

പതിനാലാം കേരള നിയമസഭ

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നക്ഷത്ര ചിഹ്നമിടാത്ത  
നിയമസഭാ ചോദ്യം നം.843

റബ്ബറധിഷ്ഠിത സംരംഭങ്ങൾ ആരംഭിക്കുന്നതിനുള്ള ലൈസൻസ്

ചോദ്യം  
ശ്രീ.ടി. വി. ഇബ്രാഹിം :

മറുപടി  
അഡ്വ.കെ.രാജു  
(വനവും മൃഗസംരക്ഷണവും മൃഗശാലകളും  
വകുപ്പു മന്ത്രി)

(എ) റബ്ബറധിഷ്ഠിത സംരംഭങ്ങൾ ആരംഭിക്കുന്നതിനുള്ള ലൈസൻസ് / നിരാക്ഷേപപത്രം ആവശ്യപ്പെട്ട് വനം വകുപ്പിന് എത്ര അപേക്ഷകൾ ലഭിച്ചിട്ടുണ്ട്; ജില്ല തിരിച്ചുള്ള കണക്ക് വ്യക്തമാക്കാമോ;

(എ) റബ്ബറധിഷ്ഠിത സംരംഭങ്ങൾ ആരംഭിക്കുന്നതിനുള്ള ലൈസൻസ് / നിരാക്ഷേപപത്രം ആവശ്യപ്പെട്ട് വനം വകുപ്പിന് 1099 അപേക്ഷകൾ ലഭിച്ചിട്ടുണ്ട്.

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(ബി) അപേക്ഷ ലഭിച്ചിട്ടും ലൈസൻസ് / നിരാക്ഷേപ പത്രം അനുവദിച്ചിട്ടില്ലെങ്കിൽ അതിനുള്ള കാരണം വ്യക്തമാക്കാമോ;

(ബി) സർക്കാർ ഉത്തരവ് GO (Rt) No.469/2014/വനം തീയതി 14.10.2014 പ്രകാരം 3,17,000 M3 റബ്ബർ തടിയധിഷ്ഠിത വ്യവസായത്തിന് ലൈസൻസ് നൽകുന്നതിന് അനുവാദമുള്ളതാണ്. പ്രസ്തുത അനുമതി പ്രകാരം 22.05.2018 തീയതി വരെ ലഭിച്ച അപേക്ഷകളിൽ ക്രമ പ്രകാരമുള്ളവർക്കെല്ലാം ലൈസൻസ് നൽകിയിട്ടുണ്ട്. സർക്കാർ അനുവദിച്ച പരിധി കഴിഞ്ഞാൽ തുടർന്നുള്ള അപേക്ഷകളിന്മേൽ ലൈസൻസ് നൽകാൻ നിർവ്യാഹമില്ലാത്തതാണ്. 22.05.2018 ന് മുമ്പ് ലഭിച്ച അപേക്ഷകളിൽ, ആവശ്യപ്പെട്ടിട്ടും വ്യക്തമായ വിവരങ്ങൾ നൽകാത്തവ, നിർദ്ദിഷ്ട മാനദണ്ഡങ്ങൾ പാലിക്കാത്തവ, ഒറ്റത്തവണ നിക്ഷേപം ഒടുക്കാത്തവ എന്നിവയും 22.05.2018 ന് ശേഷം അപേക്ഷിച്ചവയും ഉൾപ്പെടെ മൊത്തം 26 അപേക്ഷകൾ ലൈസൻസ് നൽകാതെ അവശേഷിക്കുന്നുണ്ട്.

(സി) റബ്ബർ മരത്തിന്റെ ലഭ്യതയെക്കുറിച്ച് പഠനം നടത്തുന്നതിന് ഏതെങ്കിലും സ്ഥാപനത്തെയോ ഏജൻസിയെയോ ചുമതലപ്പെടുത്തിയിട്ടുണ്ടോ; എങ്കിൽ അതിന്റെ വിശദാംശങ്ങൾ ലഭ്യമാക്കാമോ;

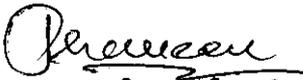
(സി) റബ്ബർ മരത്തിന്റെ ലഭ്യതയെക്കുറിച്ച് പ്രത്യേക പഠനം നടത്തുന്നതിന് ഏജൻസികളെ ചുമതലപ്പെടുത്തിയിട്ടില്ല. എന്നാൽ കേരളത്തിലെ തടിലഭ്യതയെ സംബന്ധിച്ച് പഠനം നടത്തുന്നതിനായി കേരള വനഗവേഷണ കേന്ദ്രം, പീച്ചിയെ ചുമതലപ്പെടുത്തിയിരുന്നതും ആയതിൻ പ്രകാരം "Wood Balance Study in Kerala

2014 - 15" എന്ന റിപ്പോർട്ട് സമർപ്പിച്ചിട്ടുള്ള തുമാണ്.

(ഡി) പ്രസ്തുത സ്ഥാപനം / ഏജൻസി (ഡി) പകർപ്പ് ഉള്ളടക്കം ചെയ്യുന്നു.  
റിപ്പോർട്ട് സമർപ്പിച്ചിട്ടുണ്ടെങ്കിൽ അതിന്റെ പകർപ്പ് നൽകാമോ;

(ഇ) റബ്ബർ അധിഷ്ഠിത സംരംഭങ്ങൾക്ക് വനം വകുപ്പിൽ നിന്ന് ലൈസൻസ് / നിരാക്ഷേപ പത്രം ലഭിക്കുന്നതിനുള്ള സമയക്രമം അറിയിക്കാമോ?

(ഇ) The Kerala Forest (Regulation of Sawmills and Other Wood-based Industrial Units) Rules, 2012 ചട്ടം 7 (1) പ്രകാരം ലൈസൻസിനുള്ള അപേക്ഷകൾ തീർപ്പ് കൽപ്പിക്കുന്നതിന് 3 മാസത്തെ സമയ പരിധിയാണ് നിശ്ചയിച്ചിട്ടുള്ളത്. എന്നാൽ സർക്കാർ അനുവദിക്കപ്പെട്ടിട്ടുള്ള റബ്ബറിന്റെ അളവിനുള്ള ലൈസൻസുകൾ നൽകി കഴിഞ്ഞിട്ടുള്ളതിനാൽ പുതിയ ലൈസൻസുകൾ നിലവിലെ ചട്ടങ്ങൾ പ്രകാരം നൽകുവാൻ കഴിയുകയില്ല. പ്രസ്തുത പരിധി വർദ്ധിപ്പിക്കുന്ന കാര്യം സർക്കാർ പരിശോധിക്കുന്നതാണ്.

  
സെക്ഷൻ ഓഫീസർ

**WOOD BALANCE STUDY IN KERALA 2014-15**  
**(Project sponsored by the Kerala Forest Department)**

**V.Anitha**  
**S.Sandeep**



**KSCSTE-Kerala Forest Research Institute**  
An Institution of Kerala State Council for Science, Technology and Environment  
**Peechi - 680 653, Kerala, India**



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### ABSTRACT OF PROJECT PROPOSAL

<b>Title</b>	Wood Balance Study in Kerala 2014-15
<b>Objectives</b>	<ol style="list-style-type: none"><li>1. To assess the contribution of different sources of wood supply in 2014-15.</li><li>2. To assess the installed capacity of the saw mills and other wood based industrial units in Kerala during 2014-15.</li><li>3. To assess the total consumption of various types of wood by the saw mills and other wood based industrial units of the State during 2014-15.</li><li>4. To assess the surplus/deficiency in the availability of various timber species during 2014-15.</li></ol>
<b>Practical utility</b>	Report on wood-balance position of the State stating the total consumption and exports, total production and imports and surplus/deficiency in the availability of various timber species during 2014-15.
<b>Funding agency</b>	Kerala Forest Department, Government of Kerala.
<b>Project Team</b>	Director, Kerala Forest Research Institute, Peechi Additional Principal Chief Conservator of Forests (Special Afforestation) & Nodal Officer, Kerala Forest Department Research Coordinator, Kerala Forest Research Institute V.Anitha, Senior Scientist, KFRI S.Sandeep, Scientist, KFRI.

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## EXECUTIVE SUMMARY

This study estimates the demand and supply of timber wood in Kerala for the year 2014-15. The demand for timber wood during 2014-15 in Kerala was estimated to be 10.98 million m<sup>3</sup> of round wood equivalent. The households sector accounted for 14.1 per cent and industries sector 77.55 per cent of the total demand. Export accounted for 8.35 per cent of the total timber wood demand. Export of packing cases was in the order of 7,52,000 m<sup>3</sup> round wood equivalent during 2014-15 and rubber wood alone contributed 3,38,175 m<sup>3</sup> round wood equivalent to this export.

During 2014-15, home gardens and estates (including rubber estates) catered to > 95 per cent of the timber wood demand in the State. The study reveals a comfortable situation in the matter of timber wood availability in Kerala, mainly due to the large volume of rubber wood production which is used by the packing case, plywood and even furniture industries. Of the total timber wood demand, a major portion is used for furniture, fixtures and construction (66.9% of the total demand) where the preference of the timber species is as jack wood > teak wood > anjily. The dependency of wood based industries on the state forest was minimal. During 2014-15 period 2,66,044 m<sup>3</sup> of round wood equivalent was imported to the State either from neighbouring states or other countries. Import of timber wood into Kerala has been growing and the trend is expected to continue in the future. The estimates of the demand and supply of timber wood in Kerala during 2014-15 highlights a scenario where supply meets the current timber wood demand.

A total of 9256 wood based industrial units have been provided with license/NOC by the Empowered Committee - Kerala Forest Department. At present these units handle 10.79 million m<sup>3</sup> of round wood equivalent per annum whereas the total demand is for 10.98 million m<sup>3</sup> of round wood equivalent per annum leaving a gap of 0.190 million m<sup>3</sup> of round wood equivalent per annum between demand and installed sawmill capacity. This gap is filled by unregistered units or units working with the permission of local bodies alone. The present number of licensed units meet the current timber wood demand in the state. A physical verification of the sawmills should be taken up at periodic intervals to ensure that the licensed units are functional and wherever cases of non-functional units exist, the numbers may be met by issuing new licenses or permitting technological upgradation of the existing ones in the respective categories.

