

Sustainable Utilization of Timber Resources in Sri Lanka

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Introduction

Twenty years ago, the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, identified the major challenges facing sustainable forest management including the need to reduce deforestation and forest degradation through ensuring the sustainability of forest resources, to protect and conserve biological diversity and ensure the sustainable use of the genetic resources, and to enhance the full valuation of forest goods and services.



There is growing acceptance that forest resources and timber resources should be managed to meet the social, economical, ecological, cultural and spiritual need of present and future generation. It can be understood that sustainable forest management is the essential basis for sustainable utilization of timber resources. In Sri Lankan context, The historical pattern of forest utilization began from forest exploitation up to the 1880, after that forest management based on timber

harvesting from 1880 to mid 1950s, followed by peak and decline of timber harvesting from mid 1950s to early 1980s, and finally consolidation from mid-1980s. After a long period of time, now steps are being taken now to manage the Sri Lankan forest resources for sustainable development of the country. This need becomes even more important in the present context where there is a continuous increasing demand for timber resources caused by increasing population, underutilization and industrialization. In this scenario all the remedial measures have to be taken simultaneously to manage forest resources and to utilize timber resources in a sustainable manner.

In 1881, 84% of Sri Lankan land area was covered by natural forest, but today around 6-7% (about 106000 m³) of national timber demand which is around 1.6 million m³, is met with imported timber. As far as foreign exchange is concerned, in 2011, Sri Lanka spent Rs: 6,751,401,928 to import timber and timber base products. Meanwhile Sri Lanka has earned Rs:5,591,907,461 as foreign exchange by exporting the timber and timber base products. This earning is below than the cost incurred for timber importation. The foreign trade account deficit is Rs:1,363,343,295.

Forest Department is managing around 90000 ha of forest plantation in Sri Lanka, out of which average 1100 ha of plantation are released annually to State Timber Corporation for harvesting. The average

timber yield of this harvesting is about 100000 m³ which contribute to shares 7-8% of national timber demand. If these plantation can be managed in sustainable manner with 30 years rotation and annual harvestable area of 3000 ha. There is a good potential to harvest around 500000 m³ of timber annually. It is obvious that with this increased timber supply, Sri Lanka becomes a country with self sufficient of timber. In order to sustain his favorable situation, the timber supply from other resources in Sri Lanka which discussed in this paper, should be managed in sustainable manner. It is understandable that not only sustainable forest management but also efficient and scientific timber utilization should exist in operation to achieve the sustainable development goal. Furthermore proper timber utilization mechanism should be established base on sustainable principle at all the level of timber processing from timber harvesting to finished product. It is no doubt , every body's expectation is that well qualified and experience personnel of Forest Department and State Timber Corporation (STC) will devote to manage this valuable forest resources for the sustainable development of Sri Lanka.

1. Timber Resources in Sri Lanka

The timber resources in Sri Lanka consists of the forest timber resources and the non-forest timber resources.

1.1 The Forest Timber Resources

- 1.1.1 Natural forest
- 1.1.2 Man-made forest plantation

1.2. Non-Forest Timber Resources

- 1.2.1. Contribution of home garden for timber supply
- 1.2.2. Contribution of Rubber and Coconut plantations to timber supply.

1.1 The Forest Timber Resources

1.1.1. Natural Forest

Natural forest cover in 1999 comprised of 3,100 ha of montain forest; 65,792 ha of sub-montain forest; 124,340 ha of lowland rain forest; 221,977 ha of moist monsoon forest; 1,027,544 ha of dry monsoon forest; 18,352 ha of Dry zone riverine forest; 9,530 ha of mangrove and 471,583 ha of Sparse forest amounting to 1,942,219 ha. It is reported that total forest cover has been decreased by 0.8 % in last decade .The low land rain forest has , an average of 205 stems/ha of at least 10cm dbh (diameter at breast height) and this forest contain an average 126m³/ha in trees of more than 30 cm dbh. The dry monsoon forest and the moist monsoon forest have , an average of 123 stems/ha and 152 stems/ha at least 10cm dbh trees respectively . These forest contain an average 21 m³/ha and 39 m³/ha of more than 10 cm dbh respectively. It can be roughly calculated that the low land rain forest contain 15,666,840 m³ of timber. The dry monsoon forest and the moist monsoon forest have 21,578,424 and 8,657,103 cubic meters of timber respectively. At present these natural forest are being managed for the conservation purposes.

Some of these forests may be managed to obtain timber using suitable harvesting methods after comprehensive study. Forestry Sector Master Plan (FSMP-1995) made projection of procured supply of construction and industrial wood from closed canopy forest and sparse forest are 68200 m³ and 13200 m³ respectively. However in 1989 due to moratorium for logging of natural forest was imposed considering need of conservation. Thereafter the contribution from natural forest towards the country's timber demand was legally stopped however illicit harvesting is still been carried out in small scale.

