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Potentials, Threats and Challenges in Managing Natural Heritage in the Penang National Park

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Abstract. Penang is one of the most developed and highly urbanised states in Malaysia with very little remaining forests. The Penang National Park (PNP) was gazetted in 2003 with only 1200 hectares. It is one of the smallest national parks in the world, but the park is rich in natural heritage such as pristine rainforest, rich biodiversity, white sandy beaches, crystal clear sea, clean rivers, a meromictic lake and a scenic natural environment. However, many threats to the PNP are identified, including encroachment from farming, tourism development, environmental pollution, over-collection of plants and animals, poaching, ineffective management, poor enforcement and the lack of stakeholders' involvement. The challenges in managing the PNP include addressing all the mentioned threats. Although not a straight forward and easy task, the threats can be reduced via a holistic and integrated management approach, careful planning and expert guidance, strict monitoring of development and enforcement, and active involvement of all stakeholders via empowerment. The park can also be developed into a nature education centre for students and used as a natural laboratory for research and data collection. On the whole, integrated environmental planning and management of the PNP with a focus on ecotourism will lead to sustainable development and ensure the park remains a lasting natural heritage area.

Keywords and phrases: Penang National Park, national park management, natural heritage, ecotourism, environmental conservation

Introduction

Penang is one of the most developed and highly urbanised states in Malaysia. Much of its original forest cover has been cleared for development, with very little forest remaining (62.9 km^2 or 6.1 percent of total land area) as water catchments (Maidinsa 2011). The Penang National Park (PNP) was gazetted in 2003 to preserve this remaining natural heritage area (Kumar 2004a). Chan et al. (2003) noted that with an area of only 1,200 hectares, the PNP (previously Pantai Acheh Forest Reserve or PAFR) is one of the smallest national parks in the world. Hong et al. (2013) and Hong (2013) have documented the threats to the

PNP via SWOT analysis. The PNP is surrounded by urban, agricultural and other built-up areas, all of which are putting pressures on the park, making this rich natural heritage site highly sensitive to environmental damage. Despite its small size and the many threats surrounding it, the park is a treasure trove of attractive natural heritage such as pristine rainforest, rich biodiversity, white sandy beaches, crystal clear seas, clean rivers, a meromictic lake, scenic environment and other natural attractions. It has all the potentials to be a major natural heritage destination in northern Peninsular Malaysia, most notably for ecotourism, education and conservation (Chan et al. 2004).

The PNP is a small natural sanctuary surrounded by urban built-up areas as well as agricultural land and aquaculture farms in the seas, resulting in many threats faced by the park. Amongst the threats are encroachment from farming, infrastructure development, environmental pollution, over-collection of plants and animals, poaching, mass tourism, ineffective park management, poor enforcement and the lack of stakeholders' involvement. These threats have given rise to many challenges in managing the PNP. The challenges include addressing all the threats the park face, although this is not a straight forward and easy task. The threats can be reduced via careful planning and expert guidance, strict monitoring of development and enforcement, prudent planning and involvement of all stakeholders via empowerment. The PNP can be effectively monitored and managed in specific development zones. While government agencies have the mandate to manage the park, they should invite non-governmental organisations (NGOs), industry, business and the public to work together to manage the park. NGOs can run public awareness programmes on biodiversity, flora and fauna, public education activities on catchment, river and water conservation, and "Save Wildlife" camps. The private sector's Corporate Social Responsibility (CSR) programmes can be matched with government and NGO programmes holistically into providing funding, mandates and expertise in managing the park. Industry and businesses can also team up with NGOs to run various environmental activities in the park. Tour operators and hotels in Penang should also start to market the PNP more aggressively by offering tour packages (especially ecotourism) into the PNP. All stakeholders, particularly local communities, should be involved actively in managing the park. Study tours should be a top priority of tour operators rather than mass tourism. There should also be avenues for tourists to take part in meaningful environmental conservation activities in the park. The park can also be developed into a nature education centre for students and used as a natural laboratory for research and data collection. On the whole, integrated environmental planning and management of the PNP will lead to sustainable development and make the park into a lasting natural heritage area (Hong et al. 2014).

In terms of heritage conservation, Penang has always had a vibrant civil society that is concerned with the well-being of community, economy and the environment

(Sustainable Penang 2014). In the area of heritage, civil society has created much awareness and there is a strong movement to conserve the state's heritage. However, much of heritage conservation is largely focused on the conservation of cultural heritage. This is more evident when George Town was listed as a UNESCO World Heritage Site on 7 July 2008 (Khor 2008). This listing was largely based on George Town's history and rich cultural heritage including the clan jetties, its fort, old buildings and other cultural heritage. Without taking away Penang's glamour and the deserved award as a UNESCO World Heritage Site, it has to be stressed that Penang has equally attractive natural heritage, despite the fact that it is one of the country's most rapidly developing states. Penang is in fact peninsular Malaysia's northern growth pole; the state being one of the most rapidly industrialising, urbanising and affluent in the country. Such development has brought about negative effects on its environment and natural heritage.