## INTRODUCTION

Wood a natural resource, in its primary form is guaranteed to be absorbed in the market. Over a period of time, with changing global wood scenarios, for long-term planning broad magnitudes of supply and demand of wood are necessary. A wood balance study is helpful to assess the quantities of wood supply, demand and thereby to assess the surplus or deficiency in the available timber species. It also depicts net trade balance of the wood movements. There is a surplus in the economy when export exceeds import, and vice versa. An analysis of the wood balance situation provides an understanding of the structure of the wood economy and enables enlightened policy interventions in the wood sector. The first wood balance assessment of Kerala was done in the year 1987-88 by Krishnankutty (1990) to estimate the demand for wood by various sectors and supply from different sources in Kerala. Since then, changes in the wood utilization pattern and liberalization of trade have altered the situation. Hence a second study was conducted by Krishnankutty *et al.* (2005) to assess the situation in 2001. After 2001, drastic changes have taken place in the supply of timber and industrial wood. While

production of rubber wood from estates indicated an increase, supply through imports mainly from abroad also depicted an increasing trend. Furthermore, Krishnankutty and Chundamannil (2012) estimated the timber supply situation in Kerala from different sources for the year 2010-11. The study highlighted the presence of large volumes of rubber wood production (used by the packing case, plywood and furniture industries) indicating a comfortable timber availability scenario in the State.

Areas outside forests of Kerala produce bulk of the timber, that is consumed in Kerala and a large component of this production is rubber wood (Krishnankutty, 1990; Krishnankutty *et al.*, 2005; 2008, 2012). Over a period of time changes have taken place in the demand and supply situation of timber wood and in this context it is highly essential to arrive at a realistic picture of the present wood balance scenario in the State so as to facilitate decision making towards problem solving in critical areas. In this context, the objectives of this study are:

## **1.1. Objectives**

- 1. To assess the contribution of different sources of wood supply in 2014-15.**
- 2. To assess the installed capacity of the saw mills and other wood based industrial units in Kerala during 2014-15.**
- 3. To assess the total consumption of various types of wood by the saw mills and other wood based industrial units of the State during 2014-15.**
- 4. To assess the surplus/deficiency in the availability of various timber species during 2014-15.**

## METHODOLOGY

The study focuses on timber wood. Wood is used as timber for house construction, repair and alteration and for making furniture, implements etc. The timber wood processed by industries, include packing case, pulp and paper, plywood, veneer, etc. Volume of timber is presented in cubic meter ( $m^3$ ) roundwood equivalent. Volume of sawn timber in  $m^3$  and weight of timber in metric tonne were converted to  $m^3$  roundwood equivalent using appropriate conversion factors (Krishnankutty 1990).

### 2.1. Demand estimation of timber wood

Demand for timber wood is defined as the effective demand which is taken as the sum of domestic consumption of wood and export in a year (Krishnankutty, 1990). The total demand for timber wood was estimated under: household, industries and service (all other wood-using) sectors and export. Demand for timber wood is disaggregated into the demand for wood by the above four sectors.

#### 2.1.1. Household sector

The household sector was divided into

rural and urban household sectors. Households in all the grama panchayats in Kerala constitute the rural household sector and those in municipalities/corporations constitute the urban household sector. The household timber wood consumption was estimated under three broad categories: i) New house construction, ii) House repair and alteration iii) Making furniture, fixtures implements etc. (Krishnankutty, 1990).

Timber wood use in rural households was assessed by conducting household primary surveys in rural areas of each district in Kerala. Random sampling procedure was adopted to generate the primary data. From each of the districts, two blocks were selected randomly. In each of these blocks, two panchayaths and from each panchayat two wards were chosen at random. Baseline information on population and households (existing/ new) of the panchayats (ward-wise data) was collected from the respective panchayats (Sanjaya website). Five per cent of the total households in the selected wards were visited to collect primary information. All the households in the selected wards were visited to collect information covering year of

house construction, utilization of timber wood during the reference year 2014-15 and actual measurements on all types of timber wood usage was also made. The procedure for measuring timber wood used in construction, fixtures and furniture was as follows: each item was measured and dimension [length, breadth and thickness] of its individual members recorded. The species of timber wood used as well as its source was also detailed in each case. In cases where the timber and source could not be identified, it was recorded as unknown.

Stratified three-stage sampling design was adopted for the estimation of the total quantity of timber wood used in the household sector of Kerala. Grama panchayats/ municipalities/ corporations were treated as the first stage units of sampling. The wards in the grama panchayats/ municipalities/ corporations were treated as the second-stage units of sampling. Households in the selected wards were treated as the third-stage units of sampling. The total quantity of timber wood used in each of the categories i) new house construction, ii) repair and alteration iii) making furniture, fixtures implements, was separately estimated using the formula for three-stage sampling design given in Murthy (1967). The per capita quantity of timber wood was derived separately for the above three categories by:

$$\hat{Q}_{pct} = \frac{\bar{q}_{hij} r_{hi}}{P_{hi}}$$

Where  $\bar{q}_{hij}$  denotes the average quantity (in  $m^3$ ) of timber wood used in the selected  $j^{\text{th}}$  household in the ward in the  $h^{\text{th}}$  panchayat;  $r_{hi}$  and  $P_{hi}$  represents total number of households and the population during the reference year. Total population with respect to each ward was estimated on the basis of population as per 2011 census and the annual population growth. The quantity of timber used in all households in the rural area of Kerala,  $Q$  is estimated by

$$\hat{Q} = \sum \bar{Q}_{pct} P_d$$

Where  $\bar{Q}_{pct}$  denotes the average per capita quantity of timber wood in each category;  $p_d$  denotes the estimated rural area population in each district.  $\hat{Q}$  is computed each of the three categories and added together to give the total quantity of timber used by the households in the rural areas of Kerala. Similar procedure was applied in the urban area, whereby the total quantity of timber wood used by the households in the urban areas of Kerala was estimated

### 2.1.2. Industries sector

Wood consumption in the industries sector in this study refers to the consumption of timber wood as raw material. Industries such as, packing case, plywood, match, furniture, pencil, photo frames, boat making, handicrafts, pulp and paper, etc. use timber wood as

raw material. Industries like tile-manufacturing, brick-making, tea-processing, automobile workshops, metal industries, textile mills, production of hand tools, rubber goods among others also consume timber wood.

There exists several state agencies that provide certificate/No Objection Certificate (NOC) for wood based industries in the state. However, the maximum number of certificates/NOC under a very broad categorization inclusive of all types of wood based industries is provided by the Empowered Committee - Kerala Forest Department (EC - KFD) and this was considered for the present study. The data on industrial units with NOC from EC - KFD was collected for the reference year (2014-15) based on the number of units and the quantity consumed, average consumption of timber wood by wood based industries in different categories was worked out. In each category, 5 per cent was selected at random for primary survey and the quantity of wood consumption estimated. The total quantity of timber wood in each category was assessed using the formula

$$\hat{Q} = \sum \bar{q}_i N_i$$

Where  $\bar{q}_i$  denotes the average quantity (in  $m^3$ ) of timber in each category and  $N_i$  denotes number of units in each category.

### 2.1.3. Service sector

Timber wood consumption in the service sector in the form of construction timber, furniture and fixtures was assessed. Timber wood use in this sector is mostly in the construction of non-residential buildings like government institutions, business establishments, educational institutions, hotels, schools, hostels, hospitals, temples, churches, etc. The service sector timber wood consumption was estimated under three broad categories: i) New building construction, ii) repair or alterations the existing buildings iii) making furniture, fixtures implements etc. during 2014-15. Along with the household survey, all non-residential establishments in the selected wards in the sample grama panchayats /municipalities/corporations were visited. Stratified three-stage sampling design was adopted for the estimation of the total quantity of timber wood used in the service sector of Kerala (Murthy, 1967).

### 2.1.4. Export

Export refers to the quantity of timber wood exported from Kerala to other states in India and to other countries. The data was compiled from the timber wood movement registers maintained at all the inter-state border forest check-posts, sale-tax check-posts (where there exists no forest check-posts), Railway Division Offices, and for ports the Cochin and Kozhikode Chamber of Commerce and Industries.

## **2.2. Supply of timber wood**

Supply of timber wood is defined as production plus import. Production refers to the actual quantity of timber wood extracted and used during the reference year. Different sources of timber wood production in Kerala are forests, home gardens and estates. Timber wood supply was assessed under four components: import, forests, rubber estates and home gardens.

### **2.2.1. Forests**

Data on recorded production of timber wood from forests was compiled from the administrative report of the Kerala Forest Department. The quantity of such production was also estimated using information on source and quantity used from the timber wood use surveys in households.

### **2.2.2. Home gardens and estates**

The amount of timber wood used from the home gardens and estates was assessed from surveys of households and published reports of Rubber Board.

### **2.2.3. Import**

Import includes the quantity of timber wood coming to Kerala from other States in India and from other countries. Quantity of timber wood imported to Kerala was calculated from the data available in the registers maintained at the ports and all inter-State border forest check-posts to estimate the total import.

## **2.3. Demand and Supply analysis**

The relationship between consumption, production and trade of timber wood during a year is given by: Consumption equals the sum of production and import less export. Import will include the quantity of timber wood coming to Kerala from other States in India and from other countries. Export refers to the quantity of timber wood moved out of Kerala to other States in India and to other countries. The sum of consumption and export was taken as the effective demand and sum of production and import as the supply (Krishnankutty et al., 2005; 2012).

## RESULTS AND DISCUSSION

Demand for timber wood in the household, industries and service sectors and for export is analyzed in this section, followed by estimation of timber wood supply through import and production from forests, home gardens and estates. Thereafter, the wood-balance situation in Kerala during the reference year 2014-15 is presented.

