

## HUMAN INTERVENTION ON MANGROVE AREA IN AMBONG BAY, KOTA BELUD, SABAH

Ejria Saleh<sup>1</sup>, Andy R. Mojiol<sup>2</sup> & Nurul Waheeda Abd Halim<sup>1</sup>

<sup>1</sup>Borneo Marine Research Institute,  
Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia

<sup>2</sup>School of International Tropical Forestry,  
Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia

**ABSTRACT.** *Mangrove is one important coastal vegetation that provides natural habitat for much marine life and serves as protection to the shoreline. Most mangrove areas in Kota Belud are located in the southern part (Kuala Abai and Ambong Bay) of this district. However the mangrove along the shoreline of Ambong Bay belongs to the Sabah state government. High demand of the mangrove area for personal use and exploitation of the resource have contributed to the destruction of mangrove ecosystem and its function as shoreline protection. The objectives of the study are to identify the change of mangrove cover and to identify the dependency level, human impact and conservation knowledge of local communities on mangroves along the shoreline of Ambong Bay, Kota Belud. The evaluation of spatial and temporal changes in mangrove areas were conducted based on Landsat TM imagery in 2001 and 2005. The data was analysed by using Erdas Imagine 9.1 version software. Field trips were conducted for ground checking and questionnaires were randomly distributed at 3 villages to assess their dependence on and conservation knowledge of mangrove. Small changes of mangrove cover can be seen from satellite images however ground checking indicated that this area was highly exploited by the local community for human settlement, conversion to paddy fields and aquaculture activities. During high tide and heavy rain, some areas are flooded which affects the human activities along the roads. Most of the respondents were unaware of the importance of the mangrove as shoreline protection, source of food and habitat for marine life. The local communities are keen to participate in any mangrove conservation activities but so far no related programme has been conducted in that area. Therefore, an awareness programme and sustainable management of the remaining mangrove should be implemented. Strong support from government and local authorities are also needed to ensure the success of the programme.*

**KEYWORDS.** Mangrove changes, human interference, conservation knowledge, Ambong Bay

### INTRODUCTION

Mangrove forest comprises of salt-tolerant trees and shrubs that grow in the shallow tidal waters of estuaries and coastal areas in tropical and subtropical regions. Mangroves are predominantly inter-tidal habitats that are found widely at sheltered and shallow water coastlines (Nagelkerken *et al.*, 2008). They are socio-economically important ecosystems, 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 (Dahdouh-Guebas *et al.*, 2000).

Mangroves play an integral role in the ecology of watersheds, including protection against coastal erosion and providing nutrients to support a marine food web (Seto & Fragkias,

2007). In recent years, the pressure of increasing population, the resulting expansion of agricultural land and industrial area as well as urban development have caused a significant decrease of the Sabah's mangrove resource. Mangrove ecosystems and its associate marine life species can be threatened by various forms of human pressure such as pollution and reclamation (Farnsworth & Ellison, 1997; Hamilton & Snedaker, 1984). Most of the mangrove areas in Kota Belud are located in the southern part of the district such as Kuala Abai and a long the shoreline of Ambong Bay. The objectives of this study are to identify the change of mangrove cover and human impacts on the mangrove area in Ambong Bay, Kota Belud, Sabah. The study is also to assess the level of dependency on mangrove products and conservation knowledge level of the coastal communities.

## STUDY AREA

Ambong Bay is located in the Southern part of Kota Belud, Sabah (Figure 1). It is a semi-enclosed area and the inner part of the bay is fringed by mangroves while the outer part is formed by beautiful sandy beach. The bay is shared and governed by the Kota Belud and Tuaran Districts. Kg. Baru-Baru is under Tuaran District and Kg. Ambong, Kg. Igot and Kg. Tolus Kota Belud District. The number of houses scattered between Kg. Igot and Kg. Ambong is estimated less than 50 houses. Growing population has contributed to water shaded clearing for agriculture and mangrove intervention for human settlement.