Over the past half a century or so, Penang, especially the island, has undergone phenomenal changes. In terms of land use, very little natural vegetation is left as they have been replaced by urban, industrial, commercial, housing and agricultural land use (Chan et al. 1998). While such changes have brought development, additional income and better standard of living, urbanisation and industrialisation to the state, they have not come without cost. In fact, development has brought about high environmental costs in terms of loss of natural heritage, habitats and drop in the quality of life. Haphazard development has also exacerbated environmental hazards and brought about general degradation of the living environment (Chan et al. 2003). Air pollution caused by the ever increasing number of motorised vehicles, industries, commercial business and homes has also given rise to bad air quality, increased frequencies of haze episodes and the urban heat island effect (Sin and Chan, 2004). Consequently, very few natural forested areas are left on the island. Currently, only 6,406 hectares of land (6 percent of total land area) is gazetted as Permanent Forest Reserve (PFR) in which the administration, management and conservation of forest and forestry departments are provided for in the National Forestry Act 1984. This forested area is small in comparison to other states as the national policy proposes maintaining at least 50 percent coverage of forest (Penang State Government 1999, 7).

In terms of climate change, an issue that is gripping the global community, Chan et al. (2003) have found that the micro-climate within Penang state is changing, but more importantly, it was found that the city of George Town experiences significantly higher temperatures compared to forested areas. The study found that the cooling effect of trees and their canopies have reduced temperatures in the forest, which is cooler by a degree or so compared to the city. The relative

humidity inside the forest is also significantly higher, due to high and abundant evapotranspiration. Evapotranspiration takes away a significant amount of heat from the forest, transporting the heat into the atmosphere. Hence, the forest remains cooler even during mid-day. Naturally, solar radiation hardly reaches the forest floor due to the dense canopy. The dense forest trees also form a barrier against wind, reducing wind speed due to friction. There is hardly any wind inside the forest even during the daytime when the sea breeze is constantly blowing. The forest also fogs up easily during the early mornings and at night. Because of its unique micro-climatic characteristics, the forest should be protected from encroachment and deforestation of all forms.

On a global perspective, the forest forms a green lung that gives out oxygen; it serves as a carbon sink, absorbing carbon dioxide from the atmosphere during photosynthesis. Hence, the forest acts as a regulating agent to maintain the air quality of the place. Sin and Chan (2004) has demonstrated that rapid urbanisation on Penang island, a process that reduces forested land and green areas into urban built-up areas, has resulted in George Town, Bayan Baru, Air Itam and other townships experiencing the "Urban Heat Island Effect". Consequently, the average temperatures, both day-time and night-time, are one to three degrees Celsius higher than forested areas such as the Penang Botanic Gardens and the Penang National Park. Over the years, the rate of urbanisation in Penang island has increased rapidly from 75 percent in 1991 to 86.1 percent in 2000 (Chan et al. 1998). As a result of development pressures on hill land and forest land, more and more of such areas are targets for development and since such areas are environmentally sensitive, not only are forest and biodiversity lost but also hazards such as soil erosion, landslides, water pollution and flooding are on the increase. In the light of the above scenario, PNP, located in the northwest, and covering about 1,265 hectares of primarily coastal hill dipterocarp forests, coastal mangrove forests, beaches and rocky shores, has been gazetted as a PFR under the Forestry Ordinance of 1928. It is managed by the Penang Forestry Department and the PNP represents one of the few remaining significant forested areas in Penang state. The significance of the area as a natural heritage was recognised by nature lovers in the 1950s who pushed for it to be gazetted as a state park. However, it was only in April 2003 after more than half a century that the area was declared and gazetted as PNP. Thereafter, the PNP was put under the management of the Department of Wildlife (Jabatan Perlindungan Hidupan Liar dan Taman Negara [PERHILITAN] 2009).