### 3.1. TIMBER WOOD DEMAND

#### 3.1.1. Household sector

Three forms of timber wood are found

to be in demand in the household sector, i.e. for construction of new residential houses; repair of existing houses, and timber wood for furniture, fixtures and other uses. Among these, new houses accounted for 74 per cent of the demand. Timber wood consumption in the household sector is presented in Table 3.1. The total quantity of timber wood used is estimated at 15,50,000 m<sup>3</sup> roundwood equivalent. Jack, teak and anjily are the most preferred timber wood species used in house construction. Approximately, 58 per cent of the timber wood consumed was

**Table 3.1 Household sector species - wise timber wood consumption in Kerala (2014-15)**

Timber	('000 m <sup>3</sup> roundwood equivalent)			Total volume
	New house construction	Addition/repair of old house	Furniture and other uses	
Teak	211.80	4.34	49.96	266.11
Jack	478.73	23.95	124.94	627.62
Anjily	179.72	6.57	41.14	227.44
Rosewood	5.98	1.03	14.40	21.41
Mahagony	77.95	5.71	32.39	116.05
Pyncoda	109.94	3.50	20.55	133.99
Coconut wood	16.97	10.70	26.99	54.67
Rubber wood	0.56	0.00	0.65	1.21
Other timbers	68.34	6.19	26.97	101.50
<b>Total</b>	<b>1150.00</b>	<b>62.00</b>	<b>338.00</b>	<b>1550.00</b>

Figures in parentheses are percentages of the total demand.

accounted by jack wood and teak wood. The quantity of rosewood used is extremely small. The contribution of mahogany and pyncoda was found higher than the coconut wood.

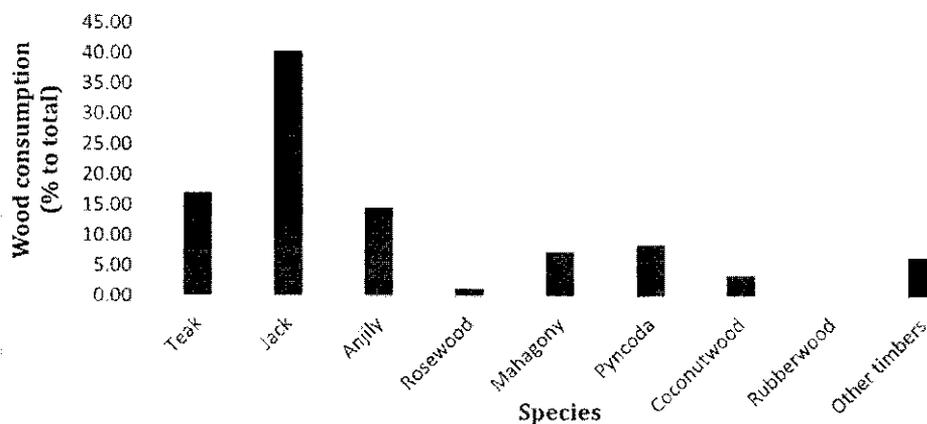
Of the total consumption in the household sector, around 7 per cent of timber wood is classified as other timbers, viz., Palkaini (*Briedelia retusa* (L.) A. Juss.), Unnam wood (*Grewia tiliifolia* Vahl.), Venga (*Pterocarpus marsupium* Roxb.), Jathi (*Myristica fragrans* Houtt.), Manjiyam (*Acacia mangium* Willd.), Njavel (*Syzygium cumini* (L.) Skeels), Konna (*Cassia fistula* L.), Kattadi (*Casuarina equisetifolia* L.), Ayini plavu (*Artocarpus hirsutus* Lam.), Pooparathi (*Thespesia populnea* (L.) Sol. ex Corrêa), Urippu (*Hopea parviflora* Bedd.), Karivelakam (*Acacia ferruginea* DC.), Neem (*Azadirachta indica* A.Juss.), Unnam (*Grewia tiliifolia* Vahl.), Rubber

wood (*Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg.), Malaveppu (*Melia azedarach* L. var. *umbraculifera* Knox), Mango wood (*Mangifera indica* L.) and Acacia (*Acacia* sp.). The consumption of jack wood (*Artocarpus heterophyllus* Lam) is very high in this sector (Figure 3.1).

### 3.1.2. Industries sector

Timber wood sawing and packing case units are the important wood based industries in Kerala. Sawn timber is used in the household, industries, service sectors and for export. Consumption of sawn timber in the saw milling and packing case industries are not shown separately under the industrial sector to avoid double counting. Among the timber wood using industries in Kerala, furniture and fixtures making and plywood manufacturing is the largest. These units depend largely on jack

**Figure 3.1. Species-wise timber wood consumption in the household sector (2014-15)**



wood, teak wood and anjily as raw material (Table given in the saw mill section). Jack wood, teak wood and anjily are largely sourced from the home gardens, estates and the plantations of the State Forest Department. Kerala has substantial area under rubber plantations and the Rubber Board provides a subsidy for replanting. The Kerala government policy of banning the export of unprocessed rubber wood from the State to favour the local wood possessing industry also helped this sector to obtain rubber wood at a low cost. Subsequent to the lifting of the ban, the processing units in Kerala have to pay competitive prices for raw materials. The consumption pattern of rubber stem wood was mainly by the plywood industry (45%), packing case industry (40%), and treated wood sector (15%).

wood consumed as raw material in industries sector during 2014-15. The total quantity of timber wood used in the industries sector is estimated at 85,20,100 m<sup>3</sup> roundwood equivalent. The highest consumption of timber wood was in the wooden furniture and fixtures industry.

The second highest consumption is recorded by the plywood industry. Most of the plywood units in Kerala now use rubber wood as raw material. The pulpwood industry in Kerala saw the exit of a major private sector unit which used forest bamboo and eucalypt plantation wood. The only surviving pulp industry unit is a public sector newsprint factory which obtains its raw material from the forests of Kerala and through import from neighbouring states. Percentage wise consumption of timber wood in different industrial sectors is shown in Figure 3.2.

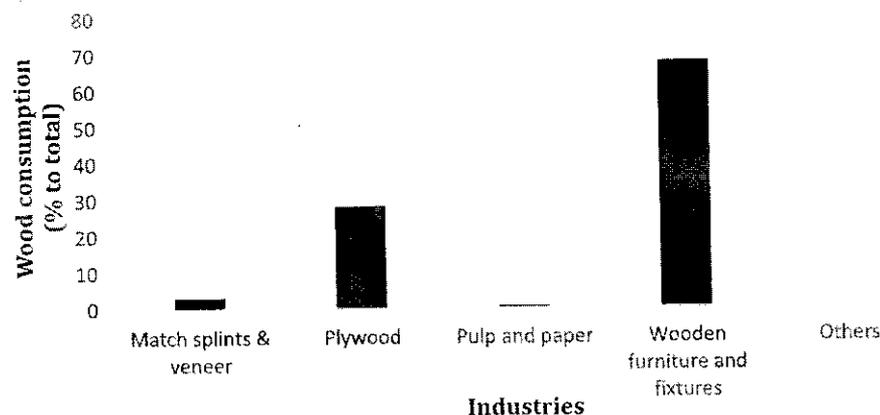
Table 3.2 gives the volume of timber

**Table 3.2 Timber wood consumption by the Industries sector in Kerala (2014-15)**

Industries*	Quantity('000 m <sup>3</sup> roundwood equivalent)
Wooden furniture and fixtures	5775
Plywood	2404
Match splints and veneer	265
Pulp and paper	62
Others	14
<b>Total wood</b>	<b>8520</b>

\*The household and service sector timber wood consumption and export was deducted to avoid double counting.

**Figure 3.2. Timber wood consumption in different industrial sectors (2014-15)**



### 3.1.3. Service sector

The estimated timber wood consumption in the service sector is 39,651 m<sup>3</sup> (Table 3.3). Timber wood demand is mostly in the form of furniture and other uses. The Government of India directives to the Central Public Works Department to

reduce or avoid the use of timber wood in their buildings, has resulted in substitution of timber wood with metal, glass, concrete, and others. The graphical representation of timber wood consumption in the service sector is shown in Figure 3.3.

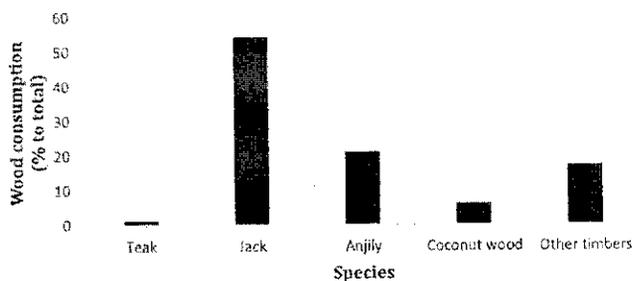
**Table 3.3 Timber wood consumption by the service sector in Kerala (2014-15)**

Timber	('000 m <sup>3</sup> roundwood equivalent)			Total volume
	New building	Addition/repair of old building	Furniture and other uses	
Teak	0	0	1	1
Jack	5	0	16	21
Anjily	3	0	6	9
Coconut wood	0	0	2	2
*Other timbers	2	0	5	7
	10	0	30	40
<b>Total</b>	<b>(23.68)</b>	<b>(0.00)</b>	<b>(76.31)</b>	<b>(100.00)</b>

Figures in parenthesis represent respective percentages.

\*Vaka, Mahogany, Maruthu, etc.

**Figure 3.3. Species-wise timber wood consumption in the service sector (2014-15)**



### 3.1.4. Export of wood

The export of timber wood from Kerala is substantial, accounting for 8,80,400 m<sup>3</sup> roundwood equivalent (Table 3.4) with 85 per cent of the export comprising of packing cases, mainly of rubber wood. Teak and rosewood together accounted for only about five per cent of the total export. Teak wood export outside India is nil and the bulk of it is exported to other states in India.

