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# STUDY ON PLANT COMMUNITY STRUCTURE IN ALAUNGDAW KATHAPA NATIONAL PARK, MONYWA DISTRICT IN SAGAING REGION

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## Abstract

To study the plant community structure of Alaungdaw Kathapa National Park in Sagaing Region, a total of 124 relevés were taken and analyzed during January and May in 2013. The phytosociological study of plant communities were computed using the methods of Braun-Blanquet (1964) and Fujiwara (1987). Canopy layer can be classified into eighteen communities. They are *Tectona grandis* L. f., *Terminalia tomentosa* Wight & Arn., *Xylia xylocarpa* (Roxb.) Taub., *Dipterocarpus tuberculatus* Roxb., *Pinus khasya* Royle ex Parl., *Shorea siamensis* (Kurz.) Miq., *Dillenia parviflora* Martelli., *Pterocarpus indicus* Willd., *Lagerstroemia speciosa* (L.) Pers., *Shorea obtusa* Wall., *Quercus mespilifolia* Wall., *Homalium tomentosum* Benth., *Syzygium cumini* (L.) Skeels., *Melanorrhoea usitata* Wall., *Croton persimilis* Muell., *Harrisonia bennetii* Hook.f., *Strychnos nux-vomica* L. and *Wendlandia paniculata* DC. communities. The recent research recognizes the information and phytosociological data to identify the actual natural vegetation and to develop practical technology for the management of National Park. Therefore, the present study can serve as baseline data for sustaining and monitoring of environmental changes in the future.

**Key words:** plant community, canopy layer, phytosociological.

## Introduction

The world's biodiversity includes all living organisms (animals, plants, fungi, and microbial groups inclusive of genetic diversity and ecosystem/landscape diversity) in their interactive state contributing to multitude of services of relevance to sustain the ecological integrity for the benefit of the humankind (Kumaraswamy and Udayakumar 2011).

Distinguishing plant communities has been at the heart of vegetation science for centuries, with a traditional focus on the distribution, composition and classification of plant communities. Plant communities are

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defined as an assemblage of functionally similar species populations that occur together in time and space (Magurran 1988).

The plant community of a region is a function of time; however, altitude, slope, latitude, aspect, rainfall and humidity play a role in the formation of plant communities and their composition (Kharkwal *et al.* 2005). The special field of synecology which is concerned with the structure and classification of plant community is known as phytosociology (Shukla and Chandel 2006).

Phytosociology involves the study of vegetation and its internal "social" relationships, not only classification of plant communities but also analysis of their structure, composition, successional relations; relationships to environmental factors, as well as comparison of different communities. Phytosociology provides useful basis data for ecology, geography, landscape science, conservation, environmental science, etc. because the data represent integrated units in vegetation systems. Relevés (vegetation samples) as basis materials, and their classified units in also contribute documentations of natural environments for use in conservation of nature and ecosystems, protections of gene pools, and restorations of natural environments in disturbed area (Fugiwara 1987).

The aim of this research is to get the representative plant community from the study area, the objectives of this study are to identify the plant communities and their characteristic of species and to study the relationships of plant species community structure and environmental factors.

## **Materials and Methods**

### **Study Area**

The study area of Alaungdaw Kathapa National Park is situated in Mingin Township, Monywa District. It lies between 22°05' - 22°45' N latitude and 94°15' - 94°40' E longitude. It covers an area of 1598.045 square kilometers. The elevation of this area varies from 300 m to over 1220 m above sea level. The location map of the study area as shown in Figure 1.

