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RESOURCE MANAGEMENT AND CONSERVATION OPTIONS OF TASEK BERA WETLAND, PAHANG, MALAYSIA

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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Chairman : Professor Datuk Mad Nasir Shamsudin, PhD
Faculty : Environmental Studies

Demand factors for a certain environmental asset should be highlighted clearly in determining the most appropriate actions to be taken by resource manager. The main attributes of Tasek Bera wetland currently jeopardized by economic activities and other externalities. Both resource management and conservation options policy should be able to attain a sufficient sum of revenue in order to continuously managing the resources of Tasek Bera wetland efficiently. Hence, this study attempts to estimate the use value of the wetland. Contingent valuation and choice experiment have been used in these exercises. Structured questionnaires have been developed and distributed to the respondents in targeted site of Tasek Bera wetland area specifically at the main entrance. A total of 600 questionnaires have been distributed conveniently among the visitors of Tasek Bera wetland area. However, only 533 respondents were reliably selected for further analyses. Structured questionnaires have been developed and distributed to the respondents in targeted site of Tasek Bera wetland area specifically at the main entrance.

Firstly, the study attempted to explore the underlying dimensions that affect the environmental perception among users towards Tasek Bera wetland area. In line with that, the study provided the surface responses and demands by users subject to the needs of efficient resource management and development. The exploratory factor analysis (EFA) has been applied in order to identify the dimensions that affect the environmental perception towards the wetland area. Further then, the study found have confirmed through confirmatory factor analysis (CFA) that visitors' attitudinal perception towards environmental issues of the wetland has been structured by six factors of wetland function, agricultural activities, efficient management, society benefit, information provided and salient belief. All the factors are interrelated with each other since it has been identified through CFA.

In CVM estimation, the reductions of agriculture activities have been found to be significantly raising the utility of respondents towards the wetland. Willingness to pay for the improvement in resource management and conservation options of the wetland has been elicited through the logit model. Approximately 53% of the visitors agreed to pay the hypothetical entrance fee to the wetland area. Dichotomous choice approach has successfully obtained the average hypothetical entrance fee of RM 17.75 per visitor. With a pessimistic scenario consideration, assuming there will only one time donation of the value of entrance fee, the value of contribution to the sustainable management of Tasek Bera wetland has been assumed to be RM 1,538,747.50. Optimistic scenario (monthly basis with annual contribution) on the other hand would give a total value of RM 18,464,970.

Two blocks of estimations were analysed which are biodiversity conservation, and ecotourism facilities and services in CE estimation. The concerns of visitors are more towards the restoration of the wetland function of ecosystem for conservation options. A total of 57.22% of them selected one of the options above the status quo level of conservation charge. While in resource management block, visitors mostly preferred in enhancement in license skill tourist guide attribute which recorded 61.16% of respondents selected one of the options above the status quo level of entrance fee. The study estimated the average consumer surplus representing the extra benefits gain from the wetland up to RM 29.86 per individual for the conservation options. Surplus enjoyed by visitors estimated to be RM 39.64 per visitor in the resource management block.

The visitor's preferences identified in the study from the list of attributes level studied would be useful information for resource manager. The study identified that gender, age, education level and work status were significantly influenced the willingness to pay for resource management and conservation options among the visitors of Tasek Bera. Therefore this information would be helpful in deriving the guidelines in efficient improvement of the wetland.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENGURUSAN SUMBER DAN PILIHAN PEMULIHARAAN TANAH LEMBAP TASEK BERA, PAHANG, MALAYSIA

Oleh

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Faktor-faktor permintaan untuk aset persekitaran tertentu harus diketengahkan dengan jelas dalam menentukan tindakan yang paling sesuai untuk diambil oleh pengurus sumber. Ciri-ciri utama tanah lembap Tasek Bera kini terancam oleh aktiviti ekonomi dan factor luaran. Kedua-dua dasar pengurusan sumber dan pilihan pemuliharaan harus mampu mencapai jumlah pendapatan secukupnya untuk terus mengurus sumber-sumber tanah lembap Tasek Bera secara efisien. Oleh itu, kajian ini cuba untuk menganggarkan nilai penggunaan tanah lembap. Kaedah *contingent valuation* dan *choice experiment* telah digunakan dalam eksesais ini. Soal selidik berstruktur telah dibangunkan dan diedarkan kepada responden di kawasan sasaran kawasan lembah Tasek Bera khususnya di pintu masuk utama. Sebanyak 600 soal selidik telah diedarkan dengan menggunakan persampelan mudah di kalangan pelawat kawasan tanah lembap Tasek Bera. Walau bagaimanapun, hanya 533 responden telah dipilih untuk analisis selanjutnya.

Pertamanya, kajian ini cuba untuk meneroka dimensi asas yang mempengaruhi persepsi persekitaran di kalangan pengguna ke kawasan tanah lembap Tasek Bera. Selaras dengan itu, kajian ini memberikan respons dan permintaan permukaan oleh pengguna yang tertakluk kepada keperluan pengurusan dan pembangunan sumber yang cekap. *Exploratory Factor Analysis* (EFA) telah digunakan untuk mengenal pasti dimensi yang mempengaruhi persepsi persekitaran terhadap kawasan tanah lembap. Lebih jauh lagi, dapatan disahkan melalui *Confirmatory Factor Analysis* (CFA) bahawa persepsi sikap pelawat terhadap isu-isu alam sekitar tanah lembap telah distrukturkan oleh enam faktor iaitu *wetland function*, *agricultural activities*, *efficient management*, *society benefit*, *information provided* dan *salient belief*. Semua faktor saling berkaitan antara satu sama lain dan telah dikenal pasti melalui CFA.

Dalam anggaran CVM, pengurangan aktiviti pertanian didapati meningkatkan utiliti responden ke arah tanah lembap. Kesediaan untuk membayar untuk peningkatan dalam pengurusan sumber dan pilihan pemuliharaan tanah lembap telah didapati melalui model logit. Kira-kira 53% pengunjung bersetuju membayar yuran masuk hipotetikal ke kawasan tanah lembap. Pendekatan pilihan dikotomous telah berjaya memperoleh purata yuran masuk hipotetik sebanyak RM 17.75 setiap pengunjung. Dengan pertimbangan senario pesimis, dengan anggapan bahawa hanya ada satu kali bayaran kemasukan, nilai sumbangan kepada pengurusan lestari tanah lembap Tasek Bera telah diandaikan sebanyak RM 1,538,747.50. Senario yang optimistik (asas bulanan dengan sumbangan tahunan) sebaliknya akan memberikan nilai keseluruhan sejumlah RM 18,464,970.

Dua blok anggaran telah dianalisis iaitu pemuliharaan biodiversiti, dan kemudahan dan perkhidmatan ekopelancongan dalam eksesais CE. Kebimbangan pelawat lebih kepada pemulihan fungsi ekologi tanah lembap untuk pilihan pemuliharaan. Sejumlah 57.22% daripada mereka memilih satu daripada pilihan di atas tahap *status quo* berbanding caj pemuliharaan. Sementara itu dalam blok pengurusan sumber, pengunjung kebanyakannya memilih untuk meningkatkan sifat pemandu pelancong kemahiran lesen yang mencatatkan 61,16% responden memilih salah satu pilihan di atas tingkat *status quo* berbanding bayaran masuk. Kajian ini menganggarkan purata lebihan pengguna yang mewakili manfaat tambahan dari tanah lembap berjumlah sehingga RM 29.86 setiap individu untuk pilihan pemuliharaan. Lebihan dinikmati oleh pengunjung dianggarkan bernilai RM 39.64 setiap pelawat di blok pengurusan sumber.

