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MANGROVE FOREST IN KUDAT, SABAH MALAYSIA: CHALLENGES OF THE MANGROVE CONSERVATION

(Hutan Mangrove di Kudat, Sabah, Malaysia: Tantangan dalam Konservasi Mangrove)

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ABSTRACT

Kudat is located in the North part of the island of Borneo, with land area of 1,287.2 km^2 or 130,787 ha. Out of the overall total area, 25% or 33,307 ha of area are gazetted under Forest Reserve. Most of the Kudat coastline area is patches of mangrove forest. A total of 19,507 hectares of the total mangroves in the Kudat district have been gazetted as permanent forest reserve under class-V Mangrove Forest Reserve. Mangroves play many important functions such as physical protection to the coastline, important breeding ground of marine life and nurseries, source of socio-economy activity to the local people, natural habitat for the living organisms, home to wide range of flora and fauna. Another function is they provide opportunities for the development for eco-tourism. Some locations in Kudat, which are of high potential for tourism development, are Kg. Sikuati, Simpang Mangayau, Sg. Ranggu, Pulau Banggi, Pulau Malawali and Pulau Balembangan. In 2005, about 2,440 ha or 0.8% of the Mangrove forest reserve in Sabah has been lost mainly due to land conversion for people's settlement. As for Kudat, exploited area recorded are as follow; settlement/urban development (500 ha), aquaculture (15 ha), agriculture and infrastructure (13 ha) - *power supply way leave*, pipeline, and common tower. Illegal squatters involved about 2 ha and land use conflict of mangrove forest reserve in Kudat were lost to agricultural conversion due to uncoordinated and technical discrepancies of boundaries on the ground. Some challenges in mangrove conservation are, currently there is no management plan prepared for the management of mangroves in Kudat. The management of mangrove area thus far is focusing on protecting the gazetted area under permanent forest reserve under Class V – mangrove forest, gradually by the forest district. Apart from mangroves in PFR, there are also some scattered Stateland mangroves which are not quantified, monitored and protected under any legislation. Considering their locations, roles and functions, steps must be taken to gazette existing mangroves inside estuaries and lagoons as Permanent Forest Reserve (PFR). The apparent of boundaries between state land and Mangrove Forest on the ground are vital to be carried out by the authority. Important effort to better manage the Kudat mangroves is carrying out nourishment and planting activities in existing mangroves. Other challenges are to involve the local communities to conserve mangroves areas, especially thus living nearby the mangrove forest. This paper highlights the status of mangrove, to emphasize the important function of mangrove, and to distinguish the threat and challenge of mangrove conservation in Kudat district.

Keywords: Mangrove forest, status and function, threat and challenges, conservation, Kudat.

INTRODUCTION

Kudat located in the North part of Borneo, with area 1,287.2 km^2 or 130,787 ha. Out of the total area, 25% or 33,307 ha of area are gazetted under Forest Reserve. The administrative area include peninsular of Kudat and the islands of Banggi, Balembangan and Malawali. In the west part of the district is South China Sea while Marudu Bay and Sulu Sea at East part of the district. Kudat is accessible by road, boat / ship and plane via a small airport in Kudat. The terrain is undulating and gradually sloping up towards middle of the district. Most part of the coastline area patches of mangrove forest. The climate, rain and dry season are inconsistency, exaggerated by monsoon. Agriculture, fisheries and livestock are major agents of economic growth of the district. Forest activities include processing of charcoal product, extraction of mangrove trees for piling and manufacturing of rattan and acacia trees for furniture. Forest activities for recreation are still in small amount, but become more popular and presume to be another potential activity to be exploited in the district.

