



UNIVERSITI PUTRA MALAYSIA

**ECONOMIC VALUATION OF BIODIVERSITY CONSERVATION AND
MANAGEMENT ATTRIBUTES OF A RAINFOREST DISCOVERY CENTRE
IN SABAH, MALAYSIA**

FIONA JANE FRANCIS

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BY

FIONA JANE FRANCIS

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

May 2018

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

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One of the main challenges faced by many protected areas is financial sustainability. A well-functioning protected area needs sustainable revenue in order to conserve its natural resources and to sustain in the long-run. The Rainforest Discovery Centre (hereafter RDC), Sabah is situated on the northeast of the Island of Borneo and classified as a Virgin Jungle Reserve (under the Sabah Enactment 1968) which established primarily for forest research purposes. The first objective of this study is to assess the visitors' perceptions and willingness to pay (WTP) for the RDC, Sabah, Malaysia. The four factors analysed in the confirmatory factor analysis (CFA); namely social relationship (F1), nature appreciation (F2), escape from routine (F3) and challenges and freedom (F4) as well as the socioeconomic attributes of respondents were incorporated into the contingent valuation method (CVM) model to estimate the visitors' WTP for the RDC, Sabah. The choice experiment (CE) method was used to meet the second and third objectives of the study, which is to assess visitors' preferences and their WTP towards management and conservation attributes of the RDC, Sabah. The results of the study revealed that visitors are ready to pay for additional fees for better conservation practices in the RDC. The CVM logit model revealed that the total economic value of RDC, Sabah would have been about RM 534 288 in 2017 compared to its actual revenue, which was RM 327 730. In the CE analyses, visitors were generally support the proposed development for RDC. The improvement of 'protection level' (PL) attribute was the most concerned issue for the management aspect of RDC. Since the random parameter logit (RPL) model revealed that PL was specified as random, therefore the individual heterogeneity exists for PL. On the other hand, the 'declining in wildlife species' (DP) attribute is the one of compelling issues in biodiversity aspect and need greater attention. In sum, any protected areas (PAs) need sustainable revenue for better conservation practices as well as to sustain and remain relevant to ecotourists. Entry fees is one of the most reliable

sources of income to fund the development and operation of any PAs as well as to conserve the biodiversity.



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

**TASKSIRAN EKONOMI KEATAS PEMULIHARAAN KEPELBAGAIAN BIO
DAN PENGURUSAN DI RAINFOREST
DISCOVERY CENTRE, SABAH, MALAYSIA.**

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Salah satu cabaran utama yang dihadapi oleh kebanyakan kawasan perlindungan ialah kemapanan kewangan. Kawasan perlindungan memerlukan pendapatan yang mampan untuk memelihara sumber alam semula jadi dan untuk terus beroperasi dalam jangka masa yang panjang. Rainforest Discovery Centre (RDC), Sabah terletak di timur laut Pulau Borneo dan dikelaskan sebagai Rizab Hutan Asli (di bawah Enakmen Sabah 1968) yang ditubuhkan untuk tujuan penyelidikan hutan. Objektif pertama kajian ini adalah untuk menilai persepsi pengunjung dan kesanggupan mereka membayar (WTP) untuk RDC, Sabah, Malaysia. Empat faktor yang dianalisis dalam (CFA); iaitu *social relationship* (F1), *nature appreciation* (F2), *escape from routine* (F3) dan *challenges and freedom* (F4) serta sifat sosioekonomi responden dianalisis dalam *contingent valuation method* (CVM) untuk mentaksir kadar kesediaan membayar tambahan yuran masuk ke RDC, Sabah. Kaedah *choice experiment* (CE) digunakan untuk mencapai objektif kedua dan ketiga kajian, iaitu untuk menilai pilihan pelawat dan WTP mereka terhadap atribut pengurusan dan pemuliharaan RDC, Sabah. Hasil kajian mendedahkan bahawa pelawat bersedia untuk membayar yuran tambahan untuk amalan pemuliharaan yang lebih baik di RDC. Model CVM logit mendedahkan bahawa jumlah nilai ekonomi RDC, Sabah adalah kira-kira RM 534 288 pada tahun 2017 berbanding hasil sebenarnya iaitu RM 327 730. Dalam analisis CE, pelawat pada umumnya menyokong pembangunan yang dicadangkan untuk RDC. Peningkatan atribut 'tahap perlindungan' (PL) adalah isu yang paling membimbangkan bagi aspek pengurusan RDC. Oleh kerana model *Random Parameter Logit* (RPL) mendedahkan bahawa 'PL' dinyatakan sebagai rawak, maka heterogenitas individu wujud untuk PL. Sebaliknya, atribut 'penurunan dalam spesies hidupan liar' (DP) adalah salah satu isu yang membimbangkan dalam aspek biodiversiti dan memerlukan perhatian yang lebih besar. Secara amnya, kawasan perlindungan (PA) memerlukan pendapatan yang mampan

