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Phytodiversity Assessment of Tropical Rainforest of North Andaman Islands, India

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Abstract: A detailed phytodiversity inventory was done on tropical rainforest of North Andaman Islands to assess the higher angiospermic species diversity. Stratified random sampling was done to collect phytosociological data and the ground data was analyzed for species richness and diversity in each forest type. Study also emphasized on the factors that have contributed for high species richness, heterogeneity and diversity within each forest type. Analysis showed semi evergreen forest as highly diversified community with high species richness that enhances biological richness of the north Andaman forest.

Key words: Rain forest, species richness, endemic, ecological equivalents, companion species

INTRODUCTION

Tropical rain forests the greatest celebrations of life on earth (Myers, 1991) deserve special environmental attention, as they constitute the most biologically diverse terrestrial ecosystem. Phytodiversity studies in tropical rainforest are important in the context to know the processes or mechanisms that maintain high diversity, species richness, species assemblage, carbon budget with in these forest at the same time providing a database about the number and status of the species existing in that area. Connell (1978) Phillips and Gentry (1994) were carried out in different rainforest of the world to reveal the secret behind the existence of high species diversity within these forests. In India, there are three ecological hot spots where these rainforest occur, viz., Western Ghats, North Eastern Himalayas and Andaman and Nicobar Islands archipelago.

Andaman and Nicobar islands are considered as one of the important biosphere in terms of their species diversity and endemism. These islands are relatively placed away from the human disturbance coupled with island habitat in the tropical region and high intensity of rainfall. The climate and physiographic setup of these islands represents the sites of biological endemism. Floristic features of these islands show much similarity with the flora of Myanmar, Thailand and Northeast India (Reddy and Dutt, 2005).

Since for a long time Andaman Islands have been objects of mystery, intrigue and scientific curiosity to researchers for their distinctive species, giving a way to explore newer taxa or species. Work done towards the diversity studies in Andaman Islands is less due to their relative inaccessibility and inapproachability (Anonymous, 2003; Stutee *et al*., 2004). Inspite of these barriers, many taxonomists and ecologists contributed to certain extent in exploring these islands to list the flora and

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fauna existing in these islands (Singh *et al*., 1987). The studies were concentrated more towards the floristic surveys rather than species diversity (Reddy *et al*., 2004). Hence the present study was carried out to with an objective to understand and stratify the North Andaman vegetation by assessing the species diversity, dominance, heterogeneity and richness of angiospermic taxa within each forest type.

MATERIALS AND METHODS

Study Area

Andaman district comprises three sub divisions viz., North, Middle and South Andaman, covering more than two third of the archipelago island area. North Andaman comprising 72 islands lies 285 km south of Myanmar, between 12°95°N and 92°86°E covering an area of 1458 km^2 (Fig. 1). Saddle peak is the highest peak (732 m msl) in North Andaman, which is the highest hill elevation in the entire Andaman and Nicobar Islands. This peak is thought to be paradise for the taxonomist to explore a variety of new species. Andaman vegetation falls under Indo-Malayan type. As per the Champion and Seth (1968) the predominant vegetation types of North Andaman forest are Andaman Tropical Evergreen Forest (1A/C2) andaman Semi evergreen forest (2A/C1) and Andaman Moist deciduous forest.

Based on the species area curve method minimum quadrant size of 0.1 ha (31.6×31.6 m) has been considered as a matter of convenience for phytosociological data collection. Stratified random sampling method was used and overall about 100 quadrants of 0.1 ha were laid in three predominant forest types viz, Evergreen (32), Semievergreen (28) and Moist Deciduous (40) of North Andaman during 2001-2003. Each quadrant was systematically analyzed for tree data and trees >30 cm girth at 1.37 m above the ground were identified and measured. Species identification was done while carrying out the enumerations (either botanical name or local name). Incase of doubt about identification, specimens were collected with proper field information (quadrant number, locality, habitat etc.) and identified at Botanical Survey of India (BSI), Port Blair where the specimens were identified with the help of literature and existing authentic specimens.

