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Editorial's office

Advanced Wood & Technology Center
(AWTEC),
Politeknik Kota Kinabalu
Jalan Politeknik, 88450
Kota Kinabalu Sabah

Phone: 6088-401880
Fax: 6088-499960
Email : awtec@polikk.edu.my

Publisher's office

PKK Publisher
Politeknik Kota Kinabalu
Jalan Politeknik, 88450
Kota Kinabalu Sabah

Phone: 6088-401880
Fax: 6088-499960
Email : webmaster@polikk.edu.my

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Assessment of Mangrove Forest in Kota Kinabalu Industrial Park Sepanggar Sabah

Mohd. Nizar Bin Mardan^{1,a,*}, Edi Shahril Bin Kamal^{1,b}, Zaryl Faizal Bin Zaryl Gaffar^{1,c}

¹Jabatan Kejuruteraan Awam,
Politeknik Kota Kinabalu,
Kota Kinabalu, Sabah:

nizar@polikk.edu.my^a, shahril@polikk.edu.my^b, zaryl@polikk.edu.my^c

Abstract. Mangrove forest are important as breeding grounds for a variety of marine life such as fish and crustaceans. Malaysia harbours approximately 12% of Southeast Asia's mangrove area and occurs mainly along the coasts of Sabah (57%), Sarawak (26%) and Peninsular Malaysia (17%). This study was conducted in Kota Kinabalu Industrial Park (KKIP) mangrove forest beside of Politeknik Kota Kinabalu (PKK). A total of 469 individual trees with dbh \geq 5cm representing 5 species belong to 3 genera in 3 families were identified within nine 0.04 ha plots of KKIP mangrove forest. In terms of species composition, *Rhizophora apiculata* (IVI = 165.42), and *Rhizophora mucronata* (IVI = 109.83) emerged dominant species. Families with the highest no of families were Rhizophoraceae (451 individuals or 96%), followed by Aviciniaceae (14 individuals or 3%), and Sonneratiaceae (4 individuals or 1%) respectively. Rhizophoraceae presented the height of Families Important Value (FIV) were contributed (275.25). The mangrove forest in KKIP have an economical potential especially in charcoal industry. From this study, the *Rhizophora apiculata* (Bakau Minyak/Bangkita) is the most common species in the stand studied.

Keywords: Mangrove forest, KKIP mangrove forest, Important Value Index, dominant species

Introduction

Mangrove forests are important as breeding grounds for a variety of marine life such as fish and crustaceans. Mangrove are the basis of the food chain of all life that lives in mangrove ecosystems. Mangrove forest provide a wide array of niches, as habitats for feeding, breeding, spawning and hatching of sedentary and migratory species. Furthermore mangroves play an important role as biological filters and carbon sinks. Malaysia harbours approximately 12% of Southeast Asia's mangrove area and occurs mainly along the coasts of Sabah (57%), Sarawak (26%) and Peninsular Malaysia (17%).

Mangroves are predominantly inter-tidal habitats that are found widely at sheltered and shallow water coastlines [4]. They are socio-economically important ecosystem, especially for the inhabitants of coastal regions which depend on mangroves as primary source of income, charcoal, timber, food resources, medicine, and other basic necessities [1]. Mangroves play an integral role in the ecology of watersheds, including protection against coastal erosion and providing nutrients to support marine food web[5].

Methodology Of Study

This study was conducted in Kota Kinabalu Industrial Park (KKIP) mangrove forest beside of Politeknik Kota Kinabalu (PKK). Total area for KKIP mangrove forest approximately 54.59 ha (Lot 1). Nine sample plots of 20m x 20m totalling 0.36 ha (0.66 % from total area) were established along the transect lines. Distance between each plots were 20m and distance between sample line is 50m. Only trees with dbh > 5cm were enumerated, measured and identified. Parameter in this study were diameter breast height (dbh), height of tree, number of individual and name of species. According to [2], Important Value Index (IVI) which indicates the structural importance of a species within a stand of mixed species, has an equation as follows : $IVI = RD + RF + RDo$, where:

$$RD = \frac{\text{No of individuals of a species}}{\text{Total no of individuals of all species}} \times 100 \quad (1)$$

$$RDo = \frac{\text{Total basal area of a species}}{\text{Basal area of all species}} \times 100 \quad (2)$$

$$RF = \frac{\text{Frequency of species}}{\text{Total frequency of all species in different plots}} \times 100 \quad (3)$$

Family Importance Value (FIV) were used to compare the relative contribution of each taxonomic family to forest composition as the sum of the following three variables Mori *et al.* (1983) same equation like IVI. Family Importance Value (FIV) can be measured as follows, $FIV = \text{Relative Dominance} + \text{Relative Density} + \text{Relative Diversity}$; Where:

$$\text{Relative Dominance} = \frac{\text{Total basal area of family}}{\text{Total basal area}} \times 100 \quad (4)$$

$$\text{Relative Density} = \frac{\text{Number of individuals in family}}{\text{Total number of trees}} \times 100 \quad (5)$$

$$\text{Relative Diversity} = \frac{\text{Number of species in family}}{\text{Total number of species}} \times 100 \quad (6)$$

Result And Discussion

A total of 469 individual trees with dbh \geq 5cm representing 5 species belong to 3 genera in 3 families were identified within nine 0.04 ha plots of KKIP mangrove forest (Table I). *Rhizophora apiculata* (IVI = 165.42), and *Rhizophora mucronata* (IVI = 109.83) were respectively the dominant species (Table II). Families with the highest number of individuals were presented by Rhizophoraceae (451 individuals or 96%) of total number of species, followed by Aviciniaceae (14 individuals or 3%), and Sonneratiaceae (4 individuals or 1%). Referring to (Table III) family from Rhizophoraceae were presented the height of Families Important Value (FIV) were contributed (275.25).

