

Floristic Inventory and Quantitative Vegetation Analysis of Tropical Dry Deciduous Forest in Piranmalai Forest, Eastern Ghats, Tamil Nadu, India

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ABSTRACT

Tree diversity, species richness, basal area, population structure and distribution patterns were investigated in disturbed, moderately disturbed and undisturbed areas of the tropical dry deciduous forest of Piranmalai, Eastern Ghats in Tamil Nadu. The forest areas were selected based on the disturbance index. Six sites of 0.1ha area were established in the Piranmalai forest. Two sites, Nehru park (N.P) and Foot hill (F.H), were located close to the mining, quarrying and human settlement area, while two other sites, Vannar iruppu (V.I) and Alaguchokkan (A.C), are located in a selective felling area, and two others, Dhargha area (D.A) and Veerappan koil (V.K), are situated in a relatively undisturbed forest. These are 3 to 5 K.m apart in the forest disturbed stand (60% disturbance index), Moderately Disturbed stand (30% disturbance index), and Undisturbed stand (10% disturbance index). Tree species richness varied along the disturbance gradient in different stands. The undisturbed stand showed the highest species richness (11 – 9). Species richness was lowest (5-4) in the Disturbed stand, while in the Moderately Disturbed stand the diversity was somewhat higher (8 – 7). The Shannon – Wiener index for tree species ranged from 1.33 to 2.184 in all the stands. The highest tree diversity was recorded in the undisturbed stand and the lowest in the Disturbed stand. The stands differed with respect to the tree species composition at the family and generic level.

Key words: Eastern Ghats, Piranmalai, Disturbance, Tropical dry deciduous forest.

INTRODUCTION

Tropical forests occupy ca 7% of the earth's area (Myers, 1984). In India, they occupy ca 84% of the total forest cover (637293 Km²), which is 19.39% of the total geographical area (State Forest Report, 1999). Though the total geographical area of tropical wet evergreen forests is ca 15010 Km² (10.7% of the tropical forest cover of India), phytogeographically these forests are rich in biological diversity (Chandrasekharan, 1960). These forests face a serious threat, both natural as well as anthropogenic. Eventually, several species have become endangered. This implies a poor natural regeneration potential of the species. Thus, the need to set priorities for conservation of diversity has become inevitable. Identification of conservation areas ideally requires exhaustive knowledge of species and ecosystem diversity and distribution (Menonet *al.*, 2001,

Angelstan *et al.*, 2004 a, Felix *et al.*, 2004 and Reese *et al.*, 2003).

Primary forests of Asia, particularly those of the Western Ghats and the Eastern Ghats of Peninsular India are disappearing at an alarming rate due to anthropogenic activities and are replaced by forests comprising inferior species or their land use pattern changed (Parthasarathy, 1999). The disappearance of tropical forests threatens us at a time when our knowledge on their structure and dynamics is woefully inadequate (Hubbell and Foster, 1992). Understanding of forest processes is necessary for assessment of potential impacts, the amelioration of effects of disturbance, optimisation of productivity and rehabilitation of ecosystem (Congdon and Herbohn, 1993).

As there is so much species diversity, tropical trees are especially interesting subjects (Condit *et al.*, 1996) and species diversity is generated by species interaction such as competition and niche diversification (Pianka 1966; Bada 1984), the latter being greatly manifested in the tropics due to high humidity and temperature (Ojo and Ola-Adams 1996). Quantitative plant biodiversity inventories of Indian tropical forests are available from various forests of Western Ghats (Sukumar *et al.*, 1992; Ganesh *et al.*, 1996; Pascal and Pelissier, 1996; Ghate *et al.*, 1998; Parthasarathy, 1999; Parthasarathy and Karthikeyan, 1997a; Ayyappan and Parthasarathy, 1999) and on the Coromandal coast (Parthasarathy and Karthikeyan, 1997; Parthasarathy and Sethi, 1997), but the Eastern Ghats is poorly studied in these aspects, except those of Kadavul and Parthasarathy (1999a) in the Shervarayan hills and Kadavul and Parthasarathy (1999b) in the Kalrayan hills.