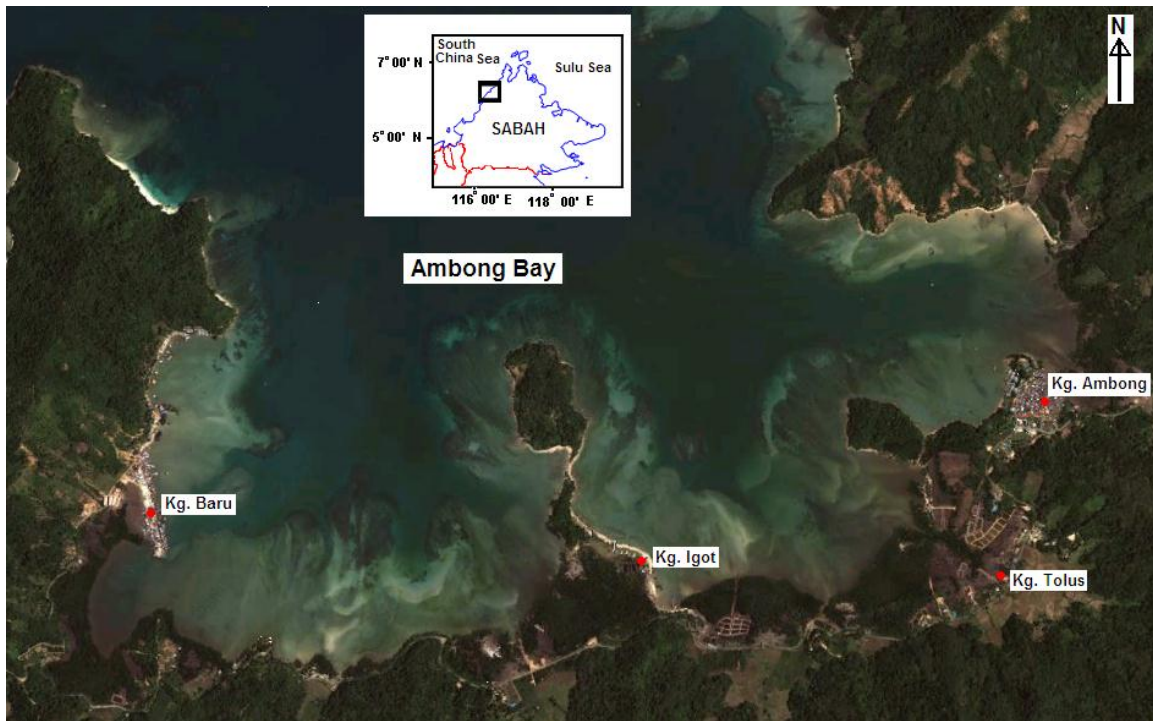


Figure 1. Location of the villages (marked in red) involved in the study.

