused by external agency or by bad conditions of drying.
- (12) Cup Is curvature across the fibres, across the width of the timber. Is measured from a line in the middle of the piece at the part of greatest curvature.
- (13) Spring Is curvature along the length of the piece, being measured by the depth of the arc formed.
- (14) Cross grain With grain not parallel to the axis of the piece, producing rough grain. Also cross grain caused by excessive knots.
- (15) Sap fermentation is the fermentation of sap in bad conditions of drying in stacks.
- (16) Powdering is the advanced disintegration of wood, caused by fungus, manifesting itself by deterioration of the wood, which appears weak, fibrous, cracked and discoloured.
- (17) Bark and wane Is bark or absence of timber for whatever reason on a corner of the piece. This defect affects the width and thickness of a piece, and is measured in the plane affected and at the point where the defect is most extensive.



- (18) Splits Are open separations of the fibres caused by irregular or inadequate drying.
- (19) Cracks Are openings in the end of a piece produced during drying.
- (20) Shatters Are ruptures of the fibres.
- (21) Plugs Material introduced into holes and cavities to conceal defects.

Art. 20 Timbers of the State of Pará, when not graded, will be classified in accordance with State Decree No. 4519 of January 1944, on the basis of the present regulation. When exported abroad, they will be taxed by the Service of Rural Economy of the Ministry of Agriculture in accordance with the regulations of State Decree No. 659 of 6 November 1946.

List of Pará Timbers to which the Grades apply

1. Piquia	26. Anany	51. Tamanquara
2. Sucupira	27. Guajara	52. Paranai
3. Pau Malato	28. Jacaranda	53. Assacu
4. Louro	29. Mangue	54. Paruru
5. Pau Amarelo	30. Macacauba	55. Uxi
6. Cedro	31. Mogno	56. Paraca
7. Faveira	32. Muiracatiara	57. Muirajuba
8. Angelim	33. Pau Santo	58. Bacuri
9. Cumaru	34. Pracuuba	59. Copaibarana
10. Acapu	35. Piquiarana	60. Mutamba
11. Marupa	36. Tonto	61. Umirirana
12. Pau d'Arco	37. Mata-Mata	62. Pau Marfim
13. Quaruba	38. Jarana	63. Tatapinica
14. Araracanga	39. Itauba	64. Acariuba
15. Freijo	40. Anapa	65. Itaubarana
16. Pau Roxo	41. Achua	66. Quariuba
17. Muirapinanga	42. Buiussi	67. Muirajussara
18. Sapucaia	43. Cinzeiro	68. Muirapinima
19. Cupiuba	44. Envireira	69. Papo de Mutum
20. Umiri	45. Jacareuba	70. Pracaxi
21. Morototo	46. Jasminzeiro	71. Abiurana
22. Macaranduba	47. Margoncalo	72. Sorveira
23. Mandoqueira	48. Para-Para	73. Uxirana
24. Andiroba	49. Genipapo	74. Maparajuba
25. Jutahy	50. Pente de Macaco (Pau de Jangada)	75. Coataquicaua

NOTE ON THE ABOVE

These rules are clearly defective and may lead to dispute in interpretation. It is very doubtful if they would be accepted as a basis for grading in export countries.

What is needed is a more clearly defined, though simple set of rules, with tolerances defined and with degree of defectiveness more adequately set out. As the rules stand, the top grade is too perfect, while the third grade is indeterminate.

Definition of grades needs mill and log study in the closest consultation with the trade. As far as export grades are concerned, it would be as well to sound opinion in the main markets before publication.

For Mahogany and Cedar grading - the NHR rules, which are standard in the USA, will probably have to continue. What is needed is to drag out from the mass of NHR rules what applies purely to Mahogany and Cedar and to put it into separate pamphlet form, together with a simplified interpretation if possible.

There is a widespread feeling that rules of the NHR type, such as have been adopted for Malaya, are unnecessarily involved for use with tropical hardwoods. A much simpler form can be used to define grades and, most important, to elicit the full understanding of local grading staffs.

SPECIFICATION FOR SLEEPERS FOR THE E.F. CENTRAL DE BRASIL

E.F. Central Do Brasil

Conditions for receipt of sleepers

1. Dimensions --

Broad Gauge 2.80 x 0.24 x 0.17 m.

Narrow " 2.00 x 0.20 x 0.14 m.

2. Sleepers must be straight, of rectangular section and square-edged, without bark, sapwood, surface cracks, end splits, rotten knots and other defects, which will affect their life and strength. The ends must be rectangular and square edged and the faces sawn or perfectly hewn.