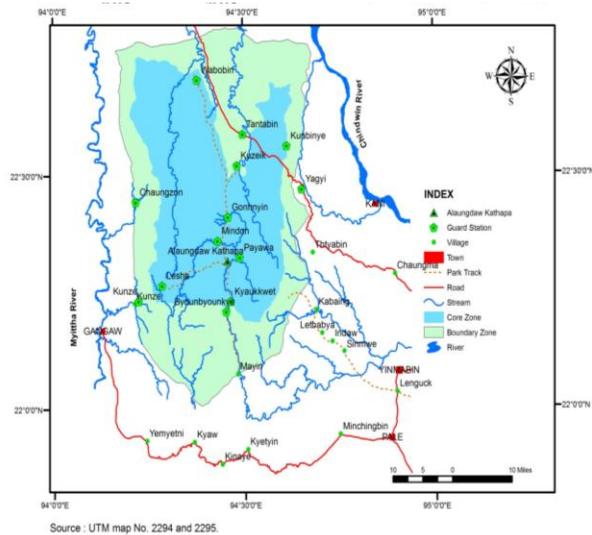


Figure 1. Location Map of Alaungdaw Kathapa National Park

### Choice of sampling and minimal area in the field

To study the community composition and phytosociological characteristic of the vegetation at the selected sites, field surveys were conducted during January and May in 2013. Phytosociological attribute of each species were studied by the methods of Braun-Blanquet (1964) and Fujiwara (1987). In the field survey, the releves (vegetation samples) are used as basic material. For the classification of plant communities, homogenous vegetation and homogenous site were chosen and appropriate number of releve was established. Sometimes the dominant species were used for the best samples locations.

The number of sample plots and plot sizes established in each study site were differences due to the area coverage of the study sites. The height of vegetation was used to estimate the necessary length on site of a square releve range from 900m<sup>2</sup> (30m x 30m), 500m<sup>2</sup> (25m x 20m) and 150m<sup>2</sup> (15m x 10m), etc. for canopy layer but the dimensions of the sample plot may differ, as dictated by topography.

### Making the species list and recording environmental factors

All species within the releve were recording by layer, such as the canopy tree (T<sub>1</sub>), understorey tree (T<sub>2</sub>), shrub (S) and herb (H) . At each releve, the physical environment factors were recorded, including elevation, slope, aspect, topography, soil types, soil depth and depth of the litter layer.

### **Total estimate and sociability**

The term "total estimate" combines the measures of cover and abundance, as described by Braun-Blanquet (1964). The cover percentage of vegetation was estimate in each layer. To estimate the percentage of cover and abundance, there are seven levels. These were:

- r- occurring hardly in the releve
- + - occurring sparsely and covering very small percentage
- 1- abundant of individuals with low cover
- 2- abundant with coverage of 5-25% of total plot area
- 3- the number of individuals with coverage of 25-50%
- 4- the number of individuals with coverage of 50-74%
- 5- regardless of the number of individuals, with coverage of 75-100%

Sociability expresses the horizontal aggregation pattern of species. To estimate the percentage of sociability, the five levels (Braun-Blanquet 1964) of indication are as follow:

- 1- growing isolated
- 2- growing in small groups, as small clumps
- 3- growing in small patches, as cushions
- 4- growing in large patches, in carpets
- 5- growing in larger crowds and covering the whole releves area.

In the present study, 124 releves were taken from the study area by using phytosociological method.

### **Soil analysis**

The soil samples were taken from the soil surface (0 - 30 cm) depth. The soil were analyzed for soil pH, soil texture, organic carbon, humus, K<sub>2</sub>O, Ca, Mg, Na and Nutrient (N, P, K) at the laboratory of Land Use Section, Myanmar Agriculture Service, Insein, Yangon.

## **Results**

### **Canopy Layer**

The plant communities of canopy layer can be differentiated into eighteen communities in the study area.

#### **1. *Croton persimilis* Muell. (*Thetyin gyi*) Community**

*Croton persimilis* Muell. community commonly occurred in flat and slightly moist area of study site (452 – 502 m). This community was collected from 6 survey points in study site. This community was mainly developed in trees layer and the height of this community was 4 to 15 m.

The total coverage was from 50 – 90% and the litter layer was 0.3 -1.5 cm. Total number of species composition varied from 20 – 37. In this community, tree layer is composed of 35 species, shrub layer 38 species and herb layer 66 species as shown in Figure 2 (A).

## **2. *Dipterocarpus tuberculatus* Roxb. (In) Community**

*Dipterocarps tuberculatus* Roxb. community commonly found in widely distributed in the whole area of study site (446 – 550 m). This community was collected from 8 survey points in study site. This community consists of three layers, tree, shrub and herb. In this community, trees layer well developed. The height of community varied from 8 to 30 m. The total coverage of tree layer was 50 – 90% and the litter was 1.0 – 3.0 cm. The number of species in this community was 44 – 72. This community consists of 69 trees, 92 shrubs and 177 herb species as shown in Figure 2 (B).

