

Original Research Article

Estimation of Wood Density of Trees in 10 Hectare Forest Dynamics Plot at Pachaimalai, Tamil Nadu

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Abstract: This study was conducted in Pachaimalai, a part of southern Eastern Ghats in Tamil Nadu. A 10 ha plot was established in Punavarai village in Attur Taluk, Salem District. In all, 29 species spread in 23 genera and 17 families recorded from study plot. Physiognomically both deciduous and evergreen trees are present in study plot. In all, 15 deciduous species and 14 evergreen species were there in study plot. Wood density of species varied from 0.45 to 0.90 g cm⁻³ in study plot. The mean density of study plot is higher than what has been reported for the Indian sub-continent, Africa, Australia and North-America.

Keywords: tropical forests; Eastern Ghats; Indian trees; physiognomy.

INTRODUCTION

Wood density (WD) is of great ecological and phylogenetic importance and it is closely associated with several factors such as growth and survival rates of woody plants [1, 2], hydraulic properties such as water storage capacity, degree of resistance to xylem cavitation [3, 4], drought-induced embolism [5] and level of resistance of stems to pathogen attack and to mechanical damage [6]. Data on WD is an important factor to accurately estimate biomass stockpile of woody vegetation. India is home for more than 2000 tree species. However, information on WD of Indian trees are very limited [7]. This study was conducted to estimate WD value of trees in a 10 hectare forest dynamic study plot situated at Pachaimalai, Tamil Nadu.

MATERIALS AND METHODS

This study was conducted in Pachaimalai, a part of southern Eastern Ghats in Tamil Nadu. The Eastern Ghats are a series of discontinuous low ranges running generally northeast-southwest parallel to the coast of the Bay of Bengal. They cover an area of about 75,000 sq km in the Indian peninsular, with an average width of 220 km in the north and 100 km in the south. They extend over a length of 1750 km between the rivers of Mahanadi and Vaigai along the East Coast of India across the states of Orissa, Andhra Pradesh and Tamil Nadu.

A 10 ha plot was established in Punavarai village in Attur Taluk, Salem District. The study plot was sub-divided in to two hundred and fifty 20m×20m

workable sub plots (total area 10 ha). Wood cores were taken in the height of 100–150 cm from the ground. Sampled trees were tagged with aluminium tags to facilitate further survey and monitoring (Figure 1).



Fig-1: Tagging of trees with aluminium tag in study plot

The length of cores was roughly equal to half the diameter of the trees. The resulting holes were filled with synthetic resin to avoid infestation by pathogens. Wood cores were kept in plastic bags and sealed until returned to the laboratory, further the samples were then cut into small cylinders. Firmly attached bark (if any) or equivalent phloem tissue are integral part of the functioning stem therefore these were included in stem density estimation [8] (Figure 2). The length and volume of the cylindrical cores were calculated from the length and inner diameter of the increment wood corer. Fresh weight of the samples was estimated then

the wood cores were kept in hot air oven at 105 °C for 48 h to bring them to constant weight (Figure 3).



Fig-2: Collection of wood cores with increment wood borer



Fig-3: Dried wood samples

RESULTS

Species richness

In all, 29 species spread in 23 genera and 17 families recorded from study plot. The family Euphorbiaceae represented by large number of species (5 species) followed by Ebenaceae (4), Rutaceae (3) and Combretaceae, Melastomataceae and Rubiaceae each represented by two species, whereas, 11 families had one species' each in study plot (Table 1).

