PHYTOSOCIOLOGICAL ANALYSIS OF TREE DIVERSITY IN SELECTED LATERITE HILLOCKS OF KANNUR, KERALA

BY

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DISSERTATION

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DECLARATION

We do hereby declare that the dissertation entitled PHYTOSOCIOLOGICAL ANALYSIS OF TREE DIVERSITY IN SELECTED LATERITE HILLOCKS OF KANNUR, KERALA is a record of project work done by us and that this dissertation has not previously formed the basis for award of any degree, diploma, fellowship or other similar title, of any other University or Society.

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CERTIFICATE I

This is to certify that the dissertation entitled "Phytosociological analysis of tree diversity in selected laterite hillocks of Kannur, Kerala " is submitted for the award of B.Sc. Forestry of Kannur University, Kannur is a bonafide research work carried out by Rabeeha Sherin, Abdul Basith KKP, Fairooze M, Nandana E P and Sajnas under my supervision and that is has not previously formed the basis for award of any degree, diploma, fellowship or other similar title , of any other University of Society.

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CERTIFICATE II

This is to certify that dissertation entitled PHYTOSOCIOLOGICAL ASSESSMENT OF TREE DIVERSITY IN SELECTED LATERITE HILLOCKS IN KANNUR, KERALA is submitted to Kannur University, Kannur in partial fulfillment of the requirements for the degree of B.Sc. Forestry has been approved.

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INTRODUCTION

INTRODUCTION

Geographically Kerala state is divided into three regions namely coastal planes, the midland hills and the high land hills. The midland hills are characterized by laterite plateaus stretching from Malapuram district to Kasargod district in Kerala and even beyond up to Dhapoli in Maharashtra. These hill ranges are unique habitats for many plants and animals. The unique habitat has been facing serious danger of degradation over the years. Most of the area had been converted to plantation, building sites, mining sites etc. This severely affects the biodiversity, soil and water availability in the area. The ecological and cultural values of the laterite hillock of the northern Kerala have not been understood properly as it deserves. There are several tools to study the quality of a habitat. Since the tree species are very specific in every habitat they can be used to study the quality of hillocks.

Phytosociology, also known as phytocoenology or simply plant sociology, is the study of groups of species of plant that are usually found together. Phytosociology aims to empirically describe the vegetative environment of a given territory. It's a part of the vegetation science that deals with the distribution of plant communities among specified locations (Delngler, 2016).

This method is widely accepted for evaluating the vegetation status of an area and several million studies have occurred using this method (Dengler *et al*., 2011)

The main objective of the present study is to understand the vegetation and species richness in the midland laterite hillocks of Kannur, Kerala

The specific objectives are

- To understand the presence of various plant species in the midland laterite hillocks of Kannur, Kerala.
- To gather information on the population status and species richness in the midland laterite hillocks of Kannur, Kerala.
- To compare vegetation of laterite hillocks in Kannur.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

2.1 PHYTOSOCIOLOGICAL ANALYSIS

The phytosociological analysis is the most extensively used method for evaluating the diversity and distribution of plant communities in the world (Dengler *et al*., 2011). Many attempts have been made so far to utilise plant communities as an indication to biological diversity all over the world (Costa *et al*, 1999; Rey and Scheiner,2002). Gould and Walker in 1997 and 1999 have used plant communities to study the biological diversity of an area and derived relationship between number of community types and their distinctiveness. Ewald (2002) evaluated the understory vegetation associations in coniferous forests in Alps. Shanon index have been used to analyse the diversity characters by Karrer (1994). Data from vegetation plots can be used for the assessment of recent vegetation change. It can be done mainly by comparison of old and new records from permanent plots established for vegetation monitoring, revisiting historical phytosociological plots and subsequent comparison of pairs of old and new records from the same sites, and comparison of large sets of old and new phytosociological plots from the same area but different sites (Chytry *et al*., 2014).

It is possible to estimate various degrees of diversity of various ecosystems or landscapes using the concepts of integrated phytosociology or dynamic-zonal phytosociology (Loidi, 2004). Dynamic-zonal phytosociology organises vegetation communities under two categories; dynamism and ecological gradient (Alcaraz, 1996). The dynamic principle says about the ecological relationship between homologous areas. The dynamic and zonal approaches paves a systematic way of analysing landscape diversity (Loidi, 2004). Such kind of studies have been conducted by Decoq (2000) and assessment of diversity in the spatial dimension has made by Cabello *et al*. (2001) using three hierarchical levels with units based on concepts of integrated phytosociology. It is possible to conduct studies for estimating the alpha, beta and gamma diversities of various vegetation fragments using the principles of integrated phytosociology. The plant community types are determined by site conditions and constituted by the grouping of species performing a balance between floristic and ecological information (Liodi, 2004).

The study by Ighbareyeh and Carmona (2008) presents a floristic and vegetation study 3 of the territories of the Idna-Hebron of Palestine, corresponding to one area with three different names as Abu Salman Forest Reserve, Khallet Osman mountains, and Hamra Aslimi. These sites are very important at a local level of the flora with a high endemic rate. The floristic analysis revealed the existence of 48 species, of which 10 (20.83%) are endemic endemic.

