Population Diversity and Ecological Successful Species of Mangrove Forest in Thabawt Kan Area, Ayeyarwady Region

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Abstract

This vegetation study was aim to determine species compositions, population diversity and ecological successful mangrove species in Thabawt Kan area, Ayeyarwady Region. In this study 15 families, 20 genera and 22 mangroves species were recorded. Family Rhizophoraceae obtained the highest species compositions with six mangrove species these are: *Rhizophora mucronata*, *Rhizophora apiculata*, *Bruguiera gymnorrhiza*, *Bruguiera cylindrica*, *Ceriops decandra* and *Ceriops tagal* in this study. Diversity index of site 2 (2.79, 0.82) was relatively higher than site 1 (2.64, 0.78) by using Shannon-Wiener and Simpson indices, 1963. Ecological successful species with the highest Importance Value Index was observed with *Bruguiera gymnorrhiza* (97.93%) followed by *Rhizophora apiculata* (30.55%) and *Rhizophora mucronata* (27.00%) in site 1. *Bruguiera gymnorrhiza* (72.83%) followed by *Rhizophora apiculata* (61.76%) and *Rhizophora mucronata* (46.23%) in site 2 by the method of Curtis and McIntosh, 1950. The present study will give crucial information of mangrove population diversity and ecological successful species to access management and conservation of mangrove forest in Thabawt Kan area, Ayeyarwady Region.

Keywords; Diversity, Importance Value Index, Management and Conservation

Introduction

The term mangroves refers to an ecological group of halophytic plant species which is known as the salt tolerant forest ecosystem and provides a wide range of ecological and economic products and services, and also supports a variety of other coastal and marine ecosystems. Mangroves occupy less than 1% of the world's surface (Saenger, 2002).

Myanmar is the largest country in mainland Southeast Asia with a continuous coastline of almost 3000 km extending along the Bay of Bengal and Andaman Sea. The Myanmar continental shelf covers approximately 230,000 sq. km and is relatively narrow offshore of the Rakhine coast, widest (and still growing) offshore of the central delta, and with a relatively wide portion offshore of Tanintharyi to the south. The Ayeyarwady delta and its adjoining coastal plains form an expanse of fertile alluvial land with a network of small rivers and streams extending northward inland to varying distances of some 80 to 320 km (Zockler *et. al*., 2013).

Richness is a measure of the number of different kinds of species present in a particular area. Evenness compares the similarity of the population size of each of the species present. Measures of diversity are regarded as indicators of the well-being of ecosystems (Magurran, 1988). The dominant species can be quantified by calculating a statistic known as "importance value" (Smith and Smith, 2001).

Importance Value Index (IVI) was calculated for all species for each sampling plot as the sum of relative density, relative dominance and relative frequency (Curtis and McIntosh, 1950). Forest stand structure is the distribution of species, vertical and horizontal spatial patterns, size of trees or tree parts, tree age, or combinations.

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Descriptions of forest stand structure are commonly based on the aggregation of individual plant measures such as density, tree diameter at breast height distribution (Oliver and Larson, 1996).

A mangroves forest gives various functions as well as direct and indirect. Mangrove trees provide timber for construction, firewood and charcoal, fishing poles, pulp and tannin. Mangrove also provides protection and as habitat suitable as breeding and nursery areas for many organisms, and provides important regulatory functions. They reduce coastal erosion and flooding, supply and regenerate nutrients and retard run-off. Mangroves play an important role in water storage and trapping of sediments and carbon, contributing to the control of the quality and quantity of water, particles, and solutes discharged to the ocean (Cited in Kasawani *et al.*, 2007).

This study aims to accomplish species compositions, population diversity and mangrove forest structure and to give base line information for the environmental conservation and management of mangrove ecosystems in Thabawt Kan area, Ayeyawady region.