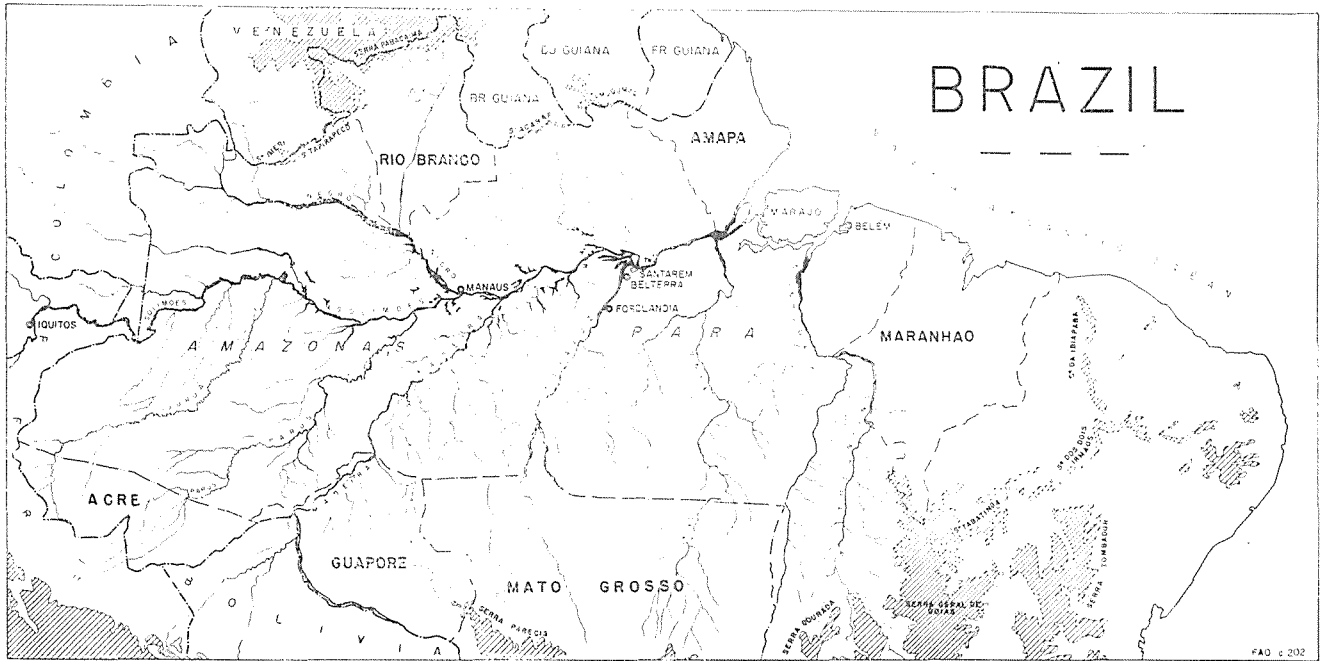
3. Tolerances - Minor deviations will be tolerated such as -
  - a) Horizontal curvature not exceeding 0.04 m of arc.
  - b) Vertical curvature not exceeding 0.03 m of arc.
  - c) Width not less than 0.24 Broad gauge and 0.20 for Narrow gauge sleepers.
  - d) Provided dimensions above not exceeded by 0.05 m in length 0.03 m in breadth and 0.02 m in thickness.
4. Smaller dimensions than specified in 1 above will not be tolerated.
5. Sleepers with tolerances will not exceed 20% by number of total acceptance on each occasion of presentation.
6.
  - a) Horizontal faces are the wide faces.
  - b) Vertical faces are the narrow faces.
7. Straight sleeper - A sleeper will be considered straight -
  - a) If a cord passing from the middle of the ends does not diverge from the middle of the sleeper by more than one third the width.
  - b) Similarly for the narrow faces.
8. Faces will be considered parallel where the distance between them does not alter by more than 0.015 m at any point.
9. Bachelors sleepers - i.e. those obtained from the logs that do not permit more than one sleeper, will be accepted as hewn as per 2 above, provided the curvature on any face does not exceed 0.01 m.
10. Extra payment will not be made for sleepers which exceed the standard dimensions.
11. Two opposite faces of each sleeper must be clearly marked by the supplier with his brand. Inspectors will refuse to pass sleepers not bearing such a mark. In his offer, the supplier will indicate the brand mark that he will use.
12. Acceptance of sleepers will be by a Commission consisting of the Resident Engineer and one Line Inspector, both from the section where the material is to be inspected, together with a marking officer designated by the Department of Material. The Resident Engineer will have overall responsibility for all sleepers passed in his jurisdiction.
13. Rejected sleepers must be removed from the Railway premises within 30 days.

14. Under no circumstances will the Railway receive rejected sleepers.
15. After marking, sleepers will be transported and piled, at the supplier's account, on a prepared, flat bit of land in the Railway estate. Having done so, the responsibility for the sleepers will pass to the Railway authority. Piling must be done within 200 meters of a station or of the residences of Railway personnel.

Ninety-five sleeper species are listed - 40 first class and 45 second class. The only common Amazon timbers included are Succupira and Massaranduba, which figure as first class sleepers.

Note on sleeper specifications

It would be of assistance to sleeper suppliers in Pará if a single set of specifications and tolerances could be devised for application to all Brazilian Railways. A booklet clearly illustrating standard terms, with diagrams, as was done for Eastern Bengal, should be circulated freely in the forest areas where sleepers are being cut.



*The Amazon Valley covers nearly 42 percent of the land area of Brazil and extends into Bolivia, Colombia and Peru. Within Brazil itself, the valley comprises the States of Amazonas and Pará, and the Federal Territories of Guaporé, Acre, Rio Branco and Amapá. Areas shaded in the above map indicate land over 600 m. elevation.*