2.2 PHYTOSOCIOLOGICAL STUDIES IN INDIA AND KERALA

India have long stories to tell on phytosociological analysis. Padalia *et al*. (2004) has conducted such studies in Andaman and Nicobar Islands. The study analysed the pattern of tree species diversity, diameter class distribution, species versus girth class relationship, evenness characteristic and similarity parameters of tree populations for different forest types of Andaman. They identified that there are nine forest types in Andaman. The tree layer in evergreen forest were dominated by *Myristca andamanica*, and that of moist deciduous forest is *Pterocarpus dalbergiodes*. A total of 94 woody plant species (including 44 tree and 50 shrub species) belonging to 72 genera and 44 families were reported by Malik and Bhatt (2015) from Kedarnath Wildlife sanctuary in the western Himalayas. They also pointed out that Low value of maturity index and contiguous distribution of species denoted the early successional status of the forests.

Earlier, similar studies were conducted in Kumaun Himalaya by Saxena and Singh (1982). They investigated the phytosociological conditions along 1200 to 2523 m altitude and along four different type of forest: *Pinus roxburghii*, mixed*, Quercus leucotrichophora*, *Q. lanuginosa*, and *Q. floribunda* forests. The study revealed that The mixed forest had the greatest tree diversity, and among the others diversity increased with increasing basal cover. They also worked out a positive relation between the diversity of shrubs plus seedlings and trees plus saplings in *P. roxburghii* and mixed forests; whereas this relationship was inverse in the three oak forests.

Phytosociological analysis was carried out in other vegetation types such as riparian forests of the central India. A study conducted in the riparian patch of Machhli river in Chhattisgarh revealed 33 species of tree species (Kujur *et al*., 2021). They also identified

potential associations among different species in different locations, viz., *Shorea robusta* and *Syzygium cumini*, *Bridelia retusa* and *Dalbergia sissoo* etc.

Dugaya, *et al*., (2020) analyzed phytosociological characteristics of a tropical dry deciduous forest located in an urban environment of Indian Institute of Forest Management (IIFM) Campus in the capital city of Bhopal of Madhya Pradesh state, Central India. A Comparison has been made among the tree community characteristics during the years 1988, 2002 and 2020 in terms of tree species composition, stem density, basal area and Importance Value Index (IVI).

The studies conducted by Rout *et al*. (2018) characterised the structure of plant community in the forests of Kuldiha Wildlife sanctuary, Odisha. A total of 38 species of trees have been identified from the study site and they belong to 38 different families. In addition to that, they were documented 38 species of shrubs and 32 species of herbs from the same area. The most common plant species based on importance value in tree, shrub and herb layers were *Terminalia tomentosa*, *Shorea robusta* and *Croton roxburghii* respectively. Euphorbiaceae were found to be most dominant family.

The phytosociological analysis can be done in any patch of vegetation. Plant diversity along roadside has been evaluated in Kottayam, Kerala to identify the tolerant plant species for disturbed habitats (Ray and George, 2009). The roadside vegetation is highly susceptible for exposure to toxic metals and gaseous pollutants and thus the plant species with high tolerance level can only survive in those kinds of habitats. The study identified 85 species of plants belonging to 27 families as tolerant such adverse environmental conditions. Phytosociological investigations on roadsides enable identification of the hyper-tolerant; also provide information regarding patterns of introduction of exotics into natural vegetation. Hyper-tolerance is useful clue to the preliminary screening of the hyper-accumulation potentials of plants (Ray and George, 2009).

2.3 LATERITE HILLOCKS IN KERALA

The laterite hillocks are unique type of geographical feature present in the mid-western Ghats region extending north from Malappuram district in Kerala to Southern Karnataka (Jayarajan, 2004). Lateritic hillocks of Kerala which are often considered as

'wastelands' in remote sensing images due to devoid of vegetation were analysed for its floral wealth and microhabitat diversity (Sreejith *et al*., 2016).

The soil in such area is characterised by brown-red coloured semi hard soil, which is used for construction purpose in those localities (Narayanaswamy 1992). Those type soil appeared to be soft when dug out and gradually become heavily strong when contacted with air and water ((Raychaudhuri 1981).

The laterite hillocks are enormously rich in diversity and many of the species present in those area are found to be confined to those specialized habitats. Floristc studies in lateritc plateaus have reported occurrence of many endemic species and habitat-specifc fora (Bachulkar 1983; Yadav & Sardesai 2002; Watve 2013) throughout the Western Ghats, India. Some of the new species discovered from laterite ecosystems in India include *Rotala malabarica* (Pradeep *et al*. 1990), *Nymphoides krishnakesara* (Joseph & Sivarajan 1990), *Justcia ekakusuma* (Pradeep & Sivarajan 1991). Some other taxa also described from laterite habitats, especially from the Western Ghats and adjoining areas are: *Ceropegia atenuata* Hook. var. *mukambikae* (Diwakar & Singh 2011) from Mookambika Hills, Karnataka, *Ceropegia ananti* (Yadav *et al*. 2004), *Dipcadi concanense* (Dalzell) Baker (Prabhugaonkar *et al*. 2009), both from low elevaton laterites of the Konkan region in Maharashtra.

