Pre-and post-tsunami coastal planning and land-use policies and issues in Malaysia

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The maritime nation of Malaysia, with a population of some 26 million (much of it concentrated on the west coast of Peninsular Malaysia), occupies an area of 33 million hectares and has a 4 800-kilometre coastline.

Malaysia is now an industrialized country, but until the 1970s it depended mainly on agriculture. Rice was one of the earliest crops, but rubber and later oil-palm became the major crops.

Forestry was also a major industry, but by the 1970s almost all the lowland forests on the peninsula had been harvested. Mangrove forests line some two-thirds of the coast on the west coast of Peninsular Malaysia, with the rest dominated by sandy beaches.

Malaysia is a federation of 14 states and has a federal system where land matters are under the jurisdiction of each state. Management of the coasts is thus done at the state level and, as yet, none of the states manages their coasts based on the concept of Integrated Coastal Zone Management (ICZM) (although the ICZM concept has been introduced by foreign funding agencies to a number of states).

Although mangrove forests provide a variety of goods (from forestry to fishery products) and services (from environmental to navigational) they are under the jurisdiction and management of each of the state forestry departments and not on a multisectoral basis. When these coastal forests have to be converted to alternative uses (for example shrimp ponds or housing estates) the jurisdiction lies essentially with each of the states’ executive councils. The decision-making process is not very transparent.

Even though the west coast of Peninsular Malaysia was one of the least affected areas hit by the massive 2004 Indian Ocean tsunami, over 50 people lost their lives, about 200 were injured, a few thousand were made homeless and there was damage to coastal property (hundreds of houses, boats, fishing gear etc.).

The displaced people have been temporarily housed and new housing is being provided through funding by generous (about US$20 million) public donations and government support (mainly in the form of land and infrastructure).

As the damage from the tsunami was minimal there was no lesson to be learned and there has been no change to coastal management policies.

The highest profile reaction to the tsunami is the federal government’s commitment of some US$11 million to rehabilitate mangroves, even though they were barely affected by the tsunami.

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1. Background

1.1 Preamble

Malaysia is a maritime nation, with more area of seas (including the Exclusive Economic Zone) than land under its jurisdiction. The coastline is some 4,800 kilometres long (Teh, 2001) and the total land area is 33 million hectares. About half of the coastline is lined by sandy beaches; rocky shorelines are not common. Even though mangroves are found along most of the coast, they only constitute about 1.5 percent of the total land area. In the Straits of Malacca, Peninsular Malaysia (the part of the country that was affected by the 2004 Indian Ocean tsunami), mangroves line about two-thirds of the coast and constitute closer to three percent of the land area (based on catchment). This paper addresses west Peninsular Malaysia, or the Malaysian coastline along the Straits of Malacca (Figure 1).

![Map of Malaysia](image)

**Figure 1. West Peninsular Malaysia (from Ong and Gong 2001)**

The main mountain range runs almost the entire length of Peninsular Malaysia with a rather extensive coastal plain that extends some tens of kilometres west into the Straits of Malacca.
All of this coastal plain was over a hundred metres below the present sea level some 10,000 years ago. The sea level rose rapidly until about 5,000 years ago, when it reached 1.5 metres above the present sea level and the coast was a few kilometres inland from the present coast. Kamaludin (2001) reported old beaches and cheniers (beach ridges deposited from storm surges or tsunamis) that extend more than two kilometres from the present coast.

Most of the coastal plain is now agricultural land (mainly paddy fields). When the conversion took place (over a century ago), the natural vegetation was in all likelihood freshwater swamp forest — as found in many other areas in Southeast Asia — and converted to rice fields (Whitmore, 1990), but this is not certain.

It is perhaps pertinent to mention here that the mangrove ecosystem does not occupy the entire intertidal zone. Mangroves cannot survive if they are inundated by tides (Watson, 1928). The intertidal zone that is inundated by tides is known as tidal mud or sand flats and constitutes a distinct ecosystem. Tidal mudflats can range from only a few metres wide to hundreds of metres or more. Seagrasses may sometimes grow in the lower reaches of this zone, but extensive mudflats are the favourite haunts of wading birds. Mangroves grow in the upper reaches of the intertidal zone (as high as the highest tides), where they merge into inland vegetation. The upper reaches of mangroves are usually the most species-diverse. Sandy beaches occur to the highest watermark. The vegetation that is associated with sandy beach is known as strand vegetation. Strand vegetation starts from near the high spring-tide mark and usually extends not more than tens of metres inland. Species such as *Scaveola tacada* and *Ipomea prescapae* often occur in the lower zone and may be inundated by high spring-tides.