As one of the most urbanised states in the country, much of the forest in Penang has been cleared. The PNP is one of the few remaining forested areas left on the island. It is rich in natural heritage as manifested by the many species of flora and fauna (Chan et al. 2003). Many expeditions have been carried out in the PNP over the years. In 1978, the Malaysian Nature Society (MNS) Penang Branch, in

collaboration with the School of Biological Sciences, Universiti Sains Malaysia (USM) carried out a natural resources survey in the PNP and found that species diversity was high with 25 species of mammals, 53 species of butterflies, 46 species of birds and a considerable variety of marine life (such as sea anemones, corals, molluscs, crustaceans, echinoderms and sea turtles). In 1985, the MNS Penang Branch again sent a memorandum to the Penang State Structure Plan Unit advocating that PNP be designated as a national park in the Penang Island Structure Plan. The Penang State Government has also commissioned two comprehensive studies, "The Penang Environmental Conservation Strategy" and "The Balik Pulau Drainage Study", both of which recognised the importance of conserving the PNP (Penang State Government 1999). In 2000, the MNS and USM jointly organised a scientific expedition to study the PNP and this culminated in a seminar titled "Penang National Park: The Case for a State Park". The seminar paved the way for the then Chief Minister Tan Sri Dr Koh Tsu Koon to announce that the State Government was committed and had targeted turning the PNP into a conservation park. In April 2003, the area was declared a national park (Kumar 2004a).

Materials and Methods

This study is based on both primary as well as secondary data. The analysis on the geography, topography and geomorphology was based on existing aerial photographs and topography maps (1:50,000 scale). Interpretation of aerial photographs, topographic maps and existing research reports were carried out in the map library of the School of Humanities, USM. Description of the geography, topography, land use and geomorphic features were based on these interpretations. Field survey to verify the data was carried out. Primary data on the physical aspects of the study area was also collected. Recording and interpretation of the topography (altitude, slopes, hill peaks and lowlands), geomorphology (promontories, bays and beaches), hydrological features (the meromictic lake, streams and wetlands), land use (vegetation, crops, orchards and mangroves), soils and other geographic features were documented with digital camera and on-sight mapping via land survey methods. Basic chain and compass survey methodology was used in mapping the physical features. Identification of threats was carried out via observation and documentation, as well as interviews with stakeholders. Secondary data on climate, land use, geology and other features was also obtained from various sources. The essay is written based on data collected from various other secondary sources including Chan et al. (2003).

Results and Discussion

The PNP is located in the north-western portion of Penang Island covering an area of more than 1,265 hectares, i.e., less than 4.2 percent of the total area in Penang island. Other than the Penang Hill area, it is currently the only sizable forest reserve left on Penang Island. Because it is forested, the micro-climate is markedly different from that of George Town, with slightly cooler temperatures ranging from 23°C in the early mornings to 30°C in the afternoons. Inside the dense cover of the forest canopy, temperatures seldom exceed 28°C. Humidity is high, up to 80 percent, usually reaching saturation in the early mornings and hence giving rise to fog and mist. Annual rainfall is also high, averaging more than 2,600 mm. Penang state is located close to the Equator but far enough north to experience some monsoon effects. Therefore, it has an equatorial climate with minor monsoon characteristics. Hence, the climate of the PNP is hot and humid, typically equatorial, but under the influence of the southwest monsoon winds and the presence of a distinct short dry season. Temperatures in the PNP are generally high all year round with slightly lower temperatures of between 0.5°C and 1.0°C in the hill peaks and inside the forested areas. Because of this uniform temperature all year round, the seasons in the PNP are distinguished not by temperature but by rainfall. Basically (although there are small variations between regions), the year is divided into four seasons: (1) the northeast monsoon season (November–March); (2) the southwest monsoon season (May–September); (3) the first inter-monsoon season (April/May); and (4) the second inter-monsoon season (October). Monsoon winds play an important role in determining the climate of the island. Due to its maritime nature and high rainfall, the humidity is constantly high (averages about 90 percent but can reach saturation in the early mornings and in areas of high altitudes). Due to the high temperatures, a high rate of evaporation occurs.

Potentials of Natural Heritage Attractions in PNP

The PNP is a rich natural heritage area as discovered by Chan (2003). Despite its designation as a forest reserve, the PNP is not a virgin forest as timber extraction has been variously carried out between the late 1910s and the late 1930s. Despite being logged previously, however, there are currently about some 72 hectares of virgin jungle reserve left in the PNP and these areas are floristically rich. Other unique characteristics of the PNP are: its diversity of ecologically sensitive habitats; rich fauna; the sandy beaches, some of which are Pantai Kerachut, Pantai Mas and Pantai Acheh; a number of trekking trails suitable for ecotourism; the USM biological station at Muka Head; many natural streams which possesses potential water resources; its unique climatic characteristics which differ significantly from its developed fringes; and other biological traits. All these combine to make the PNP an invaluable natural laboratory for scientific study