About 263 species of angiosperms have been identified from the area during a study by Sreejith *et al*. (2016) in three lateritic hillocks of Kerala. Another study in the Kavvayi river basin revealed a total of 535 species of plants (Sreejith *et al*., 2020). Recent reports of new angiosperm species like *Lindernia madayiparense*, *Eriocaulon madayiparense*, *Eriocaulon kannurense*, and *Rotala khaleeliana* from the lateritic hills in northern Kerala indicates the importance of these ecosystems in terms of floral diversity and species richness (Sreejith *et al*.,2020). Larger woody trees are also seen in the lateritic soils. Trees like *Stereospermum colais*, *Careya arborea* are reported from Madayipara, Kannur (Divakar *et al*., 2013).

Pramod and Pradeep (2021) has investigated the floristic diversity of Madayipara, a lateritic hillock in Kannur district of Kerala, has reported as much as 636 taxa of angiosperms under 110 families, 406 genera.

The lateritic habitat is again classified in to smaller micro habitats, which are very variable in characters. The soil is moderately thick in the valleys and ultra-thin over the

rocky tops. In rock surfaces, the vegetation is very distinct with the predominance of drought tolerant species. Species such as *Lepidagathis keralensis*, *Euphorbia deccanensis*, and *Polycarpaea corymbosa* occur on open lateritic surfaces mostly rooted in the humus rich crevices of the laterite rocks. The fine dust and humus accumulated in the vermiform tubes and cavities of the laterite rock provide nutrients to the supporting herbaceous vegetation (Pramod and Pradeep., 2021).

Fimbristylis pokkudaniana, a new species of Cyperaceae from the laterite hillocks of Kannur District, Kerala has been reported from Kannur and its known to be only present in Madayipara, Kannur (Sunil *et al*., 2017). The species is named after the late Mr Kallen Pokkudan, a renowned environmental activist in northern Kerala, who had been working for the protection of mangroves and wetlands since 1989.

There are 68 sacred groves in the mid-land region of Kavvayi river basin (Jayarajan et.al,2003). Most of them are in hill slopes. Some of them are large and conspicuous. The sacred groves also add to the biodiversity of the hills. 246 species of macro flora from 83 families, 117 species of butterflies 8 species of spiders, 11 species of amphibians, 23 species of reptiles, 178 species of birds and 24 species of mammals have been identified from sacred groves alone (Jayarajan, 2004).

2.4 THREATS TO THE UNIQUE ECOSYSTEM

The laterite hillock system has been facing serious danger of degradation over the years. It faces greater threats of conversion. Many of the hills have been converted to urban settlements and residential areas. Laterite stone mining initiated a geological transformation in these areas. As the transport facility increased, more and more stones were transported to lowland (Jayarajan, 2004).

The mining for the 'china clay' has been causing severe damage to the system. The ecological and cultural values of laterite hillocks have not been got the due weight age it deserves. Up to about 1990 the rate of transformation of hillocks was gradual. But in the last decade the rate of exploitation exceeded what has happened for centuries (Jayarajan, 2004).

MATERIALS AND METHODS

MATERIALS AND METHODS

3.1 STUDY AREA

The present study was conducted in laterite hillocks of Kannur district Kerala. Lateritic soils are a unique feature of northern Kerala (Sreejith *et al*., 2020). The distribution of lateritic hillocks starts from Malapuram district in Kerala and extends northward to southern Karnataka (Jayarajan, 2004). These specialised type of soil, belongs to the order ultisol, is found in high rainfall areas. The soil is formed due to heavy leaching of minerals except iron and aluminium from the upper horizons (Chandran *et al*. 2005). Those type soil appeared to be soft when dug out and gradually become heavily strong when contacted with air and water (Raychaudhuri, 1981).

The location which are selected for the studies where Muyyam (12°01'40.1"N 75°23'38.0"E), Chudala (12°05'21.6"N 75°19'09.4"E) and Nadukani (12°06'22.2"N 75°24'41.9"E) areas near Taliparamba Municipality. The elevation of these areas ranges from 53 m to 166 m above sea level and the annual rainfall in these area ranges from 2400 mm to 2800 mm (Guhathakurta, 2020).