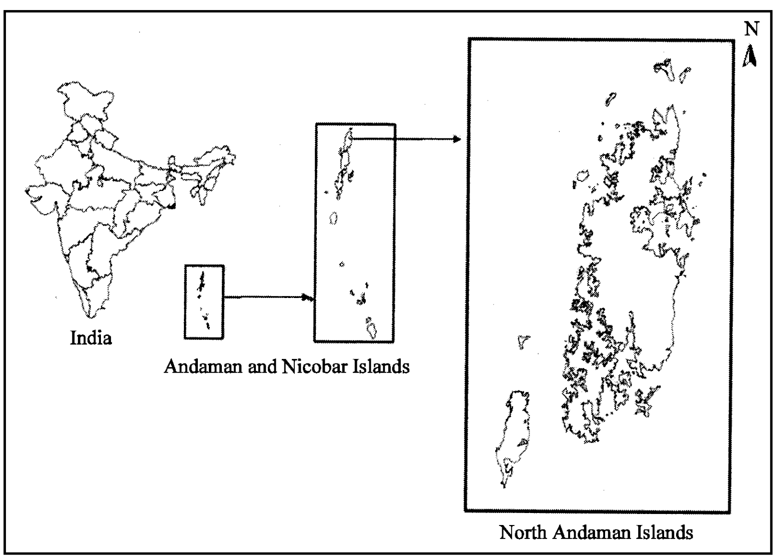

Fig. 1: Location map of North Andaman Islands

Data Analysis

The vegetation data were quantitatively analysed for basal area, relative density, relative frequency and relative dominance (Phillips, 1959). The Importance Value Index (IVI) for the tree species was determined as the sum of the relative frequency, relative density and relative dominance (Cottam and Curtis, 1956).

Basal area (m^2)	=	Area occupied at breast height (1.3 m) = $[(dbh/2)^2]$.
Relative density	=	No. of trees of species/total number of trees.
Relative frequency	=	No. of time species occurs/total number of species.
Relative dominance	=	Total basal area of a species/total basal area for all species.
Importance Value Index (IVI)	=	Sum of (relative density+relative frequency+relative dominance)/ 100.

Species diversity of each forest type was determined (Shannon and Weiner, 1963).

$$H' = - \sum [(ni/N)\log2(ni/N)]$$

Where,

ni = The total No. of individuals of species i and

N = The total No. of individuals of all species in that vegetation type.

Evenness Index (Hill, 1973) also used to determine species diversity. This index identifies the pattern of distribution or abundance of individuals between the species. The maximum value of 1 occurs when all species are equally abundant.

Concentration of dominance (Simpson's index of dominance) was also measured using the formula (Simpson, 1949):

$$C = - S(ni/N).$$

Where, ni and N are the same as those for the Shannon-Weaver information function.

Similarity between three forest types was determined (Sorenson's index of similarity, Sorenson, 1948).

The Family Importance Value Index (FIVI) is used to predict the dominance and importance of families based on single value, which is the sum of the relative diversity, the relative density and the relative dominance of all individuals of the family in the sample (Mori *et al*., 1983).

Girth class wise species distribution and diversity was also analysed to understand population structure.

RESULTS

Vegetation Type Composition

The Andaman tropical rain forests vary in both species composition and structure due to micro level variations in the climate, duration and availability of precipitation, nature of soils, slope and altitude.

Andaman Tropical Evergreen Forest

This type of forest is encountered throughout the North Andaman Islands capping the hills. The top and middle layer of the forest is dominated by tall emergent trees such as *Dipterocarpus gracilis*, *Myristica glaucescens*, *Dipterocarpus grandiflorus*, *Artocarpus chaplasha*, *Pterocymbium tinctorium* (Table 1).

Table 1: Results of phytodiversity analysis in predominant forest types of North Andaman

Vegetation types	Evergreen	Semi-evergreen	Moist deciduous
General parameters			
No. of individuals	2478	1993	2830
No. of species	151(5)	148(4)	258(11)
No. of genera	119	113	113
No. of families	54(5)	47(4)	40(11)
No. of stems ha^{-1}	774	711	708
Basal area ha^{-1} (m^2)	54.19	49.4	47.4
Species diversity			
Shannon diversity	5.80	6.00	5.70
Sompson's dominance	0.04	0.02	0.03
Hill eveness Index	0.80	0.84	0.79

No. in bracket indicate unidentified species

Andaman Semi Evergreen Forest

It is a luxuriant forest compositionally the densest in the islands with giant trees including both evergreen and deciduous species distributed mainly on well-drained immature alluvial soils in the valleys. Top storey constitutes tree species like *Pterocarpus dalbergoides*, *Celitis wightii*, *Pterygota alata*, *Diospyros pilosula*, *Aglaia oligophylla* and *Dipterocarpus gracilis* (Table 1).