(Chan 2000). The major flora of the PNP corresponds closely with that which is characteristic of the vegetation of Peninsular Malaysia, viz. the coastal mangrove forest, lowland dipterocarp forest and some hill dipterocarp forests near the peaks of some of the hills in the PNP. The main families in the dipterocarp forest found are *Dipterocarpaceae*, *Leguminosae*, *Apocynaceae*, *Burseraceae*, *Dillenaceae*, *Palmae* and others. Herbaceous plants in the forest include *Araceae*, *Marantaceae*, *Gesneriaceae*, *Zingiberaceae* and *Commelinaceae*. However, some of the commercially important species are Balau (*Shorea materiales*), Seraya (*Shorea curtisi*), Meranti (*Shorea sp.*), Resak (*Hopea sp.*), Merawan (*Hopea sp.*), Damar Laut and Damar Minyak. The Seraya, in particular, is an easy sight as it has distinct greyish green foliage emerging from the canopy. The Damar Minyak (*Agathis dammara*) is also easy to identify with its distinctive flaky bark which oozes a resin when cut. Another common tree is the fig tree belonging to the family *Moraceae*. This tree produces a round-shaped fruit that has an opening on the lower exterior. Ferns and fern-allies are also found in abundance in the PNP. One unique species is the Stag Horn's Fern (*Platycerium coronarium*). Another is the Bird's Nest Fern (*Asplenium nidus*) which is usually found on tree trunks and branches. The Oak Leaf Fern (*Drynaria spp.*) has nest-like leaves that appear brownish and dehydrated. In higher areas in the forest, the sun loving ferns such as *Dipteris conjugata* and *Dicranopteris linearis* (Chan, 2004) are found growing well. Wild orchids are also found in the PNP. The Slipper Orchid (*Paphiopedium barbatum*), with its slipper-like lip, was once the pride of Penang. The flower of this orchid is purplish with green stripes. However, this species is now endangered because of over-collection and encroachment of its habitat by farmers. It has not been seen for a long time. Other more common wild orchids are the *Bromhedia finlaysoniana* with white flowers and mauve lips, the *Arundina graminifolia* with bamboo-like leaves, and the Jewel Orchids, i.e., species from the *Anaectochilus*, *Ludisia* and *Goodyera*. Due to their sensitivities to environmental change, it is rare to encounter wild orchids in the forest. One would have to trek deep into the forest, especially in more remote areas to see them. The forests of the PNP are also the home of many species of wild ginger. The more common ones are the *Hedychium longicornitum*, an epiphytic form, but most are terrestrials such as *Alpinia javanica*, *Amomum biflorum*, *Amomum uliginosum*, and *Globba pendula*. The *Achasma* has scarlet flowers protruding from the ground. Other types are the torch ginger, *bunga kantan* (now commercially cultivated) and *lengkuas* (*Alpinia galanga*). The pitcher plant is perhaps the most recognisable flora in the PNP because of its unique features. Some common ones are the *Nepenthes albomarginata* recognised by the white ring below the pitcher's mouth and the *Nepenthes ampullaria*.

The PNP also has mangrove forests which are found in small pockets in the coastal zones, both in the northern as well as the western and southern coasts. The major species of mangroves are the *Avicennia-Sonneratia* zone (furthest seaward) usually

colonised by *api api* (*Avicennia alba* and *Avicennia marina*) and *perepat* (*Sonneratia alba*). Further inland is the *Bruguiera-Rhizophora* zone, largely dominated by *berus* (*Bruguiera cylindrica*), *tumu* (*Bruguiera gymnorrhiza*) and *bakau kurap* (*Rhizophora mucronata*). Most of the mangroves in the PNP are found on the muddy parts of the western coast along Pantai Mas and towards the south near Kampong Pantai Acheh. Some mangroves can also be seen on the north coast just as one enters the PNP. *Gelam* trees (*Eugennia spp.*) are found in the meromictic lake in the Pantai Kerachut area. Other coastal vegetation include the colourful Sea Morning Glory (*Ipomoea pes-caprae*) on sandy shores with its prominent purple coloured flowers, Leguminosae (*Canavalia microcarpa*), and some grasses of the Graminae type such as *Ischaemum muticum, Spinifex littoreus* and *Zoysia matrella*. In particular, the *Ipomoea pes-caprae* are found in large colonies on the sandy beaches of Pantai Kerachut. In other sandy areas, the *Barringtonia* association found in areas flooded during high tide thrives. In drier areas, the *Barringtonia* association is colonised by trees, shrubs and tall herbs such as the Lecythidaceae (*Barringtonia asiatica* or *putat laut*) and Clusiaceae (*Calophyllum inophyllum* or *bintangor laut*). Another coastal plant is the Sea Lettuce (*Scaevola frutescens*), a shrub. This plant produces white flowers which appear split. The Sea Hibiscus (*Hibiscus tiliaceus*) has bright yellow flowers with a maroon coloured heart.

