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AVAILABILITY OF WOOD RAW MATERIAL FOR PLYWOOD INDUSTRY

(Kerala-Karnataka Region)

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CONTENTS

ABSTRACT

Plywood industry is an important and traditional wood based industry in the Kerala-Karnataka region. A major Problem of the industry is under utilization of capacity, which is primarily attributed to the inadequate supply of wood raw material.

The purpose of the present study is to examine the problem of wood raw material requirement and to identify strategies to resolve the problem.

Part I provides an analysis of the basic details on which the suggestions in Part II are based. Magnitude of the problem of wood raw material procurement is examined in Chapter 2. In the case of Kerala the gap between demand and supply is already very wide and it tends to widen due to the finishing supply. In the case of Karnataka the problem now is not due to the low output of wood, but a resultant of the imbalances in the distribution. An analysis of the forest resources in the region reveals that the potential yield is considerably higher than what is obtained now o Chapter 5 gives an account of the present system of procurement of wood raw material from the forests and Chapter 6 examines the various causes of under utilization of the resource.

In Part II strategies for meeting the wood raw material requirement of the industry are discussed. Short-term measures, which will enhance the resource, flow from the existing stock and long-term measures that will increase the resource stock and thereby increase the wood output are examined. There is an urgent need to switch over to a more intensive monocyclic system of management in the evergreen and semi evergreen areas in the region. Further, 1t is also necessary to organ1se the supply of wood

available from the clear felling areas. Import of timber from outside the region is recommended only as a last resort to make up marginal deficits. Even with all these measures, Kerala will just be able to satisfy the established capacity of 12 million square meters and there is no scope for increasing the capacity in the are seeable future. In the case of Karnataka, plywood timber production .can be increased to about 150,000m3 by 1980 and this can sustain a capacity of 15 million square meters. With the adoption of a monocyclic system, timber output can be increased to 210,000 m3 and therefore by 1990 there is scope for increasing the capacity. This being the maximum sustainable yield obtainable with the present reserve stock, there is no scope for increase in the capacity beyond .21 million square meters.

Of the long-term measures, raising man-made forests can increase the supply of plywood timber by 80,000 m3 in the case of Kerala and 160,OOO m3 in the case of Karnataka, by 2040. Regeneration measures suggested in the Case of the evergreen and semi evergreen forests will take a considerably long time to yield results and it is necessary to plan a plantation strategy now so that a sizable resource base is achieved before the existing scope for "mining" plywood species from natural forests gets reduced.

Complimentary measures such as investment on roads to inaccessible areas and technological improvement in production are also discussed.

It is also necessary to bring out considerable changes in the institutional set up so as to streamline the production, extraction and marketing of the raw material.

CHAPTER 1

INTR00UCTION

1.0 **Background of the study:** Importance *of* Forest and Forest based industries in the economic development of the country is being realized increasingly, and the need to evolve an integrated approach to planning in this sector has been repeatedly stressed. It is due to this growing importance that the National Commission on Agriculture has gone into details of Production Forestry and the institutional changer necessary for achieving the various production targets. While the Commission estimated the wood requirements for all the major wood based industries for 1980 and 1990 and found a widening gap between demand and supply in respect of all industrial uses, the remedial measures suggested by them are mostly confined, to the Pulp and Paper Industry and very little attention has been paid to the raw material requirement of other industries. Planning to meet the wood requirements of the Pulp and Paper Industry is important; but it cannot be the sole purpose of forest industrial planning as other wood based industries also have a significant role to play. In these cases, planning is more difficult because of the much longer gestation period involved and a short-term strategy is required for the interim period during which the long-term strategy is evolved and implemented. It is in this con- text that the present study on the wood raw material for the Plywood Industry was undertaken, with particular reference to Kerala - Karnataka region.

2.0 **Objectives:** Study on the wood raw material to the Plywood Industry in the Kerala-Karnataka region was undertaken to assess the wood raw material problem of the industry in the present and future and to explore the possibilities of bridging the gap between raw material demand and supply. Broadly the objectives 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:** A Questionnaire (Appendix I) was sent to the Plywood Manufacturing Units to obtain information on the production of plywood, wood consumption, sources of wood, quantity procured, system of procurement, prices, transport costs etc. These details were analyzed to find out the trends in wood consumption trends in supply etc. A number of 1eading p1ywoodl units in the region were visited to get detailed information about the wood requirements, sources of supply, system of extraction and the problems in wood procurement. Information on the growth of capacity,

production, raw material requirements etc., were collected from the federation of Indian Plywood and Pan*el* Industry and the South Indian Plywood Manufacturers Association.

To assess the availability of wood raw material now and in future, working plans, resource survey reports, administration reports and project reports on forestry development were examined. Discussions were also held with officers of the Forest Departments in Kerala and Karnataka States. In addition, information on plywood production, raw material procurement etc., available in various publications was examined. Estimates on the present and future availability of wood were prepared on the basis of the analysis of the above details.

4.0 **Limitations:** One important limitation to the study was the non-availability of adequate and reliable information on various aspects of demand and supply. Response to the questionnaire from the plywood units was lukewarm and only 30% of the units supplied the information, and so we could not get a complete picture of the problem. Since these units accounted for the production of the major share of plywood in the region, in the analysis it was presumed that the problems indicated by them were more or less the same as that of other units also. Response from the units in the Karnataka was particularly poor, and in the absence of any other published information on the industry in that State it was not possible to assess the problem in more precise quantitative terms.

CHAPTER 2

PLYWOOO INDUSTRY IN THE KERALA-KARNATAKA REGION

1.0 **Plywood Industry in the Country:** an Overview: Plywood industry in India was established mainly for producing tea chests. Earlier tea chest requirements were met by Ye import from countries like Finland, Sweden and Japan. Consequent to the import problems created by the Second World War, the requirements had to be met by indigenous 1S production and this gave a fillip to the industry. Most of the units were of small scale and medium scale and Calcutta being the center off tea trade had a concentration of these units. with faster growth of the Commercial and decorative plywood .in the later period, there 1S has been a tendency for market and product differentiation between the large scale and small scale units. Presently, the small scale units primarily concentrate w on the production of tea chests and their share in the production of commercial and decorative plywood is rather negligible.

2.0 **Capacity and Production:** Table 1.2.1 below gives the capacity and production of the Plywood Industry in the country.

Between 1970 and 1976, the growth rate (compound) of the capacity has been about 15% while the actual production increased only at the rate of 7%. The faster the rate of growth of installed capacity has not matched be with corresponding increase in the capacity utilization. The gap between installed capacity and production is more

Table I.2.1

Capacity and Production of the Plywood Industry

(In Million Square metres - 4mm. thickness equivalent)

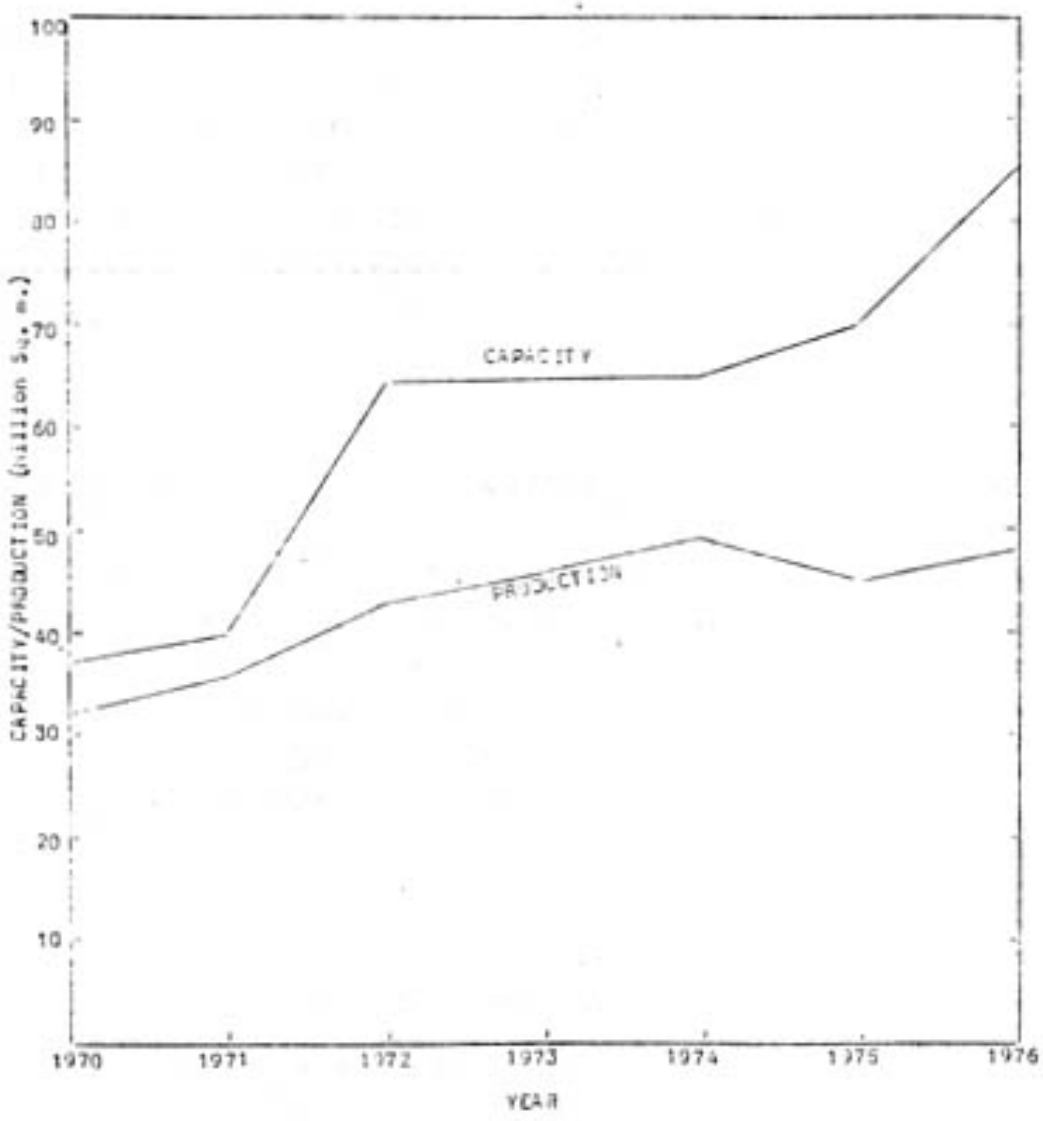
Year	Capacity			Production			Capacity Utilisation (%)
	DGTD Units	Others	Total	Tea chest	Others	Total	
1970	23.65	13.56	37.21	12.00	20.00	32.00	86.00
1971	26.12	13.56	39.68	10.81	24.97	35.78	90.00
1972	43.01	21.50	64.50	13.00	30.40	43.00	66.70
1973	43.01	21.50	64.50	13.00	33.00	46.00	71.30
1974	43.34	21.67	65.01	13.00	36.00	49.00	75.40
1975	46.79	23.35	70.14	12.00	33.00	45.00	64.20
1976	60.49	25.00	85.49	10.32	37.75	48.07	56.20

Source: Federation of Indian Plywood and Panel Industry.

evident from diagram 1.1 Production of tea chest more or less remained stable with insignificant year to year fluctuations. This is understandable as production of tea chest plywood is related to the tea industry whose demand has more or less remained steady. A substantial increase in the demand for tea chest plywood is quite unlikely in the near future due to this reason. Production of other types of plywood, namely, commercial plywood, decorative plywood, flush doors, blackboards etc., has grown steadily and between 1970 and 1976 the growth has been of the order of 89%.

1It can be seen from the table that between 1975 and 1976 the capacity has increased by about 22%. Usually for the new units established, it takes some years to attain full capacity production, and the high-unutilized capacity in 1976 could partly be due to this factor also.

Diagram 1
CAPACITY AND PRODUCTION OF THE PLYWOOD INDUSTRY



Underutilization of capacity: The underutilized capacity is increasing, and it is necessary to go into the causes. Main difficulty in full capacity utilization is attributed to non-availability of' adequate quantities of suitable timber. Information supplied by the various plywood units also indicates that underutilization of capacity is primarily due to inadequate supply of wood raw material. In an earlier study Nagaraju et al (1974) pointed out that non-availability and uncertainty in the supply of essential raw materials like timber and adhesives are the main constraints in the growth of the ply- wood industry in the country. In this report, the situation in Kerala-Karnataka region which has the maximum concentration of the industry in South. India is examined. This region accounts for about 28% of the Country's in- stalled capacity.

2.0 Plywood industry in the Kerala-Karnataka Region

2.1 Plywood industry in Kerala:

Chirayath (1966) pointed out that Kerala accounted for nearly one-fifth of the country's production of plywood. He estimated that by 1980-81 the annual output of plywood from the State would be 12 million square metres (4mm. basis) and the timber requirements for meeting the production would be about 120,000 m3 These Estimates were based on the assumption that Kerala's share in the production of plywood in the whole of the country would continue to be: of the same magnitude as in 1965. He further added that actual requirements would be more than the estimates as most of the manufacturing units had ambitious expansion programmes.

A recent study (Government of Kerala, 1977) has given details of production of plywood in Kerala.

Production figures during 1973-’74, 1974-’75 and 1975-’76 are as follows:

Table I.2.2

Plywood Production in Kerala

Year	Production in M^2 (4mm. thickness)	Percentage share in All India production
1973-'74	8.82	19.2
1974-'75	8.94	18.2
1975-'76	7.73	17.2

Source: 1. Government of Kerala (1977). Report of the Committee formed to assess the requirements of Softwood to Plywood Manufacturing units in Kerala.

2. Annual Reports of the Travancore Plywood Industries Ltd.

It is seen that Kerala's share in the total production has registered a decline between 1973-'74 and 1975-'76. This is mainly due to (1) the growing underutilization of capacity in Kerala and (2) creation of additional capacity and increased production outside Kerala.

Table 1.2.3 gives the details of the timber obtained from different sources and gives a rough estimate of the gap between the demand and supply of timber when the units work on a single shift basis. The above figures however do not give a complete picture of the extent of underutilization of capacity. Timber requirements have been calculated on the basis of single shift, though a few units work for more than one shift.

Table I.2.3

Supply of Timber to Plywood Units in Kerala

Year	Quantity obtained through quota (In m^3)	Timber obtained from other sources (In m^3)	Total (In m^3)*	Actual requirement for a single shift capacity working (In m^3)
1973-'74	50091	41613	91704 (77.6)	118,200
1974-'75	57818	44494	102312 (86.6)	
1975-'76	43860	37715	81575 (69.0)	

* Figures in parenthesis is the percentage of the total supply to actual requirements. The percentages for 1973-'74 and 1974-'75 are calculated taking the total requirement as 118200 m^3.

Source:
1. Government of Kerala (1977). Report of the Committee formed to assess the requirements of Softwood to Plywood manufacturing units in Kerala.
2. Annual Reports of the Travancore Plywood Industries Ltd.

The Committee which assessed the requirements pointed out that, though most of the units work for more number of shifts for dryers and presses to meet the single shift capacity of the peeler, the wood requirements have been calculated on the, basis of the machine capacity on single shift basis for all the machines.

The following table gives the share of capacity, share of timber consumption and share of production among the large scale, medium scale and small-scale units in 1975-'76.

Table I.2.4

Capacity, Timber Consumption and Production of Plywood in 1975-'76

Category	Percentage share in the total capacity.	Timber consumption			Production (In million m^2 4mm. thickness
		Allotment (m^3)	Procured from other sources (m^3)	Total (m^3)	
Large scale units	54.1	29234 (66.7)	21108 (56.0)	50342 (61.7)	5.23 (67.8)
Medium scale units	21.0	5891 (13.4)	6573 (17.4)	12464 (15.3)	1.05 (13.6)
Small scale units	24.9	8735 (19.9)	10034 (26.6)	18769 (23.0)	1.44 (18.6)
TOTAL :	100.0	43860 (100.0)	37715 (100.0)	81575 (100.0)	7.72 (100.0)

* figures in parenthesis gives the percentage.

Source: 1. Government of Kerala (1977). Report of the Committee formed to assess the requirements of Softwood to Plywood manufacturing units in Kerala.

2. Annual Report of the Travancore Plywood Industries Ltd.

From the table above it is seen that timber allocation (and total procurement) is not on the basis of the share in the install ed capacity .Out put of plywood is more or less proportional to timber consumption. The large-scale units consumed 61.7% of the total timber and accounted for 67.8% of the plywood produced in the State. The share of medium scale-units and the small scale units in the production was lesser

than their share in timber consumption. This is due to the comparatively low recovery in the small scale and medium scale units.[1] Small-scale units depend more on the wood from private sources. They are probably in better position to tap the wood available in the private~ lands due to the dispersed nature of their location.

Trends in Future Production: Chirayath (1966) estimated the production and the wood requirements as follows:

Year	Estimated production (Million m^2)	Estimated timber requirement (m^3)
1970-'71	6.2	62000
1975-'76	8.0	80000
1980-'81	12.0	120000

Source: J.T. Chirayath (1966). A study on the Plywood Industry in Kerala.