## **MATERIAL AND METHOD**

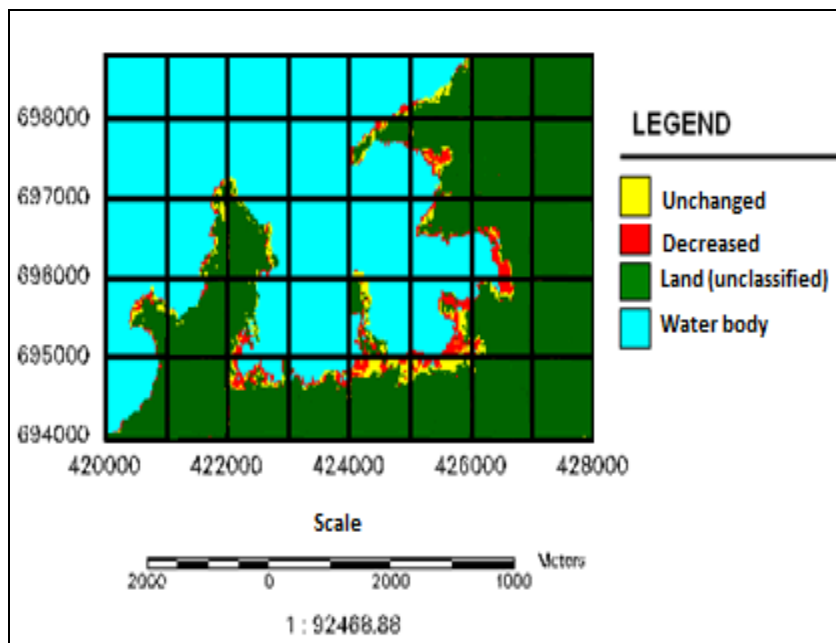
The large mangrove cover in Ambong Bay were detected by using remote sensing data derived from Landsat Thematic Mapper Plus (TM) in 2001 and 2005. The images selected are the best image that is available for this area in Borneo Marine Research Institute collection. These images were used to identify changes of mangrove cover in these particular years. The images were analysed by using Erdas Imagine 9.1 version software. Field survey of mangrove was also conducted in January and March 2008 to observe the decline of mangrove cover along the coastline of Ambong Bay. The survey was conducted along the road from Kg. Ambong to Kg. Baru-Baru (Tuaran District). The coordinates at each sampling point were recorded and transferred into Google Earth map for mapping purposes. The findings of the fieldwork were compared with the remote sensing data.

Data on the level of dependence and knowledge to mangroves as well as general idea of mangrove cover changes were conducted through surveys and interviews. Semi-structured questionnaires were distributed to 43 coastal communities of different background (government servant, non-governmental, farmers, and fishermen) in the three coastal villages (Kg. Ambong, Kg. Igot and Kg. Tolus) visited during the field trip. Emphasis was highlighted on Local Ecological Knowledge (LEK) data collection. Interviews were also conducted at weekend market in Kota Belud on 3 September 2008 to get some idea of fish landing and mangrove related product sourced from Ambong Bay. Annual Fisheries Statistics from 1992 to 2004 were referred to relate the fish landing from these villages.

## **RESULTS AND DISCUSSIONS**

### **Mangrove Area**

The Landsat images revealed that there was a change of mangrove cover around Ambong Bay from 2001 to 2005 (Figure 2). Results showed that the mangrove areas along the road have clearly decreased. However based on these results, it is hard to estimate the exact mangrove cover change due to resolution of the image and the study area is relatively small. Some part of the images was blocked by the cloud cover. Based on mangrove cover detected through field observation and information gathered from the interviews, human intervention of the mangrove area is drastically increased after the construction of the road. Since the entire mangrove is located on the state land, the local community is free to develop and it is allowed to apply for land title through Land and Survey Department, Sabah. Mangrove area that 60 m from shoreline is considered under the jurisdiction of Department of Drainage and Irrigation and reserve as a buffer zone.



**Figure 2. Condition of mangrove cover between 2001 and 2005.**

A small part of mangrove area was affected by road construction from Kg. Ambong to Kg. Igot Baru in the 1970s. The size of cleared mangrove is increasing yearly (Figure 3). Most of the undisturbed mangrove area is near the shoreline that gazette as a buffer zone by the government. The farmers developed the inland side of the road for paddy field after access of seawaters was limited by the road (Figure 4a). The road allowed easy access to the mangrove area for charcoal and firewood. The villagers were dependent on mangrove for firewood before the supply of electricity was available to this area while the wood from the mangrove was widely used for fishing and housing materials. Since 1990s, huge mangrove areas were cleared for human settlement along the road especially in Kg. Ambong (Figure 4b), Kg. Tolus and Kg. Baru Baru (Figure 4c). Mangrove areas were also reclaimed for housing and aquaculture activities (Figure 4d). Dahdouh-Guebas *et al.* (2005) reported that mangrove suffered from direct impacts such as cutting and often regarded as unpleasant environments with little intrinsic value.