Andaman Moist Deciduous Forest

This type of forest is found throughout the islands on low-level grounds where soil moisture is low, with deciduous trees having heavy girth, large buttresses and fairly shrubby evergreen growth (Devraj, 2001). Bamboo and canes are often more in number. This type is confined to the hilly ground and does not extend much over 100 m elevation where it is displaced by tropical evergreen forest. *Pterocarpus dalbergioides* is the predominant tree with large buttress and very low or poor regeneration growth. Co-dominants include *Diospyros pilosula*, *Celtis wightii*, *Mitragyna rotundifolia*, *Aglaia andamanica*, *Terminalia bialata* and *Lannea coromandelica* forming the upper and middle strata of forest (Table 1).

Species Richness and Diversity

Shannon diversity in three forest types ranged between 5.6 and 6.0. Analysis indicated high species diversity (6.0) in semi-evergreen forest represented by 148 species, 113 genera and 47 families followed by evergreen (5.8) with 151 species by 55 families and 119 genera, then moist deciduous (5.6) with 147 species by 113 genera and 40 families.

Hill Evenness

The index ranged between 0.79-0.84 in three forest types. This index identifies the pattern of distribution or abundance of individuals between the species. In the present context the low value of 0.79 for moist deciduous and high value of 0.84 in semi evergreen type indicates uneven and even abundance of species distribution in two vegetation types, respectively.

Forest Heterogeneity

Simpson dominance Index predicts basically the heterogeneity of community and the values ranged between 0.02-0.04 in three forest types. This value gives the probability of randomly chosen two individuals belonging to the same species. The low value of 0.02 in semi-evergreen forest indicates the system being highly heterogeneous than the evergreen (0.04) and moist deciduous forest (0.03).

Similarity Index

The index value shows that more than 50% of tree species are common or shared by the three forest types. About 116 species between evergreen and semi evergreen, 102 between semi evergreen and moist deciduous and 107 between evergreen and moist deciduous were found to be common. High similarity (76%) was found between semi-evergreen and evergreen types.

Stem Density and Basal area

High stem density (774 stems ha^{-1}) and basal area (54.19 m^2 ha^{-1}) was recorded in evergreen type. In evergreen 34% of the tree density was represented by *Myristica glaucescens* (350), *Dipterocarpus gracilis* (219), *Dipterocarpus grandiflorus* (114), *Celtis wightii* (89) and *Artocarpus chaplasha* (72). In Semievergreen 24% by *Celtis wightii* (142), *Dipterocarpus gracilis* (98), *Aglaia oligophylla* (80), *Pterygota alata* (76) *Diospyros pilosula* (74) and in moist deciduous 33% by *Diospyros oocarpa* (278), *Diospyros pilosula* (205), *Pterocarpus dalbergioides* (167), *Celtis wightii* (159), *Aglaia oligophylla* (133).

Similarly 42% of the total basal area (m^2) is contributed by *Dipterocarpus gracilis* (15.7%), *Myristica glaucescens* (8.9%), *Dipterocarpus grandiflorus* (7.1%), *Artocarpus chaplasha* (5.6%), *Pterocymbium tinctorium* (4.3%) in evergreen, 37% by *Pterocarpus dalbergioides* (11.8%), *Dipterocarpus gracilis* (7.9%), *Artocarpus chaplasha* (6.3%), *Pterocymbium tinctorium* (6.2%), *Planchonia andamanica* (4.5%) in semi evergreen and 45% by *Pterocarpus dalbergoides* (31.1%), *Terminalia bialata* (4.2%), *Diospyros oocarpa* (3.6%), *Pterocymbium tinctorium* (3.5%), *Lannea coromandelica* (2.8%) in moist deciduous.

Importance Value Index

Importance value index is calculated as sum of relative frequency, relative density and relative basal area to predict the dominance of species with single value in each forest type (Table 2).

