Assessment of Plants Distribution and Biodiversity Status of Wi Lar Tha Taung, Banmaw Township, Kachin State

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Abstract

Kachin state is the biological rich region in Northern Myanmar. The present study deals with the assessment of plants distribution and diversity status of Wi Lar Tha Taung in Banmaw Township. Wi Lar Tha Taung is located in the northwest region of Banmaw, North latitude 24° 25′ 52″ and East longitude 97° 12′ 2″. A total of 94 plants species and 84 genera of 46 families were analyzed in the study area of two different sites A and B. There were 20 quadrats (20 x 20) m^2 established in two different sites. On the collected field data, Importance Values Index (IVI) for all species of each sampling plots was the sum of relative density, relative frequency and relative dominance according to Curtis and McIntosh (1950). Species diversity of each study site was based on species richness, evenness and diversity indices by using the Shannon-Wiener and Simpson indices. Species richness was mathematically calculated by Jackknife estimate. *Xylia xylocarpa* (Roxb.) Taub. and *Baccaurea sapida* Muell. Arg. were found to be the highest IVI value on both study sites as ecologically successful species. Shannon-Wiener diversity index (H) was range from 5.31 at Site A and 5.42 at Site B. The Simpson diversity index (D) was 0.955 at site A and 0.963 at site B. The Simpson index of evenness (E) varies from 0.87 and 0.88 respectively. Jackknife estimate of species richness (S) was 66.39 at site A and 72.28 at site B. Number of unique species (*k*) was 9 species on site A and 12 species on site B. All the diversity indices show that Site B is more diverse than site A. The present study can serve as baseline information for monitoring and phytodiveristy of Wi Lar Tha Taung in Banmaw Township, Kachin State.

Keywords: Species Diversity, Richeness, Evenness, Importance Value Index, Phytodiversity.

Introduction

The study area is located in Banmaw District in Kachin State. Banmaw Township lies between 24°13′0″ - 24°33′0″ North latitude and 97°7′0″ - 97°45′0″ East longitude. The elevation of Banmaw is 115m (378′) above the sea level. The climatic condition of study area is temperate climate zone. It is bounded by Tarpain River to the North. According to the physiological features, the study area possesses large area of water-flooded land by Taping River and Nanpha-inn. Therefore, the local people receive the alluvial soil, it is suitable for cultivation of various crops and growing for the various types of the natural vegetation. The total forest area less than 2000 square miles is in the hills and the rest in the plains.

Vegetation ecology includes the investigation of species composition and sociological interaction of species in communities (Mueller-Dombois and Ellenberg, 1974). The quantitative study of vegetation is called phytosociology and its principal aim is to describe the vegetation, explain or predict its pattern and classify it in a meaningful way (Ilorkar and Khatri, 2003).

Current species diversity reflects historical as well as environmental factors since environmental change and human actives lead to changes in species composition and competition (Barbour et al., 1998). High diversity does not necessarily reflect a large

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number of different species (Kent and Coker, 1992). Forest can be described by their composition, function and the structure.

The quantitative parameters, namely, density, relative density, frequency, relative frequency, mean basal area and relative dominance are measured to determine the distribution and ecological aspects of the species. It is one of the chief characters to determine the relative dominance of a species and nature of the community (Santra, 1999). By adding the values of relative density, relative frequency and relative dominance can be obtained the overall picture of ecological success of any species. Importance values can be calculated after the size and number of individual trees of the various species is measured. The trees with the highest importance values will be those that exist in the greatest number or are of the greatest size; these are the trees that may have the greatest effect on the community.

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Methodology

Study site

The study region, Wi Lar Tha Taung is located in northwest region of Banmaw, North latitude 24° 25′ 52″ East longitude 97° 12′ 2″ and the elevation between 400 – 1900 m. The two different sites are located at an elevation between 210 – 430 m and 467 – 1030 m as shown in Figure 1.