Mangrove in Kg. Tolus and Kg. Igot was cleared for large aquaculture farm (Figure 4d). Currently, almost all aquaculture ponds are abandoned and unattended. Respondents from Kg. Tolus (28.6%), Kg. Ambong (7.1%) and Kg. Igot (33.3%) agreed that mangrove reclaimed for human settlement and agriculture activities. Primavera (2006) stated that conversion of mangrove area to aquaculture contributes to habitat loss, habitat modification and release of wastes. Aquaculture activities also contribute to high salinity in the soils and destroy the nutrients balance through the accumulation of sodium chloride. Increase in salinity in the buffer zone and over extraction of resources also creates serious threat to mangrove.

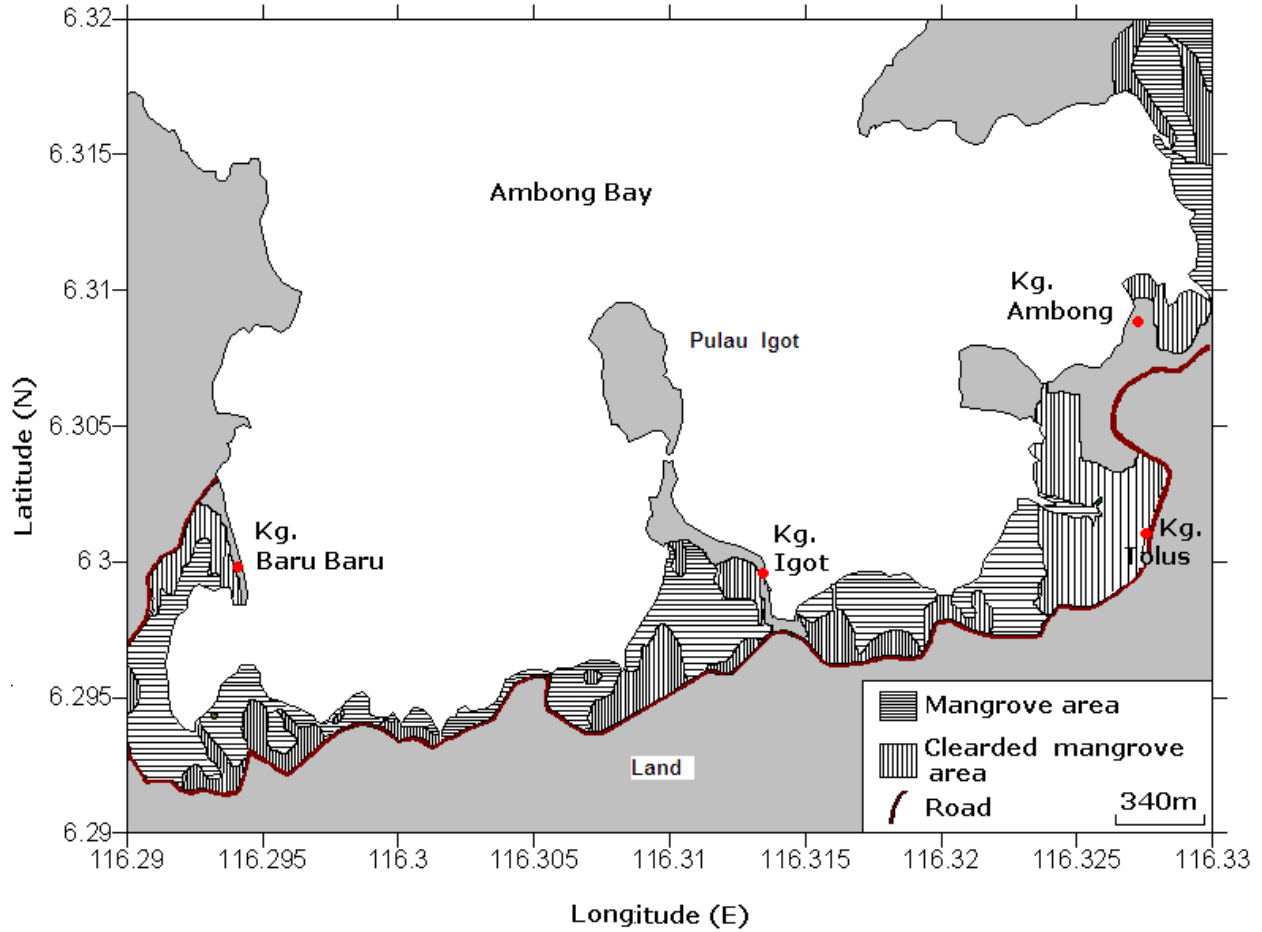