untuk amalan pemuliharaan yang lebih baik serta kekal relevan dalam industri ekopelancongan. Yuran kemasukan adalah salah satu daripada sumber pendapatan yang paling boleh dipercayai untuk membiayai pembangunan dan operasi mana-mana PA dan untuk memulihara biodiversiti.



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LIST OF ABBREVIATIONS

PRF	Permanent Reserved Forest
UV	use value
NUV	non-use value
EE	Environmental Education programme.
SFD	Sabah Forest Department
RDC	Rainforest Discovery Centre
CE	Choice Experiment
CVM	Contingent Valuation Method
TEV	Total Economic Value
CL	conditional logit
FA	factor analysis
BSBCC	Borneon Sun Bear Conservation Centre
SORC	Sepilok Oran-utan Rehabilitation Centre
OV	option value
DUV	direct-use values
WTA	willingness to accept
RUM	Random utility theory
WTP	willingness to pay
EFA	exploratory factor analysis
CFA	Confirmatory Factor Analysis
SFD	Sabah Forest Department
FMU	Sabah Forest Management Unit
FDPM	Forest Department of Peninsula Malaysia
PAs	Protected Areas

CHAPTER 1

INTRODUCTION

1.1 Introduction

The South and Southeast Asia account for 17 % from 5.6 billion hectares of tropical forest land area (Malhi, 2010). The tropical forest of Southeast Asia plays a significant role in safeguarding the biodiversity, along with the living conditions and socio-economy of the forest-dependent communities (Lee,2009). These forests are important in mitigating the impacts of Greenhouse Gases (GHG). More than 50 % of the global biodiversity is vulnerable to extinction due to rapid and massive deforestation (Laurance et al, 2001; Sayer et al, 1991). About a quarter of man-made global GHG emissions can be attributed to the deforestation of tropical rainforests (Werf et al., 2009), and it is reported that Southeast Asia was a top contributor of deforestation (Achard et al.,2002). Approximately 10 % or 7.36 million hectares of Borneo land is occupied by Sabah. Its population has multiplied from 1.34 million to 3.12 million between 1987 and 2010 (DOS, 2010), with slightly more than 40 people to every 100 hectares. Three big cities in Sabah; Kota Kinabalu, Sandakan and Tawau accounted for half of the total population, with no major forest-dwelling communities. The main driver of deforestation in the 1950s was commercial logging (Norwana *et al.*,2011). Starting from the 1980s and to the most recent decade, the main driver of deforestation has shifted to agricultural plantation (McMarrow *et al.*,2001). It is approximated that 59.5 % of Malaysia's total land area is covered by forest (FDPM, 2004), with nearly half of the total land area or 14.45 million hectares, are Permanent Reserved Forest (PRF). Permanent Reserved Forest (PRF) can be further classified into Protection Forests and Production Forests and the natural resources in Malaysia are managed by three distinct bodies according to the three geographical regions: Sarawak, Sabah, and Peninsular Malaysia. Therefore, each respective region has distinct resource management systems.