## **3. *Shorea siamensis* (Kurz.) Miq. (Ingyin) Community**

*Shorea siamensis* (Kurz.) Miq. community mainly occurred in slightly dry and slop area of study site (521 – 1075 m). This community was collected from 8 survey points in study site. This community was mainly dominant in trees layer and the height of this community was 8 to 20 m. The total coverage by trees layer varied from 40 – 90% and the litter layer was 0.5 - 2.5 cm. The number of species in this community was varied from 21 – 68. Species richness of 57 by tree layer, 83 by shrub layer and 128 by herb layer was found in this community as shown in Figure 2 (C).

## **4. *Pinus khasya* Royle ex Parl. (Htinshu) Community**

*Pinus khasya* Royle ex Parl. community commonly occurred in open, sunny area of hill slope of study site (1090 – 1120 m). This community was collected from 6 survey points in study site. Trees layer was well developed in this community. The height of the trees in the community was from 8 to 20 m. The total coverage by tree layer varied from 50 – 80% and the litter layer was 0.5-1.5cm. The number of species in this community was 23 – 40. In this community, species richness by tree layer was 32, shrub layer 36 and herb layer 69 species respectively as shown in Figure 2 (D).

### **5. *Shorea obtusa* Wall. (Thitya) Community**

*Shorea obtusa* Wall. community occurred in dry and slightly slope area of study site (423 - 990). This community was collected from 6 survey points in study site. Trees layer was well developed in this community. The height of community was 5 to 15 m. Total coverage by this layer varied from 40 – 80 % and litter layer was 0.5 – 2.5 cm. The species composition of this community was from 12 – 34. In this community, species richness by tree layer was 34, shrub layer 39 and herb layer 45 respectively as shown in Figure 2 (E).

### **6. *Melanorrhoea usitata* Wall. (Thitsi) Community**

*Melanorrhoea usitata* Wall. community commonly occurred in slightly slope and dry area of study site (501 – 960 m). This community was collected from 8 survey points in study site. Trees layer was well developed in this community. The height of the trees in this community was 8 to 20 m and total cover of the trees layer was 40 – 80%. The litter was 0.5 – 1.0cm. The number of species in this community was 32 – 43. In this community, species richness by tree layer was 40, shrub layer 67 and herb layer 113 species respectively as shown in Figure 2 (F).

### **7. *Quercus mespilifolia* Wall. (Saekya) Community**

*Quercus mespilifolia* wall. community commonly occurred in slope and slightly dry area of study site (422 – 1066 m). This community was collected from 7 survey points in study site. Trees layer was well developed in this community. The height of the trees layer was 5 to 15 m. The total coverage by in this community was from 50 – 90% and the litter layer was 0.5 - 1.0 cm. The number of species in this community varied from 17 – 29. This community consists of 32 trees, 30 shrubs and 62 herb species as shown in Figure 3 (A).

### **8. *Tectona grandis* L. f. (Kyun) Community**

*Tectona grandis* L. f. community is widely distributed in the whole area of study site (423 – 912 m). This community was collected from 8 survey points in study site. In this community, trees, shrubs and herbs layer well developed. The height of trees layer varied from 8 to 30 m. Total coverage was 50 – 90% and litter layer was varied from 1.5 – 3.0 cm. The species composition of in this community was 53 – 77. Species richness of 75 by tree layer, 99 by shrub layer and 178 by herb layer was found in this community as shown in Figure 3 (B).

### **9. *Terminalia tomentosa* Wight & Arn. (Taukkyan) Community**

*Terminalia tomentosa* Wight & Arn. community commonly occurred in flat and slightly moist area of study site (433 – 526 m). This community was collected from 8 survey points in study site. This community well developed with trees, shrubs and herbs. The height of trees layer was from 10 to 30 m and had a cover of 50 – 90% and the litter was 1.5 – 2.5 cm. The number of species in this community was present 63 – 76. In this community, species richness by tree layer was 78, shrub layer 115 and herb layer 183 species respectively as shown in Figure 3 (C).

### **10. *Xylia xylocarpa* (Roxb.) Taub. (Pyinkado) Community**

*Xylia xylocarpa* (Roxb.) Taub. community commonly occurred in flat and slightly dry area of study site (423 – 433 m). This community was collected from 8 survey points in study site. This community consists of trees, shrubs and herbs layer. In this community, trees layer was well developed. Trees layer height was varied from 10 to 30 m. The cover percentage of trees layer varied from 50 – 90% and the litter layer was 1.5 – 2.5 cm. In this community, the number of species varied from 62 – 75. This community consists of 79 trees, 107 shrubs and 181 herb species as shown in Figure 3 (D).