Though in 1975-'76 the actual production almost approached the figures Estimated by Chirayath, the overall share of production declined. In the face of acute shortage of wood raw material no additional capacity will be created. During the study, leading plywood manufacturing units have pointed out that they are not prepared to invest on increasing their capacity without en assured supply of raw material. Most of the units have

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[1]As per the Report of the Committee constituted by the Government of Kerala to assess the requirements of Soft-wood timber to Plywood manufacturing units the percentage of recovery is 43.4%, 30.2%, 32.8% in DGTD units, medium scale units and small scale units respectively.

pointed out that the present supply of timber is not even sufficient to meet their existing requirements and therefore. The question of expanding the capacity does not arise at all.

Chandrasekharan (1973) worked out the alternate consumption outlook for various wood products in Kerala. His estimates for plywood are as follows:

Table I.2.6

Alternative Estimates of Consumption Outlook for Plywood*

(In million m^2 - 4mm. thickness)

Alternative Estimates	Year 1980	1990	2000
Low	8.7	15.75	26.25
High	16.95	34.05	66.75

*Includes export consumption also.

Source: C. Chandrasekharan (1973). The Wood Using Industries of Kerala and their implications for Forest land use and Development. Ph.D. thesis - Michigan State University.

These estimates are, however, based on certain assumed capita income, population growth and increase in per capita consumption of plywood. Further it depends on assumptions regarding availability of wood, availability of substitutes, their prices etc. It should be borne in mind that a substantial portion of production goes to the packaging industry (primarily to be" the tea industry) and there is a limit up to which the consumption in that sector can grow. When we take these factors into account, the high estimates seams to be rather unrealistic.

Official consumption targets for plywood are 5.6 million m^2 by 1980, 10.5 million m2 by "1990 and 16.7 million m^2 by 2000. End use wise break up of these; targets are given below

Table I,2.7

Growth of Consumption of Plywood

End Uses	1980	1990	2000
	--thousands of square metres (4mm. basis)--		
1. Residential Building	804	2706	3949
2. Non-residential Building	1420	3470	7520
3. Other construction	300	500	700
4. Transport equipment	800	900	1000
5. Wood Works including furniture	500	700	900
6. Packaging	1800	2200	2600
TOTAL:	5624	110476	16669

Source: Chandrasekharan, C.(1973). The wood using industries of Kerala and their implications for Forest land use and Development. Ph.D. thesis - Michigan State University.

If we assume that the existing production consumption ratio is maintained, the total production including that to maintain the share of exports will be 8.4, 15.75 and 25.05 million square meters for 1980, 1990 and 2000 respectively. However, this depends on our Export policy, our ability to compete in the international market with other major plywood producing countries etc.

Assuming an average plywood recovery of 40%, the total timberrequirements for various projected targets of production will be as follows.

Table I.2.8

Projected Timber Requirements for the Plywood Industry in Kerala

(In m^3)

Projection	Year		
	1980	1999	2000
1	120000	--	--
2	87000	157500	262500
3	84000	157500	250500

1. Projection made by J.T. Chirayath
2. Low estimates of Chandrasekharan
3. Official consumption targets

Plywood Industry in Karnataka; Plywood industry is one of the important wood based industries in the State. In 1973 production was around 7.1 million square-meters and this accounted for 17% of the Country's production (Nagaraju et al, 1974) .Of this approximately 5.2 million square meters are produced by the five D.G.T.D. units in the State. It is pointed out that almost all units in the State have stopped producing tea chest plywood. General shortage of raw materials, irregular delivery of logs, lack of adequate Facilities for storing timber etc., are said to be the problems faced by the industry. By 1975 total wood consumption was about 100,000 m^3.

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[1]As a large number of plywood units in the Karnataka region have not responded, it was not possible to estimate the aggregate consumption figures. There for reliance had to be placed on other published information.

Installed capacity of the 5 D.G.T.D. units in the State is 10.57 million m2. Raw material supplied to these units from government forests during the lost five years is as follows:

Table 1.2.9

Wood Supply from Government Sources

(In M3)

Year	Wood Supply*
1971-'72	72760
1972-'73	89617
1973-'74	73989
1974-'75	83372
1975-'76	95314

*Includes a portion that is being utilised as core in the manufacture of flush doors and blockboards.

Average annual allotment to these plywood units comes to about 95,000 m (Forest Department - Karnataka) and the total allotment is more or less sufficient to meet the full capacity working. Table 1.2.10 gives the distribution of the D.G.T.D. units in various size classes (based on the:: installed capacity) , their share in the total installed capacity end the percentage distribution of the timber obtained from the Government sources.

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[2]As per the figures furnished by the Federation of the Indian Plywood and Panel Industry, the installed capacity of these five units is 7.48 million square meters. The figures quoted are based on the information furnished by the plywood units, and includes the cep2city for veneer production in the semi processing units of the major units.

Table I.2.10

Distribution of Capacity and Wood Consumption among the O.G.T.D. units in Karnataka

Size class Million m^3/year	No. of units*	Percentage share in the total**	Percentage distribution of wood raw material obtained from the Government sources***		
			1973-'74	1974-'75	1975-'76
Below 0.5	1	4.0	4.4	4.4	2.1
0.5 - 1.0	-	-	-	-	-
1.0 - 2.0	1	13.2	6.5	5.7	4.6
2.0 - 3.0	2	47.3	35.3	35.1	29.7
3.0 & above	1	35.5	53.8	54.8	62.9
TOTAL:	5	100.0	100.0	100.0	100.0

*Only O.G.T.D. units are taken into account.

**Gives the share in the total capacity of all the O.G.T.D. units.

***Share of the wood supply is based on the total quantity supplied to 5 O.G.T.D. units.

From the above table, it is seen that, units in class 1.0 to 2.0, constitutes 13.2% of the installed capacity, but received only 4.5% of the timber supplied in 1975-'76. In all the classes excepting the class 3.0 and above, there is a progressive decline in the share of wood received. In the case of the unit in the class 3.0 and above, the share of wood supply has been progressively increasing from 53.8% in 1973-'74 to 62.9% in 1975-'76. From this it can be seen that in Karnataka the present problem is more due to imbalances in the distribution of available wood supply, rather than inadequate supply

No reliable data is available on the contribution of the medium scale and small-scale units. As per the available records there are 15 plywood factories which obtain the raw.

material from the State Forest Department. Of this one unit is located in Kera1a. Except for the major units, no informa*tion* is available on the production of plywood, consumption of wood, system of procurement of wood etc. No comprehensive survey has been carried out on the small scale~ units in the~ State. Unlike Kerala small scale units which depend on timber from non-governmental source Cannot survive in Karnataka due to the non-availability of plywood timber in the open market. About 90% of the production is said to be in the organized sector.

Trends in Future Production: So far no attempt has been made to Estimate the trends 1n future plywood production in the State. As per the report on Integrated Forest Development Project (Forest Department, 1973) the requirement of plywood *in* the State in 1973 was of the order of 0.400 million cubic meters and the anticipated demand in 19805 is stated to be around 2052 million cubic meters. Even if we take this as round log, the corresponding plywood production will be (assuming 40%, yield) 40 million square meters and 252 million square meters detailed analysis is necessary to understand that these figures are very unrealistic.

The National Commission on Agriculture (1972) £estimated the requirement of Panel products for 1980 and 1990. Assuming that Karnataka's share of production in the Country's output will be about 15%, the probable plywood production and the timber requirements to achieve the above production targets are given in Table 1.2.11.[1]

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[1]In 1973 Karnataka's share in the Country's production was 17%. With the location of new plywood in other regions where wood is available, the share of Karnataka’s contribution in the Country's production is likely to decline. There fore UG have assumed the share as 15%.

Table I.2.11

Estimated Wood Requirements for Plywood Industry in Karnataka

Karnataka's share in the Country's production (%)	1980		1990	
	Estimated production (million m^2)	Wood requirements (m^3)*	Estimated production (million m^2)	Wood requirements (m^3)*
15	12.11	121,100	22.13	221,300

*Assumes a yield of 40% (100 m^2/4mm. thickness/ for 1 m^3 of timber).

3.0 Conclusion: Important conclusions that emerge from the analysis in this chapter are as follows:

1. Already there is wide gap between the demand and supply of raw material to the plywood units in Kerala. Even if we take only single shift capacity working, in 1975-'76 there was a gap of about 36,000 m3 between demand and supply. In the case of Karnataka, however, there is no much of gap, and the problem appears to be mainly of proper distribution of raw material between various units.

2. If we take into account the projections of future production, the gap between demand and supply in the case! of Kerala will be very wide. Even if we assume that the quantity of timber obtained from private sources is not likely to decline and assuming that quantity obtained through quota will be maintained at the 1975-'76 level the gap between demand and supply will be 38,400, 76,000 m and 180,000 m3 in 1980, 1990 and 2000 respectively.

As the private resource is likely to dry up gradually this gap will be higher it estimated production target have to be achieved. In the case of Karnataka, the gap between demand and supply will be 21,100 m^3 by 1980 and 121,300 m^3 by 1990, if the annual supply continue at the level of 100000 m^3.

In order to fully utilize the existing capacity and meet the projected production estimates, it is essential to ex amino the sources of supply, actual supply techno economic and the institutional factors responsible for the incomplete utilization of the available resources. It has also to be examined whether a fuller utilization of the. Existing resources will b~ sufficient to meet the production targets and the short-term and long-term measures to be adopted to bridge the gap between the demand and supply.

CHAPTER 3

WOOD RAW MATERIALPR08LEM INDUSTRY'S VEIW

1.0 Wood availability, though the major factor contributing to the growth of the Plywood Industry, has not received the attention, which it deserves. The industries emphasis was on the uncertainty of availability of timber and the periodic cost hikes caused by the revision of the royalty rates for timber supplied from the Government forests. Leading plywood manufacturers have expressed their concern on the wood raw material problem time and again. Availability of adequate quantity of timber of the right quality at reasonable prices on a sustained long-term basis is the most important factor in the growth of the industry (Vissanj, 1971). Sharp increase in the price of timber has been pointed out as a matter of concern for the industry (Khaitan, 1971). Dokania (1974) has pointed out that timber availability continues to be a cause of concern and the main bottleneck seems to be an acute shortage of funds for exploitation of additional Forest areas. It is pointed out that government holding monopoly in the control of, forests must make available to all sectors of the industry sufficient raw materials at reasonable cost to maximize production for internal consumption as well as for exports (Kaderkutty. 1975).

2.0 During the present study, the plywood units in the region have pointed 'out various problems pertaining to the supply of wood. For the units located in Kerala, non-availability of adequate quantity of wood and the uncertainty in supply seems to be the major problems. There is considerable year to year fluctuations in the supply, from both government a1 and non-governmental

sources. The system of supply through annual quotas is said to be en important factor for the uncertainty of wood supply. It is pointed out that in most cases there is considerable delay in quota allotment end often actual period available for working down the timber is reduced. Allotment is based on estimated availability, end most often the actual availability on working is less than what is estimated. A number of units have pointed out that government should make some arrangements to procure wood from Andaman's for meeting the demand. Need for earmarking areas for me8ting the wood requirements, and long term leases have also been pointed out.

3.O In the Case of Karnataka, wood supply is more stable and steady than Kerala. This is mainly due to the working of the forest areas on the basis of long-term leases. However, some of the units have pointed out that the Government is not in a position to supply the quantity stipulated in the lease deed. Loss of forest area due to conversion into other forms of land use has been pointed out as a factor responsible for reducing the areas available for plywood production. Restrictions imposed on the number of trees to be removed end the minimum distance to be kept between the trees felled are also factors responsible for the inadequate supply of wood to the industry.

A major factor it is pointed by a number of units, for the present problem is the establishment of new manufacturing units, without looking into the availability of raw material. Establishment of veneering units in Maharashtra and Madhya Pradesh from where the decorative plywood (especially decorative teak) requirements were met has been a factor responsible for the uncertainty in the supply of these timbers and the increase in their cost. Further, the severe

competition from the lag exporters. was also responsible 1 for the price hike and uncertainty in supply .[1]

Cost of wood raw material has also been a paint of concern for a number of manufacturing units. Many of the units have suggested a rationalization of pricing on a region or country basis. Cost escalation, of wood suitable for the production of decorative veneers is true to some extent; however in the case of quota timber the analysis carried out on the basis of information supplied by the plywood units indicate that there has not been any extraordinary increase in the cost. The trend in the cost of wood raw material has been more or less similar to that of the trend in the wholesale prices of agricultural commodities. [2]

3.0 Conclusion: It can therefore be seen that the major problems of the industry, as pointed out by the various units are (1) inadequate supply of wood and (2) uncertainty in the supply. In such situation it is not possible to plan effectively and in the face of uncertainty in the supply of the basic raw material it is not possible to think of any programme of expansion within the region. Some of the points raised by the plywood units regarding the procurement of wood will be discussed in a subsequent chapter.

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[1]The export of rosewood and teak logs have since been banned. The trend in the supply and price of this has to be watched. It is hoped that the supply position will improve considerably, due to the ban on exports.

[2] A detailed analysis of cost trends of quota timber from the Kerala-Karnataka regions is in Appendix II.

CHAPTER 4

PLYWOOD RESOURCES IN THE REGI0N

1.0 Problems pertaining to the demand and supply of wood raw material to the industry in the region has been examined in the previous chapters. Apart from the factors affecting equitable distribution of wood it is the low output from the forests, which is the primary reason for the gap between demand and supply. To examine the potential, it is necessary to anal use the forest resource in the region and the factors responsible for the low output.

Plywood resource in the region is confined to a continuous belt along the Western Ghats and the composition is more or less the same both in Kerala and Karnataka. But there is considerable difference in the system of working etc. and it is therefore necessary to examine the resource position separately.

2.0 **Forest Resource in Kerala:** About 9,214 square kilometers of the geographical area of Kerala consists of forests and this forms about 23.6% of the total land area. From the management point of view these forests can be grouped into the following categories.

1.Forest Area under the ownership of government before and after 1971	}7,520 Sq. km.
2.Foreat Area vested with the Government as per the Vesting and Assignment Act, 1971	} 1,694 Sq. km
Total	9,214 Sq. km[1]

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[1]As per the resource survey reports the total area of forests including 1880 sq. km. of private forests has been estimated as 9400 sq. km. Now these forests have beer. vested with the Government and their area has been estimated as 1694 sq. km. Therefore the total area of forests will be only 9214 sq. km.

Systematic management is in vague in most of the Government forests and the entire area as covered by detailed working plans. In the erstwhile private forests; there was no systematic management except in one or two cases.

Important forest types: From the point of view of wood raw material to the plywood industry not all forest types are equally important. It is therefore essential to identify the important forest types and to assess their potentialities. Broadly the reserve forests can be grouped into the following vegetation types.

Table I.4.1
Forest Types and Their Area

Forest type	Area in Sq. km.
1.Tropical evergreen	1,937
2.Tropical semievergreen	1,711
3.Moist deciduous	2,337
4.Dry deciduous	136
5.Pure reeds	185
6.Montane temperate shola	14
7.Grasslands	98
8.Plantations	1,102
Total	7,520

Source: C.Chandrasekharan (1973). Forest Resources of Kerala - A quantitative assessment. Kerala Forest Department.

Pre Investment Survey of Forest Resources in Kerala has revealed the preponderance of plywood species in the evergreen and semi evergreen forests. In the case of trees above 180 cm. girth, 56% of the plywood trees

are in the evergreen forests. The traditional and most desired plywood species such as Vellapine, Kulamavu, Kalpine, Chorappine, Pali etc., are found in the evergreen and semi evergreen areas from the point of view of availability or plywood resources these forests are the most important. A detailed examination of the distribution of the area under evergreen and semi- evergreen forests and the stocking will reveal the important supply zones.

2.2 **Distribution of evergreen and semi evergreen forests in Kerala:** Table 1.4.2 gives the distribution of the ever9reen and semi evergreen forests in Kerala in the various forest divisions.

Table I.4.2

Distribution of Evergreen and Semievergreen forests in Kerala

(Sq. km.)

Name of Division	Ever-green	% of the total	Semi-ever-green	% of the total	Evergreen and Semi-evergreen	% of the total
1.Ranni	407	21.01	210	12.23	617	16.91
2.Periyar(Wild Life Division)	305	15.74	275	16.07	580	15.90
3.Chalakudi	202	10.43	134	7.83	336	9.21
4.Palghat	176	6.09	54	3.16	230	6.30
5.Munnar	143	7.38	75	4.38	218	5.98
6.Nemmara	140	7.23	72	4.21	212	5.81
7.Wynad	132	6.81	60	3.51	192	5.26
8.Trivandrum	108	5.58	65	3.80	173	4.74
9.Thenmala	105	5.42	146	8.53	251	6.88
10.Nilambur	76	3.92	34	1.99	110	3.02
11.Malayattoor	48	2.48	210	12.27	258	7.07
12.Kottayam	42	2.17	188	10.99	230	6.30
13.Trichur	22	1.14	35	2.04	57	1.56
14.Konni	16	0.83	82	4.79	98	2.69
15.Kozhikode	13	0.67	--	--	13	0.36
16.Punalur	2	0.10	71	4.15	73	2.00
Total	1937	100.00	1711	100.00	3648	100.00

Source: C.Chandrasekharan (1973). Forest Resources of Kerala - A quantitative assessment. Kerala Forest Department.