1.1.2 Man-made Forest Plantation

Forest plantation in Sri Lanka consists of mainly forest plantations belong to Forest Department (FD) and companies under ministry of plantation industries. According to five year forestry management plan prepared by 21 said companies, have reported that they have 16463 ha of total forest plantations which contribute to national timber demand by providing fuel wood, wooden electrical transmission poles and Railway sleepers, sawn timber etc.

From recent past, several private companies have started Teak ,Mahogany and White Sandal wood reforestation programs attracting public to invest in their business. This private sector participation for reforestation may have positive impact on Sri Lankan's forestry sector development if they performed well . The total forest plantation under forest department is given in Table 1.

Table 1: Total Forest Plantations under Forest Department in 2012 May

Name of tree species	Hectares	Name of tree species	Hectares
1. Teak	31,678	10. Kohomba	1,011
2. Pinus spp	15,924	11. Alastonia	116
3. Eucalyptus grandis	6,813	12. Kaya	587 +
4. Eucalyptus microcoris	1088	13. Jak	110
5. Eucalyptus teraticonis	1219	14. Hora	170
6. Eucalyptus camaldulensis	12152	15. Indigenous and other	5033
7. Mahogany	4997		
8. Acacia	3924		
9. Albizia	392		
Total			85,217

Table 2: Age Class Distribution and Growing Stock of Teak, Eucalyptus and Pinus species in Forest Department Plantation.

Age class	Teak		Eucalyptus		Pinus spp	
	Extent (ha)	Total volume (m ³)	Extent (ha)	Total volume (m ³)	Extent (ha)	Total volume (m ³)
0 - 5	8580		4532			
6-14	327	11,510	68	2176		
15	779	35,445	651	26040		
16 -20	386	15,054	1584	138600	249	28286
21 -25	297	13,365	5993	692192	1272	139387
26-30	1229	54137	7520	1368640	4978	627228
31 and 31 +	14735	559,930	1920	299520	3500	474250
Total	26333	689,441	22268	2527168	9954	1269152

Source: APFSOS 11: Sri Lanka/Forest Department

Table 3. shows the quantity of timber harvested by State Timber Corporation (STC) from these plantation in the last 4 years.

Table 3: Timber harvested by STC from FD plantation.

Name of the species	2008		2009		2010		2011		Average volume m ³ /ha
	Harvested area(ha)	Harvested volume (m ³)	Harvested area(ha)	Harvested volume (m ³)	Harvested area(ha)	Harvested volume (m ³)	Harvested area(ha)	Harvested volume (m ³)	
Teak	484	28,640	625	32,559	562	28,374	558.5	26,564	52
Pinus spp	49	25,480	32	26,252	152	44,824	83.3	50,418	464
Eucalyptus spp	201	32,500	193	41,688	140	23,615	152.7	6,649	152
Mahogany(thinning)	208	2,705	174	2,266	127	1,654			13
Total	942	86,325	1,024	102,765	886	98,486	794.5	83,631	

Source: State Timber Corporation

According to Forestry Sector Master Plan (FSMP-1994) it has been projected to supply 470,400 m³ of industrial timber from forest plantation in 2012 which consist of 249,100 m³ of conifer, 131,700 m³ of eucalyptus- 81,300 m³ of teak - 4,700 m³ of mahogany and 3,600 m³ of others. When analyzing present Age class distribution and growing stock of Teak, Eucalyptus and Pinus species in Forest department plantation , there are over mature and mature plantations having with of 614,067 m³ of teak stock, 1,668,160 m³ of eucalyptus stock and 1,101,478 m³ of pinus stock (see table 2). This 3,383,705 m³ of timber stock will have to be utilized in sustainable manner aiming the development objectives of Sri Lanka in next decade. However present timber supply from forest plantation is much bellow than FSMP projected figures. Apart from this, there is a scarcity of long length construction timber in Sri Lanka. At present, the construction timber produced by up country *Eucalyptus grandis* and *Eucalyptus microcoris* are not adequate because major portion of volume (10000 m³) are being used to manufacture of Railway sleepers. Dry zone *Eucalyptus camaldulensis* plantation are not producing adequate amount of industrial timber as expected. This badly effects to fulfill the timber demand of Sri Lankan construction industry because *Eucalyptus camaldulensis* plantation has occupied 12,152 ha of land from the total forest plantation.

Teak and Mahogany are preferably used for furniture, joinery , decorative and parquet industries as super luxury and luxury timber respectively. The production of teak by State Timber Corporation in recent past was adequate to meet the demand of Sri Lankan market. In this context, the species composition of timber plantation and plantation area of particular timber species will have to be matched with timber demand at market and its technical specification too. Hence this aspect can be rectified when and where plantation establishment is planned.

