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AVAILABILITY OF WOOD RAW MATERIAL

FOR PLYWOOD INDUSTRY

(North – Eastern Region)

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CONTENTS

ABSTRACT

Plywood industry is an important sector in the economy of the North Eastern Region, particularly of Assam. Essentially the industry developed to meet the requirements of tea chests and have powerful forward linkages. With the rapid growth and diversification of products, availability of wood has become an important constraint in full utilization of capacity. The present study examines the magnitude of the problem of wood supply and indicates the options available.

Chapter 2 provides an analysis of the growth of the industry in the region. Presently, Assam accounts for nearly 55% of the installed capacity in the country and about 87% of the capacity in the region. Growth of the industry in the state has been primarily due to the expansion of capacity of already existing units. Available data indicate that there has been rapid increase in the capacity without taking into consideration-sustained availability of wood raw material. An analysis of the forest resource base and the system of management indicate that in Assam, concerted effort has been made to meet the ever increasing demand by changes in the prescriptions of forest management. There are reasons to believe that the intensive working now followed in the Hollong-Makai forests are likely to result in lower yields after some time. We have also examined the resource base and estimated the potential supply of veneer logs. In chapter 4 a brief account of the system of timber extraction followed in various States is given.

Chapter 5 gives the possible strategies to overcome the problem. As far as this region is concerned short-term strategies are more important. Since the industry is concentrated in Assam, we have examined the feasibility of enhancing wood supply from the State's own sources and found that there is

little scope to increase the supply. However, there are States/Territories within the region with surplus wood. Therefore, the only feasible course available is to plan industrial capacity and wood supply on a regional basis. In such a regional planning, there are two options, namely (1) to move wood from surplus areas to deficit areas or (2) to move excess industrial capacity to wood surplus areas. A decision to choose any of the alternatives above is not dependent solely on wood availability, but should also take into account other economic and institutional factors.

Though better utilization of wood, adoption of improved technology in wood processing etc. are also important they cannot help to substantially reduce the demand supply imbalances in the region and therefore we have not gone into those details.

CHAPTER 1

INTRODUCTION

1.0 **Background of the study:** The background of undertaking a study on the wood raw material availability to the Plywood Industry has already been explained in an earlier report on the Kerala – Karnataka region. The states of Assam, Manipur, Tripura, Meghalaya and Nagaland and the Union territories of Arunachal Pradesh and Mizoram in North Eastern India (referred as North Eastern Region in this report for convenience) form an important area as far as plywood production in the country is concerned. Of the above, Assam has the highest concentration of plywood units and presently account for nearly 55% of the installed capacity in the country. Plywood units were first established in Assam in 1924 primarily in response to the demand for tea chests. There has been a rapid growth of the industry in this state during the last decade and at present the industry is unable to meet its requirement of wood raw material from the forests of the state. The primary objective of this study is to make an overall assessment of the capacity of the plywood units in the region and to examine the feasibility of meeting the raw material requirements to the optimum extend consistent with established norms of forestry practice and to suggest strategies for the future.

2.0 **Objectives:** Broadly the objectives of the study are

(1) To study the present system of raw material supplies and method of procurement.

(2) To critically analyze the estimated future demand of wood for the industry taking into account the growth of production of the existing and proposed units.

(3) To assess the present and future raw material supply position to the industry taking into account the present trends in forest management.

and

(4) To suggest short term and long term measures to ensure supply of wood raw material to the industry.

3.0 **Methodology:** Methodology adopted in this study is the same as that in the Kerala – Karnataka region. A questionnaire was sent to the plywood units in the region to gather information on installed capacity, expansion of capacity, plywood production, consumption of wood, sources and prices of wood etc. A large number of the units, particularly in Upper Assam, were visited to get the details on system of timber allocation, method of extraction and the institutional factors governing timber supply etc. Discussions were also held with the managers of some of the plywood units in the region and their views on the problem were ascertained.

Information regarding wood supply was gathered from the working plans, resource survey reports, administration reports, project reports etc. Details of the system of timber extraction, regeneration etc. were ascertained through discussions with forest officers at various levels in the region. During the visit to the region considerable information was gathered from timber contractors, local tribals etc. especially as regards the system of wood supply from non-governmental sources.

4.0 **Limitations:** Information could not be gathered from all units as response to the questionnaire was very poor and many of the units did not supply all the information in spite of repeated attempts. Even after personally meeting the managers, required information was not forth coming. Though the questionnaire was sent to the various units at least thrice and in spite of the personal interest taken by the Secretary, Assam Plywood Manufacturer's Association only 20% of the units furnished required information. In a few cases, obviously incorrect information was supplied. Thus there was a great handicap in making an objective assessment of the status of the industry in the region. This resulted in unavoidable delay in compiling this report.

CHAPTER 2

PLYWOOD INDUSTRY IN THE NORTH EASTERN REGION

1.0 **Introduction:** Establishment and growth of the plywood industry in the region is very closely linked with the growth of the tea industry. Plywood units were first established in the country primarily to meet the requirement of tea chests in Assam and West Bengal. Their close linkage explains the concentration of the industry in the above states. In 1905, tea chests made of three plies were used for the first time for packing tea and from then onwards it was imported for meeting the requirements of tea industry. Difficulties in the procurement of tea chests due to the world war stimulated indigenous production and two factories namely Assam Saw Mills & Timber Company at Murkong-Selek and Assam Railways and Trading Company at Margherita were set up.

The growth of the industry has been very slow till about the country's independence. Thereafter there was rapid growth and diversification of products. Table 2.1 gives the year wise capacity and production of plywood in the country.

Table 2.1

Capacity and Production of Plywood

(In Mill m^2 (4mm thickness)

Year	Capacity	Production			Capacity utilization
		Tea chest	Commercial plywood & others	Total	
1951	-	4.18	0.82	5.00	-
1955	-	4.48	1.80	10.28	-
1960	-	9.13	5.84	14.94	-
1964	-	9.75	10.62	20.37	-
1965	32.82	10.40	12.37	22.77	-
1968	36.65	12.09	17.56	29.65	-
1970	37.21	12.00	20.00	32.00	86.0
1971	39.68	10.81	24.97	35.78	90.0
1972	64.50	13.00	30.00	43.00	66.7
1973	64.50	13.00	33.00	46.00	71.3
1974	65.01	13.00	36.00	49.00	75.4
1975	70.14	12.00	33.00	45.00	64.2
1976	85.49	10.32	37.75	48.07	56.2

Source: Federation of Indian Plywood and Panel Industry, New Delhi.

It can be seen that the installed capacity has been growing at a rapid rate, while actual production has grown at a slow pace resulting in increased under utilization of capacity. Under-utilization of capacity in any industry can be attributed to demand constraints or supply constraints. Time and again the industry has pointed out that the major constraint in full capacity utilization is non-availability of timber. Though this is not the only factor, in the present study we will examine the

problem of under utilization of capacity mainly in relation to wood supply.

Table 2.1 also shows some important characteristics of the growth of the industry. Between 1960 and 1976 the annual growth rate of tea chest production was only 1.2%. In contrast, production of commercial plywood registered a rapid annual growth rate, about 12% between 1960 and 1976. Till 1964, emphasis was on production of tea chest. In 1964 the output of commercial plywood surpassed that of tea chest and in 1976 it accounted for almost 79% of the total production.

The pattern of export led industrial growth witnessed in the country influenced the growth of the plywood industry also. The rapid expansion of capacity between 1970 and 1976 is to some extend in response to the demand generated in the export market. Facilities made available for export through subsidy and other measures gave an impetus to the industry. Value of exports of veneer sheets, plywood etc. from the country is given below.

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[1] Underutilization of capacity is a characteristic feature o the Indian industries, and lack of demand (arising from lack of purchasing power of the majority of the people) is pointed out as the main reason.

Table 2.2
Export of Plywood and allied products
(Rs in million)

Year	f.o.b. value
1972 - 73	9.4
1973 - 74	43.8
1974 - 75	82.0
1975 - 76	41.33
1976 – 77	86.61

Source: Federation of Indian Plywood and Panel Industry, New Delhi.

A detailed analysis will indicate that the rise in exports is related to the boom in the construction activity in the Middle East countries. Export to these countries accounted for almost 73% of the export in 1974-75.[1] As such the trend in export earning is largely dependent on the pace of construction activity in these countries and it is necessary to look into the long term trend of construction to predict the future export possibilities.

With the above background, the growth of the plywood industry in the North Eastern region will be examined to see the nature and magnitude of the problem of procurement of wood, which is the most important raw material

2.0 Plywood Industry in Assam: Right from the inception of the industry in the country, Assam continues to be the leading plywood producing State. In 1976, Assam accounted for about 54% of the plywood production in the country.

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[1] Source: Government of India (1976): Statistics on Foreign Trade.

Availability of quality timber within easy reach and a local market in the tea gardens are the main reasons for the concentration of plywood units in the Upper Assam region. With the shift in emphasis to production of commercial plywood, the second reason is no more valid, as finished products have to be taken to markets outside the state.[1]

2.1 Growth of the Industry in Assam: Growth of the industry in Assam is the result of (1) growth due to the increase in the number of mills and (2) growth due to the expansion of capacity of the existing mills. Expansion of capacity and its consequent impact on wood supply has been well documented by the Assam forest department. In 1956 there were only 9 units in the State and the Forest Department was able to meet the entire requirement of timber for these factories. It was after 1956 that the industry registered rapid growth and new mills established. Along with this, the existing mills expanded their capacity. Table 2.3 gives the pattern of growth of the industry in the State.

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[1] At present important markets for commercial plywood are Bombay, Delhi, Punjab and Calcutta.

Table 2.3

Growth of Plywood mills and their capacity in Assam

	Category	No. of mills	Capacity (In mill m^2)[1]		
			1968	1972	1975
1.	Mills existing by 1956	9	5.313	9.323	14.014
2.	New mills between 1956 and 1968	12	6.941	13.338	15.767
3.	New mills between 1968 and 1972	7	-	0.312	4.552
4.	New mills after 1972	3	-	-	2.322
	Total	31	12.254	22.973	36.655

Source: Forest Department, Assam.

In 1975, in addition to the 31 mills above, there were 3 more mills outside the Upper Assam region, which were getting timber allotment on an adhoc basis. In addition there were mills, which were not getting any quota timber. Most of the increase in capacity is due to the expansion of the capacity of the existing mills rather than the addition of new mills. As can be seen from table 2.3, between 1972 and 1975, 83% of the increase in the capacity of the industry is accounted by the expansion of capacity of already existing mills, while only 17% can be attributable to establishment of new units.[2]

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[1] Based on the wood intake, capacity has been worked out assuming a yield of 125 Sq. metres per cubic metre of timber.

[2] When all the mills in the State (including those which do not get quota) are taken into account increase in total capacity attributable to new mills will be slightly higher.

As per an estimate of the Assam Plywood Manufacturer's Association total capacity of the Assam mills in 1975 was 45.8 million square metres. By 1976 the number of mills increased to 37 and then the total capacity was 46.6 million Sq. metres. In 1977 there were 39 mills recognized by the forest department for timber allotment. In addition to the above there were 4 mills which do not get any quota timber from the forest department. Presently no information is available on the exact capacity of the industry in Assam. Considering the expansion that has taken place after 1976, the installed capacity of the industry in Assam could be very near to 50 million Sq. metres.

An important feature in the growth of the industry is the most of the units came into existence primarily for producing tea chests. In due course, additional investment was made to expand the capacity and to switch over to production of commercial plywood. After some stage most of these units cease to produce any tea chest plywood. New units came up to take up tea chest production. Most of the tea chest production is, therefore, concentrated in the small and medium scale units. This, however, is not true in the case of units which are subsidiaries of tea manufacturing companies. As it is essential for them to produce tea chests for their constituent tea gardens they continue to produce tea chests. There are number of reasons for the units to switch over to commercial plywood production, the chief among them being the price difference between commercial and tea chest plywood and the rigid specifications for tea chest plywood.[1]

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[1] At present exfactory price for tea chest is Rs.8.10/m^2 while that of commercial plywood is Rs. 9.70/m^2.

Production of Plywood: Evan as regards the statistics on production of plywood there is considerable difference between the figures furnished by different agencies. Table 2.4 below gives the yearwise production of plywood from two sources.

Table 2.4
Production of Plywood in Assam
(In Mill m^2 – 4mm thickness.)

Year	Production	
	Source[1]	Source[2]
1971	19.6	-
1972	19.8	-
1973	24.4	25.6
1974	27.4	29.2
1975	23.4	27.2
1976	-	25.8

Source: 1. Economic Survey – Assam 1975-76
Directorate of Economics and Statistics.
2. Assam Plywood Manufacturer's Association.

It is evident that there have been considerable year-to-year fluctuations in the production of plywood particularly after 1973. However there is a long term upward trend, and Assam maintained its share in the total production of plywood in the country. In 1971 Assam produced about 19.6 mill m^2 and this accounted for about 55% of the total plywood produced in the country. In 1976 the share was 54%. Between 1972 and 1975 the installed capacity has increased by 86% while production has increased by 31% only. Upto about 1956, the industry had no problem in the

procurement of wood. The entire requirement could be met from within Assam, in spite of the conservative system of forest management followed. Further, there were extensive area under the unclassed State forests at that time, and a substantial quantity of logs were obtained from them. By 1965 due to the increase in capacity the industry began to experience difficulties in meeting the wood requirements and therefore a system of rationing had to be introduced. Since 1965 the policy was to allot timber to meet about 2/3rd of the estimated drying capacity of each mill. However with the rapid expansion of the capacity, it was not possible to meet even this and therefore and upper and lower limit was introduced. Under this system, allotment was based on the drying capacity subject to a minimum of 1416m^3 (50,000 cft) and a maximum of 5664m^3 (2,00,000 cft). Further increase in capacity necessitated a change in the criteria for quota allotment and from 1975 onwards as basic quota of 708m^3 (25,000 cft) was fixed and the balance was allotted on the basis of the drying capacity. By then output from the unclassed state forests declined and presently it is no more a dependable source of wood supply.