Figure 3. Status of mangrove area surrounding Ambong Bay, Kota Belud in 2008.

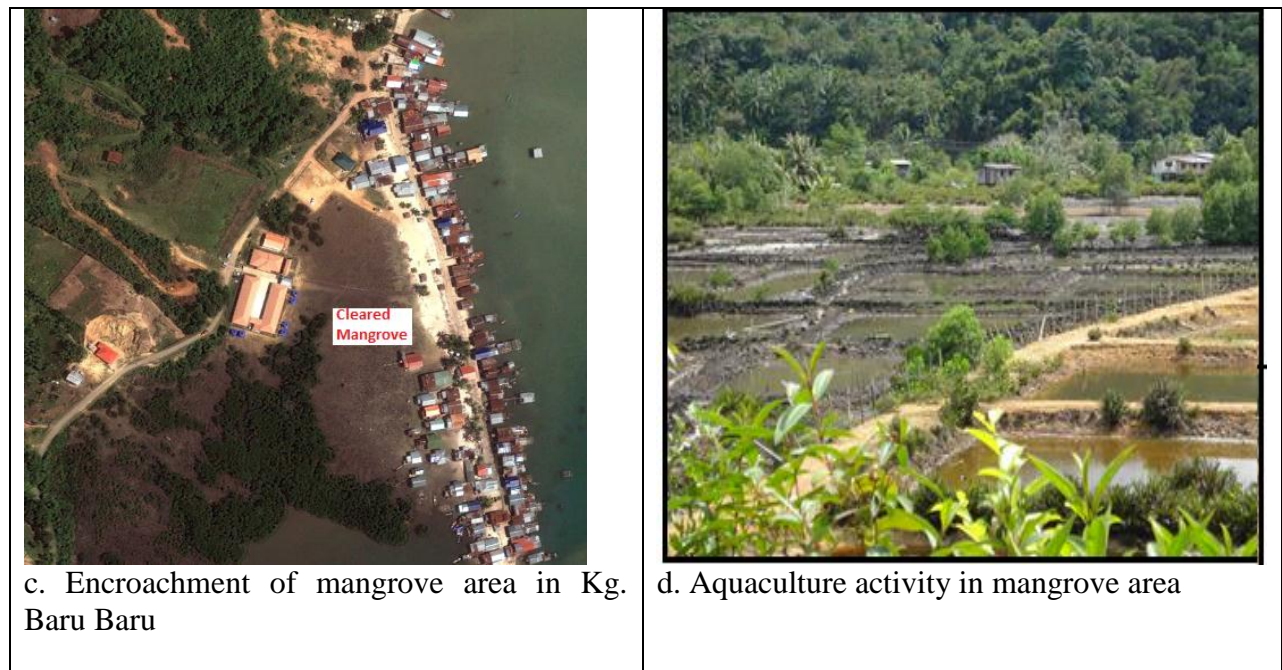


a. Mangrove are converted to paddy filed



b. Houses built in mangrove area





**Figure 4. Threats of mangrove area in Ambong Bay.**

### **Dependence and Knowledge of Local Community to Mangroves**

There were 43 respondents from different villages around Ambong Bay. All respondents are male with age ranged from 21 to 60 years and are permanent residents to the village. Ten respondents work as fulltime and 20 as part time fishermen. Other respondents are working as government servants and/or farmers. Two respondents did not know or do not care about the mangrove changes. Most of the respondents working as fishermen usually sell their daily catch at the fish market in Kota Belud.