Production and Sale values of some timber species produced by State Timber Corporation in 2011 is given in **Annexture 1**

According to **Annexture 1**, State Timber Corporation is marketing few non forest plantation timber species other than main plantation species. This is mainly due to not extraction of natural forest at the moment and many development projects located in sensitive areas of forest land are also discouraged or restricted on the ground of environment reasons.

Table 4: Production of Timber and Timber Products by the STC from 2007 to 2011

Year	Logs (m ³)	Round poles (nos)	Fence post (nos)	Tran.Poles (nos)	Sleepers (nos)	Sawn Wood (m ³)	Fire wood (m ³)	Furniture (Rs.)
2007	120576	190173	99273	66502	95273	4918	85412	55700000
2008	94429	99908	42938	52552	134095	5887	84661	65800000
2009	91416	106777	68439	77656	163484	5384	75985	57800000
2010	137317	126065	79858	19472	133822	5519	118544	83400000
2011	138632	113584	77135	31863	66699	3753	97838	140205788

Source: Annual reports of State Timber Corporation

1.2. Non-forest timber resources

Even though natural forests and forest plantations have the potential to meet country's total timber demand, most of this forest resources is either in inaccessible, protected area or felling is banned. Therefore, around 70% of the industrial timber supply comes from home gardens, rubber and coconut plantations, and trees planted along farm boundaries, on roadsides, and in urban areas.

1.2.1. Contribution of Home Gardens towards National Timber Demand

The extend of home gardens in Sri Lanka in 1983 was 781000 ha compared to 858500ha in 1993. There are more than 400 woody species planted and naturally regenerated in home gardens. Average tree density of home garden in dry zone and wet zone have been recorded 125 trees per hectare and 260 trees per hectare respectively. Three main multi purpose tree species namely coconut, Jak and Mango would produce 38 percent of the total timber volume produced in home gardens. Five exotic timber species namely mahogany, Alstonia, Albizzia, Eucalyptus and Teak contribute 30 percent of the total timber volume produced in home gardens. Home gardens contribute 40 percent of Sri Lankan timber demand but the major portions of timber produced from home gardens are less durable and low quality timber which can not be used for structural purpose of construction industries. Home gardens will produce an average of about 0.95 m³ of saw logs and 0.5 m³ of poles per hectare per year.

Most common and valuable timber species grown in home gardens according to a study conducted by Mr: K.P.Ariyadasa (2002), Conservator of Forest, are listed in Table 5. Average price and volume of log and sawn timber marketed by State Timber Corporation are given in annexure 1.

The log price mentioned in annexure 1, varies with mid girth classes of log and log grading.



Table 5. Most Common and Valuable Timber species Found in Home Gardens

Botanical Name	Density of Timber at 20% m.c. (kg/m ³)	Uses of Timber (see the notes)	Botanical Name	Density of Timber at 20% m.c. (kg/m ³)	Uses of Timber (see the notes)
Cocos nucifera	480-560	2, 13	Melia dubia	400	10,14(a)
Hevea brasiliensis	640-720	9,10,13	Chloroxylon swietenia	960-1040	1,7,8,9,13,14
Artocarpus heterophyllus	640	1,2,3,5,6,7,8,9,12,13	Grevillea robusta	560	4,5,7,9,13,14
Swietenia macrophylla	560	7,8,9,10,11,13,14	Berrya cordifolia	800-880	1,2,3,4,5,6,7,9,10,11,13,14
Alstonia macrophylla	640	15, 5	Toona sinensis	560	13,14a,16
Mangifera indica	480-560	10	Dipterocarpus zeylanicus	800-960	1,2,3,4,5,7,9
Albizia molucana	480-560	16	Vitex altissima	880-960	1,2,3,4,5,6,7,9,11,12,14
Eucalyptus microcoris	850-900	1,2,3,4,5,7,9,11,,14	Terminalia arjuna	720-800	1,2,4,5,6,7,9,11,12,13,14
Eucalyptus grandis	550-650	2,3,4,5,13	Pterospermum canescens	640	4,5,7,8,9,10,12,14
Tectona grandis	720	2,3,4,5,7,8,9,10,11,13,15	Ardina cordifolia	720	2,4,5,7,8,9,13,14
Azadirachta indica	720	2,3,4,5,7,8,9,13,14,15	Albizia odoratissima	800-880	1,2,3,5,7,8,9,11,13,14
			Pericopsis mooniana	800	13,14

Notes: (1)Beams, (2)Rafters, purling, Ridges, Hips, (3)Ceiling joints, wall plates, (4) Reapers, (5) Ceiling spacers, (6) Fascia Boards, (7) Door and window frames, (8) Door and window sashes, (9)Partition frames, (10) Ceiling Board (11) Floor Board, (12) Weather Board, (13) Furniture, (14) Paneling(14a) and Decorative work, (15) Transmission pole.(16) Packing cases

