**International Journal of Ecology and Environmental Sciences**
www.ecologyjournal.in
Online ISSN: 2664-7133; Print ISSN: 2664-7125; Impact Factor: RJIF 5.28
Received: 06-03-2020; Accepted: 08-04-2020; Published: 20-06-2020
Volume 2; Issue 2; 2020; Page No. 22-27

# Assessment of carbon stock in harvested timber in Kodagu district, central Western Ghats

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**Abstract**
Globally, the two most important carbon sinks are vegetation and the ocean. Kodagu district located in central part of the Western Ghats in one of the largest wooded areas with nearly 80% is under tree cover. The present study is an attempt to through light on the quantity of Carbon stored in the harvested timber. We have collected the data on different tree species harvested and their volume was collected from 2006 to 2017 in the Government timber depots. For each species-specific gravity data was obtained from the secondary data and the same was used to estimate the total carbon stock. The carbon stock varied from year to year. The average volume of timber harvested per year was 9664.46 $m^3$ with an average biomass of 6112.38 t and the average carbon was 2872.82 t per year. From the different species harvested, *Dalbergia latifolia* itself contributes to 25 per cent total carbon.

**Keywords:** Western Ghats, carbon stock, Kodagu

## 1. Introduction
Increase in atmospheric concentration of GHGs is the major reason for climate change, as accumulated in the atmosphere intercept outgoing infrared radiations and trap heat, raising the atmospheric temperature. The increase in greenhouse gases, especially carbon dioxide concentration in the atmosphere has become one of the important global environmental issues in the recent years because of its potential to change the global climate. The consequences of global warming could be melting of glaciers in the arctic region, rise in sea levels, changes the cloud formation and rainfall pattern *etc*. There is an increasing concern that our planet is becoming more and more unpleasant for human habitation. Further, continuous human interference with the world's fragile climate system may trigger global warming at an alarming rate and poses major threats to the ecosystem functioning and stability with possible loss of important ecosystem services of the society [6]. Both human poverty as well as affluences has contributed for this present crisis.

Large volume of carbon can be removed from forests by absorbing it from air and assimilating it into its biomass. Forests can therefore be effectively mitigated global warming, as they can help in carbon conservation, storage and as carbon substitution. Conservation options include controlling deforestation, protecting forest in reserves, changing harvesting regimes and controlling other anthropogenic disturbances like fire and pest out-breaks. Storage measures include expanding forest ecosystem by increasing the area or biomass and soil carbon density of natural and plantation forests and increasing storage in durable wood products. Substitution measures aim at increasing the transfer of forest biomass carbon into products rather than using fossil fuel-based energy and products, cement-based products and other non-wood building materials.

The wood harvested and converted into various utility products can help in sequestering atmospheric carbon. Worldwide, the industry's annual production of the utility products from wood contains approximately 290 million t of carbon in the form of wood products. Long useful lifespan for many of the wood products with increasing standards of living, stocks of carbon in wood products are growing and are expected to increase further for the foreseeable future [1, 3]. Conversion of harvested wood into various products serves the purpose of carbon sequestration in two ways. One, the utility products retain carbon in the wood for varying duration and secondly the vacancy created due to harvest, would allow new vegetation to grow and accumulate carbon in its biomass afresh and with greater vigour.

One way of diminishing uncertainty of the carbon pool estimates is to develop direct stock inventories of wood products. This means to obtain stock estimates independent from flow estimates, input or output, and can be used to verify flow-based methods and calculation models associated with them. Stock inventories may be most practicable for the major carbon pools of products in use such as the wood products in constructions, furniture's and various other products [9].

With this background this study was undertaken to quantify the wood harvested from Kodagu district of Karnataka with the following objectives,

- To quantify the total wood removed from Kodagu district.
- To quantify the carbon stock in the harvested wood.
- To understand the fate of the locked carbon.