The mangrove ecosystem is a complex one. It is composed of various inter-related elements in the land sea interface zone which is linked with other natural systems of the coastal region such as corals, sea grass, coastal fisheries and beach vegetation (FAO, 1985). The government is concerned with significant roles and contributions of mangrove forests as an integral part of wider ecosystems in the country. As been strongly emphasized by Y.B Dato Sri Haji Adenan Haji Satem, Minister of Natural Resources and Environment; Malaysia stated that everyone include policy masters, scientists, researcher, stake-holders, academicians, foresters and the public at large to submit the following undertaking: (i) to respect the fragility of mangrove ecosystems and their intrinsic characteristics; (ii) safeguard the genetic; diversity inherent in mangrove ecosystems. (iii) preserve mangrove habitat; (iv) maintain sustainable productivity of mangrove forests without degrading the integrity of other ecosystems with which they co-exist; and (v) secure the mangrove ecosystems against indiscriminate destruction, natural harzards, pollutions and damage resulting from disturbance of surrounding areas (Adenan, 2004).

The need to highlight the important function of mangrove forest is a necessity to all area in Sabah. For Kudat district, there is no inventory data has been recorded and the presence of detailed survey on vegetation and fauna is a necessity. The data on information of status of mangrove in Kudat area is limited and far using the old information. While Kudat located in northern land of Sabah, is more significant associated of mangrove forest due to most of the area concealed by the lagoon and protected from the high wave. The aim of this paper is to highlight the status and function of mangrove forests particularly in Kudat district, and secondly to identify the important threats and challenges in consideration to mangrove management practices and conservation in Kudat.

BRIEF NOTE OF MANGROVE FORESTS IN SABAH

Based on forest inventory carried out in 1969 – 1972, the total area of Sabah mangroves constitutes approximately

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322,349 hectares or 4.6 percent of the total land area of the State (Sabah Forestry Department, 2005). A total of 317,423 hectares or equivalent to 93 percent of the total mangroves in the State have been gazetted as permanent forest reserves, of which 315,042 hectares are under Mangrove Forest Reserve (Class V – set aside to supply mangrove timber and other produce), and 2,381 hectares are Virgin Jungle Forest Reserve (Class VI – reserved primarily for the purpose of conservation and research) as shown at the Table 1.

Table 1. Areas of mangroves by Districts

Forest District	Class V (Ha)	Class VI (Ha)	Total (Ha)
Tawau	45,294	164	45,458
Semporna	15,712		15,712
Kunak	5,839		5,839
Lahad Datu	11,862		11,862
Kota Kinabatangan	53,662		53,662
Sandakan	43,751	1,235	44,986
Beluran	54,318		54,318
Beaufort	5,710		5,710
Kota Kinabalu	2,635		2,635
Kota Belud	1,396		1,396
Kota Marudu	9,550		9,550
Pitas	50,735		50,735
Kudat	19,504	982	20,486
TOTAL			322,349

Sources: *Annual report of Sabah Forestry Department (2005)*

A review of the past and current status of mangrove management in Sabah by Kugan (2003) reveals that the mangrove of Sabah is regarded mainly as protection areas for the past three decades, as mangrove wood is not exploited extensively due to the vastness of timber resources from inland forest. Activities such as collection of poles and fuel wood have been allowed to a level that has minimum disturbance to the ecosystems in avoiding detrimental impacts on other ecological functions of mangroves. The production of chipwood and mangrove bark is the only commercial venture ever entered by the state government, involving mangrove forest reserve. Chipwood production was first introduced in the early 70s through the issuance of special licenses to Jaya Chip Sdn Bhd and Syarikat Bakau Sdn Bhd, involving 50,000 hectares of mangrove reserves within Sandakan, Kinabatangan and Tawau district, for the production of chipwood. During this period, an average of 150,000 tonnes of chipwood were exported annually at an average FOB price of about RM70 per tonne (with revenue of RM 780,000 collected annually), whereas the export of mangrove (tengar) bark at about 1,700 tonnes annually at an average FOB price RM 120 per tonne (with revenue of RM17,500 collected annually) (Tangah, 2004).