In terms of fauna, the PNP is also quite rich as it has been documented that there are at least 25 species of mammals, 53 species of butterflies, 46 species of birds (including a significant number of migrants) and a considerable variety of marine life in the adjacent sea (including sea anemones, corals, molluscs, crustaceans, schinoderms and sea turtles). There are also many species of land and sea snakes, the python being most commonly found. Other fauna that have been sighted in the PNP include the common tree shrew (*Tupaia glis*), slow loris, flying lemur (*Gynocephalus veriegatus*), sea otters (Pantai Mas area), pangolin or scaly ant-eater, leopard cat and civet cat. Wild boars and mouse deer are common. There are also many species of bats in the PNP. Campers are often treated to the flight of giant Flying Foxes or Giant Fruit Bats, i.e. the largest of all the bats. In the swampy areas of the PNP, monitor lizards are abundant. The common ones are the Black Jungle Monitor, the Water Monitor and the Tree Monitor (Chan 2000). Tourists and nature lovers can see the green turtles (*Chelonia mydas*) which usually arrive in the beaches of the PNP from April to August. They are then followed by the Olive-Ridley (*Lepidochelys olivaceae*) from September to February. The green turtles get their name from the colour of its fat content as a mature turtle can grow to a size of about one metre in length weighing more than 150 kg. The Olive-Ridley, however, are one of the world's smallest turtles weighing around 40 kg. The PNP is only one of two known breeding sites of the Olive-Ridley in the whole country (the other site is Terengganu). Most of the above types lay their eggs in the sandy beaches of Pantai Kerachut although they are also found in Pantai Mas,

Teluk Kampi, Teluk Ketapang and other beaches. The Hawkbill turtle (*Eretmochelys imbricata*), though less common, is also found. As a form of protection and conservation for these turtles, a hatchery has been set up by the Wildlife Department in 1995 in Pantai Kerachut.

According to Kumar (2004b), Penang island, especially the PNP, is a haven for birdwatchers. Penang island has a recorded total of about 200 species of birds, and the majority of them can be found in the forests of Pantai Acheh. Bulbuls is a common forest bird which is resident in the PNP. Most forest birds are insect-eaters and they include flycatchers, warblers and babblers. The Grey-throated Babbler and Fluffy-backed Tit-Babbler are two of the more commonly found babblers. The sunbird is another common species found. Kingfishers such as the small Oriental Dwarf kingfisher or the large Stork-billed kingfisher are also commonly sighted. In the mudflats of Pantai Mas, one can often see many migrants such as the Japanese Sparrowhawk, Crested Honey-buzzard and the Black Baza. There are also some eagle families in the PNP, particularly in the peaks near the lighthouse on Muka Head, notably the white-bellied sea eagle. The PNP is also home to many species of monkeys. The most common is the Long-tailed Macaque and the Dusky Leaf Monkey. Though the monkeys roam the entire length of the forest, they are increasingly found in fruit orchards and human-inhabited areas for obvious reasons. In the campsite in Pantai Kerachut, for example, these monkeys can be a nuisance as they steal foodstuff, bags and other belongings of campers.

In terms of geomorphic natural heritage, Ibrahim Jaafar and Chang (2003) have documented a unique lake in the PNP. In the PNP at the Pantai Kerachut area lies a unique seasonal lake known as the *Meromictic Lake* (Figure 1). This lake is only apparent and visible during the wet season between the months of March to August. Many small streams flow through the lake into the sea via a narrow bottleneck channel on the right side (north) of Pantai Kerachut. First, during the mentioned months, the water flowing through this bottleneck is partially blocked when the rough seas deposit large quantities of sand and other wave sediments there. Hence, instead of flowing into the sea, the stream water floods the lake. Second, the rough sea sends sea water gushing into the lake. The most intriguing and unique feature of the lake, however, is that the sea water and fresh water layers somehow remain unmixed. Hence, the lake has two distinct layers with the layer of warmer sea water underlying the cooler layer of fresh water on top. Hence, the scientific name "meromictic lake". This is one of the few known meromictic lakes in the whole country. The beaches of PNP are also pristine. Some examples are Pantai Kerachut (Figure 2) and Pantai Duyung.

