

The Potentials, Threats and Challenges in Sustainable Development of Penang National Park

HONG CHERN WERN*, CHAN NGAI WENG

ABSTRACT

The Penang National Park (PNP) is recognized as an initiative of sustainable development of the Penang State Government. Since the gazettelement of the young Penang National Park about 8 years ago, much have yet to be done to fully realize its potentials. These include growing into a world class ecotourism site in tandem with the UNESCO heritage status of Georgetown, to develop into a world class research center, to create sustainable income as a socio-economic contributor to local communities, and to showcase the success of a national park within a highly urbanized island. However, there are threats to PNP such as development pressures due to land scarcity, encroachment of urban and agricultural land use into the park, illegal developments, and apathetic attitude amongst local visitors which have created many environmental issues, problematic solid waste pollution, and infrastructure construction in the park. All these threats need to be addressed in order to ensure sustainable development of the PNP. The challenges include having political will, creating an effective awareness and environmental education system for all stakeholders, develop a sustainable management plan, environmentally-friendly infrastructure, and focusing on ecotourism rather than mass tourism in the PNP.

Key words: Penang National Park, sustainable development, ecotourism, socio-economic, political will, environmental awareness

ABSTRAK

Taman Negara Pulau Pinang dikenali sebagai suatu inisiatif pembangunan mapan kerajaan negeri Pulau Pinang. Sejak digazetkan sebagai Taman Negara Pulau Pinang yang baru kira-kira 8 tahun yang lalu, masih banyak perlu dilakukan untuk membangunkan potensinya. Ini termasuklah memajukannya sebagai tempat ekopelancongan bertaraf dunia seiring dengan status warisan UNESCO bagi Georgetown, untuk membangunkannya sebagai pusat penyelidikan bertaraf dunia, untuk mewujudkan pendapatan mapan sebagai sumbangan sosio-ekonomi bagi komuniti setempat, dan untuk menjadikannya contoh sebagai taman negara yang berjaya dalam pulau yang amat terbandar. Bagaimanapun terdapat ancaman terhadap Taman Negara Pulau Pinang umpamanya tekanan pembangunan disebabkan oleh kekurangan tanah, kemasukan guna tanah bandar dan pertanian ke dalam kawasan taman, pembangunan haram, dan sikap apati pengunjung setempat yang telah menimbulkan banyak isu alam sekitar, masalah pencemaran sisa pepejal, dan pembinaan infrastruktur dalam taman. Kesemua ancaman-ancaman tersebut perlu diatasi demi memastikan pembangunan mapan Taman Negara Pulau Pinang. Cabaran untuk mengatasinya termasuklah keperluan kepada kemahuan politik, mewujudkan sistem kesedaran dan pendidikan alam sekitar untuk semua pihak berkepentingan, membangunkan pelan pembangunan mapan, mewujudkan infrastruktur yang mesra alam, dan memfokuskan kepada ekopelancongan dan bukannya pelancongan massa dalam taman tersebut.

Kata kunci: Taman Negara Pulau Pinang, pembangunan mapan, ekopelancongan, sosio-ekonomi, kemahuan politik, kesedaran alam sekitar

INTRODUCTION

Sustainable Development

Sustainable development, a catch phrase which has been one of the most mentioned word in the past few decades to address global climate change. According to the common definition by Brundtland Commission, sustainable development is defined as any development that “meets the needs of the present without compromising the ability of the future generations to meet their own needs.” (United Nations 1987; WCED 1987). The study of sustainable development can be theoretically divided into three ‘pillars’ namely environmental sustainability, economic sustainability and socio-political sustainability.

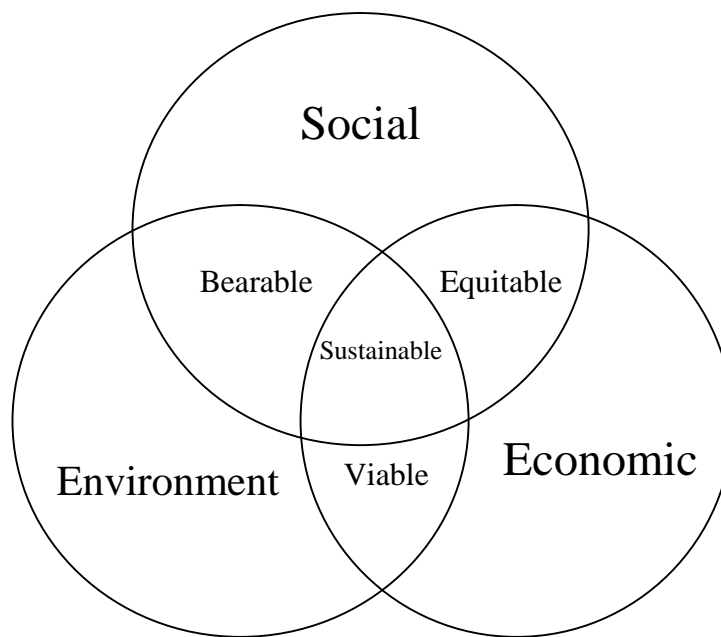


Figure 1. Three pillars concept of sustainable development
Source: IUCN 2006

Based on Figure 1, the three ‘pillars’ intersected together to create an equitable economy for the society, while making it viable for the environment, so that it is bearable for the society and thus result in achieving the sustainable development concept.