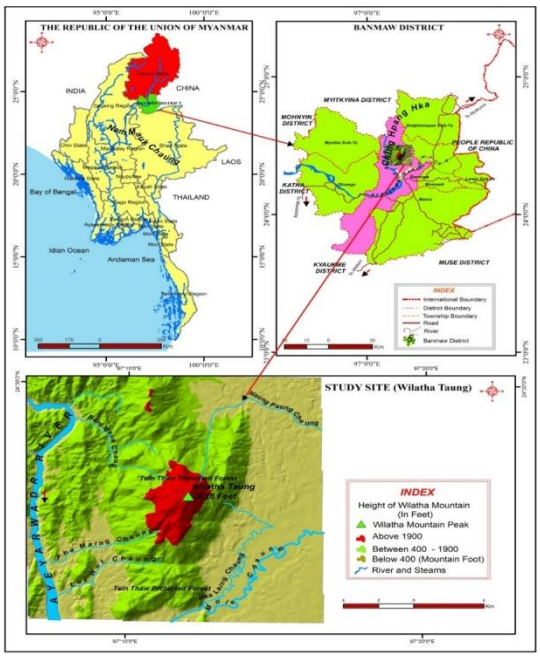


Figure 1 Location Map of Study Area

Data Collection

In the study of vegetation in Wi Lar Tha Taung, a total 20 quadrats size (20 x 20) m were laid in 2 different study sites with mountain base and slope site. All the plots were systematically surveyed during May 2022 and March 2023. All species were recorded and counted. Plant specimens were collected, pressed, dried and identified by Herbarium specimens of Botany Department, Banmaw University and checked by Handley and Chit Ko Ko (1961), Kress et al (2003), and Dassanayake (1980-1999). Shannon-Weiner index (H), Simpsons index (D), Simpsons evenness index (E) and Jackknife estimate of species richness ŝ index were calculated. The vegetation data were quantitatively analysed for abundance, density and frequency according to the formulae given by Curtis and McIntosh (1950). The relative values were summed up to represent Importance Value Index (IVI) as per Curtis (1959). Soil samples were taken from (15 cm) depth below the soil surface. They were sent to the Laboratory of Land Use Section, Myanmar Agriculture Service, for the analysis of soil texture soil pH, humus, organic carbon, K_2O, Na, Ca, Mg and nutrient contents (N, P, and K).

Jackknife estimate of species richness

According to the Heltshe and Forrester 1983, the formula of Jackknife estimate of species richness is:

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

of plant species diversity and evenness

Species diversity is the number of different species in a particular area (species richness) weighted by some measure of abundance such as number of individuals or biomass (Kumar 1996). Two commonly used measures are Shannon's index and Simpson's index.

Shannon-Wiener Index

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

Simpson Index (1949)

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

Evenness

Species evenness is the relative abundance that each species is represented in an area.

According to Shannon-Wiener function (1963) the most meaningful measure of evenness is as follow;

$$E = \frac{H}{H_{max}} \qquad H_{\max} = Log_2 S$$

Investigation of Importance Value Index (IVI)

The overall picture of ecological importance of a species in relation to the community structure can be obtained by adding the value of relative density, relative

dominance and relative frequency (Lamprecht 1989). Mathematically, it can be expressed as follow;

IVI = Relative density + Relative dominance + Relative frequency

Results

Site A consisted of 66 species, 58 genera and 39 families and Site B was 72 species 69 genera and 46 families were found in Table 1.

Table 1 Number of families, genera and species of the study area

Taxonomic Rank	Site A	Site B
Species	66	72
Genus	58	69
Family	39	46

Jackknife estimate of species richness

According to the results of Jackknife estimate of species richness; the canopy layer of Site A and Site B were 69.39 and 72.28 respectively as shown in Table 5.

Among these study sites, Site B showed higher species richness than Site A showed the lower species richness.