### **11. *Dillenia parviflora* Martelli. (Zinbyun) Community**

*Dillenia parviflora* Martelli. community commonly occurred in moist and flat area of study site (442 – 520 m). This community was collected from 7 survey points in study site. Trees, shrubs and herbs layer well developed in this community. The height trees layer was 6 to 20 m and the total coverage by this layer varied from 50 – 90%. Litter layer was varied from 1.0 – 2.5 cm. The species composition of in this community was 52 – 66. In this community, tree layer is composed of 50 species, shrub layer 88 species and herb layer 138 species as shown in Figure 3 (E).

### **12. *Pterocarpus indicus* willd. (Padauk) Community**

*Pterocarpus indicus* willd. community mostly occurred in slightly moist and flat area of study site (420 – 435 m). This community was collected from 6 survey points in study site. This community has layers from herb to tree. The height of trees layer was 10 to 30 m. Total coverage was 50 – 90% and litter layer was 0.5 – 1.5 cm. In this community, the number of species ranges from 53 – 64. Species richness of 55 by tree layer,

85 by shrub layer and 137 by herb layer was found in this community as shown in Figure 3 (F).

### **13. *Homalium tomentosum* Benth. (Myaukchaw) Community**

*Homalium tomentosum* Benth. community commonly occurred in moist and flat area of study site (905 – 922 m). This community was collected from 6 survey points in study site. This community was well developed from herbs to trees layer. The height of trees layer was 8 to 30 m. The total coverage of this community varied from 40 – 90% and litter layer was 1.5 – 2.0 cm. The number of species in this community was present 49 – 63. In this community, species richness by tree layer was 41, shrub layer 67 and herb layer 122 species respectively as shown in Figure 4 (A).

### **14. *Lagerstroemia speciosa* (L.) Pers. (Pyinma) Community**

*Lagerstroemia speciosa* (L.) Pers. community commonly occurred in moist and flat area of study site (902 – 925 m). This community was collected from 6 survey points in study site. This community consists of three layers, trees, shrubs and herbs layer. The height of the trees layer was 8 to 25 m. Total coverage of this community varied from 40 – 90% and the litter layer was 1.5 – 2.5 cm. The number of species in this community was 45 – 67. In this community, tree layer is composed of 43 species, shrub layer 71 species and herb layer 104 species as shown in Figure 4 (B).

### **15. *Harrisonia bennetii* Hook.f. (Sugyin) Community**

*Harrisonia bennetii* Hook.f. community commonly occurred in dry and flat area of study site (350 – 359 m). This community was collected from 6 survey points in study site. This community was mostly found in trees layer. The community of trees layer was 4 to 5 m. The cover percentage of trees layer was from 90 – 95%. The litter layer was 0.5 – 1.5 cm. The number of species in this community varied from 13 - 19. Species richness of 14 by tree layer and 56 by herb layer was found in this community as shown in Figure 4 (C).

### **16. *Syzygium cumini* (L.) Skeels. (Thabye) Community**

*Syzygium cumini* (L.) Skeels. community commonly occurred in flat land area of study site (468 – 492 m). This community was collected from 6 survey points in study site. This community was mainly dominant in trees layer and the height of trees layer was from 8 to 30 m. The total coverage by trees layer varied from 40 – 90% and the litter was 1.5 – 2.0 cm. The

number of species in this community was varied from 28 – 42. This community consists of 34 trees species, 44 shrubs species and 66 herb species as shown in Figure 4 (D).

#### **17. *Strychnos nux-vomica* L. (Kabaung) Community**

*Strychnos nux-vomica* L. community is widely occurred in the whole area of study site (350 – 970 m). This community was collected from 7 survey points in study site. Trees layer was well developed in this community. The height of trees layer was 4 to 5 m. The total coverage by this layer varied from 80 – 90% and litter layer was 0.5 – 1.0 cm. The species composition of this community varied from 18 – 22. In this community, species richness by tree layer was 24 and herb layer 77 species respectively as shown in Figure 4 (E).

#### **18. *Wendlandia paniculata* DC. (Sakyin) Community**

*Wendlandia paniculata* DC. community is widely distributed in the whole area of the study site (420 – 990 m). This community was collected from 7 survey points in study site. In this community trees layer was well developed. The height of community varied from 4 to 5 m. Total coverage by this layer was from 80 – 90% and the litter layer was 0.5 – 1.0 cm. The species composition of this community varied from 13 – 22. In this community, tree layer is composed of 18 species and herb layer 67 species as shown in Figure 4 (F).