As for Kudat, the mangrove forest consist the following area; Pulau Banggi/Belambangan (11,504 ha), Pulau Malawali (791 ha) and Kudat / Kota Marudu Bay (8,191 ha). The production of Charcoal (Kayu Arang) and Piling (Cerucuk) was done in a small scale basis and operated only by local. Up to date the Charcoal plant production convergent only in 2 areas namely Sg. Ranggu (1) and Tanah Merah (2) which located in Kudat/Marudu bay. The royalty price charge by the Forestry Department is RM1,50/ Bundle (guni charcoal). For

piling operator, only one licenses and only operated in Sg. Sabur, Banggi by the villager usually formed in group of 10 – 15 people. The royalty price charge by the Forestry Department is RM10 per Entry Fee and RM2.50 per running feet. Not much management prescriptions or activities prescribed for mangroves, and the daily management and supervision of all mangrove forests emplaced under District Forestry Officer. More efforts in safeguarding the mangrove forests from threats that may jeopardize this unique ecosystem and only small scale exploitation is allowed to make the responsible use of mangrove resources profitable to enhance the economic value of maintaining mangrove forests and thus safeguard them for long-term sustainability (piling, fire woods, charcoal and fish traps).

MATERIAL AND METHOD

Available information on the past and present distribution, ecology and function of mangrove in tropical rainforest and other regions of South-east Asia was reviewed. Secondary literature from Forestry Department Sabah, annual report concerning on status and function of mangrove as an important indicator for conservation, and by conducting field surveys and observations in Kudat Mangroves as a complement and confirmation to the mechanisms. For the field survey, the circular sampling plot had been used to investigate the plant community and vegetation zones. The detailed circular sampling plot was sketch (see Figure 1.) while, map of the mangrove area was shown in Figure 2.

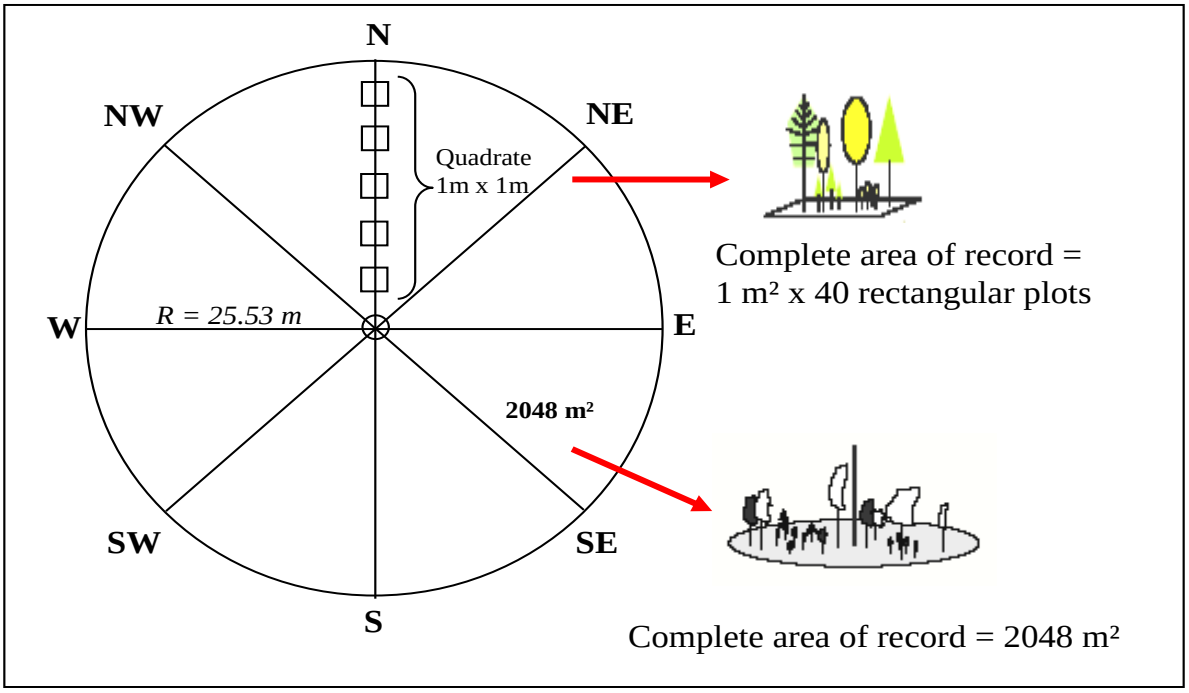

Figure 1. Circular plot for detailed vegetation analysis and natural regeneration