Disturbance to an ecosystem means any discrete event that disrupts the ecosystem, community or population structure, or the physical environment (Pickett & White 1985). Species composition, community dynamics and human welfare services of forest ecosystems become adversely affected by disturbances of both natural and anthropogenic origin (Sousa 1984). Whitemore & Burslem (1996) classified disturbance into large scale or community wide (landslides, volcanoes, drought, lightning, forest fire and various human activities) and small-scale disturbances such as mortality of few trees. In fact many kinds of disturbances both natural and anthropogenic are amenable to scientific experimentation and immeasurable directly. Most of the studies on forest ecosystems in relation to disturbance were focused on species-rich tropical rain forests (Ashton 1993; Aravind *et al.* 2001; Bhuyan *et al.* 2001; Whitemore & Burslem 1996) or temperate forests (Gilliam 2002; Schumann *et al.* 2003). Dry deciduous forests of tropical areas are under constant disturbances of both climatic and anthropogenic origin. In India, habitat destruction, over exploitation, environmental pollution and anthropogenic pressure are the major disturbances to forest ecosystems (UNEP 2001). The dry tropical forest accounts for 38.2% of the total forest cover of India (MoEF 1999), which is largely disturbed by lopping, burning, overgrazing and clearing for cultivation. Such disturbances lead to their conversion into species-poor forest ecosystems. Habitat destruction is the leading cause of species extinction and biodiversity loss in natural ecosystems (Koh *et al.* 2004; Pimm & Raven 2000). Unfortunately, studies on tropical dry deciduous forests in relation to disturbances were much limited in India (Khera *et al.* 2001; Puyravaud *et al.* 1995) particularly, on Eastern Ghats in south India (Rajan *et al.* 1995). Thus, the present study evaluated the disturbance to a tropical dry deciduous forest of the Piranmalai forest (Eastern Ghats), Sivagangai, south India using selected direct (number of trees, number of butterflies and herb density) and indirect (number of sunspots and number of man-made tracks) measures.

MATERIALS AND METHODS

This research was conducted in the Piranmalai forest of the Eastern Ghats in Tamil Nadu. It was one of the major hill ranges in the southeastern part of the Eastern Ghats located in Sivaganga district of Tamil Nadu, between North latitude 9° 31' to 10° 27', East longitude 78° 8' to 79° 2' (Fig.1) the elevation of the hill measures about 2450 feet above the sea level. A bridal path runs from the foot of the hill to top. The district as a whole was very dry and had a hot tropical climate. April, May and June are the hottest months. The South west monsoon brings rainfall from September to November. From December to February rainfall is received from the North east monsoon. (Fig.2) The district has a mean annual rainfall of 1176.83mm. The taxonomy of the soil was fine loamy, Koolinitic, isohyperthermic, calcareous and very deep.

The vegetation varies considerably with altitude. The food hills harbour scrub vegetation which extends up to an altitude of 400M, dry and mixed deciduous forest occur in the whole hill areas. These forests have been free from human interference over the centuries. This has been mainly due to the very limited human population in the area and the location of the villages. Drastic extraction of Medicinal plants, timber and honey collection were taken up from the 18th century. Some fellings in this area started in 1969, mostly for opening up roads, *Annona squamosa* were planted after clearing sub canopy with the object to cultivate a suitable cash crop that can yield revenue to the area people.

Six 0.1 ha quadrat plots (N.P, F.H, A.C, V.I, V.K and D.A) are established. Sites N.P and F.H are located near human settlements, besides the road. The site N.P is closed to Oduvanpatty village, F.H is near to Piranmalai village human activities are more. They are always collecting forest products daily. Human activities in the area include selective logging of trees such as *Albizia amara*, *Wrightia tinctoria*, *Alangium salvifolium* for fuel and for making agricultural implements. These sites are closed to the agricultural field and stone mining areas. Sites AC and V.I are situated in the interior region. Illegal selective felling for fuel wood and medicinal plants collecting was witnessed on two sites. Sites V.K. and D.A are situated on the peak at an altitude, they are steeper than the other sites and are less disturbed due to poor accessibility, the forest floor contains huge boulders. Occasional browsing and by cattle was noticed.