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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

DOE	Department of Environment
DWNP	Department of Wildlife and Natural Parks
FELDA	Federal Land Development Authority
TCM	Travel Cost Method
CVM	Contingent Valuation Method
CM	Choice Modeling
TBRSMU	Tasek Bera RAMSAR Site Management Unit
CE	Choice Experiment
CL	Conditional Logit
CFA	Confirmatory Factor Analysis
CpV	Compensating Variation
CpS	Compensating Surplus
MU	Marginal Utility
RUM	Random Utility Model
RUT	Random Utility Theory
TEV	Total Economic Value
WTA	Willingness to Accept
WTP	Willingness to Pay
SEM	Structural Equation Modeling
EFA	Exploratory Factor Analysis
SP	Stated Preference Techniques
RP	Revealed Preference Techniques
MRS	Marginal Rate of Substitution
GLM	General Linear Model

DBDC	Double Bounded Dichotomous Choice
EqV	Equivalent Variation
EqS	Equivalent Surplus

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Wide reports of losses on tropical environments should be seen as a vital sign of the concern of society towards its surroundings. The constituency and referendum from specific consumers' segment translated into the implementation of conservation and restoration plans or efforts can be seen in environmental issues such as the deforestation of tropical rain forests and threatened marine ecosystems. Increasing public attention towards issues of environmental destruction has ignited the growth of efforts among policy makers and towards the management of natural resources (Bamberg, 2003; Bogner, Brengelmann, & Wiseman, 2000; Churchman, Bechtel, & Churchman, 2002; Henle et al., 2008; Segerson & Miceli, 1998). Efficient exploitation of natural resources consequently affects their future consumption and utilization (Schultz, 2002; Stern, 2000; R Kerry Turner et al., 2000).

Economic valuation in definition can be explained as the effort to designate the quantitative values of resources provided by environment, either the market prices were available or not. Environmental resources basically provide their products and services at no cost, and then the willingness to pay by consumers could describe the value of the resource in providing such commodities (Birol & Koundouri, 2008; Blamey, Bennett, Louviere, Morrison, & Rolfe, 2000; Do & Bennett, 2009; Kaffashi et al., 2012; Louviere, 2001; Pek & Jamal, 2011; Yacob & Shuib, 2009). The general definition of a wetland area is the territory that is mostly covered by peat swamp forests which are tropical moist forests where waterlogged soils prevent dead leaves and wood from fully decomposing, and which over time creates a thick layer of acidic peat. A wetland area basically consists of use and non-use values. Wetlands are the areas that mainly contain with water which directly and indirectly associated with the animals and plant in the environment. Wetlands occur where the water table is at or near the surface of the land, or where the land is covered by water.

The RAMSAR Convention on consensus had decided to determine the wetlands under the text of the Convention (Article 1.1), where wetlands are defined as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine water the depth of which at low tide does not exceed six metres" (Mandal & Mukherjee, 2010). For the purpose of protecting coherent sites, Article 2.1 provides that wetlands are to be included in the RAMSAR List of internationally important wetlands, and "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands" (Cowardin & Golet, 1995).

Five major wetland types are generally recognized, namely, marine (coastal wetlands including coastal lagoons, rocky shores, and coral reefs); estuarine (including deltas, tidal marshes, and mangrove swamps); lacustrine (wetlands associated with lakes); riverine (wetlands along rivers and streams); and palustrine (meaning "marshy" - marshes, swamps and bogs) (Cowardin, Carter, Golet, & LaRoe, 1979; Scott, 1980; Seto & Fragkias, 2007; R Kerry Turner et al., 2000). There are also human-made wetlands such as fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms, and canals. The RAMSAR Convention has adopted a RAMSAR Classification of Wetland Type which includes 42 types, grouped into three categories: Marine and Coastal Wetlands, Inland Wetlands, and Human-made Wetlands (Brander, Florax, & Vermaat, 2006; Cowardin et al., 1979; Prentice, Surut, Christiansen, & Sinniah, 2002).

The issues of deforestation in Malaysia were highlighted before in many discussions, either academically or non-academically. As natural forests constituted more than 1.5 million hectares (UNDP, 2006) in Malaysia, mostly positioning the natural wetlands with its rich biodiversity and ecosystem functions, it is important to control not only the deforestations but it is also vital to alternatively implement sustainable management of the resources with the utilization of appropriate conservation options.

Malaysia sustains tropical rainforests as well as peat swamp forests, both of which feature diverse ecosystems threatened by human activities. Deforestation threatens a number of endangered fauna species, such as the *orang utan*, which lives only on the islands of Borneo and Sumatra. The timber extraction through illegal logging was consistently reported as the critical threat to the environment especially forests area (Tacconi, 2007). Frequently, timber is brought into Borneo from outside the country to be processed. However, the country's illegal logging and mining issues still contributing the Malaysia's forests degradations.

The rapid expansion of oil palm plantations has led to an increase in deforestation in Malaysia. In fact, oil palm agriculture acts as the major threat to biodiversity across Southeast Asia (Wilcove & Koh, 2010). Palm oil is an ingredient in numerous products ranging from foods to cosmetics, and it has even been heralded as a bio-fuel, though its "green" virtues in the latter case are hotly debated (NASA, 2010). Oil palm's massive establishments have turned the diverse natural ecosystem into the monoculture crops of oil palm plantation. As reported by World Watch Institute, before 2006, Malaysia was the world's largest producer of palm oil but has fallen behind Indonesia after that. However, Malaysia still remains as one of the world's top producers, but in the expense of the deterioration of the country's natural forests (Block, 2009).

Various factors contribute to deforestation and some of them are the factors that cause the possibility of a more severe dimension of damage, as if intermittent. For instance, forest fires have been reported to be the critical factor in demolishing

Malaysia forests, but these fires frequently stem from human activities such as land clearing for oil palm plantations and other slash-and-burn agricultural activities (Barbier, Acreman, & Knowler, 1997; Do & Bennett, 2009; NASA, 2010; Rahim, Shamsudin, Radam, & Ghani, 2014; Seto & Fragkias, 2007). In other words, fires intended to be controlled often grow out of control. Fires have been particularly devastating for Malaysia's peat swamp forests, reaching the built-up layers of peat below the surface as well as the rest of the ecosystem (Parlan, Shamsuddin, & Hamzah, 2011).

There is no perfect word or statement that would be able to describe 'deforestation' since the terminology is still not standardized yet. It can be determined as a situation that highlights not only forest conversion but also different types of degradation (Wunder, 2000). Deforestation is generally based on some matters or purposes as indicated by Geist and Lambin (2001). There are three main proximate causes, of which expansion of agriculture is one, followed by wood extraction and infrastructure extension (Cowardin & Golet, 1995; Kaffashi et al., 2012; Seto & Fragkias, 2007). The major contributor to deforestation is from the agricultural sector, especially for countries that rely on commercial large scale plantations like Malaysia.

Agricultural expansion can be categorized into at least four types consisting of shifting cultivation such as the traditional and colonist shifting cultivation, permanent cultivation with pointed out activities such as subsistence farming, as well as commercial farming, and rural integrated development agriculture project. As shown in **Table 1.1**, the decreasing forest cover in hectare from 1990 to 2010, indicating that Malaysia's deforestation activities were increasing. In 2012, a report produced by the United Nations Economic and Social Commission for Asia and the Pacific, Asian Development Bank and United Nations Environment Programme, (UNESCAP-ADB-UNEP) stated that "total loss of forest cover appears to have accelerated in Afghanistan, Armenia, Cambodia, Malaysia, Pakistan and Sri Lanka".

Table 1.1 : Malaysia's Forest Cover (excluding planted forests)

Forest Cover (1000 ha)			
1990	**2000**	**2005**	**2010**
20420	19932	19317	18649

(Source: Source: (Butler, 1999-2009)

The Food and Agriculture Organization of the United Nations (FAO) stated that Malaysia's annual deforestation rate jumped almost 86 percent between 1990-2000 period and 2000-2005. Malaysia lost an average of 140,000 hectares in total, or about 0.6 percent of its forest area per year since the early millennium compared to the other Southeast Asian countries that lost an average of 78,500 hectares or 0.35 percent of its forests annually, during the 1990s. As presented in **Table 1.2**, the

trends of deforestation in natural forest cover in Malaysia had been estimated to be 0.2 percent in both the 1990 to 2000 and 2000 to 2005 periods, but experienced an abrupt increase in the period of 2005 to 2010 by 0.64 percent.

Table 1.2 : Trends in Natural Forest Cover (Deforestation), 1990-2010

Annual Change Rate (1000 ha and %)		
1990 - 2000	***2000 - 2005***	***2005 - 2010***
*-49	*-49	*-128
**-0.2	**-0.24	**-0.64

*Note: (-) number represents deforestation, (*) represents hectare, (**) represents percentage
(Source: (Butler, 1999-2009)

Most of the land cover changes in this country were dedicated to commercial-agricultural expansion as has been reported by Tsuyuki and Goh (2011) in their specific case study in Sarawak. Their report stated that oil palm plantation had increased from 28 500 ha in the year 1985 to 744 372 ha in 2008. The depletion of natural forests, particularly peat swamp forest, for large scale oil palm plantation was also estimated at about 70 percent increase annually as the current figure noted more than 1 million ha of oil palm plantation existed in Sarawak. The driving force for this particular situation is fundamentally derived from the dependency of the state economy from the forest productions which contributed to 52 percent of state revenue.