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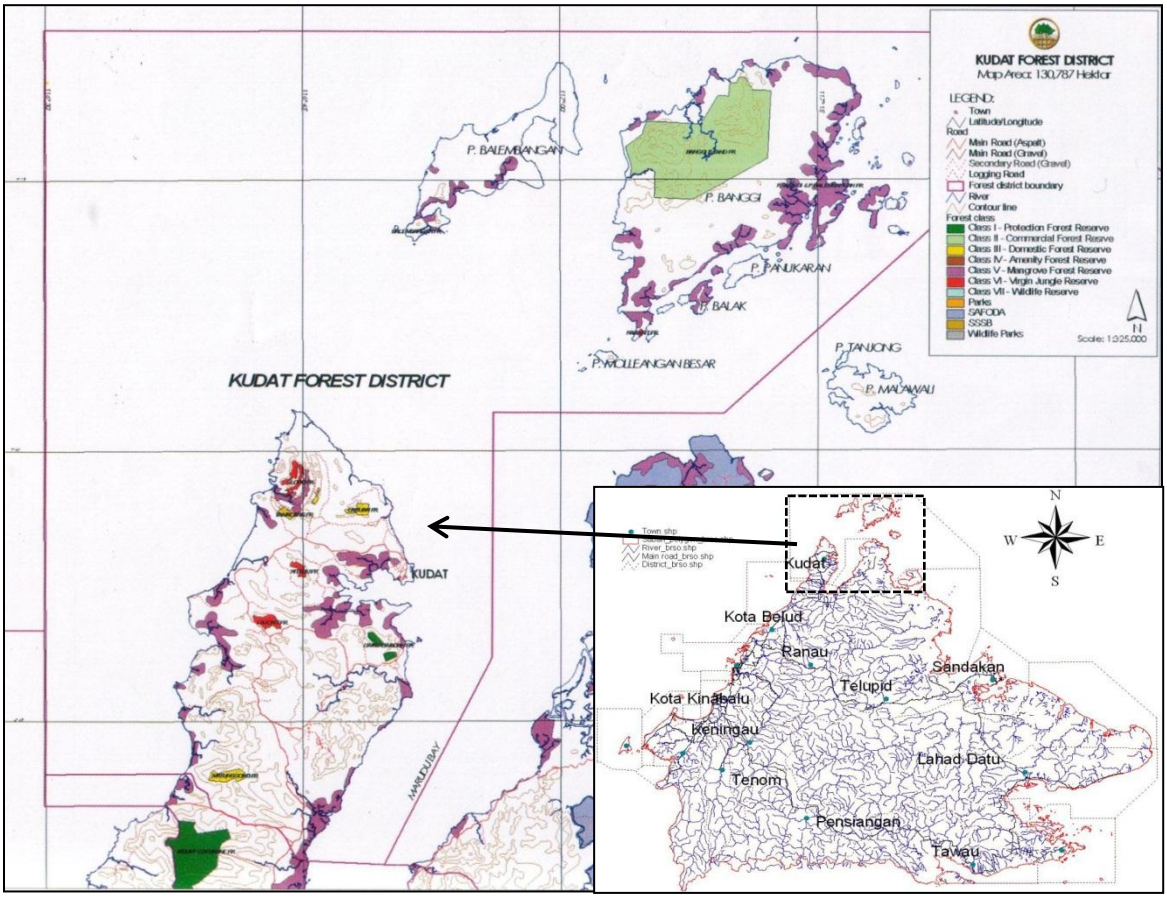

Figure 2: Mangrove forest (Class V) reserves in purple color for Kudat, Sabah District (left)

RESULT AND DISCUSSIONS

The mangrove lands that used to be considered as "waste land" in the past, have recently been treated as a valuable ecosystem, especially for their unique features. Mangrove forests have been traditionally utilized by the local people for a variety of purposes. These include the wood and non-products, as well as products and amenities provided within and beyond its physical limits. Values of mangroves are recognized as "tangible" and "intangible" benefits (Clough, 1993).