Phytosociological studies were conducted in all the six study sites during 2002-2003. The density, frequency and basal area were estimated in the randomly placed quadrates. 10 quadrates (10 x 10 m) for trees (individuals with gbh more than 30.1 cm) seedlings and saplings of trees were constructed. Girth at breast height (gbh) at 1.37 m above ground level of all trees and tree seedlings in each quadrate was measured for each species. Diameter at ground level of seedlings was measured using Vernier calipers. Epiphytes were not sampled in this study. Plant species were identified in the field with the help of Gamble (1925) and Mathew (1981-1988) and later counter checked with the reference materials available at the Madras Herbarium (Botanical Survey of India), Coimbatore. A reference collection of specimens were submitted to centre for Biodiversity and Forest studies, School of Energy sciences, Madurai Kamaraj University, at Madurai, in India.

The vegetation data were analyses for relative frequency, relative density and relative dominance. The sum of relative frequency, relative density and relative dominance represented the Importance Value Index (IVI) for various species (Curtis, 1959). The index of the dominance of the community was calculated by Simpson's index (Simpson, 1949) as $C = S (ni/N)^2$ The index of species richness (d) was calculated

following Menhinick (1964), $D = s/\sqrt{n}$. The evenness index of the community (e) was calculated following Pielou (1966) as $e = H'/\log S$. Index of similarity (s) between two samples was calculated following Odum (1971) as $S = 2c/a+b$

RESULTS AND DISCUSSION

Tree species richness

A total number of 16 tree species belonging to 14 genera, 16 species and 12 families was recorded from six sites (disturbed, moderately disturbed and undisturbed) of study area.

Tree species richness varied according to the disturbance gradient in the different stands. Consolidated data of phytosociological studies were given in (Table 1). Tree species richness (number of tree species) was higher in site VI stand (11 species) followed by site V stand (9 species). Site V stand was found to have greater density (620 ha^{-1}) and basal area ($48.494 \text{ M}^2 \text{ ha}^{-1}$). However, greater diversity index 2.184 and species richness (1.556) were recorded in site VI stand. Dominance index (0.301) in site III and evenness index (2.164) in site II stand were found to be greater. Number of species (4), diversity index (1.303), density (220 ha^{-1}) and species richness (0.853) were least in site II stand. However, basal area ($6.587 \text{ M}^2 \text{ ha}^{-1}$) and evenness index (1.932) in site I stand and dominance index (0.135) in site VI stand were found to be least. The highest tree species diversity was recorded in the sites VI, V, IV, III stands and lowest in the sites II and I stands. The similarity index value was maximum in the site V, VI stands and minimum in the sites I, II stands (Table 2).