Exploitation of natural resources such as forests or other existing biodiversity is complicated and intricate to be discussed, as the internalization of many underlying factors needs to be taken into account. The social, political, economic, cultural and technological perspectives are crucial in describing the human-environmental relations (Baker, Glynn, & Riegl, 2008; Jakobsen, Hartstein, Frachisse, & Golingi, 2007; McDorman & Tasneeyanond, 1987; Saharuddin, 1995; Teh, Teh, & Chung, 2008). The trend in Figure 1 portrayed an increasing percentage of agricultural land in Malaysia especially from the periods of 1980 to 1995. Although it had been approximately constant from the year 2000 onwards, a few other factors might have contributed to the decreasing number of Malaysia's total forest cover (Butler, 2009; Hofmann et al., 2006).

On the other hand, Malaysia's visions on the agriculture sector since the 1960's were written extensively by the government especially for socio-economic welfare as well as rural poverty eradication and had continued currently for wealth creation. In reality, the agricultural sector is struggling to fulfil the national vision on food security and self-sufficiency levels. The pace of technological enhancement should be aligned with the increasing of the population that needs to be fed. However, the technological changes in the agricultural sector might only exacerbate more deforestation no matter what systems or principles are applied such as the green

agriculture or the white agriculture. Agricultural expansion is a major force of tropical deforestation, but not all expansion results in the loss of intact forests: shrub-lands, pastures, logged or re-growing forests, degraded land, and shifting cultivation fields are all sources for new permanent agriculture (Gibbs et al., 2008).

Most influential dimensions that are possible, such as adaptation, the pace of technology generation and the impact of technological progress are abandoned when the externalities, policy-induced distortion and societal welfare are not internalized. The idea is that the impact of technological advances in agriculture to forestry depends importantly on how they directly compete with forestry for land. Fundamentally, the increase of productivity of agricultural crops such as oil palm and rubber is indirectly leading to forested land competition and further deforestation. This situation can likely be prevented by a price mechanism as in the paddy industry which so far has proved to be productive, resulting from the technological progress without too dependent on soil exploration. As stated by Jayasuriya (2001), the effect of low prices for food produced in the lowlands may increase deforestation because whenever the food prices are low, farmers' incomes will decline and this would encourage land conversion to increase the agricultural land for the maintenance of their income.

However, even if farmers were to obtain higher income as a result of high commodity prices or increase in productivity, it would also invite the possibility for deforestation as demand for the upland crops will also increase. In other words, higher income farmers will inevitably affect the exploitation of natural resources in time, indicating that the sustainable management of wetlands is an alternative that should be considered seriously. It is vital to consider the economic trade-offs that are incurred when wetlands are converted to alternative land uses, whether they are wet or dry.

Sustainable use of wetlands basically intends to effectively use the natural resources at the same time acknowledge the vital in efficient exploitation of that particular sources for the equilibrium of functions and benefits derived from it. The equilibrium is hard to achieve even for the designated protected forests since these areas usually surrounded by dense settlement and economic activity areas. Inefficient land use activities and exploitation especially in the buffer zone areas make wetlands' ecosystem vulnerable to the negative impacts. Public and private supposed to put more efforts and support to the environmental friendly management plan in order to ensure this kind of risk can be efficiently mitigated and avoided (UNESCAP-ADB-UNEP, 2012).

1.2 Study Area

Tasek Bera has been selected as the study area for the study. This topic will talk about the background of the area, potential benefits that can be derived from it, and the degradation problems it faced.

1.2.1 Tasik Bera Wetland

Tasik Bera is a freshwater marsh lake located in the middle of the watershed area of the south central part of Peninsular Malaysia Pahang River basin (**Figure 1.1**). It is a unique lake and has been labeled as a watery refuge, freshwater swamps, a wetlands mysterious legendary lake, wetland forests or wetlands that are hidden in Malaysia. All this explanation is in recognition of its unique features as a wetland habitat in Malaysia and Asia, and was gazetted as a RAMSAR site. RAMSAR Convention (Convention on Wetlands of International Importance, especially as a Waterfowl Habitat) is an international treaty that has been signed in the city of RAMSAR, Iran on February 2, 1971 between governments as a framework to conserve potential natural wetlands. The treaty was implemented on December 21, 1975.

Figure 1.1 : General Map of Tasek Bera Wetland

There are 1836 wetlands listed with an area of more than 171 million hectares globally. To date, 159 countries had agreed to sign up for the treaty (Barbier et al., 1997; Prentice et al., 2002; Yeap, Akhbar, Prentice, Lopez, & Davison, 2004). These wetlands include mangrove swamps, sea-grass, coral reefs and many other ecosystems. The status was granted to Tasik Bera in 1994 as stated by the Wetlands International - Asia Pacific, based on its biological diversity and its value of ecological and socio-economic potential. In line with this recognition, Tasik Bera and the surrounding forest were gazetted as a forest reserve by the Pahang state government with the aim of preserving and conserving the area which was full of natural treasures and valuable natural resources.

Tasik Bera with 6870 ha of wetlands in the RAMSAR site consists of freshwater and peat swamp forest (5,440 ha, 79%), open transition swamp forest (510 ha, 7%), filled with *Pandanus* plants and *Lepironia helicopus articulata* (800 ha, 12%) and open water (120 ha, 2%). There is a very wide range of flora habitat communities consisting of algae and macrophytes. A total of 374 plant species have been recorded, of which 10 species are known to be endemic to Peninsular Malaysia, while 328 species of algae have been recorded during the research in the 1970s.

A diversity of vertebrate fauna in Tasik Bera wetlands and the surrounding forest is in line with the flora diversification. A total of 453 vertebrate species has been recorded consisting of 62 species of amphibians and reptiles, 94 species of fish, 230 species of birds and 67 species of mammals. Fish species diversity is also a key value for Tasik Bera, offering breeding, treatment and source of food for fish from the Pahang River (Furtado & Mori, 2012; Lim, Furtado, & Morley, 1982; Mizuno & Furtado, 1982; Syakirah et al., 2000). The local resident Semelai aborigines, with a population estimated at around 2000 people can be found scattered throughout the area, but the majority of the village occupies an area called Pos Iskandar. The lake and forest environments are full of swamps and are largely occupied by lowland forests. This region is now greatly disturbed by shifting cultivation and illegal logging activities, as well as excessive exploitation by humans.

Malaysia's forest covered approximately 60 per cent or around 20 million hectares of the total country area. Almost 1.6 million hectares from the area are peat swamp forests and the number is decreasing. Majority of peat swamp forests are located in Sarawak while 10 percent or more are in Sabah. Less than 20 per cent of these diverse peat swamp forest are situated in Peninsular Malaysia. Most of this kind of forest area has been converted for agricultural plantation activities, residencies and other economic activities. The alteration jeopardized the physical of the landscapes and contributed to the diminishing of the important fauna species as well as the unique fauna diversity in the wetlands area.

1.2.2 The Potential Benefits of Peat Swamp Forests

The peat swamp forests are very significant to humans and the environment. It plays an important role in stabilizing ecosystems, especially in the drainage regulation, clean water and soil structure. Delineation of peat and swamp acts as a buffer between marine and freshwater systems as well as prevents excessive intrusion of saltwater into coastal land and groundwater (Giri et al., 2008; Malhi & Grace, 2000; Mayaux et al., 2005). Peat is often served in useful plant species preservation. Peat swamp forest areas can also be very beneficial through a well-managed fish extraction, timber harvesting and affordable systematic and production of various forest products such as herbs. They also have the ability to be effective carbon stores purposely in keeping the better quality of the atmosphere.

Various uses and functions of peat swamp forests are shown in Table 1.3 together with the attributes that could be enjoyed from biodiversity ecosystem of the wetlands. Peat swamp forests are also managed not only for reducing the risk of flash flooding by lowering the velocity of the water, but are also able to provide a large area for flood water storage depending on the capacity and space availability (Parlan et al., 2011; Rahim, Serin, & Wahab, 2013; Rivera-Monroy et al., 1998; Rivera Monroy, Torres, Bahamon, Newmark, & Twilley, 1999; Valiela, Bowen, & York, 2001).The dispersion of water when peat swamp area is flooded due to the reduction of water velocity remove most of the suspended sediments from the water thus providing clean water to flow into the river. As the water from floods held in peat swamps is released gradually over a long period, it can also contribute to the upkeep of base flows in rivers by maintaining their water level that run through them during dry periods. Peat is also able to bind some metals such as mercury and arsenic and can act as a reservoir for these toxic metals. This is due to the accumulation of airborne and waterborne sources over the long periods.