## 2. Materials and Methods
The present investigation was carried out for the entire Kodagu district which is located in the central part of Western Ghats. Kodagu lies between 11°56′and 12°50′ N latitude and 75°22′and 76°11′ E longitude. The district is one of the densest forested districts in India with 80% of landscape under tree cover. The total geographical area of Kodagu district is 4102 sq.km, of which coffee plantations cover 29% of the area and are found mainly in the central part of the district. Other plantations that cover 6% of the district include teak, rubber, eucalyptus and cardamom [7]

The data on the total quantity of wood that has been removed from the natural forest as well as private plantations of Kodagu district for the period 2006 to 2018 was collected from government timber depots. From the collected information, depending on size, wood was classified into different classes like logs, poles, billets and stumps as per the specification followed by the Karnataka State Forest Department. According to Chaturvedi and Khanna (1982), when a round timber is converted into usable form of wood, generally 36.4% is treated as waste and 63.6% is the usable form of wood obtained or out turn. We have used the existing method in the reciprocal way and obtained a factor of 1.5723 and multiplied this with the quantity of size and reepers. Information on the wood harvested in the form of logs, billets and stumps of different species was collected in terms of volume ($m^3$).

**2.1 Total above ground biomass harvested and Carbon stock:**
Generally, to quantify the amount of biomass present in the crown, expansion ratio (ER) is used [2]. In this study in order to obtain total above ground biomass from which the harvested wood has come, we have used the concept of ER. In the present investigation, to estimate the total harvested above ground biomass, we have applied the ER of 1.40 to the quantity of wood which was obtained in the form of logs and poles.
The volume of wood of each species was multiplied with the density of that particular species to obtain the total dry weight of the harvested wood. Carbon content of wood is taken as 47 per cent of the dry weight of the wood [3].

**2.2 Conversion of round timber to sawn timber**
The per cent wastage of wood, while converting round timber into sawn timber, was 36.4 for poles and billets, whereas for logs it was 21.4 per cent [5]. Since poles, billets and logs have been classified as round timber in the classification the amount of wastage during their conversion was considerably more compared to all other classes, which are processed form of wood such as reapers and sizes.

**2.3 Conversion of sawn timber to final product**
In the second stage of conversion, i.e., conversion of sawn wood to various utility products, considerable amount of wood go as waste during the craftsmanship. To quantify this waste we have developed a method, as there are no protocols available. According to this, the wastage was found to be 26.17% of the sawn wood [12].

**2.4 Quantification of carbon dioxide**
The quantum of carbon was then converted to the quantum of carbon dioxide using the following formula [1].

Quantum of $CO_2$ = Quantum of carbon $\times \frac{44}{12}$

Where,

44 is the molecular weight of $CO_2$

12 is the atomic weight of the carbon.

**3. Results and Discussion**
The study was conducted to quantity the total amount of wood removed from both natural forests and the private plantation of the district is presented here. The purpose of this study is to quantity the harvested wood and to assess the quantity of carbon that will be either sequestered or combusted. For this study, a period of 12 years between 2006 and 2017 was considered.

**3.1 Gross amount of harvested wood:**
Total quantity of wood removed in the form of different species was taken from both natural forests as well as private plantation is presented in Table 1. The wood has come from more than 60 different tree species. The quantity of wood obtained from the harvested biomass was 1.15 lakh $m^3$, which include both natural forests and private plantations. Among the different species removed, large quantity of wood is contributed by *Dalbergia latifolia* (29175.36 $m^3$) followed by *Tectona grandis* (5954$m^3$) (Table 1) contributing 25 and 5 percent to the total harvested wood respectively (Figure 3). Most of the wood (about 80%) wascame from Private plantations and remaining 20% was came from natural forests. Apart from 60 different species a few species which have not been identified were categorized into jungle wood, which contributed 4266.43 $m^3$of wood and billets and fire wood contributed 38522.48 $m^3$ (Table 1) to the total wood.
Total quantity of above ground biomass harvested from the Kodagu district was estimated to be $1.6\times10^5$ $m^3$ (Table 5). The total quantity of harvested wood from natural forests as well as private plantations, accounts to $1.15\times10^5$ $m^3$. Though the wood has come from more than 60 different species, most of it has come from *Dalbergia latifolia* (29175.36 $m^3$) and *Tectona grandis* (5954$m^3$) contributing 25% and 5% to the total harvested wood respectively (Table 1).

**3.2 Quantification of carbon**
Density of tree species varied to a large extent between 330kg/$m^3$ in case of *Bombax cebia* to a maximum of 1050 kg/m3 in case of *Mesua ferrea* (Table 1). Variation in density indicates the weight in a unit volume of wood. The quantity of biomass of each species was calculated by multiplying the values of quantity of wood with the respective density. From this biomass, quantity of carbon in the harvested wood of each species was calculated. In terms of carbon, the total quantum of carbon harvested was 34473.70 t (Table 1). The average annual harvest of carbon was estimated to be 2872.75 t. Species wise, *Dalbergia latifolia* has contributed maximum quantity (10490 t) followed by *Tectona grandis* (1818.95 t) and *Acacia* spp (1509.4 t; Table 1).