There are about 32 known species dominating the mangrove area in Kudat, which can be categorized under true mangrove species, and transitional mangrove species as shown at the Table 2.

Vegetation Zones

There are 5 major vegetation zones in Kudat as shown in figure 3 and for mangrove zone profile can be further differentiate into 6 successional manner as described as shown at the Figure 3.

Table 2. Mangrove Species in Kudat

True Mangrove Species		Transitional mangrove species	
Family	**Species**	**Family**	**Species**
Combretaceae	*Lumnitzera racemosa*	Apocynaceae	*Cerbera manghas*
Combretaceae	*Lumnitzera littorea*	Euphorbiaceae	*Excoecaria Agallocha*
Meliaceae	*Xylocarpus granatum*	Lythraceae	*Pemphis acidula*
Meliaceae	*X gageticus*	Leguminosae	*Instia bijuga*
Rhizophoraceae	*Brugiuera* sp.	Malvaceae	*Hibiscus tiliaceus*
Rhizophoraceae	*Bruiguiera cylindrical*	Malvaceae	*Thespesia populnea*
Rhizophoraceae	*B. parviflora*	Rubiaceae	*Scyphiphora Hydrophyllacea*
Rhizophoraceae	*B. sexangula*	Lecythidaceae	*Barringtonia racemosa*
Rhizophoraceae	*Ceriops tagal*	Leguminosae	*Pongamia pinnata*
Rhizophoraceae	*Rhizophora apiculata*	Malvaceae	*Heritiera globosa*
Rhizophoraceae	*R. mucronata*	Myrsinaceae	*H. littoralis*
Sonneratiaceae	*Sonneratia alba*	Malvaceae	*Brownlowia argentata*
Sonneratiaceae	*S. caseolaris*	Bignoniaceae	*Dolichandrone spathacea*
Acanthaceae	*Avicennia alba*	Primulaceae	*Aegiceras corniculatum*
Acanthaceae	*A. officinalis*	Pteridaceae	*Acrostichum aureum*
Acanthaceae	*A. marina*	Celestraceae	*Cassine viburnifolia*

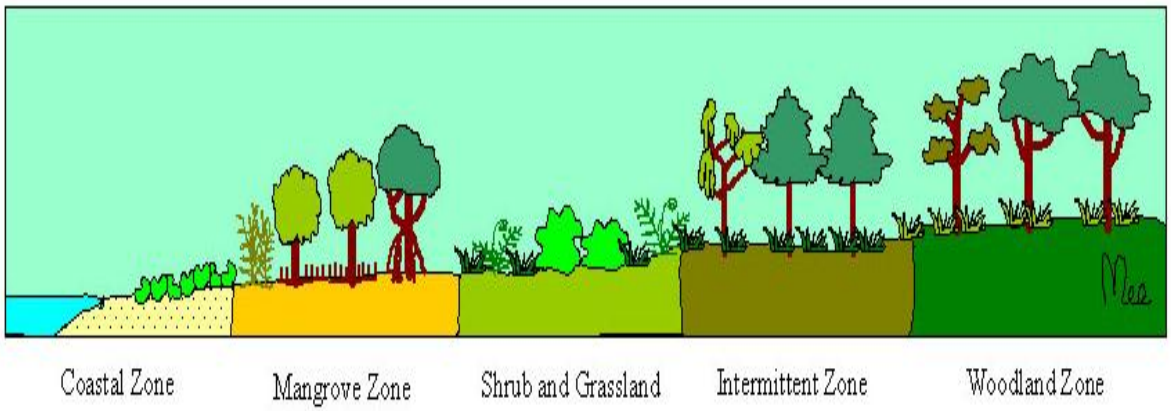

Figure 3. Vegetation classification zone (Overall profile from sea to woodland)