Figure 1. The unique meromictic lake in the PNP during the dry season (source: Chan Ngai Weng)

Figure 2. The pristine beach of Pantai Kerachut in the PNP is a huge attraction for visitors (source: Chan Ngai Weng)

Threats to the Natural Heritage of PNP

Chan (2003) has highlighted many potential threats to the PNP if a stringent park management plan is not put into place. To substantiate this point, Chan et al. (2004) has documented and modelled environmental change as a result of land use change and shown that environmental degradation can be serious if development is unplanned and uncontrolled in the PNP. For many decades, despite its forest reserve status, the PNP has been encroached by various developments. It is increasingly being encroached by squatters, illegal farmers, collectors of traditional plants and other environmentally damaging activities. Increasingly too, due to Penang island's small size but the unproportionally high demand for housing and other amenities, the state government may be under pressure to degazette part of the reserve for development purposes. This has happened elsewhere in the Paya Terubong hills and is a distinct possibility as land-starved developers are casting a covetous eye on any available tract of land for development. This is what both the MNS and the Penang public do not want, but that does not mean both these parties do not want to see the PNP developed. The word "development" can be stretched to mean many things, including the widely used term "sustainable development" which basically means the management of our natural resources at a rate that does not jeopardise the needs of future generations. MNS (Penang Branch) and the Penang public want to make sure that this last bastion of nature housing biodiversity and the natural environment be protected, sustainably developed and managed properly so as to minimise any chance of large scale environmental degradation and biological destruction. Hence, MNS (Penang Branch) wants the State Government to come up with a comprehensive management plan to manage the PNP. The PNP could be sub-divided into various zones for various controlled activities.

Challenges in Managing Natural Heritage in Penang National Park

Chan (2009) has documented the various issues and challenges of managing natural heritage in the PNP. In the past, the push and proposal to gazette the PAFR as a state or national park came from a balanced participation between government, private sector and NGO (civil society). However, after the gazettement of the PNP, the Wildlife Department was given the sole jurisdiction to manage the park. While this is not necessarily a bad thing, as the department has the expertise and resources to do so. However, other parties who were involved in the push for the park felt marginalised. Some were even of the opinion that they were "sacrificed" as they were left out of the decision-making process for the park. These include not only the NGOs but also various government departments, statutory bodies and local communities. More importantly, as the park is a national park, it now comes under the jurisdiction of the federal government which is located far away in Kuala

Lumpur. Inevitably, there are disagreements and some friction between federal and state government. This became more evident when Penang state fell to the opposition in the 2008 general election. As a result, one of the biggest challenge for PNP is poor coordination, poor enforcement, poor cooperation and institutional competition and dispute. This challenge needs to be quickly resolved if the PNP hopes to be managed in an efficient manner. Notwithstanding political differences, the various levels of government from federal to local need to put aside their differences and work together for the sake of the park. Additionally, the Wildlife Department, now the lead agency, should invite other government departments and NGOs to work with it for the sake of the park. Funding received from the federal government should be used efficiently for park development and conservation.

Agricultural and Other Encroachment

The land use of the area surrounding the PNP is a mixture of water catchment, urban and agricultural land. On one side is the Teluk Bahang Dam and on the other is the Teluk Bahang town, an urbanised area. Surrounding the park on the south and east are orchards and fishing villages. Similarly, farming, whether legal or illegal is an activity which is closely related to the development of hill land. In states where land is scarce such as Penang, farmers often resort to illegal farming of vegetables, flowers and fruit trees. Currently, many hill slopes in the Penang Hill area and in the Teluk Bahang Hill area are illegally farmed. These activities, though not as bad as completely exposing soil surfaces as in construction and deforestation, nevertheless involve clearing dense forests and replacing them with sparsely spaced crops. Soil erosion can increase many folds because of farming on hill slopes, often leading to landslides (Chan 1998). For example, Daniel and Kulasingham (1974) found that erosion rates in forested and planted (vegetable) areas are 25 m^3 km^{-2} yr^{-1} and 732 m^3 km^{-2} yr^{-1} respectively. This is an increase of more than 29 times. In the current study, soil loss data collected between June 1995 and June 1996 on Penang island and computed based on the Universal Soil Loss Equation produced a soil loss of about 19,000 tonnes/hectare/year in freshly deforested land with slopes between 20 to 30 degrees. Given the high intensity of equatorial rainfall in Malaysia, the steep terrain and the resulting high rate of soil loss, landslides are the inevitable results. In comparison, soil loss in a forested catchment in the Air Itam area is only about 0.01 to 1.3 tonnes/hectare/year. Vegetable farming on hill slopes which recorded a soil loss of between 30 to 90 tonnes/hectare/year is already regarded by the authorities with concern (Penang State Government 1993).