Materials and Methods

Study Area

Study area is located near the Thabawt Kan village, Pathein Township, Ayeyarwady Region, 17°09’13’’ N and 94°30’50’’E. This area corresponds to lowland zone, with altitudes ranging up to 200 m above sea level. The general climate has been classified as “tropical monsoon” with a seasonal variation in temperature and rainfall. Field investigations and data analysis were conducted during the period of May 2018 to May 2019.

Figure. 1 Location Map of Study Area;
(Source; Google Map)

Data Collection and Identification

Two sampling stations were established in the study area. For each station, transect lines was laid perpendicular from the bank to landward direction. Within, the transect line 30 plots (10mx10m each) were established (Santra *et al.*, 1999). All the sample trees (≥5cm girth at breast height) in each quadrate were measured for their GBH (Girth at breast height) and height. The girth is to be measured using a measuring tape. The spatial location (latitude, longitude and altitude) of each plot was

measured by using a Global Positioning System (GPS). Mangrove species were identified using the Handbook of Mangroves in Indonesia and also by verify with Checklist of Trees, Shrubs, Herbs and Climbers of Myanmar, etc.".

Data Analysis

The collected field data were analyzed for Jackknife estimate of species richness (Heltshe and Foerster, 1983), evenness (Shannon-Wiener function, 1963) and species diversity (Shannon-Wiener and Simpson indices, 1963). Coefficient of similarity was used as a means of comparing stands from floristic point of view (Lamprecht, 1989). Ecological successful species was analyzed by using the parameters: density, frequency, dominance; relative density, relative frequency, and relative dominance were sum up to Importance Value Index (IVI) for all tree species in the study area (Curtis and McIntosh, 1950).

Results

Species Compositions and Family Distribution

A total of 1184 individuals, representing 15 families, 20 genera and 22 mangroves species were recorded in this study. 13 families, 15 genera and 20 species were recorded in Site 1;of Thabawt Kan Area and 7 families, 9 genera and 13 species were recorded in site 2;. Thabawt Kan Area. Rhizophoraceae, Fabaceae and Arecaceae were dominated in site 1. Rhizophoraceae and Meliaceae families were dominated in site 2. Members of Rhizophoraceae family were *Rhizophora apiculata*, *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Ceriops decandra* and *Ceriops tagal* in this study.