Of the total area of 1937 sq.km. of evergreen forests, 407 Sq.km. is in Ranni Division and this forms the largest chunk of evergreen forests which lies contiguous to the evergreen forests in Periyar and Kottayam. Probably those forests form the most important potential source of the conventional plywood timber species .The Periyar sanctuary has about 205 :Sq.km. of evergreen forests and 275 sq.km. of semi evergreen forests. Since it is a sanctuary; these forests have to be excluded from the point of view of production. Therefore the total evergreen and semi evergreen areas that can be made available will be only 3,068 sq.km. Of this about 17% is in Ranni Division, 9% in Chalakudy 6% in Palghat and 5% in Wynad.

The moist deciduous forests is also an important source of plywood timber, and the important species, available from these forests are Haldu, Rosewood, Teak. Laurel etc. These species mostly come to the market due to the clear felling of moist deciduous forests for raising plantations. Approximately the annual area cleared is 2000 hectares, and this releases a large quantity of timber into the market. Requirements of the decorative plywood are fi1et mainly from the timber thus released to the market. Extensive teak plantations are also available in the state, the total area of which was 66,500 hectares by 1976.

2.3 **Estimates of growing stock of plywood timber:** Total growing stock of plywood timber available in the forests of Kerala has been estimated as 16.74 million m^3 (Chandrasekharan, 1973). This again is not uniformly distributed allover the State. Table below gives the distribution of the plywood timber stock in various divisions. Though Periyar sanctuary has d significant portion of the plywood growing stock, this has to be

Table 1.4.3

Growing Stock of Plywood in the Forests of Kerala

(In 000 m^3)

Circle	Division	30-89	90-179	180 and above	Total
1.Southern Circle	Trivandrum	70	645	300	1015
	Thenmala	100	790	350	1240
	Punalur	45	310	160	515
	Konni	60	420	180	660
	Ranni	185	1060	635	2060
Sub total		460	3225	1625	5510
2.Central Circle	Kottayam	90	590	415	1095
	Periyar	180	660	1060	1900
	Munnar	80	270	370	720
	Malayattoor	65	385	410	860
	Chalakudy	155	575	790	1520
	Trichur	75	340	190	605
Sub total		645	2020	3235	6700
3.Northern Circle	Nemmara	85	405	320	810
	Palghat	95	410	525	1030
	Nilambur	20	455	610	1085
	Kozhikode	35	310	230	575
	Wynad	60	460	510	1030
Sub total		295	2040	2195	4530
Total		1400	8085	7255	16740

Source: C.Chandrasekharan (1973). Forest Resources of Kerala - A quantitative assessment. Kerala Forest Department.

excluded since the area will not be available for production purposes. Therefore actually 14.83 million m^3 alone will be available This again is distributed in the evergreen, semi-evergreen, and moist deciduous forests and when we are considering only the evergreen forests as potential "plywood" zone we have to exclude the growing stock in the moist deciduous forests. Based on the numbers of trees per hectare in major forest types by utility classes (Pre Investment Survey of India - Forest Resources Survey *1970)* 52% of the plywood trees are in the evergreen and semi evergreen forests. When we take into account the distribution according to size classes 56% of the plywood trees above; 180 cm. Girth are found in the evergreen and semi evergreen forests. Taking the 3bove proportion as roughly applicable to the growing stock, 7.72 million m^3 of the total plywood growing stock will be available in the evergreen and semi evergreen areas and of this 3.47 million m3 will be in the girth class of above 180 cm.

Table 1.4.3 also reveals peculiarities in the distribution of the growing stock. When wood available in the Periyar sanctuary is excluded. Southern Circle has the largest share of the plywood growing stock and Ranni Division accounts for about 14% of the growing stock. However if we take into account the growing stock above 180 cm. only, Northern Circle has a higher percentage. It is interesting to note that. in the Northern Circle, though Nilambur Division has the largest growing stock of plywood timber, hitherto, the evergreen forests in this Division has not been tapped for plywood.

2.4 **Distribution of important Plywood species in selected areas of evergreen forests:** Appendix III gives the distribution of important plywood species under various

girth classes per hectare in some of the important evergreen forests in Kerala. Table below gives the number of trees above 180 cm. in some of these forests.

Table I.4.4

Distribution of Species above 180 cm. girth in Some Important Forests in Kerala

(No. per hectare)

Name of Reserve	Superior plywood species	Other plywood species	Total No. of trees (including others)
1.Silent Valley (Palghat Division)	3.03 (8.39)	17.38 (48.13)	36.11
2.Attappady (Palghat Division)	2.16 (9.84)	10.17 (46.31)	21.96
3.New Amarambalam (Nilambur Division)	7.01 (20.18)	4.31 (12.41)	34.73
4.Kottiyoor (Wynad Division)	10.13 (28.93)	3.35 (9.57)	35.01

Source: Compiled from the Resource Survey Report.

Table above reveals that the per hectare availability of plywood trees of and above 180 cm. girth at breast height varies from 11 to 20, However it should not be forgotten that, they are not uniformly spread over the entire area end quite often they are in clusters.

2.5 **Potential availability of plywood timber:** After examining the stock of resource available in terms of area end growing stock. it is necessary to estimate what could be theoretically exploited without taking into account the various constraints Theoretically the annual yield can be worked out by a number of methods, end they mainly fall into two categories i.e., (i) based on the area and *(ii)* based on the growing stock.

Yield based on area: Total extent of the evergreen and semi evergreen forests in the State is 3,068 Sq.km. excluding the area under Periyar Sanctuary. It is pointed out that, of the total reserve forest area in Kerala about 12% will not be available for production due to the inaccessibility of the area and other reason so Evergreen and semi evergreen areas being tl1e most inaccessible when compared to other forest types it can be assumed that the entire area of 902 Sq. km. (12% of 7,520) is in the evergreen and semi evergreen belt. Actual area available a for production is therefore taken as 2100 Sq. km. [1]

Yield from these forests will depend on the felling cycle, number of plywood trees extracted from unit area and the quantity of timber available from each tree. All I forest divisions in Kerala have approved working plans and most of the evergreen and semi evergreen forests are worked under selection system. Felling cycle varies from 15 to 30 years, and we will take it as 30 years to be on the safer side. Number of trees prescribed for removal is about 10 to 12 per hectare.[2] In the case of the semi evergreen forests, however it may not be possible to extract the above number of trees. Therefore we will take an average yield of 6 to 8 trees per hectare. Assuming an average volume of 2 m^3 per tree, [3] if all the 2,100 Sq. km. of forests are worked systematically the annual yield of plywood timber will vary from 84,000 m^3 to 112,000 m^3.

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[1]The actual area will be 2,166 Sq. km. We have taken this as 2,100 Sq. km.

[2]In the case of Wynad Division the maximum number of trees that can be removed is 20 per hectare.

[3]The Pre investment Survey of forest Resources carried out in the southern zone has worked out the net volume of a tree as 2.14 m^3 .We have taken an average volume of only 2.00 m per tree.

Yield based on growing stock: Growing stock of plywood timber available in the evergreen and semi-evergreen forests has been estimated as 7.72 million m^3 of Which 3.47 million is in the girth classes of 180 cm. and above. After making proportion reduction for the area not available for production, that actually can be made available will be 5.48 million m^3 out of which 2.46 million m^3 will be in the present exploitable class based on this the yield can be worked out either by considering the entire growing stock or by taking into account only the growing stock above 180 cm. girth. With the conventional Von Mantel's formula the yield estimation assuming, a rotation of 150 years, the annual yield will be about 73.000 m3 of plywood timber. [1] If the growing stock above 18p cm. has to be extracted over the first felling cycle, then the annual yield will be 82,000 m^3. [2]

Yield estimated above are theoretical possibilities. In an ideal working condition and when the growing stock is normally distributed. Such a possibility is an ideal, and in reality cannot be achieved. How ever it is possible to reach closer to this ideal condition with suitable management practices. Condition of the growing can be improved and better yield can be realized.

2.6 **Availability of plywood timber from the vested forests:** Growth of the plywood industry in the Malabar region appears to have been intimately connected with the

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[1]As per the Von Mantel's formula annual yield is estimated as $A = {}^{2\,GS}/_{R}$ where A = Annual Yield, G.S. = Growing Stock and R = Rotation. This however is applicable only to a normal forest which is a theoretical concept.

[2]Here we are not taking into account the growing stock which will pass into the exploitable class from the pre-exploitable class.

management of the private forests. A higher concentration of the units in this area can be explained to some extent to the availability of a substantial quantity of wood from the private forests. In 1950, total area under private forests in this region was 2,830 Sq. km. and by 1975 it has declined ,to 1,625 Sq. km. Large scale clearance that took place between 1950 and 1970 has been supporting a large number plywood and other wood based industries in the region. Vesting of these forests with the Government in 1971 has halted the clearance, and partly the wood raw material problem in this area is a resultant of the stoppage of felling.

Of the total area vested, 540 Sq. .km. is likely to be cleared and assigned to the landless people. Of the remaining forest only one-third will be capable of allowing any scientific forestry operations. This will to a large extent comprise of the reclothing of denuded slopes with tree crops for prevention of erosion and gradually replacing the valueless species with valuable species. Since most of these areas except a few like Vadassery forests, Cheriyaakunhamad's forests, A.K. forests etc. are already over-exploited in the past and since a large extent of the vested forests are in the catchments area of various irrigation projects, they have bean included in the protection-cum-selection working circle, where emphasis will be given for protection. In these circumstances it can be presumed that contribution from the vested forests towards meeting the requirements of the plywood industry will be negligible.

2.7 **Output from the moist deciduous forests:** In Kerala, annually a large area of moist deciduous forest, is cleared and converted into plantations. The extent of plantations raised, and consequently the area cleared

depends on the plan schemes. On an average about 2.000 hectares are cleared, and this releases about 100,000 m^3 timber to the market (both sale and supply). part of the timber brought to the Government depots is allotted to various manufacturing units. Standing timber in the area from where superior timber species has been extracted is sold on lump sum basis, and the plywood units generally buy the softwood species from the sale coupe contractors.

2.8 **Actual timber supply:** Table below gives the quantity of timber obtained by the plywood units in the State, by way of quota allotment.

Table I.4.5

Timber Supply to Plywood Units in Kerala

(In m^3)

Year	Quantity allotted	Quantity actually supplied
1973-74	62359	46403
1974-75	59042	45699
1975-76	47952	37892

Source: Government of Kerala (1977). Report of the Committee formed by Government of Kerala to assess the requirements of Softwood timber to plywood manufacturing units in Kerala.

The above quantity comprises of the output from the mellabhom coupes (60% to 70% of the supply is from mellabhom coupes) and allotment from the depots.

3.0 **Forest resources of Karnataka:** The geographical area of Karnataka state is 19.04 million hectares Of this8 the area classified as forests covers 2.895 million hectares- and forms about 15.2% of the total land area. Due to the varied climatic and edaphic factors the

forest type range from the most luxuriant tropical wet evergreen to the poorly formed scrub land. The Malnad area along the Western Ghats contains the most important forest resource, especially from the point of view wood raw material for the plywood industry.

The principal forest types in the States and the area and the growing stock under each type are given in the table below.

Table I.4.6

Forest Types in Karnataka

Type	Area (000 hectare)	Percentage to the total	Growing stock (m^3 per hectare)	Growing stock total (Million m^3)
1.Tropical evergreen	435.0	15.0	200	87.00
2.Tropical semi-evergreen	145.0	5.0	150	21.70
3.Moist deciduous	578.0	20.0	100	58.00
4.Dry deciduous	727.0	25.0	50	36.50
5.Scrub land	435.0	15.0	25	10.87
6.Unforested	575.0	20.0	--	--
Total	2895.0	100.0	--	214.07

Source: Karnataka Forest Department. Annual Report for 1976-77.

Consequent to the population growth and the increased need for agricultural land, there has been considerable inroads into the Forest area. Between 1956 and 1976 an area of 2,200 Sq. km. has been given away for non- forestry purposes. A major portion of this has been the area gone under submersion in the river valley projects. As most of the irrigation and hydroelectric projects are situated in the Malnad area such inroads have affected the most valuable forests.

Within the forestry land use also there has been drastic change. Need for switching over to man made forests have been realized and extensive plantation of valuable species has been raised. Extent of plantations raised so far is given below.

Table I.4.7

Area Under Manmade Forests in Karnataka

(Hectare)

Species	Area
Teak	101,725
Matchwood	30,118
Cashew	23,592
Eucalyptus	70,676
Fuel Plantations	180,409
Rubber	5,527
Others	2,374
Total:	414,421

3.1 **Distribution of the forest resources:** As far as wood raw material is concern, evergreen and semi-evergreen forests forms the most important source. Traditionally preferred species like Pali, Vellapine, Kalpine, Kulamavu etc., are found in the evergreen and semi-evergreen forests. The evergreen and semi-evergreen forests are mainly distributed in the Hassan, Chickmagalur, Shimoga, South Canara, Coorg and North Canara districts. Distribution of forests in these districts is given in -Table 1.4.8. Important divisions, which contain valuable forests with plywood specific, are South Canara, Coondapur, Mercara, Hunsur and Hassan in Coorg circle, Ha1iyal, Yellapur, Honnavar Karwar and Sirsi in Carnara circle, Chickmangalur, Koppa, Badravathi, Shimoga and Sagar in Shimoga circle,

Table I.4.8

Distribution of Forests in Important Malanad Districts in Karnataka

District	Land area (Square kilometres)	Forest area (Square kilometres)	Percentage of land under forest
1. Hassan	4874.0	483.3	9.9
2. Chickmagalur	7118.7	1751.3	24.6
3. Shimoga	10392.5	2118.5	20.4
4. South Canara	8342.3	2136.9	29.2
5. Coorg	4107.8	1356.5	33.02
6. North Canara	10266.8	8326.7	81.10

Source: Karnataka Forest Department.

Important divisions, which contain valuable forests with plywood species, are South Canara, Coondapur, Mercara, Hunsur and Hassan in Coorg Circle, Haliyal, Yellapur, Honnavar, Karwar and Sirsi in Canara Circle, Chickmagalur Koppa, Badravathi, Shimoga and Sagar in Shimoga Circle, Belgaum and Dharwar in Belgaum Circle and Mysore in Mysore Circle. At present no quantitative information is available on the growing stock of plywood timber. However some idea of the plywood resource can be obtained from the working plans dealing with the management of the various divisions in Karnataka.

Coorg Division forms an important plywood timber resource in the State. Somiah (1959) gives a detailed account of the forests and his plan is yet to be revised. In Coorg about 441 Sq. km. contains very good evergreen forests. Of this nearly 73 Sq. km. have been degraded

into a deciduous type owing to post treatment. For the evergreen working circle, Somiah has prescribed felling cycle of 45 years and the annual area to be taken up *in* 301 hectares. The rotation fixed is 135 years. Yield has been estimated on the basis of the number of trees. In all 5145 trees will be removed every year (about 17 trees per hectare). The Estimated annual removal is 15,609 m3. based on the enumeration carried out by Somiah, the average number of trees in the exploitable class is 17 per hectare. Exploitable size has been fixed as 20" diameter at breast height (210 cm. girth). Results of the partial enumeration indicate the preponderancy of plywood species like Vellapine, Pali, Kalpine, Poon and Piney. During the period of felling cycle it is estimated that a net volume of 702.755 m^3 can be removed from this area.

Evergreen and semi evergreen forests of Sirsi and Siddapur form another important source of plywood in the state. As per Shanmugappa's plan (1966-1986) the area under evergreen and semi-evergreen forests in those divisions *is* 392.75 5q. Km. (The extent of evergreen forests here *is* only 29.76 5q. km,), Important plywood species in the area are Kalpine, Poon, Kulamavu, Mango and White cedar. The evergreen areas have been formed into one felling series and are worked on the basis of felling cycle of 40 years and an assumed rotation of 200 years. Maximum number of trees that can be removed has been fixed as 20 per hectare, annual yield has been estimated as 3.600 m3. In the case of the semi-evergreen forests the maximum number of trees that can be removed has been restricted to 10 per hectare.

Forests in Karwar and Honnawar Divisions also form an important source of plywood timber in the State. In Shenmugappa's plan (1966 -1986) details of plywood

out turn from these forests has been given. Total area of the forests in these Divisions is 871.6 Sq. km. And major portion of these forests is under the southern tropical evergreen type. The area that could be worked for plywood extraction will be about 783.9 Sq. km. The working plan contains specific prescriptions to regulate the extraction of certain veneering species. Exploitable size has bean fixed as 183 cm and felling cycle prescribed is 30 years. Yield has been prescribed on the basis of number of trees, about 2658 trees per annum.

It is pointed out that those forests are situated in the interior difficult tracts with little facilities for extraction. So much so, there has never been any systematic working of these areas in the past. In the absence of proper communication such as roads, areas close to extraction paths were tapped heavily and tracts farther from roads were not at all exploited or under exploited.

Another important plywood area in the State is the Hassan ghat forest. Parishwad (1977) has prepared a detailed working plan for the area and yield of softwood and hardwood has been prescribed separately. The forest type is mainly the southern tropic3l wet evergreen and is the home of the most valuable species like Pali) Kalpine2Vellapine etc. Part of this area is being I worked by Mysore Ply woods Ltd. and Wimco since 1943. As per Kadambi's working plan the area contained over mature stock and to extract the maximum available quantity a short felling cycle of 15 years was adopted. How ever the prescribed coupe were not worked mainly due to the inaccessibility of the area. Easily accessible areas were worked repeatedly for several years, but only for few species and this resulted in the depletion of the bigger girth class trees from more

accessible areas. The quantity of timber removed during the earlier period was less than what has prescribed and this resulted in accumulation of over-mature trees. Most of the areas in Kabbinale forest and some parts of Kagenari and 8isle forests have not been worked yet.