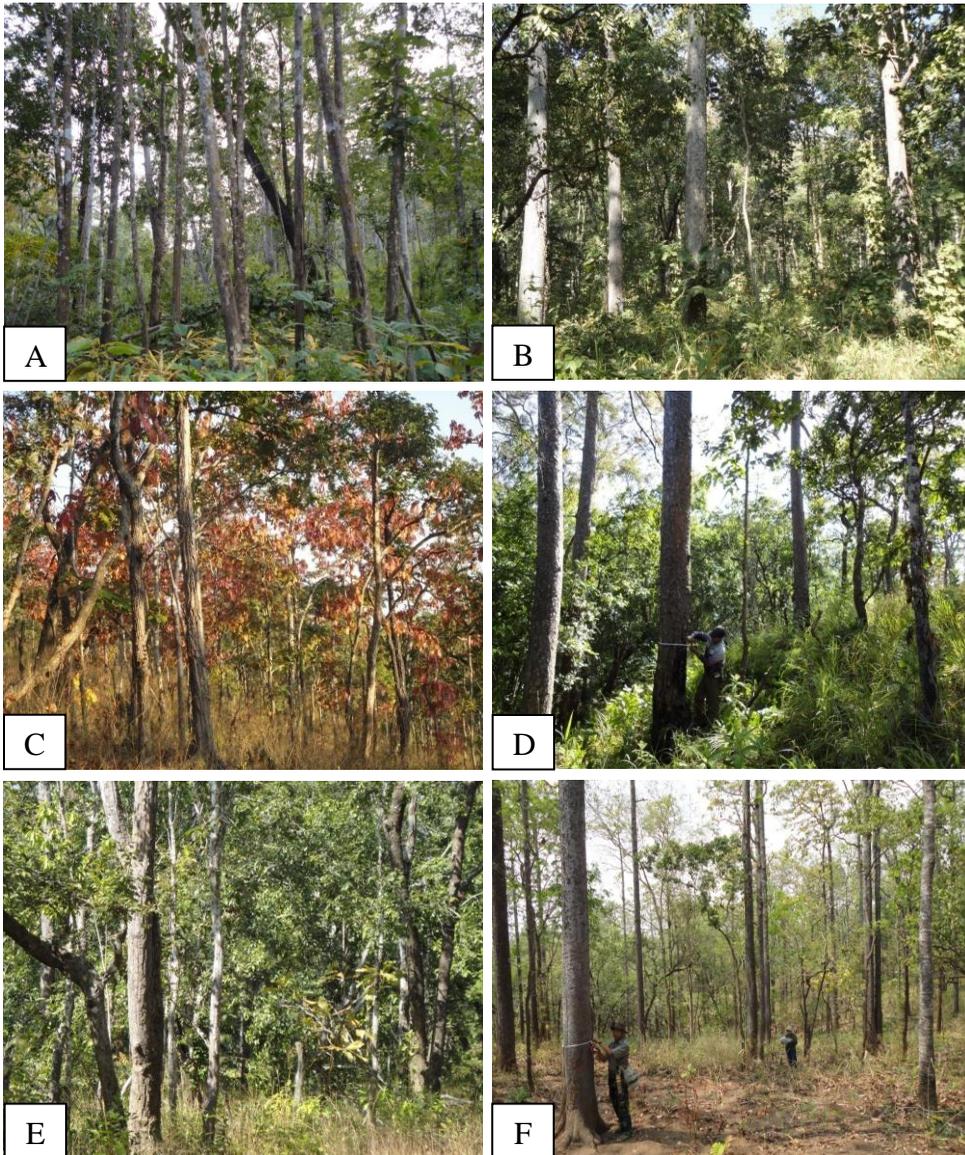


Figure 2. (A) *Croton persimilis* Muell. community  
 (B) *Dipterocarpus tuberculatus* Roxb. community  
 (C) *Shorea siamensis* (Kurz.) Miq. community  
 (D) *Pinus khasya* Royle ex Parl. community  
 (E) *Shorea obtusa* Wall. community  
 (F) *Melanorrhoea usitata* Wall. community

