

# **UNIVERSITI PUTRA MALAYSIA**

TOTAL ECONOMIC VALUE OF FOREST ECOSYSTEM SERVICES IN ENDAU ROMPIN NATIONAL PARK, JOHOR, MALAYSIA

NITANAN KOSHY A/L MATTHEW

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By

NITANAN KOSHY A/L MATTHEW

 $\bigcirc$ 

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

November 2017

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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#### November 2017

# Chair: Professor Ahmad Shuib, PhD Faculty: Institute of Agricultural and Food Policy Studies

The Endau Rompin National Park is the second gazetted national park in Malaysia. The mixed type of dipterocarp forest in the national park is rich with natural resources. The national park supplies various ecosystem services such as provisioning, regulating, habitat or supporting services and cultural and amenity services that benefit the community as a whole. Nonetheless, while existing for 24 years as a national park, it has not been without threats and management barriers. Among the examples for such barriers are illegal activities, loss of keystone species, forest degradation, forest loss, insufficient staff, low levels of finance, etc. Apart from the impacts experienced from these barriers, the lack of information pertinent to the value of the ecosystem services in the park has brought about the need to estimate the total economic value of the national park. Such information will be useful to justify the need for the conservation efforts and improve the management of the natural resources in the national park, particularly to the public, policy makers, and politicians, respectively. The aim of the study is to determine the total economic value of the forest ecosystem services in the Endau Rompin National Park, Johor. Hence, the research has a fourfold specific objective. First, it attempts to identify the profile of the visitors as well their satisfaction with the facilities and recreational activities provided by the recreational sites in the Endau Rompin National Park. The second objective is to identify the forest ecosystem services in the Endau Rompin National Park. The third and fourth objectives are to determine the market and non-market values of the forest ecosystem services in the Endau Rompin National Park. In addition, the study has identified the specific barometers that suit the total economic value of a mixed dipterocarp type of forest present in the Endau Rompin National Park through a thorough review of past studies. This has resulted in a total of 12 indicators that are comprised of timber, non-timber, handicrafts, education and research recreation, tropical ethnobotany, indigeneous cultural commoditisation, carbon sequestration, watershed services, genetic diversity and nursery services, conservation value of tourism, and biodiversity. Next, in terms of the research methodology, methods like market price, damage cost avoided, benefit transfer, and choice modelling have been utilised for the indicator measurement purposes. While, in terms of data collection, both the primary and secondary data have been obtained to estimate the total economic value of the national park. The primary data collection has involved the sampling of visitors and resources. For the earlier one,



a total of 350 respondents have been selected based on the purposive sampling among the local visitors at the Endau Rompin National Park. For the latter one, a ground forest inventory, also using the purposive sampling technique, has been utilised to choose 6 plots in Peta. On the other hand, the secondary data has been obtained from sources like annual visitor arrival data, amount of local and international funds received, the global wood density database data, and the values retrieved from the benefit transfer method. Among the results found for the first objective, which involves the descriptive analysis, it includes that the majority of the ages of the visitors are less than or equal to 30 years old, education has been attained at a tertiary educational level, earnings are above RM5,000, they are single, come in groups, and are first time visitors. For the second objective, all of the forest ecosystem services that belong to the provisioning, regulating, habitat/supporting services, and cultural and amenity services in the ERNP have been identified. They are timber, non-timber forest products, handicrafts that belong to the provisioning services, followed by carbon stock and sequestration, and watershed services; while for habitat/supporting services, they are, namely, genetic diversity and nursery services, and lastly, under cultural and amenity services they are education and research, recreation, tropical ethnobotany and indigenous cultural commoditisation, and conservation value. For the third objective, in terms of the market value of the forest ecosystem services by the total economic value components, the largest amount has been denoted by the direct use value (consumptive) at RM12,695,251,650 or USD2,827,450,254; direct use value (non-consumptive) at RM2,906,698 or USD 647,372; and finally, the indirect use value at RM1,220,380,715 or USD 271,799,714.On the other hand, in terms of the specific total economic value indicators, it has been found that the largest amount of the total economic value measured based on the market values belongs to timber at RM12,572,252,875 or USD2,800,056,318 followed by carbon sequestration at RM1, 164,672,575 or USD259,392,556. For the fourth objective, in terms of the non-market value of the forest ecosystem services by the total economic value components, it is denoted by the non-use value amounting to RM198,024 or USD44,103. The consumer surplus for the conservation and management related attributes have been estimated to be approximately RM37 for each local visitor. The findings from this study will help the management of the park to understand the value of the natural resources in the national park, understand the preferences of local visitors on the preferable management and conservation related attribute options, as well the marketing efforts of the park for tourism purposes.