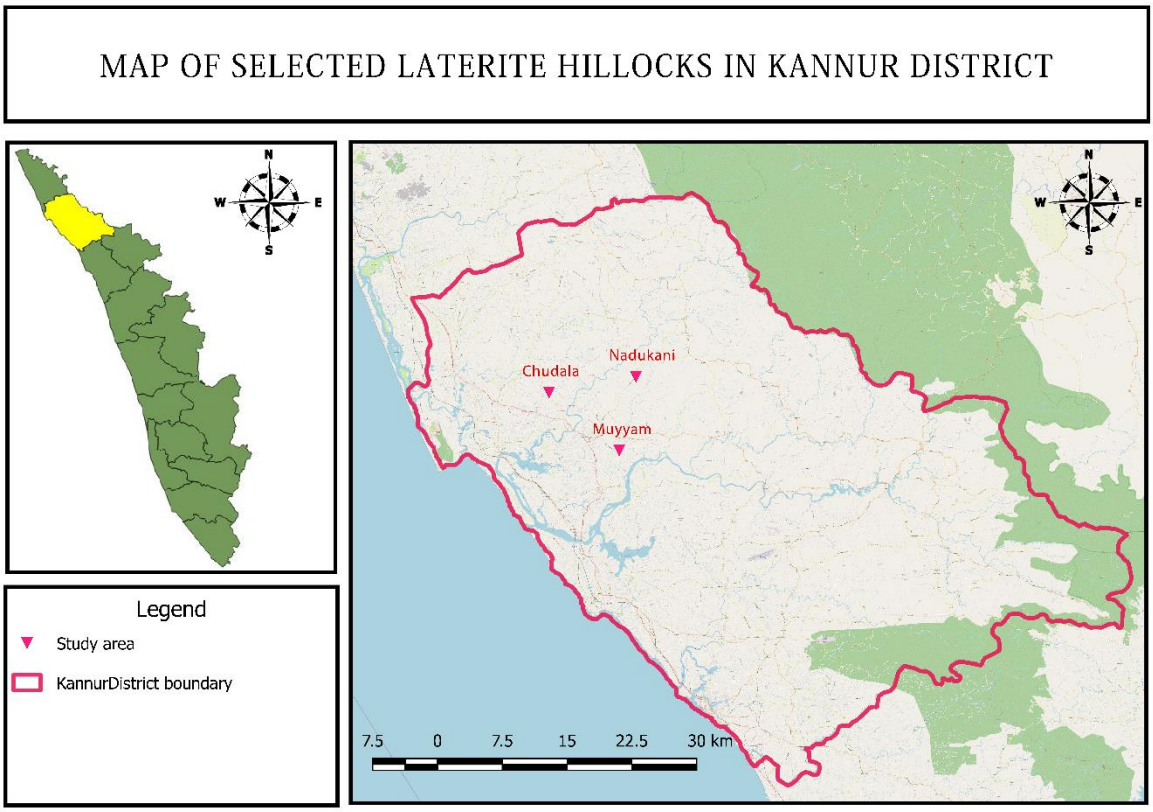

Fig. 1. Location of selected laterite hillocks in Kannur district, Kerala

Plate 1. Vegetation patch in laterite hillock of Chudala

Plate 2. Vegetation patch in laterite hillock of Nadukani

Plate 3. Vegetation patch in laterite hillock of Muyyam

3.2 METHODOLOGY

A phytosociology analysis was conducted in the above mentioned field during the month of March and April, 2022. A total of 15 plots of size 10m x 10 m has taken in total in the study sites (five plots each). The plots were laid out randomly. From each plot, the tree species having a girth over bark (GBH) of equal ore more than 10 cm have considered for analysis. The GBH of such individual trees are measured using a tape and recorded in the data sheet.

3.2.1 Importance Value Index

Importance Value Index (IVI) is a reasonable measure to assess the overall significance of a species since it takes into account several properties of the species in the vegetation (Tauseef *et al*., 2012). The IVI was calculated as per Curtis and McIntosh (1950). The parameters assessed for the purpose were density, frequency, and dominance, while importance value index (IVI) was calculated as:

Importance value index (IVI) = RD+RF+ RDo; where,

$$\text{Relative density (RD)} = \frac{\text{Density of a species}}{\text{Total density of all species}} \times 100$$

$$\text{Relative frequency (RF)} = \frac{\text{Percentage frequency of individual species}}{\text{Sum percentage of frequency of all species}} \times 100$$

$$\text{Relative Dominance (RDo)} = \frac{\text{Total basal area of a species}}{\text{Total basal area of all species}} \times 100$$

$$\text{Density (D)} = \frac{\text{Number of individuals of a species}}{\text{Total number of quadrats}} \times 100$$

$$\text{Percentage Frequency (PF)} = \frac{\text{Number of quadrants of occurrence}}{\text{Total number of quadrats}} \times 100$$

The basal area has been calculated using quarter girth formula:

$\text{Basal Area (BA)} = \frac{G^2}{4\pi}$; where G is the girth at Breast height

3.2.2 Simpson's Diversity Index

Simpson Index (D) is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. It measures the probability that two individuals randomly selected from a sample will belong to the same species (Bibi and Ali., 2013). As species richness and evenness increase, so diversity increases. It is measured by the following formula

$$Simpson'sDiversity\ Index = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)$$

n= the total number of individuals of a particular species

N= the total number of individuals of all species

RESULT AND DISCUSSION

RESULT AND DISCUSSION

Phytosociological studies were conducted in three selected laterite hillock area near Taliparamba municipality in the month of March and April 2022.

4.1 SPECIES RICHNESS IN LATERITE HILLOCKS

The study documented 25 tree species from the study sites. The list of species identified are given in table 1.