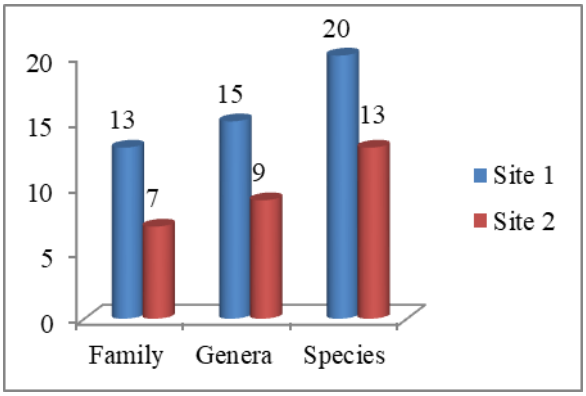

Figure. 2 Number of families, genera and species

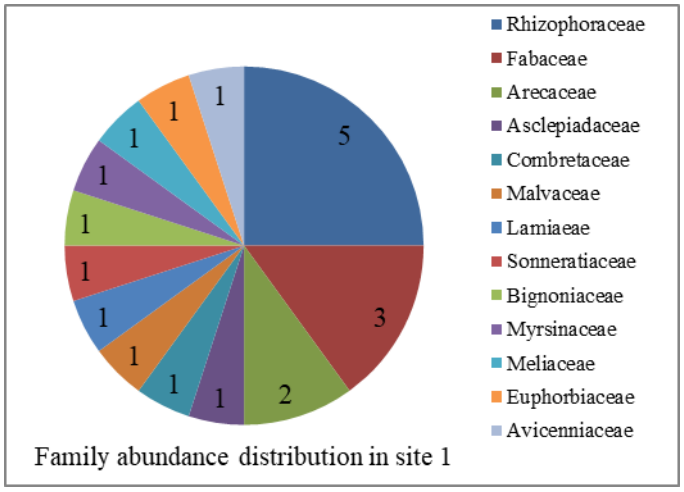

Figure. 3 Family abundance distributions in site 1

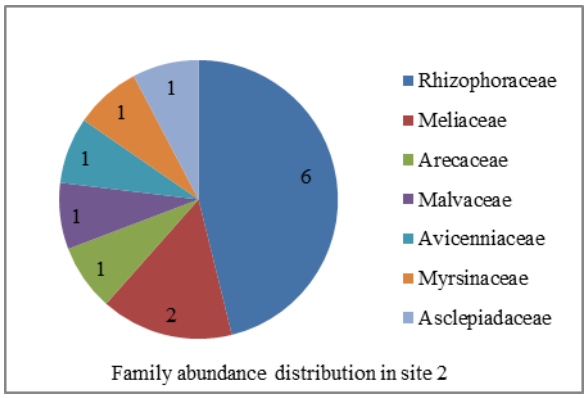

Figure. 4 Family abundance distribution in site 2

Population Diversity

The result of Jackknife estimate, species richness at site 1 and site 2 were 20.73 and 13.90 respectively. Among these two study areas, site 1 showed the highest species richness than site 2. As the results of Shannon-Wiener evenness, the plant species in the site 2 (0.77) were more evenly distributed among the species than the site 1 (0.68).

Diversity index of site 2 (2.79, 0.82) was relatively higher than site 1 (2.64, 0.78) by the method of Shannon-Wiener's Index (H) and Simpson's Index (D) respectively.

Coefficient of similarity

If both stands are floristically identical, *Ks* value is 100 and if they are completely different, *Ks* is zero. In this study, floristic compositions between site 1 and site 2 were 66.67% by the method of Sorenson index (1948).

Importance Value Index; Ecological Successful Species

The highest relative density was dominated by *Bruguiera gymnorrhiza* (49.11%), *Rhizophora apiculata* (9.15%) and *Rhizophora mucronata* (7.37%). The highest relative frequency was established in *Bruguiera gymnorrhiza* (19.23%), *Rhizophora apiculata* (11.54%) and *Rhizophora mucronata* (9.62%). The highest relative dominance of tree species was occupied by *Bruguiera gymnorrhiza* (29.59%) followed by *Excoecaria agalocha* (15.02%) and *Phoenix paludosa* (12.46%) in site 1. Ecological successful species with the highest IVI value was observed by *Bruguiera gymnorrhiza* (97.93%), followed by *Rhizophora apiculata* (30.55%) and *Rhizophora mucronata* (27.00%) in site 1 as shown in Figure 5.

The highest relative density was dominated by *Bruguiera gymnorrhiza* (24.11%), followed by *Rhizophora mucronata* and *Ceriops decandra* (21.39%). The highest relative frequency was established in *Rhizophora mucronata* (16.67%) and *Bruguiera gymnorrhiza, Ceriops decandra* and *Xylocarpus granatum* (12.50%). The highest relative dominance of tree species was occupied by *Bruguiera gymnorrhiza, Rhizophora apiculata* (36.22%) followed by *Rhizophora mucronata* (8.21%) in site 2. Ecological successful species with the highest IVI value was observed by *Bruguiera gymnorrhiza* (72.83%) followed by *Rhizophora apiculata* (61.76%) and *Rhizophora mucronata* (46.27%) in site 2 as shown in Figure 6.