The 2004 Indian Ocean tsunami (Ammon et al., 2005), generated by a 9.3 earthquake off Aceh, Indonesia, affected only the northwestern states of Peninsular Malaysia. Sumatra bore most of the main brunt of the tsunami and the waves that came into Malaysian shores were likely reflected rather than direct waves. Still, human lives were lost (52 died and five went missing) and there was damage to property; thousands of people were displaced as a result of loss of dwellings (for example some 238 houses were destroyed in Penang alone). The main areas affected were Langkawi (Kedah), Kota Kuala Muda (Kedah) and Penang. Many of the victims were picnickers and others who ventured out to collect stranded fish (as the water receded before the first wave hit). Up to three waves came from the north. Hotel operators in Phuket (Thailand) provided some early warning to those in Langkawi (Kedah), who in turn warned hotels in Penang. Thus, there were no fatalities on tourist beaches in Langkawi and Penang (Horton et al. [in review] and Bird et al. [in review]).

1.2 Status and major trends in coastal land and fisheries resource use and main driving forces of change

Most of the human population of Malaysia (some 26 million) is located in the west coast of Peninsular Malaysia with major concentrations in cities located within the coastal plain. Approximately five million people live in Kuala Lumpur and the surrounding Klang Valley, over a million in Georgetown (in the State of Penang) and around a million in Ipoh and the surrounding Kinta Valley (State of Perak). Smaller towns with sizeable populations include Malacca, Seremban, Taiping, Bukit Metajam, Sungai Petani, Alor Setar and Kangar.

For most of the last century, agriculture and fisheries were the dominant occupations, with commerce concentrated in the main cities. Agriculture includes a substantial amount of rice
1.3 Agriculture

Rice was the earliest agricultural crop, dating back a few centuries, and was based on a traditional practice that was more or less in harmony with nature (Abdul Samad, 1998a); the amount of rice grown was just enough to feed the local community. As the population rapidly grew, rice had to be imported from neighbouring countries. From around the mid-twentieth century to the early 1970s, Malaysia still had a policy to be self-sufficient in rice. To achieve this, there was increased use of both fertilizers and pesticides. Irrigation schemes were introduced (such as the Muda and Pedu dams in Kedah), together with an extensive system of irrigation canals that allowed for double and even triple cropping in Malaysia’s main “rice bowl”. The increase in rice production came at the expense of protein production (fish unable to grow owing to pesticide use and buffaloes [meat] replaced by mechanical tillers). However, this did not result in a predicted protein deficiency in the rice-planting community; perhaps the increased income from rice production was enough to supplement imported protein.

From the 1970s, when Malaysia embarked on its industrialization plan, the aim for self-sufficiency in rice was abandoned so there has been no significant increase in rice production since the 1970s. Just under 500 000 hectares are now under rice cultivation, a slight decrease from the peak between 1980 and 1995 (Abdul Samad, 1998c).

Rubber was the first major commercial crop for Malaya (as it was called then), and was introduced by the British at the start of the twentieth century (post-1910). The rubber industry expanded very rapidly and by 1939 had risen to 1.4 million hectares (Abdul Samad, 1998b), mostly owned by the British. Due to low prices and high labor costs, rubber production declined in the early 1980s. It is interesting to note that with the present increase in the price of fossil fuel, the rubber price has increased to a level that is very profitable. Rubber wood (after treatment with a newly discovered process to prevent fungal blue rot) is suitable for furniture so old trees can be harvested for wood. The Rubber Research Institute of Malaysia had also produced a fast-growing clone that has high yields for both timber and latex.