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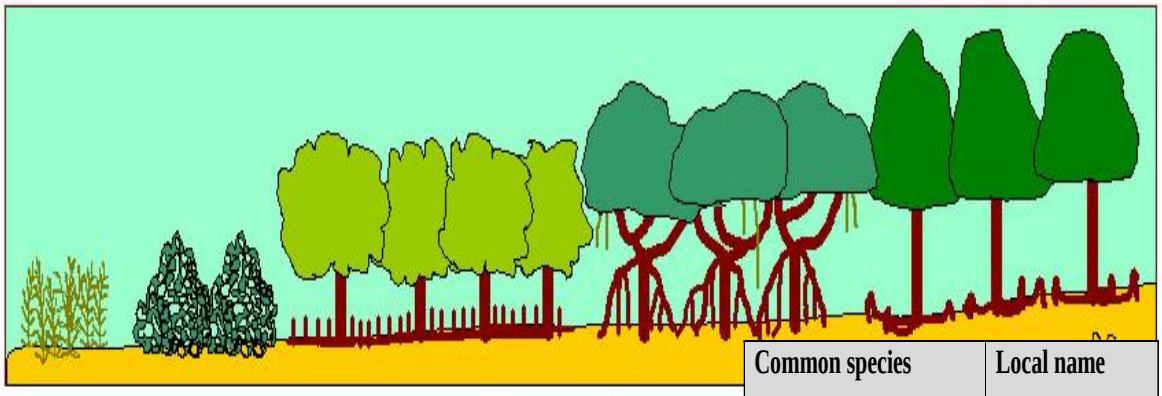

Mangrove Zone

Common species	Local name
Avicennia sp.	Api-api
Rhizophora apiculata	Bakau Minyak
Rhizophora mucronata	Bakau Kurap
Lumnitzera racemosa	Teruntum Putih
Bruguiera cylindrical	Berus
Bruguiera parviflora	Lenggadai
Acrostichum sp.	Piairaya
Nypa fruticans	Nipah

Figure 4. Vegetation classification for mangrove zone profile (5-15 m asl) *(Source: Own survey)*

There are six (6) successional types of mangrove zone in Kudat, i.e.

1. Avicennia Forest

Occur towards the seafront bordering the Kudat/Marudu bay and South China Sea. Representing newly formed forest areas, these forests are characterized by young stands of *Avicennia alba* and *A. marina* that sometimes interspersed with *Sonneratia*, *Rhizophora* and *Bruguiera* species.

2. Transitional New Forest

This forest type straddles between the accreting *Avicennia* forest and the *Rhizophora* or *Bruiguiera* forest. It comprises the older accreting *Avicennia* forest, which carries in it intermittent stands of either Rhizophora or *Bruiguiera* species in varying proportions. It needs to be clearly defined and accorded restrictive protection status to allow for its continuing natural of artificially aided transition preferably to *Rhizophora* forest.

3. Berus Forest

Berus forest usually consist of pure stands of *Bruguiera cylindrical* with small populations of *Rhizophora* and other *Bruguiera* species. Its occurrence is almostly totally along the seafront which renders it an environmentally sensitive site that warrants conservation and prudent management.

4. Lenggadai Forest

The Lenggadai Forest is an occasional forest, which usually comprises a mixture of *Bruguiera parviflora* with *Rhizophora* species towards the mainland and *Bruguiera cylindrical* towards the seafront. Lenggadai Forest is more prevalent towards the mainland and is more abundant in Marudu bay.

5. *Rhizophora* Forest

Rhizophora Forest is a major forest type in Kudat Mangroves. It comprises about 80% of the total forested area. This forest type consists predominantly of *Rhizophora apiculata* and *R. mucronata*, the two main commercial species. This forest is characterized by trees with straight boles and even canopy heights.