Presently on an average the mills get through quota about 20% of their total consumption. Another 10% to 15% is obtained from the open market, from the contractors who purchase coupes. Tea chest manufactures primarily depend on quota timber to meet their requirements and they seldom buy timber from the open market.

2.3 **Wood Supply:** Assuming an average yield of 125 Sq. metres of plywood from 1m^3 of log, the requirement of timber for producing about 46.6 mill m^2 (the installed production

capacity) of plywood will be about 3,72,800m^3.[1] Total supply of wood from Assam and the neighboring states in 1976 was only 2,04,000m^3, just sufficient to meet 55% of the capacity of the industry.[2] Table 2.5 gives the total intake of timber and the sources of supply.

Table 2.5
Wood Supply to the Plywood Industry in Assam
(In 000m^3)

Source	1973	1974	1975	1976
Assam	79	89	90	89
Other States	149	156	125	115
Total	228	245	215	204

Source: Assam Plywood Manufacturer's Association, Tinsukia.

Wood supply from within Assam is obtained from the following sources.

(1) Forest department quota (Hollong and Makai) delivered to the mills directly by the contractors of the forest department.

(2) Balance wood available in the plywood coupes (Hollong, Makai and other species) which the contractors bring to the market and

(3) Wood from other areas in Assam brought to the market and sold to plywood mills by contractors

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[1] We have assumed a conservative yield of 50%, though many plywood manufacturers have reported higher yields.

[2] Source: Assam Plywood Manufacturer's Association.

Between 1973 and 1976 there has been an increase in the supply from within Assam and this can be attributed to the intensive working of certain areas consequent to the revision of working plan. During 1972-73 the yield prescribed for Upper Assam circle was 63,259m^3 while for 1975-76 it was 79.531m^3. There has also been an increase in the plywood load fixed on the coupe contractors.[1]

From Table 2.5 it can be seen that the Assam mills depend more on the timber from outside sources, and this is mostly from Arunachal Pradesh and Nagaland. However, the supply seems to decline gradually. Plywood manufacturer's point out that sometime back they were getting about 93450m^3 (3.3 million cft) of timber from Nagaland and about 84,950m^3 (3.0 million cft.) from Arunachal Pradesh. [2] It is pointed out that both these States are imposing restriction to curb the movement of timber to Assam which has resulted in acute scarcity and consequent price hike.

2.4 **Trends in Future Production:** Already the situation regarding wood supply is quite unsatisfactory and therefore Assam may not be able to maintain its present share in the total plywood production in the country. Taking the low estimates of aggregate requirement of raw material for plywood, it will be necessary to supply 2,60,000m^3, 3,50,000m^3 and 6,72,500 m^3 of timber for 1980,1985 and 2000 respectively, if Assam has to maintain a share of 50% in the overall production in the country. We have seen, that in spite of the substantial supply of wood from Arunachal Pradesh and Nagaland, the wood consumption in 1976 was only 2,04,00m^3.

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[1] Though plywood load has increased there has been a decline in the actual quota supply.

[2] Source: Assam Plywood Manufacturer's Association, Tinsukia.

3.0 Arunachal Pradesh: Development of a viable wood based industries sector in Arunachal Pradesh has been constrained due to the inaccessibility, poor communication, shortage of power and a number of institutional factors. Presently Arunachal Pradesh has four plywood units, one at Namsoi, another at Jairampur and two at Deomali. The one located at Namsoi is one of the earliest plywood mills in the country.

Estimated Annual requirement of wood for the plywood units in the State are as follows.

1.	Assam Saw Mills and Veneer Mills	- 8000.00 m^3
2.	Nocte Timber Company	- 5000.00 m^3
3.	Narotom Co-operative Industries	- 4300.00 m^3
4.	Arunachal Saw and Veneer Mills	- 5700.00 m^3
	Total	- 23000.00 m^3

Source: Arunachal Pradesh Forest Development Corporation

Very little information is available regarding output of wood from Arunachal Pradesh. Annual yield is estimated as 1,60,000m^3.[1] As the requirement of the mills in the territory is only a fraction of the estimated yield, availability of wood for meeting the demand from existing plywood units is not a problem. As it stands now the territory has surplus wood raw material.

4.0 **Meghalaya:** There is only one plywood unit in Meghalaya, namely Meghalaya Plywood Ltd. Located at Burnihat. Installed capacity of the factory is 2,00 million m^2 and the

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[1] Source: Chief Conservator of Forests, Arunachal Pradesh.

Wood requirements for achieving full capacity utilization is 17,140m^3. The major sources of wood supply in Meghalaya is the reserved forests and the firm has entered into a long term agreement with the government of Meghalaya, stipulating the quantity, price etc. of timber for a period of 15 years. Some quantity of miscellaneous timber is obtained from Assam through contractors and timber traders.

During 1975-76 the production was only 1 million Sq. metres or 50% of the capacity. Timber consumed during 1975-76 was 8,571 m^3. It is pointed out that adequate wood is not obtained despite the commitments made by Meghalaya government. However, under-utilization of capacity cannot be attributed solely to inadequate wood supply. Factors like shortage of power etc. have also been responsible for not utilizing the capacity fully.

5.0 **Nagaland:** Presently there is only one plywood unit in Nagalad, namely Nagaland Forest products Ltd., at Tijit in Tuensand district. This was established in 1972 as a joint venture between the government of Nagaland and the Saharia group of industries. The installed capacity of the unit is 1.8 mill. m^2 . Year wise production of veneers is as follows.

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[1]Source: Forest Department, Meghalaya.

Table 2.6

Production of Plywood in Nagaland.

Year	Veneer sets (nos.)	Tea chest Finished (nos)
1972	10,622	-
1973	77,169	-
1974	1,04,435	-
1975	1,11,822	-
1976 (Jan. – June)	70,008	8,947

Source: Kaderkutty. A.K. (1976) Report on the visit to Nagaland and Nagaland Forest Products Ltd.

Reasons for underutilization of capacity are said to be inadequacy of raw material, shortage of power etc. The factory is situated in the Hollong-Makai belt of the State and the forest resources are adequate to meet the requirements of the unit. It is a paradox that a large quantity of wood from the state goes to factories located in Assam, while the factory in the state is not getting the required quantity of wood.

Preliminary work for establishing a veneering unit near Singphan is being done by Wood Crafts, Assam. It is pointed out that this unit will be able to utilize the timber available from the private forests and the veneers can be utilized in the factory at Mariani.

6.0 **Plywood Industry in other areas in the region:** Tripura, Manipur and Mizoram are industrially backward and there are no plywood units in these areas. Detailed studies have been carried out on the availability of raw material for various wood based industries by the Pre Investment Survey of Forest Resources. These details have been dealt under in a separate chapter.

7.0 Conclusion: Table 2.7 gives an overall picture of the installed capacity of the plywood industry in the region.

Table 2.7
Installed capacity of the Plywood Industry

State		Capacity (In Million m^2)[1]
Assam	=	46.6
Arunachal Pradesh	=	2.9
Nagaland	=	1.8
Meghalaya	=	2.0
Total	=	53.3

Present capacity in the region could be well over 55.0 mill.m^2 as considerable expansion has taken place since 1976.

It can be seen, that Assam accounts for 87% of the capacity in the region. The concentration of the industry is evident from the map showing the distribution of plywood units in the State. From the earlier discussions it is evident that the present problem in Assam is rather acute as expansion of capacity has taken place without taking

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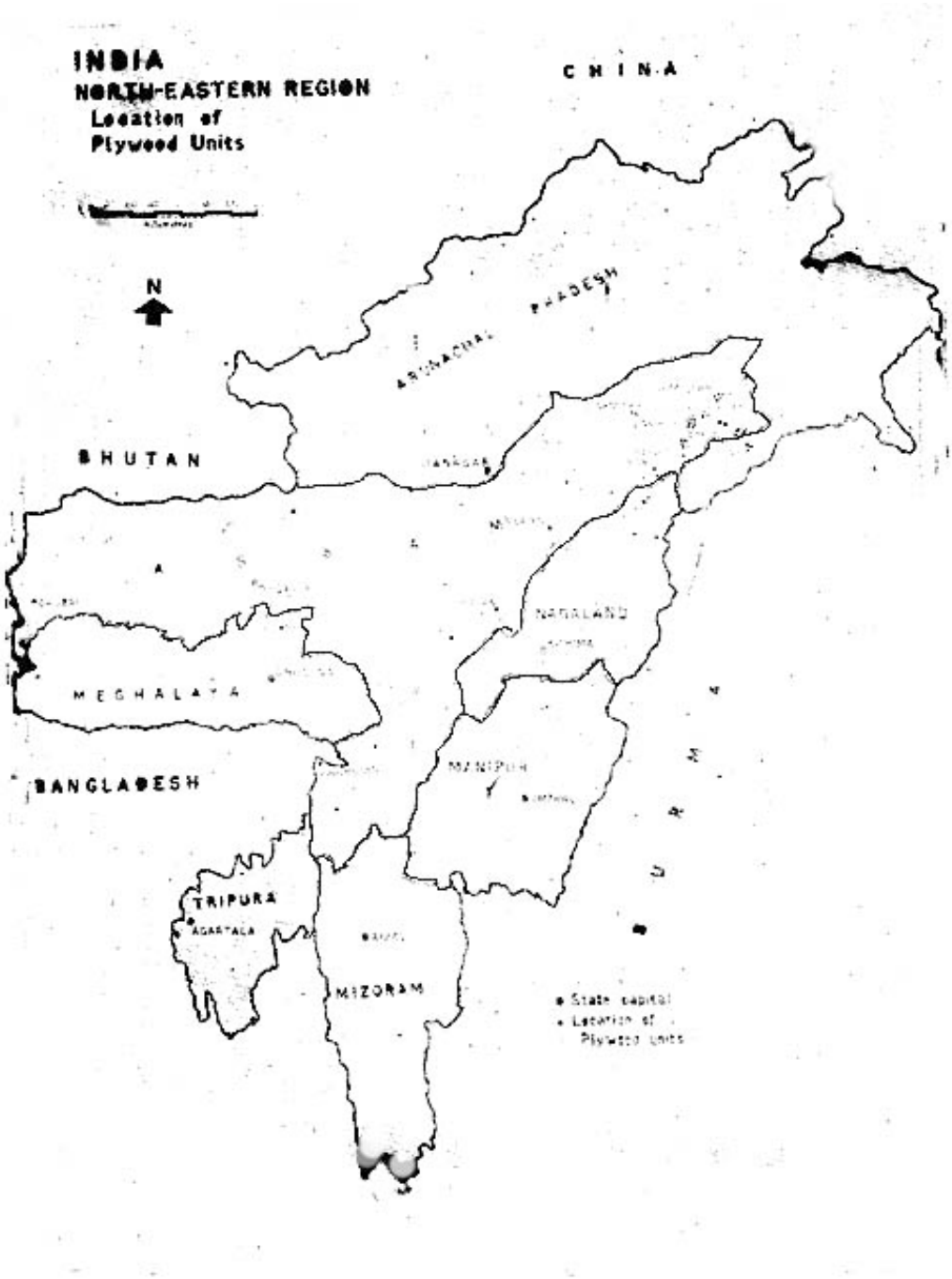
[1] Portains to the year 1976


INDIA
NORTH-EASTERN REGION
Location of
Plywood Units
N
CHINA
ARUNACHAL PRADESH
BHUTAN
NAGALAND
MEGHALAYA
BANGLADESH
MANIPUR
TRIPURA
AGARTALA
MIZORAM
• State capital
• Location of
Plywood Units

into consideration raw material availability. The potential of plywood timber in Assam has been known for sometime, and it is rather strange that expansion of already established units and establishment of new units took place rather indiscriminately during the past few years and a situation has arisen where to suggest a solution has become difficult. Arunachal Pradesh is presently a timber surplus region and provides a substantial quantity to the mills in Assam.

Nagaland is in a peculiar situation as regards wood supply. Though the joint sector unit at Tijit is finding it difficult to procure raw material a substantial quantity goes to meet the requirements of Assam.

As regards Meghalaya, it is not an important source of plywood species and there is already a factory with a capacity of 2.00 mill. Square metres.

CHAPTER 3

WOOD RESOURCES IN THE REGION

1.0 Availability of suitable timber from the extensive forests has been one of the important reasons for the concentration of plywood industry in the North Eastern Region particularly in Upper Assam. Movement of plywood units from West Bengal to Assam, installation of new units, and expansion of capacity of already existing units has been largely influenced by availability of wood. Extent of the forests and availability of wood raw material in various States and Union Territories of the region are examined in this chapter.