The direction of export of timber from Kerala to rest of India during 2014-15 is indicative (Table 3.5). Manjeswaram and Thalapady forest check-posts on National Highway 17, for instance, leads to Mumbai a major consumption center of timber wood that includes other centers in Maharashtra and Gujarat. Likewise, several roads to the east from the districts of Kasaragod, Kannur, Wayanad and Malappuram lead to

**Table 3.4 Export of timber wood from Kerala to rest of India and other countries (2014-15)**

('000 m <sup>3</sup> roundwood equivalent)						
Destination of Export	Packing case *	Teak	Rosewood	Eucalyptus	Other Timbers	Total
Export to rest of India	752	45	0.44	4.5	78	879.94
Export to other countries	0	0	0.37	0	0.09	0.46
<b>Total Export</b>	<b>752</b>	<b>45</b>	<b>0.81</b>	<b>4.5</b>	<b>78.09</b>	<b>880.4</b>
<b>Per cent#</b>	<b>85</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>9</b>	<b>100</b>

\*Primarily rubber wood. Also mango, vatta, cashew, etc.

# Percentage to column total

**Table 3.5 Direction of export of timber wood (species-wise) from Kerala to rest of India**

('000 m<sup>3</sup> roundwood equivalent)

Wood	Mumbai	Madurai	Coimbatore & Trichy	Bangalore	Volume	Total
						% to total
<i>Packing case</i>						
Rubber wood	145	14	162	17	338	38
Others	244	0	136	33	413	47
<i>Other than packing case</i>						
Teak wood	0	0	7	34	41	5
Teak Poles	0	0	3	0	3	0
Silver oak	0	0	0	19	19	2
Anjily	0	5	0	0	5	1
Venga	0	0	0	5	5	1
Eucalyptus	0	4	0	0	4	1
Rosewood	0	0	2	0	2	0
Jack wood	0	0	0	2	2	0
Other wood	0	3	25	19	48	5
<b>Total timber export</b>	<b>389</b>	<b>26</b>	<b>335</b>	<b>129</b>	<b>880</b>	<b>100</b>

Karnataka state. The leading timber wood consuming urban centers in Karnataka are Bangalore and Mysore. So timber wood moving out of Kerala through check-posts at Muthanga, Baveli, Iritty, Pazhur and Vazhikkadavu, among others were grouped together as oriented towards Bangalore. Timber wood moving out of Kerala through check-post at Walayar is shown to be oriented towards Coimbatore and Trichy. Similarly, the direction towards Madurai was based on the timber movements through check-posts at Achankovil, Kotavasal, Bodimettu, Chinnar and Parasala.

Sawn packing case timber wood accounted for 85 per cent of the total export. Rubber wood accounted for 38 per cent of the packing case export. Mango, vatta and cashew made up for the rest of packing case timber wood. Among timber woods exported other than packing cases, teak recorded the largest volume of about 41,417 m<sup>3</sup>

roundwood equivalent. It represented 5 per cent of the export, excluding packing cases, to other states in India.

### 3.2. DEMAND ANALYSIS - A COMPARISON (1987-88 & 2014-15)

The estimates on sector-wise consumption of timber wood during two time points 1987-88 and 2014-15, have been re-worked from the previous studies by refining earlier estimates by excluding poles and also coconut wood which were substantial components in the earlier timber production estimates. Table 3.2.1 depicts the demand for timber wood in Kerala during 1987-88 and 2014-15. The total demand is shown under four sectors: households, industries, services and export. The total demand for timber wood in Kerala increased from 17,69,000 m<sup>3</sup> roundwood equivalent in 1987-88 to 1,09,86,000 m<sup>3</sup> roundwood equivalent in 2014-15. Of the total export to other states in the country, wooden packing cases accounted for around 95 per cent during 1987-88 and 85 per cent during

**Table 3.2.1. Consumption and export of timber wood<sup>1</sup> in Kerala (1987-88<sup>2</sup> and 2014-15)**

Timber-using sectors	Volume ('000 m <sup>3</sup> roundwood equivalent)	
	1987-88	2014-15
Households sector	543	1550
Industries sector	742	8520
Service sector	121	40
Export (To other states in the country + To other countries)	363	880
<b>Total</b>	<b>1769</b>	<b>10986</b>

<sup>1</sup>Excluding coconut wood & poles, <sup>2</sup>re-worked from Krishnankutty *et.al* 1990.

2014-15. The remaining quantity in the total export was mainly teak wood.

### **Timber wood consumption analysis in different sectors of Kerala during 2014 - 15**

**Household sector:** The trend in timber wood use in the household sector has increased by three fold during the period 1987-88 to 2014-15 from 0.5 million m<sup>3</sup> to 1.55 million m<sup>3</sup> roundwood equivalent. The economic status of households, availability and price of timber, substitution possibilities and the relative prices of alternatives, technological advances and changing fashion and preferences, are some of the key drivers that influence wood usage. Old houses are replaced with modern designs, often in the same location and plot. With the increasing affluence of households, changing needs and fashion, renovation, repair, alteration addition and replacement of old houses have become quite common in the state. However, such activities also involve selling off the old wood work, including doors, windows, ceiling and fixtures, in an as-is-where-is condition. Often, such wood work contains good quality timber woods and excellent craftsmanship. Successful business enterprises have developed for buying and selling of such woodwork from old buildings. The buyers get these materials at very low rates in

comparison with the hassle in buying logs of timber wood and sizing them in a sawmill in addition to transportation of such materials and the greater challenge of managing the carpentry work. Pre-used wooden doors and windows from old houses are being re-worked and being widely used in the new houses and the quantity of such dismantled wood work in current house-building activities is significant enough to merit mention. The most noticeable thing in the households sector is that wood for roof support in the form of rafters and beams have completely been replaced by concrete even in the government housing schemes for the poor, including that of the tribal communities in forests. Further, substitution of wood work with other materials like concrete, steel, aluminum and fibre materials is also gaining momentum. The increasing household sector essentially puts pressure on the demand and price of timber in the state. The home gardens and imports mainly cater to the timber dependency of household sector for construction and furniture timbers. Construction timber woods such as pyncoda (*Xylia dolabriformis* Benth.), purple heart ( *Peltogyne spp.*), greenheart (*Chlorocardium rodiei* (Schomb.) Rohwer, H.G.Richt. & van der Werff), merbau (*Intsia bijuga* (Colebr.) Kuntze), billinga (*Nauclea diderrichii* (De Wild.) Merr.), sal (*Shorea robusta* Gaertn.), mora (*Mora excelsa* Benth.), babul (*Acacia nilotica* (L.) Delile) are

imported from abroad. Almost all other construction timbers, such as, jack (*Artocarpus heterophyllus* Lam.) anjily (*Artocarpus hirsutus* Lam.), etc. are from the Kerala home gardens.

**Industries sector:** The demand for timber wood in the industrial sector depicts a ten-fold increase from 742,000 m<sup>3</sup> round wood equivalent in 1987-88 to 8520,000 m<sup>3</sup> round wood equivalent in 2014-15. One of the important wood processing industries in Kerala is the sawmilling industry which has thrived due to the increasing availability from estates/ home gardens and arrival of imported timber wood to Kerala. The traditional production of home garden timber wood arrives in the local sawmills for custom sawing or as logs for sale in the sawmill cum depots in the rural areas. The packing case units, which are essentially sawmills specializing in sawing rubber wood, cater to the large markets for wooden packing cases. Almost the entire output of the packing case industry in Kerala is exported to other States particularly to Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra. Rubber wood is the most preferred species and accounts for 38 per cent (0.338 million m<sup>3</sup> roundwood equivalent) of the raw-material used in the packing case industry. The rest is the miscellaneous timber wood from home gardens and estates. The preference for rubber wood is due to the superior finish and very

low wastage during sawing. Vatta (*Macaranga peltata* (Roxb.) Müll.Arg.), mavu (*Mangifera indica* L.), eucalypts (*Eucalyptus grandis* Hill ex Maid.), silver oak (*Grevillea robusta* A.Cunn. ex R.Br.), cashew wood (*Anacardium occidentale* L.), nutmeg wood (*Myristica fragrans*), cocoa wood (*Theobroma cacao*), chempakam (*Michelia champaca*), mahogany (*Swietenia macrophylla*), murikku (*Erythrina variegata* L.) etc. are the other timber wood species used in the packing case industry. A very high demand for wooden packing case has resulted in the import of silver oak (*Grevillea robusta* A.Cunn. ex R.Br.), eucalypts (*Eucalyptus grandis* Hill ex Maid.), neem wood (*Azadirachta indica* A.Juss.), karivelam (*Acacia ferruginea* DC.), babul (*Acacia nilotica* (L.) Delile) etc. from outside Kerala to supplement the production of rubber wood in Kerala as raw material in the packing case industry to be re-exported to other States.

In the match industry in Kerala, finished match boxes were initially produced in integrated units manufacturing boxes, splints and carrying out dipping activities. Over time, the dipping activities shifted out of Kerala to drier regions of Tamil Nadu, such as Sivakasi, where weather conditions permit year round operations. Presently, there are very few units in Kerala producing finished match boxes. Matty (*Ailanthus triphisa*) is the most preferred timber

wood in the match industry. Other species like vatta (*Macaranga peltata*), ezhilampala (*Alstonia scholaris*), elavu (*Bombax ceiba*), albizia, among others, are also used in the matchwood industry. Match outer boxes and inner boxes were traditionally made with veneers using species like elavu, pala, vatta and rubber wood. Of these, pala and elavu are the most preferred wood. Now, paper boxes have come into use and match boxes using veneers have gone out of existence. Kerala continues to have a near monopoly in the production of splints which are transported out to the match units in Tamil Nadu for carrying out dipping and further processing. A small quantity of splints are also exported to France, Italy and African countries. The neighbouring State of Tamil Nadu, which has a monopoly of dipping units, have now started splints manufacturing units also. They are sourcing their raw material of matty wood from the home gardens and other wood from forest plantations in Kerala. The assured demand for matty around the matchwood units in Kerala has promoted its cultivation in the home gardens. Rubber wood is also used as veneers for match boxes. Kerala produces match veneers for match boxes and splints for the whole of south India indicative of a growing scope for expansion of the industry in Kerala.