1.2.2. Contribution of Rubber and Coconut Plantations to Timber Supply

1.2.2.1. Contribution of Rubber Plantation

There are two sectors in Sri Lankan rubber wood plantation. Estates rubber plantation sector which represents 66,076 ha of more than 20 hectares of plantation and small holding rubber plantation which represents 48,655 ha of less than 20 hectares of plantation. The total rubber plantations consist of 114,713 hectares of land in Sri Lanka. The 16 estates represent 58 percent of total rubber plantation in Sri Lanka (DCS 2002). The Ministry of Plantation Industry has begun a rubber development program in 2006 to increase the present extent of 116,000 ha to 180,000 ha in 2020. Rubber plantation will produce an average of about 0.24 m³ of peeler logs and 65 m³ of saw logs for every hectare felled at the end of a 25 years economic lifespan. It can be projected that Rubber plantations will supply approximately 1,038,180 m³ of saw logs in 2020 with this new planting program. This additional timber supply will help to narrow down the gap between supply and demand of timber under increasing population in future. Rubber wood is moderately hard and heavy with a density of 640 to 720 kg/ m³ at 15% moisture content. Rubber timber has higher shear strength value. Timber is suitable for furniture being reasonably hard-wearing, and attractive in appearance apart from the occasional unsightly black stain.

1.2.2.2. Contribution of Rubber Plantation

There are 394,800 ha of coconut plantation in Sri Lanka (Census of Agriculture 2002) which will produce an average of about 49.4 m³ of saw logs for every hectare felled at the age of at least 50 years. It is possible to obtain 0.5 to 0.6 m³/tree. It is estimated that average sawn timber yield per tree would be 0.2-0.23 m³. The density of coconut stem vary from 900 kg/ m³(outer wood near base) to 150 kg/m³ (center wood near top). Drying times required are one month for 25 mm thick timber. Treatment with boron by diffusion is possible for coconut wood. High density wood is extremely strong and can be used as a structural material like roof rafter, paneling. High density wood will give a good finish but furniture seems to be very heavy.

It can be projected that Coconut plantations have supplied approximately 211,000 m³ of sawlogs in 2010. This continuous timber supply is under threat due to clearing of Coconut plantation for some development work. We must not forget that Coconut plantation contribute 15% of national timber demand.

2. Imported and Exported Timber

As far as timber utilization is concerned ,it is very much important to analyze the statistics of import and export of timber and timber based products. This data clearly shows that what can be done for sustainable development of timber industry in Sri Lanka and further more it indicates the requirements of timber consumers , weakness ,strength and potential area of Sri Lankan timber industry. In 1993, 29,000 m³ of timber were imported to Sri Lanka which represented 5% of total sawn timber demand. According statics of Sri Lanka Custom and international Harmonized Serial (H.S) code under section ix, chapter 44 , wood and articles of wood; wood charcoal, the CIF and FOB values of imported and exported timber or timber based products of Sri Lanka in 2011 are summarized in Annexure 2.

According to custom statistics, in 2011 Sri Lanka has imported and exported various types of wood items amounting CIF value of Rs: 6,955,250,756 and FOB value of Rs: 5,591,907,461 respectively . In 2006, Sri Lanka has imported 104,082,012 Kg of sawn timber of Rs:2,084,454,637 CIF value including large quantity (15692136 kg) of coniferous timber of Rs:239,838,484 CIF value. This figure has come down to 67,592,301 kg of Rs:2,311,358,648 CIF value in 2007 after completion of construction works of Tsunami affected areas. We have exported 409764 kg of Rs: 26,470,508 FOB value of sawn timber or same category in 2007. Quantity of sawn timber in custom statistics is given in kilograms as a unit therefore it is difficult to calculate volume of timber when we do not know density and moisture content of timber. In 2011, Sri Lanka has imported mainly sawn timber, along with other finished products. Sri Lanka has imported Rs: 3,756,081,378 CIF value of sawn timber. The expenditure to import of sawn timber has been increased by 62% from year 2007 to 2011. The Second highest expenditure incurred to import Fiberboard of wood or other ligneous materials followed by Plywood, veneered panels and similar laminated wood.(see Annexure 2)

Main timber items that earned highest export income in 2011 is fiberboard of wood or other ligneous materials followed by tools, tool bodies etc. and wood charcoal, shell etc. (see Annexure 2)

Most of the timber imported comes to Sri Lanka under the category of "other" of 44.071 HS code viz but not under their Botanical or commercial name. This encourage some importers to import and market low grade timber which are bellow the accepted standards. As the buyers are not aware of the standard quality of timber or not able to identify the timber species, they tend to get mislead easily.

This prevailing situation can be minimized if standard and regulation for timber market is introduced. At the moment STC have been authorized to issue timber identification report and timber quality certification reports when requested by interested parties.