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

## JUMLAH NILAI EKONOMI PERKHIDMATAN EKOSISTEM HUTAN DI TAMAN NEGARA ENDAU ROMPIN, JOHOR, MALAYSIA

# Oleh

# NITANAN KOSHY A/L MATTHEW

November 2017

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Taman Negara Endau Rompin, adalah Taman Negara kedua yang telah diwartakan di Malaysia. Jenis campuran hutan dipterokarpa di Taman Negara ini adalah kaya dengan sumber asli. Ia membekalkan pelbagai perkhidmatan ekosistem seperti provisioning, regulating, habitat or supporting services and cultural dan amenity yang memberi faedah kepada komuniti secara keseluruhan. Namun, walaupun telah wujud selama 24 tahun, Taman Negara ini tetap berhadapan dengan ancaman dan masalah pengurusan. Antara contoh untuk ancaman dan masalah tersebut ialah aktiviti-aktiviti yang menyalahi undang-undang, kehilangan spesies utama, kemusnahan hutan, kehilangan hutan, kakitangan tidak mencukupi, kekurangan dana kewangan, dan sebagainya. Selain daripada kesan yang dialami ini, kekurangan maklumat berkaitan dengan nilai perkhidmatan ekosistem di Taman Negara telah membawa kepada keperluan untuk membuat anggaran jumlah nilai ekonomi Taman Negara. Maklumat tersebut sangat berguna untuk mewajarkan perlunya usaha-usaha pemuliharaan dan penambahbaikan pengurusan sumber asli di Taman Negara, khususnya kepada orang awam, pembuat dasar dan ahli-ahli politik. Tujuan kajian adalah untuk menentukan jumlah nilai ekonomi perkhidmatan yang ditawarkan di ekosistem hutan di Taman Negara Endau Rompin. Kajian ini mempunyai empat objektif khusus. Pertama, mengenal pasti profil pengunjung serta kepuasan mereka dengan aktiviti-aktiviti rekreasi dan kemudahan yang disediakan di tapak-tapak rekreasi Taman Negara. Objektif kedua untuk mengenalpasti perkhidmatan ekosistem hutan di Taman Negara Endau Rompin. Objektif ketiga dan keempat pula adalah mengenal pasti nilai pasaran dan nilai bukan pasaran bagi perkhidmatan ekosistem hutan di Taman Negara Endau Rompin. Di samping itu, kajian ini berjaya mengenal pasti indikator-indikator yang bersesuaian dengan penilaian jumlah nilai ekonomi bagi jenis hutan dipterokarp campuran yang sedia ada di dalam Taman Negara Endau Rompin melalui sorotan kajian lepas yang mendalam. Pengenalpastian sejumlah 12 indikator terdiri daripada kayu, bukan-kayu, kraftangan, pendidikan dan penyelidikan, etnobotani tropika, indigeneous cultural commoditisation, pemencilan karbon, perkhidmatan kawasan tadahan air, kepelbagaian genetik dan perkhidmatan nurseri, pemuliharaan nilai pelancongan, dan kepelbagaian biodiversiti. Seterusnya, dari segi kaedah penyelidikan, kaedah-kaedah seperti market price, damage cost avoided, benefit transfer dan choice modeling telah digunakan sebagai tali pengukur indikator. Manakala, dari segi pengumpulan data, data primer dan sekunder telah diperolehi untuk menganggarkan jumlah nilai ekonomi Taman Negara. Pengumpulan data primer melibatkan persampelan pelawat dan sumber. Purposive sampling telah digunakan bagi kedua-dua pensampelan, di mana sejumlah 350 responden telah dipilih dari kalangan pengunjung tempatan Taman Negara. Bagi inventori hutan, 6 plot di Taman Negara Endau Rompin Peta. Manakala, data sekunder bagi pelawat diperolehi dari data ketibaan pelawat tahunan, penerimaan jumlah dana daripada tempatan dan antarabangsa, dan pangkalan data ketumpatan kayu global, serta nilai-nilainya diperolehi daripada kaedah benefit transfer. Antara penemuan objektif pertama yang melibatkan analisis deskriptif adalah, majoriti pengunjung berumur kurang daripada atau sama dengan 30 tahun, berpendidikan tinggi, pendapatan melebihi RM5000, masih bujang, datang secara berkumpulan dan merupakan pengunjung yang datang buat pertama kali. Bagi objektif kedua pula, perkhidmatan ekosistem hutan di Taman Negara Endau Rompin, Johor telah dikenal pasti sebagai kayu, produk hutan bukan-kayu, kraftangan (provisioning), diikuti oleh stok karbon, perkhidmatan kawasan tadahan air (habitat/supporting services), kepelbagaian genetik dan perkhidmatan nursery dan akhir sekali di bawah (cultural and amenity services) adalah rekreasi, etnobotani tropika dan indigeneous cultural commoditisation dan nilai pemuliharaan. Bagi objektif ketiga nilai pasaran perkhidmatan ekosistem hutan adalah berpandukan komponen-komponen total economic value, jumlah terbesar telah direkodkan bagi komponen direct use value-consumptive sebanyak RM12,695,251,650 atau USD2,827,450,254, direct use value-Non-consumptive sejumlah RM2,906,698 atau USD647,372 dan akhirnya, indirect use value berjumlah RM1,220,380,715 atau USD271,799,714. Sebaliknya, dari segi indikator pula, kajian mendapati bahawa nilai terbesar yang menyumbang kepada jumlah nilai ekonomi berdasarkan nilai pasaran dipelopori oleh kayu dengan nilai RM12,572,252,875 atau USD2,800,056,318, diikuti pemencilan karbon, RM1,164,672,575 atau USD259,392,556. Bagi objektif keempat, nilai bukan pasaran bagi perkhidmatan ekosistem hutan berpandukan komponenkomponen total economic value dilambangkan oleh non-use value berjumlah RM198,024 or USD44,103. Lebihan pengguna bagi atribut-atribut yang berkaitan dengan aspek pemuliharaan dan pengurusan pula dianggarkan kira-kira RM37 bagi setiap pengunjung tempatan. Hasil kajian ini dapat membantu pihak pengurusan Taman Negara untuk memahami nilai sumber-sumber asli, memahami keutamaan pengunjung tempatan terhadap atribut-atribut yang berkaitan dengan aspek pengurusan dan pemuliharaan, juga penambahbaikan dalam usaha-usaha pemasaran bagi tujuan pelancongan.