6. Nypa Forest

Nypa Forest (*Nypa fruiticans*) is confined to the upper stretches of riverbanks of tidal rivers where there is greater freshwater influence. The palms grows gregariously, interspersed with *Avicennia* and *Sonneratia* species near estuaries, with *Rhizophora* and *Bruguiera* species further inland and *Heritiera* and *Excoecaria* species in the hinterland with little tidal influence. The undergrowth comprises mainly *Acrostichum* fern growing on mud lobster mounds.

The Importance Function

The Importance function of mangrove forest in Kudat identified as:

1. Protection function

Physical protection to the coastline by helping to mitigate the impact of strong waves and gushing sea water, prevention of erosion, and serving as biological filtering system and sink for pollutants. Protective function of the forests shall prevent potentially dangerous impacts and probably be able to warrant the larger part of protective functions, in particular the regulation of water and local climate features and prevention of erosion (Mojiol *et.al*, 2007).

2. Habitat function

Important breeding ground of marine life and nurseries for the immature stages of fish, prawn and crab (8% of Kudat population involved as fisherman). There are 5-aquaculture project recorded within mangrove forest in Kudat know as Prawn project (2), Crab project (1) and Fish cage project (2). Natural habitat for the living organisms, home to wide range of flora and fauna. Result from ground survey and local people observation on fauna have been spotted in mangrove forest in Kudat / Banggi area:-

- A group of 15-20 Proboscis monkey (Sungai Tamalang, Kudat) – Observation
- White Eagle (Sikuati / Banggi) - common sighting
- Crocodile (Sg. Sabur Banggi and Balembangan) - common sighting
- Long tail monkey (common in Kudat/Bangi) - common sighting
- Fireflies – (Sg. Sikuati, Kudat, East part of Banggi Island) – Observation.

3. Utility and socio-economic function

Mangroves are important resource especially to the coastal communities, which in the past depends on it for their subsistent living. Source of economy activity to the local people include firewood, mangrove barks, piling and charcoal production (3 charcoal plants exist in Kudat district).

4. Potential for nature tourism site and recreation

The uniqueness of mangrove is widely acknowledged. Mangrove has provides avenue for the development and high demand for nature tourism. In-depth study may reveal some unique resources, which could be exclusive to this area.

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Even though mangrove in Kudat is not develop for tourism yet but some activities that can attract tourist such as boat trips through the rich estuarine mangroves, sports fishing, bird watching could be a potential. Some spot area in Kudat with are of high potential for tourism development are Kg. Sikuati, Simpang Mangayau, Sg. Ranggu, Pulau Banggi, Pulau Malawali and Pulau Balembangan.

Threat of Mangrove Conservation in Kudat

In 2005, approximately 2,440 ha or 0.8% of the Mangrove forest reserve in Sabah has been lost mainly conversion for people's settlement. As for Kudat, exploited area recorded as follows; Settlement / Urban Development (500 ha), Aquaculture (15 ha -Approx), Agriculture (No record, but estimated more than 50 ha) and Infrastructure include Power Supply Way leave (9.95 ha), Pipeline (1.43 ha), Common Tower (1.5 ha). The factors influencing the encroachment of mangroves in Kudat are due to the increased of population pressures in coastal areas.

Exploitation for infrastructure and urban development, inevitably caused the use of mangrove lands for various purposes such as construction of roads, ports and harbours, industries, urbanization, etc (Hamilton & Snedaker 1984).