Oil-palm, introduced from Africa, started to take off as rubber declined so many of the big plantations, many of them now owned by Malaysians, replaced their lower profit rubber with oil-palm. Oil-palm became very profitable so more forests were cleared for this crop. Most of the new plantations are now in Sabah and Sarawak, but there are also significant new areas (many owned by Malaysian plantation groups) in Indonesia. This opening up of new lands (many of them in coastal peat swamp forests) has resulted in uncontrolled burning; burning is a cheap option to clear forests for oil-palm, but can very easily generate massive forest fires because peat, found metres underground, also burns and this results in massive smoke
pollution problems for the region. With the introduction of biodiesel, the price of palm oil will remain high and there will be continued pressures on natural forests.

1.4 Forestry

Appanah (1998) gave a concise account of forestry management in Malaysia. He showed that in 1920, 77 percent of the land in Malaysia was still under forest cover. Until 1970, 72 percent of the forests remained intact, but by 1995, only 58 percent of the forest remained. He estimated that by 2010 only 46 percent of the land in Malaysia would be under forest. Brown and Durst (2003) reported similar rates of change: total forest area from 21.7 million hectares in 1990 to 19.3 million hectares in 2000, or a mean annual rate of loss of 1.2 percent. It must be remembered that these forest cover numbers do not refer to undisturbed forest, but are productive forest reserves; this means they have been or are still being logged. Apart from some small reserves, there is hardly any pristine lowland rainforest left in Peninsular Malaysia.

Abdul Samad (1998c) reported that agriculture is the greatest encroacher of primary forest land. He described this pattern of encroachment in five phases. Phase 1 starts with a small settlement containing only a road and some paths, all surrounded by natural forests. Phase 4 is when areas suitable for agriculture are almost exhausted, leaving only small random parcels of farmland for smallholders. Phase 5 is when agriculture begins to contract in area, being increasingly converted to non-agriculture uses like urban and industrial development. The entire west coast of Peninsular Malaysia is in either Phase 4 or Phase 5.

1.5 Mangroves

Mangrove forests are the most relevant forests under forestry management in the coastal zone. They have gained prominence since the Indian Ocean tsunami as a result of anecdotal reports of mangroves saving lives juxtaposed by destroyed mangroves causing loss of life. The Government of Malaysia has also been reported to have allocated around US$11 million for the rehabilitation of mangroves in reaction to the Indian Ocean tsunami. This provides an excellent example of the need for a multisectoral approach to integrated coastal management.

It is estimated that some 50 percent of mangroves have been converted to alternative uses beginning with early human coastal settlements, to rice fields, ports and airports (the airport in Penang was formerly a mangrove area), shrimp ponds and lately to housing estates. This trend of mangrove loss of some one percent per annum has been clearly demonstrated by Haywood et al. (2001) for the Merbok mangroves and by UNEP and DANCED (1999) for the mangroves in the State of Penang (Figures 2 and 3). These examples are typical of the other mangroves in Malaysia – with the exception of the 40 000-hectare Matang Mangrove (in Perak) that has been managed successfully for a century (Watson, 1928; Ong, 1978; Gan, 1998; Chan, 2001; Gong and Wazir, 2001). The Matang Mangrove has been managed for timber production (poles and timber for fuelwood and charcoal) since the beginning of the last century, based on a 30-year rotation with thinnings at 15 and 20 years. There have been three harvest rotations, and apart from loss of plant species diversity, these mangroves have remained remarkably intact. This is indeed a rare example of sustainable timber use of a tropical rain forest. There are also a number of mangrove areas that have been designated as state parks in Johor and Sarawak. Ironically, if this trend persists, Malaysia will have lost most of its mangroves by 2020, by which time the country aims to have attained developed nation status.
Most of the conversion of mangroves to rice fields took place in the two decades around the 1950s. Bunds and tidal barrages were constructed by the Drainage and Irrigation Department to prevent seawater intrusion. Unfortunately, most of the mangroves-to-rice schemes were largely unsuccessful, mainly due to the development of acid-sulphate conditions in the soil. If mangrove land is generally not suitable for planting rice, shrimp culture is another option. One of the earliest intensive shrimp pond culture schemes (in the late 1970s) was started in the Merbok mangroves (Ong, 1978) following recommendations by FAO (Jamandre and Rabanal, 1975). Shrimp farmers faced the same problems as rice farmers, i.e. acid-sulphate conditions. Nevertheless, by the end of the last century, almost one-quarter of the mangroves in Merbok had been converted to shrimp ponds. The rate of conversion has slowed mainly because of the pandemic viral disease that hit the industry and also perhaps owing to greater public and government awareness of the usefulness of mangroves.
1.6 Beaches