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I certify that a Thesis Examination Committee has met on 10 November 2017 to conduct the final examination of Nitanan Koshy a/l Matthew on his thesis entitled "Total Economic Value of Forest Ecosystem Services in Endau Rompin National Park, Johor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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# LIST OF ABBREVIATIONS

| AGB    | Aboveground biomass                                     |
|--------|---|
| AGC    | Aboveground carbon                                      |
| BGB    | Belowground biomass                                     |
| BGC    | Belowground carbon                                      |
| BV     | Bequest Value   |
| СМ     | Choice Modelling  |
| CPI    | Consumer price index                                    |
| CS     | Compensating Surplus                                    |
| Ct     | Carbon (tonne)  |
| DANCED | Danish Corporation Environment and Development          |
| DBH    | Diamater at breast height                               |
| DMPM   | Department of Marine Park Malaysia                      |
| DUV    | Direct Use Value  |
| DWNP   | Department of Wildlife and National parks               |
| ERNP   | Endau Rompin National Park                              |
| EqS    | Equivalent Surplus                                      |
| EqV    | Equivalent Variation                                    |
| ĒŶ     | Existence Value   |
| FAO    | Food and Agriculture Organisation of the United Nations |
| GIS    | Geographic Information System                           |
| GPS    | Global positioning system                               |
| HHW    | Heavy Hardwood  |
| IUCN   | International Union for Conservation of Nature          |
| IUV    | Indirect Use Value                                      |
| JNPC   | Johor National Parks Corporation                        |
| LHW    | Light Heavy Wood  |
| MHW    | Medium Heavy Wood                                       |
| MNL    | Multinomial logit                                       |
| MNRE   | Ministry of Natural Resources and Environment           |
| MRS    | Marginal Rate of Substitution                           |
| MTIB   | Malaysian Timber Industry Board                         |
| MU     | Marginal Utility  |
| MWTP   | Marginal willingness to pay                             |
| MxL    | Mixed Logit   |
| NERC   | Nature education and research centre                    |
| NUV    | Non-Use Value   |
| OV     | Option Value  |
| PR     | Profit ratio  |
| RM/MYR | Malaysian currency in ringgit                           |
| RPL    | Random Parameter Logit                                  |
| RUM    | Random Utility Model                                    |
| RUT    | Random Utility Theory                                   |
| SFD    | Sarawak Forest Department                               |
| SRTM   | Shuttle Radar Topoghraphy Mission                       |
| SV     | Stumpage value  |
| TEV    | Total Economic Value                                    |
| UNDP   | United Nations Development Programme                    |
| WTP    | Willingness To Pay                                      |

#### CHAPTER 1

### **INTRODUCTION**

The first chapter of this study discusses the background of the study and the importance of the economic valuation of the ecosystem and services. The pragmatic challenges and gaps addressed are discussed in the section of the problem statement. The general and specific objectives are also annotated in this chapter. This is followed by the significance and justification of the study.

