

Quantitative Analysis of Tree Species Diversity and Composition in Thein Min Kha Area, Myaing Township

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Abstract

Quantitative analysis of trees species diversity and composition was investigated in dry zone forest of Thein Min Kha area, Myaing Township, from 2019 to 2020. To assess the plant species diversity and composition of forest, 10 quadrats (15 m × 15 m in size) in study sites of the forest were established and studied. The results of Shannon-Wiener's Index (H), Simpson's Index (D) and Evenness (E) of tree species are (4.49, 0.95 and 0.85) in study sites. To clarify the main parameter of vegetation, density, relative density, frequency, relative frequency, mean basal area, relative dominance and Importance Value Index (IVI) were calculated. According to the IVI value, ecologically successful species were *Terminalia oliveri* Brandis (Than) and *Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb. (Sha) in study sites. Most of the plant species are useful for timber, wood, food, medicine and other purposes for local people. Thus, the plant species recorded in the present study will give valuable data for monitoring and sustaining the natural forest in the future.

Keywords: Quantitative, Species composition, Importance Value Index

Introduction

The present study of tree species diversity and composition in the Thein Min Kha area, Myaing Township were studied from 10 quadrats (15 m x 15 m), 2019 to 2020. The areas of high temperature and rainfall were covered with sandy soil. Therefore, the natural vegetation of Myaing Township was classified as dry upper mixed deciduous forest, dry forest and barren forest.

In the study area, the plants were grown in very widely variable environmental conditions and form vegetation with individual number of species. The study area was conducted to describe quantitatively structure of the natural forest and to describe the level of species composition, diversity and distribution of the plants.

The aim of the study was to evaluate trees species of diversity, composition and distribution patterns by quantitative analysis. The main objectives of the study was to determine the ecological importance species of natural forest and to provide information for developing effect of conservation measures and to achieve this objective of research by characteristics of

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vegetation stand. These differences at different level of human disturbance were correlated with topographic factors, location factors and soil characteristics.

Materials and Methods

Study area

Myaing Township lies in the dry zone of Central Myanmar. It is the east of Chindwin River and at the 30 miles away from the west of Ayeyarwady River. It lies in the northern part of Magway Division. It is situated at 27 miles northwest of Pakokku Township lies at North Latitude 21° 36' 5" and East Longitude 94°51'3". Myaing Township composes of 3 quarters and 330 villages including 81 village tracts. Myaing Township is located 289 m high on average above the sea level according to the topography. The location map of the study area was shown in (Figure 1).

Data analysis

A total of 10 sampling plots (15 m × 15 m in each) was established at the study sites. Species collected from the study sites were listed and recorded and identified by checking Hooker (1885-1897), Backer (1965), Lawrence (1969) and Dassanayake (1980-2001).

Jackknife estimate of species richness

Species richness is the simplest measure of diversity and is simply a count of the number of different species in a given area. Jackknife estimate of species richness was used in order to estimate the species richness per study area based on the observed frequency of rare species. Heltshel and Forrester (1983) proposed the formula of Jackknife estimate of species richness as:

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

- \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

According to the Magurran (1988), species diversity is often expressed by two indices namely, Shannon Wiener index (1963) and Simpson index (1949).

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 species i in the community

Evenness

The distribution of individuals among the species is called species evenness or species equitability. Evenness is a maximum when all species have the same number of individuals. Evenness was calculated by Shannon-Wiener function (1963), as follow:

$$E = \frac{H}{H_{\max}} \quad H_{\max} = \log_2 S$$

E = evenness (range 0-1)

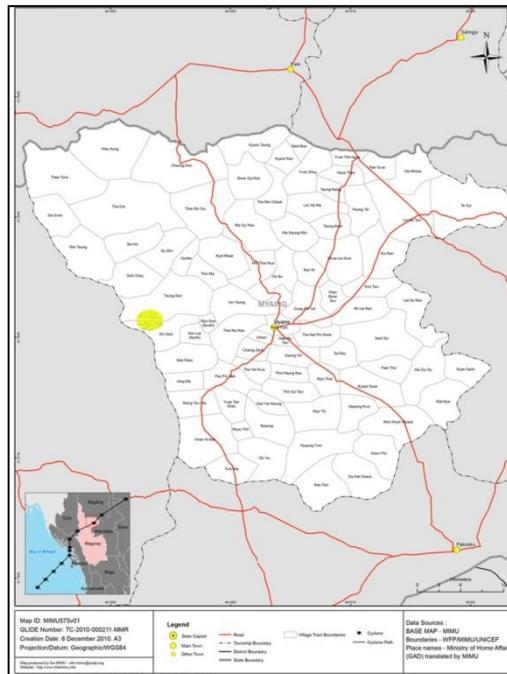
H = index of species diversity

H_{max} = species diversity under conditions of maximal equitability

S = number of species

Investigation of Importance Value Index (IVI)

