

A snapshot of woody plants composition in Byram permanent mangrove forest reserve

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Abstract. The term mangrove may refer to an ecosystem or individual plants where the distribution of woody plants usually influenced by climate, water salinity, tides, type of soil in the mangrove swamps and environmental activities including development, housing and industrial. Thus only a certain species that can survive under this extreme condition. A study had been conducted in Byram Permanent Mangrove Forest Reserve to provide baseline information on the distribution pattern of plant growth in mangrove area. The main objective of this study is to determine the composition and the distribution pattern of true-mangrove woody plant species. To assess the species composition, the forest reserve nearest to the sea, which run approximately 2.0 km, parallel to the sea, was divided into three main sections (i.e. 600 m each section with a minimum 50 m wide border between the sections). Species enumeration was conducted in 11 plots, where each plot size is 10m x 10m. In general these plots were established in random stratified manner, from the sea towards the terrestrial part of the mangrove forest. In total, we recorded 290 of individual woody plants. The most abundant species in term of occurrences within all zones and forest section is *Bruguiera parvifolia*.

Keywords: Mangrove, swamp, *Bruguiera parvifolia*

Introduction

Distribution of mangrove forest in Malaysia covers 577.558 hectares (Tan and Basiron 2000, Chong 2006) and represents 2.5% of global mangrove resources. Watson (1928) and Crona *et al.*, (2006) has identified that there are five main sections according to the zone of mangrove forests in Peninsular Malaysia following the species dominance which establish the uniformity of species from the sea area to organize rural areas. In this regard, a study was conducted to examine the distribution pattern of woody trees in Byram Permanent Mangrove Forest Reserve (BPMFR). This preliminary survey is important move towards a better management for shrinking mangrove area recently.

Materials and Methods

Studies on the distribution and composition of woody plants has been carried out in the Byram Permanent Mangrove Forest Reserve (hereafter BPMFR). This particular mangrove reserve covers an area of 240 ha and located in the mainland area in Penang. There is a large landfill sites adjacent to BPMFR. In addition, the surrounding vegetation type of BPMFR is dominated by palm oil (*Eleaies guyanensis*) plantations.

Due to constraint in logistic and safety reasons, the study was conducted within main portion of BPMFR only. This part of BPMFR run parallel to the sea of approximately 2.5 km in length and broadest at the southwestern part (i.e. 600 m each section with a minimum 50 m wide border between the section). The study area was further divided into three sections, namely the right of the plot consists of three (A,B,C) the center consisted of six plots (D,E,F,G,H, and I) and the left side of the two plots (J, K). Plot size is 10m x 10m (Rotaquio, *et al.*, 2007). These plots were established in random stratified manner, from the sea towards the terrestrial part of the mangrove forest (Rotaquio, *et al.*, 2007). The inconsistency number of plot per section is due to the irregular shape of the study area. Warning ropes and wooden stakes were used to mark the whole plot. Strap peg mounted at a height of about one meter above the ground.

In addition, DBH values obtained taken from the circumference of each tree. Because this study only focused on adult woody plants, only the tree with DBH size 10 cm are considered and height values of trees with more than 1 meter were recorded (Rotaquio, *et al.*, 2007). The number of trees in the plot are listed on the graph paper to show the composition and distribution of woody plants clearly.