#### 1.1 Background of the study

Forests are universally vital reservoirs, which are important sources and sinks of carbon (MacDicken, 2015). According to Pak, Türker, & Öztürk, (2010), forests are renewable and complex ecosystems capable of providing a wide range of environmental, economic, social, and cultural benefits. In 1990, the world had 4.128 billion ha of forest, which significantly decreased to about 3.999 billion ha in 2015, bringing the terrestrial coverage rate down from about 31.6% to 30.6% in 25 years (MacDicken, 2015). In Southeast Asia, forest covers constitute 5% of the world's total forest area of about 3.999 million ha (MacDicken, 2015). In 2015, it was reported that forests covered about 50% (210 million ha) of the land area in Southeast Asia. The national forest cover ranges from 27% in the Philippines to 81.3% in Lao PDR, while Indonesia is the largest forested area with about 91 million ha. Singapore is reported to have the lowest forest cover of only 16,000 ha (MacDicken, 2015).

Forest cover is closely associated with climate change (UNEP, 2008) as the main causes of forest loss are commercial logging and forest clearance for an establishment of oil-palm plantations (Stibig, Stolle, Dennis, & Feldkötter, 2007). Forest conversion for agricultural purposes, including the recent expansion in the area devoted to oil palm plantation, continues to be the main cause of forest losses in the region. Logging and Pulpwood clear-cutting has also been a major cause of deforestation in some areas (UNEP, 2008). Despite the deforestation evidence, awareness of the importance of forest conservation in Southeast Asia has been estimated to be high (MacDicken, 2015). As an example, the coverage of forest area within protected areas from 1990-2015 showed an increase from 47,916 million ha to 59,361 million ha, twice that obtained in 1990 (MacDicken, 2015). Malaysia remains one of the world's best performers in the retention of forest (Yong, 2014).

Malaysia's forest area today is about 22,195,100 ha (67.6%), which are more than twothirds of its total land area. Out of this 22 million ha, about 17.77 million ha (54.1%) is a totally forested land area (Forestry Department of Peninsular Malaysia, 2016). According to the Malaysian constitution, land comes under the jurisdiction of State Governments (Yong, 2014). It can be further categorised into three types or groups as shown in Table 1.1. The first category is the dry inland forest. Its examples are Montane ericaceous forest, Montane-oak forest, hill dipterocarp forest, and lowland dipterocarp forest. The second is the peat swamp forest, while the third is the mangrove forest (Forestry Department Peninsular Malaysia, 2016). It is also reported that the dry inland forest has about 15.73 million ha, the swamp forest has about 1.48 million ha, while the mangrove forest has about 0.56 million ha, respectively.

| Region     | Land<br>Area | Na                   | tural Fore      | sts                | Forested<br>land | % of<br>Land |
|------------|--------------|----------------------|-----------------|--------------------|------------------|--------------|
|            |              | Dry inland<br>forest | Swamp<br>forest | Mangrove<br>forest | -                |              |
| Peninsular | 13.18        | 4.58                 | 0.24            | 0.10               | 5.86             | 44.4         |
| Malaysia   |              |                      |                 |                    |                  |              |
| Sabah      | 7.37         | 3.17                 | 0.12            | 0.32               | 3.61             | 49.0         |
| Sarawak    | 12.30        | 7.98                 | 1.12            | 0.14               | 9.24             | 75.1         |
| Malaysia   | 32.85        | 15.73                | 1.48            | 0.56               | 17.77            | 54.1         |

(Source: Forestry Department Peninsular Malaysia (2011); Sabah Forestry Department (2011), Forest Department Sarawak (2011)

The total forested land can be further classified into the primary forest which covers about 5,041,100 ha (22.7%) of the total forest area. The naturally regenerated forest area amounts to about 15,188,000 ha (68.4%) of the total forest area, while the planted forest covers about 1,966,000 ha (8.9%) of the total forest area (MacDicken, 2015). The portion of the total forest area designated as primary forest increased between 1990 to 2015 (MacDicken, 2015). In addition, the forest area designated for the conservation of biodiversity (National Park, Wildlife, and bird sanctuary) amounting to 1,000 ha shows a persistent increase in portion from 1,120,000 ha in 1990 to 1,859,000 in 2015, which is an increase of about 40% in Malaysia (MacDicken, 2015).