The species richness of 16 tree species in the 0.6 ha of the tropical dry deciduous forest in Piranmalai forest of Eastern Ghats reflects its low diversity status. As all the six study sites are located within a distance of 6 km and an elevation between 550 and 1100 m, soil, climate and topography largely remain the same. But the difference in human interference between each study site has considerable influence on species richness, from 4 species ha^{-1} in the site II stand to 11 species ha^{-1} in the site VI stand. The diminishing tree diversity along elevational gradients in Piranmalai forest is in conformity with (Lieberman *et al.*, 1996) and (Heaney and Proctor, 1990). The present forest study sites species richness (4-11) was lowered when compared to that of semi-evergreen forests of Indian Eastern Ghats and Western Ghats, ie the number of the species in Kolli hills (26-56; Chittibabu and Parthasarathy, 2000a), Kalrayan hills (42-47; Kadavul and Parthasarathy, 1999a), Shervarayan hills (33-50, Kadavul and Parthasarathy, 1999b), three sacred groves of Kerala (14-23; Chandrashekara and Sankar, 1998), Thirumanikuzhi sacred grove (38, Parthasarathy and Karthikeyan, 1997), Kuzanthakuppam sacred grove (42; Parthasarathy and Karthikeyan, 1997) and also with Peninsular India, species richness was lowered when compared to that of various sites of western Ghats ranging from 30 species ha^{-1} Nelliampathy (Chandrashekara and Ramakrishnan, 1994) to 57 species ha^{-1} in Mylodai and Courtallam reserve forest (Parthasarathy and Karthikeyan 1997), 64 to 82 species ha^{-1} in the medium elevation evergreen forests at Kalakad (Parthasarathy 1999), 90 species on a 3.82 ha^{-1} scale in Kalakad Mundanthurai tiger reserve forest (Ganesh *et al.*, 1996) 48 to 74 species in the humid tropical forest in Tamil Nadu (Swamy *et al.*, 2000), a range of 52 to 79 species ha^{-1} in the 30 ha^{-1} of tropical evergreen forest, Varagaliar, Anamalis (Ayyappan and Parthasarathy, 1999), 30 to 31 species in the tropical dry evergreen forest on the Coromandel coast (Venkateswaran and Parthasarathy, 2003) 87 species in Sal forest of Eastern

Himalayas (Umashankar, 2001), 13-21 species Sal forest of Central Himalayas Doon valley (Pande, 1999), 3-20 species in Corbett National Park (Singh *et al.*, 1995). 16 to 54 species in tropical wet evergreen forest in Arunachal Pradesh, Eastern Himalayas (Putul Bhuyan *et al.*, 2003), 123 species in Jaintia hills in Meghalaya, north east (Upadhaya *et al.*, 2003), 11 to 150 species in the Tansa valley (Radha Veach *et al.*, 2003), 132 to 192 species in the sacred grove in Meghalaya, north east India (Mishra *et al.*, 2004), 208 species in the forest of Gorakpur (Pandey *et al.*, 2003)

Dominance of tree species

Dominance, calculated as the IVI of different species varied greatly in different stands. The IVI of trees in the study area was given in (Table 2). Greater number of tree species (11) were recorded in site VI stand followed by site V stand whereas least number of species (4) were seen in site II stand. *Albizia amara* was found as the dominant tree species in all the study sites except in site IV stand, whereas *Albizia lebbek* dominated in site IV, *Lepisanthes tetraphylla* in site III stand, *Diospyros montana* in site V and VI stands, *Holoptelia integrifolia* in site I and IV stands and *Pleiospermium alatum* in site IV stand were the least dominant in terms of IVI.

The dominance index in the present study ranged from 0.135 to 0.311 which is comparatively higher than that of Courtallum (0.079; Parthasarathy and Karthikeyan 1997), Thirumanikuzhi (0.1251; Parthasarathy and Karthikeyan, 1997), Kuzhanthakuppam (0.173; Parthasarathy and Karthikeyan, 1997) and Nelliampathy (0.08; Chandrashekar and Ramakrishnan, 1994). However, the values of dominance were closer to those of the three sacred groves of Kerala (0.12-0.36; Chandrashekar and Sankar, 1998) but lower than that of Puthupet (0.15-0.40; Parthasarathy and Sethi, 1997) and Kolli hills (0.366-0.83; Lakshmi, 1995).

Tree families, genera and species

Enumeration of plant families, genera and species in different stands showed the presence of 8 families with 8 genera in site V stand, 9 families with 10 genera in site VI stand, 7 families with 7 genera in site III stand, 7 families with 8 genera in site IV stand and 5 families with 5 genera in site I stand 4 families with 4 genera in site II stand (Table 3).

Out of the 8 families in site V stand were represented by a single genus, 9 families in site VI stand, one was by more than one genus and eight were by a single genus, 7 families with 7 genera in site III and IV stands, 5 families with five genera in site I stand and 4 families with four genera in site II stand.