Family Importance

Based on the Family Importance Value Index (FIVI) values the important families include Dipterocarpaceae (45.35), Myristicaceae (28.65), Anacardiaceae (20.90), Sterculiaceae (19.39) and Moraceae (17.71) in evergreen, Sterculiaceae (26.99), Anacardiaceae (25.36), Dipterocarpaceae (21.25), Meliaceae (19.91) and Euphorbiaceae (18.18) in semi-evergreen, Fabaceae (37.69), Ebenaceae (30.88), Meliaceae (22.55), Sterculiaceae (21.41) and Rubiaceae (15.83) in Moist deciduous. The FIVI gives an idea that Sterculiaceae, Dipterocarpaceae, Anacardiaceae and Meliaceae families represent entire North Andaman Islands vegetation.

Similarly dominant families were also listed based upon the number of individuals (density), genera and species in each family. Table 3 shows the five dominant families that represent 51.8% of total population, 31.1% of genera, 31.8% in evergreen, 49.7% of population, 33.6% of genera, 33.1% of species in semi evergreen and 50.9% of population, 33.6% of genera and 32.7% of species in moist deciduous types.

Raunkier's Frequency Classes-Vegetation-Heterogeneity

The composition of vegetation depends on the assemblage of species population of a particular type and in turn the spatial distribution pattern of species population depends on the dispersal

Table 2: Dominant tree species based on importance value index

Evergreen		Semi-evergreen		Moist deciduous	
Species name	IVI	Species name	IVI	Species name	IVI
Dipterocarpus gracilis	26.79	*Pterocarpus dalbergoides*	15.79	*Pterocarpus dalbergoides*	40.70
Myristica glaucesceus	26.16	*Celtis wightii*	14.74	*Diospyros oocarpa*	16.97
Dipterocarpus graudiflorus	12.67	*Dipterocarpus gracilis*	14.37	*Diospyros pilosula*	12.72
Artocarpus chaplasha	11.62	*Artocarpus chaplasha*	11.94	*Celtis wightii*	11.44
Pterocymbium tinctorium	7.79	*Pterocymbium tinctorium*	11.51	*Aglaia oligophylla*	10.39

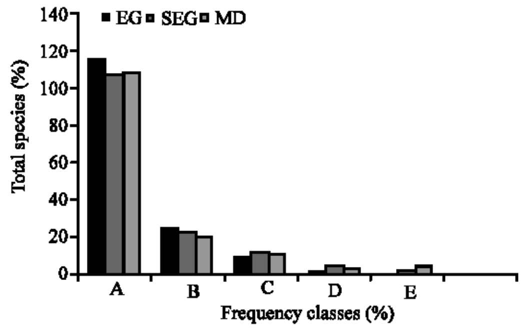

Fig. 2: Raunkaier's normal frequency classes for various forest types

Table 3: List of dominant families based on density (Individuals)

Dominant families (trees)								
Evergreen			Semi-evergreen			Moist deciduous		
Families	Density	%	Families	Density	%	Families	Density	%
Myristicaceae	415	16.7	Meliaceae	228	11.4	Ebenaceae	588	20.8
Dipterocarpaceae	380	15.3	Sterculiaceae	219	11.0	Meliaceae	329	11.6
Sterculiaceae	180	7.3	Ebenaceae	204	10.2	Sterculiaceae	182	6.4
Anacardiaceae	170	6.9	Anacardiaceae	183	9.2	Rubiadeae	172	6.1
Meliaceae	139	5.6	Lauraceae	156	7.8	Lauraceae	169	6.0
Total	1284	51.8		990	49.7		1440	50.9
Genera								
Euphorbiaceae	10	8.4	Euphorbiaceae	14	12.4	Rubiaceae	10	8.8
Anacardiaceae	8	6.7	Anacardiaceae	8	7.1	Euphorbiaceae	10	8.8
Anonaceae	7	5.9	Rubiaceae	6	5.3	Anacardiaceae	8	7.1
Rubiaceae	7	5.9	Sterculiaceae	5	4.4	Sterculiaceae	5	4.4
Meliaceae	5	4.2	Anonaceae	5	4.4	Anonaceae	5	4.4
Total	37	31.1		38	33.6		38	33.6
Species								
Euphorbiaceae	14	9.3	Euphorbiaceae	18	12.2	Euphorbiaceae	13	8.8
Anacardiaceae	10	6.6	Abacardiaceae	10	6.8	Rubiaceae	10	6.8
Meliaceae	9	6.0	Rubiaceae	7	4.7	Anacardiaceae	9	6.1
Anonaceae	8	5.3	Sterculiaceae	7	4.7	Anonaceae	8	5.4
Rubiaceae	7	4.6	Anonaceae	7	4.7	Meliaceae	8	5.4
Total	48	31.8		49	33.1		48	32.7

capacity of the species, the microclimatic conditions in which it grows and other biotic factors. Based on the frequency distribution of the species, Raunkiaer (1934) classified a community into five frequency (%) classes viz. A = 1-20%, B = 21-40%, C = 41-60%, D = 61-80% and E = 81-100% (Fig. 2).