ASSAM

2.0 Like most other states in the country, accurate statistics regarding the forest area is not available in Assam also. Legally, forests are classified into two categories, viz., (1) Reserved Forest and (2) Unclassed State Forests. Forests categorized as reserved forests is under the control of the Forest Department and their area is about 15,300 Sq.Km. As regards area classified as unclassed State Forests the land is under the control of the Revenue Department while the trees are with the Forest Department. Estimates of the unclassed State Forests vary from 11,110 Sq. Km. to 12,080 Sq. Km. Some pockets of the unclassed State Forests containing better tree growth have been proposed to constituted as reserved forests and they are, therefore, known as proposed reserve forests.

2.1 **Distribution of forest area in the state:** According to the Statistical Hand Book of Assam, 1976, total forest area in the State (reserved forests, unclassed State forests and proposed reserve forests) is 21,140 Sq.Km. and is distributed in various districts as follows.

Table 3.1
Geographical Distribution of Forests in Assam
(Area 000 ha.)

District		Forest Area	Forest Divisions
1	Cachar	270	Cachar Division
2	Goalpara	343	Kachugaon, Dhubri Hallugaon and Goalpara Division
3	Kamrup	247	South Kamrup and part of North Kamrup Divisions.
4	Darrang	196	Darrang and part of North Kamrup Divisions.
5	Nowgong	108	Nowgong Division
6	Sibsagar	231	Sibsagar Division
7	Lakhimpur	134	Lakhimpur Division
8	Dibrugarh	248	Dibrugarh, Doom Dooma, Digboi Divisions
9	Karbi Anglong	274	Karbi Anglong West and East Divisions
10	North Cachar Hills	63	North Cachar Division
	Total :	2,114	

Source: Statistical Hand Book of Assam (1976): Directorate of Economics & Statistics, Gauhati.

Area figures furnished by the Forest Department however do not tally with the above. Considerable discrepancy is noticed between the estimates furnished by different agencies.

2.2 **Reserved Forests:** Even in the case of the area under reserved forest there is difference between the various estimates. Das (1976) has estimated the area as 16,420 Sq.Km., while Gogoi's (1976) estimate puts it as 15,345 Sq.Km. Of this 12,278 Sq.Km. in the plain districts is under the management of the Forest Department while the remaining 3,067 Sq.Km. is the hill districts of Karbi-Anglong and North Cachar are managed by the district councils.

2.3 **Brief account of the Forests in Assam:** There are two major forest types in Assam, viz., (1) Evergreen forest, covering an area of about 2,000 Sq.Km. and (2) Mixed deciduous forests. Evergreen forests are distributed in the high rainfall tracts of Upper Assam, primarily in Lakhimpur, Dibrugarh, Doom Dooma, Digboi and Sibsagar Divisions. Predominant species in these forests are Hollong, Makai and Nahor, In Nowgong Division of Central Assam the evergreen forests merge into the semi-evergreen forest and the Dipterocarpus are replaced by Ajhar, Semul, Sal etc. In some areas, especially on the north bank of Bramhaputhra predominance of Bonsum and Amari is noticed. Mixed deciduous forests occur in the low rainfall area of Lower Assam districts, where Sal is the most predominant species. Forests on the higher slopes bordering the Khasi and Jaintia hills of Meghalaya and Mikir hills contain Gogra, an important plywood species in the region. On the higher slopes khasi pine is common and it comes up profusely in cleared areas.

Wood supply to the Plywood Industry is primarily from the evergreen forests. The forest which is important as regards ply timber supply is the Upper Assam Dipterocarpus - Mesua forests Champion & Seth (1968) known as Hollong – Makai

forests. Almost 90% of the supply of ply timber is obtained from these forests. Disoi Valley reserve in Sibsagar Division is the westernmost area where Hollong – Makai forest occur and then it extends to the reserves in Digboi, Doom Dooma, Dibrugarh and parts of Lakhimpur in assam, Namsa – Tijit area in Nagaland and Tirap and Lohit districts in Arunachal Pradesh.

A detailed description of the forest has been given by Das (1965). Typically the forest is composed of several canopy layers and the top canopy is entirely dominated by Hollong while Makai and Nahor form the codominants. Makai prefers higher elevations while Nahor is characteristic of illdrained areas. Other important species are Amari, Hollock, Sam, Jutuli, Titasopa and Sopa. Hollong and Makai constitute 30 – 80% of the total number of stems in the top canopy.[1] Hollong prefers well drained soil; where drainage is poor it is replaced by Hollock. Nahor and Morhal are the important middle canopy trees. Other species in the lower canopy are Bhoma, Dhuna, Hillika, Jamuk, Sellong, Bandordima etc. Hollong regeneration is found all over the forest floor. Seedlings can tolerate shade, but openings enable them to establish easily. Makai regeneration is patchy and not as plentiful as Hollong. Main problem is as regards establishment and drastic opening invariably results in profuse growth of Michenia which suppresses regeneration completely.

2.4 **Forest Management and Plywood Timber Supply:** No comprehensive resource survey has hitherto been carried out in

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[1]Distribution of the species in various girth classes in some of the representative areas is given in Appendix I.

Assam to estimate the potential of the forests to meet the growing industrial and non-industrial requirements. However, during the last two or three decades forest management has been undergoing rapid changes with emphasis being given for meeting the industrial needs particularly that of the plywood industry. This is more evident in the divisions of Digboi, Dibrugarh, Doom Dooma and Sibsagar. For convenience of analysis of the trend in forest management in relation to the needs of the plywood industry, three stages have been identified, namely, (1) the pre-growth period, upto about 1947, characterised by stagnant capacity and production, (2) the growth period, from 1947 to 1964-65, when there was considerable growth in capacity and production, but with emphasis on tea chest production and (3) accelerated growth period, from 1964-65 onwards when there was rapid growth of the industry and emphasis was on the production of commercial plywood – accentuated by the demand from external markets.

Pre-growth period: During this period, there was continuous exploitation in the easily accessible areas of the present Digboi, Dibrugarh and Doom Dooma Divisions, mainly for meeting the requirements of railway sleepers. Mackernass' plan (1931-32 to 1941-42) prescribed selection felling and for Hollong, Makai and Hollock a lower girth limit of 225 cm was prescribed. Rotation of 150 years was followed, with a felling cycle of 30 years. A comprehensive scheme for regeneration operations by way of tending of natural regeneration in the moderately stocked areas and artificial planting in the open areas was prescribed. Climber cutting was prescribed on a 15 year cycle. These prescriptions, however, could not be implemented and the slump in demand is pointed out as the main reason. With the second world war, intensive felling commenced in most of the accessible areas

and working plan prescriptions were not adhered to.

Mackernass' plan was revised by Purkayastha and he suggested the formation of three working circles, namely Shelterwood working circle, Selection working circle and Clearfelling working circle. Demand from the plywood industry was virtually negligible. Further, due to war working plan prescriptions could not be implemented.

Growth Period: It was in Srinivasan's plan (1949-1959) that specific attention was given for meeting the requirements of the plywood industry. By this time demand for plywood timber had grown. In the revised plan 4 working circles, namely (1) Veneerwood working circle (2) Hollong Local Trade working circle (3) Miscellaneous working circle and (4) Clearfelling working circle, were constituted. Veneer wood working circle comprised a major portion of the Hollong – Makai belt and the object of management was to get a sustained yield of Hollong – Makai logs for the plywood industry. Selection cum improvement felling was prescribed and compensatory regeneration was prescribed in more accessible area of the forest which were worked under the earlier plans. A rotation of 180 years was prescribed and the exploitable girth was fixed as 225 cms (7'6") . A felling cycle of 30 years was adopted. The period of the plan witnessed a rapid growth of the plywood industry in the region and the demand for veneer logs increased considerably. Even then requirement of the industry could be met satisfactorily. Working plan prescriptions relating to exploitation were meticulously followed. However, little attention was given for regeneration. Though climber cutting was prescribed before felling, it was not carried out and therefore there was very heavy damage to the seedlings from felling. Felling gaps remained uncovered.

Tending of natural regeneration was also not carried out systematically (Das, 1964)

Accelerated growth period: Importance of meeting the wood raw material requirements of the plywood industry was further emphasized in Das's plan (1965). One of the principal objectives of the plan was "to supply plywood timbers to the veneer industries which have developed considerably in the area". Two working circles were constituted for this purpose, namely, (1) Hollong – Makai shelterwood working circle and (2) Hollong – Makai selection working circle. In the Hollong – Makai shelterwood working circle rotation for the species was brought down to 140 years and a regeneration period of 20 years was prescribed. As a conversion period of 120 years was prescribed, each felling series was divided into six periodic blocks and areas to be taken up for regeneration were indicated.[1] In periodic block I the exploitable girth for Hollong and Makai was brought down to 150 cm (5'). In areas outside PBI selection felling was prescribed and for Hollong and Makai exploitable girth of 270 cm (9') (except in Powai Felling Series where the exploitable girth was 330 cm) was prescribed. Annual coupes were to be marked on an area basis for which selection and demarkation of the coupes were to be made from one side of the block and proceed to other and covering the entire regeneration period of 20 years.

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[1]The part or parts of a felling series set aside for regeneration or other treatment during a specified period is known as periodic block. Estimated number of years required to initiate and establish regeneration over the whole of a periodic block is known as regeneration period.

In the Hollong – Makai selection working circle an exploitable girth of 270 cm (9') was prescribed with a felling cycle of 20 years. Yield from this working circle was fixed as 1699.0m^3 (60,000 cft.).

The system of working in these areas were further modified in response to the rapid increase in the demand for veneer logs from the industry. Das's plan was revised prematurely in order to enhance the wood supply and to undertake large scale work on Hollong – Makai regeneration and Hollong plantation. In the revised plan which came into operation from 1974-75 onwards two working circles were constituted namely (1) Hollong Plantation working circle and (2) Hollong – Makai regeneration working circle (Das 1974). Only part II of the plan which contains the proposals for future working was written separately for Digboi and Dibrugarh Divisions and for the newly formed Doom-Dooma Division. Part I of the earlier plan was retained as such.

The Hollong plantation working circle comprises of productive blanks, poor Hollong – Makai forest and miscellaneous forests bearing a few utilisable species and the objective of management is to convert these areas into plantations of Hollong and Makai, on a rotation of 45 years. Plywood timber yield at the end of rotation has been estimated as 200m^3/Ha.[1] A felling cycle of 15 years was prescribed and in the area outside the regeneration block selection marking was prescribed.

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[1] A.C. Das (1974) working plan for the Digboi Forest Division 1974-75 to 1985-86. Calculations made to arrive the rotation are based on the growth rate of a very small sample plot on an area of 0.3 acres. Even according to the working plan Officer '45 years is the quickest period within which the species attains utilizable size'. The quickest period should not have been prescribed as rotation and variability in growth rate should have been taken into account.

In the Hollong – Makai regeneration working circle, the system of Irregular Shelter wood system was prescribed to continue. However the rotation was reduced to 84 years as against 140 years in the earlier plan and the regeneration period was also reduced to 12 years[1]. In the regeneration bloc Hollong and Makai trees up to 150 cm girth was prescribed to be retained as advance growth. In areas outside the regeneration block selection marking is prescribed. Exploitable girth in this case was fixed as 300 cms and in areas where the number of Hollong/Makai trees of 300 cms is less, trees of 270 cms girth may also be marked taking into account the condition of the forest. Yield available from the regeneration block will be taken out purely on silvicultural necessity and the balance of the prescribed yield will be taken from the unallotted areas. A set of marking rules have been prescribed for the regeneration block and for areas outside the regeneration block.

Though as per the working plan irregular shelterwood system is followed it is only for part of the area. For obtaining a large quantity of veneer logs there is considerable reliance on the area outside the regeneration block where selection felling is followed. Of the total yield of 48,063m^3 worked out for Digboi Division, only 34% is obtained from PBI and the balance is realized from Unallotted areas. As a substantial proportion of Hollong – Makai timber is concentrated in the upper girth classes, during the next period, when part of the area now in unallotted block is taken up for regeneration, total yield

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[1]The rotation was worked out not on the basis of any fresh data on growth. It is stated that a Hollong tree attains a girth of 30 cm during 12 years. Applying this rate of growth the period required to reach 210 cm was worked out. This type of extrapolation is extremely unreliable.

available is likely to be lesser. On the basis of the data on growing stock in Digboi Division, which supply about 58% of the veneer logs in the Upper Assam circle the likely trend in future yield is examined below.

Based on the area and growing stock furnished in the working plan (A.C. Das, 1974), average growing stock of Hollong and Makai over 90 cm girth for the Hollong – Makai Regeneration working circle is only 49.0m^3 per hectare. This growing stock is distributed in various girth classes as given in Table 3.2

Table 3.2
Distribution of Vol/Ha for Hollong Makai

Girth class (cm)	Vol/Hectare (m^3)	Percentage of total Vol/Ha
90 < 120	1.5	3.0
120 < 150	2.6	5.4
150 < 180	4.0	8.2
180 < 210	5.9	12.1
210 < 240	5.8	11.8
240 < 270	6.9	14.1
270 < 300	4.6	9.3
300 < 330	6.2	12.7
330 & above	11.5	23.4
Total	49.0	100.0

Based on the above distribution and the area available under the working circle, a recalculation of yield was done adopting the prescriptions contained in the working plan. Table 3.3 gives the yield for the Hollong – Makai regeneration working circle.