Mimosaceae was the densest tree family (47.03%) in the forest stand followed by Rubiaceae (11.86%), Apocyanaceae (9.88%), Alangiaceae (7.51%), Loganiaceae (7.11%), Herandiaceae (4.74%), Ulmaceae (3.95%), Sapindaceae (3.56%), Rutaceae (1.91%), Ebenaceae (1.58%), Fabaceae (1.19%) and Meliaceae (0.40%).

Tree density and species richness in different girth class

Tree stand density and species richness consistently decreased with increasing Girth class of tree species from 30 to > 240 cm gbh Girth (Fig. 2.1 and Table 2.4). The highest tree stand density and species richness were recorded in the girth class 30-60 and 60-90 cm gbh in all stands. In the site V and VI stands the highest tree stand density and species richness were found in the 90-120, 120-180 and 180-210 gbh cm Girth class, while in the site V stand the 210-240 cm gbh Girth range was recorded. In the site I and II stands no tree was

recorded of more than 120 cm gbh Girth.

The contribution of lower size class trees (30-60 cm gbh) to species richness ranged from in site V stand (22.22%) to in site II stand (100%) and (60-90 cm gbh) to species richness ranged from in site I stand (40%) to site VI stand (81.82%). In medium Girth class (90-120 cm gbh) to species richness ranged from in site I stand (20%) to in site V stand (77.78%) and (120-150 cm gbh) to species ranged from in site IV stand (12%) to in site V stand (66.67%). In the highest girth classes (180-210 cm gbh) and (210-240 cm gbh) species richness was found in sites IV and V stands. In site I and II stands no tree species richness was recorded of more than 120 cm gbh.

The contribution of lower size class trees (30-60 cm gbh) to density ranged from in site V stand (17.74%) to in site I stand (65.23%) and (60-90 cm gbh) to density ranged from in site IV stand (18.64%) to in site VI stand (38%). In medium girth class (90-120 cm gbh) species density ranged from in site I stand (8.70%) to in site V stand (24.19%) and (120-150 cm gbh) to density ranged from in site III stand (10.8%) to in site V stand (25.81%). In the highest girth classes (150-180 cm gbh), (180-210 cm gbh) and (210-240 cm gbh) density were recorded in sites IV and VI stands. In site I and II stands no tree density was found more than 120 cm gbh (Fig. 3 and 4 and Table 4).

Mimosaceae is the most important (47.03%) individualised family in the Piranmalai forest study area. This feature of a single family dominance with 47.03% contribution is greater in the Shervarayan hills, the other Indian Eastern Ghats site, where the family Oleaceae (26.6%) dominated (Kadavul and Parthasarathy 1999a) and Jengka forest reserve, Malaysia, where the *Euphorbiaceae* with 24.6% dominated (Ho *et al.*, 1987).

Mimosaceae, *Rubiaceae*, *Apocyanaceae*, *Alangiaceae* and *Loganiaceae* were the most specious families in the tropical dry deciduous forest of Piranmalai, while in the adjacent Shervarayan hills *Euphorbiaceae* and *Rubiaceae* were most dominant (Kadavul and Parthasarathy 1999a). Broad leaved forests in Taiwan showed *Lauraceae* and *Rubiaceae* to be dominant (Hara *et al.*, 1997).

In central Amazonian upland forests, *Leguminoasae*, *Lauraceae*, *Sapotaceae*, *Chrysobalanaceae* and *Moraceae* were the richest families (Ferreira and Prance, 1998).

The family dominance changed from the sites I, II stands to sites III, IV stands and to sites V, VI stands the change being more conspicuous in the sites I and II stands. A similar result has also been reported by (Thorington *et al.*, 1982), (Parthasarathy and Karthikeyan, 1997) and (Parthasarathy and Sethi, 1997). The drastic variation in tree species composition and abundance among the six sites, is evidently due to anthropogenic activities, especially in sites I and II stands.