Of the evergreen forests 4815 hectares have been put under the selection working circle and another 9340 hectares in evergreen tending working circle. Inaccessible portion comprising an area of 3302 hectares has been put under protection working circle. A felling cycle of 30 years has been adopted and the number of trees that can be removed varies from 7 to 11 per hectare.

The above details give only qualitative information regarding wood availability and the pattern of management followed in some of the important plywood timber areas in the state. It does not help to arrive at a definite conclusion on the total potential in the State and that could be removed on a sustained yield basis. The details we have examined covers about 30% of the evergreen end semi-evergreen forests in the State The Working Plans give only the availability during the plan period and does not give any idea of the total growing stock.

3.2 **Estimates of the plywood resource in the state:** The total growing stock in the evergreen und semi-evergreen forests is 108 million m^3. Assuming that of this, plywood growing stock is about 18%, the total plywood growing stock will be about 19.4 million m3.1 Assuming that

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[1]The Pre Investment Survey of Forest Resources in the Southern Zone has shown that of the 282 trees per hectare in the evergreen forests about 50 are plywood species. We have assumed that this proportion is more or less applicable to the growing stock in Karnataka State.

this is a normal growing stock, adoption of a rotation of 150 years should give an annual yield of about 260,000 m^3 .

The Karnataka Forest Department has drawn up a draft perspective plan for the period 1978-1997 and in this the annual yield of plywood and other softwood timber ha5 been estimated 3.S 219.000 m^3. Assuming that 75% of this will be plywood timber the annual yield *or* plywood timber will be 164,200 m^3.

3.3 **Resource surveys of Karnataka forests:** In the absence of a comprehensive resource survey the above figures are tentative. Karnataka forest department has almost completed a 10% enumeration in the entire forests and the results are being analyzed. A realistic estimate of the resources will be possible only after the results of the resource survey are analyzed in detail. It will be then possible to estimate the sustainable yield plywood timber from the forest. However the basis of present information, the annual yield of plywood timber should be between 164.000 m^3 and 260,000 m^3.

3.4 **Timber supply:** Following table gives the details of softwood supplied to plywood, match and packing case manufacturing units in the State during 1975-76 and anticipated supply during 1976-77 and 1977-78.

Table I.4.9

Softwood Removals from Karnataka Forests

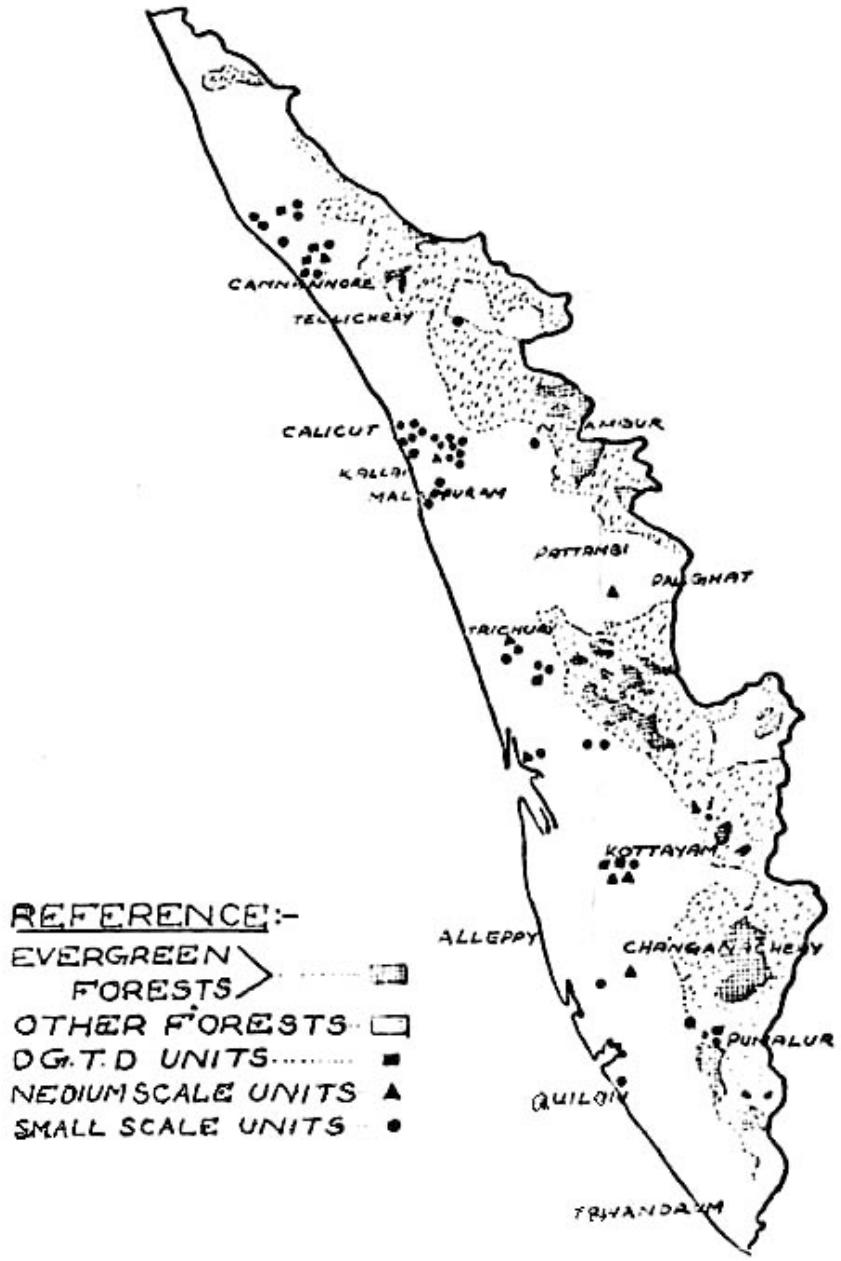
Name of circle	Actual removal in 1975-76	Total licensed for 1976-77	Probable removals 1977-78
1.Mysore	793.6	950.0	1000.0
2.Canara	34665.0	22868.0	23700.0
3.Coorg	71192.0	64450.0	70000.0
4.Belgaum	3316.4	2783.0	3500.0
5.Shimoga	27328.5	18449.4	22300.0
Total	137295.5	109500.4	120500.0

Source: Karnataka Forest Department.

4.0 **Location Vis a Vis wood raw material source:** Diagrams 1.4.1 and 1.4.2 give the location of the plywood units Vis a *vis* the wood raw material source in Kerala and Karnataka respectively. It can be seen that most of the plywood units are located close to the wood resource. However in the Malabar area in Kerala those are few numbers of units, which depend on wood from the Central Circle. Similarly there is one unit at Bangalore in Karnataka which has to bring wood from *a* considerable distance.

5.0 **Conclusion:** Details of the resource availability in Kerala and Karnataka have been examined in the previous sections. In the case of Kerala there is fairly reliable information on the important plywood timber zones and the growling stock. In the case of Karnataka no overall estimates ore available. It has been found that what is now being made available is fur less then what could be possible in an ideal condition of management. In the next chapter we will examine the system of working now being followed and then look into the factors which are responsible for the under utilization of the resources.

FOREST TYPES OF KERALA & LOCATION OF PLYWOOD UNITS



FOREST TYPES OF KARNATAKA & LOCATION OF PLYWOOD UNITS

REFERENCE:-

TROPICAL WET EVERGREEN FOREST

TROPICAL SEMI EVERGREEN FOREST

MOIST DECIDUOUS FOREST

D.G.T.D UNITS

OTHER PLYWOOD UNITS

CHAPTER 5

SYSTEM OF PROCURMENT OF TIMBER A REVIEW

1.0 Before examining the details as to how the present raw material supply can be enhanced, it is essential to look into the present system of wood procurement by the industry in Kerala and Karnataka.

2.0 **System of wood procurement in Kerala:** In Kerala there are no private forests and hence the plywood manufacturing units have to depend directly or indirectly on the timber that is removed from the government forests. A substantial portion of the requirement is met through annual quota of timber allotted by the Government. Allotment is done on the basis of the application made by the respective units through the Deputy Commissioner of each district. The quota intents are verified on the basis of the previous years production records. On the supply side, the annual availability from each division is estimated by the forest Department. Allotment is done by the Committee consisting of representatives from the forest Department and Industries Department. The quota allotted is usually in proportion to the requirement of the units and the total estimated availability of timber. Cross transport is as far as possible avoided by appropriate allocation taking into account the location of the factory and the source of the raw material.

When a quota is allotted, the allottee has to execute an agreement with the Divisional forest Officer from whose division the timber has to be collected.

The period of the quota is from 1st July to 30th June. Quota allotted is supplied either from the selection coupes on "melabhom " system or from the forest department depots. The allot tees generally prefer to work down the timber from the "melbahom" coupes and this accounts for 60% to 70% of the total quantity of timber allotted. Even the small units pool their quota an d engage a contractor to extract the allotted timber.

Under the "melabhom system", the allot tees have to make all the arrangements for extraction of timber. Standing trees, after marking and checking by the forest department staff is handed over to the allottee. Usually extraction is entrusted to a contractor who most often splits the work into various items and sublet it to other petty contractors or team of axe men. After a tree is felled and converted, they are measured, stamped and checked by forest officials. The allottee remits the value of the timber and then the timber is released from the coupe for removal to the factory. The allottee has to abide by the terms and conditions stipulated in the agreement.

In the case of the allot tees who obtain their quota from the government depots, the procedure is different. Plywood timber is brought to the depots by departmental contractors either from the clear felling coupes (supply coupes) or from selection coupes and they are measured over to the allottees, on payment of the rates specified for the species and the timber is released for removal.

System of wood procurement in Karnataka: Unlike Kerala in Karnataka raw material is collected by the manufacturing units on the basis of long term leases of well defined areas. In most cases the lease period is 20 years

and the agreement stipulates conditions regarding collection, payment of value, transport etc., of timber collected from the lease areas. Usually a felling series is earmarked for meeting the requirements of a given unit now, however, the department is not in favor of long term leases and for the recent lease deeds the period is only five years. It is pointed out that the allot tees are not such concerned with proper extraction and considerable damage is done to the standing trees.

Though the working plans prescribe different numbers of tares for different areas, now the number of trees has been restricted to 10 per hectare (4/Acre).

Usually the manufacturing units do not take up extraction directly. They engage contractors for extraction of timber. Felling, conversion into logs and road construction is entrusted to one contractor and transport is given to another contractor. These contractors often sublet the work to petty contactors or sometimes even to teams of axe men.

Marking in the annual coupes is carried out by the department. In the earlier lease deeds, the company had to prepare the marking list and commence the felling after the approval of the list by the Divisional Forest Officer. As per the existing system, however, marking has to be carried out by the department. A forester is put in charge to supervise the extraction work and to issue transit passes etc. After the logs are collected and measured, it has to be check measured and removal is permitted only on payment of the value calculated on the basis of rates prescribed for each species. The maximum quantity of timber that can be removed annually is

specified in the lease deed and this is subject to actual availability.

Departmental extraction from lease areas: Now it is the general opinion that the system of extraction through the lessees and their contractors is not desirable in the long run. The Department wants to stream - line the system of raw material supply and prevent haphazard working. Further they feel that selection felling is more of a silviculturel operation and there fore it is not desirable to leave it to the allot tees who will have only a short term interest. Departmental extraction has commenced on an experimental scale in certain areas in Mercara and Mysore .

The plywood manufacturing units are not happy about the departmental extraction. When departmental extraction is taken up, the plywood units, in addition to the value end cost of extraction has to pay a supervision charge also. It is pointed out that the department does not have the necessary infrastructure to under take timber extraction directly and so contractors had to be engaged or the basis of tenders. Most often the contractors who had been working for the plywood units earlier take up the work and so the pattern of working remains essentially the same. From the point of view of the plywood units it increases their total landed cost (in addition to the~ 10% supervision charges, most often an additional loading and unloading becomes essential). It is further pointed out that there is certain uncertainty; time lag between felling and delivery of logs to the plywood units has increased and this causes deterioration by way of fungal attacks, splitting etc.

CHAPTER 6

FACTORS INFLUENCING SUPPLY OF RAW MATERIAL

1.0 In Chapter 4, it has been brought out that considering the area and the growing stock in the region that is actually extracted is far less than that is possible.

2.0 The system of raw material supply in the two states has been examined in the previous chapter. It is necessary now to look critically into the factors, which are responsible for the inadequate output of plywood quality timber from the region.

Broadly the factors responsible for the under utilization of the available resources can be grouped into two, namely (1) Techno-economic factors and (2) Institutional factors. They are, however, not mutually exclusive and are very often closely related. Important techno-economic factors responsible for inadequate and sub - optimal resource utilization are as follows:

1) Accessibility of the forests.

2) System of working

3) Competition from other wood using industries.

4) Availability of plywood species and species preference of plywood

manufacturing units.

Accessibility of the forests: Accessibility seems to be one of the major factors responsible for the low out- put of timber fro the Evergreen and semi-evergreen areas. Most of these areas are situated in the hinterland and facilities for communication arc very meager. In 1974-'75. the total length of motorable roads in Kerala forests has been only 973 Km., and this is just 0.10 Km. per Sq. Km. Of forest. Even these roads are located in the easily accessible plantations and moist

deciduous forests. Ideal road density suggested is 1 km. per Sq. Km. of forest area.

Another factor closely related to accessibility and existence of all weather motorable roads is the working season. In Kerala and Karnataka, the working area remains cut off for about six months during the rainy season and no transport is possible during this period. Due to the absence of proper roads and bridges in the area even logs converted cannot often be transported. With the onset of the monsoon, often substan*tial* quantity of timber felled and prepared has to be left in the forests which deteriorates considerably by the time the area becomes accessible after the monsoon.

Inaccessibility has been one of the major factors responsible for not tapping the available plywood area. For example, in Kerala, though marking of plywood species was carried out in the Silent Valley Reserve in Palghat Forest Division, “the allotttees were reluctant to work the area mainly due to the high investments on the formation of roads, necessary to extract the limited quantity of timber allotted to the firms" (Chand Basha - 1977). Extensive areas in the New Amarambalam Reserve in Nilambur Division and the Ranni Reserve in Ranni Division remain untapped due to inaccessibility.

In the case of Karnataka also the absence of all weather roads is a major factor in the underutilization of the available resources. The road density is much below the ideal level. Inaccessibility has been the main reason for not working the Hassanghat forests as per the prescriptions of the working plan (Parishwad, 1977). Forests in Karwar and Honnawar Divisions has

also remained untapped mainly due to the inaccessibility, of the area (Shanmugappa, 1966).

2.2 S**ystem of working**: Intensity of working is determined by silvicultural considerations and to some extent economic considerations. Usually, in evergreen forest it is the extensive exploitation rather than the intensive management that is being practiced. In most of the working plans, one of the primary objectives of evergreen forest management laid down is the maintenance of the evergreen character of the vegetation with minimum disturbance to the ecosystem. Marking is very conservative and normally the maximum number of trees extracted is limited to 10 to 12 per hectare. Rotation, felling cycle etc., are adopted on the basis of inadequate statistical data on growth, and a conservative girth limit is also prescribed.

In the earlier days when demand for wood was limited, there was an economic reason behind such a conservative system of working. Only few species were utilizable either as plywood logs and sleepers and so it was not economical to carry out intensive working. Exploitation was carried out for specific purposes and only few species were extracted. Such an extensive system of working, however cannot afford the investment on present roads etc., to open up the areas. What has, therefore, happened is over-exploitation in easily accessible areas and under exploitation in difficult areas. It is pointed out that even if marking is uniformly spread over the coupe, it is noticed that the contractors live out the trees in the areas far away from extraction paths (Chand Basha, 1977).

Different working plans prescribe different numbers of trees to be extracted from a given area. Kerala, for example, for Wynad Division the maximum number that can be removed has been limited to 20 per hectare. For Palghat Division it varies from 10 to 12 per hectare. In the case of Karnataka the maximum number has now been limited to 10 per hectare. Many of the plywood manufacturers have pointed out that this restriction is not advantageous to both the Government as well as themselves. In many cases tress occur in clusters and is not uniformly spread over a given area. It is pointed out that prescribing the maximum number that can be removed and specifying a minimum distance between two trees to be felled will result in incomplete exploitation which may leave out a large number of trees in the exploitable class which will become useless by the time the area is taken up for felling next time.

The Polycyclic System now being followed in Kerala and Karnataka pays very little attention to regeneration of the area. In fact the whole operation amounts to selective felling of certain trees. Though rules and regulations regarding silvicultural oprations are pres cribed in the working plans, they are seldom implemented. Polycyclic system of regeneration has been completely replaced by monocyclic systems *in* other tropical evergreen forest areas.

2.3 **Competition from other wood using industries:** The major competitor for wood from evergreen forests is Railways which require a large number of wooden sleepers. Working of evergreen areas for Railway sleepers affects plywood timber in two ways. First, species like Poon, Pali, Mundani, Kalpine etc., can be used as both sleepers and plywood. Secondly when preference is given

for sleeper extraction the number of trees that can be silviculturally made available for plywood production is reduced where there is a restriction on the maximum number of trees that can be felled.