Table.3.3

Theoretical yield of Hollong Makai from the Hollong – Makai Regeneration Working Circle

	P.B.I. Area[a]						Unallotted areas[c]				
Period	Total Area (Ha)	Annual area (Ha)	Yield/Ha (m^3)	Total yield (m^3)	PB VII[b] Area (Ha)	PB VI[b] Area (Ha)	Total area (Ha)	Annual area (Ha)	Yield /Ha (m^3)	Total Yield (m^3)	Total yield (for the working circle (m^3)
1.1974-1986	5367.0	447.25	44.9	20082.0	-	-	27398.0	2283.2	17.7	40413.0	48396.0
2. 1986-1998	4566.0	380.5	27.2	10350.0	5367.0	-	22832.0	1903.0	11.5	21881.0	25785.0
3. 1998-2010	4566.0	380.5	15.7	5974.0	4566.0	5367.0	18266.0	1522.2	11.7	17899.0	19026.0

Note: [a] In PB I area all trees down to 150 cm are to be removed.

[b] Yield from PB VII and PB VI will be negligible as most of the timber would have been removed from the area during the regeneration period.

[c] In unallotted area all trees, down to 300 cm will be removed during the first period, down to 240 cm in the second period and down to 180 cm during the third period.

[d] Total yield has been worked out assuming that 20% of the calculated yield will not be available for silvicultural reasons.

It can be seen that during the first period the expected annual yield is 48,396m^3 which is almost the same as that estimated in the working plan.[1] In the subsequent periods however, the yield is much lesser. Even if we assume that veneer logs will be removed from the unallotted block annual yield comes down to 25,785m^3 and 19,026m^3 in the second and third periods respectively. Though it may be argued that increment in the residual growing stock may compensate this reduction, it is unlikely that the increment accrued can fill the gap totally.

It is also worth mentioning that the growing stock was estimated in 1964, and during the ten years that have elapsed before the preparation of the present plan these areas have been subjected to repeated fellings. Therefore it may not be correct to presume that growing stock in existence in 1964 still exists.

Working plan prescriptions for the three divisions namely, Dibrugarh, Digboi and Doom Dooma are more or less the same and therefore we need not examine the details separately.

Sibsagar Division is another area in the Upper Assam circle which supplies veneer logs to the plywood industry. Here also, management practices have evolved overtime to facilitate the supply of an increasing quantity of timber to the industry. Hollong – Makai forests are primarily seen in Disoi valley, Disoi, Tiru Hills, Geleki, Abhoypur and Dilli reserves. As there is a dispute on the boundary

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[1] For the Hollong – Makai Regeneration working circle yield has been calculated by two methods. As per the Simon's modification of Von Mantel's formula yield has been estimated as 46410m^3 while on the basis of an alternative method it is 48063m^3. To be on the safer side a yield of 46400m^3 has been prescribed.

between Assam and Nagaland the first four reserves are not being worked. The area presently earmarked for working is only 9,650 hectares spread over the Abhoypur and Dilli reserves. Annual yield as per the working plan prescription is 4,984m^3 (1,76,000 cft.). however they are now marking on an average 3,398m^3 (1,20,000 cft) only. Short fall is mainly due to the non-availability of trees of the dimensions prescribed in the working plan. Further lack of adequate communications particularly all weather roads are an important bottleneck in extracting what is available.

Increase in the prescribed yield of timber consequent to the changes in the working plan prescriptions in Upper Assam circle is as follows.

Table 3.4
Prescribed yield from Upper Assam Circle

Year	Prescribed yield (m^3)
1964 - 65	52,000
1971 - 72	63,259
1975 - 76	79,531

Source: Forest Department, Assam.

Wood Supply from other regions: Forests in the foot hills of Khasi hills and Mikir and North Cachar Hills contains Gogra, (Schima wallichi) which is an important species for the plywood industry. The Mikir and North Cachar Hills forests are under the control of district councils. Important forest types in the area are the Cachar Tropical Evergreen, and Cachar Tropical Semi-Evergreen Champion & Seth (1968). The forests are in an extremely depleted condition. Jhuming, unauthorised settlements and uncontrolled and

illicit felling have resulted in complete degradation of most of the area. These forests cannot be expected to yield any large quantity if timber (Bhattacharjee; 1965). Occurrence of Gogra is only sporadic and therefore of lesser significance as regards wood supply to the industry as a whole is concerned.

2.6 **Area of Natural regeneration and Plantation:** Annual target for natural regeneration and plantation in Assam are as follows:

Table 3.5
Annual area for Regeneration in Assam

	Division	Area for Natural regeneration (Ha)	Plantation	
			Hollong (Ha)	Miscellaneous (Ha)
1	Sibsagar	120	-	-
2	Cachar	-	-	10
3	Digboi	340	400	-
4	Dibrugarh	120	-	75
5	Doom Dooma	-	200	150
6	Darrang	170	-	-
7	Dubri	90	-	-
	Total	840	600	235

Source: Forest Department Assam.

2.7 **Unclassed State Forests:** Most of the area under this category is under occupation and therefore contain very little tree growth of value. Till about 1970 large quantity of timber was being removed from these forests to the plywood mills. Timber was allowed to be removed on a permit system.

Presently there is neither Hollong nor any other quality timber in these areas.

As indicated earlier, better quality areas on the unclassed State Forests have been earmarked for reservation. Extent of the proposed reserve is estimated as 2,203 Sq.Km. Even here tree growth is poor and in a degraded condition. In 1977-78, plywood units were issued permits to remove specified number of trees from these areas. Marking in these areas was done on the principles of selection system and a girth limit of 270 cm has been adopted. The condition of the crop can be guessed from the fact that from Sibsagar Division only about 220 trees could be obtained from an area of about 600 hectares.[1]

2.8 Trend in total yield: We have seen from Table 2.5 that wood received from within the State has registered an increase from 79,000m^3 in 1973 to 89,000m^3 in 1976. Total yield from the Divisions in Upper Assam circle registered and increase from 62,500m^3 in 1972-73 to 76,680m^3 in 1975-76. Though the quota prescribed for supply to the plywood units has correspondingly increased, it is surprising to note a decline in the actual quantity supplied to the millers through quota. It may perhaps be due to rejections, which go to the open market from where also the units obtain their requirement.[2]

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[1]Source: Divisional Forest Officer, Sibsagar Division.

[2]It should be noted that the plywood millers exert considerable influence on the contractors. In fact quite a large number of contractors get financial support from the plywood mills.

ARUNACHAL PRADESH

3.0 Arunachal Pradesh has a total geographical area of 83,578 Sq.Km. of which 51,540 Sq.Km. are forests. Area under reserved forest is, however, only 8,072 Sq.Km. and the rest are unclassed State forests. In addition there are also extensive private forests

Very little information is available on the forest resources and their management in the past. A working plan was prepared for Tirap for 1952-53 to 1962-63. Till now the area covered by various working schemes is about 5,240 Sq.Km. A resource survey division was formed in 1971-72, and till 1975 an area of 4,042 Sq.Km. has been covered. The Pre-investment Survey of Forest Resources has covered an area of about 1,022 Sq.Km. in Kameng and Subansiri Divisions and availability of timber under various utility classes have been estimated. Presently resource survey is being carried out in tirap and Lohit Divisions.

3.1 **Forest types:** As there is considerable altitudinal variation, ranging from about 300 metres to more than 7,000 metres, Arunachal Pradesh Supports a wide range of forest types, from the Tropial Evergreen Forests to Alpine shrub. As regards wood supply to the plywood industry is concerned, the most important forest type is the Assam valley Tropical Wet Evergreen Forests Champion & Seth (1968) which extends from Assam to the Lohit and Tirap Divisions of the state. Important species are Hollong, Makai, Wahor etc. A detailed description of this type of forest in Assam is given in para 2.3 and this is more less applicable to the forests in Arunachal Pradesh.

3.2 **Supply of wood:** Considering the forest wealth in Arunachal Pradesh, the potential supply of plywood timber is substantial. Presently, annual removal of timber (plywood and

non-plywood together) from the reserved forests is estimated as 1,60,000m^3.[1] Part of the plywood timber is utilised by the local units and the balance is marketed in Assam. In addition timber is also obtained from the private forests and unclassed State forests. A major portion of this finds its way to the mills in Assam. However no authentic information is available on the quantity removed from these forests.

From the available information, ply timber removed from the territory is in excess of the internal requirement of the industry. It is stated that sometime back plywood units in Assam were getting about 85,000m^3 of timber annually from Arunachal Pradesh.[2]

3.3 **Future availability:** Important sources of wood supply from Arunachal Pradesh will be

(1) Project area of the Arunachal Pradesh Forest Development Corporation.

(2) Other areas under the control of the Forest Department

And

(4) Unclassed State forests and private forests.

Details of availability of plywood timber from the above mentioned sources are examined below.

(1) Project area of the Forest Development Corporation: A forest Development Corporation has been formed to undertake logging, marketing, forest plantation and natural regeneration. Presently the area of operation is confined to the Tirap district which contain extensive

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[1]Source: Chief Conservator of Forests, Arunachal Pradesh.

[2]Source: Assam Plywood Manufacturer's Association, Tinsukia.

Hollong – Makai forests. Reserved forests to be covered by the project is about 867 Sq.Km. and it is proposed to work an area of 1,440 hectares annually. Of this about 640 hectares will be in miscellaneous forests which will be planted up with teak after clearfelling. Predominantly Hollong bearing forests over an area of 800 hectares will be worked on a rotation of 60 years with the primary objective of supplying veneer logs to the plywood industry.

Estimated output of plywood timber from the project area is 71,280m^3. As the internal requirement within the district is only about 15,000m^3 a surplus of about 56,280m^3 of ply logs will be available from the project area for supply to the Assam factories.[1] Already the Forest Development Corporation has commenced timber extraction. The modus operandi is, to collect timber, bring it to central depots and sell it in public auctions.

(2) Potential wood supply from other reserved forests: The Pre-Investment Survey of Forest Resources has estimated the growing stock of plywood timber available in kameng and Subansiri Division as 4.54 million m^3. Even if we assume a conservative extraction rate of 1% giving a wide margin for all unforseen factors it may be possible to get about 45,000m^3 of ply logs annually. Inadequacy of basic infrastructural facilities especially all weather roads, is the main bottleneck in realising the potentialities of Arunachal Pradesh.

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[1]Source: Arunachal Pradesh Forest Development Corporation.

In addition to what is indicated above a substantial quantity of ply logs will be available which are being worked by the Forest Department. Particularly Lohit district has extensive Hollong-Makai forests and therefore it is possible to obtain some timber from this area. It may be possible to produce about 50,000m^3 of ply timber from these areas.

(3) Unclassed State Forests and Private Forests: As in other regions in North Eastern India local people enjoy the right of collection of any forest produce. Jhuming is the most prevalent mode of cultivation. To control unregulated felling from the community forests, Arunachal Pradesh Anchal Reserve Forests Act, 1975, was enacted. This act aims at bringing the community forests or village forests under the management of the Forest Department and the profit will be shared by the Forest Department.[1] When managed systematically these forests also will be a source of sustained supply of timber. However, as no information is available on the type of growth, frequency of occurrence of plywood species and the area available yield from these areas cannot be estimated.

3.4 **Wood balance in Arunachal Pradesh:** To sum up, expected annual plywood timber output from different sources in Arunachal Pradesh will be as follows:

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[1]Source: Chief Conservator of Forests, Arunachal Pradesh. The share of the community is being utilised for the developmental activities of the village.

1.	Area under the Forest Development Corporation	71,280 m^3
2.	(a) From Kameng and Subansiri Divisions	45,000 m^3
	(b) From other forest areas	50,000 m^3
	Total	1,66,280 m^3

Availability from most of the areas (particularly from Kameng and Subsansiri Divisions) will largely depend on building up an effective transport system. Giving a wide margin for this at present about 1,21,000m^3 of timber can be extracted, which, however, can be enhanced to about 1,66,000m^3 depending on the investment in opening up inaccessible areas. Present demand for veneer logs in the State is estimated as 23,000m^3. It is, therefore, clear that Arunachal Pradesh will have a surplus of about 98,000m^3, which can be increased to 1,43,000m^3. In addition to this some quantity of timber will be available from the unclassed state forests and private lands also.

NAGALAND

4.0 **Forest Area:** As in the case of most states, there is considerable ambiguity as regards the area under forests; this is further complicated by the extensive degradation caused by the prevalence of jhuming in most of the forest areas. Even reserved forests are not spared from jhuming. Of the total geographical area of 16,488 Sq.Km. 14.9 or about 2,458 Sq.Km. has been categorized as forests. Reserved forests extend over an area of only 1.7% of the geographical area. Distribution of forests under various categories are as given in Table.

Table 3.6

Forest Area in Nagaland (Sq.Km.)

Division	Reserved forests	Protected forests	Private forests
Kohima	262.03	87.96	759.13
Mokokchung	-	12.44	620.36
Tuensang	-	-	535.80
Mon	23.57	-	156.70
Total	285.60	100.40	2,071.99

Source: Forest Department – Nagaland.

The reserved forests are wholly under the management of the Forest Department, while the protected forests have been constituted primarily to protect and maintain water supply to important towns like Kohima, Mokokchung etc. As regards private forests no survey records are available and therefore these area estimates cannot be relied upon for any useful planning for the development of wood based industries. A detailed description of the present condition of the forests and the system of management followed is given below so as to make an assessment of wood availability from Nagaland.