The trend of decreasing diversity and density with increasing Girth class was in conformity with the studies of (Hara *et al.*, 1997), (Jeffre and Veillon, 1990), (Kadavul and Parthasarathy, 1999a), (Newbery *et al.*, 1992) and (Paijmans, 1970). In the present study sites IV and V stands, matured stands with good regeneration were reported from Jenka forest reserve, Malaysia (Poore 1968; Ho *et al.*, 1987), Costa Rica (Lieberman *et al.*, 1985), Brazilian Amazon (Swaine *et al.*, 1987; Campbell *et al.*, 1992), Sungei Menyala in Malaysia (Manokaran and Kochummen, 1987), Mudumalai in India (Sukumar *et al.*, 1992) and in Monteverda, Costa

Rica (Nadkarni *et al.*, 1995). Sites I and II stands respectively with had low density in smaller and larger girth classes. This corroborates our field observation during this investigation. In site I and II stands, smaller Girth class trees were easy to cut and transport as head loads since the sites were closer to union road and human settlements. Majority of the cut trees were recorded in first and second Girth classes ie. (30-60 and 60-90 cm gbh). These findings indicated the preference of lower Girth class wood by the villagers to meet the household fuel wood demand and also the demand of poles for construction purposes.

CONCLUSION

Biodiversity is essential for human survival and economic well-being and for the ecosystem function and stability. The biodiversity inventories of Piranmalai forests particularly those of the poor known tropical dry deciduous forest in Piranmalai forest of Eastern Ghats. Our results suggest that a history of disturbance, accelerated during the last century has reduced biomass, canopy height and tree density in forests. The forest and soils have thus retained less of the precipitation of the monsoon and increased the effect of the post monsoon dry season on the vegetation. The quantitative biodiversity data of Eastern Ghats will be useful in forest management and conservation. Forest has been cleared for park construction, road construction, tourist resorts and agricultural land encroachments. In recent years it has become increasingly apparent that conservation of tropical forest cannot rely solely on protected area networks. A comprehensive approach to forest conservation must therefore incorporate the sustainable management of land outside protected areas (Boyle, 1977) and this requires an understanding of how human activities impact on forest resources. In the Piranmalai forest sites this is essential to prevent further expansion of construction and plantation area, as the protection of existing forests here is crucial for biological conservation of the species. Occasionally wild animals such as peacock, rabbit and monkey are hunted. Trees are selectively felled for firewood, household, furniture and fencing and for making minor agricultural implements. An alternative fuel energy source for cooking needs to be provided for the 8000 inhabitants of the hill area in order to prevent felling, and hotels in this tourist area should be instructed to use cooking gas as to save the hill forest. Presently, there is a need for increased legal protection, well designed management practices and intensive afforestation at selected altitudes especially foot- and mid-hill areas for the sustainable utilization of the dry deciduous forests.

Fig. 1. Map of study area.



Manamadurai Ilayankudi

Table 1. Consolidated details of Phytosociological analysis in the tropical dry deciduous forest ecosystem at Piranmalai forest, Eastern Ghats, Tamil Nadu, India.

S. No.	Criteria	Site I	Site II	Site III	Site IV	Site V	Site VI
1.	Number of species						
	Trees	5	4	7	8	9	11
2.	Density (no/ha)						
	Trees	230	220	370	590	620	500
3.	Basal area (m²/ha)						
	Trees	6.587	8.565	14.384	46.383	48.494	24.311
	Diversity index						
	Trees	1.351	1.303	1.500	1.872	1.953	2.184
5.	Dominance index						
	Trees	0.311	0.296	0.301	0.180	0.175	0.135
6.	Species richness						
	Trees	1.043	0.853	1.151	1.042	1.143	1.556
7.	Evenness index						
	Trees	1.932	2.164	1.769	2.073	2.046	2.097

Table 2. Importance value indices (IVI) of different trees in the tropical dry deciduous forest ecosystem at Piranmalai forest, Eastern Ghats, Tamil Nadu, India.