The sandy beaches usually consist of golden silica sand, except in areas where there are coral reefs, in which case the sand is white and of finer calcareous coral material. Associated with the upper reaches of sandy beaches is a narrow strip of an edaphic plant community known as beach or strand vegetation. The plants here are adapted to growing in sandy, saline soil and are tolerant to high temperatures as well as salt spray. These sandy beaches are major tourism assets and tourist hotels have been built close to almost all of these beaches. Early (pre-1950s) hotel developments were small scale and the environmental impacts were minimal. Later (especially from around the 1970s) developments were both rapid and large scale. This has resulted in the loss of the strand vegetation in most of these locations. Inadequate or inefficient sewage treatment of hotel waste has also resulted in pollution of adjacent beaches and coastal waters.

1.7 Fisheries

Early (pre-1950) fisheries activities were confined to the near shore and were mainly artisanal. With the introduction of engines, fisherfolk were able to venture further out to sea, but catches were mainly pelagic. With the introduction of trawlers (Ibrahim, 2001), which started out significantly in the 1970s, there was a major shift to demersal harvest and the resultant perturbation of the benthic community. By the late 1980s, the capture fisheries haul had peaked. The only potential areas left were deep-sea fishing and mariculture.

Deep-sea fishery did not develop mainly because the local population did not like being out at sea for long periods and also due to the higher capital costs involved.

Mariculture was thus favoured by the Fisheries Department and mangrove lands (because they were cheap, or rather, undervalued) were initially targeted for conversion to shrimp ponds. As a result, about one-fifth of the mangroves in Malaysia have been lost as a result of conversion to shrimp ponds in the past 30 to 40 years. There is not only conflict in terms of competing land use, but also a paradox: as mangroves act as nurseries for shrimps, the conversion of mangroves to shrimp ponds could also result in decline of the natural shrimp populations (Ong, 1978). It is only in the past decade or so that a more enlightened view has been taken in terms of the use of mangroves for aquaculture.

Not all mariculture activities are incompatible with the existence of mangroves. Blood cockles (*Anadara granosa*) occur naturally in some mangrove mudflats. The young (seeds) are harvested and grown in other mudflats where they do not naturally occur and cannot regenerate naturally. This is a multimillion dollar mariculture industry. Natural cockle beds are thus very important assets. Yet it is surprising how little is known about why natural cockle beds occur where they do or the mechanism of cockle spat settlement.

Floating-cage fish (grouper and sea bass are the two most commonly farmed species) culture in mangrove estuaries is another mariculture activity that is compatible with the existence of the mangrove ecosystem. This is also a multimillion dollar industry, but the main problem is the availability of seeds.
2. Issues

2.1 Displaced people

The 2004 Indian Ocean tsunami killed 52 people in Malaysia; five are still missing and approximately 205 were injured.

In Penang, 238 houses were destroyed, eight were badly damaged and 275 other buildings needed minor repairs; more than a thousand boats were either destroyed or badly damaged. Emergency governmental services (police, fire and rescue, ambulance) as well as non-governmental groups (the Red Crescent Society and the St John’s Ambulance Brigade) provided much of the initial assistance. Almost 3 000 people were evacuated and housed in temporary relief centres (mainly schools and community centres). Others stayed with family and friends. This housing relief was organized by the Social Welfare Department. Non-government organizations also assisted in providing living essentials, funded by public donations (Horton et al. [in review]).

A recent visit to the Tanjung Bungah (on Penang Island) tsunami-damaged site revealed a number of blocks of almost completed four-to-five-storey apartments, consisting of some 250 apparently medium to low cost units (enough to replace the 238 dwellings lost in Penang). This is almost certainly a state government project for displaced people. Almost RM79 million (RM3.65 = US$1.00) were collected from generous public donations and RM20 million (plus another RM10 million or so already used for low-quality housing) were used for housing in Langkawi, Kota Kuala Muda and Penang. It is not known if these units will be given away or sold at low cost. It is interesting to note that it took about two years after the tsunami to eventually provide permanent housing for all of the displaced people. The sociological question is whether people (especially fisherfolk) who used to live right on the beach (perhaps as squatters) would be happy with apartments (which would be legally theirs), because of the need to adjust to a change in lifestyle.