Infrastructure Construction

As the PNP is relatively new, much needs to be done to make it attractive as a tourist destination and as a recreational spot. Since its gazettement, the PNP has undergone a face lift in the sense that many new facilities and structures have been constructed to make it accessible and attractive to visitors. At the entrance now is a huge building complete with a visitor centre and other facilities. This is good for the promotion of the PNP and the enhancement of its image as a well-run park. A road has also been constructed to make it more accessible to cars. This is where NGOs and environmentalists have voiced their discontent. In the past, all visitors had to trek into the park as there were no access roads for vehicles. Even motor cycles were not allowed into the park previously. The difficult terrain made it impossible even for motor cycles to pass. In a way, this inaccessibility to vehicles had indirectly protected the park from an avalanche of visitors, tourism operators and vendors. Accommodation facilities were also limited in the past as there were only a few chalets located near the entrance of the park. Once inside the park, one had to camp if one intended to spend a night or so. Hence, there are camping facilities and piped water from springs provided by the Forestry Department at Pantai Kerachut. Critics now claimed that the infrastructure development may increase arrivals and the onslaught of motorised vehicles will not only disturb the natural tranquillity but also cause pollution and traffic accidents. All these may also overtax the park as its carrying capacity may be exceeded. Here, the challenge is to build conservatively and all facilities built should be environmentally friendly. Trees should not be cut unnecessarily but structures should be built round trees.

Other Challenges in the Penang National Park

Ecotourism has not really taken off in the PNP. It remains a big challenge to develop and make the PNP a viable ecotourism destination. Gazetting the PAFR as the PNP is not the end of the story. In fact, now that Penang has a national park, it is time to start working hard to plan and manage the park sustainably and profitably. Recent developments in Penang illustrate the Penang state government's foresight and desire to create a balance between development and conservation. One is the launching of the Sustainable Penang Initiative (SPI) under the Socio-Economic and Environmental Institute (SERI) of Penang. This is the people's response to monitor and map out Penang's current development trends into a sort of "People's Report on Penang" (Socio-Economic & Environmental Research Institute 1997). Another is the completion of The Penang Environmental Conservation Strategy (PECS) by a group of consultants in December 1998 (DCT Consultancy Services 1998). All these also culminated in the gazettement of the Penang National Park in April 2003. The PNP has been variously studied and documented. USM, the Forestry Department, the Wildlife Department, the Malaysian Nature

Society (Penang Branch) and others have documented the physical geography (climate, geology, soil, vegetation and hydrology), the biodiversity of its flora and fauna, and other environmental characteristics of the PNP. However, the environment and its attributes are dynamic and are always changing. Hence, there should be periodic expeditions to continuously document and update existing data. For example, USM is currently using the PNP as an outdoor laboratory whereby students conduct their field work in biology, ecology, forestry, hydrology besides fisheries, plants and insects. Other universities could also be invited or allowed to carry out research and field trips for their students. One potentially viable project is to entice foreign universities to bring their students to conduct summer field courses in the PNP. Already, USM has a research station at Muka Head. The state government could facilitate this and USM could link up with foreign universities in its push towards internationalisation. Areas and fields of studies include but are not limited to the following: climatology, hydrology and environmental studies; marine biology; biology, biodiversity and study of unique endemic species of flora (both land and aquatic); study of tropical species of fauna (land and aquatic); study of insects and invertebrate; study on the recreational, eco-tourism potentials and aesthetic aspects of the area; study on sustainable development of the area into forest reserves & water catchment, a nature education centre for school children, a natural laboratory for scientific research, and a viable site for eco-tourism, recreation and outdoor activities; and other studies.

As a national park, the PNP now has federal funding and there is no question that it should be managed effectively and sustainably. However, not all parts of the park should be developed for tourism or any one single focus. Chan (2000) argues that the PNP needs to be subdivided into management zones with different objectives and functions. Some of these zones should be allocated for public use. Such an area called Public Recreation Zone (PRZ), within the designated park area can be both existing recreation areas or newly created ones. These zones should be freely open to the public. Many existing areas that are considered degraded or altered beyond recovery to their original native states can be designated as PRZs. Such areas include orchards and farmed plots within the area. An example of such a zone is the present Forestry Recreation Park. The thrust of all activities here will be education towards awareness of nature coupled with recreation. There will be picnic spots, camping areas, bird watching activities, walking and jogging trails, trekking and hiking trails and mountain biking trails. However, the prohibition on all petroleum powered vehicles (including motorcycles) in the zone should be strictly enforced. Such environmentally friendly activities will have an appeal for both local and foreign tourists. Robust Recreational Zones (RRZs) are disturbed areas with some chance of recovery and will be available for a range of restricted activities like trekking, camping and character building and health promoting activities normally associated with wilderness and leadership training. The Outward Bound Society may be one of the main users in these zones as would the Malaysian Nature