A protected area is "an area of land or sea, especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, which is managed through legal or other effective means" (IUCN, 2017). The protected areas are listed in six categories (Category I to VI). The National Park falls in Category II (IUCN, 2017). In this category, a national park is defined as a large natural or near natural area set aside to protect large-scale ecological processes, along with the complement of species and ecosystems, which share common characteristics of the area. These facilitate and enhance the provision of a basis for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities (IUCN, 2017). In addition, a national park provides a number of products that underpin many rural livelihood strategies (Shackleton, 2004). These products are collectively referred to as provisioning services'. In the words of Maass, Balvanera, Castillo, Daily, Mooney, Ehrlich, and Sarukhan (2005), 'provisioning services are tangible goods, finite, though renewable, that can be directly appropriated by people, quantified, and traded'.



#### 1) Endau Rompin National Park

The ERNP in Johor is one of the totally protected areas in Peninsular Malaysia. The forest area in the ERNP has been designated into two management platforms, namely, Peta in the northern direction and Selai in the western direction, for the effective management of the park. Its designation as a national park is consistent with the objective of Malaysia's national policy on biological diversity (2016-2025). This is to ensure conservation of biological diversity, promote sustainability, and ensure fair and equitable distribution of benefits arising from the utilisation of biological resources (MNRE, 2016).

#### 1.2 Importance of the Total Economic Valuation of Ecosystems Services

The total economic valuation (TEV) encompasses all of the components of the disutility derived from an ecosystem service employing a common unit of account like cash or any market-based unit of mensuration that enables comparisons of the advantages of assorted products (TEEB, 2010). Furthermore, it was pointed out that, since in many societies, people are already familiar with money as a unit of account, expressing relative preferences in terms of cash values could provide helpful data to policy-makers. The TEV can be identified using the economic valuation approach (Ninan & Inoue, 2013). Economic valuation refers to an attempt at assigning quantitative values to ecosystem goods and services provided by environmental resources (Suryani, Sanusi, & Kamil, 2012).

In terms of importance, an economic valuation can be used to estimate the full range of benefits provided by an ecosystem, thus, providing an indicator of the importance of an ecosystem to a society (O'Garra, 2007). Also, the economic valuation of ecosystem services and biodiversity can make explicit to society in general and policy making in particular, that biodiversity and ecosystem services are scarce and that their depreciation or degradation has associated prices to society (O'Garra, 2007). If these prices are not imputed, then the policy would be misguided and society would be worse off as a result of the misallocation of resources (O'Garra, 2007). The findings from an economic valuation can be useful to justify the importance for the protection of biodiversity following the pressure to reduce biodiversity worldwide (Pearce, 2001). For example, the findings could be used to justify the investment worthiness of public funds for national parks (Gürlük & Rehber, 2008).

Furthermore, an economic valuation is useful to support habitat conservation policies (Hanley & Shogren, 2001). For example, Becker, Inbar, Bahat, Choresh, Ben-Noon, and Yaffe (2005) in their studies, determined the value of viewing griffon vultures at Gamla Nature Reserve in Israel and found their finding to be useful for further investment towards protecting the species. In addition, valuation is a must in order to arrive at natural resource accounting for methods such as Net Present Value (NPV) (Kumar, 2010). Also, quantitative estimates can be used to implement pricing schemes through the introduction of an entrance fee and decision-making management, which in turn can facilitate the efficient allocation of resources available at a particular site

(Ahmad, 2011). More so, Governments may decide to use the valuation as against the restricted, administered or operating market prices for designing natural resource activities, biodiversity or ecosystem conservation programmes (Kumar, 2010).

# 1.3 Research Problems

Humans derive benefits from diverse forest ecosystem goods and services. These include tangible benefits from timber, non-timber, and medicinal plants, while non-tangible benefits include pollination, water purification, watershed protection, renewal of soil fertility, climate regulation, provision of wildlife resources, recreation, and tourism opportunities (Baumgartner & Bieri, 2006; Sulaiman, 2005). Some of these economic values are quantifiable while others are totally ignored (Sulaiman, 2005). In particular, the intangible benefits which are not traded in conventional markets or are difficult to value have been underestimated (Ninan & Kontoleon, 2016). Consequently, forests are often valued more for their development potentials rather than for the benefit of ecosystem services (Kalaba, 2014). Pertaining to that, there are no studies that specifically identify the four ecosystem services available in the ERNP.