“Land capture” is basically not an issue in Malaysia. Many of the dwellings in Tanjung Bungah that were destroyed or badly damaged were built directly into the sea and they may have been illegally erected on Crown property (or government-owned state land). Some 100 units of temporary “houses” have been built by the government, not far from the Tanjung Bungah site, for medium-term relief for people in dire need (most likely those who were squatters or those with temporary occupancy licenses). Perhaps this a win-win situation where the squatters have to move out of their illegal dwellings (saving the government from having to otherwise remove them), but who are now being provided with alternative but legal dwellings.

In Langkawi, there was a single human fatality (a disabled person who could not get out of harm’s way in time). Some 250 houses were badly damaged or completely destroyed; 1 500 residents (of a total of approximately 3 500) were affected initially. Over 100 fishing boats were badly damaged or destroyed. No temporary housing was provided but permanent housing is planned (Bird et al. [in review]).
2.2 Fisheries losses

Bird *et al.* (in review), quoting *Aquaculture magazine* (2005) and the Worldfish Centre (2005), reported that throughout Malaysia, 155 fish farmers lost an estimated US$6.3 million and 5200 fisherfolk lost an estimated US$7.71 million. It was widely reported in the press that governments (federal and state) provided equity for those who suffered damage to boats, outboard engines, fishing gear and other property. Later press reports indicated that the funds came from public donations and that almost RM10 million were allocated to the Kedah State Government to assist affected fisherfolk. There were also accusations of misuse of funds. The author is unaware of damage to any major aquaculture ponds (there are many in the Merbok mangroves in Kedah and also on the west coast of Penang Island) by the tsunami. Fish farmers who used floating cages suffered the worst damages.

2.3 Post-tsunami coastline stabilization

Following the tsunami, almost the entire coast of west Peninsular Malaysia has been consolidated (revetments, sea walls etc.), although the natural geomorphological dynamics of accretion and erosion still occur. The Department of Drainage and Irrigation reacted swiftly with earthworks in some of the affected estuaries on the west coast of Penang. It appeared as though the estuaries had been deepened, evidenced by earth (dredge spoils) piled on one bank of the estuary. Exactly why this occurred is not known, but it resulted in a slight loss of mangroves (either physically destroyed during the earthworks or killed as a result of changes to hydrodynamics).

The main post-tsunami activity (evident in local press reports) is the new importance being placed on the mangrove ecosystem for alleviating tsunami impacts. There have been many reports of mangrove rehabilitation, despite the fact that the tsunami did not damage mangroves. Some additional consolidation (revetments as well as sea walls) is also evident in Langkawi and the northwest coast of Penang, but it is minor.

The federal government has apparently allocated substantial funding for the rehabilitation of mangroves and there has been a surge in the price of mangrove propagules and seedlings (almost entirely *Rhizophora apiculata*). Seedlings are sourced from the Matang Mangrove in Perak where there is a long tradition of planting with *Rhizophora apiculata*. A number of mangrove rehabilitation projects have been implemented in the past year and a half since the tsunami strike. From the outset, these projects are doomed to failure because there was no damage and thus no suitable areas for rehabilitation.

It must first be realized that the tsunami did practically no visible damage to the mangrove trees. A very few uprooted trees may have been visible after the event, but it is not clear if the uprooting was attributable to the tsunami. In any case, the damage was insignificant in terms of damage to mangroves. The questions then are:

- Why was there a perceived need for rehabilitation of mangroves?
- Who informed the government of this wrongly perceived need?
- Was any ground survey done to determine which mangroves were destroyed by the tsunami and thus needed rehabilitation?
In the meantime, hundreds of thousands of dollars have been spent on planting mangroves in the wrong places. In many instances the species of mangrove planted is not the most ecologically suitable. On the northwest coast of Penang there have been plantings of *Rhizophora apiculata* under an already very good cover of *Avicennia marina*. This was apparently a project involving the local community with the help of a university in Penang. Most of the planted *Rhizophora apiculata* seedlings have died (probably through lack of adequate light). This activity raises two fundamental questions: 1) In the first place, adequate mangrove cover (mainly *Avicennia marina*) was already in place, so what was the purpose of planting *Rhizophora apiculata*? 2) Are the people involved in this project aware of what they have been doing (apart from obtaining funds to carry out their work)? On the southwest coast of Penang, dredged spoils from earthworks carried out very soon after the tsunami were piled on one bank of the estuary. To be fair, the people responsible for this constructed concrete openings in the earth bund. Unfortunately, this was not enough to provide the necessary hydrological circulation for the mangrove community (dominated by *Avicennia marina*) behind the bund and a patch of mangroves was destroyed. Again, they tried to react properly by introducing mangrove seedlings to the patch where the *Avicennia* had died. Unfortunately, the seedlings they planted were *Rhizophora apiculata*, which was not a suitable species to plant. Needless to say, most of the seedlings have died. *Avicennia* seedlings may have survived better, but then again, what was the cause of the death of the original *Avicennia*? If it was due to detrimental changes to the hydrological regime, this should have been addressed scientifically rather than adopting a knee-jerk reaction by simply planting new seedlings.

Another mangrove rehabilitation project took place on the southern coast of Kedah, near Pulau Sayap. Once more, there was no visible damage to mangroves caused by the tsunami. So what was the reason for rehabilitation? *Rhizophora apiculata* mangrove seedlings grown in PVC tubes (presumably to protect against wave or even crab predation) were planted in the mudflats in the seaward front of the existing mangrove (mainly *Avicennia marina*). Within weeks, most of the seedlings had been destroyed and their PVC containers were strewn everywhere by wave action. Although the shores of the Straits of Malacca are low-energy coasts, considerable energy is generated during storm events as well as from the bow waves from passing sea vessels. Even if waves are not a problem, mudflats are certainly not the ecologically correct place to plant mangroves. Mangroves cannot survive in the long term on mud or sand flats.

Malaysia prides itself as being very knowledgeable on matters concerning mangroves, but why have the aforesaid mangrove rehabilitation projects not succeeded?

On the west coast of Penang (and also in Kedah) there was a limited amount of flooding of agricultural land by the tsunami. This affected small areas of banana, coconut and other fruit crops as well as rice. Bananas have very low tolerance to seawater intrusion and the affected crops were destroyed. The damage to crops, however, appeared to be minimal as tree crops such as coconuts were unaffected, whilst subsequent crops of bananas and rice did not appear to be adversely affected by the seawater intrusion caused by the tsunami. This was probably attributable to the quick and effective washout or leaching of salt by the high precipitation in Malaysia.
3. Policies and institutions

3.1 Governance and institutional structures for coastal land management

Malaysia is constituted by 13 states (Perlis, Kedah, Penang, Perak, Selangor, Negeri Sembilan, Malacca, Johor, Pahang, Kelantan and Trengganu in Peninsular Malaysia and Sabah and Sarawak in East Malaysia, on the island of Borneo) and the federal territories of Kuala Lumpur (on the peninsula) and Labuan (in East Malaysia). The Government of Malaysia is the federal government (with land in the federal territories under its jurisdiction) and each of the states also has its own elected government. One of the peculiar characteristics of this system (pertaining to coastal management issues) is that all land matters are under the jurisdiction of the different state governments. The main government agency that is responsible for the country’s mangroves is the Forestry Department. The Forestry Department operates at two levels. It is in overall charge at the federal level so all Forestry Department staff in Peninsular Malaysia are answerable to the Forestry Department’s director-general (federal level) in Kuala Lumpur. The exception appears to be that the forestry departments of the East Malaysian states of Sabah and Sarawak are autonomous (not under the federal Forestry Department). Forestry Department staff (especially the non-uniformed staff) in Peninsular Malaysia are liable to transfer from state to state or to Kuala Lumpur. Indeed, regular transfer of staff after a few years appears to be routine. At the state level the state forestry departments provide advice to the different state governments. Any policy or land-use decision is entirely the jurisdiction of the state governments: The agency only provides advice and recommendations. Its other main role is to manage the forest reserves in the states. A large percentage (more than 90 percent in most cases) of mangroves in the states is designated as forest reserves and this brings them under the jurisdiction of the Forestry Department. The term “forest reserve” may insinuate that they are conservation areas, but they are not. Most of the reserves are productive reserves and are thus managed for the production of timber. A small proportion are Protective Reserves and they are somewhat closer to being areas set aside for conservation (but certainly do not receive the level of protection accorded to state or national parks). The small percentage of mangroves known as State Land Mangrove are not under the jurisdiction of the Forest Department and state governments need not refer to the Forestry Department with regard to their use.