According to Chan (2009) the term "development" can be stretched to mean a lot of things. They include 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. From Zhou's (2009) explanation, sustainable development is a common development strategy to maintain harmony on these three ‘pillars’ which are the environment, economic and socio-political. By harmonizing these three sections, environmental quality could be improved and maintained. Apart from that, sustainable development is also connected and concerned with the carrying capacity of the Earth's natural system. The natural resources of the Earths is finite while the population of the Earths keeps on ‘booming’ every year and thus exerting pressures on the finite resources of the one and only Earth. As early as the 1970s, Stivers (1976) stated that "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems." In other words, the natural resources must be consumed wisely so that it would have the necessary time to be able to regenerate or ‘heal’ back to it equilibrium level.

As for the commons, the increased of economy benefits such as annual growth of each nation will always go with the decreased of the total environmental benefits. Zhou (2009) further stated that sustainable development practically, is for environment and economy benefit to achieve equilibrium.

This article deals with the identification of vast potentials, future and current threats as well as numerous challenges towards the sustainable development of Penang National Park which is part of the sustainable development initiative of the Penang State Government.

Penang and the Penang National Park

Pulau Pinang or popularly known as Penang Island is one of the states in Northern Peninsular Malaysia which has been rapidly developing in terms of urbanization and industrialization. The development activity on this northern state of Peninsular Malaysia has been undergoing phenomenal changes since the independence of Malaysia 52 years ago. According to Chan et al. (1998), with rapid urbanization and, industrialization combined with booming of commercial housings, very little natural vegetation is left. Although income levels and standard of living has improved, they have not come without a cost. The impact of development on the environment that resulted in environmental quality deterioration has somewhat been intensified since the country endeavoured further into industrialisation (Jamaluddin Md. Jahi 1996, 1999, 2001). Uncontrolled development has actually costs Penang environmental hazards and degradation of the living environment (Chan et al. 2003) for the past few decades.



Figure 2. Location of Penang and Penang National Park

Sources: <http://www.malaysia-maps.com/>

Chan et al. (2003), further stated that haphazard and irresponsible development planning has also exacerbated environmental hazards and brought about general degradation of the living environment. Decreasing of air quality such as frequent haze and urban heat island effect are caused by the ever increasing number of motorized vehicles, industries, commercial businesses

and homes (Sin & Chan 2004). Consequently, very few natural forested areas are left on the island.

As Penang is one of the many cities in the world which is experiencing climate change, the temperature of Penang has further increased especially during the month of hot season in March thanks to the amplification from the haze of the annual Indonesia's forest fire. Chan et al. (2003) have also found that the micro-climate within Penang State is changing. It is stated that the heritage city of Georgetown experiences significantly higher temperatures compared to forested areas. Studies from Chan et al. (2003) has found that the trees and their canopies which have cooling effects has reduced the temperatures in the forest, which makes it cooler by about a degree compared to the city. In addition to that, the relative humidity inside the forest is also significantly higher, due to high and abundant evapotranspiration process. This process takes away a significant amount of heat from the forest, transporting the heat into the atmosphere. Hence, the forest remains much cooler even during mid-day.

With such statement and results from the studies of Chan et al. (2003), the Penang Island definitely needs a proper and natural green space not only for climate control but for recreation as well. At the moment, only about 6,406 ha of land (6 % of total land area of Penang Island) are gazetted as Permanent Forest Reserve (PFR). The administration and management team responsible for the forest conservation is under the forestry departments which are provided in the National Forestry Act 1984. It is small in comparison to other states as the national policy proposes that at least 50 % coverage of forest must be maintained (Penang State Government 1999:7). These few natural forested areas left on the island are a result of rapid and uncontrolled development of Penang.

In the light of the above scenario, a natural green area, located in the northwest of Penang Island (as shown in Figure 2), was declared and gazetted as Penang National Park on April 2003. This declaration would not be a success if not because of nature lovers in the 1950s that pushed for it to be gazetted. According to Hong and Chan (2009), the Penang National Park was also the first protected area which was legally gazetted under the National Park Act of 1980, however the logging activities were only stopped since the year 1996.