**3.3 Annual harvest of wood**
In a period of 12 years a total of $115.973\times10^3$ $m^3$ of wood has been harvested from the forests of Kodagu district. Amount of wood harvested annually between 2006 and 2017 is presented in the Fig.1. During this period maximum quantity of wood was harvested in 2007($14.70\times10^3m^3$) followed by 2008 ($13.43\times10^3m^3$) and 2016 ($11.94\times10^3$ $m^3$). This amounts to 13, 12 and 10 percent of the total harvested wood, respectively. Quantity of wood harvested was least during 2006 ($5.33\times10^3$ $m^3$) followed by 2017 ($6.41\times10^3$ $m^3$). The average annual harvest of wood over the 12 years period was estimated to be $9.664\times10^3m^3$. The number of species harvested annually varies to a large extent. Maximum number of species were harvested in 2012 and 2013 (47) followed by 2008 (43) and least number of species was harvested during 2006 (28).
In the study, highest amount of carbon in the form of harvested wood was found during 2007 (4238.86 t) followed by 2008 (3905.52 t) and 2016 (3590.10 t) which amounts to 12, 11 and 10

percent of the total harvested carbon respectively. The least amount of carbon was harvested during the year 2006 (1520.85 t; Table 7).

The annual harvest of wood from the forests of Kodagu district is not uniform across years. It ranges between 5334.80 $m^3$ from 28 species in 2006 (1520.85 tonnes of C) to 14709.91$m^3$ from 42 species in 2007 (4238.86 tonnes of C; Table 7). Interestingly, the number of species constituting the total harvested wood varies to a large extent, and it is independent of the volume of harvested wood. Out of more than 60 species harvested, not all the species are harvested regularly. Some species like, *Calophyllum inophyllum*, *Calophyllum tomentosum*, *Madhuca indica*are harvested only once or twice in the 12 years study period (2006to 2017). Whereas few other species like *Dalbergia latifolia*, *Tectona grandis* are harvested regularly. Lowest number of species harvested was observed during 2006 (28) and highest during 2012 and 2013 (47).

### 3.4 Classification of harvested wood based on sizes

The trees harvested are primarily cut into various forms such as logs, poles, billets and stumps. Those fractions which cannot be classified under any of the above classes will be treated as firewood.

Among the different forms of harvested wood, logs contributed the highest quantity (54063.07 t) and Billets and firewood (19261.24 t) contributing 74 and 26 percent to the total harvested wood respectively and the lowest quantity was obtained in the form of stumps (24.2 t). The share of each class of wood to the total harvested wood is depicted in the pie chart (Fig. 2).

Among the various tree species harvested, a few tree species that yield commercially important timber were pooled together. Because, this wood is mainly used for construction and furniture making. The amount of wood was retained in the form of final wood products accounted to the quantity of firewood mentioned here; some amount of biomass which is removed in the process of annual maintenance (lopping of branches and twigs) will also be used as firewood. But that is not accounted in the present study. In addition, there will be some more wastage obtained during the processing of the round wood to final product. This will also be treated as firewood. Therefore, the contribution of harvested wood in the form of fire wood is helpful in replacing fossil fuel burning and reduce the global climate change as well as in biodiversity conservation of natural forests.

### 3.5 Wastage of wood during conversion

Wastage of wood occurs in the process of converting the harvested trees into final products. It occurs in two stages, one, while converting round wood to sawn wood. Usually, this occurs in the mills. Second stage is while converting sawn timber to final utility products. This occurs during the craftsmanship. The percent wastage of wood, while converting round timber into sawn timber, was 36.4 for poles and billets, whereas for logs it was 21.4 percent. Since poles, billets and logs have been classified as round timber in the classification, the amount of wastage during their conversion was considerably more compared to all other classes, which are processed form of wood such as reapers and sizes.