In terms of the theoretical gap, based on the literature reviewed to date, several studies have focused on either valuing the tangible (market value) or intangible (non-market) value of the ecosystem services. Consequently, few studies have applied the TEV approach in Malaysia, particularly in the study of forest valuation; per se. Examples of studies on the TEV approach towards forest valuation include studies by Kumari (1995) and Mohd. Shahwahid (1999) on the TEV approach towards tropical wetlands, and Sulaiman (2005) who studied the TEV approach towards the sago forest harvesting regimes in Sarawak. In addition to all this, precisely, limited studies have been conducted to determine the TEV approach towards dipterocarp type forests, per se, in Malaysia.

In the ERNP, which is the second national park in Malaysia after the Taman Negara Pahang, most of the studies conducted were on the identification of the species of flora and fauna in the park (Abdullah Mohd & Amat Ramsa Yaman, 2005; Daicus & Hashim, 2004; Noorlidah, Vikineswary, Yusoff, & Desjardin, 2007; Shahriza, Ibrahim, & Shahrul Anuar, 2012; Zakaria, Mansor, & Kamilaturrasis, 2012). A few studies have been conducted on tourists' level of satisfaction towards available facilities, services, and outdoor recreational activities, respectively (Rozana, 2003; Salleh, 2003; Sanmargaraja & Wee, 2015; Sharudin, 2003). On the other hand, another study was also conducted on the aborigines of Kampung Peta (Siti Aminah & Wee, 2014). Nonetheless, there is insufficient information on the economic valuation studies in the ERNP. In respect to this, Laily (research officer, JNPC, pers. comm. 11 November 2015) stated that there is a dearth of information on the TEV of the national park. The finding suggests that there is a gap in knowledge in the literature on this subject, hence, a potential recipe for a research opportunity.

In the course of the study, further discussions were initiated on the specific problems impacting on the TEV components: Direct use value (DUV) (i.e., Consumptive and

non-consumptive value), Indirect use value (IUV), and Non-use value (NUV), respectively. In general, the DUV can be determined based on the market value, while the other components through the non-market value. An example of the DUV (consumptive value) is timber. The need to determine the timber value in the ERNP stems from the studies of (Awang Noor & Hanum, 2008). In their studies, they observed that timber resources despite being a major component of the tropical forests are economically underestimated. Meanwhile, specific to the park, referring to Laily (research officer, JNPC, pers. comm. 11 November 2015), at present, there is a lack of information pertinent to the value of timber and non-timber resources in the park. Moreover, no recent forest inventory has been conducted by the Peninsular Forestry department since the state park was gazetted as the national park under the Johor National Parks Corporation Enactment (1989) (Laily, research officer, JNPC, pers. comm. 11 November 2015).

On the other hand, recreational and cultural values are discussed under the DUV (Nonconsumptive value). Pertaining to the recreational value, Table 1.2 shows inconsistent visitors' arrival patterns to the ERNP. The most recent data showed that there was a reduction in the visitors' arrival to the ERNP from 8,646 in 2013 to 6,284 in 2016, which is about a 27% reduction in the number of visits. More so, the number of international visitor arrivals was less than the number of the local visitors with an average proportion of a 0.18:1 ratio between 2008 and 2016. The potential underlying challenges include, firstly, the existence of diverse choices of recreational sites in the state of Johor like those under the surveillance of the Johor National Parks Corporation (JNPC). These recreational sites include the Gunung Ledang National Park, Tanjung Piai National Park, Pulau Kukup, and Taman Laut Sultan Iskandar (TIS). These have an impact on visitors' arrivals to the ERNP (Kamarul, assistant manager Endau Rompin Selai, pers. comm. 28 November 2015).

Secondly, based on the feedback information from the visitations to the ERNP, the study found out that visitors' accessibility is one of the main factors impacting on their arrival (A. Kamarul, assistant manager Endau Rompin Selai, pers. comm. 28 November 2015). Finally, despite information being gathered from visitors by respective park management officials at the Peta and Selai offices, such information obtained was incomplete and limited to basic inquiries, such as name, gender, number of participants, tourism activities, and nationality, and a form was given to gather basic feedback information only (A. Kamarul, assistant manager Endau Rompin Selai, pers. comm. 28 November 2015). Consequently, the park is unable to design and implement policies and plans geared towards its promotion and marketing that could facilitate and encourage greater visitation frequencies.

| Year | Local | International | Total |  |
|------|-------|---------------|-------|--|
| 2008 | 5749  | 1978          | 7727  |  |
| 2009 | 7069  | 1187          | 8256  |  |
| 2010 | 7393  | 1666          | 9059  |  |
| 2011 | 4708  | 1064          | 5772  |  |
| 2012 | 5844  | 1168          | 7012  |  |
| 2013 | 7171  | 1475          | 8646  |  |
| 2014 | 7123  | 1218          | 8341  |  |
| 2015 | 5465  | 1134          | 6599  |  |
| 2016 | 5352  | 932           | 6284  |  |