A national park or national forest is an area of special scenic, historical, or scientific importance and maintained and declared by the federal or central government of any respected countries (Merriam-Webster 2008). According to the International Union for Conservation of Nature (IUCN) (2006), national parks are listed as protected areas under the category II which are mainly for ecosystem protection and recreation. In this case, the Penang National Park falls under the category II which is categorised as a natural area of land and/or sea, for the purpose of ecological protection for present and future generation. Any exploitation or occupation which may cause harm to the area is excluded. In addition to that, national park which is under the category II is to provide a foundation for scientific, educational, recreational and visitor opportunities. Though national parks are listed as protected and recreation areas, proper and sustainable management are needed in order to maintain the national park.

It is currently the second largest in the nation size after the 'Taman Negara' in Malaysia (Perhilitan 2008). The Penang National Park has unique features which are not found in other national park in Malaysia. Although PNP is not a virgin forest as timber extraction has been carried out 1910's to 1930 (Chan et al. 2004a), it has a size of about 1266 hectares of coastal hill, the unique features boast of meromictic lake, wetlands, mangroves, mudflats, coral reefs and turtle nesting beaches (Perhilitan 2008).

HERITAGE AND ECOSYSTEMS OF PENANG NATIONAL PARK

The Penang National Park forms as a coastal forest on an island itself. Inland forests and woodlands would extend to the sea and thus form part of the coastal area. According to FAO (2009), they are commonly defined as the interface between land and sea which are diverse in function and form. Usually, such formations controlled and 'produced' special forest

communities and climatic factors. These communities would include beach forests, mangrove areas, peat swamps, periodic swamps and riparian forest.

The first two forest 'communities' mentioned above are notable in the Penang National Park. Apart from mangrove areas, the Penang National Park consists of eight forest beaches, rocky shores and the inner forest itself. Teluk Bahang, Pantai Kerachut, Pantai Mas and Teluk Duyung (Monkey Beach) are the famous four of the eight pristine and sandy beaches around the forest. On the other hand, the rivers flowing towards the ocean are the Sungai Duyong, Sungai Pantai Kerachut and Sungai Gemuruh.

Floral Heritage

The Penang National Park is also rich in timber as well as medicinal and ornamental plants. Although some of the area has been logged, most of the area of Penang National Park is hilly in condition which makes logging activity unsuitable. At the moment about 70 hectares of the forests of Penang National Park is a virgin forest. the PNP is not a virgin forest as timber extraction has been variously carried out between the late 1910s and the late 1930s.

The major floral ecosystem of the PNP corresponds closely to the characteristic of the vegetation in the forest of Peninsular Malaysia. The forest aforementioned are those of the coastal mangrove forest, lowland dipterocarp forest and some hill dipterocarp forests near the peaks of some of the hills in the PNP. Usually *Dipterocarpaceae*, *Leguminosae*, *Apocynaceae*, *Burseraceae*, *Dilleniaceae*, *Palmae* and others are the main families in the dipterocarp forest whereas herbaceous plants in the forest include *Araceae*, *Marantaceae*, *Gesneriaceae*, *Zingiberaceae* and *Commelinaceae*.

There are also some commercially important wood species which are the Balau (*Shorea materials*), Seraya (*Shorea curtisi*), Meranti (*Shorea sp.*), Resak (*Hopea sp.*), Merawan (*Hopea sp.*) and Damar Laut. The Seraya has a greyish green foliage emerging from the canopy which is a common sight whereas the Damar Minyak (*Agathis dammara*) is also easy to identify with its distinctive flaky bark which oozes a resin when it is cut. In addition to that, there is another common tree namely the fig tree which belongs to the family *Moraceae*. Ferns and fern-allies are also growing in abundance in the Penang National Park.

However, there is one unique species found in the forest which is the Stag Horn's Fern (*Platyserium coronarium*). Another is the Bird's Nest Fern (*Asplenium nidus*) which is usually found on tree trunks and branches. There is also Oak Leaf Fern (*Drynaria spp.*) which has nest-like leaves that appear brownish and dehydrated.

According to Chan (2004), the sun loving ferns such as *Dipteris conjugata* and *Dicranopteris linearis* grow well in higher areas in the forest. Apart from ferns, orchid lovers would be delighted to gain sightings of the Slipper Orchid (*Paphiopedium barbatum*), with its slipper-like lip, which was once the pride of Penang. It is purplish with green stripes in color but this species is now endangered because of over-collection. Other common wild orchids are the *Bromhedia finlaysoniana* with white flowers and mauve lips, the *Arundina graminifolia* with bamboo-like leaves, and notably the Jewel Orchids, from the *Anaectochilus*, *Ludisia* and *Goodyera* species. As orchids are sensitive to environmental change, it is rare to encounter wild orchids in the forest. Deeper forest trekking must be carried out into more remote areas to have a glimpse of the wild orchids.

Apart from wild orchids, the forest of the Penang National Park is also the home of many species of wild ginger. Most of the gingers are terrestrials such as *Alpinia javanica*, *Amomum biflorum*, *Amomum uliginosum*, and *Globba pendula*. There is one common wild ginger which is the *Hedychium longicornitum*, an epiphytic form. The *Achasma* on the other hand, has scarlet flowers protruding from the ground. Other gingers discovered in the forest of Penang National Park are the torch gingers, bunga kantan (now commercially cultivated) and lengkuas (*Alpinia galanga*).