After converting sawn timber to final product, log class of wood has sequestered large quantity of wood (31373.01 t) followed by billets (9044.29 t) and stump class (11.36 t; Table 3). Sequestration of carbon in the form of wood by firewood class is considered as zero, because all the carbon is lost to the atmosphere during combustion of the wood. In terms of carbon, large quantity of carbon was sequestered by logs (14745.31 t) followed by billets (4250.81 t) and stumps (5.34 t; Table 3).

Totally, in Kodagu district, out of 34473.80 t of carbon harvested (Table 1) 19001.47 t of carbon was fixed in the form of wood products (Table 2 and Table 3). In terms of $CO_2$, totally 176.907 Gg was obtained in the harvested plant biomass (Table 5).

As mentioned earlier, there will be wastage of some quantity of wood while processing the harvested trees. The first stage of loss of wood occurs when the round wood is converted into sawn wood [5]. In this process there will be loss as high as 36.4% in case of poles and billets. But in case of logs, the four sides removed will be further processed and reepers are made. Therefore, the wastage in this first step in case of logs is 21.4%. In the present study, out of 73348.31 tof round wood, 54759.12 t of sawn wood was obtained and18589.40t has gone as waste either as small pieces or sawn dust (Table 2). This waste is used as firewood and the sawn wood is used as raw material for making various utility products.

In the second stage of conversion, i.e., conversion of sawn wood to various utility products, considerable amount of wood go as waste during the craftsmanship. To quantify this waste we have developed a method, as there are no protocols available. According to this, the wastage was found to be 26.17% of the sawn wood.

While assessing the wastage it was found that, as the size of the utility product increases, the per cent wastage decreases. This indicates that the quantity of wood which go as waste is 14330.46 t (26.17%). The wood used in the construction will have a half-life period of 100 years, while the wood used for furniture making will have a half-life period of 30 years [8, 10, 11]

Out of 34.473 Gg (Table 1) of harvested carbon in the form of wood, 19.001 Gg (Table 5) of carbon is sequestered in the form of various wood products for a period of 12 years. Therefore annually, 1.58 Gg of carbon is sequestered from the harvested wood in this district.

### 3.6 Gross amount of biomass harvested

Total quantity of wood removed from the entire Kodagu district between 2006 and 2017 was 1.15 lakh $m^3$ (Table 1). From this quantity total above ground biomass harvested was obtained by applying the expansion ratio (1.4), which includes all non-stem biomass like twigs, branches, foliage, etc. Thus, the total above ground biomass harvested was 1.6 lakh $m^3$(Table 5).

### 3.7 Sequestration of carbon in the form of wood

The total quantity of harvested wood from few selected tree species, which are generally used for furniture making and house construction, is 43427.58 t. From this quantity of harvested wood, 20391.8 t of wood was found to be present in the final utility products. In terms of carbon 9584.15 t was sequestered in the form of wood products (Table 6).

**Table 1:** List of tree species and quantity of wood harvested in terms of volume and biomass and amount of carbon present.