The Importance Value Index (IVI) for the tree species was determined as the sum of the relative density, relative frequency and relative dominance (Curtis and McIntosh, 1950). The index was calculated by summing the three relative values, viz., relative density, relative frequency and relative dominance as per the methods of Curtis (1959).



Source: Department of Meteorology and Hydrology, Mying Township

Figure 1. Location Map of Their Min Kha Area

Results

Floristic composition

In the present study, a total of 433 trees individual, representing 41 species, 37 genera belonging to 21 families of Thein Min Kha area, Myaing township. 7 species (17.07% total species) was only one individual and 8 species (19.05% total species) was only one individual in study sites. *Terminalia oliveri* Brandis (Than) was found the most abundant species in study sites, followed by *Senegalia catechu* (L. f.) P.J.H. Hurter & Mabb. (Sha) in study sites.

The most dominant tree species was Fabaceae family with 9 species, followed by Anacardiaceae and Combretaceae with 4 species, Rutaceae, Annonaceae, Rhamnaceae, Malvaceae, Ebenaceae and Lamiaceae with 2 species and 12 families had only one species in study sites. Therefore, Fabaceae family was most abundantly in study sites.

Jackknife estimate of species richness

According to the result of the Jackknife estimate for species richness at study sites, the tree layer (41.70) was described in (Table 1).

Species diversity indices

Shannon-Wiener and Simpson Indices

Among the different measurement of species diversity indices, the floristic diversity of the study area was analyzed using the Shannon-Wiener index (H), Simpson index (D) and Shannon evenness (E) because these indices do not only take taxa richness into account but also depend on the relative distribution of individuals. Diversity value of Shannon-Wiener index (H) is (4.49) and and Simpson index (D) (0.95) for trees in study area.

Evenness (E)

As a result of Shannon-Wiener evenness (E) for tree was (0.85) in study sites.

Vegetation Analysis

Importance value Index (IVI)

Importance value index for all species reaching a GBH ≥ 10 cm were measured and the species were ranked according to their importance value index studied among the tree species in study sites. The vegetation data was quantitatively analyzed for density, frequency and mean basal area. The importance value index (IVI) for the tree species was determined as the sum of the relative frequency, relative density and relative dominance.

The highest IVI values of ten major dominant tree species in study sites were *Terminalia oliveri* Brandis (Than) (43.39%), *Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb. (Sha) (34.58%), *Terminalia tomentosa* W. & A. (Tauk kyan) (24.08%) *Tectona hamiltoniana* Wall. (Dahat) (21.19%), *Hiptage benghalensis* (L.) Kz. (Zwe ni) (21.05%), *Lannea coromandelica* (Houtt.) Merr. (Nabe) (18.03%), *Diospyros burmanica* Kz. (Te) (13.95%), *Phyllanthus embelica* L. (Zibyu) (10.14%), *Bauhinia racemosa* Lam. (Phalan) (9.05%) and *Flacourtia inermis* Roxb. (Na ywe) (7.22%).

Table 1. Jackknife estimate of species richness in study sites

Name	Total number of species	Total individual in all sample plot	Total number of unique species (K)	Quantitative Jackknife estimate of species richness
Trees	41	433	7	41.70

Table 2. Species diversity indices in the study sites

Diversity category	Tree
Shannon-Wiener Index (H)	4.49
Simpson Index (D)	0.95
Evenness (E)	0.85

Table 3. Ranking of importance value index (IVI) in study sites

No.	Scientific Name	R.D. (%)	R.F. (%)	R.Dm. (%)	IVI (%)
1	<i>Terminalia oliveri</i> Brandis	13.63	10.46	19.11	43.39
2	<i>Senegalia catechu</i> (L.f) P. J. H. Hurter & Mabb.	12.70	7.19	14.59	34.58
3	<i>Terminalia tomentosa</i> W.& A.	7.62	5.88	10.57	24.08
4	<i>Tectona hamiltoniana</i> Wall.	6.00	7.19	8.09	21.19
5	<i>Hiptage benghalensis</i> (L.) Kz.	12.24	6.54	2.48	21.05
6	<i>Lannea coromandelica</i> (Houtt.) Merr.	3.93	6.54	7.59	18.03
7	<i>Diospyros burmanica</i> Kz.	4.39	4.58	4.97	13.95
8	<i>Phyllanthus embelica</i> L.	3.00	4.58	2.59	10.14
9	<i>Bauhinia racemosa</i> Lam.	2.08	3.92	3.07	9.05
10	<i>Flacourtia inermis</i> Roxb.	3.70	1.96	1.76	7.22
Total		100	100	100	300