Table 1. Tree Species Composition For Kkip Mangrove Area.

Family	Saintific name	Local Name
Rhizophoraceae	<i>R. apiculata</i>	Bakau Minyak
Rhizophoraceae	<i>R. mucronata</i>	Bakau Kurap
Aviciniaceae	<i>Avicinea alba</i>	Api-api
Aviciniaceae	<i>Avicinea officinalis</i>	Api-api Ludat
Sonneratiaceae	<i>Sonneratia alba</i>	Perepat

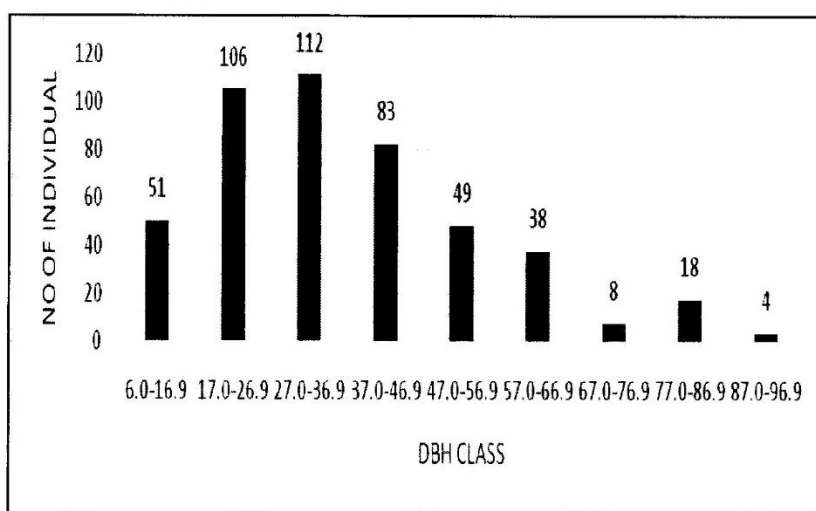
Table 2. Summary Of Importance Value Index (Ivi) For Kkip Mangrove Area.

Family	Saintific name	IVI
Rhizophoraceae	<i>Rhizophora apiculata</i>	165.42
Rhizophoraceae	<i>Rhizophora mucronata</i>	109.83
Aviciniaceae	<i>Avicinea alba</i>	11.96
Aviciniaceae	<i>Avicinea officinalis</i>	6.75
Sonneratiaceae	<i>Sonneratia alba</i>	6.04

Table 3. Summary Of Families Important Value (Fiv) For Kkip Mangroves Area.

Family	FIV
Rhizophoraceae	275.25
Avicineaceae	18.71
Sonneratiaceae	6.04

- *Relationship between DBH and Basal Area in KKIP Mangrove Area.*

**Fig.1.** Distribution of dbh class for tree dbh \geq 5cm in nine 0.04 ha plots in KKIP Mangrove Forest, Sepanggar, Sabah.

From Fig. 1 showed distribution of dbh class for trees dbh \geq 5cm in KKIP mangroves forest. From the result, class from 27.0-36.9 cm were the highest number contributes 112 individuals or (24% from total number of individuals) followed by class 17.0-26.9 cm contributes 106 individuals (23% from total number of individuals). This showed that KKIP mangroves forest area have an ideal dbh for harvested processed or also can used for conservation mangrove area.

Based on (Table IV), the highest basal area contribute by *Rhizophora apiculata* (4.17 m² per ha) and followed by species *Rhizophora mucronata* (2.59 m² per ha). Thus, there is also showed significant findings (Table V) where the highest basal area for family contribute from Rhizophoraceae. This is showed that, KKIP mangrove forest area were dominand by this both species and have a rich resource for downstream industry such as production of charcoal.

Table 4. Tree Basal Area For Kkip Mangrove Forest, Sepanggar, Sabah.

Family	Saintific name	BA/ha (m ²)
Rhizophoraceae	<i>Rhizophora apiculata</i>	4.17
	<i>Rhizophora mucronata</i>	2.59
Avicineaceae	<i>Avicinea alba</i>	0.03
Avicineaceae	<i>Avicinea officinalis</i>	0.02
Sonneratiaceae	<i>Sonneratia alba</i>	0.01

Table 5. Tree Basal Area For Families In Kkip Mangrove Forest, Sepanggar, Sabah.

Family	BA/ha (m ²)
Rhizophoraceae	6.76
Avicineaceae	0.05
Sonneratiaceae	0.01

Conclusion

The mangrove at KKIP are not only aesthetically attractive but provide many nooks and corners for activities that can be undertaken by the local community inhabiting the area to uplift their mearge income. Amongst others are mangrove crusinng, recreational fishing, and manymore. Mangrove are also ecologically linked with other coastal ecosystems such as coral reefs, mudflats, rocky shores, and seagrass bed. Degradation and destruction of the mangroves can thus damage these coastal ecosystems and impact the KKIP coastal communities economically. In order for the KKIP community to enjoy in perpetuity the benefits of the mangrove forests, it is important to conserve its biodiversity and use these resource sustainably.

In addition, mangrove forest in Kota Kinabalu Industrial Park (KKIP) have a higher potential especially in charcoal industry. From this study, as we can see species from *Rhizophora apiculata* (Bakau Minyak or Bangkita) were the higher number of individual in this area. In addition, mangrove forest in Kota Kinabalu Industrial Park (KKIP) have a higher potential especially in charcoal industry. From this study, as we can see species from *Rhizophora apiculata* (Bakau Minyak or Bangkita) were the higher number of individual in this area.

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