2.4 **Availability of Plywood species and species preference of plywood manufacturing units:** Though ISI list of species approved for the manufacture of plywood is exhaustive not all of them are being used by the plywood manufacturers. Of the 19 manufacturing units in the region who expressed their species preference all but one preferred species like Vellappine, Pali, Kulamavu and Kalpine. Even the Softwood Committee which went into the details of the problem relating to the supply of softwood to plywood, matchwood and packing case units in Kerala has pointed out that though there are a number of species approved by the ISI, many firms are not utilizing all the available species for one reason or the other. Species like Punna, Thallipyne, Cheeni, Nedunar etc., are also ISI approved and increased use of these species would ensure a better utilization of forest resources. The Committee had also pointed out that though there are other species of timber reported to be suitable for plywood but not included in the ISI list.

Reasons pointed out by the plywood units for the preference of the traditional species are that they give a higher yield and better quality plywood. Conventional species like Kalpine, Vellapine, Pali etc., attain large dimensions with excellent bole and therefore the ratio of plywood yield to extraction cost per unit volume is very high. As payment for felling, extraction etc., is based on out turn, there is always a tendency to concentrate on those trees which will give the maximum outturn.

3.0 **Institutional Factors:** Institutional factors are generally those that are capable of extracting a control over the production and distribution of the raw material. Though ownership of the resource is vested with the government and utilization is in the hands of the industries, it is the intermediaries like contractors who act on the link between production and consumption. Their objectives diverge from that of the producer and the consumer. Generally they have short-term profit maximization as the objective and therefore we cannot expect them to make long-term investments on roads etc. Even in Karnataka where contiguous areas are allotted to the same unit on a long-term basis, the contractors carry out timber extraction. Very little attention has been paid to improve the logging methods and to minimize wastage, and this is due to the system of engaging petty contractors. Further they concentrate on the ply logs alone, resulting in considerable wattage of materials which otherwise could be utilized elsewhere.

PAR T - II

CHAPTER 1

NEED FOR A STRATEGY

1.0 The details presented in Part 1 give an idea of the problem of wood raw material in the region. Already, there is a gap between demand and supply that is increasing consequent to the increase in demand and the ever diminishing supply. The present problem when properly examined is not entirely due to lack of raw materiel. Historically plywood industry has been depending on the timber "mined" from the natural forests, which was actually considered as a god given asset and therefore very little planning has gone into the proper tapping of the resource. " Though the problem of raw material has been in existence and the need for proper integrated management of forests and forest based industries has been stressed, very little effort has gone into evolving a strategy for solving the problem.

2.0 As pointed out in Chapter 1 of Part I, the National Commission on Agriculture has gone into the need for evolving an integrated development of the forest and forest based industries sector. Requirements of wood for the various wood based industries have been worked out. However, suggestions for meeting the future requirements have been primarily confined to the pulp and paper industry and a clear cut strategy for other wood based industries has not been formulated. The lack of any strategy for wood based industries other than pulp and paper has reflected in the subsequent developments in the sphere of forest management. Forest Development Corporations formed in most of the status as an outcome

of the recommendations of the National Commission on Agriculture are primarily oriented towards the building up of the resource base for the pulp and paper industry. About fifteen Forest Development Corporations have already been established. Of these the project reports of just four corporations have programmes to meet the requirements of the plywood industry and the rest are primarily geared to meeting raw materiel requirement of the pulp and paper industry.

In the Kerala-Karnataka region also Forest Corporations have been formed mainly to meet the requirements of the pulp and paper industry. No strategy has been incorporated to meet the wood requirements 1f the plywood industry, though traditionally the Kerala - Karnataka region has a number of locationaly advantages, especially from the point of view of raw material source and marketed, both internal and external.

3.0 Shortage of wood is not a problem solely confined to this country or region; it situation faced by of the wood based industries in the world. It is only through proper planning at the production and utilization stages of the raw material that a satisfactory arrangement is possible.

We have seen in Part I that potential availability of raw material is apparently more than the present flow and the situation is not hopeless. In fact this region is in a favorable position as compared to many other regions. The potential productivity is highs and with suitable changes in our policies and techniques the problem can be eased.

In the next chapter the various technical and policy options available to solve the wood raw material problem will be discussed.

CHAPTER 2

STRATEGY TO MEET WOOD RAW MATERIAL REQUIREMENT OF THE INDUSTRY

1.0 As it stands now there is an established capacity of the plywood industry built up during the course of a few decades. This capacity is underutilized for a variety of reasons, chief among which is the inadequacy of wood raw material. The present demand based on the existing capacity needs to be met and firm programmes initiated to meet the already established demand in future years. Moreover, strategies have to be defined and concrete projects formulated to meet the additional demands of future consequent to increased capabilities, the trends of which are already discernible.

As indicated earlier, planning for both production of wood and establishment of plywood units cannot be done simultaneously, mainly because of the long gestation period required for production of plywood quality timber. The gestation period is nothing less than 50 to 60 years. Therefore any strategy should prescribe options available in the short term as well as in the long term. In the short term (or short period} the physical stock of wood (i.e., the wood capital) available is fixed and cannot be increased and the options available are limited to optimal utilization. In the long term (or long period) the stock of wood can be increased by raising plantations, natural regeneration etc., and thus the resource flow can also be enhanced. A detailed analysis of the various short term and long term measures, and the consequences of adoption of these measures on the wood raw material availability to plywood industry is given below:

2.0 **Short term measures:** Short-term measures aim at maximizing the flow of resource available from the existing or fixed stock of wood resource. The possible measures under this can be grouped as follows:

i) measures which will increase the flow of raw material.

ii) complementary measures which are essential to increase the raw material output and to increase the out turn of plywood.

The measures that can increase the raw material availability are:

1) Modification of the system of working the forest area.

2) Division of world available from clear felling areas.

3) Procurement of timber from other regions or from other States with in the region, and

4) Better utilization of available raw material.

2.1 **Modification of the system of working the forest areas:** The present system of selection felling followed in the evergreen end semi evergreen forests in Kerala and Karnataka is extremely conservative. It is a polycyclic system with long felling cycles and restrictions on the number of trees that can be removed. There is no scientific evidence to conclude that it *is* the most suitable system. In an industrially und6veloped stage there was en economic justification for a very conservative approach such a justification is no more valid

and therefore a closer scrutiny of the system has to be made.

Two technical alternatives are feasible for adoption in the case of selection forests. One is to Continue with the present polycyclic system and increase the yield with a less conservative approach and the other to completely switch over from the polycyclic to an intensive monocyclic system.

(a} **Intensification of management under the present polycyclic system**:

Even with the present polycyclic system the yield can be increased by

(i) reducing the felling cycle and thus carrying out selection felling in a larger area.

(ii) increasing the number of trees extracted from unit area and

(iii) reducing the minimum girth limit for selection marking.

Felling cycle in Kerala and Karnataka varies from 15 to 45 years. With longer felling cycles the treatment should approach very closely to a monocyclic treatment and the number of trees extracted should be high. Presently, the number of trees removed is restricted to 10-12 per hectare. Evan with the existing girth limit of 180 cm. adopted in most areas, more number of trees can be extracted. .Table 1.2.4 clearly indicates such a possibility. If all the trees in the exploitable girth can be extracted the annual yield could be

increased approximately by 15%. In Kerala this will amount to an additional yield of 4500 m3 where as in Karnataka the additional yield can be about 15000 m^3.

Increase in yield can also be achieved by reducing the minimum girth of felling. In most of the divisions in Kerala and Karnataka the minimum girth for felling is 180 cm. This can be reduced to 150 cm. Even assuming that 50% of the trees will not be available for extraction and giving a wide margin for poor stocking in certain areas the number of trees that can be removed can be increased by about 30% from one hectare. In terms of volume yield this will amount to on increase by about 20%.[2] The additional yield by reducing the girth limit will be about 6000 m^3 for Kerala and about 20,000 m^3 in the case of Karnataka.

What will be the impact of intensifying the present polycyclic system on wood raw material availability in the region? Present gap between demand and supply in Kerala is about 36600 m^3 and by 1980 this will be 39000m^3. Suggestions made above can produced on additional quantity of about 10500 m^3 only and even with this there will be a gap of 26100 m now and 28500 m by 1980.

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[1] This estimate is based on the assumption that average annual yield of plywood from the selection working areas is 30,000 m^3 in Kerala and about 100,000 m^3 in Karnataka. Average annual supply of plywood timber from Kerala during the years 1973-'74 to 1975-'76 was about 43380m^3 end this 70% was from melabhom coupes. In working out the additional yield, we have taken into account the yield from areas currently exploitable only.

[2] On an average there are 8 trees per hectare suitable for plywood production in the girth class 150-180 cm. Commercial volume per tree of this class is taken as 1.45 m^3 .

In the case of Karnataka, intensification of the present system as suggest6d above can produce about 35000 m^3 of timber, and temporarily there will be some surplus. However, if additional capacity is created to meet the projected demands, in 1990 there will be a gap of 66000 m^3. This clearly brings out the need for the adoption of a much more intensive system of working.

(b) **Introduction of Monocyclic system of Management:** The polycyclic system of treatment is an extremely conservative system. It has practiced when very little has known about the management of tropical evergreen forests. Work carried out in the Rain Forests of South East Asia has clearly brought out the possibilities of switching over from the polycyclic to monocyclic treatment. In India itself this system is being followed in the case of the Rain Forests in Andaman and Nicobur Islands and it has been introduced in parts of North Eastern region also. A monocyclic system has clear-cut advantage over the selective felling now followed. Firstly it provides for intensive natural regeneration of important species and the treatment is flexible to take into account the status of regeneration. Secondly the operations are more intensive and concentrated end therefore the marginal cost and average cost of timber extraction will be far less than that of the selection felling system.

In a monocyclic system, the felling in a given area will be spread over a number of years to ensure establishment of adequate regeneration. Usually a conversion period is adopted during which the irregular crop will be converted into a more or less regular series of age classes. Considering the presence of a large number of saplings and poles which will be retained at the time of felling, a conversion period of

100-120 years will be realistic for the region. When the area available for conversion is taken as 2100 Sq. km. and 4000 Sq. Km. for Kerala and Karnataka respectively, the annual yield of plywood timber during the conversion period will be 102,000 m^3 for Kerala and 193,000 m^3 for Karnataka. [1] As there will be a conscious attempt to favor superior plywood species at the time of regeneration, during the second rotation, the yield of plywood will be substantially high as against the present system where intensive regeneration operations are seldom carried out.

Adoption of a monocyclic system has to be based on initial trials and it may take a few years to standardize the technique in the area. Since the techniques have been more or less standardized in Andaman and Nicobar Islands, it will not be difficult to evolve a system suitable to the region. However, it will be unrealistic to assume that it can be adopted immediately as it takes time to evolve the technique suitable to the region. It is also essential to make the area more accessible in order to od9pt the system. It could be possible to switch over to this system by 1990 and till then it will be necessary to meet the demand by other means. Even if a monocyclic system is adopted the gap between demand and supply will be 55,500 m^3 in 1990 and 160,500 m^3 in 2000 in the case of Kerala end 28,300 $m3^3$ in 1990 in the case of Karnataka.

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[1]Based on the area suitable for conversion the approximate annual area that will be taken up for conversion will be 1750 hectares in Kerala and 3300 hectares in Karnataka. Average yield of plywood timber has been taken as 58.5 m^3 per hectare based on the number of trees above 90cm. girth. Yield based on the above figures will be 102375 m^3 for Kerala end 193050 m^3 for Karnataka.

It is evident from the above that for Kerala the gap between demand and supply will persist from now till 1980 and beyond when the wood supply resulting from the monocyclic treatment is made available. Even after an intensified working in the selection forests under the Polycyclic System, there will be a gap of about 28,500.m^3 in 1980, which will persist till 1990. Therefore to bridge the gap immediately the only alternatives available are procuring timber from the clear felling areas and/or to import timber from other States. Feasibility of these measures and their impact on wood supply now and in future arc examined below.

2.2 **Utilization of wood available from clear felling area:**

(a) The Kerala Forest Development Corporation has launched a project for raising 45100 hectares of Eucalyptus plantation during a period of 10 years by clear felling the existing moist deciduous forests spread over the Central and Southern Circles in Kerala. As this activity is undertaken by a corporation and carried out on a large scale it will be possible to organize the supply of the available plywood timber from this area systematically to the various units located close to the working area. On an average the total timber yield per hectare from the area is estimated as 50 m^3 inclusive of supply and sale (Nair, 1977) and therefore the annual yield from the clear felling will be of the order of 225,000 m^3. Assuming that at least 10% of this will be suitable for commercial plywood production, the annual yield

of plywood from this area will be about 22,500 m^3. With a proper organizational set up to arrange collection, classification, grading and supply the gap in 1980 in Kerala can be reduced to about 6000 m^3 however this additional yield will last till 1986-187 only, by which time the targeted area will be converted into plantations.

(b) In addition to the above there will be a continuous flow of timber from the areas, which will be taken up for raising plantations on a lung term basis. Considering the net area of moist deciduous forests available the annual area that can be taken up on a 60 year rotation period will be about 1800 to 2000 hectares in Kerala. Assuming a plywood yield of about 5 m^3 /hectare from these areas the output that can be made available will be about 9000- 10000 m^3. Even then, there will be a gap of 45,500 m^3 and 150,500 m^3 in 1990 and 2000 respectively.

Karnataka can convert a larger area and it will be possible to clear about 4000 hectares of moist deciduous forests every year. Proper planning of the clearance of the above magnitude can enhance the supply of plywood timber by about 20000 m^3. Utilization of this output can reduce the gap between demands and supply to about 13300m^3 in 1990.

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[1]The distribution of the number of plywood and non- plywood species actually marked during the working of certain areas in Trivandrum and Ranni divisions indicate that actually more could be obtained. To take into account the wide area to area variations we have taken the yield as only 5 m /hectare.

What will be the impact of the above measures on-wood raw material supply to the industry in Kerala now and in future? Immediately by proper canalization of output from the clear felling areas of the Kerala Forest Development Corporation the gap can be bridged to the extent of 22,500 m^3, and still a gap of 6000 m^3 will be left. This can be bridged only through import of timber from other areas. The possibilities of importing timber from outside the region or from within the region, i.e., from Karnataka are examined in the following sections.

2.3 **Procurement of timber from other regions:** Wood import from other regions is suggested as a short-term measure to tide over the present problem. Andaman and Nicobar Islands have been suggested as a possible source of large quantity of timber. Some of the plywood units in Kerala and Karnataka have obtained timber from Andamans. Discussions with SIPMA representatives revealed that so far about 2400 m^3 of timber has been procured from Andamans. It is therefore worthwhile to examine the possibility of obtaining timber from Andamans and to see whether it is an economically feasible proposition.

(i} Forest resource in Andamans and tend in Supply:

Productive forest area in Andaman and Nicobar Islands has been estimated as 6000 5q. Km. Tentative estimates of the growing stock has shown that these forests can sustain an annual yield of

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[1]Even now, the annual clear felling of about 2000 hectares by the Forest Department produces an output of 10000m^3 of timber suitable for plywood. Part of this is brought to the depots and allotted as quota. The rest goes to the sale coupe contractors from whom the plywood units purchase it. By 1990, it is presumed that the system of timber extraction etc., will be changed, no that whatever is produced will be directly channeled to the industries.

365,000 m^3. However this includes the yield from inaccessible areas and so the realizable potential is far less. A project report for Logging, Marketing, Forest Plantation and Natural Regeneration in the little and North Andaman Islands has been drawn up by the Andaman and Nicobar forests and Plantation Development Corporation limited. In the first phase of the activity 6800 hectares in little Andaman and 975.5 hectares in North Andamans would constitute the project area and the annual area proposed for working will progressively in- crease from 200 hectares in the first year to 2245 hectares in the fifth year of the project. Output of plywood timber will be 7500 m^3 in the first year and it will gradually increase to 51,000 m^3 at the 5th year and will continue up to the 10^{th} year. In the project report it is suggested to establish a wood industry complex in the joint sector which would be in a position to utilize the timber output from the area. Establishment of such a complex will take time and export of timber to the, markets .in the mainland is envisaged in the initial stages. Therefore the plywood units in Kerala can depend on this timber provided it is economical.

(ii) Cost of Andaman Timber: It is therefore necessary to examine the financial and economic feasibility of utilizing Andaman timber in the plywood units in the Kerala -Karnataka region. F.o.b. rates fixed for plywood logs from Andamans are as follows. [1]

1. Ply gurjan logs = Rs.235.70/m^7

2. Non gurjan logs = Rs.178.00/m^3

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[1]These are the f.o.b. rates (which includes the royalty and working charges) given in the project report of the Andaman and Nicobar Islands forest and Plantation Development Corporation.

The present transport cost charged for delivering the logs at Madras harbour is Rs.108.30/m^3. Cost of handling and clearing charges (including the cost of loading in railway wagons) qt Madras port is Rs.72.00/m^3. Therefore logs loaded in Wagon at Madras will cost Rs.358.80/m^3 for non-gurjan logs and Rs.415.50/m^3 for gurjan logs. In addition, the manufacturing units will have to incur the costs of railway transportation, unloading at the railhead, loading in trucks at rail head, road transportation and unloading cost at factory site. Total landed cost at factory site will be about Rs.630.00/m^3 for non gurgan logs.