Table 1.3 : Potential Benefits Provided by Intact Peat Swamp Forests

Value	Specific Benefit
Uses	
Marketable commodities from direct consumption	*Forestry* *Agriculture* *Recreation/tourism* *Research/education* *Water supply* *Wildlife production* *Fish production*
Functions	
Non-marketable commodities from indirect consumption	*Flood mitigation* *Saline water intrusion avoidance* *River flows maintenance* *Sediment removal* *Nutrient removal* *Toxicant removal* *Groundwater recharge* *Groundwater discharge*
Attributes	
Non-monetary value but contribute to inner satisfaction	*Biological diversity* *Cultural/spiritual value* *Historic value* *Aesthetic value* *Wilderness value*

Note Adapted from UNDP (2006)

Estimates suggested that 5,800 tons of carbon per hectare could be stored in a 10-metre deep peat swamp compared to 300-500 tons per hectare for other types of tropical forest (UNDP, 2006). Peat swamps often serve as a natural gene bank, preserving potentially useful varieties of plant species. The peat swamp forests preservation in the wide scale play the important role in delaying the global warming phenomenon through the availability of carbon storing and few other ecosystem functions provided.

The peat swamp forests are very useful for educational purposes and to provide an opportunity for research, other than its high potential as an eco-tourism site that provides recreational activities and exciting holiday experience for nature lovers and anglers. Biological diversity and the wilderness value are among the main attractions that would draw the attention of people to come, experiencing them and might contribute towards their conservation.

1.2.3 Environmental Issues in Tasek Bera

The peat swamp forest is an important component of a tropical environment, even though the publicity it receives is lesser. The concern about the continual degradation of these forests has been highlighted in numerous literatures at the local

and global levels. The peat swamp forest or wetland area consists basically of the properties that can be directly harvested, used and marketed, such as in the forestry, agriculture, and recreation/tourism, together with research/education, water supply, wildlife and fish production.

Tasek Bera wetland provided as much as list of recreational activities and ecosystem functions to be consumed either directly or indirectly. As can be seen in Table 1.7 there are few general recreational activities provided in Tasek Bera area. Moreover, there are also the indirect benefits that are intangible but play a vital role such as flood mitigation, prevention of saline water intrusion, maintenance of base flows in rivers, sediment removal, nutrient removal, toxicant removal, groundwater recharge, carbon sink and groundwater discharge.

Table 1.4 : Facilities and Activities Provided in Tasek Bera

FACILITIES			
Prayer room	Active	Kayaking	Active
Bath & dressing room	Active	Quarters	Active
Toilet	Active	Management building	Active
Parking	Active	Interpretive centre	Active
Jetty	Active	Interpretive trail	Active
Carriageway	Active	Camping site	Active
Walkway	Active	Information board	Active

(Source: Tasek Bera RAMSAR Site Management Unit (2014)

The biodiversity at Tasek Bera wetland area is decreasing due to the human activities. The number of different species of plants, animals and their population levels need to be increased if not maintain in order to sustain the flora and fauna diversity. The deteriorations of the forest environment are also jeopardizing the wildlife natural habitats. Currently it is estimated that 30 percent of the biodiversity of the wetland already deteriorated. As the number of cases related to illegal encroachment activities is getting frequent, it would be troublesome and stocking liabilities on biodiversity capabilities in ensuring the ecosystem services of the wetland can be effectively functioning. It is vital to put the efforts in increasing the flora and fauna along with the restoration for at least 20 percent of the natural habitats.

At current, the surface water area of the Tasek Bera is covered by 'rasau'. The water level is becoming increasingly shallow due to the existence of ‘rasau’ and potentially decreasing the marine life population of the lake especially fishes. It also indirectly influences the hydrological functions of the wetland such as flood mitigation, toxicant and sediment removal. The evasion of these plants will ensure the sustainability of marine wildlife (habitats and population) and ecosystem functions. Various uses and functions are could be enjoyed from the wetlands' biodiversity

ecosystem. Tasek Bera wetland area is currently facing the degradation of its ecosystem functions due to the destructive human activities. The restoration of the ecosystem functions is vital since the services are directly and indirectly give an impact to human and the society such as the functions of toxicant removal, sediment removal and flood mitigation.

Table 1.5 : Resources and Management Status of Tasek Bera Wetland Area

Tasek Bera Biodiversity Conservation	
Biodiversity	No change (30% conversion to agricultural land)
Open Water Surface Area	Shrouded by 'rasau'
Ecosystem Functions	Decreasing
Conservation Charge	RM 0 (Not implemented)
Ecotourism Facilities & Services	
Accommodation	1 unit
Recreational Activities	Touring, camping and fishing
License-skilled Tourist Guide	3 Green-badge holder
Entrance Fee	RM 0 (Not implemented)

The accommodations with reasonable prices and convenient usually considered by the tourist or visitors when they come. Rationally, sometimes tourists with families demand a convenient environment to enjoy holidays and accommodation is necessarily one of the factors that affect them as well as their desire to enjoy the rich biodiversity that is available at Tasek Bera. At present, only one resort operating in Tasek Bera and has a small capacity and have not upgraded in a long time. The development of suitable and appropriate choices for accommodation at Tasek Bera should not be compromised as various accommodation choices will greatly contribute to the alleviation of the wetland image as main attraction for different environmental related activities either among the locals or foreigners.

Interesting activities provided in a place usually is one of the main factors to attract the tourist to come to a place. Tasek Bera which is actually rich in biodiversity has many potential to be used such as the species diversity and the beauty of her natural environment. Activities such as fishing, forest marching, sightseeing and camping are the interesting activities for recreational experiences and suitable for the Tasek Bera's environmental landscape. The program and activities layout should be upgraded extensively by exploiting the existing natural resources.

The touring in the forest reserve requires guidance and assistance to ensure the security of the tourists. The tourist guides also should be able to aiding the tourists for the learning or educating processes such as explaining the rare flora and fauna that can be found at Tasek Bera and provide the trekking lessons. The development of license-skilled tourist guides is needed as currently there are limited quantities of amateur and professional license-skilled tourist guide provided guidance and for the

safety purposes. It has been identified that to the date there are only 3 green badge holders of license skilled tourist guide at Tasek Bera.

Conservation charge is the revenue collection system in Tasek Bera wetland area by the managers for the maintenance, management and operation expenses. The collection will be channeled to Tasek Bera Wetland Trust Fund and will be used in the various forest reserve conservation activities. The current fund system for management activities in Tasek Bera wetland area is depending on the state and federal allocations which is not sufficient to cover the maintenance, management and operational expenses. In addition, the establishment of entrance fees should be considered to provide funding to maintain and improve the quality of facilities and services offered to the visitors of Tasek Bera. The funds raised pursuant to fee will remain exclusively within the improvement of ecotourism facilities and services.

Agricultural Activities and Current Deterioration Status

The agricultural activities have been determined based on qualitative observations including interview and physical observation with forest rangers from Tasek Bera RAMSAR Site Management Unit. The wetland in total are segregated into 5 different characteristics namely peatland, peat swamp forests, mangrove and transitional forest, lake and river, and wildlife. On the other hand, agricultural activities have been categorized into 8 different categories.

The overall threat level for the construction of drains, drainage or diversion system from the main river system is moderate. It implies that the activity in supporting the agricultural cultivation is not critical compare to the conversion of forests to agricultural land or aquaculture which has been found to be high. More than 30% of the total Tasek Bera wetland area has been converted to agricultural land as refers to the qualitative information attained from the study.

The climate change phenomenon has affected few economic activities and indirectly affects the hydrological regime of this wetland area. The main lake of had experienced extreme degradation of water level causes by the increasing of average temperature when the El Nino hit. This was further compounded by the congested ‘rasau’ plants that increasingly dominate every inch of the open water surface area of the lake. Forest burning, using fish poison in the water flow and the extraction of timber have also been identified as contributor towards deterioration of the wetland area but in the moderate manner. However, the upstream developments are determined to be high in overall threat level as can be seen from the table. The land conversion from forest area into residencies area especially by the aborigines have been identified put a high threat level to the biodiversity conservation of the wetland as a whole.