As given by Raunkaier, when classes A B, C, D are high, the community is considered to be heterogeneous, undisturbed or least disturbed; on the other hand if class E is greater than other, the community is a uniform or homogenous community. In the present study all the three vegetation types satisfy the criteria given by Raunkaier and are heterogeneous and least disturbed communities.

Species Area Curve

The species area curve plotted with cumulative number of species on Y-axis and area sampled (ha) on X-axis, reached asymptote at 7.5 ha indicating the sampled area (10 ha pooled from 100 quadrants of 0.1 ha size) in the present study is adequate to capture the species richness of the area (Fig. 3).

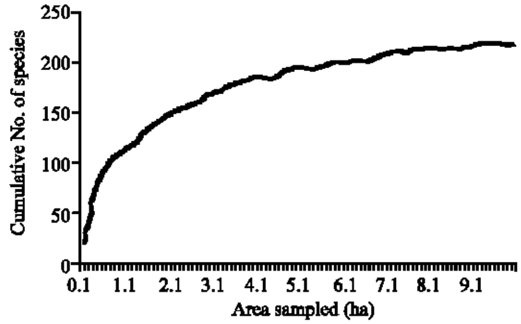

Fig. 3: Species area curve (100 random plots of 0.1 ha size)

Table 4: Tree girth class wise species diversity, stem density, species richness and basal area in Evergreen (EG), Semievergreen (SEG) and Moist Deciuous (MD) forest types

EG	Diversity	Individuals	Species	Percentage of species	Basal area	BA (%)
30-60	5.8	1286	134	88.7	19.2	11.1
60-90	5.5	542	96	63.6	23.1	13.3
90-120	5.3	245	71	47.0	21.3	12.3
120-150	4.9	155	48	31.8	21.6	12.4
>80	4.4	146	37	24.5	66.8	38.5
SEG						
30-60	5.9	1096	130	87.8	16.1	11.6
60-90	5.6	421	87	58.8	17.7	12.8
90-120	5.3	187	55	37.2	16.0	11.5
150-180	4.8	65	35	23.6	13.9	10.1
120-150	4.7	100	39	26.4	13.4	9.7
>180	4.2	124	31	20.9	61.2	44.2
MD						
30-60	5.3	1685	125	85.0	12.5	14.2
60-90	5.6	500	92	62.6	20.8	12.6
90-120	5.5	139	64	43.5	19.9	12.0
120-150	4.4	118	36	25.5	16.6	10.0
150-180	3.8	104	29	19.7	22.3	13.4
>80	3.4	184	33	22.4	86.5	52.1

Girth Classes vs Diversity

Among the three vegetation types, high species richness and density was observed in lower girth classes (30-60 cm gbh) and species richness decreased with increasing girth class, whereas density decreased with increasing girth class upto 150-180 cm class and then after increased in higher girth class (>180 cm gbh). High diversity was recorded in the girth class of 30-60 cm in both evergreen (5.8) and semi evergreen (5.9) and in girth class of 60-90 cm in moist deciduous (5.6). In case of evergreen and semi evergreen diversity decreased with increasing girth classes and specific trend was not observed for moist deciduous.

Girth Wise Basal Area

In all the three types of forest girth class >180 contributed higher basal area i.e., in evergreen (38.5%), semi evergreen (44.2%) and moist deciduous (52.1%) and does not follow any sequence of increasing or decreasing with the girth class in contrast to the observations by Ayyappan and Parthasrthy (1999) in 30 ha plot where basal area increased with increasing girth class up to 150 cm gbh and then after decreased exponentially (Table 4).