The plywood industry in Kerala has

firmly established itself using the plentiful supply of rubber wood. A total of 9,61,426 m<sup>3</sup> of rubber wood (from unregistered rubber plantations) is now used in the plywood sector. A good quantity of rubber wood also comes from the unregistered small and marginal holders. Packing case industry which happened to be the major consumer of rubber wood is now fast replaced by the plywood industry. The traditional plywood units in Kerala depending on forest timber had either closed down or transformed into rubber wood based units. Vatta (*Macaranga peltata* (Roxb.)), eucalypts (*Eucalyptus grandis* Hill ex Maid.), silveroak (*Grevillea robusta* A.Cunn. ex R.Br.), kadukka (*Terminalia bellirica* (Gaertn.)), vellapine (*Pinus strobus*), mahogany (*Swietenia macrophylla* King), plavu (*Artocarpus heterophyllus* Lam.), anjily (*Artocarpus hirsutus* Lam.) and imported logs are also used in plywood industry. The pulp industry uses eucalypts and acacia wood from forest plantations. It also obtains eucalypts wood from private areas within and outside Kerala.

The furniture scenario in Kerala has changed over the last decade with international designs and modular furniture made easily available either as imported furniture or produced from highly mechanized units. Rosewood furniture, made from rosewood imported from Karnataka, is also

available. Furniture units are thriving in Kerala, although the more modern mechanized units are located in the neighbouring State of Tamil Nadu, where labour is cheaper. Old dismantled houses contain large quantities of timber wood in the form of doors, windows, frames, ceilings, attic, fixtures and furniture. There are traders who buy such woodwork and manage modern wood working units to refurbish or convert the old timber wood work and joinery into new furniture. Large beams are re-sized and each item of joinery is recycled for use in new timber wood products like furniture and fixtures. The units specialized in dismantled timber wood do not use any new timber in their workshop. The old timber is mainly teak, jack, anjily, irul, venthekku, vengal and rosewood. Such units at Mezhathur near Pattambi, Mangalamkunnu near Ottappalam, Chittur, Koduvayoor, and several other places in Kerala, source their dismantled joinery from different parts of Kerala and from places like Karaikudy in Tamil Nadu.

#### **Service sector**

Construction of commercial buildings and flats, has now accelerated. The plentiful availability of timber substitutes, such as, concrete, aluminum and plastics which are cheaply available for door frames and toilet doors, cupboard shutters, etc. has promoted its wide adoption. Wood for

roof support in the form of rafters and beams have completely been replaced by concrete. Between 1987 and 2015, a drastic shift in the pattern of timber wood consumption was noticed in the services sector, using very nominal quantity of timber. The consumption in the commercial buildings and public institutions sector in Kerala during 2014-15 is only 40,000 m<sup>3</sup> roundwood equivalent, a drastic decrease from 1,21,000 m<sup>3</sup> roundwood equivalent in 1987-88.

#### **3.3. TIMBER WOOD SUPPLY**

Total timber wood imported to Kerala during 2014-15 was 2,66,045 m<sup>3</sup> roundwood equivalent (Table 3.7 and Figure 3.4). Timber wood was imported to Kerala from rest of India (84%) and from other countries (16%). Among timber wood species, teak accounted for 8 per cent, purple heart 12 per cent and pyncoda 6 per cent and all other species accounted for 74 per cent of all timber wood import.

Around 2 per cent of eucalypt enters Kerala through Cochin port. Myanmar is one of the major countries accounting for 43 per cent of import. Purple heart contributed 12 per cent of the import, i.e., 3,23,14 m<sup>3</sup> among other timber woods imported. Another major species is natural teak from other neighbouring countries, largely used for ornamental front doors of houses. The import of

greater acceptance in Kerala due to its low price and almost cylindrical form providing very high out-turn.

### Timber wood production from forests

Table 3.9 shows the timber wood production from forests during 2014-15. The recorded production of timber wood from forests was assessed at 77,934 m<sup>3</sup> round wood equivalent of which, eucalyptus and fire wood accounted for 3 per cent and 8 per cent respectively. Teak including poles accounted for 33 per cent respectively of the total production from forests. A quantity of 6123 m<sup>3</sup> round wood equivalent of fuel wood used in the household sector was obtained from forests

### 3.4. ANALYSIS OF SAW MILLS IN KERALA 2014-15

The term sawmill used for the survey is a mechanized industrial unit in which

timber is sawed into planks, boards etc. Certificate/ NOC for sawmill units in the state are issued by a number of state agencies, namely, The Empowered Committee - Kerala Forest Department, Health Department, Fire and Safety, Factories and Boilers, Sales Department (VAT), Kerala State Electricity Board, Pollution Control Board and Local Bodies. Nearly all functional units in the state have a certificate/NOC from Empowered Committee - Kerala Forest Department that has got a broad classification of ten categories (Table 3.4.1) inclusive of all types of sawmill industry.

No functional units were found in category 9 and 10, hence not included in the study. Broadly, the saw mill units in the State covers the following activities:

- i. Saw mills - firm in which only milling activity is carried out
- ii. Saw mills plus depots - firm in which both milling and sales of timber wood is carried out

**Table 3.9 Species-wise timber wood production from the forests of Kerala (2014-15)**

Products	('000 m <sup>3</sup> roundwood equivalent)	
	Quantity	% to total
Teak	21	27
Eucalyptus	2	3
Teak poles	5	6
Fuelwood	6	8
Other Timbers	44	55
Total	78	100

**Table 3.4.1. Categories of sawmill and other wood based industrial units (as per EC - KFD) in Kerala**

Categories	Classifications
I	Sawmill using all types of wood
II	Furniture making units using above 5 HP.
III	Small scale units for manufacturing products such as match splints, match box, pencil slat and photo frame.
IV	Medium scale industrial units using all types of wood for manufacturing products such as packing case, block board and tea chest.
V	Medium scale industrial units using exclusively rubber wood for manufacturing products such as packing case, block board and tea chest.
VI	Large scale industrial units using all types of wood for manufacturing products such as furniture, veneer, plywood and particle board.
VII	Large scale industrial units using exclusively rubber wood for manufacturing products such as furniture, veneer, plywood and particle board
VIII	Wood based industrial units using exclusively Imported wood.
IX	Institution which impart training in wood processing and carpentry.
X	Small scale units for processing coconut palm or palmyrah wood or both

iii. Saw mill plus others – firm in which milling, sale of timber wood and other activities like manufacture and sales of furniture is carried out

iv. Miscellaneous units – Plywood manufacturing units, match stick making units, packing box manufacturing units etc.

The major species used by different saw mill units and their sources are given in the Appendix 13.

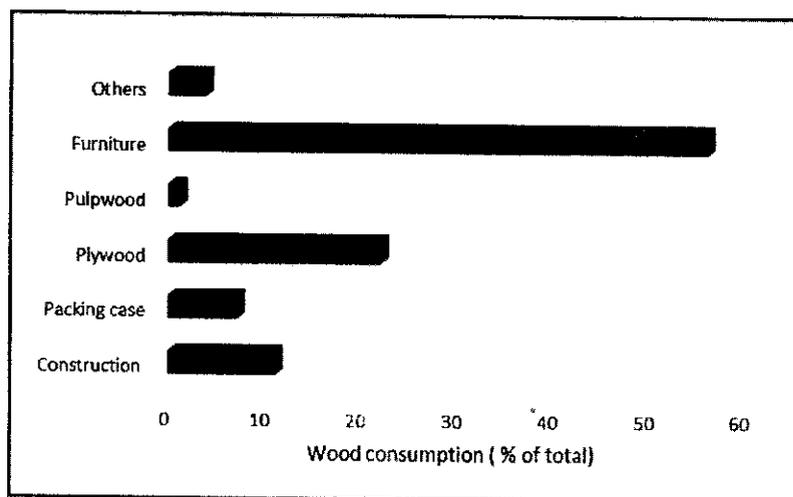
#### **3.4.1. Installed capacity**

The major timber used in industrial sector are jack, teak, anjily, and eucalyptus which are exclusively used as construction timber wood in households. Major portion of timber wood used for packing cases in the industrial sector is rubber wood that contributes 22 per cent of the total used in the industry (Table 3.4.2 and Figure 3.6).

**Table 3.4.2. Quantity of timber wood used in different industries in Kerala**

Category	Species	Quantity
Construction timber	Jack,teak,anjily etc.	1220976
Packing case	Rubber,Vatta,mavu and cashew	751502
Plywood	Rubber,Vatta and others	2403565
Pulpwood	Eucalyptus and accacia	62468
Furniture	Jack,teak,anjily etc.	6143066
Others	All other species	404296
<b>Total</b>		<b>1,09,85873</b>

**Figure 3.6. Consumption pattern of timber in different wood based industries in Kerala**



Other than rubber wood, vatta and eucalyptus are used for plywood. Eucalyptus is mainly used by the paper industry as the main source of paper pulp. Other timbers such as venga, mahagoni and ayini are used for furnitures as well (Appendix 13).

A total of 9256 certificates/ NOC for sawmill units have been issued by the Empowered Committee – Kerala Forest Department. At present these units handle 10.79 million m<sup>3</sup> of round wood equivalent per annum whereas the total demand is for 10.98 million m<sup>3</sup> of round

wood equivalent per annum leaving only a small gap (0.190 million m<sup>3</sup> of round wood equivalent per annum) between demand and installed sawmill capacity. This small gap at present is filled by unregistered units or units working with the permission of local bodies alone.