This study aims to assess the visitors' preferences toward the management and conservation attributes of the Rainforest Discovery Centre, Sandakan; by investigating the trade-offs among diverse elements, specifically at the virgin forest reserve (Class VI). The focal point of the study is to estimate the economic values of Rainforest Discovery Centre, Sandakan from the estimated visitors' willingness to pay (WTP). In similar studies (i.e. environmental economics), researchers were interested on species richness as a representative for the variable of non-use value and appealing scenery as a non-consumptive use value. The analysis considered the heterogeneity (i.e. each attribute has different levels) of the visitors' choices at the study site. Having the capacity to assess the impact of changes (i.e. improvement) on the conservation and management attributes is beneficial for the authorities and managers of the centre. The quantitative amount of impact of different management and conservation set-ups on visitors' satisfaction is generally provided within the welfare analysis. Altering the conservation and management regime would satisfy some visitors while others might

find it displeasing. The examination of who would lose and gain due to the changes made in management can be conducted by inserting the indication of heterogeneous preferences. The economic assessment of conserving the biome needs to include these heterogeneous preferences resulting in reduced cost for forest conservation (i.e. protected areas).

1.1 Importance of Valuation

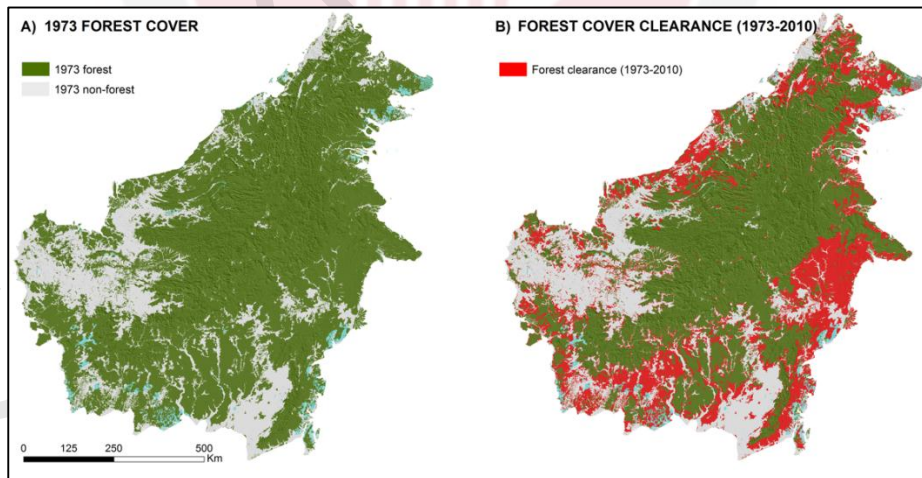
People can experience and understand how the forest ecosystem functions through the establishment of protected areas (e.g. national parks, marine parks, and forest reserves). It offers a reference site for specific assessments or case studies that are related to sustainable practices of forest management (Norton, 1999). Protected areas also establish opportunities for interconnectivity in the landscape, mitigate impending uncertainty, enhance conservation of species and processes, and also other valuable functions that are hard to measure (Hunter, 1996). Governments of developing countries have difficulties providing sufficient fund for the maintenance of the protected areas (e.g. forest areas and national parks) (Krug, 2000). As a result, protected areas had to rely on donor and funding (i.e. non-profit organisations) to safeguard the ecosystem within the areas and often unsustainable in the long run.

Therefore, placing proper values on environmental services and goods are needed per the central theme of the sustainable development and environmental economics. Environmental goods and services such as clean air, biological diversity in a tropical forest, and storm protection function of a mangrove forest are broadly categorised as a non-market commodity. Therefore, are not traded in the competitive economic market. Valuing non-market commodity is problematic since market prices are unavailable for measuring its economic value. Hence, non-market-based valuation techniques must be employed to assess the economic value of environmental quality. Non-market commodity cannot be gauged easily as the generic goods in the market cannot affect the market due to their availability to customers at a zero price. This is a serious issue as most people are willing to pay to assure their continued availability and environmental goods and services generally have positive values and (Pearce et al, 1989) such uncertainty increases the difficulty in determining if the specific level of goods and services offered in amenity forest reserve has fulfilled the visitors' total utility. Hence, this study aims to examine the visitors' preferences and the value on the environmental good and services offered in the amenity forest reserve. The outcome would indirectly aid the sustainable management and conservation of forest reserve. The evaluation of non-marketed goods and services can be measured through a series of economic valuations methods or approaches. Hence, these approaches are accessible for the valuation of non-use value (NUV) and use value (UV) of forest reserve. Therefore, the inspection of visitors' preferences across different levels of attributes in the forest reserve can be estimated too.

