

Assessment of plant species diversity and species composition in Botaung Reserved Forest, Myeik Township, Tanintharyi Region

Cho Cho Than¹

Abstract

The present study deals with the assessment of plant species diversity in Botaung Reserved Forest, Myeik District, Tanintharyi Region. Twelve plots of 25 m² were established within the forest area. A total of 229 individuals, 35 tree species representing 29 genera and 17 families were recorded in the study area. The results of the diversity indices such as Shannon-Wiener Index (H), Simpson Index (D) and Shannon-Wiener evenness (E) were 4.25, 0.85 and 0.83 respectively. All the diversity indices pointed out that the study area is floristically diverse. Quantitative analysis of dominance and their relative values of frequency, density and basal area were calculated and summed to get Importance Value Index. According to the result of Importance Value Index, the three leading dominants in study area were *Eugenia bracteolata* (Thabye) 33.76%, *Lithocarpus falconeri* (Thabeik) 31.16% and *Theobroma* sp. (Thit-me) 29.16%. Those tree species could be considered as ecological successful species of the study area. This outcome would be useful for formulating appropriate conservation and management strategies.

Keywords- species diversity, evenness, importance value index, conservation.

Introduction

The future of the species on earth depends on maintaining high biodiversity. Biodiversity is important for human wellbeing as it provides food, potential foods, industrial material and new medicine. Biodiversity measurement typically focuses on the species level and species diversity is one of the most important indices which are used for the evaluation of ecosystems at different scales (Ardakani, 2004). Species richness index was estimated as the number of species inventoried in the plot. To quantify the diversity of the plant species, the Shannon index (H) as a measure of species abundance and richness is applied. In addition, the Simpson index (D) and the evenness index (E=Evenness) are considered as a measure of species dominances and a measure for evenness of spread, respectively (Magurran, 1988). Diversity is of theoretical interest because it can be related to stability, productivity, evolutionary time, predation pressure and spatial heterogeneity (Hill, 1973). The aims of this paper are to find out plant species diversity, richness and evenness, to investigate ecological dominance plant species with IVI value and to record species composition of the study area.

Study Area

Botaung Reserved Forest is located in Myeik Township, Tanintharyi Region. This area is situated between 12° 28' N latitude and 98° 40' E longitude. It is about 64.846 meter above sea level. Botaung Reserved Forest is 114.12 hectare and has protected since 1939. Topographically, there are some rugged hills and steep slopes.

Methodology

Data Collection

To clarify the tree species diversity and to calculate the important value index (IVI), twelve quadrats (25m x 25m each) were randomly selected and observed. Some plant specimens were collected, pressed, dried and identified by checking with appropriate references. The spacial location (latitude, longitude and altitude) of each quadrat was collected using a Global Position System (GPS). Care has been taken to cover different elevation, slope, aspects, rainfall and temperature gradients to study overall spectrum of tree species diversity. To know climatic variation of Botaung reserved forest temperature, rainfall and relative humidity of Myeik District were taken from Department of Meteorology and Hydrology, Myeik station.

Data analysis

The vegetation data were quantitatively analyzed for relative frequency, relative density and relative dominance. The importance value index (IVI) for the tree species was determined as the sum of the relative density, relative frequency and relative dominance.

$$\text{Importance Value Index (IVI)} = \text{RD} + \text{RF} + \text{R.Dm}$$

Relative density (R.D) = total number of individuals of species/total number of all species x 100

Relative frequency (R.F) = Number of quadrats in which the species occurred/total number of quadrat studied x 100

Relative dominance (R.Dm) = total basal area of species/total basal area of all the species x 100

Species richness**Jackknife estimate**

$$\hat{S} = S + \left(\frac{n-1}{n} \right)^k$$

- \hat{S} = Jackknife estimate of species richness
 S = observed total number of species in “n” sample plots
 n = Total number of plots sample
 k = number of unique species

Species diversity

Shannon-Wiener Index

$$H = -\sum_{i=1}^s (p_i) (\log_2 p_i)$$

- H = index of species diversity
 S = number of species
 P_i = proportion of total sample belonging to the i^{th} species

Simpson Index

$$D = 1 - \sum_{i=1}^s (p_i)^2$$

- D = Simpson's index of species diversity
 S = number of species
 P_i = proportion of individual of i^{th} species in the community

Specieevenness (E)

Evenness was calculated by Shannon-Wiener function (1963), as follows:

$$E = \frac{H}{H_{\max}}$$

$$H_{\max} = \text{Log}_2 S$$

- H_{\max} = species diversity under conditions of maximal equitability
 S = number of species
 H = index of species diversity
 E = evenness (range 0-1)

Results

In the study area, a total of 229 individuals representing 35 species, 29 genera and 17 families were recorded. According to the result, Myrtaceae is the most abundant family chiefly represented by 6 species with 38 individuals. Dipterocarpaceae represented 5 species with 20 individuals is the second most ranking family and Anacardiaceae represented 4 species with 17 individuals are third.