Maximum timber wood is used for the manufacturing of furniture which accounted for 55 per cent of the total timber wood consumption. Plywood along with packing case industry use 36,24,541 m<sup>3</sup> roundwood equivalent which constitutes about 29 per cent of the total timber wood. Only 1 per cent of timber wood was found used by the paper industries (Table 3.4.2). Rubber wood was found to be used by all categories of sawmill industries and as per the reports of the Rubber Board 14,81,986 m<sup>3</sup> of timber wood was supplied from the rubber estates. However, the actual consumption of

rubber wood was much higher as per the saw mill unit analysis which may be attributed to the unregistered and units of the marginal and small holders (Table 3.4.3) Total Consumption of timber by various sawmill industries was 1,07,95,957 m<sup>3</sup> during 2014 -15 (Table 3.4.4 and Figure 3.7). The results show that wood based industries in the categories 1, 2 and 7 use the maximum amount of timber wood in the state. Furniture making units (category 2 of EC -KFD) depend largely on home gardens, estates and import which provides sufficient raw materials for their smooth running. Similarly, wood based industrial units using rubber wood exclusively (category 7 of EC - KFD) for manufacturing products, such as, furniture, veneer, plywood and particle board depend exclusively on estates within the state and import from other states. The number of licensed units by EC-KFD could just meet the current timber wood demand in the state.

**Table 3.4.3 Quantity of rubber wood used in different industries in Kerala (2014-15)\***

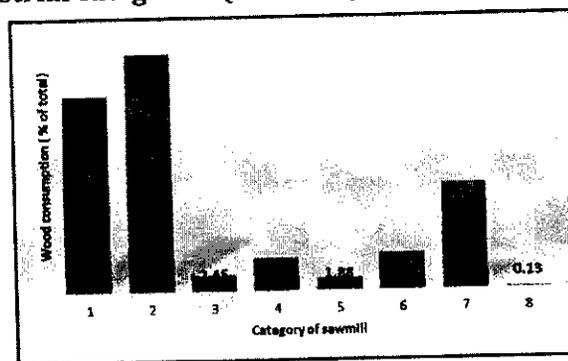
Category	Quantity(m <sup>3</sup> roundwood equivalent)
Treated wood	183469.05
Packing case	337091.85
Plywood	961426.00
Total	1481986.90

\*As per the records of Rubber Board.

**Table 3.4.4 Total timber consumption under different wood based industrial categories (EC - KFD) of Kerala (2014-15)**

Category	Total ('000 m <sup>3</sup> roundwood equivalent)
1	3334
2	4030
3	265
4	546
5	203
6	614
7	1789
8	14
<b>Total</b>	<b>10795</b>

**Figure 3.7. Wood utilization pattern under different industrial categories (EC - KFD) of Kerala (2014-15)**



The average timber wood consumption by different categories (m<sup>3</sup>/HP/annum) is given in Table 3.4.5. The study shows that the sawmill units in all categories were performing much below the potential consumption capacity of 100 m<sup>3</sup>/ HP/ annum (in case of horizontal band saw) or 300 m<sup>3</sup>/ HP/ annum (in case of vertical band saw) as stipulated by the Kerala Forest Department vide G.O (Rt) No.469/2014/F&WLD, dated 14.10.2014. However, the full potential

can be attained by technological upgradation of the sawmill units thereby equipping them to compete in the national and international markets and meet the increasing timber wood demand of the state. Some of the contributing factors for sawmill units having lower capacities include recurring costs, labour attainability, capital at disposal, availability of wood, type of wood, uninterrupted continuous power supply and outmoded technology.

**Table 3.4.5. The mean wood consumption per unit installed capacity per annum in different sawmill categories (2014-15)**

Category	Average timber wood consumption per annum
	(m <sup>3</sup> /HP/annum)
1	27.95
2	35.90
3	90.64
4	67.46
5	19.91
6	33.43
7	22.47
8	49.36
Total	347.16

### **3.5. TIMBER WOOD BALANCE SITUATION OF KERALA 2014-15**

#### **3.5.1. Timber wood demand**

Table 3.5.1 depicts the sector-wise demand for timber wood in Kerala. The estimated total timber demand is 10.98 million m<sup>3</sup>. Of the total demand, industries sector accounted for the major share (77.55 %), household sector ranked next (14.1 %), followed by the services sector (0.36 %). Wood export accounted for 8.35 per cent of the total demand for wood (Figure 3.5.1).

#### **3.5.2. Timber wood supply**

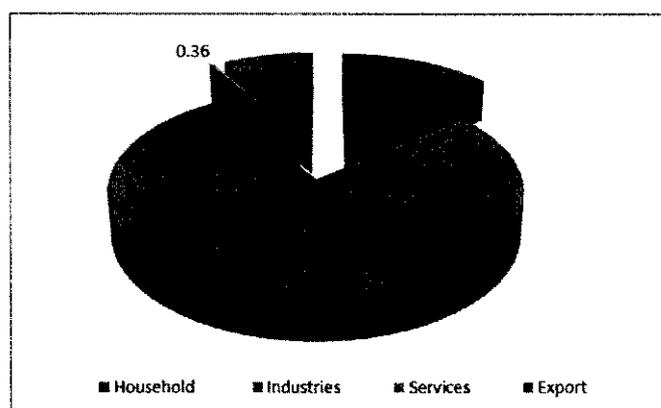
Timber wood supply in Kerala from

home gardens, rubber estates, forests and import is shown in Table and Figure 3.5.2. The Figure on timber wood production from home gardens includes production from private estates of cardamom, coffee and tea. Since production from such estates was negligible, it is not shown separately. Home gardens contributed 83.38 per cent of the total timber wood supply. Rubber estates alone contributed 13.49 per cent. Forests contributed less than one per cent of the total supply. Wood imported from other states and countries was 2.42 per cent of the total timber wood supply.

**Table 3.5.1 Sector-wise demand for wood in Kerala during  
2014-15**

Sectors	Volume ('000 m <sup>3</sup> roundwood equivalent)
Household	1550
Service	40
Industries	8520
Export	876
<b>Total</b>	<b>10986</b>

**Figure 3.5.1 Timber wood consumption in Kerala**



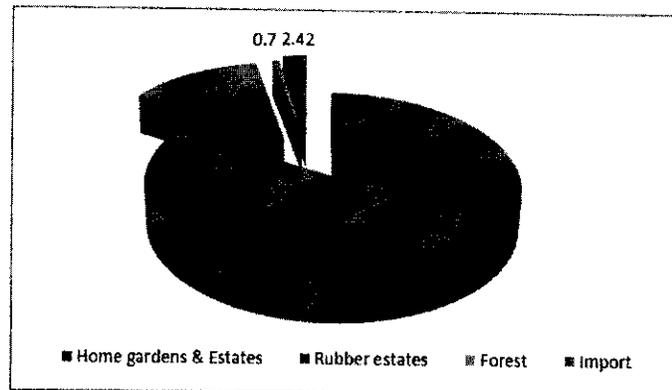
**3.5.2 Source-wise supply of wood in Kerala (2014-15)**

Source of supply	Volume (‘000 m <sup>3</sup> roundwood equivalent)	% to total
Home gardens & Estates	9159908	83.39
Rubber estates*	1481986	13.49
Forest	77934	0.70
Import	266045	2.42
<b>Total</b>	<b>10985873</b>	<b>100.00</b>

\*Source: As per records of the Rubber Board.

Rubber wood not accounted for in the Rubber Board reports has been included in the category of home gardens and estates.

Figure 3.5.2. Supply of wood in Kerala



### 3.5.3. The timber wood balance of Kerala 2014-15

The wood-balance situation in Kerala during 2014-15 indicated an export surplus of timber wood. In case of teak, the net export was of 25,397 m<sup>3</sup> roundwood equivalent. In the case of all other timbers, the production exceeded

consumption showing a surplus of 2,50,408 m<sup>3</sup> roundwood equivalent. The consumption and production of timber wood in Kerala during 2014-15 was 10.109 million m<sup>3</sup> and 10.719 million m<sup>3</sup> of round wood equivalent respectively with a net export of 6,13,950 m<sup>3</sup> (Table 3.5.3).

Table 3.5.3. Wood-balance situation in Kerala during 2014-15 ('000 m<sup>3</sup> roundwood equivalent)

Wood	Demand		Supply		Net export (5)=(2)-(4)
	Consumption	Export	Production	Import	
0	1	2	3	4	
Teak wood	267.612	45.417	288.009	20.02	25.397
Rubber* wood	1143.845	338.175	1481.99	0.03	338.145
All other timbers	8698.63	496.408	8949.04	246	250.408
<b>Total timber</b>	<b>10109.5</b>	<b>880.00</b>	<b>10719</b>	<b>266.05</b>	<b>613.95</b>

\*Source: As per records of the Rubber Board.

Rubber wood not accounted for in the Rubber Board reports has been included in the category of all other timbers.

## CONCLUSIONS

The key findings of the demand-supply analysis of timber wood in Kerala during 2014-15 are summarized herewith.

### Timber wood demand

The total effective demand for timber wood in Kerala during 2014-15 was 10.98 million m<sup>3</sup> of round wood equivalent. Majority of the sectors (household, industry and export) depicted an increasing trend with respect to timber wood demand over the years. The demand for timber wood in the household sector had increased by three fold (i.e, from 543000 m<sup>3</sup> in 1987-88 to 1550000 m<sup>3</sup> in 2014-15) and the industrial sector by ten-fold (from 742,000 m<sup>3</sup> in 1987 - 88 to 8520,000 m<sup>3</sup> in 2014-15) in the past three decades. However, timber wood demand in the service sector is on a decline wherein it is being increasingly replaced by alternate means.

In the household sector 58 per cent of the timber wood demand was accounted by jack wood and teak wood. On the other hand, industrial sector depicts a dominance of rubber wood based units which also caters to a wider

social base. A major portion of the rubber based wood products is intended for export, though it serves the domestic market as well. As there is an assured supply of rubber wood by way of replanting existing plantations, the rubber based industry is expected to thrive in the short term and the price of rubber will have a bearing in the long run. The export of timber wood from Kerala was 8,80,400 m<sup>3</sup> of roundwood equivalent of which the major portion was exported to other states in India. Timber wood consumption in the state indicates an increasing trend.