3. Supply, Consumption, and Demand for Timber and Timber Based Product Wood consumption per Capita.

The estimates of forest product demand are based on certain explicit and implicit assumptions on driving forces of demand, GDP and population have been adopted as basic economic/demographic shifters. It was assumed that population and GDP in 2005 is 20.06 millions and 14,615 USD millions respectively and it would increase to 21.86 millions and 22,266 USD millions in 2015 respectively (FSMP-1995)

In 2008, Sri Lankan timber consumption under any category of industrial wood, sawn wood and pulp and paper are lower when compared with most of other countries. In Sri Lanka, sawn wood and pulp and paper consumption per capita in 2008 is 35 m³/1000 persons and 13,600 kg/1000 persons respectively.

87% of the household sector had consumed fuel wood and other bio energy in 1992. According to energy composition in industry, the fuel wood represents 49%. The tea industry is the main consumer of fuel wood of about 43%, followed by hotels and eating house (16%), the brick and tile industry (14%) and Bakery (9%). Inefficient utilization of fuel wood can be found elsewhere these resources are undervalued. We have surplus of fuel wood supply as a whole but some districts eg: Nuwara eliya, Gampaha, Badulla and Jafna are facing fuel wood shortage. The gap between surplus and deficit is difficult to narrow down due to high cost of fuel wood transportation.

Roundwood Consumption by Supply Source

Total consumption of round wood in 2008 was approximately 1.975 millions m³, out of which almost 100% industrial logs (1.531 millions m³) was used to convert into the sawn timber. This conversion of logs into sawn timber should be taken to consideration when country's total timber requirement is calculated. The estimated share of wood supply in 2010 can be given as bellow: This estimation was based on imported timber data of custom, STC timber production, FSMP data in 1994 and our survey findings.

The estimated share of saw log by supply source in 2010

The source of timber supply	Volume of timber (m ³) (000)	% of share
Home gardens	642	40.6
Rubber plantation	270	17.1
Coconut Plantation	231	14.6
State Timber Corporation	122	7.7
State sector	77	4.8
Others	80	5.1
Unsustainable timber source	50	3.2
Imported timber	106	6.7
Total	1578	

It is time to review the projections made by Forestry Sector Master Plan (FSMP) in 1994, 14 years ago on timber supply and demand in Sri Lanka. It has projected to supply 345,000 m³ from forest plantation in 2007. However the supplied amount in 2007 from forest department plantation is around 122,000 m³ which is far below expected yield according to FSMP (1994) projection.

4. Timber Industry in Sri Lanka

Sri Lankan timber Industry consists with Sawmilling, Sawn wood processing Industries, (a) Furniture (b) Packaging (c) other wood products (d) Timber Seasoning and Impregnation.

Wood-based Panels Industries (a) Plywood (b) Fibre Board (c) Particle Board), Pulp and Paper Industries, Wood and Wood based Industries eg: Safety Match and Boat Building)

Sri Lankan economy and population have increased during the last decade. This has resulted in increase of demand for sawn wood, panels, paper and other industrial products. The biggest challenge faced by the timber industry is that there is no guaranteed continuous supply of wood resources which need to feed existing industries and to encourage new investment in this industry. In addition to this, the other weakness reflected are, lack of stable policy direction, excessive regulation of transport of wood and finished product, bad image of the industry, lack of industry information, inadequate management technology and skill. Even under this situation, at present timber industries consume around 1.57 millions of m³ of log for different usage annually.

5. Past and Present of Sri Lankan Timber based Enterprises

The increased construction activities in Sri Lanka have created an increased demand for timber. With the conservation of natural forest for environmental reasons resulted in reduction of local supply of timber. The increased demand for timber has to be met through other means of imported timber or man made forest. Statistics published by authorities doest not reveal the real picture of supply source because part of timber supply still comes from illegal and unreported manner. This scenario is well explained by the census conducted in 1995 that shows, majority (75%) of timber based enterprises were not registered. However this situation has been improved now.

According to Forest Department report the registered number of timber based enterprises have increased from 4208 in 1994; 12734 in 2006 and 16200 in 2010 (see table 6). During the last decade, the largest number of timber based enterprise are remained in the Colombo, Gampaha and Kurunegala districts.

Table 6: Total Number of Registered functioning Timber Based Enterprises in 2010.