| Sl No | Scientific Name | Local name | Quantity ($m^3$) | Density (kg/m3) | Biomass (t) | Carbon (t) |
|---|---|---|---|---|---|---|
| 1 | *Acacia spp* | Acacia | 5352.47 | 600 | 3211.48 | 1509.40 |
| 2 | *Acrocarpus fraxinifolius* | Balanji | 860.29 | 617 | 530.80 | 249.47 |
| 3 | *Ailanthus malabaricum* | Halmaddi | 12.86 | 450 | 5.79 | 2.72 |
| 4 | *Albizzia lebbeck* | Bage | 210.47 | 642 | 135.12 | 63.51 |
| 5 | *Albizzia odoratissima* | Bilwara | 1887.50 | 736 | 1389.20 | 652.92 |
| 6 | *Anacardium occidentale* | Geru | 1.34 | 440 | 0.59 | 0.28 |
| 7 | *Anogeissus latifolia* | Dindala | 100.98 | 850 | 85.83 | 40.34 |
| 8 | *Artocarpus hirsutus* | Hebbalasu | 751.56 | 623 | 468.22 | 220.06 |
| 9 | *Artocarpus integrifolius* | Halasu | 1893.70 | 641 | 1213.86 | 570.52 |
| 10 | *Azadirachta indica* | Neem | 0.35 | 825 | 0.29 | 0.13 |
| 11 | *Bauhinia purpurea* | Basavanapada | 4.47 | 550 | 2.46 | 1.16 |
| 12 | *Bischofia javanica* | Neeli | 782.50 | 769 | 601.75 | 282.82 |
| 13 | *Bombaxceiba* | Boorga | 274.17 | 330 | 90.48 | 42.52 |
| 14 | *Calophyllum inophyllum* | Surahonne | 1.41 | 638 | 0.90 | 0.42 |
| 15 | *Calophyllum tomentosum* | Poon | 14.19 | 634 | 9.00 | 4.23 |
| 16 | *Canarium strictum* | P pain | 1.50 | 655 | 0.98 | 0.46 |
| 17 | *Casuarina equisetifolia* | Casuarina | 1.60 | 1000 | 1.60 | 0.75 |
| 18 | *Cedrella toona* | Noga | 1787.43 | 468 | 836.52 | 393.16 |
| 19 | *Chukrasia tabularis* | Karadi | 456.20 | 666 | 303.83 | 142.80 |
| 20 | *Cordla maeloodi* | Hadaga | 80.60 | 500 | 40.30 | 18.94 |
| 21 | *Dalbergia latifolia* | Rose wood | 29175.36 | 765 | 22319.15 | 10490.00 |
| 22 | *Delonix regia* | Gulmohar | 23.05 | 500 | 11.53 | 5.42 |
| 23 | *Dysoxylum malabaricum* | Devadaru | 37.95 | 689 | 26.15 | 12.29 |
| 24 | *Eucalyptus spp* | Neelagiri | 1657.09 | 570 | 944.54 | 443.93 |
| 25 | *Ficus mysorensis* | Gooli | 216.75 | 390 | 84.53 | 39.73 |
| 26 | *Ficus recemosa* | Athi | 67.68 | 390 | 26.39 | 12.41 |
| 27 | *Gmelina arborea* | Kooli | 170.98 | 530 | 90.62 | 42.59 |
| 28 | *Grevillea robusta* | Silver oak | 160.60 | 570 | 91.54 | 43.02 |
| 29 | *Grewia tiliaefolia* | Thadasalu | 1552.02 | 792 | 1229.20 | 577.72 |
| 30 | *Hopea parviflora* | Irpu | 100.94 | 923 | 93.17 | 43.79 |
| 31 | *Lagestroemia lanceolata* | Nandi | 4475.48 | 688 | 3079.13 | 1447.19 |
| 32 | *Lannea coromandelica* | Godda | 241.81 | 557 | 134.69 | 63.30 |
| 33 | *Madhuca indica* | Hippe | 2.88 | 915 | 2.64 | 1.24 |
| 34 | *Maesopsis eminii* | Mesopsis | 198.90 | 500 | 99.45 | 46.74 |
| 35 | *Mangifera indica* | Mango | 540.49 | 662 | 357.80 | 168.17 |
| 36 | *Melia dubia* | Kadabevu | 62.14 | 595 | 36.97 | 17.38 |
| 37 | *Mesua ferrea* | Nagasampige | 4.61 | 1050 | 4.84 | 2.28 |
| 38 | *Michelia champaca* | Sampige | 223.22 | 494 | 110.27 | 51.83 |
| 39 | *Palaquium ellipticum* | Pali | 0.03 | 606 | 0.02 | 0.01 |
| 40 | *Pongamia pinnata* | Honge | 14.36 | 640 | 9.19 | 4.32 |
| 41 | *Pterocarpus marsupium* | Honne | 3771.60 | 803 | 3028.60 | 1423.44 |
| 42 | *Samanea saman* | Rain tree | 198.89 | 680 | 135.25 | 63.57 |
| 43 | *Sapindus emerginatus* | Antuwala | 6.63 | 810 | 5.37 | 2.53 |
| 44 | *Shorea talura* | Jala | 22.89 | 670 | 15.34 | 7.21 |
| 45 | *Spathodia companulata* | Spathodia | 28.37 | 220 | 6.24 | 2.93 |
| 46 | *Spondio saccuminata* | Ambatte | 29.79 | 410 | 12.22 | 5.74 |
| 47 | *Stereospermum chelonoides* | Malali | 422.93 | 500 | 211.46 | 99.39 |
| 48 | *Stereospermum personatum* | Oodi | 152.43 | 500 | 76.21 | 35.82 |
| 49 | *Swietenia mahagoni* | Mahagony | 35.21 | 500 | 17.60 | 8.27 |
| 50 | *Syzygium cumini* | Nerale | 2382.19 | 770 | 1834.29 | 862.11 |
| 51 | *Tamarindus indicus* | Tamarind | 7.54 | 710 | 5.35 | 2.51 |
| 52 | *Tectona grandis* | Teak | 5954.03 | 650 | 3870.12 | 1818.95 |
| 53 | *Terminalia arjuna* | Bilimathi | 0.67 | 760 | 0.51 | 0.24 |
| 54 | *Terminalia bellirica* | Thare | 1293.97 | 660 | 854.02 | 401.39 |
| 55 | *Terminalia paniculata* | Uluve | 849.90 | 776 | 659.52 | 309.98 |
| 56 | *Terminalia tomentosa* | Mathi | 3026.59 | 874 | 2645.24 | 1243.26 |
| 57 | *Vateria indica* | Doopa | 168.66 | 585 | 98.67 | 46.37 |
| 58 | *Vitex altissima* | Naviladi | 54.01 | 937 | 50.61 | 23.79 |
| 59 | *Xylia xylocarpa* | Irulu | 188.33 | 810 | 152.55 | 71.70 |
| 60 | - | Yellow teak | 1187.77 | 500 | 593.89 | 279.13 |
| 61 | - | Billets and firewood | 38522.48 | 500 | 19261.24 | 9052.78 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 62 | - | Jungle wood | 4266.43 | 500 | 2133.22 | 1002.61 |
| | Total | | 115973.24 | | 73348.31 | 34473.70 |