From the above it can be seen that with the existing F.o.b. prices and transport costs, the landed cost will be prohibitive and the industry in the region cannot depend on the resource available in Andaman. High oceanic transportation cost and handling costs make the Andaman timbers uncompetitive. Reliance can be placed on timber from the region only if there is a government-to-government arrangement for supplying the logs at competitive rates and subsidizing the transport cost. However, subsidizing plywood industry is a policy question and involves sectoral priorities, factors of income distribution etc., which should be studied in detail.

(iii) **Wood from other regions:** Another alternate source suggested is Arunachal Pradesh. Stumpage for Arunachal timber varies from Rs.122.50/m^3 to Rs.157.50/m^3. Freight

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[1]It is pointed out that this rate was fixed about 10 years ago and in the present condition the cost will be substantially high.

charge from rail heads in Arunachal Pradesh to Cochin is approximately Rs.32S.50/m^3. In addition timber has to be colleted and transported to rail heads in Arunachal Pradesh. Considering the remoteness and inaccessibility of the region this will be an expensive item of work. In addition, Cost has to be incurred for transport of wood from railhead to factory site.

Considering the above factors, it is not advisable to go for the raw material from such remote areas. Further it will amount to diverting the raw material that could be better utilized in the industry in the North Eastern region that is presently facing a crisis as regards the supply of wood raw material.

Therefore, dependence on timber from other regions can only be adopted as a temporary measure, and should be used only to supplement the wood supply from within the region. Higher costs and uncertainty of supply are the major bottle-necks in utilizing timber from other regions. Further the emphasis on regional development and regional self-sufficiency necessitates the establishment of processing units close to the raw material source. To bridge the gap between demand and supply in Kerala, marginally timber can be imported from Andamans - probably about 2000 m^3. However, as manufacturing units will be established there in the course of a few years it will not be possible to import timber on a long-term basis. Therefore it has to be examined whether there is any possibility of procuring timber from within the region, namely Karnataka.

2.4 **Procurement of Timber from Karnataka:** With the present system of forest management the supply deficit is very high in Kerala, whereas in Karnataka the supply is more or less sufficient to meet the present demand. Even now a certain quantity of timber is brought to Kerala from Karnataka. With the existing system there is very little scope for increasing this flow. However, if the suggestions on intensified working under the present system are implemented, the yield from Karnataka can be increased by about 35,000 m^3 and there will be a surplus of about 34,000m^3. It will be possible to utilize this surplus in the Kerala based manufacturing units. However this also will be a temporary measure and can at the most supplement the Kerala requirements for the next four or five years only.

Thus, as regards procur3ment of wood from other areas, Kerala has two options i.e., (1) to obtain the timber from Andamans and (2) to obtain it from the probable additional yield from Karnataka. Considering the cost, the second option will be preferable. However, it will depend on the implementation of the suggestions made earlier. Since, Andaman Forest and Plantation Development Corporation has already commenced the project works, the supply from Andamans is certain; cost is the only factor against the use of timber from there.

2.5 **Better utilization of the resources:** A better utilization of the available resource can be achieved in the following ways:

(a) Rational allocation of timber between the various users.

(b) utilization of wood species not presently used or used as a small percentage of the potential wood supply and

(c) minimizing logging waste end deterioration in storage.

(i) Rational allocation of timber between various users:

One of the measures often suggested to augment the availability of wood to plywood units is a division of the plywood quality logs currently used in saw milling etc., based on a rational allocation policy. Many plywood units pointed out that a substantial quantity of wood in the form of large logs is utilized by the saw milling industry for purposes which can be met with small sized logs. To find out the possibility of rational allocation, a detailed analysis has to be carried out on the following aspects.

(1) Quantity of round logs utilized by the saw milling industry and other users such as railways, defense etc.

(2) Size and species wise distribution of the logs and their end uses.

{3) What proportion of the above quantity can be utilized by the plywood industry and

(4) In case it is possible to divert part of the timber supplied to saw milling, railways etc., how their requirements of wood can be met and what will be the social costs and benefits of such a replacement .

A rational allocation is also dependent on the species preference, sizes etc. Considering the wide range of species available in the forests in the region and the species preference of each industry, region and consumer, it is difficult to estimate the additional supply that could be possible by a rational allocation. The argument for rational allocation, it appears, is based on what is observed in Europe and North America where the forests

comprises of a few species having multiple end uses. In such a situation it is easy to allocate different sizes of logs between different consuming industries.

It is therefore not possible to say in quantitative terms the effect of a rational allocation of raw material unless a detailed study is carried out. However, there appears to be limited possibilities for such an allocation between the industries competing for the same raw material, namely plywood, packing case arid match industries.

(ii) Utilization of wood species not presently used or used as small percentage of the potential supply:

As pointed out earlier most of the plywood units have definite species preference. Present problem of raw material shortage is also, partly due to the tendency of the plywood units to stick on to the species traditionally used. There are a large number of species approved by the I.S.I. as suitable for plywood. Increased use of these species can ease the present problem. It is also necessary to examine the suitability' of a number of species for producing plywood. With the increasing demand it is imperative to use species hitherto unutilized. Gradual shifts of raw material requirements to a wider range of acceptable species and smaller diameter trees could improve the resource base considerably.

Associated with this is the need to evolve a rational pricing policy by the Government, so that there is an incentive or compulsion, to use non traditional species. A pricing system taking into account the species and size of the logs will have to be evolved. In an earlier study (Government of Kerala, 1972) it has been pointed out that part of the complaints from the

industry in regard to price, quantity and usefulness of timber supplied in the result of the desire for concentrating on superior species to the exclusion of the logs of more conventional species and to the exclusion of certain species.

(iii) Minimizing logging waste deterioration in storage and transit:

With the traditional methods of felling, conversion into logs etc., there is considerable waste of valuable raw material. The system of working through contractors, sub contractors etc., does not permit any improvement in logging techniques. Evan in areas, little improvement has been brought about in the system of working. What is aimed at is to maximize the timber out turn and it need not necessarily improve the plywood yield. Appendix IV gives the measurements of some sample logs obtained from the intake register of a plywood-manufacturing unit in Kerala. These logs have to be cut into standard lengths in order to be lobed into the peelers. As conversion into logs at the forest site is done without looking into this aspect, wood waste during end cutting is substantial. Considerable wood is wasted due to nonvertical cutting of the logs at forest site and the loss in volume during cross cutting varies from 9% to 14% of the initial lag volume (Nagaraju et al, 1974) .

Considerable damage is caused to timber due to cracks, and splits, fungal attack etc. The Indian Plywood Research Institute has done considerable work in the field of treatment of logs to prevent such damages. However, very little has been done to adopt such methods on a large scale.

3.0 **Complementary measures:** In order to increase the output of timber a number of measures are suggested. To implement these measures, it is necessary to build up necessary infrastructure like roads, buildings etc. Further investment will be required for technological improvement in plywood production. These measures can be implemented during the coming few years.

3.1 **Investment in building roads and exploitation of resources not currently exploited**:

A study of the resource potential and the bottlenecks in the faller utilization of the available resource has shown that both in Kerala and Karnataka extensive areas remain untapped mainly due to inaccessibility of the area. The system of working adopted in the area does not give any incentive for investing on infrastructure development. From the societal point of view, it is necessary to tap these resources. A good net work of forest roads is essential not only to ensure proper extraction, but also for carrying out regeneration works in the area. Assuming an ideal road density of 1 Km. per square kilometer of forest, this will involve an additional investment of about 1.5 to 2.0 lakhs of rupees for tapping 100 hectares. At the current intensity of working this will amount to an additional investment of Rs.75.00 to Rs.100.00 per cubic meter of timber extracted. If a monocyclic system is adopted the additional cost will vary from Rs.25.00 to Rs.34.00 per cubic metr. [1] How. ever, the entire cost of forming a road system need not

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[1]Here we have taken into account only the plywood quality timber. If the total timber (plywood and non-plywood) that can be extracted in 120-150 centimeter then the cost of road formation will only be about 13 to 17 rupees per cubic meter. If the firewood and miscellaneous timber is also taken into account the cost per cubic meter will be far less.

be charged to the industries. As the forest Department will be the main user of a road network, the whole expenditure can be collected from the Industries in the form of a Forest Development Tax as being done in Karnataka. [1]

Road con5truction is a la::>our intensive operation and therefore does not involve the use of any scarce resources. With the emphasis on creation of employment, the vast unutilized man power available in the rural areas can be utilized to layout a net work of roads to make the area accessible and to tap the potential wood resource. If a social-cost benefit analysis is carried out on such an investment programme, in all likelihood, it will be feasible proposition from the societal point of view.

3.2 **Technological Government in Plywood production:**

Increasing the yield of plywood through technological improvement, though outside; the scope of the present study is directly related to the wood raw material problem. Need and Scope for reduction of waste and increasing the yield in plywood manufacturers has been discussed earlier also (Nagaraju et al 1974). It is pointed out that some of the manufacturers are unaware of proper peeling techniques; each factory, often each operator has a different idea of lathe settlings. Planned maintenance of machinery is also not practiced. Considerable waste is noticed due to improper rounding end incorrect centering.

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[1]In Karnataka State a Forest Development Tax at the rate of 5% is levied on the value of all forest produce sold. This amount is credited to the forest Development Fund in the State.

In many cases the peelers are very old and the diameter of the core produced varies from 15 to 18 cm. [1] In sev8ral foreign countries waste reduction has been achieved through technological improvement. Average diameter of the logs used is 20-25 cm. and smallest acceptable diameter in some cases is only 15 cm. Final core thickness is just 6.0 to 6.5 cm. Although there are technical limitations in using small sized logs of broad leaved species, there is considerable scope to reduce the size of the logs and the core thickness by adoption of improved technology.

Raw material shortage is a worldwide problem and the quantity and quality of timber is deteriorating. In Kerala and Karnataka extraction on the second felling cycle has not commenced so far; it is quite natural that logs obtained during the second cycle is likely to be of smaller sizes. Reduction in the quality and quantity of wood raw material can be counteracted to some extent by improved technology. (Grudzinski,1975). Technological improvement will be absolutely essential when small sized logs from natural and manmade forests have to be utilized. Unless many of the existing units initiate a modernization progrnmme, it will not be possible for them to use the species and sizes of logs hitherto not used. Using obsolete machinery will thus result in waste of valuable raw material.

1.0 **Long term measures:** In the conventional economic sense, the capital stock can be increased in the long period and

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1A number of loading plywood manufactures have peelers older than 20 years. This has been responsible for the low yield despite the large dimensions of logs fed into the peelers.

thus the flow of output can be increased. The rea1ity as regards forest resource all over the world and particularly in the region under study is, however, different. In the long run, it is quite probable that the resource flow may be reduced considerably consequent to the use of forest land for non-forestry purposes. Therefore it is essential to resort to measures which will maintain the flow by continuously increasing the growing stock. Raising manmade forests and increasing the productivity of natural forests through natural or other means are important measures in this direction.

4.1 Creation of manmade forests with species having multiple end uses:

Extensive mar.m8de forests are being raised both in Kerala and Karnataka and the major species are teak and Eucalyptus. Eucalyptus is planted mainly to meet the requirements of the pulp and paper industry and managed on the basis of a ten-year rotation. For teak the rotation varies from 60 to 80 years. Very little attempt has been made in Kerala to raise softwood species to meet the wood requirements of the plywood industry. In Karnataka some attempts are being made to raise softwood species and the rate of planting is about 2000 hectares per annum (Karnataka Forest Department, 1977). Industries like pulp and paper, match etc., require only short rotation timber and therefore it is possible to build up the necessary resource lease even in a short period. For plywood, however, it takes more than 50 years for the trees to mature and therefore a long term planning is essential. with the conventional investment criteria short rotation plantation projects have an Economic advantage especially when the scarce finance has to be allocated between competing projects. Therefore, a plantation programme exclusively for meeting the

requirements of plywood industry has little chance of becoming financially viable and hence it is necessary to adopt a programme with species having multiple end uses.

This need not be a pure plantation programme. It can also be in the form of gap regeneration' now being followed in Karnataka. However, gaps are difficult to manage, and supervision will not b6 effective Especially when large area has to be tackled.

There are a number of' fast growing indigenous species that Can be raised in this region. Some of the indigenous species that can be raised are Mundani, Gamari, Kadam, Somel etc. Nursery and plantation techniques have been more or less standardized for these species. It is necessary to evolve tending suitable to the various species.

Availability of area: The major constraint in taking up a programme of manmade forests will be the limited availability of land. In Kerala the annual area of moist deciduous forests that can be converted on the basis of a 60 year rotation will be about 1500-2000 hectares. (This is excluding the area that will be converted by the Kerala Forest Development Corporation for their Eucalyptus Plantation Project). Considering the requirement of other wood based industries it may not be possible to earmark more than 1000 hectares annually for raising plywood species.

In the case of Karnataka, a much larger area can be earmarked for raising plywood species. Considering the largo area of forests, it will be possible to raise (about 2000 hoctt3res of plantation every year.

Yield and rate of return: Very little information available on the growth statistics and the treatments to be carried out at different stages. Therefore, it is difficult to estimate the probable yield and rate of return on investment at different rotations and under different thinning regimes. However, on the basis of a 60 year rotation it is possible to get about 80 m^3 of plywood quality timber per hectare. Therefore, from 2040 onwards the suggested plantation programme can supply about 80,000 m^3 and 160,000 m^3 of timber from Kerala and Karnataka respectively.

Even if the rotation is more than 60 years, the thinning can be regulated to provide a substantial quantity of wood for meeting the requirements of the pulp and paper industry. The intermediate yields and the multiplicity of uses can overcome the problem of risk and uncertainty on manmade forests having long rotations.

4.2 Investment in enhancing natural regeneration in the evergreen and semi-evergreen areas:

At present very little attempt is being made for maintaining the productivity of selection forests.[1] Once the marked trees are felled, practically no attention is paid to the area. The adoption of a monocyclic system will not only ensure a higher output of timber, but also will promote regeneration in the area. By the time the conversion period is over the area will have a qualitatively end quantitatively better growing stock. Since the conversion period will be about 120 years the yield consequent to the natural regeneration will be available from 2100 onwards only.

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[1]A brief account of the pest attempts on natural regeneration in Kerala and Karnataka is given in Appendix V.

The project prepared by the Andaman and Nicobar Islands Forest and Plantation Corporation has drawn up a scheme of natural regeneration for reclothing the area felled.[1] The cost per hectare has been estimated as Rs.750.00 in the first year, Rs.140.00 during the second year and Rs.105.00 in the third year. An exercise on the return consequent to the investment has shown that the net present value at 10% discount rate is Rs.45.46 per hectare in the case of evergreen forests and Rs.61.67 per 2 hectare for deciduous forests.

5.0 Outlook for timber supply to the Plywood Industry in the Region:

Tables 11.2.1 and 11.2.2 give the trends in the wood raw material supply consequent to the various measures suggested in the earlier sections. In the case of Kerala (see Table 11.201) it is possible to achieve the targeted production of 12 million square meters in 1980 (which is approximately the present capacity) provided about 6000 m^3, of timber 13 procured from outside the State. From 1990 onwards however the supply will be less as the outside sources will dry up and the quantity obtained from the private sources will be negligible. Till 2040, timber available to the industry will remain about 112,000 m^3. Once the manmade forests start yielding, the supply will go up to about 182,000 m^3 and this can sustain a capacity of about 18 million square meters (4mm. thickness).

1As per the Project Report 70% of the area will be regenerated by natural means.

[2]See Appendix VII of the Project Report. This exact financial evaluation has considerable drawbacks as it rests on a number of assumptions regarding expect ad output, prices etc. It is particularly sensitive to intermediate yields.

Outlook for Timber Supply to Plywood Industry - Kerala

(In m^3)

Demand and Supply	1980	1990	2000	2040
1.Projected demand	120,000	157,500	262,500	--
2.Current level of supply:				
a).Quota*	44,000	--	--	--
b).Private source	37,000	--	--	--
c).Total	81,000	--	--	--
3.Short term measures				
a).Additional supply consequent to the intensification of the present system	10,500	--	--	--
b).Supply of timber due to the adoption of monocyclic system	--	102,000	102,000	102,000
c).Timber supply from clearfelling areas**	22,500	10,000	10,000	--
d).Timber supply from other sources:				
i).Andamans	6,000	--	--	--
ii).Karnataka				
4.Long term measures				
a).Supply from man made forests	--	--	--	80,000
b).Increased output from natural forests***	--	--	--	--
5.Total supply	120,000	112,000	112,000	182,000
6.Deficit	--	45,500	150,500	--

* It is assumed that by 1990 the present system of supply will be changed. By then the private sources are likely to dry up completely.

** Even now about 2000 hectares is clearfelled annually and this produces a substantia quantity of plywood timber. Part of this is allotted to the plywood units on the basis of annual quotas. Therefore in 1980 we have taken into account only the additional output that could be tapped from the Kerala Forest Development Corporati areas.

*** If a conversion period of 120 years is adopted, the yield from the naturally regenerated areas will be available only in 2100.