Forest Division	Saw Mills	Timer Depots	Mechanized Carpentry Sheds	Carpentry Sheds	Furniture Shops	Fire Wood Depots	Total
Colombo	167	527	486	52	192	7	1431
Gampaha	216	405	389	51	281	10	1352
Hambanthota	152	165	439	114	389	51	1310
Kalutara	178	223	226	15	68	8	718
Kurunegala	282	243	569	62	522	42	1720
Other 16 Districts	1424	1754	2591	902	2678	320	9669
Total	2419	3317	4700	1196	4130	438	16200



According to census report , Colombo and Gampaha lead the timber stock among the other districts by 23% and 19% respectively. Census timber stock comprise with Albizia (17%), Jak (9%), Coconut (8%), Rubber (7%), Ginisapu (6%), Lunumidella (6%), Mango (6%) and Teak, Eucalyptus and Alstonia each by 3%. The greatest majority of available log timber stock are of class 11(12%) and class 111(63%). The study reveals that out of available 89000 m³ of timber stock, 55% and 45% are found in form of logs and sawn timber respectively. 32 different dimensions of sawn wood are used widely for three most important purposes, namely manufacture of furniture (19%), door/window (38%) and roofing materials (42%). Larger portions of total supply of timber come from wet zone which is needed to be treated with preservatives to improve its durability. For that, It is necessary to develop cost effective treating methods. Otherwise added cost for preservation exceed the cost of good timber species available.

It is time now to conduct another study of this nature to review available timber resources and pattern of timber utilization which might have been changed during the last decade due to popularizing exotic timber species (Teak, Mahogany, Eucalyptus and Alastonia species) and existing demand for Rubber wood and other timber raw materials created by Medium Density Fiber board manufacture.

Timber is one of the oldest building material used by man. Sri Lankan timber species consist of several hundred different wood species, some of which are least known and each species possesses different wood properties according to its kind. People in Sri Lanka, in the past, used popular timber species such as Satin (*Chloroxylon swietenia*), Palu (*Manilkara hexandra*) and Milla (*Vitex altissima*) etc when it was a commodity very widely and freely available. This situation was in existence even before colonization. However today we depend mainly on plantation species and some timber species in home gardens which are not durable as hard wood in dry zone. Therefore right use of timber based on timber technology is very helpful to achieve the goals of sustainable utilization of timber resources in Sri Lanka. In this direction, Timber Technology Training Institute (TTTI) of State Timber Corporation has launched a **Diploma course for Sustainable Management of Forest Plantation**.

6.Choice of timber for various purposes

Timber resources in Sri Lanka will have to be used efficiently. Every species, grade and quality should be used in such a manner. Their characteristics and properties are employed in the best way of timber utilization. The competent and efficient use of timber to manufacture wood based products or sawn timber for construction, depends on the selection of the best timber depending on the task. Basically



there are two aspect to the choice of timber . One aspect is selection of the most appropriate species for the given set of environment and stress conditions; second aspect is to obtain the correct grade or selecting the appropriate specification for the wood of any one species. When selection of timber for a particular purpose, not only its technical performance but also its cost, size and availability should be concerned. The technical performance of a timber lie on its durability, movement, strength, stiffness and toughness, permeability, ease of processing and appearance. The importance of these properties vary with the task the timber has to perform. Table 5: show the availability of some timber species in Sri Lanka, its density and uses.

Sustainable timber is harvested in such a way that each tree removed is replaced by another tree, either naturally grown or planted. Right use of timber results to delay the forest to be harvested for compensating the timber demand.

6.1 Importance of timber identification for timber utilization

Wood identification is of value in a variety of context eg: commercial, forensic, archaeological and paleontological. One means of conserving tropical forest is ensuring that any tree cut is properly used, and its full value realized, thereby reducing waste, and resulting in fewer trees being cut to meet demand. Timber identification is an integral part of timber grading specially with a high species diversity of tropical forest. Furthermore proper processing of wood , especially drying, depends upon correct species identification. In timber trade, customs officers need to know whether logs, timber, or wood products are correctly labeled so that tariffs can be properly assessed and trade regulation enforced. STC have been authorized to issue timber identification and timber quality reports when requested by interested parties. These reports are issued by well qualified officers in Research division of State Timber Corporation.

6.2 Maximum utilization of Timber

As far as timber utilization is concerned, it is also necessary to identify how and where valuable wood

is wasted from the time a tree is felled in the forest till it is brought to a processing factory. The wasting of timber due to harvesting operation have to be minimized to get maximum expected yield from a tree. , The logging waste vary with harvesting method, harvesting condition and nature of defect in the timber and so many other reasons. In Sri Lanka upcountry eucalyptus has higher logging waste (around 15%) than low land teak plantation(5-10%). Residues produced by various harvesting activities like cutting branch wood, tops, and trimmed ends at stump site needs to be absorbed for a suitable industries rather than using for fuel wood. Wastage of timber can be minimized by using proper machines and adopting new technology at each and every value addition process eg: saw milling and wood processing industry. The study carried out by M.G.Mohamed Thariq (2010) on recovery rate for mahogany logs with newly introduced saw mills machines in State Timber Corporation showed that the average volume of wood and bark were 85.8% and 14.2 % respectively and wood volume recovery was 55.5%. The average volume of out side slabs, firewood, final off cuts and saw dust were 6.6%, 7.1%, 9.3%, 3.3 % and 9.6% respectively.