The pitcher plant or famously known as the 'Monkey Cup' is perhaps the most recognisable flora in the Penang National Park because of its unique carnivorous features. Some common ones are the *Nepenthes albomarginata* which is recognised by the white ring below the pitcher's mouth and the *Nepenthes ampullaria*.

Coastal vegetations

Some of the coastal areas in the Penang National Park are consist of mangrove forests. They are both found in the northern as well as the western and southern coasts. Mostly, the mangroves in the Penang National Park are found on the muddy parts of the western coast along Pantai Mas and towards the south near the Pantai Acheh Village. The major species of mangroves are the *Avicennia-Sonneratia* zone which is usually colonised by *api api* (*Avicennia alba* and *Avicennia marina*) and *perepat* (*Sonneratia alba*). The *Bruguiera-Rhizophora* zone, largely dominated by *berus* (*Bruguiera cylindrica*), *tumu* (*Bruguiera gymnorrhiza*) and *bakau kurap* (*Rhizophora mucronata*) could be seen further inland.

There are other coastal vegetation in the Penang National Park which include the Sea Morning Glory (*Ipomoea pes-caprae*) with its beautiful purple coloured flowers, Leguminosae (*Canavalia microcarpa*), and some grasses of the Graminae type such as *Ischaemum muticum*, *Spinifex littoreus* and *Zoysia matrella*. In other sandy areas, the *Barringtonia* are found in areas flooded during the high tide. In drier areas, the *Barringtonia* is colonised by trees, shrubs and tall herbs such as the Lecythidaceae (*Barringtonia asiatica* or *putat laut*) and Clusiaceae (*Calophyllum inophyllum* or *bintangor laut*). In addition to that, the Sea Lettuce (*Scaevola frutescens*), a shrub could also be seen around the coastal area as well as the Sea Hibiscus (*Hibiscus tiliaceus*) which has bright yellow flowers with a maroon coloured heart.

The Meromictic Lake

A meromictic lake has layers of water that do not mix with each other (Wetzel 2001). It describes as a condition whereby two layers of different density liquids, the salty sea water and fresh clear water from rivers or lakes remained separated. Black sea is considered as the largest meromictic lake in the world as the deep waters do not mix with upper layer of water. The upper layer of water is the only layer which receives oxygen from the atmosphere which makes the black sea part anoxic.

About 10 hectares of the total 1266 hectares of forest of Penang National Park consist of the Meromictic lake or lagoon. It is one of the few natural meromictic lakes in the Asian region. This makes the meromictic lake as one of the most distinctive features in the park. During the season between late March and August, 2 layers of water could be seen. One which is the seawater during the rise of sea level and the other layer on top is the freshwater because of the higher density in sea water compare to the freshwater. The depth of the lake could reach up to three meters, twice the height of an average man. Several species of crabs, prawns and fishes could also be found because they breed very well in the lagoon. Besides that *Gelam* trees (*Eugennia spp.*) are also found in the meromictic lake in the Pantai Keracut area.

Faunal Heritage

Apart from the exclusive existence of the meromictic lagoon, the Penang National Park harbours rich faunas. There are at least 25 species of mammals, 53 species of butterflies, 46 species of birds including migratory birds and a considerable variety of marine life in the adjacent seas (such as soft corals, sea anemones, crustaceans, sea turtles etc.) which have been documented.

Giant flying squirrel, slow loris, monkeys, flying lemurs (*Gynocephalus veriegatus*) and mouse deers are also spotted in the forest of Penang National Park. In addition to that, common faunas were also spotted such as wild boars, civet cat, leopard cats, pangolin (scaly ant eaters) as well as the common tree shrew (*Tupaia glis*). Sea otters are also spotted at the Pantai Mas beach. Campers and trekkers will be able to sight and observe giant flying foxes as well as giant fruit bats which are the largest of all the bats. Monitor lizards could be found abundantly around the swampy areas in the forest of Penang National Park. According to Chan (2000), the common ones are found to be the Black Jungle Monitor Lizard, the Water Monitor and the Tree Monitor.

Rantau Abang in the state of Terengganu has been a synonymous name for turtles breeding annually but in the Penang National Park, turtle lovers will be able to see the green turtles (*Chelonia mydas*) during the breeding season of between April and August. Following that, the Olive-Ridley turtle species (*Lepidochelys olivaceae*) will replace the green turtle until the next month of February the following year. The green turtle could grow up to a size of about 1 metre in length with a weight of more than 150 kg. The Olive-Ridley however is one of the smallest turtle in the world weighing around 40 kg. A less common turtle species, the Hawksbill turtle (*Eretmochelys imbricate*) is also found in the park. The turtles could be found laying their eggs in the Pantai Kerachut beaches as well as Pantai Mas, Teluk Kampi and Teluk Ketapang. As part of protection and conservation for the turtles, a hatchery has been set up by the Wildlife Department in 1995 in Pantai Kerachut. Furthermore, the Monkey Beach got its name as a beach with increasing monkeys roaming around. Apart from the Monkey Beach, the monkeys are also part of the residents of the Penang National Park. The most common species are the Long-tailed Macaque and the Dusky Leaf Monkey.