**Table 2:** Quantity of out-turn of sawn timber from round timber

| Wood class | Wt. of wood(t) | Amt. of usage(t) | Amt. of wastage(t) |
|---|---|---|---|
| Logs | 54063.07 | 42493.58 | 11569.50 |
| Billets | 19261.24 | 12250.15 | 7011.09 |
| Stump | 24.20 | 15.39 | 8.81 |
| Total | 73348.52 | 54759.12 | 18589.40 |

**Table 3:** The quantity of carbon sequestered from various forms of wood extraction.

| Wood class | Total quantity of wood(t) | % wastage in craftsmanship | Quantity of harvested wood sequestered(t) | Amount of carbon fixed(t) |
|---|---|---|---|---|
| Logs | 42493.58 | 26.17 | 31373.01 | 14745.31 |
| Billets | 12250.15 | 26.17 | 9044.28 | 4250.81 |
| Stumps | 15.39 | 26.17 | 11.36 | 5.34 |
| Total | 54759.12 | | 40428.66 | 19001.47 |

**Table 4:** Quantity of wastage of wood while manufacturing some of the common utility products (Average ± S.D)

| Quantity of wastage of wood while manufacturing some of the common utility products (Average ± S.D) | | | | |
|---|---|---|---|---|
| **Item** | **Initial wt.** | **Final wt.** | **%Wastage** | **%Usage** |
| Chairs & Tables &accessories | 5.54±4.53 | 4.43±3.99 | 22.28±6.81 | 77.72±6.81 |
| Tepoi&Accessories | 7.19±2.78 | 5.89±2.46 | 18.86±2.48 | 81.84±2.48 |
| Cot & Accessories | 10.33±11.31 | 8.07±9.44 | 27.44±7.15 | 72.56±7.15 |
| Lattinige | 1.20±0.40 | 0.88±.37 | 25±6.25 | 75±6.25 |
| Wooden Box | 2.15±1.68 | 1.67±1.31 | 23.6±3.63 | 76.4±3.63 |
| Door & Accessories | 8.6±10.07 | 6.7±9.05 | 35.47±20.22 | 64.53±20.22 |
| Window & Accessories | 6.55±5.7 | 5.53±5 | 22.22±8.16 | 77.78±8.16 |

**Table 5:** Total amount of biomass derived from the harvested wood

| Total quantity of stem biomass($m^3$) | Expansion Ration | Value of above ground biomass($m^3$) | Biomass derived from the harvested wood(t) | Total above ground biomass(t) | Carbon content(t) | $CO_2$ content(t) |
|---|---|---|---|---|---|---|
| 115941.90 | 1.40 | 162318.60 | 73324.32 | 102654 | 48247.40 | 176907.10 |