S. No.	Name of the species (Trees)	Family	Site I	Site II	Site III	Site IV	Site V	Site VI
1.	<i>Alangium salvifolium</i> (L.f.) Wanger in ssp. <i>Salvifolium</i>	Alangiaceae		66.855	12.696	42.6094		16.666
2.	<i>Albizia amara</i> (Roxb.) Boivin ssp. <i>amara</i>	Mimosaceae	141.646	129.348	144.654	68.1018	98.054	78.090

3.	<i>Albizia lebbbeck</i> (L.) Benth.	Mimosaceae				84.2369	40.891												
4.	<i>Azadirachta indica</i> Adr. Juss.	Meliaceae																	10.475
5.	<i>Diospyros montana</i> Roxb.	Ebenaceae	30.181											5.616	6.241				
6.	<i>Gyrocarpus americanus</i> Jacq.	Herandiaceae				14.578								22.334	37.992				
7.	<i>Haldenia cordifolia</i> (Roxb.) Ridsd.	Rubiaceae											165.037						
8.	<i>Holoptelea integrifolia</i> (Roxb.) Planchon	Ulmaceae	13.298	46.920									15.428						28.679
9.	<i>Lepisanthes tetraphylla</i> (M.Vahl) Redlk.	Sapindaceae				11.750							21.4039	25.729					
10.	<i>Morinda tinctoria</i> Roxb.	Rubiaceae	67.482							60.651					32.020				34.734
11.	<i>Pleiospermium alatum</i> (Wright and Arn.) Swingle	Rutaceae											13.6051						
12.	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae													13.362				
13.	<i>Prosopis juliflora</i> (Sw.) DC.	Mimosaceae																	11.869
14.	<i>Strychnos nux-vomica</i>	Loganiaceae								12.770			38.5779	21.660	26.588				
15.	<i>Strychnos potatorum</i> L.f.	Loganiaceae																	15.799
16.	<i>Wrightia tinctoria</i> (Roxb.) R.Br.	Apocyanaceae	47.393	56.877		42.892									40.333				32.868

Table 3. Family wise contribution of genera(G), species(S) and density of trees in the tropical dry deciduous forest ecosystem at Piranmalai forest, Eastern Ghats, Tamil Nadu, India.

S. No.	Family	Site I			Site II			Site III			Site IV			Site V			Site VI		
		G	S	D	G	S	D	G	S	D	G	S	D	G	S	D	G	S	D
1.	Alangiaceae				1	1	50	1	1	20	1	1	90				1	1	30
2.	Apocyanaceae	1	1	20	1	1	40	1	1	50				1	1	80	1	1	60
3.	Ebenaceae	1	1	20										1	1	10	1	1	10
4.	Fabaceae													1	1	30			
5.	Herandiaceae							1	1	20				1	1	40	1	1	60
6.	Loganiaceae							1	1	10	1	1	60	1	1	40	1	2	70
7.	Meliaceae																1	1	10
8.	Mimosaceae	1	1	120	1	1	90	1	1	170	1	2	340	1	2	300	2	2	170
9.	Rubiaceae	1	1	60				1	1	90	1	1	20	1	1	70	1	1	60
10.	Rutaceae										1	1	30						
11.	Sapindaceae							1	1	10	1	1	30	1	1	50			
12.	Ulmaceae	1	1	10	1	1	40				1	1	20				1	1	30

Table 4. Species richness (No. of species), and density/ha of the trees (10-30 cm dbh) recorded at Piranmalai forest, Eastern Ghats, Tamil Nadu, India.

S. No.	Girth Class	Number of species						Density/hectare					
		Site I	Site II	Site III	Site IV	Site V	Site VI	Site I	Site II	Site III	Site IV	Site V	Site VI
1.	30-60	3	4	5	4	2	7	150	120	220	120	110	120
2.	60-90	2	3	5	6	5	9	60	60	90	110	190	190
3.	90-120	1	2	2	4	7	4	20	40	20	100	150	90
4.	120-150	-	-	1	6	6	6	-	-	40	130	160	100
5.	150-180	-	-	-	3	-	-	-	-	-	30	-	-
6.	180-210	-	-	-	-	1	-	-	-	-	-	10	-
7.	210-240	-	-	-	1	-	-	-	-	-	10	-	-
8.	240-270												
9.	270-300												
10.	300 >												

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