Table.1. Ranking of family by number of tree species composition in the study area

NO.	Family	No. of species	No. of individuals
1	Myrtaceae	6	38
2	Dipterocarpaceae	5	20
3	Anacardiaceae	4	17
4	Meliaceae	3	9
5	Sterculiaceae	2	39
6	Fagaceae	2	32
7	Rubiaceae	2	10
8	Sapotaceae	2	5
9	Theaceae	1	16
10	Flacourtiaceae	1	15
11	Ebenaceae	1	11
12	Euphorbiaceae	1	6
13	Lecythidaceae	1	6
14	Moraceae	1	2
15	Hypericiaceae	1	1
16	Fabaceae	1	1
17	Verbenaceae	1	1
Total		35	229

Table.2. Species Composition of the study area

Taxonomic Rank	Number
Family	17
Genera	29
Species	35
Individual	229

Among the different measurement of species diversity indices, the floristic diversity of Botaung reserved forest was analyzed by using Shannon Wiener index (H) and Simpson's index (D) and Shannon Wiener evenness (E), because these indices do not only take taxa richness into account but also depend on their relative distribution of individual. According to the result of Jackknife estimate, the species richness is 34.32. The result of diversity indices of Shannon Wiener index (H) was 4.25, Simpson's index (D) was 0.85 and Shannon Wiener evenness (E) was 0.83. (table 2). According to the result, the diversity indices of tree species are high. (table. 3)

Table.3. Diversity and Evenness Indices of the study area

Shannon- Wiener Index (H)	4.25
Simpson Index (D)	0.85
Shannon- Wiener Index (E)	0.83
Jackknife estimate	34.32

Importance Value Index (IVI)

The IVI is commonly used in ecological studies as it shows ecological importance of a species in a given ecosystem. The high IVI is largely due to its higher relative frequency, density, and dominance compared to other species.

It can be seen that from the results of relative density, *Theobroma* sp(Thit-me) had the highest relative density value 16.67% followed by *Eugenia bracteolata* Wight(Thabye) 11.84% and *Lithocarpus falconeri*(Kurz) Rehd (Thabeik) 10.53%. So these species were abundantly occurred in the study area.

According to the results for the relative frequency of the species, *Eugenia bracteolata* Wight(Thabye) had the highest relative frequency value 9.73% followed

by *Theobroma* sp(Thit-me) 7.08% and *Hydnocarpusanthelmintica*Pierre(Kalaw)7.08%.So they can occur everywhere and contain in all sample plots.

According to the results for the relative dominance of the species, the order of most common species were *Lithocarpusfalconeri*(Kurz) Rehd (Thabeik) 15.32%, *Shorea*species(Hput-ma-tat) 13.99% and *Eugenia bracteolata*Wight(Thabye) 12.18%. So *Lithocarpusfalconeri*(Kurz) Rehd (Thabeik) had large basal diameter and occupied the area more than other species.

As a combination result of relative density,relative frequency and relative dominance of all recorded tree species,the highest IVI of the major tree species in the study area were *Eugenia bracteolata*Wight(Thabye) with the highest IVI value of 33.76%, the second most dominant species is *Lithocarpusfalconeri*(Kurz)Rehd(Thabeik) (IVI=31.16%) and *Theobroma* sp (Thit-me) (IVI= 29.16%) is third. So these species are ecologically successful in the study area.

In order to clarify the homogeneity or heterogeneity of the floristic distribution in the study area, species distribution by frequency classes was examined. According to the outcome of frequency chart, 51.43% of the total number of species was in lower frequency classes A and while 20% was observed in higher frequency class B and C .It indicates that the forest in study area is floristically heterogeneous according to Lamprecht (1989). There are two species occur in frequency class D. There is only one species belongs to highest frequency class E. The species which fall in highest frequency class E was *Diospyrosehretioides*Wall(Aukchinsa).

Table (4) Ranking of Importance Value Index (IVI) in the study area

Scienific name	Family	R.F (%)	R.D (%)	RDm (%)	IVI (%)
<i>Eugenia bracteolata</i> Wight	Myrtaceae	9.73	11.84	12.18	33.76
<i>Lithocarpusfalconeri</i> (Kurz) Rehd	Fagaceae	5.31	10.53	15.32	31.16
<i>Theobroma</i> sp.(1)	Sterculiaceae	7.08	16.67	5.42	29.16
<i>Shorea</i> sp.	Dipterocarpaceae	5.31	3.95	13.99	23.25
<i>Hydnocarpusanthelmintica</i> Pierre	Flacourtiaceae	7.08	6.58	6.69	20.35
<i>Swintonia floribunda</i> Griff.	Anacardiaceae	6.19	4.39	8.36	18.94
<i>Schimawallichii</i> (DC.) Korth	Theaceae	4.42	7.02	5.03	16.47
<i>Wendlandiaglabrata</i> DC.	Rubiaceae	6.19	3.95	1.65	11.80
<i>Diospyrosehretioides</i> Wall.	Ebenaceae	4.42	4.82	2.52	11.77
<i>Phyllanthusalbizziioides</i> (Kurz) Hook.f	Euphorbiaceae	4.42	2.63	2.86	9.92