Table 1. List of tree species identified from study areas

Sl. No	Name of species	Common Name
1.	*Acacia mangium*	Mangium
2.	*Gliricidia sepium*	Seemakonna
3.	*Ziziphus mauritiana*	Thudali
4.	*Anacardium occidentale*	Cashew
5.	*Zanthoxylum rhetsa*	Mullilam
6.	*Ziziphus trinerva*	Perum thudali
7.	*Strychnos nux-vomica*	Kanjiram
8.	*Lagerstoemia speciosa*	Venteak
9.	*Santalum album*	Sandal
10.	*Olea dioica*	Edala
11.	*Swietenia macrophylla*	Broad-leaved Mahogany
12.	*Hopea parviflora*	Kambakam
13.	*Macaranga peltata*	Vatta
14.	*Trema orientalis*	Aamathali
15.	*Alstonia scholaris*	Ezhilam pala
16.	*Hevea brasiliensis*	Rubber
17.	*Stereospermum colais*	Paathiri
18.	*Careya arborea*	Vallabham
19.	*Acacia auriculiformis*	Acacia
20.	*Xylia xylocarpa*	Irul
21.	*Sterculia guttata*	Peenari
22.	*Ficus exasperata*	Parakam
23.	*Tabernaemontana alternifolia*	Kundalapala
24.	*Terminalia paniculata*	Vella maruth
25.	*Terminalia bellirica*	Thanni

4.2. SIMPSONS DIVERSITY INDEX

The Simpson's index D (introduced by Simpson in 1949) is the probability that any two individuals randomly selected from an infinitely large community will belong to the same species. It takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases.

Simpsons Diversity Index is a measure of diversity which considers the number of species present, as well as the relative abundance of each species. Simpsons Diversity Index at Nadukani, Chudala, and Muyyam are 0.7938, 0.8283, and 0.8903 respectively. This clearly depicts that Muyyam is dominant in species richness

Table 2. Simpson’s diversity Indices for different study sites

Sl. No	Name of site	Simson’s Index
1.	Muyyam	0.8903
2.	Nadukani	0.7938
3.	Chudala	0.8283

Out of the three area surveyed, Muyyam recorded highest number of species. But that area was under heavy stress of laterite mining. Conversion of land for other activities like building construction is also catching up its pace in that area.

4.2 IMPORTANCE VALUE INDEX (IVI)

Importance Value is a measure of how dominant a species is in a given forest area. It is a standard tool used by foresters to inventory a forest. The IVI of the study areas are as follows.

Table 3. IVI of Muyyam Laterite Hillock

SI No.	Species	RF	RD	RDo	IVI
1	*Anacardium occidentale*	8.7	10.71	6.45	25.86
2	*Olea dioica*	17.39	17.86	8.44	43.69
3	*Swietenia macrophylla*	13.04	14.28	58.01	85.33
4	*Acacia mangium*	17.39	14.28	2.25	33.92
5	*Hopea parviflora*	4.35	3.57	0.44	8.36
6	*Macaranga peltata*	8.7	7.14	1.98	17.82
7	*Trema orientale*	4.35	3.57	0.52	8.44
8	*Alstonia scholaris*	4.35	7.14	1.34	12.83
9	*Hevea brasiliensis*	4.35	7.14	15.32	26.81
10	*Stereospermum colais*	4.35	3.57	3.71	11.63
11	*Ziziphus mauritiana*	4.35	3.57	0.44	8.36
12	*Strychnos nux-vomica*	8.7	7.14	1.13	16.97

RF- Relative frequency; RD- Relative density; RDo- Relative dominance; IVI- Importance Value Index

Table 4.IVI of Nadukani Laterite Hillock

SI No.	Species	RF	RD	RDo	IVI
1	*Careya arborea*	12.5	10	13.72	36.22
2	*Acacia auriculiformis*	4.17	2.5	0.82	7.49
3	*Acacia mangium*	16.67	27.5	34.41	78.58
4	*Xylia xylocarpa*	20.83	32.5	19.41	72.74
5	*Santalum album*	16.67	10	0.77	27.44
6	*Zanthoxylum rhetsa*	4.17	2.5	6.46	13.13
7	*Sterculia guttata*	4.17	2.5	4.34	11.01
8	*Ficus exasperata*	4.17	2.5	2.89	9.56
9	*Tabernaemontana alternifolia*	4.17	2.5	1.33	8
10	*Terminalia paniculata*	4.17	2.5	3.66	10.33
11	*Anacardium occidentale*	4.17	2.5	6.39	13.06
12	*Terminalia bellirica*	4.17	2.5	5.81	12.48

RF- Relative frequency; RD- Relative density; RDo- Relative dominance; IVI- Importance Value Index

Table 5. IVI of Chudala Laterite Hillock

SI No.	Species	R.F	R.D	R.Do	IVI
1	*Acacia mangium*	20	30.3	39.04	89.34
2	*Gliricidia sepium*	16	12.12	4.46	32.58
3	*Ziziphus mauritiana*	16	18.18	18.65	52.83
4	*Anacardium occidentale*	12	12.12	12.36	36.48
5	*Zanthoxylum rhetsa*	12	9.09	9.07	30.16
6	*Ziziphus trinervia*	4	3.03	0.51	7.54
7	*Strychnos nux-vomica*	8	6.06	14.35	28.41
8	*Lagerstoemia speciosa*	8	6.06	0.97	15.03
9	*Santalum album*	4	3.03	0.58	7.61

RF- Relative frequency; RD- Relative density; RDo- Relative dominance; IVI- Importance Value Index

The highest IVI of 78.58 and 89.34 was reported for *Acacia mangium* at Nadukani and Chudala respectively (Table 3 and Table 4). At Muyyam, highest IVI (85.33) was observed for *Swietenia macrophylla* (Table 2). The highest IVI value indicate that species dominates in that area. Acacias, being a suitable species for dry areas are seen abundantly in Chudala and Nadukani region.