4.1 **Management of Reserved Forests:** There are only 4 reserves in the State, spread over two Divisions. Extent of each reserve is given below:

Kohima Division	Rangapahar	4,582 Ha
	Intanki	20,202 Ha
	Diphu	1,419 Ha
Mon Division	Singphan	2,357 Ha
	Total	28,560 Ha

No information is available on the present condition and composition of the reserved forests. It is a decade since Bhattacharjee (1968) has prepared a working scheme for the Rangapahar reserve and even today reliance has to be placed on the information furnished in this scheme though considerable changes have taken place. Rangapahar reserve is located in the foot hills, and predominantly consists of deciduous species. The area has been subjected to heavy exploitation during the war resulting in complete deterioration of the growing stock. Important species found in the area are Bonsum, Amari, Bola, Bogipoma, Sam, Sopa, Gomori and Gonsori. However, their frequency is low which can be attributed to the uncontrolled exploitation in the past. Presently the main object of management of the Rangaphar reserve is to clearfell the tree growth and convert them into plantations as quickly as possible. A rotation of 100 years has been prescribed and the annual area taken up for working is about 63 hectares (155 acres). Important species being raised in the area are Teak, Bonsum and Gomari.

Almost the entire Diphu reserve is under encroachment and hence not available for wood production. Intanki reserve contain a substantial quantity of timber. However the area has been declared a sanctuary and therefore has to be excluded from the purview of large scale commercial management. Singphan is largely an inaccessible area. As and when communications are built up timber extraction takes place from the areas thus opened up. No survey has been hitherto carried out and no estimates of growing stock and potential annual cut are not available. Considering various pressures on the forest area especially for settled cultivation, it is quite realistic to assume that the potentiality of the area to produce plywood timber is very much limited.

4.2 Private Forests: Though the area under private forests is about 2,072 Sq.Km., the tree growth is in an extremely degraded condition consequent to jhuming. Jhuming has been the way of life of the people and is in vogue ever since these hills were habitated. The local people enjoy two customary rights, viz. (1) to jhum the area by cutting and burning the vegetation and (2) to levy a charge of 'Naga commission' on any forest produce removed from the area. Every attempt to bring these forests under protective measures is therefore vehmently objected to by the local people and every action of the government is viewed with suspicion. With the result it has not been possible even to survey the area and assess the availability of timber. It was with considerable difficulty that a working scheme for the Namsa – Tijit area could be prepared (Bhattacharjee, 1968). This area represents the only compact block of Hollong-Makai bearing forests in Nagaland and is situated in the North eastern corner of Mon Sub Division.

The working scheme was prepared with the specific objective of examining the feasibility of establishing a plywood unit in Nagaland. A partial enumeration was carried out to assess the growing stock and to estimate the annual yield of plywood timber. Percentage distribution of important species as per the enumeration carried out is as follows:

1	Makai	24.4
2	Hollong	21.2
3	Nahor	16.0
4	Jutuli	6.0
5	Amari	4.3
6	Sopa	2.5
7	Sam	1.9
8	Hilika	1.1
9	Others	22.6
	Total :	100.0

Source: Bhattacharjee (1968) : A working scheme for the forests of the Namsa – Tijit area in Nagaland.

The area is subject to all the customary rights. Apart from realizing a royalty on the timber removed government have no control over the area. In the absence of any legal protection, there has been extensive exploitation, cutting and lopping and topping of trees since the preparation of the scheme for the area. Feasibility of supplying raw material to the plywood industry on a sustained basis will depend on the protection given to these areas.

4.3 **Estimates of wood availability:** Wood availability for manufacture of plywood has been estimated by Bhattacharjee (1968) as follows:

Table 3.7
Estimated availability of plywood timber from Nagaland

Area		Species	Net Annual Yield (m^3)	Potential annual yield (m^3)
1	Namsa - Tijit	Hollong and Makai	4248	5664
2	"	Other spp	283	707
3	Rangapahar	"	1284	1467
4	Intanki	"	4489	5986
5	Other Forests	Hollong, Makai and other spp	316	1752
		TOTAL	10620	15576

Source: Bhattacharjee (1968): A working scheme for the Hollong – Makai forests of the Namsa – Tijit area of Nagaland.

The above estimates pertain to 1968 and since then considerable changes have taken place by way of uncontrolled exploitation, illicit removal and jhuming. Yield of Hollong

and Makai prescribed above is on the basis of a felling cycle of 25 years and adopting a minimum exploitable girth of 270cm. Though there are prescriptions for raising Hollong and Makai plantations, nothing has been done hitherto.

4.4 Wood Balance in Nagaland: From Table 3.7 it is evident that potential annual yield from Nagaland is 15576.0m^3. During the ten years that have elapsed since the preparation of the scheme a substantial quantity of timber has been removed and if a reassessment is made now the sustainable annual yield will be much lower. Assuming a 50% yield, Nagaland Forest Products Ltd., require about 14,400m^3 of timber annually. It is, therefore, clear that what is available in Nagaland now is just sufficient to meet its internal requirement.

MEGHALAYA

5.1 Out of a geographical area of 22,548 Sq.Km. in Meghalaya, reserved forests form 821 Sq.Km. only. Apart from the reserved forests there are 7,400 Sq.Km. of unclassed state forests, mostly under the management of district councils and about 384.0 Sq.Km. under private ownership. There are also forest under the ownership of the community as well as temples.

5.1 **Forest types:** In Meghalaya three forest types can be distinguished. The Cachar Tropical Evergreen forest is found on the windward side facing Surma Valley. On the slopes facing the Bramhaputhra valley on the north, moist deciduous forest with Sal is the most important. The subtropical pine forest consisting mainly Khasipine , is seen on the plateau region.

Reserved forests containing substantial quantity of plywood species are either on the southern side of the state close the Surma Valley or on the northern side

facing the Bramhaputhra Valley. Of this the most important are, the Nongkphyllen reserve in Khasi Hills and the Narpuh and Saipung reserves in Jaintia Hills. Even these forests have been subjected to Pan jhuming and encroachment. The Nongkphgllen reserve has been included under the clearfelling working circle in Choudhry's plan. These forests are situated on the lower elevations and predominantly consists of mixed evergreen forests and bamboos. Important species are Bogipoma, Kadam, Khokon, Hollock, Gogra etc. After clearfelling it is proposed to convert these areas into plantations of Teak, Hollong, Bogipma, Titasopa, Bhola etc. Total area of the Narpuh and Saipung reserved forests is 315.76 Sq. Km. Leaving aside the areas situated on precipituous slopes and jhumed areas the area available for timber production is only 141.14 Sq. Km. Miscellaneous forest in these blocks contain a good number of plywood species. As per the working plan prepared for the area the objectives of management are (1) to obtain the maximum sustained yield, (2) to improve the condition and composition of the growing stock and (3) to device a technique to accelerate the growth of the naturally regenerated crops. Irregular shelterwood system has been prescribed for the area. Girth limit for marking is 150 cm and a felling cycle of 20 years have been suggested.

5.2 **Meghalaya Forest Development corporation:** The Meghalaya Forest Development Corporation has drawn up a project for raising 1,000 hectares of plywood species annually, the species being Teak. It is rather strange that when there are a large number of plywood species occurring naturally in the area the corporation has identified teak as the

most suitable. It is argued that teak is a species whose performance is well-known and which will fetch a reasonable return on the investment.[1]

5.3 **Wood availability:** The Meghalaya Government has already entered into an agreement with Meghalaya Plywood agreeing to supply a minimum quantity of 8,400m^3 of timber annually from the three reserves for a period of 15 years. Annual requirement for full capacity utilization is 17,142 m^3. As per the working plan and schemes applicable for the area the total yield will be about 5,400m^3 per annum, which is short of the requirement.

It can be seen that prospects of wood supply from Meghalaya forests is far from satisfactory and what is available may not be sufficient even to meet the internal requirements.

TRIPURA

6.0 The forest area of the State is 6,187 Sq.Km. of which 406 Sq.Km. are plantations and the rest natural forests. Of the total forest area 69% form reserved and proposed reserve forests. Important forest types in Tripura are

(1) East Himalayan Bhabar SalCachar

(2) Tropical Evergreen Forest

(3) Moist mixed deciduous forest

(4) Low Alluvial Savannal wood land

(5) Moist mixed Deciduous forest

And

(6) Secondary moist bamboo brake.

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[1]With the considerable freedom of action available for the Corporation, attempts should have been made in hitherto unexplored fields. There is also a larger question as to whether it is desirable for a public sector undertaking to choose projects purely on financial viability.

The Pre-Investment Survey of Forest Resources has carried out a survey and the information regarding availability of plywood furnished in their report is summarised below.

Important plywood species in the State are Kanak, Gurjan, Bahera, Harguza, Am, Korai, Udal, Poma and Harish. These species are mostly found in the three forest types enumerated first above. It has been estimated that with the existing growing stock, an annual yield of 19,800m^3 of plywood timber can be obtained from the forests. As there are no wood based industries in the State at present, it is possible to support a plywood unit with an annual intake of 15,000m^3 of timber.

Timber as well as bamboos have local market only. For want of proper and economic means of communication the major forest products have not been exploited for developing wood based industries.

MANIPUR

7.0 The geographical area of Manipur is 22,366 Sq. Km. Until the survey by the Pre-Investment Survey of Forest Resources in1975, very little was known about the forests, their composition, growing stock etc. Till then the Forest Department was under the impression that the area under forests constituted about 27% of the geographical area. However the survey revealed that the forest area in the state is 15,155 Sq. Km. Or about 68.8% of the geographical area. Information furnished by the Resource Survey is summarized below.

7.1 **Forest Types:** Important forest types in the region are (1) Wet temperate forests, (2) Pine Forests, (3) Wet Hill forests, (4) Semi Evergreen Forests and (5) Teak-gurjan

forests. These forests have been grouped into tree forests with comparatively dense growth and open forests where tree growth has become sparse due to biotic interference especially jhuming. The forests are sharply stratified by altitude. The Cachar Tropical Evergreen Forests are seen on the foot hills upto an elevation of 900 metres. Important species are Bonsum, Amari, Poma, Gamari, Gogra etc.

Teak-gurjan forests also falls in the same altitudinal zone and occurs along the Burma border. Important species are Gurjan, Hrguza, Xylia etc. Though it is known as Teak-gurjan forests, teak is conspicuous by its absence.

The Khasi Sub Tropical Wet Hill Forests (58/C2) are found at altitudes ranging from 900 to 1,800 metres and the species are Saurauja spp, Bonsum, Gogra, Cinnamomum, Castanopsis etc.

Other forest types met in the State are Assam Sub Tropical Pine forests (9/c2) East Himalayan Wet Temperate Forests ($11B/C_2$) and Sub Alphine forests above 2,700 metres.

For estimation of growing stock under different utility classes Harish, Korai, Poma, Gurjan Hollong, Harguza, Champ, Am, Kaimala, Bonsum, Gogra, Udal, Bahera and Teak were grouped as species suitable for plywood.

7.2 **Wood availability:** Annual availability of plywood timber from the various forest types are as follows:

1	Wet temperate forests	17,878 m^3
2	Broad leaved trees in Khasi pine forests	5,766 m^3
3	Wet Hill Forests	74,302 m^3
4	Semi Evergreen Forests	7,211 m^3
5	Teak Gurjan Forests	5,311 m^3
	Total :	1,10,468 m^3

The resource survey has pointed out that there is scope for establishing a plywood unit with an annual intake of 1,10,000m^3 of timber. Assuming a 50% yield the wood resource can sustain a production of 13.75 million Sq. metres of plywood.

7.3 **Constraints:** The resource survey gives an indication of the potentialities. However, realization of the potentiality depends on a number of technical and institutional factors. The major economic constraint is the lack of adequate infrastructural facilities especially roads. The terrain is extremely rugged and substantial investment is required for development of adequate facilities for communication. The state as a whole is poorly served by roads and the only all weather road which links the state with the rest of the country in the Imphal – Kohima – Dimapur road, which also is liable for frequent closure due to land slides.

The peculiar land tenure system in the State is another constraint in the industrial utilization of the forest resources. Jhuming is the most important system of cultivation. Reserve forests cover an area of only 1,329 Sq.Km. and even these are not spared from jhuming. A large part of the forest are still under village council ownership. Uncertainty of the legal status is a major constraint in the development of the forests and forest based industries.

8.0 **Resources in other areas:** Total area of the forests in Mizoram is estimated as 12,980 Sq.Km. However no information is available on the potential yield of wood, factors influencing annual yield such as communication facilities and the institutional factors such as land tenure etc. Jhuming is the most prevalent mode of cultivation and the tribal communities enjoy a number of rights and concession in the area.

9.0 **Conclusion:** Table below gives an idea of the wood availability in the region as a whole.[1]

Table 3.8
Wood Availability from the North Eastern Region (1M.m^3)

State	At the current level of production
Assam	89,000
Arunachal Pradesh	1,21,000
Nagaland	11,000
Meghalaya	5,400
Tripura	-
Manipur	-
Total :	2,26,400

With all effort, in the immediate future it may not be possible to get more than 2,26,000m^3 of timber from the region as a whole. We have dealt with at length, the system of forest management in Assam, and has seen that the possibility of increasing yield is very little. It may be quite possible that at the current rate of extraction, output may decline after a few years. Arunachal Pradesh alone seems to be in a position to supply timber over and above its internal requirement. Forest resources in Nagaland is just sufficient to meet the requirement of the industry in the state. Present indications are that even Meghalaya will be a deficit state as far as veneer log requirement is concerned. Tripura and Manipur has the potential for meeting part of the requirements of the industry in the region. However, there are a number of economic and institutional factors that inhibit the industrial utilisation of the resources in these states.