Kumar (2004) further testified that the Penang National Park is a haven for bird lovers and birdwatchers with a total of about 200 species of birds recorded. Insect eater species are common in the forest which includes flycatchers, warblers and babblers. Commonly found babblers include the Grey-throated Babbler and Fluffy-backed Tit Babbler. Kingfisher species such as the Oriental Dwarf Kingfishers or the large Stork-billed Kingfisher are also could be spotted at the forest of Penang National Park. Whereas in muddy areas of Pantai Mas, migratory birds could be spotted such as the Black Baza, Japanese Sparrowhawk, and the Crested Honey-buzzard. The carnivorous eagle, notable the white-bellied sea Eagle could be spotted on the peak of the lighthouse on Mukah Head. Other common birds found at the Penang National Park are the Bulbuls and sunbirds.

THE POTENTIALS OF SUSTAINABLE DEVELOPMENT OF PENANG NATIONAL PARK

Since the inception of the Pantai Acheh forest as the Penang National Park about 8 years ago, much still have to be done sustainably. Potentials of the Penang National Park have yet to be fully tapped yet there are threats and challenges to be addressed for sustainable development of the Penang National Park (Chan 2009).

With pristine beaches, rich floral and fauna, exclusive unique features and so forth, some of the opportunities for the Penang National Park include vast potentials to grow into a world class center for eco-tourism attraction. Since the Georgetown city of Penang has acquired the prestigious UNESCO heritage in the month of July 2008, it would be a good combination to promote not only the Georgetown City but the Penang National Park as well. Currently, the tourism authority of Penang is just focusing on promoting cultural and heritage value of Georgetown. However, according to the Penang Outlook Forum speech by the Chief Minister of Penang, Mr. Lim Guan Eng, which was held in the month of June 2009, the Penang blueprint-based for sustainable development will be based on eight key measures which includes on the environmental aspect to transform Penang into an international city. Based on the key measures, it will definitely be a good opportunity to include the Penang National Park to align with the

sustainable development practices of the Penang State Government into the tourism sector of Penang.

In addition to that, the Penang National Park has the potential to grow as an environmental education center. Since back then, the beaches around the park have been visited by student scouts as part of their recreation cum survival training activity. Not many students besides those student scout groups have visited the Penang National Park (then Pantai Aceh Forest). Once more, aligning with the state governments plan on sustainable development; it would be an initiative to be taken to declare the park as a formal hub for environmental education for the schools in Penang as well as the general public. River education and awareness could be carried out in the forest as there are clean riverines while the rich floral and fauna could be applied into forest ecosystem education and awareness programme in the school co-curriculum. Environmental-based Non-Governmental Organisation (NGOs) such as the Water Watch Penang and Malaysian Nature Society would be more than happy to be part of this sustainable development education programme. Furthermore, with the 'Accelerated Program for Excellence' (APEX) status acquired by the USM, it gives the opportunity to promote and nurture the Penang National Park as a world class research forest to other universities from other parts of the world. In turn it will further intensify educational research on the forest of Penang National Park.

With the potential to grow as a world class ecotourism site, the Penang National Park has the chance to increase the income indirectly. However, direct income would be possible if minimal fees are charged for park visitors. The fees could be used to increase the infrastructure development and improve management efficiency of the park. At the moment there is no admission fee for the Penang National Park. Apart from that economic potential, partnership could be forged with hotel owners, boating companies, small scale tour agencies and so forth around the vicinities of the Penang National Park on promoting eco-tourism activity besides planning for interesting tour packages around park. In this, there will be employment opportunities as well as further development of tourism information.

THE THREATS TO SUSTAINABLE DEVELOPMENT OF PENANG NATIONAL PARK

While there are good potentials to upgrade and develop the Penang National Park sustainably, definitely there are threats which could deter further proper development of the park. According to the Hong and Chan's (2009) Strength-Weakness-Opportunities-Threats (SWOT) analysis on the Penang National Park, one of the threats include environmental degradation of the park. This factor is caused mainly by the low level of environmental awareness among the park visitors. Anthropogenic environmental degradation includes solid waste pollutions especially plastics material used by the visitors for recreational purposes as well as pollutions by illegal small scale food sellers in the park. Most of the rivers are clean but one of the rivers, namely Sungai Takun is slightly polluted because of the river chalet built nearby.