Until a few years ago the Forestry Department was under the Federal Ministry of Primary Production (as forests produce timber). It is now under the Federal Ministry of the Environment and Natural Resources. It is hoped that there will also be a paradigm shift in the way forest resources are treated.

The Fisheries Department, another important agency for the management of mangroves, has a similar organizational structure but has no legal jurisdiction on mangroves. However, it is often consulted, especially when fisheries issues are involved.

3.2 Community-based governance

Essentially, governance in Peninsular Malaysia is top-down with the government providing equity, so community-based governance is virtually non-existent. At the village level there are village heads who act more as community leaders with only informal government recognition, so their role in policy issues is marginal, at best.
3.3 Policies and regulations governing coastal land/resource management and use: conflicts and gaps

Whilst it is clear that the intertidal mangroves are under the jurisdiction of the Forestry Department, there was initial (in the 1970s) uncertainty as to which department had jurisdiction over the subtidal and even the marine areas. For instance, when the question of marine parks arose in the 1970s, neither the Fisheries Department nor the Marine Department were clear about their roles. Although there is currently a National Parks Department, the Fisheries Department now plays a major role in the management of marine parks (perhaps because coral reefs are very much in their domain). This is an example of “it has nothing to do with us” or the other extreme of fighting over jurisdiction (depending perhaps on the political flavor of the day).

Mangroves provide a multitude of goods and services (Ewel et al., 2001), but under the Forestry Department management essentially concerns tree care and timber harvesting. Fish produce is also important, but the Fisheries Department has no jurisdiction over the mangroves. If mangroves are important to fisheries, why did the Fisheries Department encourage the conversion of mangroves to shrimp ponds? Perhaps the causal problem is economic in nature because mangroves are grossly undervalued (Ong et al., 2001) and economic market failure requires the government to intervene and provide equity.

3.4 Integrated coastal management

There have been a number of attempts at integrated coastal management (ICM), the first of which was an ASEAN–USAID project in the State of Johor almost 20 years ago (MCRST, 1992). The plan still remains on the shelf although Chua (2001), the main author of the plan, reported that in 1996, the state government formally established an ICM unit “to execute some of the plan’s recommendations for South Johor.” The question is: how effective is an ICM when it is only executed in part?

Perhaps the main reason for the lack of follow up is that the existing structure of decision-making is such that it would take considerable effort and change to incorporate coastal area management plans into the mainstream. Government officials are more often than not conservative and new ideas are not easily accepted. The early plans were perhaps weak in terms of understanding or explaining what changes needed to be made to the governance structure in order to implement ICM plans.

More recently (for example Penang State Government and DANCED, 1998), there was a DANCED project in Penang (and also in Sabah and Sarawak). The Penang project folded as soon as Danish funds terminated, so the plan remains on paper. Apparently only the Sabah project has seen some follow-up action. It would be a useful lesson to investigate why two of the projects failed (for example sourcing the reports that emerged from the Penang project) whilst the other was more successful.

The lack of political will or commitment by the responsible implementing agency may be another reason for failure. The initial offer of aid from foreign funding agencies is usually too attractive to refuse, but once the funds run out there is either a lack of will or the mechanism to follow through. Funding agencies must find a mechanism to ensure the long-term sustainability of the projects they fund.
3.5 Planning and decision-making processes

As land is a state issue, policies and regulations are essentially under the State Executive Council that makes all of the decisions (in consultation with the relevant government agency).