7. Timber seasoning and preservation in Sri Lanka

As discussed earlier, at present the majority of timber supply come from home gardens and wet zone in Sri Lanka consist of less durable timber which need to be properly handled to get maximum benefit out of them. The service life of timber can be prolonged by using proper seasoning techniques and adequate preservative treatment. This longer serviceable life of timber would result in lesser quantity of timber needed to fill the timber demand.

7.1. Timber seasoning

Timber is a hygroscopic material. It shrinks or swells with changes in the moisture content of the environment. The process of timber evenly drying under controlled conditions is referred to as seasoning. It could be mentioned that majority of timber marketed in this country is either unseasoned or partially seasoned. For this reason it is advisable for the user to plan ahead, say 3-4 months to ensure that the timber is seasoned for use and in a well dried state, under local conditions depending on species and atmospheric conditions. the equilibrium moisture content will be any thing from 12-18%. This equilibrium may be attained by easily drying timber in about 2 months for 1" plank. But the period may be very much longer for dense timber such as Satin, Palu.

State Timber Corporation operates 6 Kiln seasoning plants of 110 m³ capacity which are used to season the timber used for furniture manufacturing. A few furniture manufactures and timber dealers also own kilns but these kilns operate mainly for their private use . It is somewhat difficult to prepare seasoning schedules to guide the user due to variation between species. It is quite evident that if the moisture content of the timber is kept bellow 20% , the timber become dimensionally stable, more strong and less prone to insect and fungi attack. If people are educated to use the seasoned timber which definitely help to achieve the sustainable timber utilization objective.

7.2.Timber preservation

The principal causes of deterioration of wood in service are fungal infection, termite and other insect or marine-borer attack, mechanical failure, and fire. The resistance of timber to these agents may be increased by applying suitable chemical preservatives. The selection of the most suitable chemicals and method of treatment is of the utmost importance. When selecting wood preservatives following properties are useful as a basis for comparison: Highly poisonous to fungi and insect, readily penetrating into wood, chemically stable, Easy to apply, cheap and readily available, Non-corrosive to iron, fire

retardant. It is a common question asked by people "how is durability of timber ". Durability of the particular species cannot be expressed meaningfully without a knowledge of the situation in which the timber is going to be used. Many species of wood which are not durable when exposed to weather , become perfectly durable when kept under shelter.

The popular preservative treatment in current use in Sri Lanka are pressure treatment with creosote, pressure treatment with copper chrome arsenate preservatives(CCA), diffusion treatment with boron or mixtures containing boron and low pressure treatment with light organic solvent preservatives (exposed building timber and joinery). CCA preservative was used to treat Transmission poles and sawn timber by STC until Import and use of CCA was prohibited recently.

Creosote preservatives is a mixture of many organic compound obtained during the distillation of coal tar. Creosote has good penetrating quality, toxic or repellent to most wood destroying organism and protect wood from physical weathering. STC operates 3 creosote impregnation plants , capacity of each dia:1.8 m x length 15m to treat Railway sleepers and Electric transmission poles for Railway Department and Electricity Board respectively. The most common diffusion treatment is boron because this needs minimum equipment and cost. In addition to mixture of boric acid and borax, fungicide to be added to control mould growth during diffusion especially when pine and rubber sawn timber are treated. Freshly sawn timber will have to be dipped in a bath of the correct chemical concentration. The performance of treated timber vary with methods of treatment, type of , retention of preservatives, the species of wood, the climate and the condition of use. Therefore knowledge of timber preservation will have to develop in Sri Lankan situation and it is a long time felt need for a standard or regulatory body to control or monitor the use of preservatives.

Conclusion

Ninety three percent of Sri Lankan timber demand is met by local timber supply. This trend cannot be sustained if we are not able to cater the 2% of annual increase with present requirement of 0.753 millions cubic meters of sawn timber. It is a pleasure to mention here that up to now Forest Department has been able to release its mature forest plantation to STC for harvesting with consistent manner. Hence State Timber Corporation is able to share 8% of national timber demand by supplying average of 100000 m³ of timber logs. Attempt must be taken to increase timber yield in Teak plantation situated in north-east, Puttalam and Monaragala districts. There are more than 14,000 ha of over mature teak plantation which should be harvested with proper utilization and marketing plan. Dry zone *Eucalyptus camaldulensis* can be replaced with suitable timber species. the annual timber production by Forest Department plantation may be doubled If this proposal can be achieved. The yield harvested from Pinus plantations are overwhelming but timber utilization point of view it is not in satisfactory level due to inherent timber properties of pine and lack of infrastructure for timber preservation. More than 50% of timber in market comes from timber species belong to class 11 and class 111. Quality of this timber can be improved with careful seasoning process and application of suitable preservatives. Therefore longevity of timber in use depends on how timber is rightfully used.

Finally, education and awareness program on right use of timber can play a big role for successful implementation of sustainable principle in timber utilization of Sri Lanka.