Loss of Flora and Fauna

In addition to that, the park is also facing serious environmental threats in terms of flora and fauna. There has been reported loss of species such as the clouded leopard due to illegal poachers. In addition to that, turtle eggs are also reportedly being stolen from the coastal area which will decrease the chance of turtle visiting in the future (Lee & Leong 2003). Unaware visitors have also plucked flowers or stealing ornamental plants from the National Park. Besides stealing and plucking of plants, encroachment of farmers around the vicinity of the Penang National Park has caused destruction of trees resulted from forest clearing. Chan et al. (2003), further stated that some places have also been illegally planted with fruit trees, spices and flowers as well as vegetables. This might disturb or affect the ecosystem of the forest as parts of the area are needed to be cleared for farming activity.

Sensitive Environment and Land Scarcity in Penang

Chan (2003) has highlighted that there are many potential threats to the PNP if a stringent park management plan is not put into place. To support this claim, Chan et al. (2004b) stated that a documented and modeled environmental change on a result of land use change have shown that environmental degradation can be serious if development is not planned in a sustainable way in the PNP.

According to Chan et al. (2003), the forest of Penang National Park is environmentally and ecologically sensitive. That means no major development activity or unsustainable development activities to be carried out in or around the vicinity of the forest of Penang National Park. Although the national park has been gazetted under the National Park Act 1980, with the scarcity of land in Penang, the state government would be constantly pressured to degazette the land for housing development in the near future. If degazettement were to happen, adverse impacts such as flash floods, landslides, mud floods and so forth could happen to the housing areas nearby. Examples could be seen in the Paya Terubong Hillside area of Penang Island in which the hills were cleared for construction of mass apartment units (Chan 2009). Besides increasing rate of erosion and risk of landslides, the people living nearby and the tourist will also be endangered especially during rainy season. Jamaluddin Md. Jahi et al. (2009a), further added that more frequent and intensified flood and flash flood occurrences will happen besides soil erosion, sedimentation of drainage system.

Soil erosion can also increase many folds through of farming on hill slopes, often leading to landslides (Chan 1998). This has been proven in the research of Daniel and Kulasingham (1974). They have found that erosion rates in forested and planted (vegetable) areas are $25 \text{ m}^3 \text{ km}^{-2} \text{ yr}^{-1}$ and $732 \text{ m}^3 \text{ km}^{-2} \text{ yr}^{-1}$ respectively. From a simple mathematical calculation, we could see that the erosion rate has increase more than 29 times. Penang Island has been computed based on the Universal Soil Loss Equation. The results showed a soil loss of about 19,000 tonnes/hectare/year in a freshly deforested land with slopes between 20 to 30 degrees. With high equatorial rainfall and the steep terrain and the resulting high rate of soil loss, landslides are the inevitably results in the PNP if there is no control of agricultural activities be it legal or illegal. A soil loss rate in a forested catchment in the Air Itam water catchment in the Penang hills is only about 0.01 to 1.3 tonnes/hectare/year whereas vegetable farming on hill slopes have recorded a soil loss of between 30 to 90 tonnes/hectare/year. This matter is already regarded by the authorities with concern by the Penang State Government.

Though physical environment is very sensitive, natural disturbances do always exist. However, natural disturbances always act towards achieving a state of dynamic equilibrium. Through uncontrolled human activities in the PNP, the disturbances could be further intensified. In this case, dynamic equilibrium in nature cannot be achieved if the change is too huge to handle (Jamaluddin Md. Jahi et al. 2009b)

Fortunately, there is no permanent settlement in PNP at the moment except for the biological field station of Universiti Sains Malaysia and the earlier mentioned chalet. Further 'nagging' of the sustainable development initiative, water is an important asset for an industrial state as well as the well being of the residences. Penang is a water stress state as 80% of the state's water supply comes from the Muda River of Kedah. There are 3 dams built in Penang but one of the dams, the Teluk Bahang dam, is situated just below the Penang National Park. The adjacent slope of the dam would be weakening if there are many developments to be carried out nearby the national park. Safety asides, the state government cannot afford to destroy any water catchment (the forest of Penang National Park) if they are to prevent the state from serious water crises and water shortages in the future. With regards to agricultural activities again (farming), Jamaluddin Md. Jahi et al. (2009b) mentioned that agriculture activity, especially through livestock rearing, and industrial activities have been contributing to water pollution that affect not only aquatic life and recreational activities, but also water

treatment plants for domestic water supply. Thus through this reasoning, the PNP is also facing threats on aquatic life and water pollution.

With regards to sensitive environment of the Penang National Park, the aquatic ecosystem in the forest especially the meromictic lake would be greatly affected. Deforestation and rapid development could result in increasing suspended solids and adulteration of bottom substrate as well as micro-inhabitants of fishes. These impacts are irreversible most of the time and the species of the fishes will be greatly reduced. This is further amplified by the fact that the recovery rate is very slow especially the fish ecosystem on the meromictic lake which is also very sensitive to environmental changes. Expansion of water volume in the lake may cause major casualties to the freshwater fish species at Pantai Kerachut as those fishes are unable to withstand the salinity of the seawater.