**Table 7:** The total quantity of wood harvested annually from different number of trees pieces and the amount of carbon present.

| Year | Volume ($m^3$) | Biomass (t) | Carbon (t) | No. of species |
|---|---|---|---|---|
| 2006 | 5334.80 | 3235.85 | 1520.85 | 28 |
| 2007 | 14709.91 | 9018.85 | 4238.86 | 42 |
| 2008 | 13431.61 | 8309.61 | 3905.52 | 43 |
| 2009 | 9638.55 | 5950.92 | 2796.93 | 40 |
| 2010 | 8823.45 | 5732.74 | 2694.39 | 42 |
| 2011 | 7820.59 | 5137.38 | 2414.57 | 39 |
| 2012 | 11304.15 | 7086.07 | 3330.46 | 47 |
| 2013 | 10787.89 | 6965.39 | 3273.73 | 47 |
| 2014 | 7031.78 | 4387.03 | 2061.90 | 39 |
| 2015 | 8732.44 | 5669.72 | 2664.77 | 42 |
| 2016 | 11941.90 | 7638.51 | 3590.10 | 42 |
| 2017 | 6416.45 | 4216.44 | 1981.73 | 33 |
| Total | 115973.52 | 73348.52 | 34473.80 | |

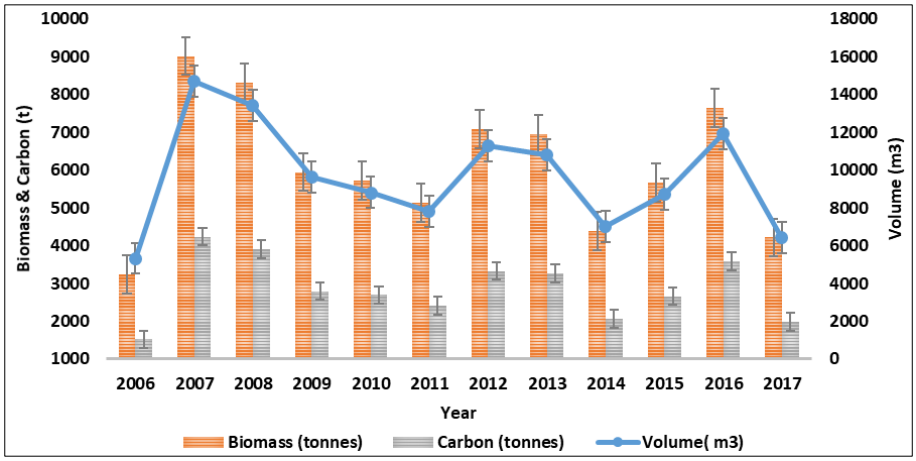


**Fig 1:** Quantity of wood harvested annually from different amount of carbon present.

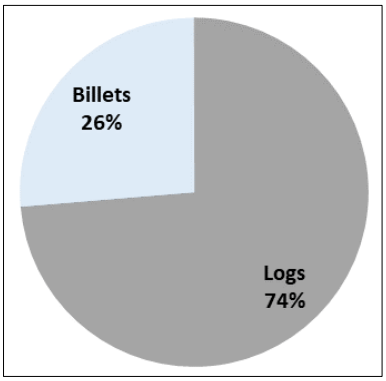


**Fig 2:** Quantity of wood harvested in different forms

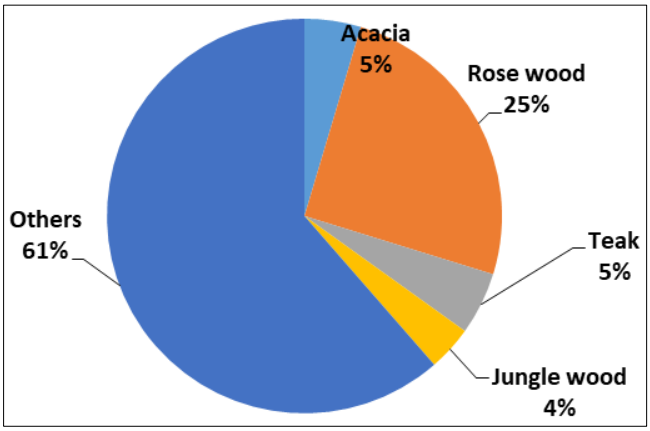


**Fig 3:** Contribution of different species to the total harvested wood

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