In the case of Karnataka (See Table 11.202) the position is comparatively better. If the various measures suggested are implemented, Karnataka will have a surplus of about 34,000 m^3 in 1980, part of which can be supplied to Kerala. The total supply even after meeting the entire deficit of 6000 m^3 in Kerala will be about 149,000m^3 and thus there is scope for increasing the capacity in the State. However, by 1990 the total supply in Karnataka will be about 213,000 m^3, and there will be a deficit of 8300 m^3 if the estimated production has to be attained. Additional supply will be possible only by 2040, by which time the manmade forests will start yielding from then onwards the supply will be 373,000 m^3 per annum.

5.1 **Planning Plywood Production:** Considering the limited supply of wood, it is necessary to carefully plan the creation of further capacity for plywood production in the region. In Kerala there is practically no scope for creation of additional capacity till about 2040. It is therefore batter that the capacity is restricted to that which is possible with a wood intake of about 120,000 m^3. (12 million square meters of 4mm. thickness with the present technology). However, it is necessary to bring out technological improvement in plywood production, so that the wood raw material available is fully utilized and waste is minimized. Once the manmade forests start yielding it will be possible to increase the capacity to about 18 million square meters.

In the case of Karnataka there is some scope for expansion of capacity. By 1980 the total wood supply can be increased to about 150,000 m^3 and this can sustain a production of about 15 million square meters. 8y 1990 the capacity can be increased to about

Table II.2.2

Outlook for Timber Supply to Plywood Industry - Karnataka

(In m^3)

Demand and supply	1980	1990	2040
1.Projected demand	121,100	221,300	--
2.Supply at the current level*	120,000	--	--
3.Short term measures			
a).Additional supply consequent to the intensification of the present system	35,000	--	--
b).Supply of timber due to the adoption of monocyclic system	--	193,000	193,000
c).Timber supply from clearfelling areas (Natural forests)	--	20,000	--
4.Long term measures			
a).Supply from man made forests	--	--	160,000
b).Increased output from natural forests**	--	--	--
5.Total supply	155,000	213,000	353,000
6.Excess or Deficit	(+) 33,900	(-) 8,300	--

* This includes some quantity of timber obtained from the clearfelling of natural forests in addition to that from the selection areas. Therefore yield from the clearfelling areas has not been separately taken into account for estimating the supply in 1980.

** As we have adopted a conversion period of 120 years, yield from these areas in the second rotation will be available from 2100 only.

21 million square meters. However, by then it would have reached the maximum sustainable production and till the manmade forests start yielding it will not be possible to increase the capacity. With proper management the plywood timber production can be increased to 353,000 m^3 by 2040 and this can sustain a capacity of about 35 million square meters.

6.0 **Institutional changes:** In an earlier chapter the role of certain institutional factors governing the production, distribution, utilization etc., of the raw material in the underutilization of the resource has been pointed out. Most of these institutional factors have come into existence in a given historical context. When improvement has to be brought about in the production and distribution of wood raw material, it will be necessary to bring out drastic changes in the institutional set up. Various measures suggested in the previous sections can be implemented more effectively by a new organizational set up which has certain committed objectives. Traditionally there has been no integration or coordination between forest resource management and forest industries. Traders and contractors continue to form the mail link between the resource managers and resource users. Such a link cannot play an effective role in the face of resource scarcity.

It is necessary to identify major plywood timber zones in each State and to earmark them for supplying the raw material required by the industry. In the case of Kerala the areas available has been indicated. Such an identification of the zones is possible in Karnataka also once the resource survey is completed. As most of these areas are situated in rather remote areas where competition from other forms of use is less

it will be possible to identify a zone primarily meant for supplying the wood requirements of the industry.

Once such an area is identified, it will be necessary to have a suitable agency to manage the area and to supply the wood to the various, industrial units. Opening up the interior areas will require substantial investments and it may be necessary to draw institutional finance to support such a scheme. The managing agency will be required to undertake commercial activity and therefore considerable freedom of action should be given. Timber extraction, transport, marketing, regeneration etc., will be undertaken by the agency. [1]

6.1 It is also necessary to look into certain aspects of industrial licensing procedures. At present while granting licenses for establishing new units or expanding the capacity of the existing units, the raw material availability is seldom looked into. It is necessary that forest departments who control the production of raw materials be consulted while granting such licenses.

7.0 **Conclusion:** Broadly, various measures that can be adopted to solve the wood raw material problem are grouped into short-term measures and long-term measures. Important solutions that emerge are the intensification of the management system and the tapping of areas hitherto unexploited or under exploited. Resources

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[1]Here it is pertinent to point out that the above activities should be based on a clear-cut forest end industrial policy and should form part of a broad perspective plan for the Forestry Sector.

Available in other regions or within the region but outside the State should be relied upon only as a temporary measure. Considering all these factors it can be seen that in Kerala there is no scope for increasing the present capacity. In the case of Karnataka there is however some scope. But any increase beyond 21 million square metros will be difficult.

In the long run the resource availability will depend on the investment on manmade forests on enhancing regeneration in the evergreen and semi evergreen areas. Land availability will be the major constraint in increasing production of plywood quality timber. Considering this, it will be still possible to produce by 2040 about 182,000 m^3 and 353,000 m^3 of plywood quality timber from Kerala and Karnataka respectively.

CHAPTER 3

CONCLUSIONS AND RECOMMENDATIONS

1.0 Present situation with regard to wood raw material supply to the plywood industry is far from satisfactory. If production has to be increased to meet the increasing consumption needs. Arrangements have to be made to enhance wood raw material output from the forests. Even to satisfy the already existing capacity considerable effort is required. In the absence of any effort to increase output creation of additional capacity will only increase the quantum of unutilized capacity.

2.0 A number of measures have been suggested to augment raw material supply, to reduce waste and to increase output of plywood. Important recommendations and their impact on raw material supply are given below:

1.To meet the immediate requirements, the options available are: (i) decrease the girth limits of felling and (ii) to increase the number or trees marked from unit area. These measures are recommended till a monocyclic system of treatment suitable to the region is perfected after trials.

Additional yield consequent to the adoption of the above measures will be about 10,500 m^3 in the case of Kerala and 35,000 m^3 in the case of Karnataka.

2.Considering the various advantages of the monocyclic system especially its ability to ensure regeneration, adoption of the system in Kerala and Karnataka is recommended Initial trials have to be commenced immediately so as to standardize the system by about 1990.

Adoption of the above system will ensure a sustained supply of 102,000 m^3 from Kerala and 193,000 m^3 from Karnataka.

3.It is necessary to regulate the flow of timber now extracted from the areas earmarked to the Kerala forest Development Corporation in Kerala. It is possible to obtain about 22,500 m^3 of plywood timber from these areas.

4.The usual clear felling programmes in Kerala and Karnataka should be carefully planned and properly phased.

Considering the area available for clear-felling it will be possible to obtain a yield of about 10,000 m^3 and 20,000 m^3 from Kerala and Karnataka respectively.

5.Even if the above measures are adopted there will be a deficit in Kerala in 1980, which will persist till about 1990. Till then arrangements will have to be made to import timber either from Andamans or from Karnataka. If part of the surplus generated in Karnataka can be diverted to Kerala. there is no need for importing timber from Andamans.

6.In the long run. it is essential to increase the growing stock and for this a concerted effort has to be made for raising manmade forests, natural regeneration etc. Kerala and Karnataka forest Departments should earmark at least about 1000 hectare's and 2000 hectares respectively for undertaking u plantation project and intensify natural regeneration operations to generate wood supply for the industry in future.

If such a project is undertaken by about 2040 the wood supply can be enhanced by 80,000 m^3 in

the case or Kerala and 160,000 m^3 in the case of Karnataka.

Subsidiary measures:

7.There is an urgent need to minimize waste at different stages of logging. Improved logging, treatment to prevent splits, cracks, fungal damage etc., have to be adopted.

8.A detailed study of the possibility of rational utilization of timber is essential. Scope for rational allocation based on size, species, quantity, alternate uses etc., has to be examined.

Complimentary measures:

9.In order to tap all the available resource, the forests have to be made more accessible by a network of roads. A part of the roading cost can be charged to the industries as a tax on the produce removed. A road construction programme; being labor intensive has a number of social benefits and therefore there is justification for undertaking such a programme immediately.

10.Use of obsolete machinery, a characteristic feature of most of the traditional Indian industries, has also been partly responsible for the present wood raw material problem of the plywood industry. Manufacturing units should undertake modernization of machinery in a phased manner to improve the yield and reduce waste.

Institutional changes:

11.It is necessary to identify certain areas and earmark them for production of raw material to the plywood industry further their should be well organized agency to undertake production, extraction and marketing of wood raw material

to the industry. System of extraction through intermediaries should be replaced.

12.In the case of Karnataka, the problem faced by some of the units is due to the imbalances in the distribution of available raw material. A criteria for a rational distribution of available wood based on the installed capacity of the existing units has to be evolved. A linear programming model can further give the optimal allocation for each of the units taking into account the source of the raw material and the location of the processing units.

13.Licensing of new units and expansion if the capacity should be permitted only after correctly assessing the resource position. The present study indicates that in Kerala there is no scope for expanding the capacity at present. In the case of Karnataka the score for additional capacity has been indicated.

3.0 **Limitations:** As pointed out earlier, the present study has a number of limitations. Due to the poor response from the plywood units, it was not possible to assess exactly the demand and supply. For estimating the availability of wood information was collected from various working plans, resourced survey reports, administration reports etc. A number of working plans, resource reports etc., were prepared years back and the growing stock would have undergone changes. In the absence of any other information, reliance had to be placed on the information available in these reports.

This study is confined to the wood raw material problem only. To grasp the problem in its totality, it is necessary to carry out a detailed study of the

industry going into its structure, intra and inter industry relationships, ability to command the resources, markets etc. However the present study gives an idea of one of the most important problems of the industry and provides a base for planning to meet the future wood requirements of the industry. With batter insight into the resource base, those conclusions can be improved further.

APPENDIX I

QUESTIONAIRE:

KERALA FOREST RESEARCH INSTITUTE

Study of Wood Raw-material Status for Plywood Industry

1. General Particulars

1.1 Name & Postal address of the factory.

1.2 Location of the factory
(a) State
(b) District
(c) Taluk
(d) Village

1.3 Register No. of the factory

1.4 Year of establishment

1.5 Year of commencement of production

1.6 Location of the Head Office

1.7 Accounting Year

1.8 Type of ownership

1.9 Type of management

1.10 Name & address of the Manager or Officer-in-charge

2. Information on Capacity and Production

2.1 Installed Capacity
(Million Square meters of 4mm. thickness)

(a) Commercial

(b) Decorative

(c) Tea chest

(d) Flush doors

(e) Black Boards

(f) Others

2.2 Increase in Capacity (Million Square metres of 4mm. thickness)

Year	Commercial	Decorative	Tea chest	Flush doors	Block boards	Others
1965						
1970						
1971						
1972						
1973						
1974						
1975						

2.3 Do you contemplate any expansion of capecity? Yes/No

(a). If yes, proposals for the following years.

Year	Capacity
1980	
1985	
1990	
2000	

(B) If not why?

2.4 Do you intend to reduce capacity? Yes/No

(a) If yes, please state reasons.

(b) When do you want to reduce capacity?

2.5 Actual Production
(Million Square metres
of 4mm. thickness)

Year	Commer-cial	Decora-tive	Tea chest	Flush doors	Block boards	Others
Year of installa-tion.						
1965						
1970						
1971						
1972						
1973						
1974						
1975						

2.6 Reason for not fully utilising the capacity
(Indicate the item by tick marking the
item applicable)

1. Non-availability of wood raw-material.
2. Non-availability of non-fibrous raw-material
3. Lack of demand

3. Procurement of Wood raw-material

A. General

3.1 Source (a) Government

(b) Other sources
(specify)

3.2 Method of procurement from Government sources
(Indicate the method by tick marking the
item applicable)

(a) Quota System
(b) From Government depots in public auction.
(c) From Government depots at fixed rate.
(d) Lease of forest area
(e) Any other method

If Quota system

(a) Do you collect the timber directly from the forest at your cost? Yes/No

or

(b) Do you obtain it from the Government depots? Yes/No

3.3 How do you obtain wood from other sources?

3.4 Have you entered into any long term agreement with the Government regarding the supply of wood Yes/No

If yes

(a) Period of agreement
(b) Quantity specified for supply.
(c) Amount to be paid
(d) Important conditions of the agreement.

1.
2.
3.
4.

3.5 Do you, either yourself or through assistance to Forest Department, carry out regeneration of forests? Yes/No

If yes, total area (annually).

3.6 Do you have difficulties about sustained availability of wood raw material? If so, brief particulars.

8. Wood Supply in the Last Five Years From Government Sources

3.7 From Within the State

Year	Quantity cum.	Value paid Rs.	Transport cost Rs.	Landed cost Rs.	Name of State
1971					
1972					
1973					
1974					
1975					

3.8 From outside the State

Year	Quantity Cum.	Value paid Rs.	Transport cost Rs.	Landed cost Rs.	Name of State
1971					
1972					
1973					
1974					
1975					

3.9 Do you have any preference to particular species? Yes/No

If yes (a) What are the species?

1.
2.
3.
4.

(b) Reasons for the preference

1.
2.
3.

3.10 (1) Do you prefer to enter into long term agreements with the Government for req material supply? Yes/No

(2) Do you like to take forest areas on long term lease and take up the responsibility of regeneration also? Yes/No

3.11 (1) Do you have any problem in obtaining timber from outside the State? Yes/No

(2) Do the State Governments impose any restrictions in the movement of timber etc.? Yes/No

(3) If yes, give details of restrictions.

C. Wood Supply in the Last Five Years From Non-Governmental Sources

3.12 From within the State

Year	Quantity Cum.	Value paid Rs.	Transport cost Rs.	Landed cost Rs.
1971				
1972				
1973				
1974				
1975				

3.13 From outside the State

Year	Quantity cum.	Value paid Rs.	Transport cost Rs.	Landed cost Rs.	Name of State
1971					
1972					
1973					
1974					
1975					

3.14 Do you have any regular suppliers of wood? Yes/No

If yes

(1) Is there any agreement regarding quantity and price? Yes/No

(2) How do they obtain the supply? Governmental source/ Non-Governmental source

4. Specific Suggestions, if any, for a long term policy in Wood Raw material supply

APPENDIX II

TREND IN THE COST OF WOOD RAW METERIAL TO THE PLYWOOD INDUSTRY

Timber is primarily obtained from government sources and the royalty to be paid by the plywood-manufacturing units is decided by the Government periodically. It has been pointed out by many of the manufacturing units that the price of the raw material is increasing, and the increase is unjustifiable. In this context it is worthwhile to examine the trend of the cost of wood obtained from government sources, and see whether the argument put forth by the plywood manufacturing units is tenable or not.

Cost of wood raw material in Kerala: Table I below is prepared on the basis of the information furnished by 8 major plywood manufacturing units in Kerala, on the wood raw material procured from the Government and the various costs incurred by way of royalty, transport cost etc.

Table I

Cost of wood raw material obtained from Government sources

Year	Value paid per M^3 (Rs.)	Index of value paid	Landed cost per M^3 (Rs.)	Index of landed cost
1971-72	138.20	100.0	217.12	100.0
1972-73	126.16	91.3	214.88	99.0
1973-74	142.14	102.8	237.41	109.3
1974-75	164.16	119.0	282.25	130.0
1975-76	204.52	148.0	320.68	147.7

Value paid in the above table often includes the penalty, ground rent, other dues etc., if we take only the seigniorage value the actual increase would be much less.

As can be seen from Table I, the cost of timber at site and the landed cost have increased almost to the same extent. Between 1971-'72 and 1975-'76 there has been an increase in the cost of timber by 4B% and the landed cost have gone up by 47.7%. The sharp increase after 1974-'75 is due to the revision of the seignior age rates.

Timber from private sources account for a substantial portion of the wood consumed by the plywood units in Kerala. Based or the information furnished by the plywood units the average landed cost of timber from these sources are worked out and given below in Table II.

Table II

Landed cost of wood from non-governmental source

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Year	Landed cost in Rs. per M^3	Index of change in the landed cost*
1971-'72	285.49	131.5
1972-'73	320.18	147.5
1973-'74	327.34	150.8
1974-'75	377.40	173.8
1975-'76	464.11	213.8

*Landed cost of timber obtained from government sources in 1971 is taken as 100 to give a comparative picture.

It can be seen that the average landed cost of timber from private sources has also increased; however the increase has been much steeper than that of the timber from government sources.

Here we have not taken into account the cost of timber such as teak, rosewood etc., obtained for the production

of decorative plywood, where quality, price, size gradient etc. also plays an important role.

Cost of Wood raw material in Karnataka: Based on the information furnished by 7 plywood manufacturing units in Karnataka the cost of timber at site and the landed cost has been worked out as follows:

Table III

Cost of Wood raw material in Karnataka

Year	Cost at site per M^3 Rs.	Transport cost per M^3 Rs.	Landed cost per M^3 Rs.	Index of landed cost
1971-'72	78.94	96.31	175.25	100.0
1972-'73	80.98	99.78	180.76	103.1
1973-'74	100.00	111.81	212.77	121.4
1974-'75	104.24	121.09	225.68	128.8
1975-'76	82.91	129.24	212.54	121.3

From the table above it can be seen that the raw material cost has been relatively stable and the increase in cost has not been very substantial.[1] Here again we have taken into account only the timber obtained from the leased areas and not the timber like teak etc., procured from States like Maharashtra and Madhya Pradesh.