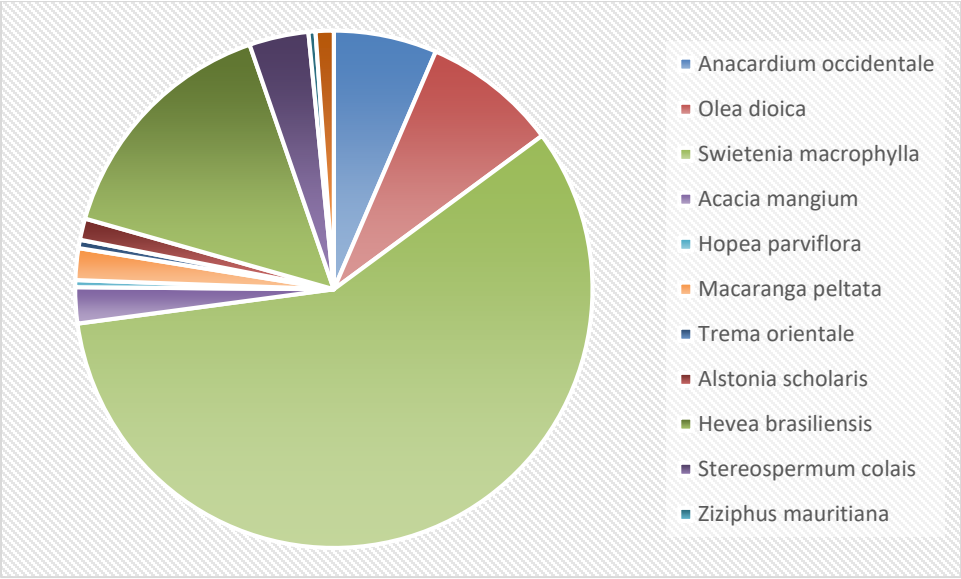

Figure 2. Relative dominance of tree species in Muyyam

In Muyyam area, Mahogany shows greater dominance over the other species (Fig. 2). The mahogany is a fast growing species and it occupy greater basal area in that region. Species like

Olea dioica and *Acacia mangium* have greater relative frequency but could not dominate the area.

Out of 12 species in Nadukani, *Acacia mangium* covered the largest basal area of 3990.81 cm^2 followed by *Xylia xylocarpa* and *Careya arborea* with basal area of 2551.37 cm^2 and 1591.31 cm^2 respectively. The highest density of 0.8 was observed for *Careya arborea* and *Santalum album*. Sandal is a semi root parasite and it found to be associated with other tree species. It is able of grow in varied soil types, especially sandy, clayey, lateritic, loamy, and black cotton soil (Das, 2021)

At the same time, among the 9 species found in Chudala, the largest basal area of 1358.45 m^2 and highest density of 2 was reported for *Acacia mangium*. The largest basal area of 1273.32 m^2 was covered by *Swietenia macrophylla* and highest density of 1 was observed for *Olea dioica* at Muyyam.

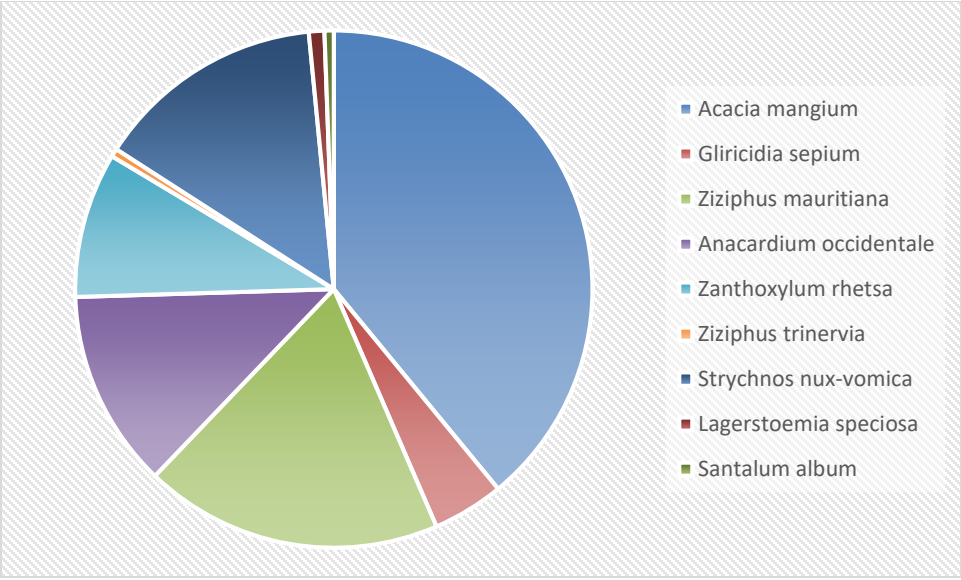

Figure 3. Relative dominance of tree species in Chudala

Zizphus shows comparatively high relative dominance in Chudala area and becomes the second most species in terms of IVI. The relative frequency for that species is higher in that area.