Table 1: Wood density of trees (g cm⁻³) recorded from Pachaimalai, Tamil Nadu

S. No.	Botanical name	Family	Local name (Tamil)
1	<i>Albizia amara</i>	Mimosaceae	Thurinjil
2	<i>Atalantia manophylla</i>	Rutaceae	Kaattuelumichai
3	<i>Buchanania lanceolata</i>	Anacardiaceae	-
4	<i>Chloroxylon swietenia</i>	Rutaceae	Purasu
5	<i>Clausena dentata</i>	Rutaceae	Kattukariveppilai
6	<i>Commiphora caudata</i>	Burseraceae	Pachaikiluvai
7	<i>Diospyros buxifolia</i>	Ebenaceae	Irumpuli
8	<i>Diospyros ebenum</i>	Ebenaceae	Irumpuli
9	<i>Diospyros montana</i>	Ebenaceae	Irumpuli
10	<i>Euphorbia antiquorum</i>	Euphorbiaceae	Sadhuraalli
11	<i>Euphorbia nivulia</i>	Euphorbiaceae	Ilaikalli
12	<i>Ficus benghalensis</i>	Moraceae	Alamaram
13	<i>Manilkara hexandra</i>	Sapotaceae	Magizhamaram
14	<i>Memecylon edule</i>	Melastomataceae	Vellaikasaan
15	<i>Memecylon umbellatum</i>	Melastomataceae	Kasaan
16	<i>Ochna serrata</i>	Celastraceae	Serunthi
17	<i>Phyllanthus emblica</i>	Euphorbiaceae	Nelli
18	<i>Phyllanthus polyphyllus</i>	Euphorbiaceae	Karunelli
19	<i>Plumeria alba</i>	Apocynaceae	Perunkalli
20	<i>Premna tomentosa</i>	Verbenaceae	Munnai
21	<i>Psydrox dicoccus</i>	Rubiaceae	Seppukora
22	<i>Sapium insigne</i>	Euphorbiaceae	Paanaivedi
23	<i>Strychnos nux-vomica</i>	Loganiaceae	Etti
24	<i>Syzigium cumini</i>	Myrtaceae	Naval
25	<i>Tarenna asiatica</i>	Rubiaceae	Therani
26	<i>Terminalia paniculata</i>	Combretaceae	Puluvaimaram
27	<i>Terminalia tomentella</i>	Combretaceae	-
28	<i>Vitex altissima</i>	Verbenaceae	Mailadi
29	<i>Zizyphus xylopyrus</i>	Rhamnaceae	Kottamaram

Physiognomy

Physiognomically both deciduous and evergreen trees are present in study plot. In all, 15 deciduous species and 14 evergreen species were there

in study plot. Density wise evergreen species (1998 individuals) had more number of trees compared to deciduous trees (129 individuals) in study plot (Table 2).

Table 2: Botanical name and physiognomy of trees recorded in Pachaimalai, Tamil Nadu

S. no.	Botanical name	Physiognomy	Density
1	<i>Albizia amara</i>	Deciduous	9
2	<i>Atalantia manophylla</i>	Evergreen	3
3	<i>Buchanania lanceolata</i>	Evergreen	246
4	<i>Chloroxylon swietenia</i>	Deciduous	9
5	<i>Clausena dentata</i>	Evergreen	72
6	<i>Commiphora caudata</i>	Deciduous	18
7	<i>Diospyros buxifolia</i>	Evergreen	6
8	<i>Diospyros ebenum</i>	Evergreen	33
9	<i>Diospyros montana</i>	Evergreen	9
10	<i>Euphorbia antiquorum</i>	Deciduous	9
11	<i>Euphorbia nivulia</i>	Evergreen	15
12	<i>Ficus benghalensis</i>	Deciduous	6
13	<i>Manilkara hexandra</i>	Evergreen	3
14	<i>Memecylon edule</i>	Evergreen	24
15	<i>Memecylon umbellatum</i>	Evergreen	1470
16	<i>Ochnaserrata</i>	Deciduous	3
17	<i>Phyllanthus emblica</i>	Deciduous	9
18	<i>Phyllanthus polyphyllus</i>	Deciduous	12
19	<i>Plumeria alba</i>	Deciduous	30
20	<i>Premna tomentosa</i>	Deciduous	3
21	<i>Psydrox dicoccus</i>	Evergreen	63
22	<i>Sapium insigne</i>	Deciduous	3
23	<i>Strychnos nux-vomica</i>	Evergreen	18
24	<i>Syzigium cumini</i>	Deciduous	3
25	<i>Tarennia asiatica</i>	Evergreen	18
26	<i>Terminalia paniculata</i>	Deciduous	3
27	<i>Terminalia tomentella</i>	Deciduous	3
28	<i>Vitex altissima</i>	Evergreen	18
29	<i>Zizyphus xylopyrus</i>	Deciduous	9
	Total		2127

Wood density

Wood density of species varied from 0.45 to 0.90 g cm⁻³ in study plot. The mean WD of trees found as 0.74±0.12. *Diospyros buxifolia* had highest WD

value (0.90 g cm⁻³) followed by *Chloroxylon swietenia*, *Phyllanthus emblica*, *Strychnos nux-vomica* (each 0.88 g cm⁻³) and *Buchanania lanceolata*, *Memecylon umbellatum* (0.85 g cm⁻³). Whereas, *Euphorbia*

antiquorum (0.45 g cm⁻³), *E. nivulia* (0.48 g cm⁻³), value in study plot (Table 3).
Plumeria alba (0.55 g cm⁻³) recorded the least WD