For example: Application for alienation of state land is made through the State Land Office (which registers and records all landownerships). The relevant government agencies are consulted to seek their opinions. For instance, an application for the alienation of mangrove land for aquaculture use (such as conversion to shrimp ponds) will go to at least the Forestry and Fisheries departments. The Drainage & Irrigation Department would most likely also be directly asked for comments. In all probability these entities would then approach the State Socio-economic Planning Unit. The final decision is made at the State Executive Committee meeting where all the government agencies are present. Even if one of the agencies is not in favor of the alienation, this does not mean that the State Executive Committee cannot make a contrary decision. Agencies may also not object (the State Executive Council is essentially their employer) if they perceive that politically powerful proponents are involved and it is already a foregone conclusion.

In the last few years there has been paid at least lip service to have relevant stakeholders involved. Some NGOs have been regularly invited to provide their comments, but it is inevitable that some relevant stakeholders are excluded.

Each of the states has its own Economic Planning Unit (EPU) and the EPU provides the necessary input to the State Executive Council. The relevant government agencies also provide input or feedback. It is not known what sort of socio-economic tools these agencies use. As their name implies, the EPUs are primarily interested in the economic viability and repercussions of the projects. Presumably some integration may occur at the EPU level. The State Executive Council listens to the various agencies, which is perhaps where any integration lies.

3.6 Environmental impact assessment (EIA)

Since the introduction of the Environmental Quality Act, 1974, all development projects covering an area in excess of 50 hectares are legally required to provide an EIA. Even though land is under the states, this item of legislation provides, at least on paper, some degree of protection to the environment: “To provide continued economic, social, and cultural progress of Malaysian people through environmentally sound and sustainable development” (Sham Sani and Sharifah Mastura, 1998). In practice, one loophole that is used is to divide development projects into slightly below 50-hectare parcels. Political pressures also appear to influence project approvals. Another problem is that there are few independent EIA assessors and there is hardly any monitoring of supposed mitigating actions. Properly implemented, the EIA would play its intended role, but as it stands it adds cost to projects with little benefit to the environment. The main beneficiaries are EIA consultants (some of whom are not very competent).

4. Lessons learned and solutions identified

The damage in Malaysia was essentially minimal and so did not evoke any paradigm shift, thus the situation remains basically “business as usual”. Two early warning tsunami buoys
have been deployed, but there are no signs as to how local populations will be warned. It is also not known if either of these buoys is functional, many months into their physical deployment. It may also be worth asking how long the buoys will remain functional; apparently the buoy deployed in Indonesian waters was non-functional so there was no warning of the recent tsunami in south Java. Installing high technology buoys is one issue, but unless a very robust maintenance element is provided they are bound to fail.

As noted earlier, early warnings were given to hotels in Langkawi and Penang (from counterpart hotels in Phuket) and some beaches were cleared of tourists (and many lives saved). This shows how useful informal local networking can be in such situations.

4.1 Opportunities missed

A few months after the tsunami, some fisherfolk in Sungai Merbok (a mangrove estuary in Kedah) mentioned that the shrimp *Acetes*, used for making a local condiment called “belachan”, had completely disappeared from their catches. The species *Acetes* is a zooplankton and it would have been interesting to have been able to trace how this planktonic species was wiped out, and then how it recovered.

The tsunami waves also brought in an unusually heavy load of sediment, because it is not just a surface wave, like wind-generated waves, but covers the entire depth. Does this phenomenon renew the sea floor (much of which has been badly scarred by years of otter-board trawl fishing)? So there may be at least a positive aspect of this extremely episodic event: one of renewal. It is also not known how much of this sediment has been deposited in the mangroves (and also on some agricultural land), or its effects.

Another anecdotal report is that the sand crab, *Emerita asiatica*, which was once very common on sandy beaches but then recently became rare or absent, has returned to the beaches after the tsunami.

It is regrettable that Malaysia does not have a mechanism in place for funding research of an episodic (or sudden) event such as the 2004 tsunami. Perhaps this is an issue policy-makers should address and incorporate into future science policies. It this respect, Malaysia was extremely slow in scientific surveys of the impact on its various coastal ecosystems.

Bibliography