Species diversity indices

Shannon-Wiener and Simpson Indices

The most widely used diversity indices are the Shannon-Wiener index (H*'*), which combines species richness and relative abundance and Simpson Index (D). The calculated diversity parameter is shown in Tables 2.

It was observed that Shannon-Wiener index ranged from 5.31 and 5.42 respectively. In the same way Simpson index ranged from 0.955 and 0.963.

Evenness (E)

As the results of Shannon-Wiener evenness, Site A and Site B range from (0.87 and 0.88) respectively. According to these results, Site A and Site B was similarly distributed in each study area as shown in Table 2.

Table 2 Consolidate detail of species inventory of Site A and Site B

Parameters	Site A	Site B
No. of sample plots	10	10
No. of species	66	72
Shannon-Weiner diversity index (H)	5.31	5.42
Simpson diversity index (D)	0.955	0.963
Simpson evenness index (E)	0.87	0.88
Jackknife estimate of species richness *ŝ*	66.39	72.28

Vegetation analysis

Total of 20 sampled plots area are represented by 46 families, 84 genera and 94 species.

Relative density, relative frequency, relative dominance and importance value index of plant species were arranged in descending order as shown in Tables 6 & 7.

Importance Value Index (IVI)

Among the plant species in Site A, the highest IVI value was observed for *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) 76.71% followed by *Tectona grandis* L.f. (Kyun) 19.51% and *Schleichera oleosa* (Lour.) Oken (Kyoe) 14.84%. Incidentally, in Site B, the dominant plant species was *Baccaurea sapida* Muell. Arg. (Ka na soe) 28.80%, *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) 18.57% and *Terminalia bellerica* Roxb. (Thit seint) 18.12%. According to the result of quantitative analysis, the majority of tree species with high IVI value were ecologically and economically important species.

Table 3 Ranking of Important Value Index (IVI) at Site A

No.	Sp. Name	RD%	RF %	RDm %	IVI
1	*Xylia xylocarpa* (Roxb.) Taub.	16.18	5.88	54.6513	76.711
2	*Tectona grandis* L.f.	6.32	4.12	9.0172	19.512
3	*Schleichera oleosa* (Lour.) Oken	3.67	4.12	7.0505	14.841
4	*Adina cordifolia* Hook.f.	4.30	2.35	5.5671	12.217
5	*Flacourtia indica* (Burm.f.) Merr.	2.91	1.76	6.2035	10.874
6	*Combretum acuminatum* Roxb.	4.17	2.94	1.3221	8.432
7	*Homalium tomentosum* Benth.	2.40	2.35	1.2132	5.963
8	*Careya arborea* Roxb.	1.90	3.53	0.3792	5.809
9	*Chukrasia velutina* Roem.	2.15	2.35	0.9082	5.408
10	*Shorea obtusa* Wall.	2.40	1.76	1.0004	5.160
Others		53.60	68.40	82.97	135.074
Total		100	100	100	300