Table 1.2: Visitor arrivals to Endau Rompin National Park from (2008-2016)

(Source: Johor National Park Corporation, 2017)

Note: ERNP is closed from the month of Nov- February due to monsoon season

Another significant example is the cultural value (Kumar, 2010; Plottu & Plottu, 2007). The existence of the Orang Asli Jakun culture in the ERNP is perceived as unique and attractive to visitors (Siti Aminah & Wee, 2014). This cultural aspect includes their practice of artifacts, handicrafts, food, and dance performances as well as the non-material culture of their belief system and taboos, and their traditional and customary marriages (Siti Aminah & Wee, 2014). In respect to this, a study suggests that there is a cultural link and traditional knowledge loss, respectively at the ERNP (UNDP, 2008). Hence, the cultural value in monetary terms for the ERNP remains unknown to justify its conservation, (S. Nazrah, assistant manager Endau Rompin Peta, pers. comm. 11 November 2015).

In regards to the IUV, the problem related to carbon sequestration is discussed. An estimate of about a 20% annual greenhouse gas (GHG) emission was triggered by carbon sinks, forest losses and its modification due to natural and anthropogenic disturbances worldwide (Omar & Hamzah, 2012). Though, the forest in the ERNP is important in climate change mitigation, playing a role as carbon sinks and scrubing  $CO_2$ , respectively. However, the amount of carbon stock and carbon sequestration present, particularly in a mixed dipterocarp forest like in the ERNP remains unknown for monitoring purposes (Laily, research officer, JNPC, pers. comm. 11 November 2015).

A ground forest inventory was conducted at Peta to determine the amount of biomass content in the trees. However, because of the low limit of the diameter at breast height (DBH) criterion used to select trees, only 60 (11%) out of about 539 trees were found with greater than 20 cm (Zakaria et al., 2012). Furthermore, the study did not account for the monetary value of the carbon stock to justify the resource conservation. Another important component under the IUV is the value of the watershed services in the ERNP, which remains unknown (Laily, research officer, JNPC, pers. comm. 11 November 2015). In terms of the non-market valuation of the ecosystem services, there arises a perceived problem pertinent to the NUV, which originates from the lack of market, market prices, and other direct behavioural links. The perceived problem includes conversion from quantities of natural resources and services to economic values (Kalaba, 2014). Thus, this results in the underestimation of the real benefits

from the ecosystem services Rolfe, Bennett, and Louviere (2000) as NUV derived from the forest ecosystem remain unknown in the ERNP (Laily, research officer, JNPC, pers. comm. 11 November 2015).

In regards to the NUV, the entrance fee is used as a proxy to estimate the utility of the visitors. However, the study of Samdin, Aziz, Alias, and Yacob (2013) reports that it is unclear whether the entrance fee charges are significant or not to the level of utility derived from the visits. Consequently, the existing entrance fee at the ERNP was not determined based on the empirical analysis of the visitors' utility derived from their demand (Laily, research officer, JNPC, pers. comm. 11 November 2015). Furthermore, the entrance fee in this park has not experienced an upward review in the last 13 years. As a result, despite the purpose of an entrance fee being to recover the cost of the maintenance of the facilities in the ERNP, the park has not generated enough funds to sustain itself (JNPC, 2016b). In addition, there is no specific funding for conservation purposes in the park (S. Nazrah, assistant manager Endau Rompin Peta, pers. comm. 11 November 2015).

Other than price (entrance fee), there are other aspects impacting on the visitors' utility (Hanley, Mourato, & Wright, 2001). Hence, understanding the tourists' preference towards nature appreciation, infrastructure, and other attributes of protected areas is crucial (Hearne & Salinasà, 2002). Pertinent to the ERNP, relevant attributes can be drawn from the underlying issues in the park like hunting, killing, and collection of terrestrial animals and agarwood, loss of keystone species, lack of research, and educational programmes, and the insufficient number of workers for enforcement and monitoring purposes (UNDP, 2008). On the same note, the knowledge on the extent of the resource improvements of the current conditions and the impact of these improvements on the visitors' utility remains unknown in the ERNP. In such a manner, conservation and management related attributes are essential to confirm the suitability level of fee charges for visitors in the ERNP.

On the other hand, pertinent to the TEV components, there are limited studies, which have utilized the concept to integrate the ecosystem services framework with the TEV framework that have been proposed by (Kumar, 2010; Ninan & Inoue, 2013) to derive at a more holistic TEV framework. Consequently, a holistic framework for a TEV of Mixed Dipterocarp forest remains unknown.