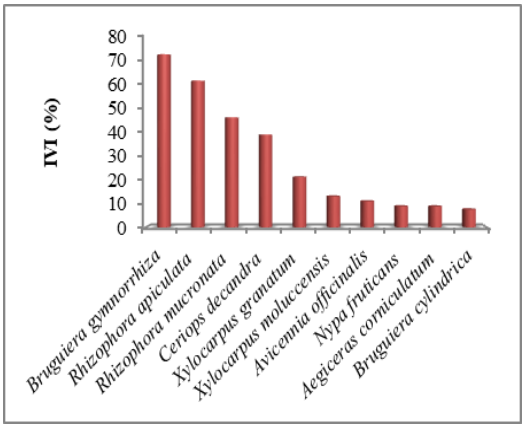

Figure.5 Ranking of Importance Value Index in site 1

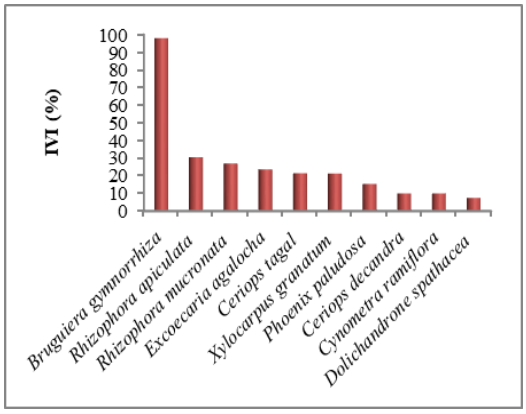

Figure.6 Ranking of Importance Value Index in site 2

Forest Structure

Horizontal structure

Population Density of Mangrove Species across GBH Class Interval

Population density of tree species distribution across GBH class interval revealed that 16 species, 231 individuals, 50.99% of individuals were belonging to 5-10cm category; 15 species, 186 individuals, 41.06% of individuals in 11-20cm; 4 species, 25 individuals, 5.52% of individuals in 21-30cm; 4 species, 9 individuals, 1.99 % of individuals in 31-40cm categories and 1 species, 2 individuals, 0.44% of individuals belong to largest GBH class of 41 ≤ cm in site 1 as shown Figure 7.

Population density of tree species distribution across GBH class interval revealed that 12 species, 422 individuals, 57.49% of individuals were belonging to 5-10cm category, 10 species, 261 individuals, 35.56% of individuals in 11-20cm, 7 species, 44 individuals, 5.99% of individuals in 21-30cm, 3 species, 6 individuals, 0.82% of individuals in 31-40cm categories and 1 species, 1 individuals, 0.14% of individuals belong to largest GBH class of 41 ≤ cm in site 2 as shown in Figure 8.

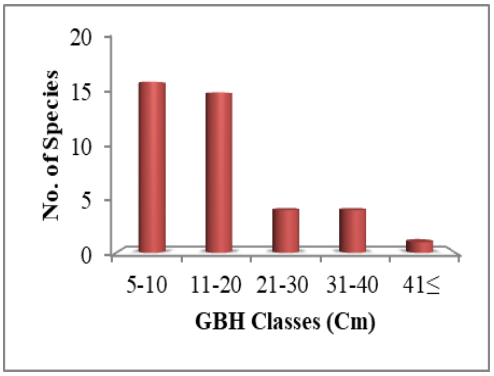

Figure. 7 Population Density of Mangrove Species across GBH Class Interval in site 1

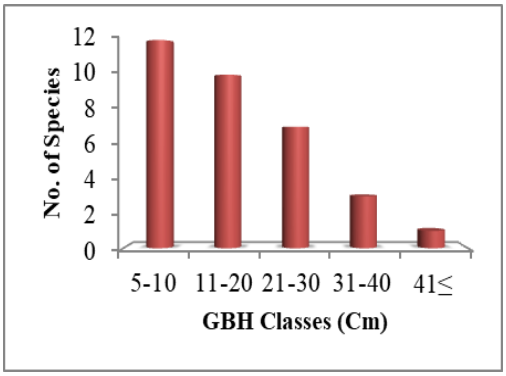

Figure. 8 Population Density of Mangrove Species across GBH Class Interval in site 2

Horizontal Structure of Mangrove Species across GBH Class Interval

In site 1 area, horizontal structure of mangrove species across GBH classes interval showed that largest contribution in total basal area and basal area per hectare were (0.31m, 3.10m^2/ha) and 4650 trees per hectare belong to 11-20cm. The smallest contribution in total basal area and basal area per hectare were (0.04m, 0.40m^2/ha), 50 trees per hectare belong to largest GBH classes of 41≤cm as shown in Figure. 9.