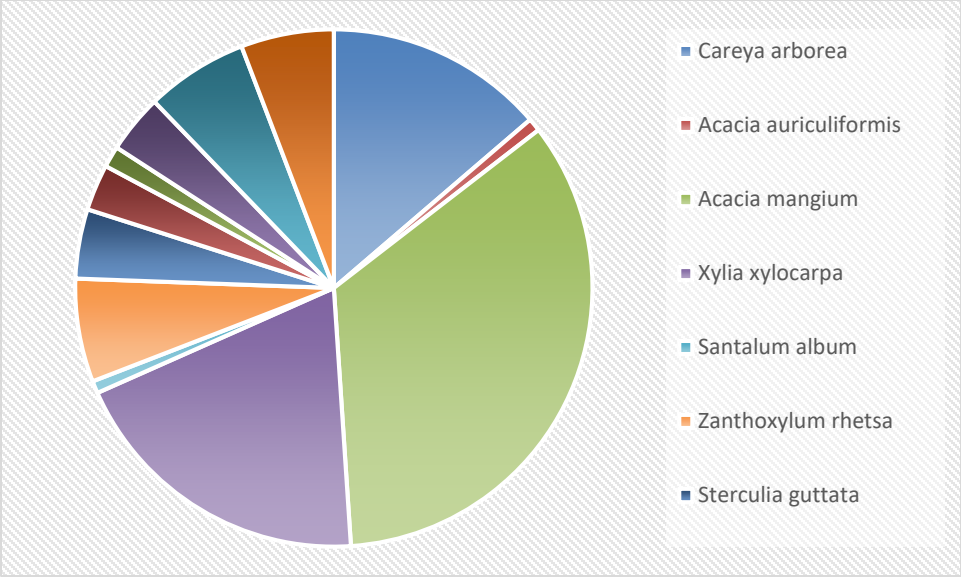

Figure 4. Relative dominance of tree species in Nadukani

When comparing Fig. 3 and 4, *Acacia mangium* is showing greater dominance over the other species. Even though Sandalwood have greater frequency those trees are not growing in larger size.

Acacia species shows comparatively high dominance in the lateritic soil (Table 3 and 4). *Acacia mangium* is considered as a good species for afforestation of lateritic soils (Ghosh and Verma., 2006). *Xylia xylocarpa* is also thriving well under the lateritic conditions. It is a species that performs better under acidic soil conditions of lateritic soil (Kanmegne, 2011).

The commonly observed species in all the three sites are *Acacia mangium* and *Anacardium occidentale*. *Ziziphus mauritiana* and *Strychnos nux-vomica* was found in both Chudala and Muyyam. The species found in Muyyam alone include *Olea dioica*, *Swietenia macrophylla*, *Hopea parviflora*, *Macaranga peltate*, *Terema orientale*, *Alstonia scholaris,Hevea brasiliensis,Steriospermum colais.*

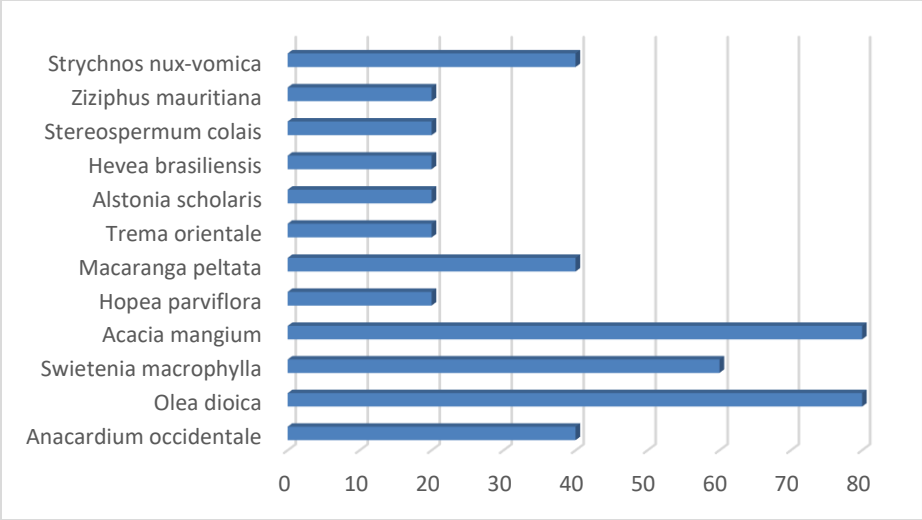

Figure 5. Percentage frequency of species in Muyyam

The distribution of species is slightly variable in Muyyam area, as no species is common for all the plots taken (Fig. 5). *Olea dioica* and *acacia mangium* shows greater distribution in that area. It may be attributed to the regeneration potential of that species.