Cluster Analysis-Forest Communities

The application of cluster analysis technique made it possible to divide each forest type into further different clusters by hierarchical classification. Cluster analysis was performed by Statistica

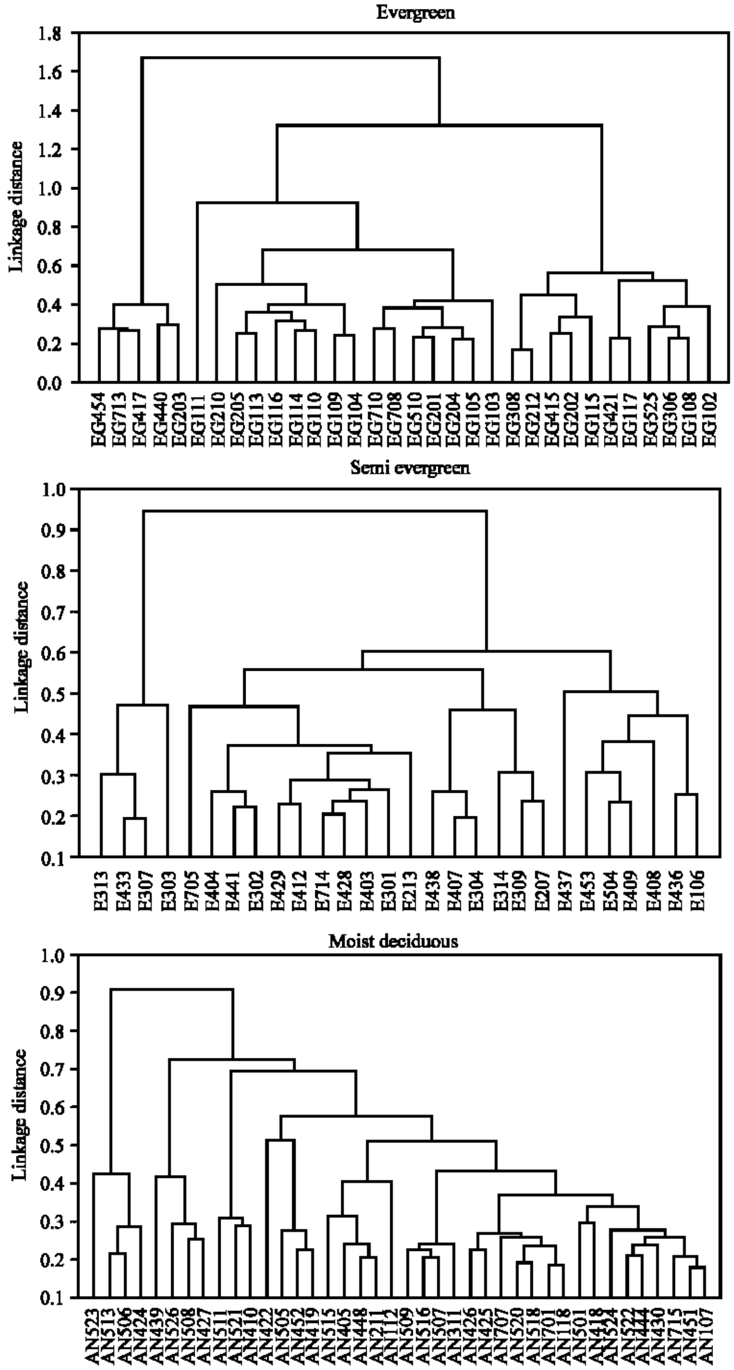

Fig. 4: Cluster analysis dendrogram of three forest type

software (6.0) using Wards method with Euclidean distance. Each cluster was delineated as a different community and in evergreen 32 quadrants were grouped into 5, in semi evergreen 28 into 4 and in moist deciduous 40 into 9 communities (Fig. 4).

Evergreen Communities

Five communities representing the entire North Andaman evergreen forest are further reduced to 3 predominant communities and are named after the dominant species as *Dipterocarpus grandiflorus*, *Anacolosa frutescens* and *Myristica glaucescens* communities.

Semi Evergreen Communities

Within semi evergreen four communities reduced to three groups as *Dipterocarpus grandiflorus*, *Celtis wightii* and *Pteygota alata* communities.

Moist Deciduous Communities

Nine communities of moist deciduous were reduced to six groups as *Mitragyna rotundifolia*, *Pterocarpus dalbergoides*, *Celtis wightii*, *Diospyros oocarpa*, *Diospyros pilosula*, *Aglaia andamanica*.