In site 2 area, horizontal structure of mangrove species across GBH classes interval showed that largest contribution in total basal area and basal area per hectare were (0.35m, 3.50m^2/ha) and 2610 trees per hectare belong to 11-20cm. The smallest contribution in total basal area and basal area per hectare were (0.02m, 0.20m^2/ha), 10 trees per hectare belong to largest GBH classes of 41≤cm. as shown in Figure 10.

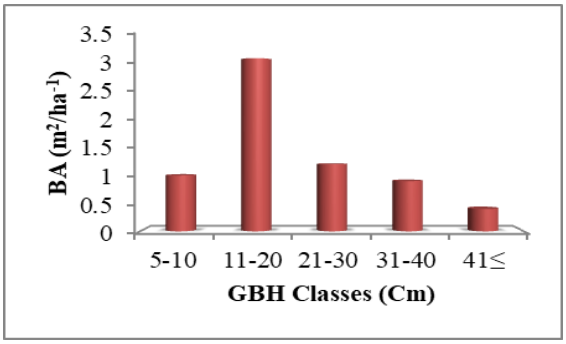

Figure. 9 Horizontal Structure of Mangrove Species across GBH Class Interval in site 1

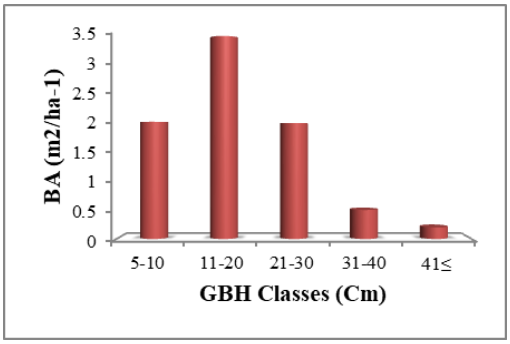

Figure.10 Horizontal Structure of Mangrove Species across GBH Class Interval in site 2

Vertical Stand Structure

Population Density of Mangrove Species across Height Class Interval

Population density of mangrove species distribution across height class interval revealed that 17 species in site 1 and 11 species in site 2 belonging to ≥3 category; followed by 8 species in site 1 and 11 species in site 2 belonging to 3-5cm category in site 1. In the present study, height class of ≤ 3cm, population density of mangrove species found that (84.55%) of individuals in site 1, (62.67%) of individuals in site 2 area. The second highest population density of mangrove species belongs to high class of 3-5cm, found that (14.57%) of individuals in site 1 area, (34.33%) individuals in site 2 area (Figure. 11 and Figure. 12).