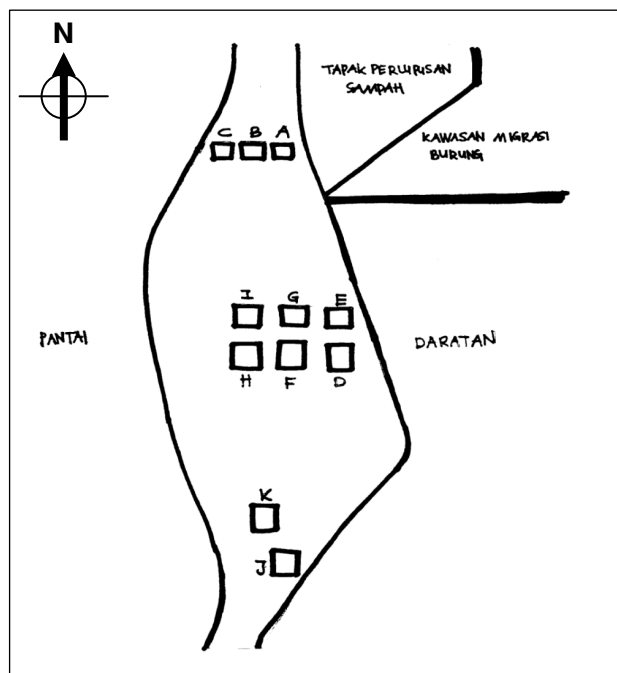


Figure 1. Diagram of Relative Plot Position with Terrestrial and Coastal Area

Results and Discussion

Overall species composition in BPMFR, Plot A, D, E, and J showed that there were 109 individual trees in the terrestrial zone based on Table 1. Based on Figure 4, the most abundant plants in the area is *Bruguiera parviflora* with a total of 82 trees (75%). Followed by *Rhizophora apiculata* 17 trees (16%), *Avicennia lanata* with six individuals trees (5%) and *Bruguiera sexangula* with a total of four individual trees (4%).

As for plot B, F, G, and K which located in the central area between the terrestrial and coastline, were recorded 78 trees (Table 1). *Bruguiera parviflora* was recorded with the highest number in this area by 53 individual trees (Figure 5) with the percentage 70%. This is followed by nine trees recorded for *Rhizophora apiculata* (10%), *Avicennia lanata* 7 trees (9%), *Bruguiera sexangula* 4 trees (5%), *Sonneratia ovata* 4 trees (5%) and lowest number of species recorded, *Avicennia*

marina which consists only of one individual tree 1%. The coastal plots (i.e. plot C, H, and I) were recorded with 103 woody plants (Table 1). *Avicennia officinalis* was recorded with the highest number of individual trees in this area; 72 trees (70%). This is followed by *Avicennia alba* with 27 trees (26%), *Avicennia lanata* 3 trees (3%) and finally *Rhizophora apiculata* with only 1 individual tree (1%). From the results, *Bruguiera parviflora* dominates the terrestrial and intermediate zones while *Avicennia officinalis* turned out to have the highest number of individuals in coastal zones.

Table 1. Number and Distribution of Woody Plants Species By Zone (Part Terrestrial, Intermediate, Coastal)

No	Species	Terrestrial (A, D, E, J)	Intermediate (B, F, G, K)	Coastal (C, H, I)
1	<i>Avicennia alba</i>	-	-	27
2	<i>Avicennia lanata</i>	6	7	3
3	<i>Avicennia marina</i>	-	1	-
4	<i>Avicennia officinalis</i>	-	-	72
5	<i>Bruguiera parviflora</i>	82	53	-
6	<i>Bruguiera sexangula</i>	4	4	-
7	<i>Rhizophora apiculata</i>	17	9	1
8	<i>Sonneratia ovata</i>	-	4	-
TOTAL		109	78	103

Source: Field Work, 2010.

Mangrove zonation is usually parallel to the terrestrial zone and the broadness is determined by the amplitude of the tidal sea water (Baltzer 1969; Marchand *et al.*, 2006). Occurrence of tidal seawater which occurs every day plays an important role in the propagation of seedlings and eventually create a strata in the area of mangrove forest. Exposure to the strong wind and waves from the ocean bring obvious changes to the vegetation pattern and contribute to the occurrence of *A. alba*, *A. lanata*, *A. marina*, *B. parviflora*, *B. sexangula*, *R. apiculata* and *S. ovata*. In the terrestrial zone, the sediments were comparatively thicker than the intertidal zone. This provide strong anchorage for different mangrove species such as *A. lanata*, *B. parviflora*, *B. sexangula* and *R. apiculata* on the landward zone. *Bruguiera parviflora* dominates this area and usually a common features