Although the wetland intangible attributes are widely known to many people, it is undeniably that the roles of the functions integrated in the ecological systems is always underappreciated and forgotten. Unsustainable land practices, over exploitation of the natural resources existed; unregulated hunting and timber extraction and many other negative economic intervention activities in the wetland area have led to the declining uses and functions. Biodiversity losses and flora or fauna habitat damages have been widely reported throughout the years. These are basically the problems and constraints that always been faced by the resource manager of Tasek Bera wetland area Table 1.6.

Table 1.6 : Agricultural Activities and Current Tasek Bera's Deterioration Status

Activity	Peatland	Peat Swamp Forest	Mangrove & Transitional Forest	Lake & River	Wildlife	Overall Threat Level
The construction of drains, drainage or diversion system	Moderate	Low	Moderate	Low	-	**Moderate**
Conversion of forests to agricultural or aquaculture	High	High	Low	-	High	**High**
Climate change (impact on the hydrological regime)	High	Moderate	-	High	High	**High**
Forest burning	High	Moderate	Low	Low	-	**Moderate**
Upstream developments (land conversion)	-	-	Moderate	High	-	**High**
The extraction of timber	High	Moderate	Low	Low	-	**Moderate**
Use of fish poison in the water flow	-	-	-	Moderate	-	**Moderate**
Illegal hunting / gathering of forest products for commercial purposes	-	-	-	-	-	**Low**
Threat status for each character	**High**	**Moderate**	**Moderate**	**High**	**Low**	**High**

Note: High => 50%, Average => Low = 30% and> 10%. The determination of the level of threat based on quantitative data and qualitative observations (interview and physical observation with forest rangers

Deforestation

The extensive programmes of Federal Land Development Authority (FELDA) from 1970's until 1990's changed the landscapes of Tasek Bera forests area which converted 292.86 kilometre squares of original forest area into oil palm and rubber plantations. In between four decades, not less than 10 times of expansion activities have been recorded as reported by Raj (2013) and Gharibreza et al. (2013). Deforestation, large scale conversion to agricultural plantation and forest fires were the common activities in phase of setting up an oil palm plantations which is economically agreed upon that time.

Furthermore, Wu¨st and Bustin (2004) recorded the continuation of anthropogenic activities and encroachment specifically onto the Tasek Bera RAMSAR site area from 47.14 km^2 in 1994 to 340 km^2 in 2009 for the establishment of oil palm and rubber plantations resulted in cleared land increasing. It has been identified that this deterioration masterminded by local residents as they acknowledged the monetary benefits gained from running the oil palm plantations (Angelsen, Kaimowitz, Lee, & Barrett, 2001; Geist & Lambin, 2001). Facilities and conveniences for undertake the plantations since it had been surrounded by oil palm plantations and mills encouraged the locals to operate these activities. It has been reported that at least 20 ha of wetland's reserved area have been converted to oil palm and rubber plantations in 2015 by the aborigines.

Deforestation and land clearing were carried out by FELDA between 1970 and 1975, 1976 and 1980, 1981 and 1985, 1986 and 1990, 1991 and 1995, whilst similar activities were carried by local residents between 1995 and 2000. A total forested area of 340 km2 was clear-cut to provide land for oil palm and rubber plantations in the Bera Lake catchment (Chong, 2007). Development of oil palm plantations typically involves five main stages, namely; (1) land clearing, (2) nursery establishment, (3) site preparation, (4) field establishment, (5) maintenance and harvesting, and (6) replanting/abandonment (MPOC, 2007). The total drainage area of Tasek Bera obtained is approximately 590 km^2 which more than 50 percent of the area has been converted into oil palm and rubber plantations. The morphology of the wetland area can be seen in **Figure 1.2** below.

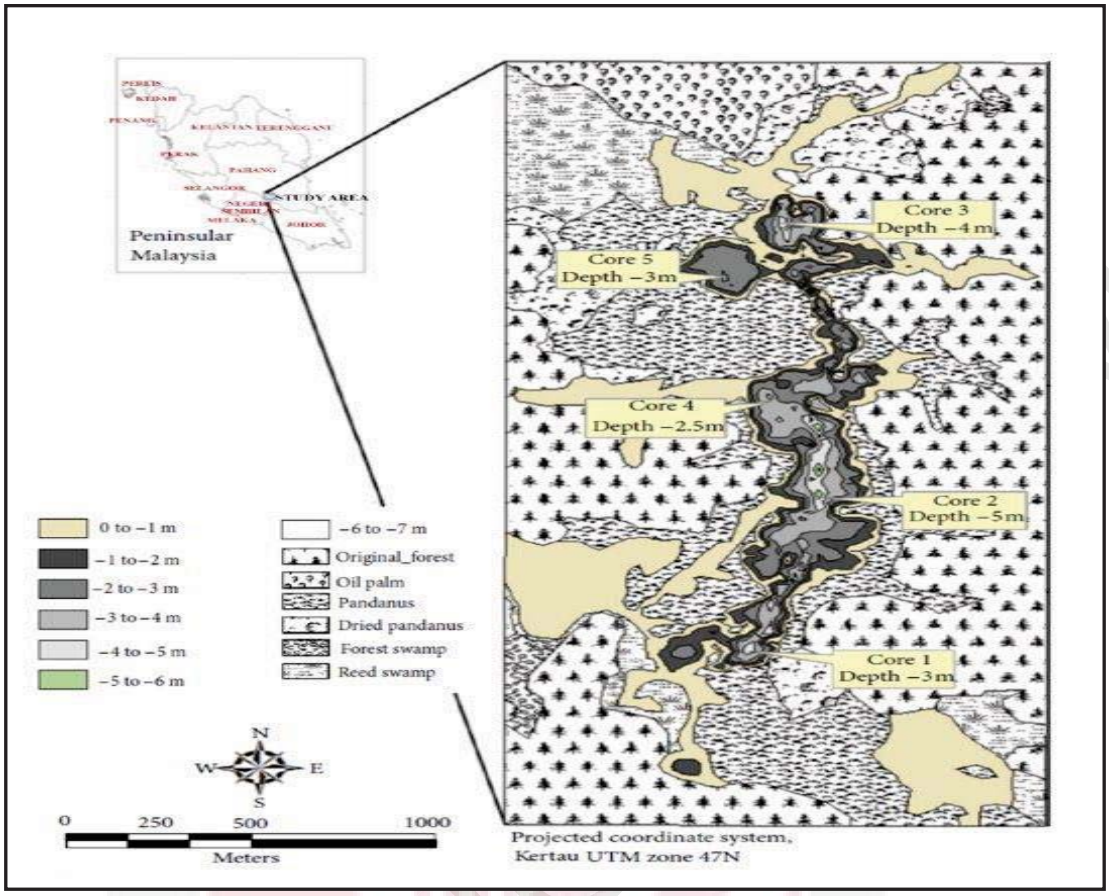

Figure 1.2 : Oil Palm Plantations Map Surround of Tasek Bera Wetland

Rubber and oil palm plantations covered almost half of the drainage area of the wetland as much as 300 km^2 from total 625 km^2. Due to the massive conversion, the regulative effect of forest canopy in lowering the evapotranspiration of water net loss has been decreased approximately half of its function. The dense canopy provides the microclimate that regulates and protects the soil and understory from drying out. Decreasing the forest's inventories such as original trees and other plants also contributed to the loss in carbon sequestration function (Hofmann et al., 2006; Page, Wust, & Banks, 2010; Schimel et al., 2001; Twilley, Chen, & Hargis, 1992; Wust et al., 2007).

Semelai Aborigines

The *Proto Malay*, Semelai aborigines has occupied Tasek Bera since 600 years ago. This tribe has been living along the banks of and also deep in the forest surrounding the Tasek Bera. The indigenous people of Tasek Bera before, heavily depended on the natural resources existed in the lake and its surround. In the pre-colonial era, Semelai people practiced the shifting cultivation especially for the rice cultivation.

They cultivated rice mainly for their needs for food also for their ancestor's legacy continuation. Rice, which has afforded them prestige vis-à-vis other cultures, is highly salient to Semelai agriculture and identity. In fact, they probably cultivated it mostly for its symbolic value since it was not traded (Gianno & Bayr, 2009). A primary commitment to rice cultivation, with cassava as insurance: 'The Semelai are husbandmen and grow dry rice as the staple crop, with tapioca as a stand-by (Needham, 1974).