# 1.4 Objectives of the Study

The aim of this study is to determine the total economic value of the forest ecosystem services in the Endau Rompin National Park, Johor.

The specific objectives of the study are:

- To determine the socio-demographics, characteristics of the visit, and satisfaction of local visitors at the recreational sites, Peta and Selai, in the Endau Rompin National Park;
- 2) To identify the forest ecosystem services in the Endau Rompin National Park;
- To determine the market value of the forest ecosystem services in the Endau Rompin National Park; and
- 4) To determine the non-market value of the forest ecosystem services in the Endau Rompin National Park.

#### 1.5 Significance of the Study

This research hopefully will provide a theoretical contribution that will enhance knowledge and understanding of the TEV of the forest ecosystem services in the ERNP. The research is required to obtain information in determining the market and non-market values of the forest ecosystem services in the ERNP. The information obtained will be significant to the following groups:

# 1.5.1 Literature

The research work will contribute to the existing literature with a dearth of information on the TEV studies of the forest ecosystems, particularly in Southeast Asia. Despite existing studies on valuation in the literature, not many of these studies have concentrated on the TEV. Consequently, the value obtained from the benefits from the forest ecosystem services may be underestimated. Hence, the study proposes a suitable framework for determining the TEV precisely from forest and ecosystem services. In addition, the study has integrated the ecosystem services' framework with the TEV framework to derive at a more holistic TEV framework. Afterwards, the TEV framework can be used as a benchmark to conduct similar studies in the future within Southeast Asia.

# 1.5.2 Local visitors' Willingness to Pay

At present, the park imposes an entrance fee to visitors; however, the effectiveness of the pricing policy is questionable since it was not determined based on the proper economic analysis. Hence, the Willingness-To-Pay (WTP) concept can be used to determine visitors' preferences toward both the conservation and management related attributes in the park by using an appropriate environmental valuation technique, Choice Modelling (CM). This is important to ensure that the management of the park realises the value allotted by visitors to the park.



#### 1.5.3 Community and Environment

The importance of this study is to understand the value allotted by the community on the environment as well as the value obtained from the ecosystem services to the community. For example, through the conservation efforts at the ERNP the important ecosystem services beneficial to humans are conserved. These include non-timber forest products, mitigation of landslides and floods, prevention of soil erosion, watersheds and improvement of the water quality and its supply, carbon sequestration, etc. Therefore, the findings of the study may alert the community of the importance of conserving the forest ecosystems and their services in the national parks. Failure to conserve the national park may result in possible forest degradation and the reduction in the ecosystem contributions to communities.

## 1.5.4 Johor National Parks Corporation and Johor State Government

The possible finding on the TEV is expected to alert the management authority and the JNPC to the value of the forest ecosystem services. Furthermore, the findings are expected to encourage the Johor state government on the possible justification towards allocating financial resources to this national park. This is necessary for the maintenance and conservation of the park. In addition, the findings would facilitate a better understanding of the local visitors' preferences towards a preferable management and conservation related choice of attributes; hence, indirectly involving them in the decision-making process of the national park. Moreover, identification of the socio-demographic characteristics of the local visitors will be useful by the JNPC in their marketing plans towards a formidable market segmentation effort.

#### 1.6 Definition of key terms and concepts

1) Ecosystem services: Ecosystems vary both in size and, arguably, complexity, and may be nested one within another (Kumar, 2010). Ecosystem services are benefits that people obtain from the various ecosystem services, namely, provisioning services, regulating services, habitat/supporting services, and cultural and amenity services (Groot, Brander, Ploeg, Costanza, Bernard, Braat, & Beukering, 2012).

2) Total economic value: The economic concept of value has been comprehensively defined as any net change in the welfare of society (Pak et al., 2010). A total of the values that belong to the two main clusters, namely, the use value and non-use value includes items such as direct, indirect, option, and existence values of the natural resources defined as the TEV concept (Groot et al., 2012).

# 1.7 Structure of the Thesis

Chapter one gives brief information encompassing an introduction to forest and forest protected areas, and issues surrounding the forest in a wider worldwide view. The latter part of chapter one discusses the research problem, research objectives, research questions, and the justification for the study, respectively. Chapter two provides a review of the literature relevant to this study and the theoretical framework adapted for the study. Chapter three reviews the methodologies adopted in previous but similar studies. The chapter ends with the discussion on the sampling and survey procedures. Chapter four presents the analysis and findings of the study, while Chapter five provides the summary and conclusions relevant to the study.



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