Society. For instance, rock climbing and abseiling activities can be permitted on some of the cliff structures located within these zones. A further example is the Pantai Kerachut area which for long has been unofficially a robust recreational zone although the completion of a concrete trail to it will soon make it freely accessible to the public. The nature of such a zone shall be similar to the Taman Negara concept. By the nature of the wilderness and the specialised knowledge required, the robust recreational area will remain unattractive to the casual visitor unless they make a genuine effort to learn the necessary skills.

It is hoped that the host of such clubs and associations in these activities will be encouraged to use the zones and then openly offer their training to the general public. Environmentally conscious and sympathetic tourists who shall be making up the bulk of foreign tourists (as a result of awareness programmes in the West) will appreciate such zones. Hopefully, this may rub off on local tourists who will eventually embrace, practise and support environmental conservation programmes. Environmental NGOs such as MNS, Water Watch Penang (WWP), WWF Malaysia and others can play an increasingly important and active role in these areas. Exclusion Zones (EZs) are areas from which unauthorised people are excluded. They are undisturbed sites with native fauna and flora. They include breeding areas or areas for scientific research. These areas will run programmes for local school children or the public and use them as accessories in the study of the geography, environment, ecosystem and wildlife to inculcate awareness, appreciation and love for the natural world.

An example of a possible type of programme can be typified by the Huemel Survey conducted by participants in a Rayleigh Project in Chile recently or Water Watch Australia's Community River Quality Monitoring network which involves thousands of local inhabitants. In this respect, MNS Penang Branch can collaborate with WWP to conduct water monitoring using school children and volunteers from the general public. Such a project not only involves the public in terms of community character building but also gives the MNS and WWP a chance to create greater environmental awareness in environmental education (Chan 1998). Scientific studies can focus on documenting the physical geography of the PNP, and the conservation and maintenance of refuges (nesting sites for birds etc.) for the native wildlife and flora. In cooperation with the proper bodies, the exclusion zones may also be used for the re-introduction of species previously extinct in the area. Approved research on wildlife should also be allowed (turtle breeding, etc.). A small part of such zones may be opened by controlled entry for paying visitors to observe animal in their natural habitats. This can be done through the provisions of observation hides under very close supervision by rangers or appointed staff. The Coastal Zone (CZ) will be considered a public recreation area because of the difficulty of policing the entire coastline within the PNP. However, no one will be

permitted to land from here to the exclusion zones if they are located on the land side (e.g., mangrove swamps). It is expected though that if a breeding area extends out to the sea, the marine extension should be part of the exclusion zone. Currently, some coastal areas are already developed for tourism such as the chalets near the mouth of the Sungai Tukun.

Conclusion

The Penang National Park (PNP) is one of the smallest national parks in the world. However, it is a rich natural heritage area that is sensitive to development and environmental change. The PNP has rich natural attributes such as pristine rainforest, rich biodiversity, crystal clear sea, and geomorphic heritage in pristine beaches and a meromictic lake. All in, it has all the potentials to be a major natural heritage destination. Hence, there is no reason why ecotourism cannot be developed for the PNP. Currently, ecotourism is not properly promoted to foreign and local tourists. Infrastructure construction has affected the natural heritage in the park.

The many threats identified are encroachment from farming, infrastructure development, pollution, over-collection of plants and animals, poor enforcement, poor cooperation between institutions, and erosion of biodiversity. These threats can be reduced via careful planning and expert guidance, strict monitoring of development and enforcement, prudent planning and involvement of all stakeholders via empowerment. The PNP can be effectively monitored and managed in specific development zones. While government agencies have the mandate to manage the park, they should invite NGOs, industry, businesses and the public to work together to manage the park. NGOs can run public awareness programmes on biodiversity, flora and fauna, public education activities on catchment, river and water conservation, and "Save Wildlife" camps. The private sector's CSR programmes can be tapped into to provide funding. Industry and businesses can also team up with NGOs to run various environmental activities in the park. Tour operators and hotels in Penang should also start to market the PNP more aggressively by offering tour packages (especially ecotourism) into the PNP. All stakeholders should be involved actively in the park. Study tours should be a top priority of tour operators. There should also be avenues for tourists to take part in meaningful environmental conservation activities in the park. For school children there should also be a "schools' programme" in the park. The park can also be used for research and education. Proper planning and management of the PNP will make it into a lasting natural heritage area.

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