### Timber wood supply

Home gardens and estates (including rubber estates) cater to more than 95 per cent of the timber wood demand in the state. The state forests provided 77,934m<sup>3</sup> (0.70 per cent of the total timber supply) indicating that dependency of wood based industries on the state forest is at a minimum. During 2014 -15, 266044 m<sup>3</sup> of round wood equivalent was imported to the state from other states and abroad (2,23,000 m<sup>3</sup> and 43,000 m<sup>3</sup> respectively). The supply was able to meet the current demand.

### **Saw mill analysis**

A total of 9256 wood based industrial units have been registered under different State agencies. At present these units handle 10.79 million m<sup>3</sup> of round wood equivalent per annum whereas the total demand is for 10.98 million m<sup>3</sup> of round wood equivalent per annum leaving only a small gap (0.190 million m<sup>3</sup> of round wood equivalent per annum) between demand and installed sawmill capacity. This small gap at present is filled by unregistered units or units working with the permission of local bodies alone. The number of licensed units could just meet the current timber wood demand in the state. A physical verification of the sawmills should be taken up at periodic intervals to ensure that the licensed units are functional and wherever cases of non-functional units exists, the numbers may be met by issuing new

licenses or permitting technological upgradation of the existing ones in the respective categories.

### **Timber wood balance situation in Kerala**

Of the total timber wood demand a major portion is used for furnitures', fixtures and construction (66.9% of the total demand) where the preference of the timber wood species is as jack wood > teak wood > anjily. Plywood and packing case industry together account for 29 per cent of the total timber wood demand where rubber wood is the preferred timber species. The consumption and production of timber wood in Kerala during 2014-15 was 10.109 million m<sup>3</sup> and 10.719 million m<sup>3</sup> of round wood equivalent respectively with a net export of 6,13,950 m<sup>3</sup> of round wood equivalent.

## REFERENCES

- Krishnankutty, C.N. 1990. Demand and supply of wood in Kerala and their future trends. Kerala Research Report No. 67, Kerala Forest Research Institute, Peechi, India
- Krishnankutty, C.N., Thambi, K.B. and Chundamannil, M. 2005. Wood balance study in Kerala and market survey, Kerala Research Report No. 268, Kerala Forest Research Institute, Peechi, India
- Krishnankutty, C.N., Thambi, K.B. and Chundamannil, M. 2008. Trees outside forests (TOF): a case study of the wood production-consumption situation in Kerala. *International Forestry Review*, 10(2):156-164.
- Krishnankutty, C.N., Thambi, K.B. and Chundamannil, M. 2010. Demand and supply of teakwood in Kerala, India. *Indian Journal of Forestry*, 33 (1): 1-5. Kerala Research Report No. 268, Kerala Forest Research Institute, Peechi, India
- Krishnankutty, C.N., and Chundamannil, M. 2012. Timber supply situation in Kerala, Kerala Research Report No. 426 Kerala Forest Research Institute, Peechi, India.
- Murthy, M.N. 1967. Sampling: Theory and applications. Statistical publishing Society, Calcutta.

## Appendix 1

### Survey summary of rural area household and service sectors

Sl.No	District	Block	Panchayat	Ward	OHH	NHH	THH	SS
1	TCR	Ollukara	Puthoor	9	19	6	25	20
				23	30	4	34	5
		Kodakara	Mattathur	10	29	3	32	0
		Mathilakam	Edathirithy	18	13	7	20	10
		Thalikulam	Engandiur	3	15	3	18	5
11	18			4	22	10		
2	TVM	Nemom	Pallichal	3	27	3	30	10
				21	25	5	30	12
			Kalliyoor	15	26	11	37	8
		17		34	12	46	9	
		Nedumangadu		Karakulam	22	27	10	37
			23		29	8	37	13
Aanadu	6	24	3	27	8			
	8	23	6	29	6			
3	MPM	Pernithalmanna	Elamkulam	1	22	14	36	7
				2	17	9	26	25
			Angadipuram	15	51	13	64	19
		16		35	12	47	14	
		Kalikkavu	Kalikkavu	12	22	21	43	12
				17	23	19	42	7
			Edapatta	4	20	6	26	12
5	12			5	17	11		
4	KNR	Thalipparambu	Alakkodu	15	26	5	31	10
				16	25	9	34	15
			Pariyaram	11	19	7	26	16
		12		24	6	30	15	
		Thalasery	Muzhippilngadu	2	20	4	24	9
				15	14	3	17	7
			Dharmadam	2	25	3	28	5
3	23			4	27	8		
5	KLM	Anchal	Kulathupuza	5	23	3	26	7
				19	25	6	31	6
			Anchal	2	25	1	26	3
				3	24	1	25	7
		Ithikara	Kalluvathikal	14	24	3	27	19
				15	34	3	37	8
			Chathannur	14	23	5	28	3
				15	28	0	28	12

Sl.No	District	Block	Panchayat	Ward	OHH	NHH	THH	SS
6	WYD	Manathavadi	Thavinjal	5	20	6	26	15
				7	19	3	22	10
			Thondarnad	7	28	5	33	5
		Kalpatta	Meppady	8	32	6	38	21
				4	20	4	24	11
			Vengapally	5	26	4	30	10
				8	21	5	26	10
				9	24	4	28	7
				3	40	2	42	7
7	EKM	Parakkadavu	Edakkattuvayal	4	22	4	26	5
				7	38	9	47	38
			Parakadav	9	45	13	58	25
		Mulamthuruthy	Maneed	5	21	3	24	10
				6	22	1	23	18
			Puthanvellikara	10	19	11	30	0
				11	21	6	27	0
				1	34	3	37	0
				2	27	6	33	14
8	KSD	Parappa	Kodambellur	1	38	7	45	8
				8	24	2	26	18
			Bellur	6	9	3	12	2
		7		12	2	14	9	
		4		13	7	20	7	
		Karadukka	Dhelampady	12	13	10	23	12
				4	17	5	22	7
			Ramankary	5	22	3	25	10
		9	APZ	Veliyanadu	Ramankary	12	18	2
13	23					4	27	7
Haripadu	Karthikapally			7	18	1	19	13
10	PTM	Mallapally	Kunnamathanam	9	21	2	23	10
				17	24	4	28	9
		Konni	Pramadam	18	22	2	24	12
11	KTM	Vazoor	Karukachal	9	24	0	24	8
				10	23	2	25	8
			Vellavoor	6	16	5	21	7
		4		22	4	26	6	
		Erattupetta		Melukavu	5	11	0	11
			12		16	2	18	4
			Theekoyi	12	15	4	19	9
				13	15	5	20	11
		12	KZD	Balusery	Naduvannor	6	16	1
Unnikulam	3				24	7	31	15

OHH- Old house hold, NHH- New house hold, SS- Service sector

Source - <https://sanchaya.lsgkerala.gov.in/assessment/>

<https://kerala.gov.in/census2011>

## Appendix 2

### Survey summary of urban area household and service sectors

Sl No	District	Municipality/ Corporation	Wards	OHH	NHH	THH	SS
1	Kozhikode	Vadakara	1	24	2	26	1
			4	19	5	24	5
2	Palakkad	Mannarkkad	5	16	4	20	1
			7	15	1	16	1
3	Iduky	Kattappana	5	17	2	19	9
			6	12	2	14	1
4	Thrissur	Thrissur	9	39	4	43	6
			23	31	3	34	4
	Total		6	173	23	196	7
							3

OHH- Old house hold, NHH- New house hold, SS- Service sector

**Appendix 3**

**District-wise household sector timber wood (species-wise) consumption in Kerala**

District	Jack	Teak	Anjily	Pyncoda	Mahogany	Coconut wood	Rubber wood	Other timbers	Total qty(m <sup>3</sup> round wood equivalent )
TVM	47091	9406	16259	7408	7912	29	653	4700	93459
KLM	39013	5828	13345	0	12910	0	0	8859	79956
PTM	18137	31211	7782	0	3177	773	0	1309	62389
APZ	35984	10128	10609	0	145	14593	0	3616	75076
KTM	20857	17793	25790	4997	9863	2191	0	334	81824
IDK	19862	557	22738	817	0	0	0	6131	50105
EKM	24403	22317	18786	1604	7755	1524	0	5542	81932
TCR	18264	10101	254	6820	6239	3066	0	14310	59054
PKD	47118	47039	724	1721	6762	7683	0	16910	127957
MPM	57384	55035	11014	12007	21067	11302	0	21832	189642
KZD	45817	2083	1717	12936	0	491	563	246	63852
WYD	20705	559	3187	2062	0	0	0	6724	33237
KNR	7175	10812	5917	6534	3381	0	0	10266	44086
KSD	14301	3680	161	12565	5888	0	0	16277	52871
Urban area	211507	39562	89154	64513	30948	13020	0	5439	454143
Total	627620	266111	227437	133983	116048	54671	1216	122495	1549582

#### Appendix 4

#### District-wise service sector timber wood (species-wise) consumption in Kerala

District	Jack	Teak	Anjily	Pyncoda	Mahogany	Coconut wood	Rubber wood	Other timbers	Total qty (m <sup>3</sup> round wood equivalent )
TVM	5494	0	3094	0	0	0	0	1537	10125
KLM	861	0	0	0	0	0	0	307	1168
PTM	0	0	0	0	0	0	0	110	110
APZ	0	0	0	0	0	0	0	0	0
KTM	0	0	0	0	0	0	0	0	0
IDK	0	0	0	0	0	0	0	0	0
EKM	0	0	363	0	0	0	0	0	363
TCR	2324	0	0	0	0	0	0	110	2434
PKD	0	0	0	0	0	0	0	0	0
MPM	10394	501	0	0	0	2398	0	617	13910
KZD	130	0	0	0	0	0	0	0	130
WYD	1757	0	4912	0	0	0	0	1803	8472
KNR	585	0	0	0	94	0	0	1020	1700
KSD	0	0	0	0	0	0	0	1241	1241
Total	21545	501	8368	0	94	2398	0	6747	39654