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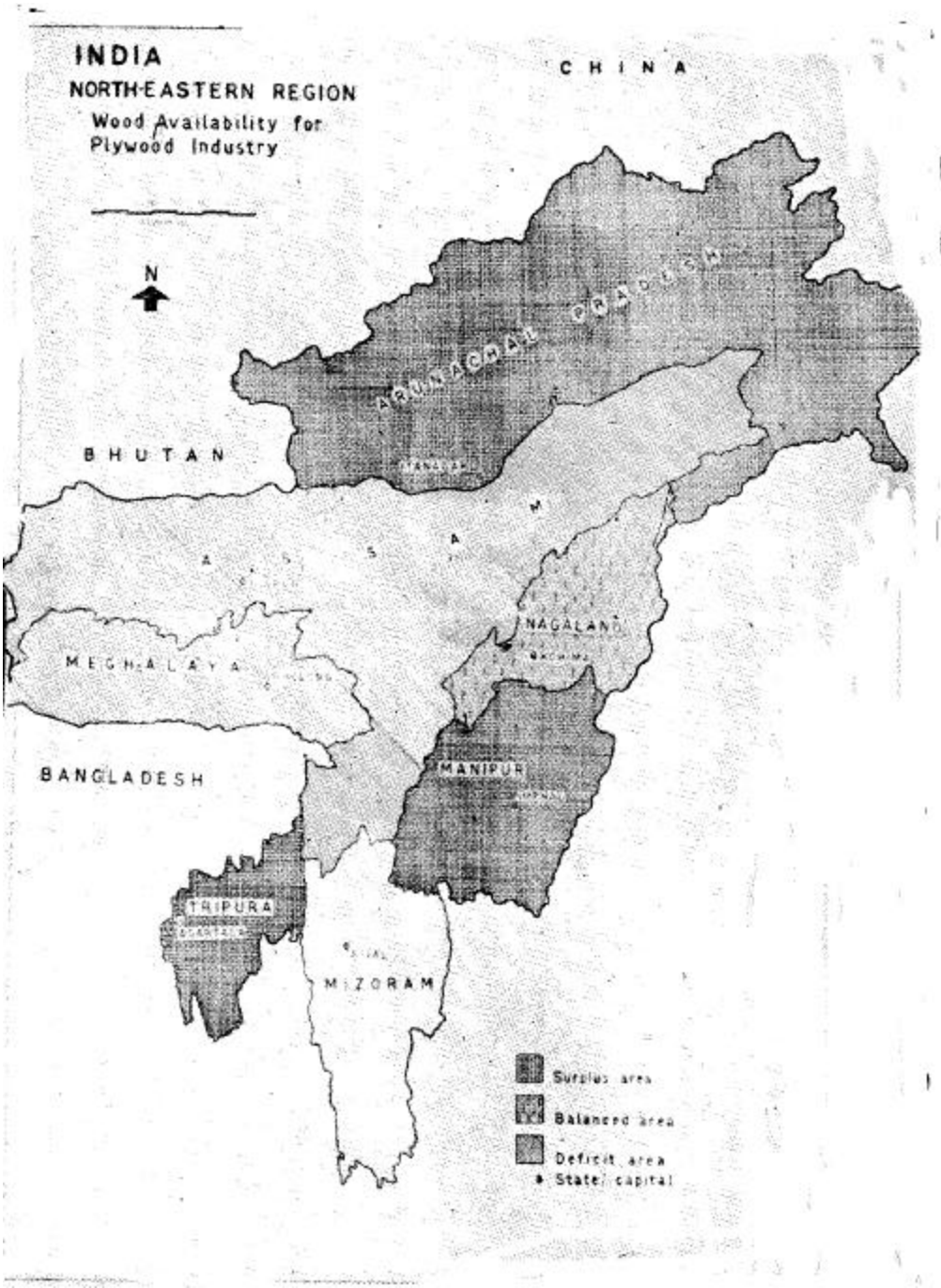
[1] Wood availability for plywood industry in various states/territories in the region is indicated in the map.


INDIA
NORTH-EASTERN REGION
Wood Availability for Plywood Industry
N
CHINA
ARUNACHAL PRADESH
BHUTAN
NAGALAND
MEGHALAYA
BANGLADESH
MANIPUR
TRIPURA
MIZORAM
Surplus area
Balanced area
Deficit area
State capital

CHAPTER 4

System of Wood Procurement in the North Eastern Region

A review

1.0 In Chapter 2 mention was made about the successive changes in the policy of allotment of timber in Assam to the plywood industry to keep pace with the increasing demand. The system of wood procurement is an important link between wood production and its utilisation and in this chapter we will go into details of the practices followed in the plywood producing states in the region.

2.0 In the early stages of growth of the industry in Assam certain units were obtaining timber from areas leased to them. Timber extraction was carried out by mills themselves. But presently none of the plywood mills have any long term leases and all of them depend on the annual quota allotted by the Forest Department. Supply of quota timber is effected through coupe contractors who purchase standing timber in the coupes. These contractors are bound to supply a fixed quantity of plywood timber (mainly Hollong & Makai) to mills specified in the agreement.

Marking in Hollong-Makai coupes is carried out by the department according to working plan prescriptions. The department invites sealed tenders for sale of the produce. The purchaser of the coupe will have to supply a stipulated quantity of plywood logs to a specified mill for which he will be paid at the rate of Rs.376.34/m^3 for logs above 122cm girth and Rs. 276.13/m^3 for logs below 122cm. The plywood mill reimburses the amount to the department

immediately after receipt of the timber. It is incumbent on the part of the contractor to fell all marked trees, convert them to logs of specified lengths, present them for passing and transport them to the mill site. Presently 80% of estimated volume of Hollong & Makai has to be delivered to plywood mills.

2.1 All marked trees are to be felled and the contractor shall have no claim on any other tree in the coupe. Trees should be converted into logs of 83, 210, 275 and 400 cms length and in unavoidable circumstances it may be converted into 150cm lengths. These logs are marked with department hammer and they should be extracted to the road side within ten days after prophylatic treatment. After inspection of these logs by forest officials, they are passed for delivery to the mills. The contractor delivers these logs to the plywood mill along with the inspection note and transit permit. After obtaining acknowledgement from the mill, these documents are handed over to forest officials for effecting payment. The plywood mill can reject logs which are found unsuitable for manufacture of plywood.

The rejected logs and timber in excess of the quantity stipulated in the agreement are removed by contractor after sale marking and obtaining a transit permit from forest officials. The rejected logs and quantity in excess of the volume stipulated for delivery in the mill forms the source of timber in the open market.

2.2 Earlier the millers were being permitted to participate in the tenders and coupes were being worked by them or by their agents. With the objective of encouraging local entrepreneurship, the government imposed a ban on millers taking up contracts. It is understood that the plywood manufacturers finance the contractors to enable them

to get timber which the contractor can otherwise dispose off in the open market. It is also gathered that in some cases the manufacturers enter into and understanding with contractors for delivery of the entire output of ply logs from the contracted area to the mill site on payment of agreed rates. To encourage persons belonging to backward castes and tribes, there is a condition in the sale that their tender can be accepted even if the offer is less by 71/2% of the highest bid and some mills are said to take advantage of this.

3.0 The system of timber extraction followed in Arunachal Pradesh is very similar to that in Assam. Earlier the plywood mills could participate in coupe auctions and then timber working was to a great extend controlled by them. Later the government imposed a ban on the participation of the millers in auction to encourage local entrepreneurship. Now, only the local contractors can participate in the auctions. This however does not appear t have brought any material change as many of the local contractors have the backing o plywood millers.

3.1 With the setting up of the Arunachal Pradesh Forest Development Corporation, extraction and disposal of timber is carried out by Corporation in the project area. Now, the Forest Development Corporation works down timber to depots from where it is sold in auction. When the tempo of working of the Arunachal Pradesh Forest Development Corporation increases a much larger quantity of wood will be available from the depots.

3.2 Private forests and unclassed State forests also form an important wood source. Timber removal is regulated from these forests through a permit system. In this system permits are given to eligible local persons for felling of

marked trees after payment of royalty. There is no scope for regulation of price at which timber is sold as the permit holder naturally disposes the timber where he gets the maximum price. This has resulted in certain amount of instability in price.

4.0 Private forests form the most important source of plywood timber in Nagaland and there is no specific system of timber extraction.

For timber and other produce from Jhumlands or from the forests under community rights permits are issued to the right holders on payment of royalty with or without a monopoly fee. For disposal of the trees, it is necessary for right holders to get permission from the Deputy Commissioner before approaching the Forest Department for transit permit. From 1965 onwards the issue of permits in a year has been restricted to 1,000 trees in a division. With the objective of conserving the timber resources in the state and to prevent indiscriminate felling recently the government have introduced a quota system whereby a ceiling is fixed on the quantity of timber that can be removed annually from each district. Total quota fixed for the seven districts in the state for 1977-'78 is 11,000m^3.

Permits are usually issued to the landowners or persons authorized by them. Permits to an individual should not exceed a quantity of 20m^3. Of the ceiling fixed for each division, the Divisional Forest Officer has been authorized to issue permits to an extent of 60% while the remaining 40% is to be issued by the government. As per the procedure prescribed, an application has to be made by the person specifying quantity, locality etc., and the applicant have to remit the royalty in advance. The trees are to be marked by the Forest Department after which

they will be felled and converted into logs by the applicant. These logs will be measured by the Forest Department, balance royalty if any will be collected and they will be then released to the applicant after marking with sale hammer and issuing transit permit. However, this procedure is seldom followed in actual practice. Most often application is filed only after the trees are felled and converted into logs. It is gathered that due to inbuilt flexibility in the system a much larger quantity of timber than permitted usually finds its way out. The system in a way encourages movement of timber to outside the state.

5.0 In Meghalaya certain reserved forests have been leased out to Meghalaya Plywoods Ltd., for a period of 15 years and here the company makes its own arrangements for timber extraction. Trees will be marked by the Forest Department according to the working plan prescriptions. Felling and conversion has to be carried out by the lessee, which after hammer marking and measurement will be released for removal to the factory.

CHAPTER 5

STRATEGY TO MEET WOOD RAW MATERIAL REQUIREMENT IN THE NORTH EASTERN REGION

1.0 **Need for a Strategy:** A detailed analysis of the wood raw material requirements of the industry and the extend of availability has been made in earlier chapters. Imbalances in the demand and supply of wood are very acute particularly in Assam and the matter needs to be examined to evolve a workable strategy. The expansion of industry has apparently taken place with out adequate consideration of wood resources and the present imbalance is a result of lack of integration between forest management and development of the industry.

A strategy for meeting wood requirements of plywood industry should have short term as well as long term measures. Short term measures aim at maximizing the flow of wood from the resource stock available, while long term measures aim at increasing the total growing stock resulting in increase of the flow. As long term measures will have any tangible effect only after a few decades, they are of little help to solve the immediate problem of scarcity of wood.

2.0 During discussions with some of the leading plywood manufacturers in the region, they have put forth a number of suggestions to overcome the problem. Important suggestions are as follows.

(1) To augment wood supply by (a) reducing the rotation from 84 years now followed in Assam and (b) taking up extensive plantations on a short rotation by clear felling the existing forests. This, it is pointed out, will solve the problem in the short run as well as in the long run.

(2) To treat the states and territories in the region as single zone for planning raw material supply to the plywood units in the region. Available timber supply from the region should be pooled together and supplied to the plywood units in the region.

(3) Imposing a ban on the establishment of new units and the expansion of capacity by existing units.

The industry point out that both the long term and short term strategies are closely linked, as a programme of large scale plantation to meet future needs of the industry require clear felling of extensive areas which will release a large quantity of timber to meet the immediate demand. The feasibility of implementing these suggestions are examined subsequently.

3.0 From discussions in the previous chapters it is evident that inspite of the declared objectives of forest management plans to supply a sustained output of plywood timber, the problem of wood supply has increased. This is mainly due to the expansion of industrial capacity without taking into consideration the prescriptions worked out for forest management. Need for a clear cut strategy is, therefore, evident from the present state of the problem. We will now examine the technical options available for the individual states separately and then for the region as a whole and indicate the policy options as well as the institutional changes needed to implement the strategy.

4.0 From earlier chapters dealing with industrial capacity and resource availability in various States/Territories in the region, it can be seen that certain states are deficit as regards wood supply is concerned. There are however, areas which produce wood in excess of their present internal requirements. Our attempt will be first to examine whether there is scope for increased output in the deficit states and whether such an increase in wood supply is adequate to bridge the gap. It is also proposed to examine the optimum extend to which the present wood surplus areas can augment their output. On this basis the demand-supply gap for the region as a whole will be worked out to study the feasibility of integrating industrial capacity and resource availability for the region as a whole.

5.0 **Assam:** Most of the plywood timber output of Assam is obtained from the Hollong-Makai belt which is the traditional source of supply. In addition some quantity is obtained from other areas also. We will examine here the feasibility of enhancing the yield from the traditional wood supply regions as well as forests outside the Hollong-Makai belt.