THE CHALLENGES LEADING TO SUSTAINABLE DEVELOPMENT OF PENANG NATIONAL PARK

To be able to develop and build up the Penang National Park based on the potentials in a sustainable manner, it is a challenge to address the threats which could deter or slow down the development of the park.

Institutional Management

First and foremost, the challenge is on institutional and management issue to address and tackle environmental threats. For management efficiency, zoning of areas could be implemented for activities such as research area, conservation (off-limit) area, recreation and economic activity. To further support this suggestion, Chan (2000) has also argued that the PNP needs to be subdivided into management zones with different objectives and functions. Application of GIS and remote sensing technology could be utilized in the planning of zones. Zones could be allocated public use within the designated park area can be both existing recreation areas or newly created ones. Chan (2009) further mentioned that with many existing areas that are considered degraded or altered beyond recovery to their original native states can be designated as PRZs. Restricted zone (RZ) are areas from which unauthorised people are excluded. They are undisturbed sites with native fauna and flora. They could also be breeding or floral cultivation for research purposes. Though zoning could result in disputes especially among small scale business owners, negotiation and mediation could be carried out to ensure understanding and cooperation.

Infrastructural development

As the park is the only protected area in Penang Island is protected by the National Park Act of 1980, this act must definitely remain for the forest. Large scale land clearance must not be allowed for major development. Any development for the sake of Penang National Park must be accompanied with environmental impact assessment. Rule of thumb is to keep infrastructure development at its minimal rate to maintain the natural landscapes and to avoid adverse. Only a few chalets located near the entrance of the park as accommodations must be limited. Even if infrastructure development is necessary, green designs are recommended for sustainable development of the park. At the moment, there are no major permanent settlements except for USM biological station. Trees should not be cut unnecessarily but structural landscaping could be built around trees. Toilets and waters are provided by the Forestry Department who is also the management team of the park. Presently, a road has been constructed to make PNP more accessible to cars. This is where NGOs and environmentalists have voiced their discontent (Chan 2009) No major road developments should be allowed in the forest for trekking and avid campers are required to bring their own tent and camping equipment. Critics now claimed that the infrastructure development may increase arrivals of visitors but at the cost of environmental

which is deemed unsustainable. Motorized vehicles will not only cause air pollution but noise pollution on the natural tranquility as well. Without road development, the difficult terrain made it impossible even for motor cycles to pass. This in a way had indirectly protected the park from an avalanche of visitors, tourism operators and vendors.

Political challenges

According to Chan et al. (2004b), after the Penang National Park has been gazetted, the Wildlife Department was given the sole jurisdiction to manage the park. This makes the Wildlife Department under the jurisdiction of the Federal Government in a broader umbrella. Further claim from Chan et al. (2004b), is that, there is disagreement and some friction between federal and state governments. This became more and more evident when the Penang State fell to the opposition parties in the 2008 general elections. Thus poor cooperation and coordination between the state government and the wildlife department became more intensified. In addition to that, other parties who were involved in the pushing for the gazettelement of the Penang National Park felt marginalized. This includes the Non Governmental Organisations (NGOs) as well as various government departments, statutory bodies and local communities. The department has the expertise and resources to carry out the management, it is recommended to involve other parties to be included in some decision making processes. Expertise from those various organizations could be utilized to increase management efficiency as well as transparency. This could be a good move to prevent any conflict with the government and to smoothen the coordination as well as providing win-win situation to everyone. Of the issues mentioned, the biggest challenge for an efficient management is for the state government and the federal government to mend and resolve current conflicts and issues.

User-pay system for sustainable income generation and cost recovery

While at this very moment, the total of number of park visitors is not overwhelming yet. However in the near future with the assumption of successful promotion and management, rising in number of park visitors must be anticipated. As a positive feedback, employment rate would increase to cater for better management. To have a sustainable income, the Penang National Park's income must not solely depend on the fundings from the government itself. Charging user fees is one challenge to create a sustainable income. It is recommended that the locals to be charged at minimal fee while foreign visitors to be charged at a higher fee as they could afford it. Extra fees could also be charged for extra activities such as campings and other group activities. The fees could in turn be used for maintenance of the facilities.

Environmental Management

According to Jamaluddin Md. Jahi et al. (2009a), environmental management is carried out through a number of measures either legislative or non-legislative. Legislative measures includes form of licensing, regulations and orders, which could be seen through relevant government agencies usually stipulated in various acts, enactments and ordinances carries out through enforcement. Non-legislative measures, on the other hand, include awareness raising, environmental education, research & development, planning, monitoring, and public policy.