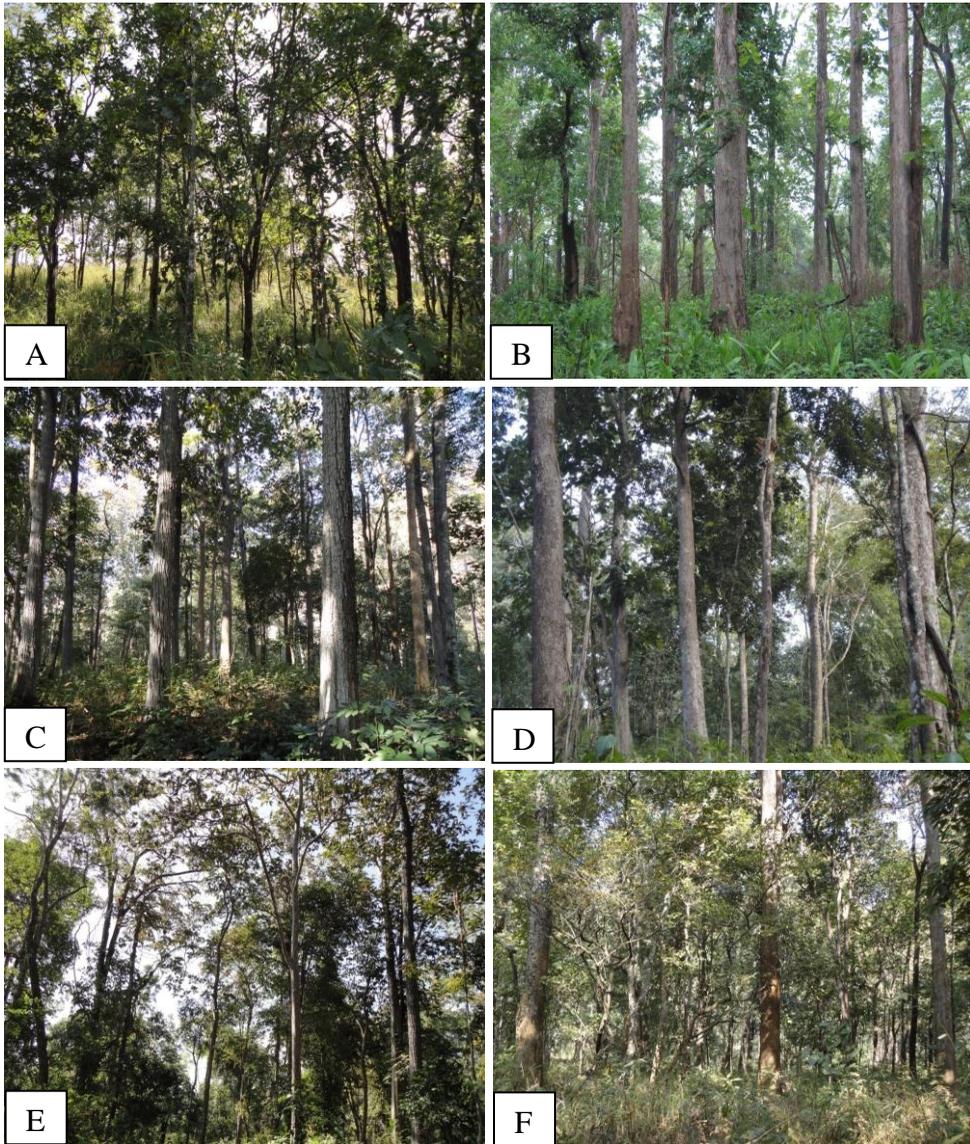


Figure 3. (A) *Quercus mespilifolia* Wall. community  
 (B) *Tectona grandis* L. f. community  
 (C) *Terminalia tomentosa* Wight & Arn. community  
 (D) *Xylia xylocarpa* (Roxb.) Taub. community  
 (E) *Dillenia parviflora* Martelli. community  
 (F) *Pterocarpus indicus* Willd. community