Appendix 5

Timber movement (species-wise) through forest check post (export)

CHECK POST	Quantity (m <sup>3</sup> round wood equivalent)										
	SPECIES										
	TEAK	ROSE WOOD	EUCALYPTUS	TEAK POLES	SILVER OAK	ANJILY	VENGA	JACK WOOD	OTHER	PACKING CASE	TOTAL
ACHANKOVIL	0	0	0	37	0	0	0	0	0	0	37
THALAPADY	0	0	0	0	0	0	0	0	0	389278	389278
BAVELI	32357	69	7	0	10275	0	0	0	5940	0	48647
BODIMETTU	0	0	0	0	0	0	0	0	0	0	0
CHINNAR	0	0	2675	0	0	0	0	0	15	0	2690
IRITTY	40	0	0	0	0	0	0	0	36	33066	33142
KOTTAVAASAL	137	0	1468	40	0	4818	0	0	3436	13527	23427
PARASALA	0	0	0	0	0	0	0	0	0	0	0
PAZHUR	27	19	0	0	375	0	0	110	1179	0	1710
WALAYAR	7083	19	0	3064	28	0	40	2	25494	298722	334452
VAZHIKADAVU	1029	0	0	0	0	0	0	0	3712	0	4741
MUTHANGA	744	336	319	0	8708	19	4910	533	8625	16909	41103
TOTAL	41417	444	4468	3141	19386	4837	4950	644	48438	751502	879227

### Appendix 6

#### Major countries of timber wood export from Kerala

Country	(m <sup>3</sup> roundwood)	
	Quantity	% to total
USA	115.33	25.39
China	109.86	24.19
UAE	54.65	12.03
Japan	43.09	9.49
South Korea	23.54	5.18
Other Countries*	107.76	23.72
Total	454.25	100

\*Italy, Spain, Saudi Arabia, Sri Lanka, Canada, Israel, Germany, Australia, Malaysia, Indonesia, Czech Republic, Twinsburg, UK, Mauritius, Iraq, Sweden, Philippines, South Africa, Zambia, Vietnam, Brazil, New Zealand, Thailand, Myanmar, Cuba, France, Kuwait and Finland.

### Appendix 7

#### Major species of timber wood exported from Kerala to other countries

Species	(m <sup>3</sup> roundwood)	
	Quantity	% to total
Rosewood	368.85	81.20
Rubberwood	68.36	15.05
Teak	0.00	0.00
Ebony	0.00	0.00
Beechwood	10.45	2.30
Othertimbers	6.59	1.45
Total export	454.26	100.00

**Appendix 8**

**Timber wood export trend**

Year	Timber wood (Quantity in kgs)								Total
	Rose wood	Rubber wood	Teak	Mahogany	Ebony	Other timbers	Beech wood	Coconut wood	
2006-07	710709	266745	13413	7478	17252	421739	0	0	1437336
2007-08	747968	298772	17729	250	17674	225561	0	0	1307954
2008-09	847948	1137344	11526	0	16081	232928	0	0	2245827
2009-10	637004	1816174	3000	0	4834	127682	0	0	2588694
2010-11	638052	1566734	5010	348	3413	43269	0	0	2256826
2011-12	674117	376127	0	0	19704	67786	15101	17000	1169835
2012-13	674418	136973	0	0	2145	428147	7022	0	1248705
2013-14	836872	11150	0	0	1128	77593	49721	0	976464
2014-15	878221	162750	0	0	0	15700	24889	0	1081560

Appendix 9

Timber wood movement (species-wise) through forest check post (import)

CHECK POST	Quantity (m <sup>3</sup> round wood equivalent )										
	Species										
	Teak	Rose wood	Eucalyptus	Teak poles	Silver oak	Anjily	Venga	Jack wood	Other timbers	Packing case	Total
KOTTAVASAL	6707	0	0	0	0	0	0	0	46922	0	53629
BODIMET	0	0	2	0	0	0	0	0	0	0	2
WALAYAR	10101	0	0	0	1088	0	12628	0	101794	0	125610
PARASALA	3048	0	0	0	0	0	0	0	26500	0	29548
BAVELI	19	15	1603	0	17	0	0	0	1372	0	3026
CHINNAR	0	0	0	0	0	0	0	0	0	0	0
PAZHUR	0	0	13	0	8	0	0	3	507	0	531
IRITTY	13	266	17	0	47	0	0	154	2842	0	3340
VAZHIKADAVU	36	0	0	0	0	0	0	0	2588	0	2624
MUTHANGA	97	0	2727	0	0	0	0	63	1999	0	4885
TOTAL	20020	281	4361	0	1160	0	12628	220	184524	0	223195

Appendix 13

Species and source of timber wood used in different wood based industries during 2014-15

Industry	Species being used	Species name	Sources
Construction timber (Sawmills)	Jack	<i>Artocarpus heterophyllus</i> Lam.	Home gardens import abroad , forest
	Teak	<i>Tectona grandis</i> L. f.	
	Eucalyptus	<i>Eucalyptus grandis</i> Hill ex Maid.	
	Paduak (Burma)	<i>Pterocarpus macrocarpus</i> Kurz	
	Pyncoda	<i>Xylia dolabriformis</i> Benth.	
	Purple heart	<i>Peltogyne</i> spp.	
	Greenheart	<i>Chlorocardium rodiei</i> (Schomb.) Rohwer, H.G.Richt. & van der Werff	
	Merbau	<i>Intsia bijuga</i> (Colebr.) Kuntze	
	Billinga (Cameron)	<i>Nauclea diderrichii</i> (De Wild.) Merr.	
	Sal	<i>Shorea robusta</i> Gaertn.	
	Kusia (Trade Name)	<i>Nauclea diderrichii</i> (De Wild.) Merr.	
	Mora timber	<i>Mora excelsa</i> Benth.	

Industry	Species being used	Species name	Sources
	Babul	<i>Acacia nilotica</i> (L.) Delile	
	Mahagani	<i>Swietenia macrophylla</i> King	
	Palkaini	<i>Briedelia retusa</i> (L.) A. Juss.	
	Unnam wood	<i>Grewia tiliifolia</i> Vahl	
	Venga	<i>Pterocarpus marsupium</i> Roxb.	
	Jathi	<i>Myristica fragrans</i> Houtt.	
	Manjiyam	<i>Acacia mangium</i> Willd.	
	Njavel	<i>Syzygium cumini</i> (L.) Skeels	
	Konna	<i>Cassia fistula</i> L.	
	Kattadi	<i>Casuarina equisetifolia</i> L.	
	Ayini plavu	<i>Artocarpus hirsutus</i> Lam.	
	Pooperathi	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	
	Urippu	<i>Hopea parviflora</i> Bedd.	
	Poovarasu	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	
	Karivelakalm	<i>Acacia ferruginea</i> DC.	
	Neam	<i>Azadirachta indica</i> A.Juss.	
	Unnam	<i>Grewia tiliifolia</i> Vahl	
	Coconut wood	<i>Cocos nucifera</i> L.	

Industry	Species being used	Species name	Sources
	Rubber wood	<i>Hevea brasiliensis</i> (Willd. ex A.Juss.) Müll.Arg.	
Packing case	Rubber	<i>Hevea brasiliensis</i> (Willd. ex A.Juss.) Müll.Arg.	Estates, Home gardens, Import from other States
	Vatta	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	
	Mavu	<i>Mangifera indica</i> L.	
	Cashew wood	<i>Anacardium occidentale</i> L.	
Plywood	Rubber wood	<i>Hevea brasiliensis</i> (Willd. ex A.Juss.) Müll.Arg.	Estates, Home gardens, imports from other states and abroad.
	Vatta	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	
	Eucalypts	<i>Eucalyptus grandis</i> Hill ex Maid.	
Pulpwood	Eucalypts	<i>Eucalyptus grandis</i> Hill ex Maid.	Forests, Import from neighbouring states
	Acacia sp	<i>Acacia</i> sp.	
Furniture	Teak	<i>Tectona grandis</i> L.f.	Forests, Home gardens, Estates, Imports from other states and abroad.
	Jack	<i>Artocarpus heterophyllus</i> Lam.	
	Rosewood	<i>Dalbergia latifolia</i> Roxb.	
	Purple heart	<i>Peltogyne</i> sp.	
	Rubber wood	<i>Hevea brasiliensis</i>	
	Mahagani	<i>Swietenia macrophylla</i> .	
	Palkaini	<i>Briedelia retusa</i>	

Industry	Species being used	Species name	Sources
	Unnam wood	<i>Grewia tiliifolia</i> Vahl	
	Venga	<i>Pterocarpus marsupium</i>	
	Jathi	<i>Myristica fragrans</i> Houtt.	
	Manjiyam	<i>Acacia mangium</i> Willd.	
	Njavel	<i>Syzygium cumini</i> (L.) Skeels	
	Konna	<i>Cassia fistula</i> L.	
	Kattadi	<i>Casuarina equisetifolia</i> L.	
	Ayini plavu	<i>Artocarpus hirsutus</i> Lam.	
	Pooparathi	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	
	Urippu	<i>Hopea parviflora</i> Bedd.	
	Poovarasu	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	
	Karivelakalm	<i>Acacia ferruginea</i> DC.	
	Neam	<i>Azadirachta indica</i> A.Juss.	
	Unnam	<i>Grewia tiliifolia</i> Vahl	
	Coconut wood	<i>Cocos nucifera</i> L.	
	Acacia	<i>Acacia</i> sp.	
	Silver Oak	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	
	Rose wood	<i>Dalbergia latifolia</i> Roxb.	

Prepared by  
G. S. S. S. S.