1. Traditional industry – local activities with small magnitude and negligible to the destruction of mangrove forest. Higher short-term benefits: Alternative uses of mangrove lands, especially for the production of fish and prawns, succeeded in fetching higher monetary gains over a short period and led to the conversion of mangroves to fish ponds. At the same time, the conversion of mangrove lands to salt beds and rice fields brought in higher monetary returns within a short period.
3. Illegal squatters – not less than 300 ha of mangrove forests have been encroached by illegal immigrants in Sabah. In Kudat, Illegal squatters involved about only 2 Ha (approx).
4. Land use conflict – 1100 ha of Mangrove forest reserve in Sabah were lost to agricultural conversion due to uncoordinated and technical discrepancies of boundaries on the ground. Lack of government attention and most of the mangrove lands were left unattended by governments. Many of the mangrove are yet to formulate the required coastal zone management plans incorporating the details of mangrove management.
5. Inadequate manpower and logistics: The mangrove management agencies, mostly the local forestry departments, very often do not have the adequate manpower and logistics required for the implementation of effective management.
6. Besides these, Waste water effluent produced by factories, direct dumping of municipal wastes into the rivers, pesticide run-off from neighboring agricultural areas, including accumulation of heavy metals into the mangrove ecosystems, are causing definite stress on them.

Challenges in Mangrove Management Practices in Kudat

1. Mangrove management

Mangrove forest management in Kudat still needs improvement. There is

no management plan for mangrove management in Kudat. All mangrove forest under jurisdiction of Sabah Forestry Department are managed without any interference of human assistance in its regeneration and rehabilitation, based on the factor that mangroves are able to regenerate by themselves without any human intervention. The management of mangroves must be carried out holistically so as to ensure a balance management system for addressing the socio economic and environmental concern. To conserve mangrove forests to protect the ecosystem for long-term sustainability.

2. Competing land-use demand and socio-economic development

Mangrove ecosystems are subject to increased pressure of socio-economic activities or development such as marine fishery, aquaculture, agriculture activities, human settlements and tourism. With varying degree of interests, both compatible and competing uses, it is challenge to balance the diverse interests without jeopardizing the many function of the mangroves. Apart from mangroves in PFR, there are also some scattered state land mangroves which are not quantified, monitored and protected under any legislation.

3. Illegal felling and settlement

Illegal felling for poles and fishing stakes is persistence in the mangrove forests. These illegal activities are mainly along the river banks. In Kudat, deltas where mangroves exist are intersected by rivers and small streams where illegal activities are difficult to detect. Some mangrove areas are also encroached by commercial shrimp farming and illegal settlement. Unless preventive and corrective actions are taken now, increase in demand for land for settlement and aquaculture will result in more mangrove forests being encroached. Other challenges are to involve the local communities to conserve mangroves areas, especially thus living nearby the mangrove forest.

4. Reserve boundaries and the security of the resources

Safeguarding the mangrove resources from external threats can be difficult with long perimeters of reserves and absence of boundaries demarcated on the ground. To demarcate all of them is a very costly exercise.

5. Maintaining the healthy mangrove ecosystem

Apart from commercial values, the mangrove ecosystem is also known to serve many other functions, which are important for the well being of other sector of the economy. An example is the fishery sector and other marine fauna provide important feeding and breeding grounds for fish, crabs and prawns. Maintaining such functions can be challenging in view of the rapid rate of development where mangrove are exposed to threats from external activities such as pollution and solid wastes. However, not much is know about how the mangroves respond to these potential threats and the appropriate mitigation measure that can be taken at the local level.

CONCLUSION

It is acknowledged that mangrove resource in Kudat, Sabah Malaysia fulfills many extremely important productive, protective and social functions. Yet, increased population pressures in coastal

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areas and lack of awareness have lead to large-scale conversion of mangroves to other land uses. Considering their locations, roles and functions, steps must be taken to gazette existing mangroves inside estuaries and lagoons as Permanent Forest Reserve (PFR). The apparent of boundaries between State land and Mangrove Forest on the ground are vital to be carried out by the authority. Currently, there is no specific management plan for mangroves and management practices is only in-terms of regulating small-scale use of wood resources for building materials, fuel by local communities and small-scale aquaculture project. Important effort to better manage the Kudat mangroves is carrying out nourishment and planting activities in existing mangroves. Other challenges are to involve the local communities to conserve mangroves areas, especially thus living nearby the mangrove forest.

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