Wood Costs in Kerala and Karnataka; Table IV gives the cost of wood at forest site in Kerala and Karnataka and the index of cost taking the 1971-'72 cost in Kerala as the base.

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[1]ThE low average cost in 1975-'76 is primarily due to the low rates charged for the removal of partly unsound logs.

Table IV

Wood Costs in Kerala and Karnataka

Year	Kerala		Karnataka	
	Cost per M^3 (Rs.)	Index	Cost per M^3 (Rs.)	Index
1971-'72	138.70	100.0	78.94	57.2
1972-'73	126.16	91.3	80.98	58.6
1973-'74	142.14	102.8	100.00	72.4
1974-'75	164.16	119.0	104.24	75.4
1975-'76	204.52	148.0	82.91	60.0

It can be seen from the above table that the average cost of wood is very low in Karnataka when compared to that of Kerala. In 1975-'76 Karnataka units were incurring only 40% of the cost incurred by the plywood units in Kerala.

Index of the Cost of Wood raw materials compared with the Index of Agricultural Commodities:

Ye have found that the price of wood raw material has increased between 1971-'72 and 1975-'76. It will be desirable to examine how this increase compares with the increase in the price of the agricultural commodities. Table V gives the index of price of wood raw material at factory site in Kerala and Karnataka and the index numbers of wholesale prices of agricultural commodities. So when compared with the general increase in the wholesale prices of other commodities, increase in the cost of wood cannot be said to be prohibitive.

Table V

Index numbers of wood raw material cost at factory site and the Index numbers of wholesale prices of Agricultural commodities.

Year	Index of landed cost in Karnataka	Index of landed cost in Kerala	Index number of wholesale prices of agricultural commodities*
1971-'72	100.0	100.0	100.0
1972-'73	103.1	99.0	110.0
1973-'74	121.4	109.3	140.6
1974-'75	128.8	130.0	178.0
1975-'76	121.3	147.7	156.0

*This is a derived series and wholesale prices of timber and bamboos have been included in this.

Between 1971 and 1974 increase in the cost of production in plywood manufacturing is primarily due to the increase in the cost of synthetic glues (Kaderkutty, 1975) .In 1970- '71, the wood costs formed about 32% of the total cost of production, while in 1974 it was only 25%. The change is primarily due to the increase£ in the cost of synthetic glues. Between 1971 and 1974 cost of production has increased by 47% and of this only 10% can be attributed to the increase in the cost of wood. Cost increase in the case of wood raw material is not a phenomenon confined to this country alone. In Philippines, whose conditions are more or less comparable to that of India, wood costs have risen by about BO% in 1974 when compared to 1973 figures, and the average cost of 1 M3 of round timber comes to about Rs.31B.OO (Benjamin San Victores -1975).

From the above it can be seen that increase in the price of wood raw material is not in far excess of the general trend of prices and cannot be taken as factor contributing to the increase in the cost of plywood production. The main factor seems to be increased cost of synthetic glues, whose price has become prohibitive after the oil crisis.

APPENDIX III

DISTRIBUTION OF TREES PER HECTARE BY SPECIES AND SIZE CLASSES IN THE RESERVES IN KERALA

1.Silent Valley Reserve (Palghat Forest Division)

Species	Girth Class (In cm.)					
	30-60	60-90	90-120	120-150	150-180	Above 180
Vateria indica	0.56	--	0.10	0.05	--	0.09
Myristica attenuata	11.44	6.85	4.58	2.24	0.43	0.83
Machilus macrantha	5.30	6.80	4.00	1.50	0.80	1.74
Calophyllum species	0.34	0.30	0.22	0.32	0.15	0.37
Total - Superior plywood spp.	17.44	13.95	8.90	4.11	1.38	3.03
Artocarpus integrifolia	0.54	0.46	0.30	0.25	0.17	0.46
Cullenia excelsa	9.40	7.30	5.30	4.00	2.50	9.39
Palaquium ellipticus	24.10	13.60	9.24	5.40	3.20	7.53
Spondias mangifera	0.22	0.15	0.07	0.10	0.02	--
Total - Other plywood spp.	34.26	21.51	14.91	9.75	5.89	17.38
Others	187.22	56.85	37.75	17.02	8.37	15.07
TOTAL	238.92	92.31	61.56	30.88	15.64	36.11

2.Attappady Block VI (Muthikulam) (Palghat Forest Division)

Species	Girth Class (In cm.)					
	30-60	60-90	90-120	120-150	150-180	Above 180
Vateria indica	3.80	1.70	1.00	0.75	0.26	0.85
Myristica attenuata	10.00	6.10	3.80	1.90	0.10	0.26
Machilus macrantha	3.60	3.30	2.90	1.80	0.60	0.71
Calophyllum species	2.00	0.88	0.60	0.46	0.10	0.34
Total - Superior plywood spp.	19.40	11.98	8.30	4.91	1.06	2.16
Adina cordifolia	2.60	0.60	0.26	0.10	0.04	0.02
Artocarpus integrifolia	0.50	0.30	0.20	0.36	0.12	0.20
Cullenia excelsa	18.10	7.50	5.60	5.20	1.80	7.85
Dysoxylum species	2.40	0.89	0.23	0.03	--	0.12
Polaquium ellipticum	14.20	7.60	5.20	5.00	2.00	1.94
Spondias mangifera	0.80	0.70	0.50	0.40	0.02	0.04
Total - Other plywood spp.	38.60	17.58	11.99	11.09	3.98	10.17
Others	225.43	71.02	31.81	16.16	4.24	9.63
TOTAL	283.43	100.58	52.10	32.16	9.28	21.96

3.New Amarambalam Reserve (Nilambur Forest Division)

Species	Girth Class (In cm.)					
	30-60	60-90	90-120	120-150	150-180	Above 180
Vateria indica	5.60	3.50	3.27	4.68	2.57	1.63
Myristica species	0.85	1.30	1.45	2.06	0.70	0.09
Machilus macrantha	0.21	0.31	0.49	0.76	1.41	1.24
Calophyllum species	1.21	1.22	1.12	2.62	2.79	4.05
Total - Superior plywood spp.	7.78	6.33	6.33	10.12	7.47	7.01
Palaquium ellipticum	0.09	1.04	1.18	0.10	2.52	1.58
Polyalthia fragrans	5.45	4.11	2.26	2.58	1.06	0.22
Terminalia bellerica	0.12	0.15	0.14	0.27	0.45	1.36
Tetramelos nudiflora	0.07	0.18	0.21	0.19	0.44	1.15
Total - Other plywood spp.	5.73	5.48	3.79	3.14	4.47	4.31
Others	33.82	34.75	25.17	27.05	28.27	23.41
TOTAL	47.33	46.56	35.29	40.31	40.21	34.73

4.Kottiyoor Reserve (Wynad Forest Division)

Species	Girth Class (In cm.)					
	30-60	60-90	90-120	120-150	150-180	Above 180
Vateria indica	10.11	7.89	6.17	3.57	3.17	5.80
Machilus macrantha	1.43	1.17	0.83	0.94	0.41	0.38
Myristica species	9.34	6.17	4.66	2.11	1.28	1.88
Dipterocarpus indicus	1.43	1.40	0.77	0.23	0.31	0.32
Calophyllum species	3.43	4.68	2.34	1.94	1.71	1.75
Total - Superior plywood spp.	25.74	21.31	14.77	8.79	6.88	10.13
Alstonia scholaris	1.03	0.51	0.29	0.06	0.06	0.27
Artocarpus hirsuta	0.30	0.37	0.26	0.14	0.03	0.18
Artocarpus integrifolia	0.40	1.03	0.41	0.17	0.37	0.37
Dysoxylum malabaricum	0.63	0.69	0.80	0.26	0.11	0.27
Mangifera indica	1.11	0.63	0.51	0.37	0.11	0.63
Palaquium ellipticum	3.80	4.23	2.77	1.37	0.97	1.63
Total - Other plywood spp.	7.27	7.46	5.04	2.51	1.65	3.35
Others	100.27	68.33	35.95	19.89	11.19	21.53
TOTAL	133.28	97.10	55.76	31.19	19.72	35.01

Source: Forest Resources of Kerala - A quantitative assessment.

APPENDIX IV

MEASUREMENTS OF FEW SAMPLE LOGS OBTAINED BY A PLYWOOD UNIT DURING A MONTH

Sl. No.	Length (in cm.)	Girth (in cm.)
1.	450	175
2.	460	305
3.	400	134
4.	490	135
5.	460	255
6.	770	125
7.	485	140
8.	685	122
9.	540	310
10.	600	128

Appendix V

Present Pattern of Regeneration Operations in the selection felling areas in Kerala and Karnataka:

Regeneration operations in the evergreen/selection forests in Kerala and Karnataka have received very little attention so far. Most of the species in the forests were of little commercial value and therefore it was not economical to evolve a system of regeneration. Though it arose the interest of a number of foresters, it still continues to be a problem in most of the evergreen and semi-evergreen areas in the Kerala and Karnataka region. Most of the earlier attempts were on an experimental scale and no attempt has been made to apply it on a large scale.

Even today, essentially the selection system followed in the region continues to be a system of selective felling of valuable species. Some attempts are now being made in Kerala to regenerate these areas under the scheme of intensification of management, the results of which are yet to be watched. The efforts are confined to certain selected pockets in Divisions like Chalakudy, Wynad etc. The amount spent on this is extremely negligible and during 1974-176 the total expenditure on the work was only Rs.1.52 lakhs (which amounted to about 0.7% of the total plan expenditure during 1974-176).

In Karnataka some effort is being made for regeneration of the evergreen species. The lessees are pursued to carry out regeneration in the felled areas. Units like Indian Plywood Manufacturing Company raise their own nurseries and carry out planting seedlings in the gaps created by selection felling Important species planted arc Machilus macrantba, Ailanthus rnalabarica, Acrocarpus fraxinifolius, Gmelina arborea, Anthocephalus cadamba, Canarium stricyum, Duabanga somerifoides etC. It is pointed out that there is

little after care and most of the attempts are half hearted. Gap planting are generally confined to the road sides and inaccessible areas are left out.

Past attempts of regeneration in the evergreen areas were primarily in the form of gap planting or strip planting of seedlings either raised in the nursery or collected from the forests ("wildling") .These attempts were discontinued later mainly because

i) concentrated attention was needed.

ii) tending the survivals year after year was a problem.

iii) the gaps uore scattered throughout a large area and sometimes it was even difficult to trace out the gaps

And

iv) damages from uncontrollable factors were heavy (Nair , P.N.).

In order to improve the quality of the crop most of the working plans prescribe a silvicultural operation known as improvement felling. Areas subject to past working or where there is a preponderance of value less species are constituted into improvement Palling working circle and operations such as climber cutting, thinning of congested crop, removal of inferior species by girdling etc., are prescribed.

In the case of selection felling areas a number of subsidiary silvicultural operations has been prescribed which includes tending of groups of seedlings, climber cutting etc. Somiah, in his working plan for the Ghat forests of Coorg has prescribed artificial regeneration in gaps deficient of natural seedlings of Vateria indica, Dipterocarpus indicus,

Hopea parviflora, Hardwickia pinnata, Calophyllum tomentosum etc., in 1' cube pits at a spacing of 12' x 12'. A tending of the whole area has been prescribed at the sixth year.

Chanda Basha (1977} has prescribed detailed tending operations for the selection felling areas in Silent Valley and Attappady, an extract of which is given below.

"Tending: (i) Soon after the extraction in the coupo is completed, the area must be gone over thoroughly to remove all impediments to regeneration. Poles of valuable species broken down during felling should be cut. The coupe forester should prepare a map showing status of regeneration of major species. Map should show areas of various stags of regeneration. He must take random plots in each category; demarcate the area to enable future measurements and counting. The data and map should be checked by the Range Officer and the Divisional forest Officer.

(ii) The operation to be carried out should be decided by the Divisional forest Officer on the basis of the data collected above.

(iii) The map should be brought up to date every year and plots counted, measured and recorded.

Tending has been prescribed to be carried out from the year following the working of the coupe. This has to be carried out for two consecutive years and then at the fifth year and thereafter at 5 years intervals regularly.

Effective implementation of these prescriptions however depends to a great extent on making the area accessible and evolving an institutional frame work without which it is not possible to implement them. It is not due

to lack of instructions or prescriptions that many of the operations are not carried out. As pointed out by Adiyodi(1972) intensive working in the area will depend largely on the accessibility of the area and the staff and funds available for such management.

Considerable work have been carried out in Karnataka to standardize the nursery techniques of evergreen species and they have been able to perfect the technique. In evergreen areas ensuring establishment will be a real problem and to ensure success on a large-scale techniques for controlling the weeds, overhead shade etc., has to be evolved. Attempts are being made to plant up the area before the pre-monsoon showers; the performance of these operations has to be watched closely.

In the draft perspective plan prepared by the Karnataka Forest Department for the period 1978-179 it is proposed to take up gap planting over an area of 7600 hectares annually. After selection felling and stock mapping it is proposed to seedlings of evergreen species like Dysoxylum malabaricum, Lophopetallum wightianum, Calophyllum tomentosum etc., at a spacing of 4m. x 4m.

On the whole, it system of regenerating the evergreen have in Kerala or Karnataka. Encouraging results have been from the evergreen areas in Andaman and Nicobar Islands and countries like Malayasia. The suitability of the canopy lifting system followed in Andamans has to be studied in detail and it will be useful to introduce such a system rather than following the existing selective felling practice.

APPENDIX VI

PLYWOOD SPECIES IN THE KERALA-KARNATAKA REGION

Botanical name	Trade name	Vernacular name (Malayalam and Kannada)
1.Acrocarpus fraxinifolius	Mundani	Narivenga - Belangi
2.Adina cordifolia	Haldu	Manjakadambu - Ahanan
3.Ailanthus sp.		Matti - Bende
4.Albizzia lebbek	Kokko	Nenmenivaka - Bāge
5.Alstonia scholaris	Shaitan wood	Pala - Hale
6.Anthocephalus cadamba	Kadam	Kadambu - Kadamba
7.Artocarpus hirsuta	Aini	Aini - Hebbalasu
8.Artocarpus integrifolia	Jack	Plavu - Halasu
9.Amoora spp.	Amoora	Chemmaram - Mullumuttaga
10.Bombax ceiba	Semul	Elavu - Hatti
11.Calophyllum spp.	Poon	Punna - Bobbi
12.Canarium strictum	White Dhup	Thellipine - Dupa
13.Carallia integerrima	Indian Oak	Vallabham - Andimargal
14.Cedrela toona	Toon	Chuvannakil - Devadari
15.Chukrasia tabularis	Chickrassy	Malaveppu - Davala
16.Cullenia excelsa	Karani	Vediplavu -
17.Dalbergia latifolia	Rosewood	Veetti - Bite
18.Dichopsis elliptica	Pali	Pali - Palucotte

Botenical name	Trade name	Vernacular name (Malayalam and Kannada)
19.Dillenia sp.	Dillenia	Vazhapunna - Kanigala
20.Dyospyros sp.	Ebony	Karimaram - Abanasi
21.Dipterocarpus sp.	Gurjan	Kalpine - Dhuma
22.Dysoxylum malabaricum	White Cedar	Akil - Bilibudliga
23.Eugenia jambolana	Jaman	Njaval - Neredi
24.Fagara budrunga	Mullilam	Mullilam
25.Garuga pinnata	Garuga	Kattunelli - Aranelli
26.Gmelina arborea	Gamari	Kumbil - Kulo
27.Grevillea robusta	Silver Oak	Silver Oak
28.Hardwickia pinnata	Piney	Kolavu - Ennu
29.Holoptelia integrifolia	Kanju	Aaval - Kaladri
30.Kydia calycina	Pula	Veembu - Gunde
31.Lannea grandis	Jhingam	Uthi - Ajasryngi
32.Lophopetalum wightianum	Benathi	Venkotta - Boralapale
33.Machilus macrantha	Ladderwood	Kulamavu - Culimavu
34.Mangifera indica	Mango	Mavu
35.Michelia champaka	Champ	Champakam - Campaka
36.Polyalthia fragrans	Nedunar	Nedunar - Gauri
37.Pterospermum acerifolium	Hattipaila	Cherukanna - Rajataru
38.Spondias mangifera	Amra	Ambazham - Amate
39.Sterculia alata	Narikel	Anathondi
40.Sterculia foetida		Peenari - Bhutalli

Botanical name	Trade name	Vernacular name (Malayalam and Kannada)
41.Sterculia villosa	Udal	Vakka - Bilinaru
42.Swietenia spp.	Mahogany	Mahogany - Davala
43.Tectona grandis	Teak	Thekku - Saguvani
44.Terminalia tomentosa	Laurel	Thembavu - Karimatti
45.Terminalia arjuna	Arjun	Nirmaruthu - Holematti
46.Terminalia bellerica	Bahera	Thanni - Santi
47.Terminalia paniculata	Kindal	Pullamaruthu - Honalu
48.Tetrameles nudiflora	Baing	Cheeni - Bolu
49.Trewia nudiflora	Gutel	Thavala - Kadukumbala

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