In the period of communists just before the independence, Semelai community has been relocated to Pos Iskandar (fenced area) by the federal government at the edge of the forest area to easily protect the community and avoiding the communist's reach. After independence, part the indigenous people from total of 1400 in population migrated back in the forest area while half of them permanently stayed at Pos Iskandar area. Since that, Semelai aborigines have been under considerable pressure to rapidly re-adapt to a shrinking resource base as well as to the Malaysian nation-state. In concert with these changes, Semelai have lost most of their autonomy (Hoe, 2001) and their original culture knowledge (Mohamad, 2010).

Semelai today are mostly reliant on oil palm or rubber cultivation and out-migration to the nearest town to make a living rather than continuing their rice cultivation. Their proximity to more powerful societies, Orang Asli cultures have had to make accommodations and adaptations quickly as their social environment denied access to some resources while presenting opportunities for others (Gianno & Bayr, 2009). The expansion of oil palm plantations by FELDA indirectly affected the indigenous people, jeopardizing the original resources of the wetland area and insufficiently provides the tribe.

Furthermore, Semelai community dependency upon forest plant has decreasing as 70 percent of secondary forest area (Mohamad, 2010) embracing the Semelai traditional lands has been converted to intensive rubber and oil palm plantations. Those environments encouraged the Semelai to open the oil palm plantations illegally and exploited by outsiders, to cope with the needs for their livelihood and pressure from modernisation of the surround that fundamentally driven by monetary benefits.

Acts especially related to forestry and environments are bypassed by the Aboriginal Peoples Act 1954. Defense of any action violating laws by the indigenous people without a proper justification that is due to the indigenous originality is complicated to be resolved. The forest reserve is an age-old heritage of the indigenous people (Gianno & Bayr, 2009; Hoe, 2001; Mohamad, 2010; Needham, 1974). They have inherited the area for their self-survival with some irrationality and complication. Therefore, the best solution will not be easily found as long as there are no plans for intensive legal implementations which are applicable and practical.

Water Ecosystem

Water and lake ecosystem is not exceptionally affected. The development phases in the establishment of oil palm plantations especially from land clearing activities and maintenance procedures which heavily uses fertilizers and pesticides contribute to the deterioration of water ecosystem at Tasek Bera. The open water area of Tasek Bera calculated to be 112 hectares which is located at the northernmost part of the catchment area. It was a sanctuary for more than 200 bird species, 50 mammal species and 94 fish species.

Comprehensive clean-up efforts for the lake and sustainable land use scheme are needed for this wetland area as a large amount of sediments from metallic elements have been recorded in the Tasek Bera's water ecosystem (Raj, 2013). Intense chemical weathering of rock units have been reported to contribute to the sandy mud supply in the lake during the land development phases of oil palm plantations. In addition the mature oil palm plantations with high organic matter productivity deposited moderately organic-rich sediments into the water system (Furtado & Mori, 2012; Hitzhusen, 1993; Posthumus, Hewett, Morris, & Quinn, 2008; Zhao, Hitzhusen, & Chern, 1991).

Currently the extensive riparian areas have established in the lake water system covered with Rassau (Pandanus sp.) of dry land vegetation. It is a matter of time that the catchment area would change to the dry land area if the frequencies of the organic rich sediments and material are still increasing (Furtado & Mori, 2012; Pimentel et al., 1997; Scott, 1980; Zhao et al., 1991). Parts of the open water area have been covered by Kercut (Cyperaceae) while large parts of the lake have been dominated by Rassau (Pandanus sp.). Wu¨st and Bustin (2004) have presented the transition phase to a pandan-dominated due to increase in mineral water as presented in Table 1.7.

Table 1.7 : Transition to Pandan-Dominated Due to Increase in Mineral Matter

Age (Years)	Hydroseral Vegetation	Dry-land Vegetation
0	Pandanus swamp very reduced, Cyperaceae widespread	Extensive forest destruction, expansion of Lalang (Gramineae) and Kercut (Cyperaceae)
600	Pandanus swamp reduced, Cyperaceae extensive	Dicranopteris very widespread, expansion of non-forest trees, e.g. Trema
2000	Riparian taxa moderately represented, Pandanus extensive	
2400	Pandanus very widespread Elaeocarpus dominant	Extensive riparian areas with Rassau (Pandanus sp.)
3400	Riparian communities extensive, hydrophytic vegetation very limited	
5500	Dipterocarpaceae widespread	Undisturbed Meranti-Keruing rain forest (Shorea sp., Dipterocarpus sp.)

(Source: Adapted from Wu¨st and Bustin (2004)

Based on the period of transition by hydro seral vegetation presented in the table, kercut and pandanus sp. will eventually changes the landscape of the open water area of the lake in Tasek Bera. It is possible that this natural water catchment area will be replaced by the riparian plants and the worst case scenario; dipterocarps species if the chemical run off continue to enter the water area. The deterioration is not limited to the open water surface area itself but also to the flora and fauna habitats that existed together with the lake.

Wildlife Species Eradication

Wildlife species eradications in Tasek Bera are mostly due to indirect and indirect environmental issues. Deforestation of the wetlands in large scale and pollution of the water catchment areas have been identified as the main factors that contributed to the wildlife species deterioration (Norma, Mohd-Sofian, & Zakaria-Ismail, 2001). Such human impacts have destroyed the habitats as the shifting cultivation, possible pollution, destruction of watershed, logging operations, erosional and siltation known to have occurred to the detriment of many valuable species at Tasik Bera. The assessment of species status deduced from the total number of individuals collected from Tasek Bera can be seen in Table 1.8 below.

Table 1.8 : Species Status Deduced Collected from Tasek Bera

Status indicated	Range of Individual Numbers	Total Species	Species Name
Common	35 - 79	3	L. hyalina, I. acutus, N. pygmaea.
Abundant	80 - 130	1	Neurothemis fluctuans.
Very Abundant	> 130	1	Orchithemis pulcherrima.
Very rare	1-2	29	all others
Rare	< 10	15	all others
Scarce	10 - 34	10	E. analis, P. williamsoni, L. lineata, C. fluviatilis, O. sabina, R. phyllis, R. obsolescens, T. aurora, U. s. signata, Z. i. malayana.

(Source: Adapted from Norma et al. (2001)

Furthermore, the otter's population has been significantly decreased over the time as reported by Syakirah et al. (2000). This was due to the fact that the otters were being eliminated by fishermen because of the fishing nets and/or fish traps and the apparatus usually destroyed by them. Easiest way in protecting the tools was by eliminating the source of the problems faced by the fishermen, otters. In addition, five species recorded in the peat swamp forest were not recorded at the two lowland forest sites, and 21 species recorded in lowland forest were not recorded in peat swamp forest, supports the view that conservation of both these habitats is necessary.

1.2.4 Tasek Bera Management

Tasik Bera wetland area currently managed by Tasik Bera RAMSAR Site Management Unit under Department of Wildlife and National Parks (DWNP) as the leader together with other agencies such as Department of Forestry, Department of Fishery, Department of Environment and Society Development Department. Inter agencies cooperation under one management should be efficient for the implementation of various acts and legal which are enforced differently by each agency.

However, enforcement functions are not clearly defined between the responsible agencies or bodies. Tasik Bera RAMSAR Site Management Unit is a body established by the Department Wildlife and National Parks (DWNP) which has been categorized as a federal law enforcement unit, while the Department of Forestry is

responsible to the state of Pahang. The status quo for the administration of Tasik Bera Forest Reserve is based on the fact that the Tasik Bera has been gazetted as a forest reserve and is under the jurisdiction of the state government. However, currently it is administered by the federal enforcement unit which then creates inconsistencies in the enforcement objectives and approaches Table 1.9.