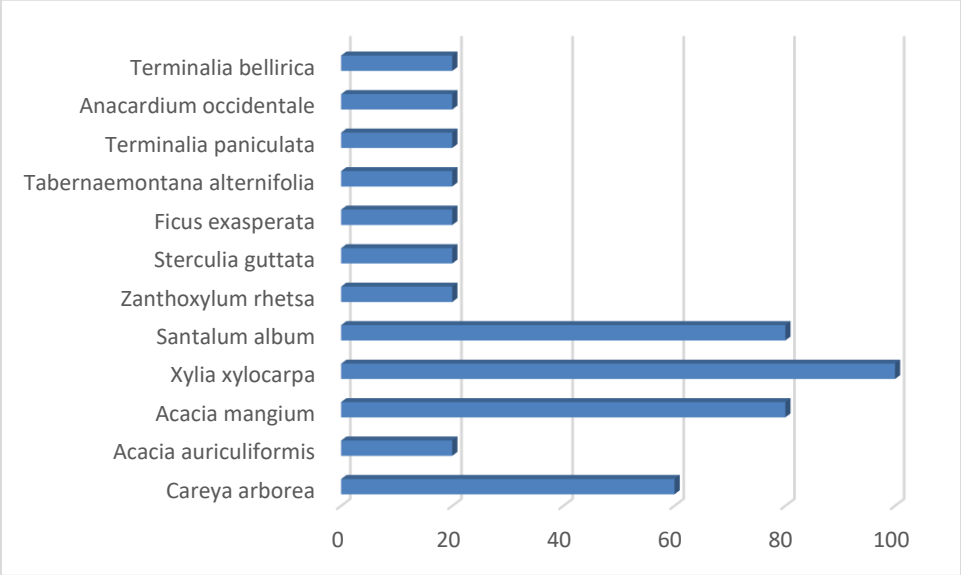

Figure 6. Percentage frequency of species in Nadukani

Unlike other plots, the distribution of *Xylia* is better in Nadukani area. It was reported from all the sample plots taken from that area (Fig. 6).

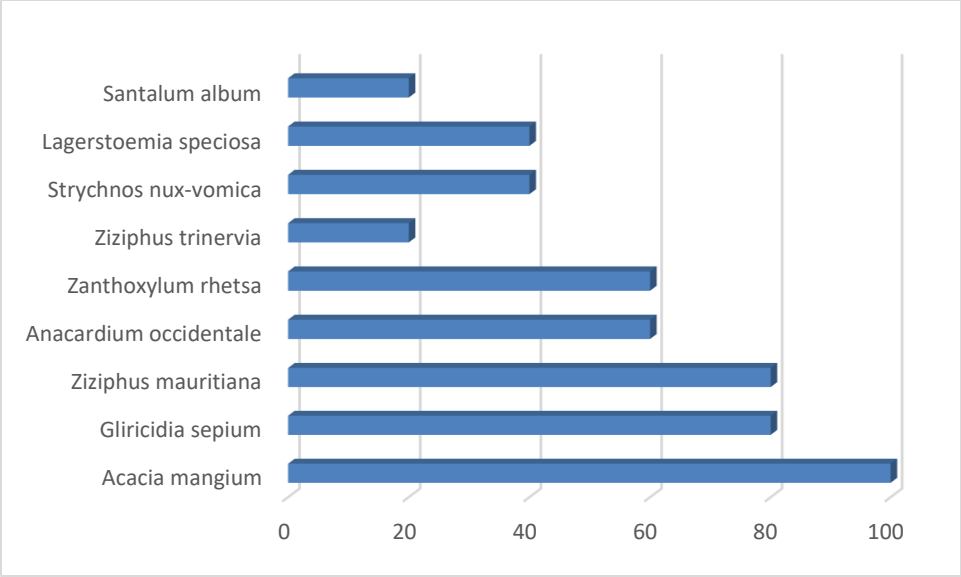

Figure 7. Percentage frequency of species in Chudala

The data from Chudala shows a gradual trend in species distribution. Here we can see some species is present in all quadrats but some are not. The specialty here is, there are only two species which present in only one quadrat. The sites like Nadukani and Muyyam have supremacy of few species, which are present in almost all the quadrats, but majority of the other species are confined to one or two quadrats. It can be assumed that the tree species are much more evenly distributed in Chudala area rather than the other two study sites (Fig. 7).

SUMMARY

Phytosociological studies are important to analyse the distribution of biodiversity and are mandatory for the basic research in tropical ecosystems. In this study we have evaluated the tree diversity of selected laterite hillocks in Kannur district, Kerala

25 different plant species were found from the three study sites. Simpson's diversity index is used to determine the species diversity in the study site. All the sites recorded an index value more than 0.7.

Importance value index is then used for identifying the most important species in each site. The highest IVI is reported for *Acacia mangium* at Nadukani and Chudala respectively. At Muyyam, highest IVI was observed for *Swietenia macrophylla*.

Out of 12 species *Careya arborea* covered the largest basal area in Nadukani. In chudala highest density species is *Acacia mangium*. The largest basal area of was covered by *Swietenia macrophylla* and highest density was observed for *Olea dioica* at Muyyam.

Anthropogenic activities like heavy laterite mining, waste dumping problems are prevalent in these areas. Many of these areas are being converted to construction areas also. The indiscriminate mining for laterite and soil demolish the hillock which threatens the biota, culture and water availability in these areas.

The present study envisages to reveal the potentiality for its richness of biodiversity and ecological status of the laterite hillocks. It is suggested that the studied laterite hillocks must be given conservation priority to protect valuable species

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