along coastal edges in shallow mud area which frequently inundated by saline water during high tide (Rotaquio, *et al.*, 2007), but see Rotaquio, *et al.*, 2007 for contradict findings). The transition middle portion of mangrove in BPMFR has deep mud and silt where there were mix of different mangrove species in common which are *A. lanata*, *A. marina*, *B. parviflora*, *B. sexangula*, *R. apiculata* and *S. ovata*. Individuals of *B. parviflora* has the wide distribution in intermediate zone. A generalization can be made that *B. parviflora* has the greatest impact in the mangrove ecosystem due to its occurrences and morphological adaptation. *Avicennia marina* recorded the least number of individual which only recorded a single woody plant with 1% in percentage . This result however is not coincide with previous study which showed that *A. marina* has vast distribution both latitudinally and longitudinally ranging from east Africa and sea along tropical and subtropical coasts according (Tomlinson 1986). Rotaquio *et al.* (2007) in their study stated that *A. marina* is common in almost all the sampling sites. Exposure to regular strong tidal water currents and higher water salinity contribute to the low occurrences of *A. marina* that mostly occupied at the outer part of coastal area.

Avicennia officinalis from family Avicenniaceae dominates the coastal zone and with total of 72 trees (70%), followed by *Avicennia alba* (26%), *Avicennia lanata* (3%) and *Rhizophora apiculata* (1%). The area is dominated by Avicennia by the reason of the adaptation of this tree to breathe with the pneumatofor roots and can live in unstable area. This specially adapted tree plays an important role in community structure and has the ability to be a natural supporter (Tomlinson 1986; Carola *et al.*, 1999; Duke 2001; McLeod 2006). *Rhizophora apiculata* were also present but they appeared only in very small numbers and can be found mostly in the terrestrial and intermediate zone. According to Rotaquio, *et al.*, (2007), *Rhizophora apiculata* in the mangroves can be found mostly in the interior part of mangrove area with shallow current of water of which the substrate is basically shallow muddy coast edges and inundated by saline water during sea tides.