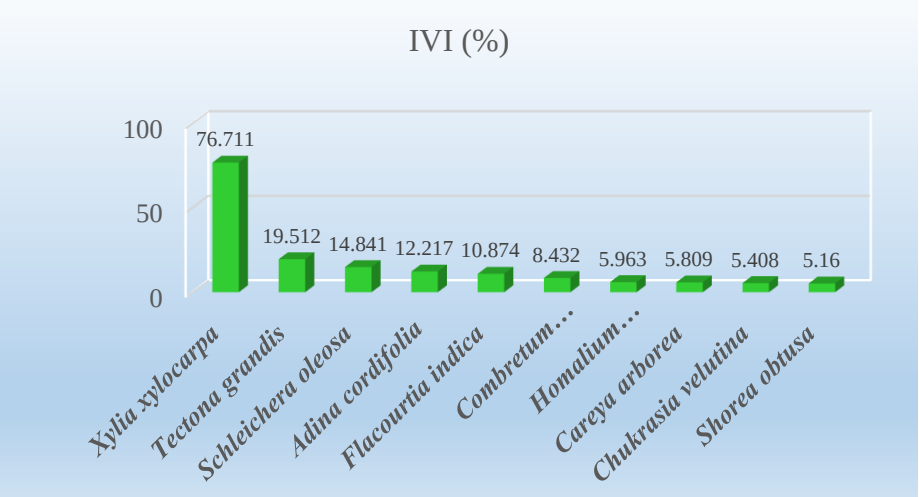


Figure 8 IVI% of major plant species at Site A

Table 4 Ranking of Important Value Index (IVI) at Site B

No.	Sp. Name	RD%	RF %	RDm %	IVI
1	*Baccaurea sapida* Muell. Arg.	12.50	2.65	13.6537	28.80
2	*Xylia xylocarpa* (Roxb.) Taub.	0.16	0.53	17.8801	18.57
3	*Terminalia bellirica* (Goertn)Roxb.	2.69	2.12	13.3105	18.12
4	*Lagerstroemia villosa* Wall. ex Kurz.	1.11	1.59	13.2275	15.93
5	*Syzygium claviflorum (*Roxb.) Wall.ex Steud.	6.33	4.23	3.3131	13.88
6	*Anogeissus acuminate* (Roxb.exDC) Wall.ex Gwill&Perr.	3.80	2.12	3.8610	9.78
7	*Schima wallichii* (DC.) Korth.	2.06	2.12	5.0619	9.24
8	*Cedrela microcarpa* C.DC.	3.32	3.70	2.2055	9.23
9	*Chukrasia tabularis* A.Juss.	3.64	3.70	0.1493	7.49
10	*Elaeocarpus floribundus* Blume.	3.16	4.23	0.0044	7.39
Others		61.23	73.01	27.33	138.43
Total		100	100	100	300

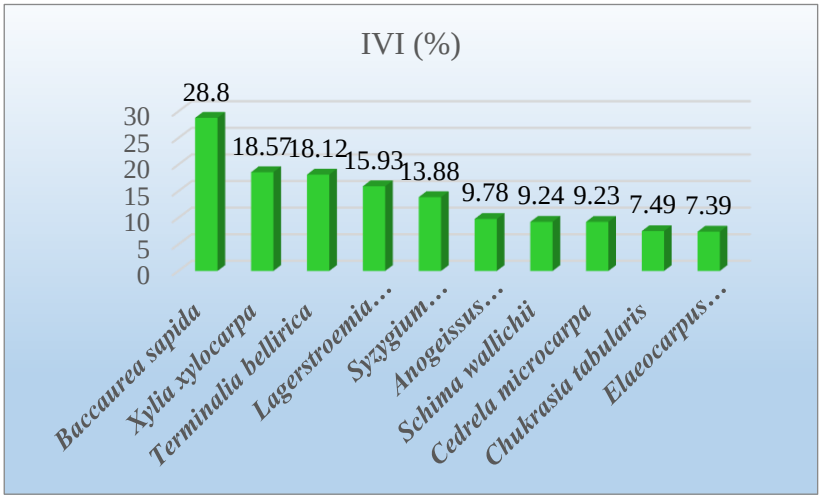


Figure 9 IVI% of major plant species at Site B

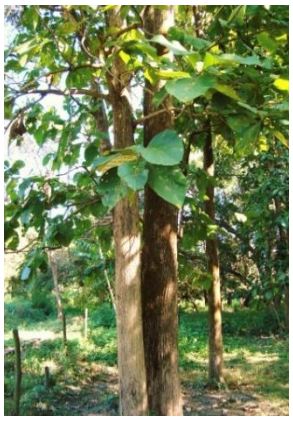
Table 5 IUCN Red List Threatened Species of Study Area