5.1 Wood supply from the Hollong-Makai belt: Nearly 90% of the veneer log supply from the state is obtained from this areas. These forests are being managed under three distinct systems, namely, (1) Irregular Shelterwood System in good Hollong-Makai area (Hollong-Makai regeneration Working Circle) (2) Clearfelling and Planting with Hollong in moderately or poorly stocked areas (Hollong Plantation Working Circle) and (3) Clearfelling and planting with miscellaneous species in barren, poorly stocked areas (Miscellaneous Plywood Working Circle). Entire yield of Hollong and Makai timber from Upper Assam is obtained

from the areas worked under the first two systems. As area managed under the miscellaneous plywood working circle do not bear any tree growth of value, no yield has been prescribed for removal. Feasibility of enhancing yield of veneer logs from the area worked under the two systems referred to above is examined below.

(a) Hollong-Makai Regeneration Working Circle: Well stocked Hollong-Makai forests in Digboi, Dibrugarh and Sibsagar divisions are worked under the above system and a total annual yield of 61,400m^3 has been prescribed as per the working plans. This accounts for 77% of the yield prescribed from the entire Upper Assam Circle. Of this, forests in Digboi division along contributes 58% of the ply timber supply.

As already indicated the girth limit prescribed for felling in PBI area is 150cm and in the unallotted areas it is 270 to 300 cm. A rotation of 84 years has been adopted. We have also pointed out the inadequacy of data on growth, yield etc, and that even with the present prescriptions there is likelihood of declining yield in future felling cycles. It thus leaves little scope for either bringing down the rotation or for adopting lower girth limits for felling.

In this connection it will be desirable to work out the optimum yield from the Hollong-Makai regeneration working circle. Sustainable yield that could be removed can be worked out on the basis of area or on the basis of growing stock and increment.

(i) Yield on area basis: In Digboi division the total area allotted under the Hollong-Makai regeneration working

Circle is 32,765 hectares. If 84 years is accepted as the rotation, annual area available for felling will be 390 hectares. If the entire area is managed under the shelter wood system annual yield with the prescribed exploitable girth will be only 17,500m^3. Even if the exploitable size is further reduced to, say, 90cm the annual yield will be only 19,000m^3.

Yield on the basis of increment: The principle of sustained yield management aims at removing only the increment accrued so that the stock of wood capital is kept in tact. No reliable data is available on the increment of the growing stock. However, Das (1974) has pointed out that when a Hollong tree from one girth class passes to the next class it puts on a volume increment of 16% and this he has used to work out the volume increment in the growing stock.[1] Even if it is assumed that this is a some what approximation of the increment put on by the growing stock, volume increment over a period of 12 years in Digboi division will be only 2,54,592m^3, which means an annual increment of 21,216m^3.[2]

In the present plan annual yield prescribed for the Hollong-Makai regeneration working circle is 46,400m^3. This is due to the prescription that in addition to fellings in PBI areas, trees above 270cm girth in unallotted

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[1] A.C. Das (1974) Working Plan for the Digboi Forest Division 1974-75 to 1985-86. Page 26. 'A Hollong tree of 300-330cms in girth on reaching 330-360cms girth gains a volume increment of (9.50-8.20) 1.30m^3 over its initial volume of 8,20m^3. Therefore volume increment comes to 16%. Similarly for other girth classes it is seen that a tree of one girth class on reaching the next higher class gains a volume increment of 16%. This increment is worked out for individual trees ad does not necessarily represent the increment of the growing stock.

[2] Growing stock of Hollong and Makai in Digboi division is estimated as 15,91,200m^3.

areas will also be felled on a 12 year cycle. While this prescription has given the benefit of higher yield now, as shown by calculations in Chapter 3, this will result in a sharp decline in the yield later on. This being the position there is no scope to further enhance the yield from the Hollong-Makai regeneration working circle.

(b) Hollong Plantation Working Circle: An area of 32, 258 hectares in Digboi and Doom Dooma divisions has been included under the system of clearfelling followed by planting of Hollong and other valuable species. It is presumed that the entire area included under this working circle is suitable for clearfelling and planting taking into consideration silvicultural and environmental factors. In this working circle the method prescribed is to fell Hollong and Makai trees down to 100cms girth in the annual area earmarked for planting and to fell trees down to 300cms in the area outside the limit prescribed for planting during the current working plan. In such areas it is proposed that fellings will be carried out on a 15 year cycle (It is further prescribed that in the second and third felling cycles exploitable girth will be 240cms and 180cms respectively).

The above method of working involves coverage of most of the area thrice before it is taken up for clearfelling. Apart from the fact that it may be uneconomical to go over the area twice or thrice it has no distinct advantages. As the entire area has been included under plantation circle it will perhaps be better to reduce the conversion period from 45 years to about 20 years. A more intensive plantation programme will have to be launched to cover the area in 20 years and the annual area for plantation may have to be increased to about

1,600 hectares. As compared to the prescribed system of clearfelling a lesser area and resorting to selection felling in the balance area this modification will have the following advantages.

(1) Cost of extraction of timber will be lesser

(2) The programme of creation of a future asset in the nature of plantations will be at a faster pace

and

(3) An additional yield of about 9,800m^3 of Hollong and Makai timber can be obtained.

The feasibility of undertaking an extensive plantation programme has to be examined in greater details, particularly keeping in view the availability of funds and other technical problems.[1]

(c) Miscellaneous Plywood Working Circle: Area identified under this category has considerable diversity and consists mostly poorly stocked forests, low lying areas liable for flooding, eroded areas, forest villages, swamps, nalas etc. For these reasons entire area put uner the working circle are not suitable for planting. Foe example out of a total area of 35,800 hectares included in the working circle in Dibrugarh division only 16,900 hectares have been identified as available for raising plantations. As these areas contain poor growth no yield has been prescribed. It is evident that veneer log output cannot be increased from these areas whatever system is followed.

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[1] Michannia micrantha a noxious climber poses a number of problems. If plantation forestry has to succeed an effective control measure has to be found out against this species.

5.2 Wood supply from areas out side the Hollong-Makai belt: Hitherto supply of timber from these areas has been negligible. Gogra is an important species used by the industry. However the exact quantity available has not been estimated hitherto. Feasibility of utilisation of more miscellaneous species was discussed with some of the plywood manufacturers. It is pointed out that if thicker veneer sheets are to be produced it will be possible to increase the intake of more non conventional species. Even now some quantity of miscellaneous species are being utilised by plywood mills. However there is a marked preference for Hollong and Makai, and unless compelled otherwise these species will continue to be the main stay of the industry. Total availability of miscellaneous species has not been estimated hitherto. Considering the low percentage of their occurrence, it is doubtful whether utilization of more miscellaneous species can improve the availability of raw material substantially.

5.3 **Improving accessibility:** Formation of a network of all weather roads is essential to make the forests more accessible and to ensure wood supply throughout the year. Inaccessibility has been a reason for not fully exploiting the forests.[1] As the factor of accessibility has not been taken into account while prescribing the yield in the working plans, these areas have been considered for estimating yield. Therefore making the area accessible may not help to enhance the prescribed yield, but will help to bridge the gap between what is prescribed and what is actually realised.[2]

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[1]For example Dilli reserve in Sibsagar division is said to be not worked fully due to inaccessibility.

In sibsagar division average annual yield is about 3,400m^3 (1,20,000cft), though what is prescribed is about 4,900m^3 (1,76,000 cft).

5.4 On the whole, it can be seen that, there is no scope for augmenting yield of Hollong and Makai timber for meeting the requirements of the industry. Even with the enhancement of the rate of conversion in the Hollong plantation working circle additional yield will be only 9,800m^3. For various reasons discussed it is doubtful whether it will be possible to maintain a sustained yield of 79,500m^3 prescribed in the working plans. In this connection it is relevant to point out the observations made by Das and Rajkhowa (1968).

> 'It will be seen from the yield figures of these Dipterocarpus forests that the entire annual cut of all species of royalty classes A to D which include practically all the recommended plywood species is only 75,940m^3 of which the two Dipterocarpaceae species contribute 51,780m^3. On the other hand the State Forest Department supplies to the plywood mills in Upper Assam 59,360m^3 of logs of plywood species including the entire cut of the Dipterocarpaceae species…. Thus the entire plywood resources of this region are fully utilised and further expansion is possible only if the list of the plywood species can be enlarged.'[1]

Already the prescribed yield for Hollong and Makai is 79,500m^3 which is about 28,000m^3 in excess of what has been estimated by Das and Rajkhowa (1968). Thus, as far as Assam is concerned, the computed yield of raw material for plywood is perhaps more than the maximum that the existing resources can sustain. The available information leads to the conclusion that there are more chances of a decline in the output in the immediate future rather than any prospect of increase.

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[1] B,N Das & S. Rajkhowa (1968) Woodlands in Assam, Indian Forester, 94(2) page 143. There are nearly 50 species in the evergreen forests which come under the royalty classes A to D.

6.o Arunachal Pradesh: From the information on forest resources furnished in Chapter 3, It can be seen that Arunachal Pradesh alone seems to be in a position to increase the annual supply. Arunachal Pradesh Forest Development Corporation has a scheme for extracting 71,280m^3 of timber. In addition to this about 50,000m^3 should be available from outside the project area of the corporation. Therefore the total yield from Arunachal Pradesh will be about 1,21,000m^3. Depending on the investments in opening up other areas, particularly in Kameng and Subansiri divisions the potential yield can be about 1,66,000m^3. As the present internal requirement is estimated as 23,000m^3 the territory is a promising source of wood surplus in the region.

7.0 Other areas in the region: As regards Nagaland the potential sustainable yield from its forests is 15,576m^3 (Bhattacharjee-1968). When Hollong and Makai alone are considered, potential sustained yield is about 7,400m^3. This should not be mixed up with the spurts of output form this state which do not have a bearing on the long term sustained availability. Meghalaya si also likely to continue as a deficit state as the scope for enhancing yield is limited. Potential availability in Manipur and Tripura has been worked out by the Pre-Investment Survey of Forest Resources and we have adopted their estimates for examining the resource position in the region as a whole.

8.0 Need for regional planning: When resource potential of each State/Territory is considered individually, gap between demand and supply is very wide and the only feasible solution seems to be to treat the State/Territories in the region as a single zone for planning industrial capacity and wood supply. Requirement and potential supply of wood for the region is given in Table 5.1.

Table 5.1

Demand and Supply of Wood in the North Eastern Region (In m^3).

State	Demand (a)	Potential production
Assam	3,72,000 (87.2)	89,000 (22.0)
Arunachal Pradesh	23,000 (5.4)	1,66,000 (41.2)
Nagaland	14,400 (3.4)	15,580 (3.8)
Meghalaya	17,140 (4.0)	8,400 (2.1)
Tripura	-	15,500 (3.7)
Manipur	-	1,10,000 (27.2)
	4,27,340 (100.0)	4,03,980 (100.0)

Note: (a) Demand has been estimated on the basis of the capacity built up by 1976.

Figures in parenthesis gives the percentage.

It can be seen that when potential wood supply for the region as a whole is examined it matches to a large extend to the installed capacity as it can meet about 94% of the requirement. After 1976 there has been capacity expansion, and when this is taken into account, if all the potential can be tapped, it may be sufficient to meet 92% of the capacity. While discussing wood availability from each state we have indicated the bottlenecks in realising the potential, particularly from states like Manipur and Tripura. If these states are excluded, then potential availability will be only 2,78,980m^3, which will be sufficient to meet 65% of the requirement. Even to achieve this level of output substantial investments will be required in building up roads, particularly in Arunachal Pradesh.

If this is not possible it may not be possible to produce more than 2,30,000m^3, Just enough to achieve a capacity utilization of about 54%. It is therefore desirable to examine the feasibility of importing timber to this region from other timber surplus regions.

8.1 Procurement of wood from other regions: In the study pertaining to Kerala – Karnataka region (KFRI, 1977) the resource position in Andaman & Nicobar Islands has been examined in detail and it has been shown that at present the Islands have surplus timber which will be available for utilization in the mainland at least till the industry develops in the Islands. The question of utilizing surplus timber of the islands in the North Eastern Region is ruled out because of the practical difficulties and cost of transportation involving multiple handling. Better markets for surplus timber in Andamans will be the coastal areas of Bengal and South India.

8.2 Balancing industrial capacity and wood supply within the region: From Table 5.1 the importance of planning on a regional basis is evident. Though Assam accounts for 87.2% of the capacity in the region, potential supply of wood is only 22% of the region. In contrast Arunachal Pradesh accounts for 5.4% of the capacity while resource potential is about 41.2% of the entire region. Tripura and Manipur accounts for 3.7% and 27.2% of the resource potential in the region respectively and as wood based panel industry has not developed in these States the potential is not being utilized now. As evident from Table 5.1, Meghalaya is likely to remain a deficit State, while Nagaland will be in a position to just meet its internal requirements.

In planning industrial capacity and wood supply for the region as a whole, there are two options, namely, (1) to transport wood from the surplus areas to the deficit areas and (2) to move industrial units from wood deficit areas to wood surplus areas. For taking a decision on these two policy alternatives, it is necessary to examine the economics of these alternatives. The overriding factor will be the transportation cost of wood: as wood is bulky the value/bulk ratio is low and therefore it is always desirable to process it close to its source. Considering the long haulage involved in moving timber from Tripura and Manipur, it may not be advantageous to bring timber from these states to the mills in Assam.

Other important factors to be taken into account in making a decision on this are

(1) Accessibility of the wood surplus areas and the investment required for opening up these areas.

(2) Availability of necessary infrastructure such as power, communications etc. and supply of man power.

(3) Cost of moving plywood units to selected wood surplus areas.