There were 36 respondents that claimed that mangrove forests have decreased in size. Most of the villagers in Ambong worked as government servants or run their own business. However, they are still depending on mangrove products and work as fishermen or farmers as their part time job. Since mangrove dependence in Kg. Ambong is high, the respondents were expecting that the mangrove cover will be continuously decreased. Increasing human populations demand more space for their housing area. Currently, houses are already built within the mangrove area (Figure 3b).

All of the respondents in Kg. Tolus claimed that mangrove products were less important because most of the villagers are farmers. The villages in Kg. Tolus only collect mangrove products (firewood and wood products) during special events or celebrations (e.g harvest festival). Respondents in Kg. Igot claimed that mangrove and its products were very important to their livelihood. Severe erosion is observed at sandy beach near Pulau Igot where there is no mangrove trees to protect the shoreline from strong winds and high tides. Signboard put up by the villagers was seen near the road side to protect the mangrove area from illegal mangrove cutting (Nurul Waheeda, 2008). The respondents from this village stated that the mangrove re-planting is needed to protect the shoreline from strong wind and waves which have affected that area.

### **Decline of Fish Landing**

According to the Annual Fisheries Statistics from 1992 to 2004, increase in number of fishermen in Kota Belud district may have contributed to the decline of marine fish landing since 1997 (DOFS, 2008; Nurul Waheeda, 2008). Fishes such as seabass (*Lates calcarifer*), rabbit fish (*Siganus spp.*), mullet (*Mugil spp.*) and Indo-pacific tarpon (*Megalops cyprinoides*) are among the marine species that directly or indirectly depend on mangrove. Seabass landing were only 2.81 and 1.92 metric tonnes in 1999 and 2000, respectively. The mangrove crab (*Scylla spp.*) and mangrove clam (*Polymesoda sp*) which live in mangrove areas were also declined in some years. Decrease fish landing would give some idea of high pressure on fisheries resources and mangrove loss in the district.

### **Weekend Market Visit**

The fishermen from Kg. Baru Baru and Kg. Ambong sell their fish in Kota Belud market. Most of fish are pelagic fish. However, reef fishes and mangrove related fishes are common but in small sizes and numbers compared to pelagic fish. The fisher monger in the market recalled that the sizes of fishes caught now are smaller compared to in the 1980's. Mangrove bark and mangrove clams were also sold in the weekly market but not from Ambong Bay area. However, it was reported that the mangrove bark was also collected in Kg. Tolus for local consumption in the past.

### **Mangrove Conservations Knowledge**

High numbers of respondents (86%) are showing interest to participate in mangrove conservation program. Mangrove dependency affects the locals' response on mangrove conservation activities. Degree of mangrove dependency is major causative factor in active participation of households from villages in conservation efforts. Villages which are highly dependent on the mangrove and its products will definitely have interest in conservation activities. Twenty six respondents were expecting the mangrove area will decrease and disappear soon if no action is taken. Other respondents (17 respondents) either do not care or do not know about what to expect from the mangrove.

The mangrove cover in Ambong Bay is declining due to human intervention. The major threats are clearing of mangrove forest for human settlement, aquaculture and agriculture activities. The mangrove areas are also declining due to natural events such high tides and strong winds. Uncontrolled exploitation of mangrove areas as marine habitats and fisheries resources may cause further declining of fish landing in the future. Also, the coastal villages may directly be exposed to natural disaster if continuous degradation of mangrove forest occurs. Planning and management of coastal areas need to be highlighted to the local authorities so that degradation of mangrove due to anthropogenic pressure can be minimised. Educational and awareness programme related to mangrove conservation should be conducted in this area since the majority of the respondents are willing to participate in mangrove conservation activities. This is important to improve their level of knowledge related to mangrove decline that affects the incomes of the fishermen and exposes the village to natural disasters.

## **ACKNOWLEDGEMENTS**

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