No.	Scientific Name	Family	Vernacular Name	IUCN Assessed Year	Conservation status / Criteria
1	*Xylia xylocarpa* (Roxb.) Taub.	Fabaceae	Pyinkado	2019	LC
2	*Tectona grandis* L.f.	Laminaceae	Kyun	2022	EN
3	*Schleichera oleosa* (Lour.) Oken	Sapindaceae	Kyoe	2019	LC
4	*Flacourtia indica (Burm.f.) Merr.*	Flacourtiaceae	Naywe	2019	LC
5	*Shorea obtusa* Wall.	Dipterocarpaceae	Thit-yar	2017	NT
6	*Shorea wangtianshuea* Y.K.Yang & J.K.WU	Dipterocarpaceae	Ma-thi	2021	EN
7	*Dalbergia paniculata* Roxb.	Fabaceae	Thabauk	2022	LC
8	*Terminalia bellirica* (Gaerth.) Roxb	Combretaceae	Thit-seint	2021	LC
9	*Baccaurea sapida* Muell. Arg.	Phyllanthaceae	Ka-na-soe	2019	LC
10	*Syzygium claviflorum* (Roxb.) Wall.ex Steud	Myrtaceae	Tha-pyai	2019	LC
11	*Schima wallichii* (DC.) Korth	Theaceae	Lyauk-yar-phyu	2019	LC
12	*Chukrasia tabularis* A.Juss	Meliaceae	Yin-mar	2019	LC
13	*Caryota urensi* L.	Arecaceae	Min-baw	2014	LC
14	*Gnelina arborea*	Liliaceae	Ya-manay	2019	LC

Roxb.

Categories: EN = Endangered, LC = Least Concern, NT = Near Threatened

Schleichera oleosa (Lour.) Oken
[Kyoe]



Tectona grandis L.f.
[Kyun]

Shorea obtusa Wall.
[Thit-yar]

Shorea wangtianshuea Y.K.Yang & J.K.W
[Ma-thi]

Dalbergia paniculata Roxb.
[Thabauk]

Gnelina arborea Roxb.
[Ya-manay]

Schima wallichii (DC.) Korth
[Lyauk-yar-phyu]

Chukrasia tabularis A.Juss
[Yin-mar]

Baccaurea sapida Muell. Arg.
[Ka-na-soe]

Discussion and Conclusion

In this study area, 94 tree species and 84 genera belonging to 46 families were recorded. According to the calculation of Shannon-Wiener and Simpson diversity index, Site B (5.42, 0.963) was slightly higher than Site A (5.31, 0.955). The species composition of Site B was slightly higher than Site A.Similarly, Site B was a little more evenly distributed than Site A cause of different degree of disturbance, some parts of the study area have decreased in species diversity. In the study Site A, *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) had highest IVI value (76.711) and in the study Site B *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) had second highest IVI value (18.57) also. The highest IVI of major tree species *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) possess in the highest relative density, high relative frequency and relative dominance value in study Site A. In this study, *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) was included among top ten species of both study sites. As a result, they can be considered as representative species of study area and it should be taken into account as ecologically important species for conservation activities. Thus, *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) was ecological and economically important species in the both study area.

All these species of study area are characteristic species having their indicator value. On the basis of the present investigation, these forests should be maintained by increasing number of seedlings and reducing disturbance (over grazing and cutting) (Thaung Naing Oo *et al*. 2008). Among the many aspects of phytoecological studies useful in environmental protection, use tolerance, rate of succession and elasticity of plant communities seem impossible without the pre-requisite adequate knowledge of plant communities, which can only be provided by phytodynamic studies and mapping (Miyawaki *et al.*, 1977). The present study, *Shorea obtusa* Wall., *Tectona grandis* L.f. and *Shorea wangtianshuea* Y.K.Yang & J.K.WU were assessing in IUCN Red List of globally Threatened and Edangered Species shown in Table 5. Thus, the recent study can serve as a primary input towards monitoring and sustaining phytodiversity of Wi Lar Tha Taung in Banmaw Township of Kachin State.

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