Taking the overall position into consideration the inevitable conclusion appears to be to evolve a regional planning for the area. In this regional planning there are no options to import raw material from outside the region due to locational problems and consequent high cost of transportation of raw material as well as finished products. The region has, therefore, to be content with the resources available within. Even here the concentration of the industry in particular areas is a problem and we have indicated the policy options. As these policy options are not depend merely on wood raw material availability the socio-economic factors should be studied in detail to consider adoption of either of the options.

APPENDIX I-A

DISTRIBUTION OF SPECIES IN THE HOLLONG-MAKAI FORESTS

LOCALITY : DILLI RESERVE
STATE : ASSAM

Girth Class (cm) Species	90 120	120 150	150 180	180 210	210 240	240 270
1. Amari	18	32	44	26	16	13
2. Bogipoma	3	-	-	2	2	-
3. Gomari	2	-	3	3	-	-
4.Gonsoroi	3	3	4	6	-	5
5. Hollock	1	1	2	-	4	3
6. Hollong	185	224	250	212	190	102
7. Makai	82	117	136	170	118	88
8. Nahor	335	329	185	70	17	3
9. Sam	21	29	34	43	26	22
10. Sopas	52	58	42	24	32	16
11. Hilika	32	25	29	13	7	2
12. Khokan	-	2	-	4	4	2
13. Poma	3	5	6	4	3	1
Class . D. (15 spp.)	273	191	121	53	23	9
Class . E. (12 spp.)	52	53	41	29	24	11
Class . F (25 spp.)	452	227	67	41	12	5
Unknown	156	100	57	25	16	3
Total	1670	1396	1021	725	494	285

Source: Srinivasan M.M. & Bhattacharjee P. (1955) Working Plan for the Sibsagar division 1951-52 to 1965-66.

APPENDIX I-A (Contd…)

Girth Class (cm) Species	270 300	300 330	330 & Up	Total	Percentage of total
1. Amari	9	4	5	167	2.71
2. Bogipoma	-	1	1	9	0.15
3. Gomari	1	-	-	9	0.15
4.Gonsoroi	2	1	1	25	0.40
5. Hollock	-	4	3	18	0.30
6.Hollong	83	81	75	1402	22.71
7.Makai	47	49	90	897	14.53
8. Nahor	2	-	-	941	15.24
9. Sam	14	9	23	221	3.59
10. Sopas	5	3	5	237	3.84
11. Hilika	2	1	1	112	1.81
12.Khokan	1	3	9	25	0.40
13. Poma	1	-	-	23	0.37
Class. D (15 spp.)	7	5	8	690	11.27
Class. E(12 spp.)	2	5	3	220	3.29
Class. F(25 spp.)	2	1	5	812	13.26
Unknown	4	5	2	368	5.96
Total	182	172	231	6176	100.00

APPENDIX I-B

DISTRIBUTION OF SPECIES IN THE HOLLONG-MAKAI FORESTS

LOCALITY : NAMSA-TIOIT
STATE : NAGALAND

Girth Class (cm) Species	90 120	120 150	150 180	180 210	210 240	240 270
1. Bonsum	3	2	2	-	-	-
2. Titasopa	10	10	10	7	2	2
3. Hollong	530	664	647	608	502	477
4. Makai	350	503	607	671	657	572
5. Bola	-	1	-	1	-	-
6. Hollock	6	13	23	27	26	22
7. Sowara	-	1	-	-	-	-
8. Gomari	4	5	1	1	-	2
9. Gonsoroi	12	11	14	15	12	3
10. K. Sopa	2	6	3	5	-	3
11. Semul	6	4	5	6	6	1
12. Ajhar	14	8	10	4	2	4
13. Amari	210	202	163	113	62	37
14. Bogipoma	18	24	20	15	6	6
15. Gogra	2	7	3	5	-	1
16.Jutuli	84	192	209	226	177	108
17. Nahor	1293	921	466	227	74	33
18. Sam	37	54	48	67	49	32
19. Sopa	99	127	84	63	48	21
20. Badam	2	-	2	2	2	-
21. H. Sopa	3	1	2	4	1	-
22. Hilika	42	54	38	35	19	11
23.Jatipoma	42	35	24	17	12	4
24.Khokon	14	12	8	17	10	9
25. Koroi	6	1	-	1	-	-
26. Siris	3	7	3	1	-	-
27. Urium	54	31	14	8	5	3
Class D (17 spp)	381	288	168	126	63	31
Class. E (12 spp)	188	233	182	118	92	27
Class. F (33 spp)	460	345	246	171	86	37
Total	3882	3770	3006	2561	1944	1446

Source: Bhattacharjee P.N (1968): A working scheme for the Hollong-Makai Forests of Namsa-Tijit Area.

APPENDIX I-B (Contd…)

Girth Class (cm) Species	270 300	300 330	330 360	360 & up	Total	Percentage of occurrence
1. Bonsum	-	-	-	-	7	0.04
2. Titasopa	1	-	-	-	42	0.22
3. Hollong	242	175	97	55	3997	21.18
4. Makai	431	310	316	188	4605	24.40
5. Bola	-	-	-	-	2	0.01
6. Hollock	17	11	10	3	158	0.84
7.Sowara	-	-	-	-	1	-
8.Gomari	-	1	1	-	15	0.08
9.Gonsoroi	2	-	2	1	72	0.38
10.K. Sopa	-	-	-	-	19	0.10
11.Semul	-	1	1	-	30	0.16
12. Ajhar	2	-	-	-	44	0.23
13.Amari	9	11	7	2	816	4.33
14.Bogipoma	1	-	-	2	92	0.49
15. Gogra	2	1	-	1	22	0.12
16.Jutuli	55	36	22	14	1123	5.95
17.Nahor	8	2	2	2	3028	16.05
18. Sam	37	18	9	8	359	1.90
19. Sopa	13	4	2	2	463	2.45
20.Badam	-	-	-	-	8	0.04
21. H. Sopa	-	-	-	-	11	0.06
22.Hilike	3	2	1	2	207	1.10
23. Datipoma	1	3	3	2	141	0.75
24. Khokon	10	4	4	6	94	0.50
25. Koroi	-	-	-	-	8	0.04
26.Siris	-	-	-	-	14	0.07
27. Urium	-	-	-	1	116	0.61
Class. D (17 spp)	21	5	8	7	1098	5.84
Class. E (12 spp)	22	11	2	3	878	4.65
Class. F (33 spp)	21	9	5	1	1381	7.32
Total	898	604	492	292	18871	100.00

APPENDIX II

Local names and Botanical names of important Species in the region

Local name	Botanical name
Ajhar	Lagerstroemia flos-reginae
Am	Mangifera indica
Amari	Amoora wallichii
Amora	Spondias mangifera
Bandordima	Dysoxylum procerum
Bhelkol	Trewia nudiflora
Bahera	Terminalia belerica
Bogipoma	Chukrasia – tabularis
Bora	Morus laevigata
Bong long	Adina cordifolia
Bonsum	Phoebe goalparensis
Borpat	Ailanthus grandis
Cham, Sam	Artocarpus chaplasha
Dhuna	Canarium resiniferum
Gahori Sopa	Magnolia griffithii
Gomari, Gamari	Gmelina arborea
Gonsoroi	Cinnamomum cecidodaphne
Gogra	Schima wallichii
Haldu Sopa	Adina griffithii
Hatipoila	Pterospermum acerifolium
Hingori	Castanopsis spp.
Hollock	Terminalia myriocarpa
Hollong	Dipterocarpus macrocarpus
Jamuk	Syzygium cuminii
Jatipoma	Toona ciliata
Jutuli	Altingia ecelsa
Kadam	Anthocephalus cadamba
Kathal	Artocarpus integrifolia

APPENDIX II (Contd…)

Khokom	Duabanga sonneratioides
Makai	Shorea assamica
Morhal	Vatica lanceaefolia
Nahor	Mesua ferrea
Outenga	Dillenia indica
Pan sopa	Michelia montana
Phulgomari	Endospermum chinensis
Pichola	Kydia calycina
Poma	Cadrela spp.
Seleng	Sapium baccatum
Semul	Bombax ceiba
Sopa	Magnolia spp, Michelia spp
San	Albizzia stipulata
Tiji	Lannea grandis
Tita sopa	Michelia oblonga
Udal	Sterculia villosa
Urium	Bischofia javanica

APPENDIX III

Important Plywood Species in the North Eastern Region

1. Albizzia stipulata
2. Albizzia procera
3. Alstonia scholaris
4. Amoora wallichii
5. Anthocephalus cadamba
6. Artocarpus chaplasha
7. Artocarpus integrifolia
8. Bombax ceiba
9. Canarium strictum
10. Chukrasia tabularis
11. Cinnamomum cecidodaphne
12. Dipterocarpus macrocarpus
13. Dipterocarpus turbinatus
14. Dipterocarpus tuberculata
15. Dillenia pentagyna
16. Duabanga sonneratioides
17. Gmelina arborea
18. Kydia calycina
19. Mangifera indica
20. Machilus macrantha
21. Michelia champaka
22. Phoebe goalparensis
23. Schima wallichii
24. Shorea assamica
25. Sterculia Villosa
26. Terminalia belerica
27. Terminalia myriocarpa
28. Tetrameles nudiflora
29. Tectona Grandis
30. Toona ciliata
31. Trewia nudiflora
32.

APPENDIX IV

A brief note on the prescriptions for working under the irregular shelterwood system in Assam

Systematic working under the irregular shelterwood system commenced in the Hollong-Makai forests on the basis of prescriptions contained in Das's working plan (1965). Area allotted to the Hollong-Makai Shelterwood Working Circle was divided into five felling series. A rotation of 140 years was prescribed and the regeneration period was fixed as 20 years. Area to be regenerated during the plan period alone was identified. (PBI).

Main object of felling in the compartments allotted to PBI is to establish the regeneration of valuable species particularly Hollong and Makai within a period of 20 years. Felling was prescribed for well stocked areas so as to provide growing space for the seedlings. In other areas only mother trees standing over established regeneration are to be removed. Felling in the regeneration block is to be done in three stages.

1	Initial Stage	Removal of overwood except the seed bearers. Removal of the underwood leaving sufficient number of such trees for shade to keep down weed growth.
2	Intermediate stage	Periodic removal of underwood and overwood as regeneration becomes established.
3	Final stage	Removal of the underwood and overwood except those retained as part of the future crop in the established regeneration areas.

The following marking rules are to be followed in the regeneration area.

A. **Well stocked area**

1. In each area trees which are about 180cm girth are to be selected as mother trees for rotention. In case trees of this girth class are not available, trees in the next higher class should be selected. They should be uniformly distributed over the area. All other Hollong and Makai trees above 150cm should be marked for felling.

2. In selecting Hollong mother trees preference should be given for trees growing in comparatively isolated condition provided the trees are within the prescribed girth limit.

3. Marking in the middle canopy will be confined to congested patches only. In marking such trees a girth limit of 180cm will be followed and marking should be done in such a way so as not to create large gaps in the canopy. In areas where middle canopy is deficient no marking will be done.

B. **Medium stocked areas**

In medium stocked areas the objective of felling is to release the established regeneration and for this all Hollong and Makai trees above 150cm are marked provided these trees are no longer required as seed bearers. Trees in the middle canopy, which interfere with regeneration of valuable species, are also to be felled. Nahor trees are to be thinned in congested patches and all trees above 180cm are removed if such removal does not create large gaps.

C. **Poorly stocked areas**

Here marking is done with care to avoid large gaps and normally no Hollong or Makai trees are felled. In patches where regeneration has come up removal of trees standing on the established regeneration is permitted. Dead, dying and wind fallen trees are to be removed whenever an area is worked.

Subsidiary silvicultural operations

In PBI the following subsidiary silvicultural operations are prescribed.

1. All marked trees not removed are felled or girdled

2. Saplings of valuable species damaged during felling are to be coppiced

3. Advance growth will be freed from any obstruction and thinned if necessary

4. Weeding should be done to free the saplings. Such removals should be confined to those standing over Hollong & Makai seedlings.

5. Low shading trees standing over young regeneration is to be removed

6. Weeding and climber cutting is to be continued for three consecutive years and then every alternate year till the 9^{th} year. Thereafter climber cutting is to be done once in three years.

7. In areas having deficient or no regeneration artificial planting should be done in strips by transplanting seedling above 8.6m high. These strips may be 1.8m wide and spaced 7.3m apart from centre to centre and transplants at 3.6m intervals. In such planting for every five seedling of Hollong at least one seedling of species such as Makai, Sam, Sopa, Amari, Dhuna etc. should be planted.

8. Periodical removal of low shading trees in the lower canopy will be necessary as the regeneration progress.

These prescriptions are more or less retained in the revised working plan also (Das, 1974). However, the rotation and regeneration periods were reduced to 84 years and 12 years respectively. Weeding and climber cutting are to be carried out at least once in a year for the first two years after which only climber cutting will be done once in a year upto the fifth year. Climber cutting will then be continued once in every alternate year upto the age when the regeneration gets established. Weeding is to be carried out selectively to prevent the spread of Michania.

In areas having scanty regeneration transplanting of Hollong and Makai should be done at a spacing of 5m x 5m in parallel lines. If nursery stock is not available thali sowing of Hollong seeds is prescribed.

For areas outside the regeneration block climber cutting is to be done immediately after timber extraction. All Hollong and Makai seedlings damaged during felling are to be coppiced.

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