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Annexure 1: Production and Sale values of some timber species produced by State Timber Corporation in 2011.

Name of species	Log volume (m ³)	Average sale value of logs (Rs/m ³)	Sawn timber volume (m ³)	Average sale value of sawn timber (Rs/m ³)	Name of species	Log volume (m ³)	Average sale value of logs (Rs/m ³)	Sawn timber volume (m ³)	Average sale value of sawn timber (Rs/m ³)
Teak	30074	37097	331	78986	Hora	250	17131	14	57071
Nedun	40	26450	0.170	36118	paramara	4083	6175	5	56601
Ebony	69	54991	7	85729	Khaya	371	8719	0.562	4554
Satin	1236	24671	65	64825	Class 1	2792	8774	77	28299
Halmilla	124	13933	5	53146	Eu.grandis	9575	8359	878	40730
Milla	385	16236	14	58064	Cypess	77	3775	2	8246
Mahogany	1812	23729	315	78078	Eu.robusta	1268	8482	0.753	39690
Jak	2091	23277	216	76892	Class 11	4888	5323	23	26362
Margosa	2035	9187	52	41499	Lunumidella	979	3778	10	23450
Palu	1303	19832	54	37895	Pinus	56460	9567	436	26548
Kolon	244	15021	4	46133	Albezia	986	2692		
Kumbuk	5585	33811	328	103732	Coconut		39691		3968
Eu.microcoris	1665	17828	440	59994	Class 111	5472	4101	67	26548

Source: monthly highlight of State Timber Corporation

Annexure 2: Value of imported and exported wood based product in 2011

HS Code and Description	Imported timber product in 2011	Exported timber product in 2011
	CIF value (Rs)	FOB value (Rs)
44.01 Fuel wood, in logs, in billets, in twigs, particles, saw dust, briquettes, pellets or similar form of wood	488,378	44,987,743
44.02 Wood charcoal including shell or nut charcoal, whether or not agglomerated.	543,456	259,234,834
44.03 Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared.	133,197,681	2,739,816
44.04 Hoopwood; split poles: piles, pickets and stakes of wood pointed but not sawn lengthwise: wooden sticks, roughly trimmed but not turned, bent or otherwise worked, manufacturing tool handle, walking sticks, umbrella	2,104,232	1,522,003
44.05 Wood wool; wood flour	28,530,796	1,578
44.06 Railway sleeper or tramway sleepers (cross-ties) of wood.	3,242,476	1,284
44.07 Wood sawn, Or chipped lengthwise, sliced or peeled whether or not planed or sanded or end-jointed, of a thickness more than 6 mm	3,756,081,378	100,417,709
44.08 Sheets for veneering for plywood or for other similar laminated wood and other wood, sawn lengthwise, sliced or peeled, whether or not planed or sanded, spliced or end-jointed, of a thickness not exceeding 6 mm	132,778,875	132,696
44.09 Wood including strips and friezes for parquet flooring, not assembled, continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, molded, rounded or like) along any of its edges, ends or faces, whether or not planed, sanded or end-jointed.	120,612,015	1,068,478
44.10 Particle board and similar board Eg: wafer board, of wood or other ligneous materials, whether or not agglomerated with resins or other organic binding substances	140,805,718	38,907,488
44.11 Fiberboard of wood or other ligneous materials, whether or not bonded with resins or other organic substances	1,550,562,364	3,043,318,526
44.12 Plywood, veneered panels and similar laminated wood	947,713,993	10,624,762
44.13 Densified wood, in blocks, plates, strips or profile shapes	6,654,756	76,939,716
44.14 Wooden frames for paintings, photographs, mirrors or similar objects.	13,692,953	2,209,716
44.15 Packing cases, boxes, crates, drums and similar pickings, of wood: cable-drums of wood: pallets, box pallets and other load boards, of wood: pallet collars of wood.	3,328,923	29,850,260
44.16 Casks, barrels, vat, tubs and other cooper's products and parts thereof, of wood, including staves.	946,337	43,341
44.17 Tools, tool bodies, tool handles, broom or brush bodies and handles, of wood: boot or shoe lasts and trees, of wood.	5,838,852	679,838,799
44.18 Builders' joinery and carpentry of wood including cellular wood panels, assembled parquet panels, shingles and shakes. Eg: door window frames, shuttering	40,579,757	10,456,151
44.19 Tableware and kitchenware, of wood eg: Spoon, forks, jars, cups, spice-box	8,965,739	1,920,825
44.20 Wood parquetry and inlaid wood: caskets and cases for jewellery or cutlery, and similar articles, of wood: statuettes and other ornaments, of wood: wooden articles of furniture not falling in chapter 94	10,336,741	81,410,315
44.21 other articles of wood.	48,227,770	1,170,381,421
Total value (Rs;)	6,955,250,756	5,591,907,461