Jamaluddin Md. Jahi et al. (2009a) further stated that environmental management should be carried out in an integrated manner because there is no single action taken that will result in any reciprocal action or response. According to Sewell (1975), environmental management is the influencing of human activities as they affect the quality of mankind's physical environment, especially the air, water, and terrestrial features. Thus increment of human presence, or known as visitors to the PNP will exert pressure on the environment. For instance,

through observation solid wastes such as plastic bottles and wrappers could be seen being dumped around the beautiful beaches especially around Pantai Kerachut and Monkey Beach.

For legislative issues, the Wildlife Department of Penang could form partnership with the Penang State Municipality as well as other environmental agencies to plan for licenses to be given to environmentally responsible contractors or stakeholders through open tender. This will also in lieu with the Penang State Government's CAT (Competency, Accountability, and Transparency) policy. This is to ensure proper and efficient environmental management in PNP. High compound fines could be further improved to include littering, vandalism besides stricter rules on wildlife and plants act. Therefore the current rules and regulations should be reviewed and reformed for improvement.

Awareness Raising and Environmental Education

Through non legislative measures, education and awareness are major components of any interventions associated with preventing major exploitation of the forest. They are an important factor in developing a better understanding of major environmental issues amongst user groups (tourist, residence and farmers) as a means of creating a willingness to change attitudes and behaviors. Good facilities such as solid waste management facilities in the Penang National Park will be rendered useless if the awareness of the visitors is low. A study conducted by Abdul Aziz Shamsuddin (2003), found that there was no significant correlation between students' conceptual understanding of the environment and their willingness to protect the environment. This statement further supported a claim by UNESCAP (2003) stating that environmental awareness in Malaysia is still at the preliminary stage. The challenges to be faced on promoting environmental education and awareness will be the effectiveness of the program. Effective methods and strategies are needed to tailor good contents which would be able to capture the mind of the locals positively. Education could be used and focused on informing user groups of the negative impact of their negative actions on the forest of Penang National Park. Awareness raising programs can also be organized and carried out monthly if possible by environmental based NGOs such as Water Watch Penang (WWP), Malaysian Nature Society (MNS) and so forth for the local community as well as foreign visitors

CONCLUSION

This article has highlighted the vast potentials of the Penang National Park to be realized as a famous eco-tourism site. However, threats and challenges have also been spotted which could be in the way towards sustainable development of the Penang National Park. Threats to the PNP such as development pressures due to land scarcity, encroachment of urban and agricultural land use into the park, illegal developments, and apathetic attitude amongst local visitors have created many environmental issues, problematic solid waste pollution, and infrastructure construction in the park. Challenges identified include having political will, creating an effective awareness and environmental education system for all stakeholders, develop a sustainable management plan, environmentally-friendly infrastructure, and focusing on ecotourism rather than mass tourism in the PNP.

According to Mansor (2003) the Penang National Park serves several reasons. Besides for recreational reason, the forest itself serves as an economic purpose. Indirectly, part of the forest of Penang National Park also acts as a water catchment area for the Teluk Bahang Dam which is just below the buffered zone of the park. About 80% of Penang's water supply comes from the Muda River from Kedah making Penang one of the water poor states in Malaysia. As Penang is a water stress state, water catchment area is important for Penang to provide water supply for domestic and industrial usage as well as tourism sector.

The PNP can also act in the role of carbon sink that is, to promote net carbon sequestration. The role in carbon sequestration appears to offer the greatest near-term potential for human

management. The floral ecosystem in Penang National Park has the ability to accumulate and isolate huge amount of carbon in relatively short time for decades and centuries. Carbon is 'sunken' through a process called photosynthesis in which it is absorbed by the plants with the sun energy to create their own food and at the same time release oxygen. As the floral ecosystem grows, the 'sink' will eventually increase.

Therefore to sustainably develop the Penang National Park is to promote and ensure sustainable development of Penang state. No city could survive sustainably without a green lung. Even megacities such as Tokyo, has gazetted several areas known green spaces. For example, the Shinjuku National Garden is situated between Shinjuku and Shibuya city with an area size of about 58 hectares and circumference of 3.5 kilometres.

To ensure proper management and development of a protected area vis-à-vis Penang National Park, threats especially from political and institutional management point of view must be addressed with speedy manner. While top-down approach is important in terms of financial support, we must not deny that bottom-up approach could be vital especially in managing the Penang National Park. Though it is a challenge to gather stakeholders from various background (professionals, business owners, local community, etc), it would prove to be the one of the vital link to sustainable development of the Penang National Park.

ACKNOWLEDGEMENT

The authors wish to thank Universiti Sains Malaysia (USM) for funding which supported field and desk research under the Institute of Post Graduate Studies (IPS) Fellowship and USM FRGS Research Grant 203/PHUMANITI/671011.

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*Geography Section,
School of Humanities,
Universiti Sains Malaysia,
11800 Minden, Penang, MALAYSIA.*

* Corresponding author,

*Mailing address:
2-12-3, Taman Lintang,
Penhill Condo-B,
11500 Air Itam, Penang, MALAYSIA.*
E-mail: cwhong1983@gmail.com