The analysis of cluster analysis gives clear demarcation of forest types with specific types of species restricted to particular forest types. Example: Genus *Dipterocarpus* exclusively to evergreen, *Diospyros* to moist deciduous. It also provides a picture of changing transitional species communities between the forest types.

DISCUSSION

Diversity, Richness and Heterogeneity

The geological formation in North Andaman is mainly responsible for the soil types, which again in its turn influence the forest composition. Heterogeneous soil and geologic characteristics brings out large variation in forest types at relatively small spatial scales. The reason for variation in diversity pattern among the three predominant forests is mainly due to the variation in microclimatic conditions, physical environment and habitat ecological situations and to certain extent anthropogenic disturbances.

An overall analysis of forest types showed that Semi evergreen forest represents a highly heterogeneous and diversified community with high tree diversity, coupled with low Simpson's dominance index. Increased productivity supports greater species diversity due to the climatic stability and increased habitat heterogeneity (Murali *et al*., 2003). High heterogeneity in turn may be due to the unpredictable natural factors like tree felling by storm or rainfall or other environmental factors. Species diversity is positively correlated with the annual rainfall or to climate (Zhang, 1999). Generally in terrestrial ecosystems, factors like low temperature and high precipitation increase species diversity. High species diversity also implies many speciation events (Hubbell and Foster, 1986) and relatively low extinction rates and usually diversity varies with the extent of disturbance. Low diversity in moist deciduous could be due to the easy approachability by people into the forest area for domestic purpose, resulting in high disturbances.

Various mechanisms could be attributed to high diversity, species richness and heterogeneity. Huston's (1979 and 1994) Dynamic Equilibrinm Model (DEM) explains that species diversity will be high in an area where opposing forces of disturbance and productivity are in dynamic equilibrinm i.e. the disturbance and productivity frequencies are relatively low, but not extremely low. Based on this it can be described that the high diversity observed in semi evergreen forest is due to its existence in low disturbance areas of North Andaman.

If abundant species are more, community shows low diversity and high unevenness as in case of moist deciduous and in turn as in case of semi evergreen if rare species are more and species are equally abundant, the community is a high-diversified community. Evenness index indicate the high heterogeneity of semi evergreen, where all species are eqnally dominating with more number of rare species.

As per Shimada and Wilson (1985) mass effect, the high local species richness as observed in semi evergreen is caused due to the immigration of species from nearby dissimilar habitats which are treated

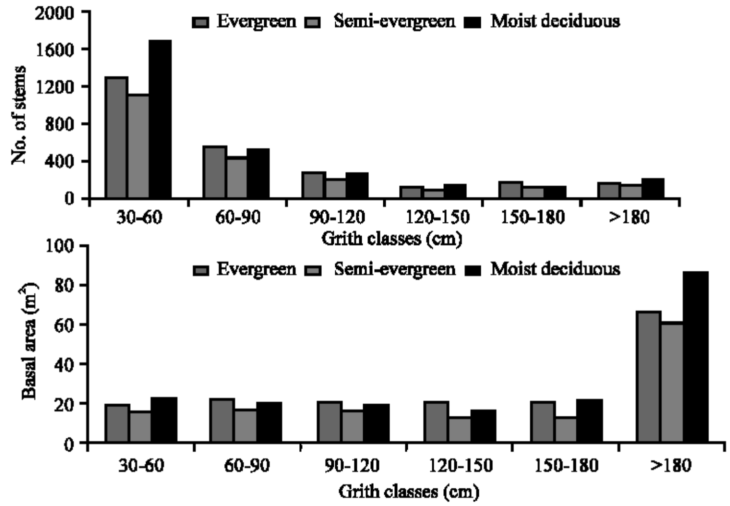

Fig. 5: Trends of stem denstive and basal area in various tree girth classes

as generalist species and are capable of performing over a wide range of habitats (Palmer, 1992). Similarity index indicates high similarity among the three vegetation types. Similar climatic factors may be one of the reasons for this kind of uniqueness among the forest types. The high percentage of stem density and basal area in three forest types represented by various dominant species indicate their space and resource utilization.