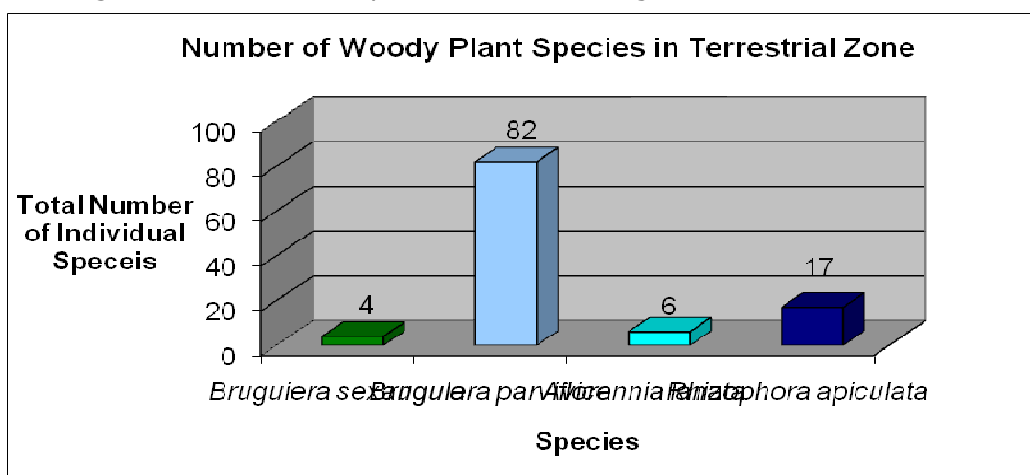


Figure 2. Total Number of Individuals Woody Plants in Terrestrial Zone

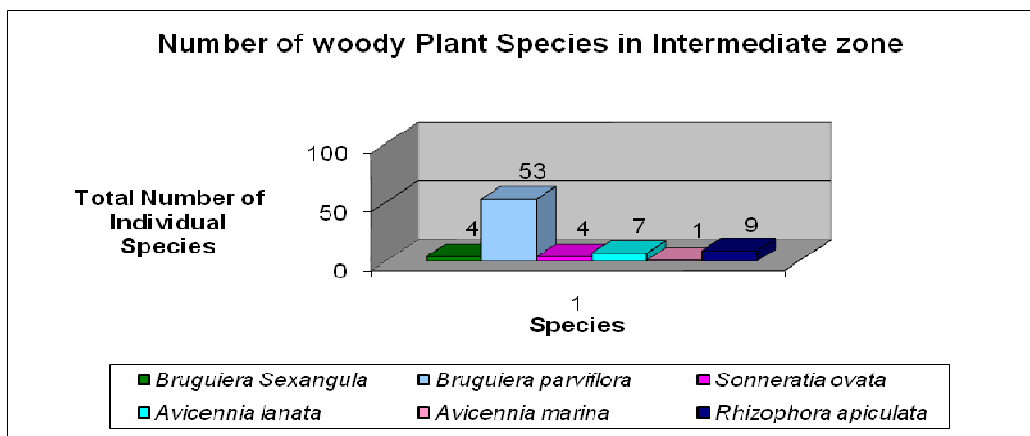


Figure 3. Total Number of Individuals Woody Plants in Intermediate Zone

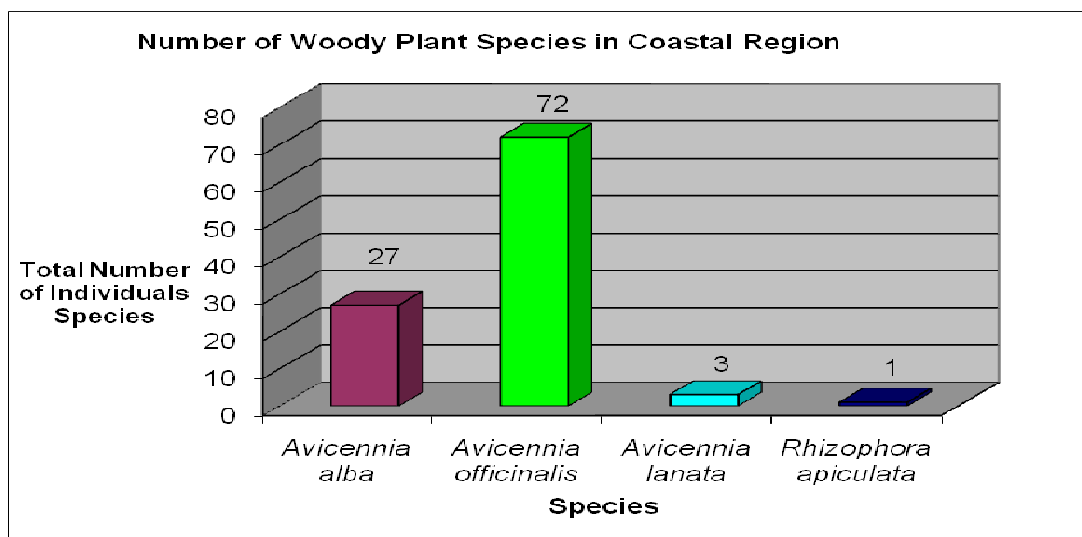


Figure 4. Total Number of Individuals Woody Plants in Coastal Region

Conclusions

Based on the result of this study, *Bruguiera parviflora* was dominant among all other species. The distribution of *B. parviflora* commonly observed on the terrestrial zone and gradually become limited on the seaward. This means that this species cannot survive under strong wind and high salinity. Contrarily to numbers of *Avicennia officinalis* which can be found growing on the coastal area. *Avicennia marina* turned out to be the lowest number of individuals present and it shows that this species has low resistant compared to *Bruguiera parviflora* which are highly adaptable to mangrove ecosystem of BPMFR. BPMFR has relatively low species composition and therefore proper management is needed for conservation in the future.

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