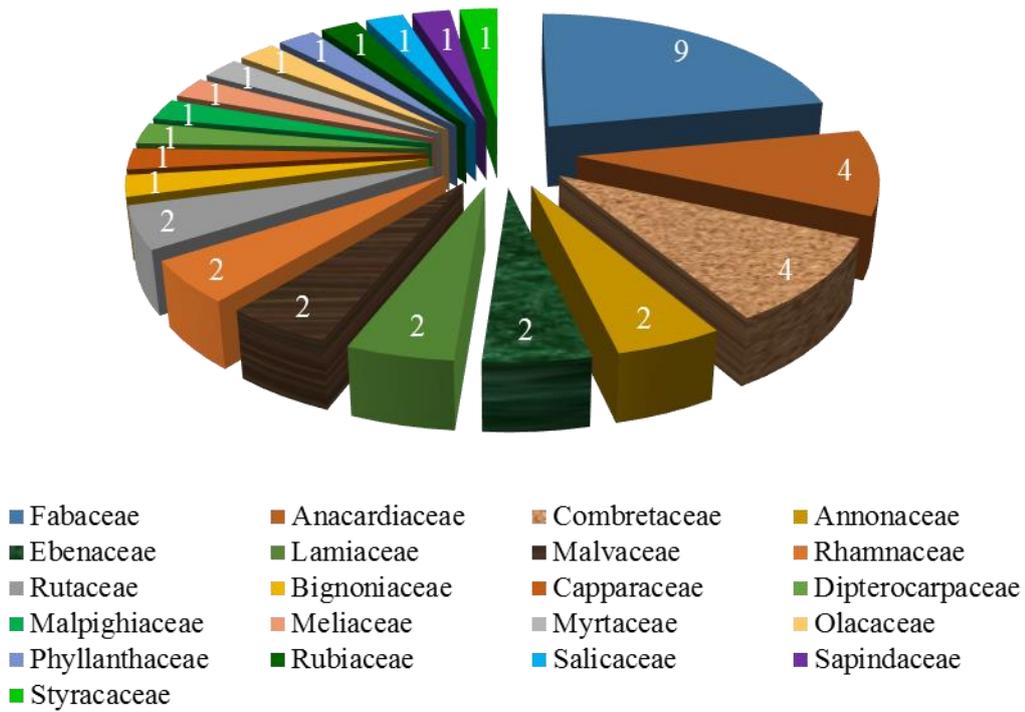


Figure 2. Family of major tree species in study sites

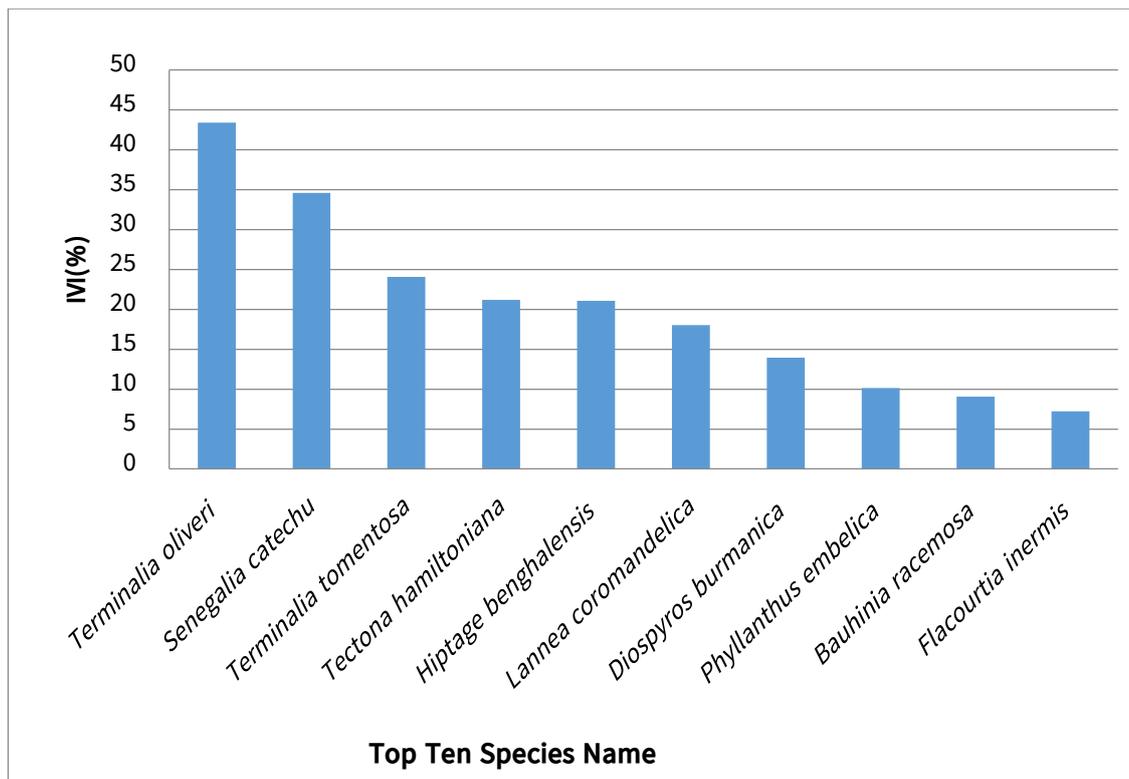


Figure 3. Importance value index (IVI) of major tree species in study sites

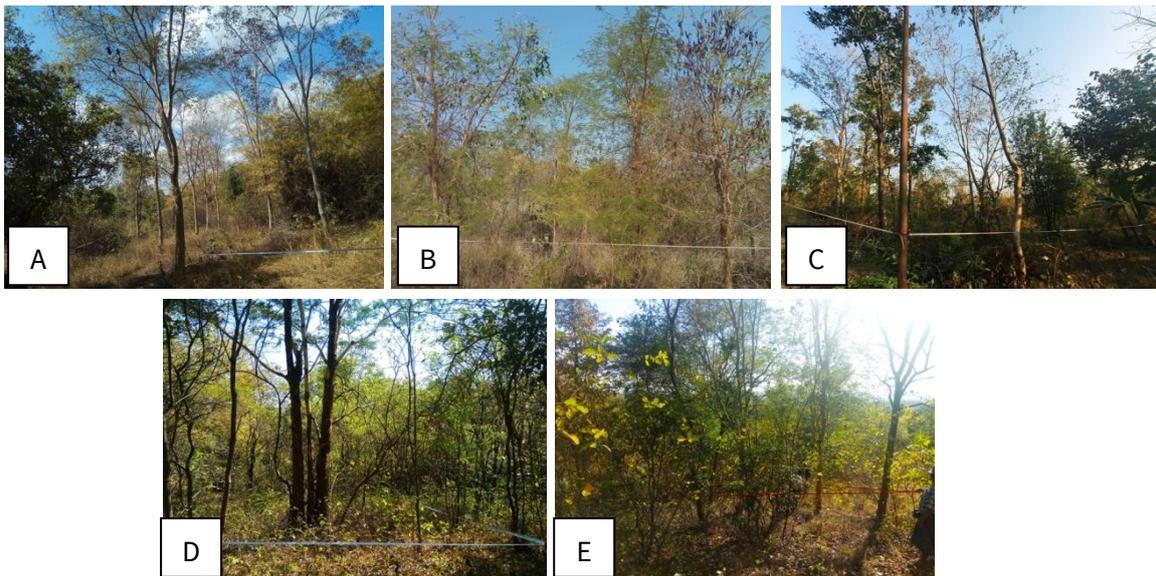


Figure 4. Location of sample plots in study sites

- (A) *Terminalia oliveri* Brandis (Than) was most occurred in sample plot 1
 (B) *Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb. (Sha) was most occurred in sample plot 2
 (C) *Terminalia tomentosa* W. & A. (Tauk kyan) was most occurred in sample plot 3
 (D) *Tectona hamiltoniana* Wall. (Dahat) was most occurred in sample plot 4
 (E) *Hiptage benghalensis* (L.) Kz (Zwe ni) was most occurred in sample plot 5