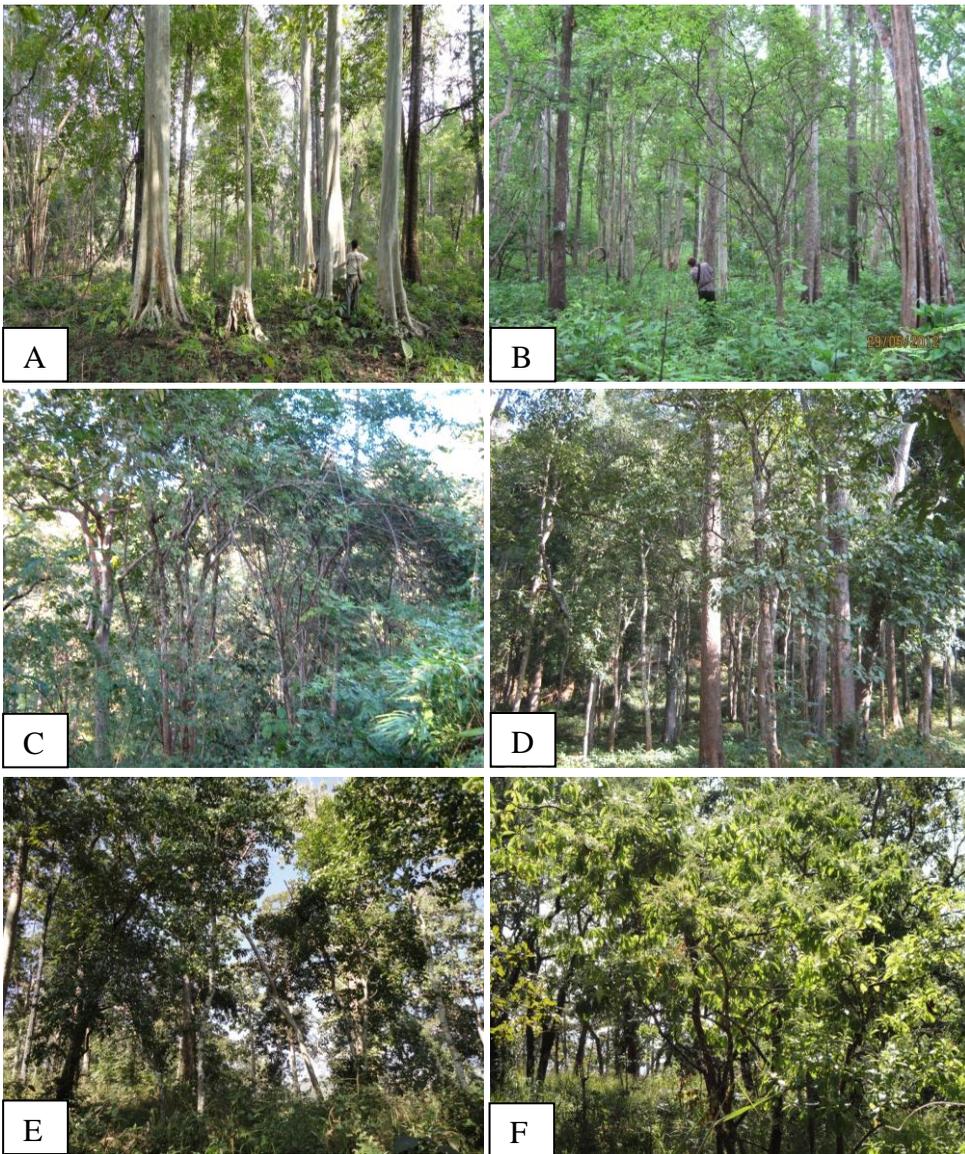


Figure 4. (A) *Homalium tomentosum* Benth. community  
 (B) *Lagerstroemia speciosa* (L.) Pers. community  
 (C) *Harrisonia bennetii* Hook. f. community  
 (D) *Syzygium cumini* (L.) Skeels. community  
 (E) *Strychnos nux-vomica* L. community  
 (F) *Wendlandia paniculata* DC. community

## Discussion

Plant community is the collection of plant species growing together in a particular location that shows a definite association or affinity with each other (Kent and Coker 1992).

In this study, it has been tried to look into the plant communities that were formed in Alaungdaw Kathapa National Park, Mingin Township, Monywa District in Sagaing Region. In the study area, phytosociologically investigated into eighteen communities in canopy layer.

Based on field data, *Tectona grandis* L.f. *Dipterocarpus tuberculatus* Roxb., *Strychnos nux-vomica* L. and *Wendlandia paniculata* DC. communities were widely distributed in the study area. *Terminalia tomentosa* Wight & Arn., *Dillenia parviflora* Martelli, *Pterocarpus indicus* Willd., *Lagerstroemia speciosa* (L.) Pers., *Homalium tomentosum* Benth., *Croton persimilis* Muell, communities were found flat and slightly moist of study area. *Xylia xylocarpa* (Roxb.) Taub., *Harrisonia bennetii* Hook.f. communities were occurred flat and slightly dry of study area. *Shorea siamensis* Kurz.( Miq., *Shorea obtusa* Wall., *Quercus mespilifolia* Wall., *Melanorrhoea usitata* Wall., communities were occurred slightly dry and slightly slope of study area. *Pinus khasya* Royle ex Parl. community was found on open, sunny and hill slope of study area.