Table 1.9 : Various Laws Related to Conservation

Law	Details
Aboriginal Peoples Act 1954	• Provides for the protection, well-being and advancement of aboriginal people. • No land within an aboriginal area can be designated as wildlife reserve.
Land Conservation Act 1960	• Specifically to conserve hill lands, to prevent soil erosion, and control salutation.
Land Capability Classification 1963	• Land use planning in PM has been partly based on LCC. • Mining and agriculture have higher priority; then only forestry and other uses. • Wildlife reserves and protected forest reserves are included in the category for land possessing little or no mineral, agricultural or productive forest development potential in Class V.
National Land Code 1965	• Makes provisions to set aside potential protected areas as wildlife reserve or national park.
Customs Act 1967 (amended in 1988)	• Identifies that the DWNP as the reference agency for import and export of any wild bird and animal, alive or dead; DWNP license; CITES permit
Environmental Quality Act 1974 (amended 1985)	• DOE monitors 20 specific activities and parameters related to pollution and environmental standards. • Prescribed activities that affect forest e.g. logging >5 km² • EIA guidelines for forestry
Local Government Act No. 171 of 1976	• Empowers the state government to create local authorities, who then may establish and manage public places, including parks and provide for the creation of small protected areas of natural habitat and intensively managed parks.
Town and Country Planning Act No. 172 of 1976	• Empowers the state to have their own T&CPD. • Ensures conservation is an essential component of land use planning and authorizes the state to set aside specific areas as conservation zones.
Third Malaysia Plan 1976–1980	• The first time mentioned on the proposed additional 15 conservation areas totaling 5,663.30 km².
The National Forest Policy 1978 revised in 1992	• Applicable to Peninsular Malaysia. • Provides the classification of forests as protective, productive and amenity forests. • Provides guidelines for the management of remaining forest resources. • Forest harvesting is carried out in the production forest and state land forest.
National Parks Act 1980	• Provides for the states to establish national parks to be administered by DWNP under the federal government.
National Forest Act 1984 (Act 313)	• Act to provide for the administration, management and conservation of forests and forestry development within the States of Malaysia.
Fisheries Act 1985 (Act 317)	• Act relating to fisheries, including the conservation, management and development of maritime and estuarine fishing and fisheries, in Malaysia

	waters, to turtles and riverine fishing in Malaysia and to matters connected therewith or incidental thereto. • Establishment of marine park and marine reserve. • Protection of aquatic mammals and turtles.
National Conservation Strategy 1993	• Emphasis on the conservation of natural resources, develop sustainable and improve efficiency in resource use and management.
National Environment Policy	• Aim at achieving development taking account the environmental carrying capacity and conserving the country's cultural and natural heritage, all within the concept of sustainable development.
National Policy on Biodiversity 1994	• Sets out a policy, strategy and action plan of programs for effective conservation and management of biological diversity. • Enhance sustainable utilization of biodiversity. • Strengthen biodiversity management.
Marine Park Island Management Conceptual Plan 1994	• Identifies important marine resources and habitats within protected waters. • Protection of specific land areas on these islands
National Ecotourism Plan 1995	• Use ecotourism as a way to promote conservation and sustainable development.

(Source: DWNP (2014)

Furthermore, the ineffectiveness of the law due to external factors such as the involvement of individuals or influential bodies would create some loopholes in the enforcements. There are many violations towards the law such as deforestation and illegal agriculture activities by settlers as they were not appropriately punished in accordance with the law or existing acts.

Lead by a Director (*Penguasa*) from DWNP, there are 20 staffs including rangers, assistants and officers from various departments in the Tasek Bera RAMSAR Site Management Unit jointly together in enforcements, routine observations, maintenances and few other obligations for this wetland conservation management as referred to the current status of Tasek Bera RAMSAR Site Management Unit Table 1.10.

Table 1.10 : Current Status of Tasek Bera Management

Responsibility	Number of Staff
Director (*Penguasa*)	1
Deputy Director	1
Wildlife Officer	
• Assistant Officer	2
• Assistant	9
Conservation Officer	
• Assistant Officer	1
• Assistant	1
Ranger	2
Environment Officer	
• Assistant Officer	1
Fishery Officer	
• Assistant	1
Society Development Officer	
• Assistant	1

(Source: Tasek Bera RAMSAR Site Management Unit, DWNP (2014)

Shortage of enforcement personnel indirectly affects the enforcement activities. It might be due to the disordered state of jurisdiction in governing this area which had not been clearly signed by relevant agencies, followed by frequent denials on the enforcement actions ever taken by existing agencies. Administrators too did not get the proper support from the parties concerned in some enforcement actions. Such matters were indirectly debilitating to the commitment in further enforcements, and these gave a negative impact on the provision of manpower and complicated financial situation.

Exploitation of environmental resources is necessary in the development of human civilization and the survival of the economic activity. The main question that overshadows managers, however, is to what extent the exploitation of resources be carried out so that environmental resources are not tapped or swallowed unto development. Is it worth these valuable natural resources to be sacrificed in the name of economic progress and development, or conservation needs to retain these resources so that future generations can benefit from it later? The importance of natural resources, particularly the forest reserve of Tasik Bera and to the survival of surrounding communities and human life is something that can be defined on an individual basis even though there is no formal information underpinning the knowledge. It is undeniable that the issues and problems that overlap the matter of national biodiversity assets have sparked some concern although not at a critical level.

Reserve forest areas rich in biodiversity are not spared from facing this misfortune. Tasik Bera is currently facing a critical threat range and damages. Among them is the illegal agricultural activity performed on a large scale: deforestation for oil palm and rubber cultivation. Illegal encroachment is done by those who do not care about the negative impact on the environment and are driven by business profits alone. Additionally, waste and chemicals streams are also flowing into the catchment forest reserves regularly and continuously, a consequence of the agricultural activities around the forest territory.

Remnants of the resources are believed to consist of compound pollution of chemical fertilizer residues and poisons that are synonymously used in farming and commercial agricultural sector. Rampant illegal logging has also occurred in the forest reserve which in turn severely affects the existing ecosystems. Indirectly, the functions of lowland habitat are very significant for the survival of flora and fauna as well as being beneficial to society that is unable to function well. These would lead to destruction as had happened to bird habitats, and the extinction of some species of dragonflies as had been reported by researchers.

In essence, the deterioration of resources and the highly acute pollution problems in Tasik Bera Forest Reserve are closely related to the natural resource management problem itself. Threats as described cannot be curbed due to several factors that have been and are being identified from the degradation sites that have been visited before. If the factors and causes that invite these resource degradation problems can be addressed, surely, the unique natural endowments can be conserved and further protected.

1.3 Problem Statement

Apparently the flora and fauna in Tasek Bera face threats to their survival in view of the large scale deforestation of wetlands and the pollution of rivers, since certain species demand some specific habitats for survival. The destruction of the Tasek Bera has also been reported by Chong (2007), concerning the deterioration of water quality and quantity. The main source of degradation includes surface run-off containing nutrient rich water from nearby plantations, sewage from communities living around the lake, logging activities and oil discharges from motorboats (Sharip & Zakaria, 2008).

Such human impacts have destroyed the habitats because shifting cultivation, possible pollution, destruction of watershed, logging operations, erosion and siltation are known to have occurred to the detriment of many valuable species at Tasek Bera as mentioned by Norma-Rashid, Mohd-Sofian, and Zakaria-Ismail (2001). Even though it may look like both the direct and indirect human activities are the causes of the destruction, the former are the major contributors towards the degradation of the peat swamp forests. More importantly, human alterations by creating conversion of

peat swamp forests to agriculture and rural settlement, as well as forestry uses and the other human activities, have recently led to the remarkable losses of wetland habitats.

These activities rapidly modify the ecosystem, frequently in an irrecoverable fashion. Unsustainable interventions quickly affect the environmental system and often invite negative and harmful effects to the flora and fauna community and not to mention the people living in the environment. Damaged groundwater tables cause significant nutrient production for plants not produced in line with existing plant requirements. Over extraction of timber sources has deteriorates natural rich of wetland biodiversity. Furthermore, it contributes to the soil compaction, which eventually altering the natural habitats and natural regeneration function in the ecosystem. Therefore, it is vital to plan and implement sustainable management and conservation since uncountable benefits can be gained from a well-managed Tasek Bera, the largest natural wetland in Malaysia, especially the lake and the peat swamp forest.

Exploitation of environmental resources is a necessity in the development of human civilization and the survival of economic activities. The main question that has dominated managers' minds is to what extent the exploitation of resources can be done so that environmental resources are not tapped or swallowed unto development. Is it worth for these valuable natural resources to be sacrificed for economic progress and development, or is conservation actions needed to retain these resources for future generations to enjoy? The importance of natural resources, particularly the forest reserve of Tasek Bera, to the survival of surrounding communities and human life is something that cannot be defined on an individual basis even though there has been no formal information underpinning the knowledge. It is undeniable that the issues and problems that overlap the matter of national biodiversity assets have sparked some concern and negative perception, even though they are not in a critical stage as yet.