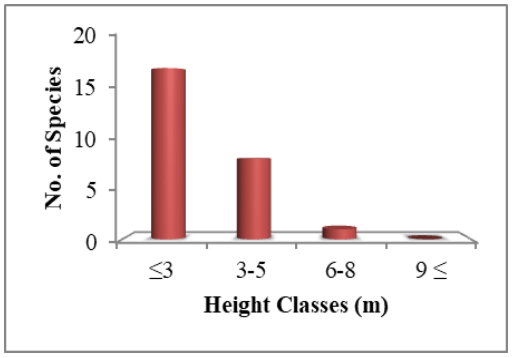

Figure. 11 Population Density of Mangrove Species across Height Class

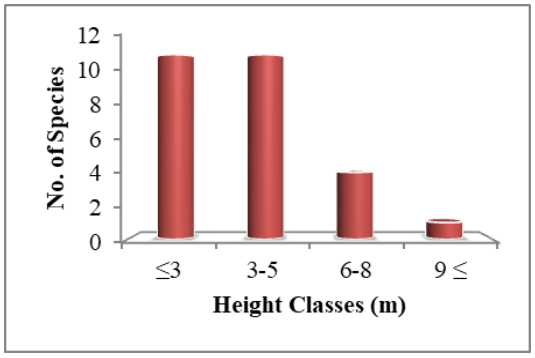

Figure. 12 Population Density of Mangrove Species across Height Class

Discussions and Conclusion

A total of 1184 individuals, representing 15 families, 20 genera and 22 mangroves species were recorded in this study. 12 families, 15 genera and 20 species were record in site 1; and 7 families, 9 genera and 13 species were recorded in site 2. Family Rhizophoraceae obtained the highest species composition with six mangrove species these are: *Rhizophora mucronata*, *Rhizophora apiculata*, *Bruguiera gymnorrhiza*, *Bruguiera cylindrica*, *Ceriops decandra* and *Ceriops tagal*.

Population diversity of mangrove species in site 2 (2.79, 0.82) was relatively higher than mangrove species diversity of site 1 (2.64, 0.78) by the method of Shannon-Winner's Index (H) and Simpson's Index (D) respectively. It may be concluded that although site 1 had more number of individual species, mangrove species of site 2 was more evenly distributed than site 1; accordingly site 2 was relatively more diverse than site 1.

Floristic compositions between site 1 and site 2 were 66.67% by the method of Sorenson index (1948). This result was agreed with Roy *et al*., 1993 who stated that the similarity index showed a high percentage (>50%) of species being shared between the two forest types.

Ecological successful species of Thabawt Kan area showed that the highest IVI value of mangrove species was observed by *Bruguiera gymnorrhiza* (97.93%), followed by *Rhizophora apiculata* (30.55%) and *Rhizophora mucronata* (27.00%) in site 1;. *Bruguiera gymnorrhiza* (72.83%) followed by *Rhizophora apiculata* (61.76%) and *Rhizophora mucronata* (46.27%) in site 2 with the high relative density, relative frequency and relative dominance. In view of that those mangrove species could be considered as ecological indicator species of the study area (Lamprecht, 1989).

Regarding the conservation status out of 22 species of mangroves, nine species Least Concern namely *Xylocarpus granatum*, *Xylocarpus moluccensis*, *Ceriops tagal*, *Nypa fruticans*, *Dolichandrone spathacea*, *Aegiceras corniculatum*, *Rhizophora mucronata*, *Rhizophora apiculata*, *Bruguiera gymnorrhiza* and two species Near Threatened status; *Phoenix paludosa*, and *Ceriops decandra*, only one species Endangered; *Heritiera fomes* were assessed by the IUCN with the least concern status in this study.

Mangrove trees have special adaptation to live in saline habitats. Among these mangrove species of Rhizophoraceae family with specialized structure, stilt roots can be the response to the intensity of wind and wave stresses to soil erosion and give the breeding and nursery grounds for a number of marine organisms including the commercially important shrimp, crab and fish species. In this study family Rhizophoraceae was dominance with in term of species numbers and individual

numbers so call it is both ecological importance and economical importance family for local communities of study area.

Description of forest structure is recognized the compositions and ecological classifications of an area. In this study, most of mangrove species distributed in smaller GBHand high classes. That revealed species compositions and population structure as highly affected by human activities in the past and have need of continuous rehabilitation programmes and the protection of natural mangrove forests in Thabawt Kan area.

The findings of this study could be used as a crucial source of information and to afford essential baseline data for assessing the environmental conservation and management of mangrove ecosystems in Thabawt Kan area, Ayeyarwady Region.

Acknowledgement

The authors are grateful to Dr Kay Thi Mya, Professor and Head, Dr Wah Wah Lwin, Professor, Department of Botany, Pathein University for their encouragement and guidance for this research work. We are also indebted to Dr Nu Nu Swe, Professor and Head, Botany Department, Yangon University of Distance Education, Dr Myat Myat Moe, Professor and Head, Dr Sandar Hlaing, Professor, Botany Department, Dagon University for allowing publishing for this research paper.

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