The girth class diversity analysis gives the scenario of the forest stand structure as expanding type with more number of trees in lower size class, with reduction in the next subsequent classes and again a slight increase for the greatest size class (class >180). Analysis also showed an inverse relationship between stem density and basal area with low basal area and more stems in lower girth classes and vice versa (Fig. 5). The trend of decreasing species diversity and density with the increasing tree size is similar to that of observed by Parthasarathy and Karthikeyan (1997) in Western Ghats, India. A low diversity was recorded in all the three forest types in the girth class >180 cm indicating the low population of mature trees, giving impression of on going climax successional stages within forest types. Generally during the early stages of community succession, the number of younger stems will be more and as community becomes older, number of younger stems decrease and mature trees increase.

Species wise *Pterocarpus dalbergoides*, the pride endemic of Andaman Islands, is found to be important dominant species contributing high IVI in both semi-evergreen and moist deciduous, with large volume and buttressed stems. Euphorbiaceae, Anacardiaceae, Rubiaceae and Sterculiaceae were found to be the most important and dominant families representing a major portion of the three forest types. This indicates a wide range of growth, adaptability and distribution of various members of these families through out the islands.

The species and families dominating tropical forest at large scales should tend to combine high reproductive rates and success, wide dispersal capabilities and tolerance to various environmental conditions. Overall the entire North Andaman vegetation, (constituting evergreen, semi evergreen and moist deciduous) is represented by 222 tree species from 62 families.

Unique and Common Species

It was observed that some of the species confined themselves to a particular forest type. These species are unique in nature that they were not found in any other vegetation types. This may be due to their adaptation to particular micro climatic conditions and specific ecological niche, outside their adaptability zone the viability of these species is less and hence act as preferential species, limiting their population to a particular type. The ecological amplitude i.e., the capacity of a species to survive in various habitats along an environmental gradient, for these species may be very low which has restricted their distribution to narrow range of conditions. As described by Varghese and Menon (1999) these species may be called as habitat specialist, which cannot survive outside their habitat.

Simultaneously about 92 species (22%) were found to be common to all the three-vegetation type, having frequency of adjusting to new ecological niches and thrive for cosmopolitan distribution of their population. These species may be termed as companion species, which survive in any type of community without showing special affinities for association. Probably these species have high ecological amplitude. In Palmer (1992) terminology these species may be termed as Ecological equivalents. These species emerged due to the isolation of the similar habitats as a consequence of decrease in habitat area. This phenomenon named as ecological equivalency, makes the common or similar species to coexist in different areas of same habitat in landscape.

In general, species show habitat preferences based on the suitable conditions for their survival. But some sites at certain periods are unsuitable for certain species due to the incompetence of species in the local abiotic habitat, or local predators (Janzen, 1970; Connell, 1971). The basic argnment is that locally common species are common because their niche requirements overlap with local environmental conditions to a greater extent than do those of rare species. To the extent that environmental conditions are spatially auto correlated, species that are locally common will also tend to be frequent and abundant across the surrounding landscape.

Endemic Species

Generally islands harbour a good number of endemic species, because of their geographical isolation from the mainland (Balakrishnan and Vasudeva Rao, 1983). In the present study about 74 endemic species belonging to 35 families were recorded in three vegetation types. Evergreen system harbours about 19% of endemic species followed by semi evergreen (18%) and Moist deciduous (17%). Out of 74 endemic species, exclusively, five species, *Casearia andamanica*, *Ixora grandifolia rosella*, *Memecylon collinum*, *Neolitsea andamanica* and *Pseuduvaria prainii* were recorded from evergreen forest. Similarly 3 species *Glochidion andamanicum*, *Blumeodendron kurzii*, *Maesa andamanica* from semi evergreen and 4 species *Blachia andamanica*. *Gomphandra comosa*, *Sageraea listeri* var. *andamanica* and *Tabernaemontana crispa* were observed from moist deciduous forest.

CONCLUSIONS

Presently all the major tropical forests of the world are subjected to rapid deforestation and it is the same with the Andaman forest. Though in comparison semi evergreen shows high diversity, but in general all the forests are endowed with high species richness and diversity, which has to be preserved. At the same time special attention is required about the rare, unique, threatened and endemic species. In the first instance it is to be identified whether the rare species described above are really rare in the natural environment. In the second instance, habitats of all those rare, unique, endangered, threatened and endemic species should be identified and certain measures should be taken to preserve those highly diversified community zones that harbour these important species which are required to maintain the ecological balance with in the vegetation types.

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