Table 3. Wood density of trees (g cm⁻³) recorded from Pachaimalai hills

S. No.	Botanical Name	Family	Wood density (g cm ⁻³ ±S.D.) (n=5)
1	<i>Albizia amara</i>	Mimosaceae	0.76±0.02
2	<i>Atalantia manophylla</i>	Rutaceae	0.81±0.01
3	<i>Buchanania lanceolata</i>	Anacardiaceae	0.85±0.02
4	<i>Chloroxylon swietenia</i>	Rutaceae	0.88±0.03
5	<i>Clausena dentata</i>	Rutaceae	0.66±0.01
6	<i>Commiphora caudata</i>	Burseraceae	0.51±0.04
7	<i>Diospyros buxifolia</i>	Ebenaceae	0.90±0.01
8	<i>Diospyros ebenum</i>	Ebenaceae	0.76±0.01
9	<i>Diospyros montana</i>	Ebenaceae	0.72±0.03
10	<i>Euphorbia antiquorum</i>	Euphorbiaceae	0.45±0.01
11	<i>Euphorbia nivulia</i>	Euphorbiaceae	0.48±0.02
12	<i>Ficus benghalensis</i>	Moraceae	0.62±0.03
13	<i>Manilkara hexandra</i>	Sapotaceae	0.72±0.05
14	<i>Memecylon edule</i>	Melastomataceae	0.82±0.02
15	<i>Memecylon umbellatum</i>	Melastomataceae	0.85±0.03
16	<i>Ochna serrata</i>	Celastraceae	0.78±0.02
17	<i>Phyllanthus emblica</i>	Euphorbiaceae	0.88±0.02
18	<i>Phyllanthus polyphyllus</i>	Euphorbiaceae	0.84±0.01
19	<i>Plumeria alba</i>	Apocynaceae	0.55±0.03
20	<i>Premna tomentosa</i>	Verbenaceae	0.66±0.01
21	<i>Psydrox dicoccus</i>	Rubiaceae	0.74±0.02
22	<i>Sapium insigne</i>	Euphorbiaceae	0.69±0.04
23	<i>Strychnos nux-vomica</i>	Loganiaceae	0.88±0.01
24	<i>Syzigium cumini</i>	Myrtaceae	0.72±0.02
25	<i>Tarenna asiatica</i>	Rubiaceae	0.76±0.02
26	<i>Terminalia paniculata</i>	Combretaceae	0.80±0.03
27	<i>Terminalia tomentella</i>	Combretaceae	0.82±0.02
28	<i>Vitex altissima</i>	Verbenaceae	0.74±0.01
29	<i>Zizyphus xylopyrus</i>	Rhamnaceae	0.82±0.02
	Mean		0.74±0.12

DISCUSSION

Wood density

The average wood density 0.74±0.12 recorded in this study is equal to a study conducted in tropical dry evergreen forests at Thiruvapur and Nagapattinam districts in Tamil Nadu (mean=0.74 ± 0.16 g cm⁻³; 55 species) [9]. The study plot contain only 6.06% of deciduous species remaining individuals are evergreens. Likewise, the study on TDEF recorded 87% as evergreens.

The mean WD (0.74±0.12 g cm⁻³) of the present study is well within the range of WD values of Indian trees (range 0.232-1.280 g cm⁻³). We found that mean WD of the current study is higher than that of

Indian sub-continent (mean 0.65 g cm⁻³) Africa (mean 0.648 g cm⁻³) and Australia (mean 0.725 g cm⁻³), North American trees (mean 0.540 g cm⁻³) [10]. However, the present study conducted in a 10 ha permanent plot in Pachaimalai. It has been reported that Pachaimalai as home for more than 200 tree species. Thus, in future studies of this kind should estimate WD of all tree species present in Pachaimalai, then only the real mean WD value of trees in Pachaimalai will come to the light.

CONCLUSION

The mean density of study plot is higher than what has been reported for Africa, Australia and North-America. However, this study estimated WD of trees in a 10 ha permanent plot. Studies of this kind with large

number of tree species are essential to demonstrate actual mean WD of tree species in Pachaimalai, Tamil Nadu. Data on WD of Indian trees is very limited in World Wood Density Database. More studies to be undertaken in future to contribute large quantity of WD data to World Wood Density Database.

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