In the study area, *Xylia xylocarpa* (Roxb.) Taub., *Pterocarpus indicus* Willd., *Syzygium cumini* (L.) Skeels and *Harrisonia bennetii* Hook.f. were commonly occurred in lower elevation at 350 – 492 m. *Pinus khasya* Royle ex Parl. community was commonly found in higher elevation at 1090 – 1120 m. *Tectona grandis* L.f., *Terminalia tomentosa* Wight & Arn., *Dipterocarpus tuberculatus* Roxb., *Shorea siamensis* (Kurz.) Miq., *Dillenia parviflora* Martelli, *Lagerstroemia speciosa* (L.) Pers., *Shorea obtusa* Wall., *Quercus mespilifolia* wall., *Homalium tomentosum* Benth., *Melanorrhoea usitata* Wall., *Croton persimilis* Muell., *Strychnos nux-vomica* L. and *Wendlandia paniculata* DC. communities were occurred in elevation at 350 – 1075 m.

The total coverage by canopy layer generally varied from 50% to 90% and their litter layer was 0.5 – 3.0 cm. The soil texture in all communities were generally clay loam, silt loam, silty clay loam, sandy loam to sandy clay loam and sandy clay. The soil pH were near neutral, slightly alkaline, slightly acid to strongly acid. *Croton persimilis* Muell. *Shorea siamensis* (Kurz.) Miq., *Tectona grandis* L.f., *Terminalia tomentosa* Wight & Arn., and *Strychnos nux-vomica* L. communities were occurred on

clay loam, *Pterocarpus indicus* Willd., and *Lagerstroemia speciosa* (L.) Pers., communities were occurred on silt loam, *Pinus khasya* Royle ex Parl., *Shorea obtusa* Wall., and *Quercus mespilifolia* Wall., communities were occurred on silty clay loam. *Xylia xylocarpa* (Roxy.) Taub., and *Dillenia parviflora* Martelli communities were occurred on sandy loam, *Dipterocarpus tuberculatus* Roxb., *Meanorrhoea usitata* Wall., *Homalium tomentosum* Benth. and *Syzygium cumini* (L.) Skeels were occurred on sandy clay loam, *Harrisonia bennetii* Hook.f. and *Wendlandia paniculata* DC. communities were occurred on sandy clay.

Thaung Naing Oo *et al.* (2006) stated that the higher IVI value of top ten major species are similar to those of present community investigation. These species were *Tectona grandis* L.f., *Terminalia tomentosa* Wight & Arn., *Xylia xylocarpa* (Roxb.) Taub., *Dipterocarpus tuberculatus* Roxb., *Pinus kharya* Royle ex Parl., *Shorea siamensis* (Kurz.) Miq. and *Syzygium cumini* (L.) Skeels. etc. In this study, *Tectona grandis* L.f., *Xylia xylocarpa* (Roxb.) Taub., *Dipterocarpus tuberculatus* Roxb and *Pterocarpus indicus* Willd. are the valuable and most famous timber tree in Myanmar.

In community analysis, detecting and describing the value of different species to indicate the environmental condition is a common practice. The altitudinal difference coupled with other environmental variation such as soil, slope etc. as well as the type and intensity of disturbance and species ecological requirements might be contributed to the formation of these communities (Mc Cunne and Grace 2002 as cited in Gebreselasse 2011).

Uttam *et al.* (2010) stated that communities are not only unaware about maintaining biodiversity, forest health, and ecosystem services of the forest but also misinformed to set the goal of sustainable forest management. Scientific knowledge about taxonomy, conservation status, methods of propagation, and utilization of species is necessary and that should be combined with the local or indigenous knowledge to design sustainable forest management goal.

Among the many aspects of phytosociological provides the classification of plant communities and recording of vegetation as basic units of natural environments. Their classified units also contribute documentations of natural environments for use in conservation of nature and ecosystems. Further, the understanding of the richness of species diversity is necessary for appropriate conservation and overall effects of

restoration work. Therefore, the present study can serve as baseline data for sustaining and monitoring of environmental changes in future.

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