It is also important to change the perception if negative; towards Tasek Bera among the society in the attempt to change the environmental attitude and their behavior. The efficient management of the resources needs to be undertaken to articulate that this wetland is capable in providing the ecosystems functions and beneficial to the people still. The changes in environmental attitude initiated by the changes in perception would help to develop the self-conscious responsibility towards environmental conservation since the efforts cannot be done alone by the resource manager. People need to understand that Tasek Bera wetland area is a public good in which need to be taken care by all level and stages in society.

1.4 Research Questions

The process of valuing the resource management and conservation options of the Tasek Bera wetland area requires these research questions to be answered:

- What are the perception towards environmental issues existing at the Tasek Bera wetland area, in the opinion of visitors
- How much would be a visitor's willingness to pay for the resource management and conservation attributes of Tasek Bera?
- What are the resource managements and conservation attributes existing at the Tasek Bera wetland area?
- What are visitors' demographic factors which influence the value of resource management and conservation options in Tasek Bera?
- What are the ranking of the resource management and conservation attributes for sustainable development of the Tasek Bera wetland area?

1.5 Objectives of the Study

The purpose of this study is to assess the value of related resources in the development of wetlands in Malaysia by using the environmental economic approach to help in their management. This study gives the options that can enhance the economic opportunities that are sustainable in the development of a wetland area. The evaluation and assessment of wetland area development is very important in order to realize that it fulfils the requirements of visitor preferences through the understanding of the concept of a wetland area.

The general objective of the study is to evaluate and determine the management of the resource and conservation options of the Tasik Bera wetland area.

Specific objectives:

1. To determine the perception towards environmental issues existing at the Tasek Bera wetland area
2. To determine the value of resource management and conservation options of the wetland
3. To rank the resource management and conservation attributes according to their importance

1.6 Significance of the Study

The significance of the study can be seen from at least three perspectives: namely, wetland management, valuation method and visitors of Tasek Bera. The study will significantly benefit the wetland management of the study area in terms of appropriate direct and indirect sustainable development. While the implementation of Choice Modeling approach will ensure the consistency of the environmental valuation technique and avoiding some potential biases from other valuation techniques.

1.6.1 Wetland Management

The measurement of the economic value of wetland development in Tasik Bera through user preferences can be used to provide information for wetland development planning and decision making. It provides resource managers and policy makers with the necessary information and knowledge for any corrective actions to be taken. This study will also provide beneficial contribution to the economic perspective to resource management and conservation practices in the wetlands of Malaysia as a whole, either directly or indirectly.

The direct significances are the sustainable physical development of the wetland such as the restoration of the ecosystem functions, increasing the quality of habitats for flora and fauna, the accessibilities, upgrading of the recreational activities and facilities, the increase of the population of deteriorating species, the provision of appropriate services for visitors' accommodations and personnel resources for efficient management and conservation options. Indirectly, providing the specific mechanism for fee collections (payment vehicle), namely the conservation charge, will intentionally be implemented for the purpose of resource management and conservation practices of the wetland area.

The study is specifically aimed at generating data on non-market values so that policy-makers can better ascertain if the forest resources have been managed in the most desirable way from the perspective of society at large. In other words, this study attempts to inform the process of determining a more desirable (Pareto improving) management plan, relative to the current plan, from the public point of view. It provides important demand-side information for policy makers to form the sustainable management of the wetland area based on the defined attributes levels and additional periodic (annually) management charge which public is willing to pay for the improvement of management and conservation quality. The analyses are important, as it seeks to identify and reduce any mismatch between what the public wants and the levels of environmental services that have been considered desirable from the technical and commercial perspectives of the resource managers.

1.6.2 Valuation Method

The economic valuation on environmental assets had undergone a continuous application and implementation starting in the 1990's in Malaysia. The valuation techniques had been used in some studies, and recorded in various subject matters with other techniques. Most of the valuation studies on non-market goods had adopted the Travel Cost Method (TCM) and the Contingent Valuation Method (CVM) as their assessment tools. N. Abdullah (1995) used the CVM in valuing outdoor recreational resources in urban parks while Willis, Garrod, and Chee (1996) used both the TCM and CVM to estimate the recreational value of forest reserve areas in Malaysia. Some studies were found that had used CVM with regard to the marine parks environmental valuation, such as Yeo (2004) who studied the recreational benefits in Pulau Payar Marine Park and Radam and Mansor (2005) wrote on the recreational value in Manukan Island, Sabah by a dichotomous choice of CVM implementation.

According to Adamowicz, Boxall, Williams, and Louviere (1998) there are several reasons for the increase in the use of the Choice Modeling Approach in valuing non-market goods, such as the reduction of potential biases of CVM, more information being elicited from each respondent compared to that of CVM and the possibility of testing for internal consistency. Furthermore, Othman and Asmuni (2003), for example, used CVM to estimate the recreational benefits in the wetlands in Kuala Selangor. Othman, Bennett, and Blamey (2004) had also used the Choice Modeling in the study of the Matang Mangrove Forest. This was followed by the study of the Redang Island Marine Park (Yacob & Shuib, 2009). There were also studies that had employed the Choice Modeling approach but on a different subject matter from the environmental valuation. These can be found in waste management as implemented by Othman (2003) that had studied the household preferences for solid waste management in Malaysia.

1.6.3 Visitors

Identifying the reasons for visitors coming to the area and discovering their preferences for the attributes of conservation and ecotourism needs for this gazetted wetland area would provide valuable information for the resource managers, state governments and the departments of forestry. These information which could be attained through direct primary source of visitors are expected to bring a wider range of societal values towards the Tasek Bera wetland specifically and natural wetlands nationally.

The determination of visitors' preferences and their interests when visiting Tasek Bera may help to realign the attribute levels of biodiversity conservation and ecotourism management options. It helps to minimize the achievement of users' expectations without neglecting the visions of the wetland managers. The maximization of the satisfaction of visitors and also of the utilities would attract

more arrivals of visitors as well as re-visitors. Hence, the generation of revenue from the conservation charge, along with the improvement of entrance fee charges would strengthen the financial books of resource managers, which in turn would help them to efficiently manage and conserve the wetland area.

1.7 Organization of the Study

Chapter I: This chapter will discuss the background of the study and the problems occurring to justify the reason for carrying it out. The scope of the study and all definitions and terms used in the study will also be discussed.

Chapter II: This chapter will discuss previous studies and findings related to the environmental issues and the determinants indicated in the theoretical foundation which would include the attributes, related variables and socio-demographic profiles that will be utilised.

Chapter III: This chapter will be presented to justify the hypothesized model and the explanations of methodologies used. The development of the research instrument will be explained. This chapter will also discuss the sampling and data collection procedures, as well as the analyses that will be applied.

Chapter IV: The preliminary results will be presented based on the analyses carried out. The results and findings of the estimations from the Exploratory and Confirmatory Factor Analysis, Contingent Valuation Method and Choice Modelling will be discussed in this chapter.

Chapter V: The findings will be summarized and concluded in this chapter. This chapter will also discuss the study contributions and its implications to the stakeholders. Limitations of the study will be presented and the recommendations for future researches will be proposed.

1.8 Summary

This chapter has described the general information of wetland especially in the Malaysian context, including the major drivers towards the degradation of wetlands in Malaysia such as past agricultural expansion activities and other development influences. This chapter also discussed the characteristics of the study area of the Tasek Bera wetland (gazetted as Tasek Bera Forest Reserve), together with its physical, social and political features. The information and knowledge of these dimensions are necessary to understand the importance that this wetland is to be studied for sustainable resource management and conservation options. The review of the management and conservation attributes will point out the appropriate

physical development to this particular wetland in line with the intangible economic value that is treasured. The challenges and constraints that have been faced by resource managers, Tasek Bera RAMSAR Site Management Unit and the State Forestry Department have also been highlighted in this chapter. The potentials and the problems that had arisen at the Tasek Bera wetland area in terms of resource management and conservation practices have encouraged the researcher to make it a case study. The study site has to be fully understood, with the information and problems that are gleaned from it being very important and useful to determine the potential research method in the next two chapters. The next chapter provides an overview of previous studies and findings that are related to the environmental valuation. The determinants indicated in the theoretical foundation including the attributes, related variables and socio-demographic profiles will be used in the study.

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