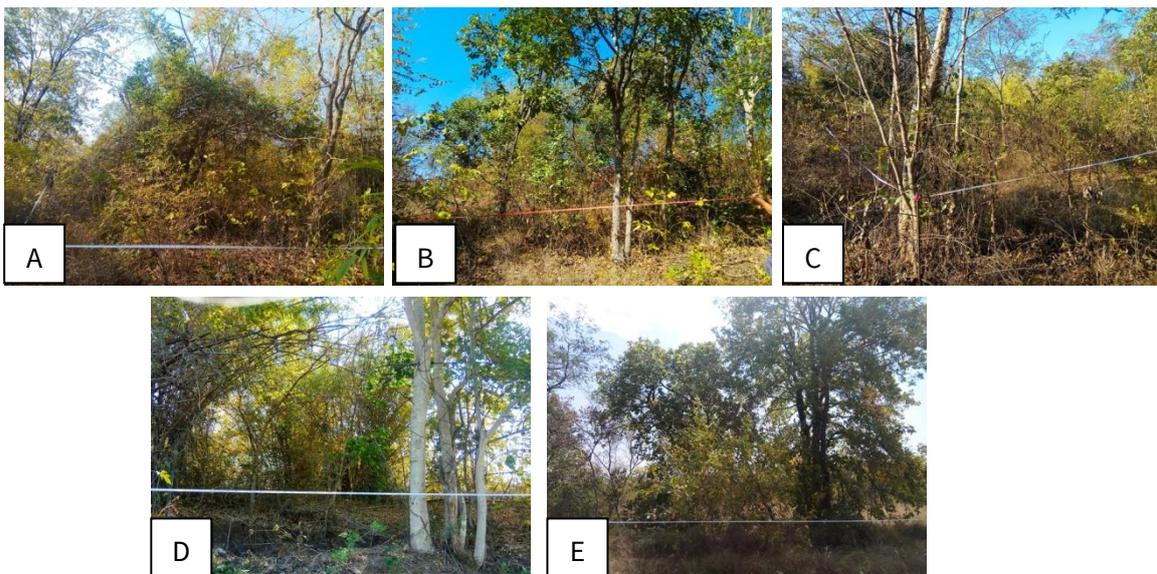


Figure 5. Location of sample plots in study sites

- (A) *Lannea coromandelica* (Houtt.) Merr. (Nabe) was most occurred in sample plot 6
 (B) *Diospyros burmanica* Kz. (Te) was most occurred in sample plot 7
 (C) *Phyllanthus embelica* L. (Zibyu) was most occurred in sample plot 8
 (D) *Bauhinia racemosa* Lam. (Phalan) was most occurred in sample plot 9
 (E) *Flacourtia inermis* Roxb. (Naywe) was most occurred in sample plot 10

Discussion and Conclusion

Quantitative analysis of dry zone forest in Thein Min Kha area was conducted by investigating density, relative density, frequency, relative frequency, mean basal area and relative dominance. A total of tree species were 41 species, 37 genera and 21 families.

The most dominant family in terms of species composition was Fabaceae, followed by Rubiaceae, Combretaceae, Malvaceae, Anacardiaceae, Rutaceae and Annonaceae in both study sites. *Terminalia oliveri* Brandis (Than) was widely distributed in study sites. Shannon-Wiener Index (H) and Simpson Index (D) of tree was higher in study sites.

The important value index indicates the extent of dominance of a species in the structure of a forest stand (Curtis and McIntosh, 1950). It is stated that species with the greatest important values are the leading dominance of the forest. The dominance species are *Terminalia oliveri* Brandis (Than), *Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb. (Sha), *Terminalia tomentosa* W. & A. (Tauk kyan), *Tectona hamiltoniana* Wall. (Dahat), *Hiptage benghalensis* (L.) Kz. (Zwe ni), *Lanea coromandelica* (Houtt.) Merr. (Nabe), *Diospyros burmanica* Kz. (Te), *Phyllanthus embelica* L. (Zibyu), *Bauhinia racemosa* Lam. (Phalan) and *Flacourtia inermis* Roxb. (Na ywe) in study sites that these species are ecologically important species.

In the present study, the plant species were disturbed by humans for wood materials to be used as fuels, furnitures, timber harvesting and livestock were fed on the plants in the forest. The forest requires strict protection of the continuous forest regeneration were to be maintained. Therefore, there was a need to improve the system currently being used to protect the forest. This included involving the local people in efforts to conserve the forest. The effective conservation and sustainable management of the forest was continued providing goods and services necessary for communities around the natural forest of the study area. This study was given baseline on forest species distribution and diversity for sustainable forest management.

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