<i>Quercus glauca</i> Thunb.	Fagaceae	3.54	3.07	1.38	7.99
<i>Tristania merguensis</i> Griff.	Myrtaceae	2.65	3.51	1.50	7.66
<i>Ammorawallichii</i> King	Meliaceae	1.77	2.19	3.01	6.97
<i>Barriagtoniacymosa</i> Fischer	Lecythidaceae	3.54	2.63	0.62	6.79
<i>Semecarpus pandurata</i> Kurz	Anacardiaceae	2.65	1.32	2.62	6.59
<i>Palaquium obovatum</i> (Griff.) Engl.	Sapotaceae	2.65	1.75	1.30	5.71
<i>Shorea farinosa</i> Fischer	Dipterocarpaceae	2.65	1.32	1.64	5.61
<i>Vaticamaingayi</i> Dyer	Dipterocarpaceae	2.65	2.19	0.65	5.50
<i>Ficus cunia</i> Buch. Ham	Moraceae	0.88	0.44	2.82	4.14
<i>Syzygium cymosum</i>	Myrtaceae	0.88	0.44	2.51	3.83
<i>Sandorium koejape</i> (Burn.f)	Meliaceae	1.77	0.88	1.14	3.78
<i>Mangifera caloneura</i> Kurz	Anacardiaceae	1.77	1.32	0.54	3.63
<i>Chisocheton paniculatus</i> Hiern	Meliaceae	1.77	0.88	0.49	3.14
<i>Syzygium fruitcosum</i> DC.	Anacardiaceae	0.88	0.44	1.37	2.70
<i>Gmelina arborea</i> Roxb.	Verbenaceae	0.88	0.44	0.90	2.23
<i>Dipterocarpus alatus</i> Roxb.	Dipterocarpaceae	0.88	0.44	0.82	2.14
<i>Dipterocarpus costatus</i> Gaertn.f	Dipterocarpaceae	0.88	0.44	0.65	1.97
<i>Lithocarpus elegans</i> (Blume)					
<i>Hatusinaex</i> . Saepadma	Fagaceae	0.88	0.44	0.58	1.90
<i>Mesua nervosa</i> Planch	Hypericaceae	0.88	0.44	0.45	1.77
<i>Tarennoideawallichii</i> (Hook.f) .D	Rubiaceae	0.88	0.44	0.30	1.63
<i>Payenaparalleloneura</i> Kurz.	Sapotaceae	0.88	0.44	0.23	1.55
<i>Heritiera javanica</i> (Blume.) Kosterm	Sterculiaceae	0.88	0.44	0.15	1.47
<i>Derris rbustaspp.</i>	Fabaceae	0.88	0.44	0.13	1.45
<i>Boueaburmanica</i> Griff.	Anacardiaceae	0.88	0.44	0.09	1.42
<i>Syzygium cumini</i> (L.) Skeds	Myrtaceae	0.88	0.44	0.07	1.40
	Total	100	100	100	300

Discussion and Conclusion

In this study a total of 35 tree species representing 29 genera and 17 families were recorded. The important value index is imperative to compare the ecological significance of species (Lamprecht, 1989). It indicates that the extent of dominance of a species (with the greatest important value) in the structure of a forest stand (Curtis and Mc Intosh, 1959).

It is stated that species with the greatest importance value are the leading dominance of the forest. Accordingly the three leading dominants in the study area were *Eugenia bracteolata* Wight, with the highest IVI value of 33.76%, the second most dominant species is *Lithocarpus falconeri* (Kurz) Rehd (IVI=31.16%) and *Theobroma* sp (IVI= 29.16%) is third. Those tree species could be considered as ecologically successful species of the study area.

Species distribution by frequency classes showed that 46.15 % of the total number of species was in lower frequency class A, (17.95%) in the class B and C. There were only two species in the frequency class D and only one species was in the class D. *Hydnocarpusanthelmintica* Pierre and *Theobroma* sp were observed in higher frequency class D. The species which fall in highest frequency class E was *Eugenia bracteolata* Wight. It indicates that the forest of Botaung reserved forest is floristically heterogeneous.

Diversity indices are commonly used to assess the state of an ecosystem (e.g as a criterion for conservation evaluation), with high diversity generally being considered a desirable property in a community or ecosystem. According to the results of Shannon Wiener Index (H), Simpson Index (D), and Shannon Wiener evenness (E), the diversity of Botaung reserved forest were 4.25, 0.85 and 0.83 and respectively. All the diversity indices pointed out that the study site is floristically high diverse. There may be many more information for further research. It hopes that the present finding would be indicators for more research for the future.

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