1.2 The Conservation and Management of RDC, Sandakan.

The Rainforest Discovery Centre in Sandakan or more commonly known as RDC has been opened to the public since 2007, without any entrance fee. However, in January 2008, Sabah Forest Department (SFD) deliberately imposed an entrance fee to the visitors using a two-tier entry fee system. With an average of RM 223 668 of revenue received annually, the collection is placed into a trust fund managed by the Rainforest Discovery Centre (RDC,2014). The trust fund is primarily used to bear the salaries of contract staff and to conduct Environmental Education (EE) programmes. Currently, the salaries of 30 permanent staff and bills for utilities are being covered by the Sabah Forest Department (SFD). Other operational cost including maintaining the centre heavily relies on contributions from non-profit organisations such as Pusat SEJADI (RDC,2015). Apart from facing financial difficulties and strong dependence on donors, the infrastructure at the centre has deteriorated. Termites and carpenter ants have destroyed some of the structure of rest sites and several steel towers of the canopy walks were rusty. To undertake an immediate repair is difficult due to fund insufficiency. This would subsequently affect the visitors' satisfaction from consuming the goods or services in the centre. Therefore, generating additional revenue is necessary in order to be self-sufficient, to maintain or improve the management practices and biodiversity at RDC. Sabah's deforestation rate is increasing at an alarming rate as more than 1.85 million hectares of forest of Sabah were reported to be gone between 1998 and 2008. In contrary, agricultural lands are rapidly increasing with a total of increase more than 1 million hectares in order to accommodate the commercial plantation and this has strongly contributed to the deforestation in Sabah. Referring to the Figure 1.1, areas shaded in red colour indicate the forest clearance between 1973 and 2010.

Figure 1.1: Four decades of forest clearance



Source: Gaveau, D *et al.* (2014)

Between 1990 and 2010, Sabah experienced a significant reduction of forest cover at 705 400 ha (Reynolds *et al*, 2011). RDC is located adjacent to an oil palm plantation and the Google satellite image (Google Maps, 2018) showed that no 'forested buffer

zone' exists between the forest reserve and oil palm plantation. Creating forested buffers is crucial to ensure that human and ecological disturbances within forest area are minimised. The loss of natural ecosystem due to the deforestation will reduce carbon sequestration and increase the global extinction of wild species. Wild animals have to compete with the production of palm oil for the limited lowland terrain for their habitat. This tragedy has become a major contributing factor of the sharp population loss of wild species including Orangutans (*Pongo pygmaeus*). Primates such as Orangutans (*Pongopygmaeus*) and Silver leaf monkey (*Trachypithecus cristatus*) roam around RDC. However, the plantation area is located just at the north of the reserve which exposes them to danger. According to Tisdell et al (2007), only 2072 individuals of orang-utans remain in Sabah, with less than 60 individual inhabiting the prominent Kabili-Sepilok Virgin Forest Reserve (KSVFR) which is adjacent to RDC. Thus, protecting the forest areas is important to preserve the rich biological diversity.

1.3 Problem Statement

The current fee system at RDC is not built on a prescribed analysis of visitors' demand. The cost of operating the centre is borne by the Sabah Forest Department (SFD) but is deemed not sufficient. Minimum allocation is obtained from the non-profit organisations. Therefore, conducting an economic valuation of management and conservation attributes at RDC is imperative to provide relevant insights to the authorities of RDC and the stakeholders in general. This study applied choice experiment (CE) and dichotomous choice contingent valuation method (DC-CVM) to elicit the visitors' willingness to pay by assessing the visitors' preferences for management and conservation attributes in RDC.

1.4 Research Objectives

This study aims to estimate the visitors' preferences for management and conservation attributes as well as their values toward the Rainforest Discovery Centre (RDC) in Sandakan, Malaysia. The objectives are specified as follows:

- a. To assess the visitors' perceptions of RDC.
- b. To examine visitors' preferences for management and conservation attributes at RDC; and
- c. To assess the economic values of management and conservation attributes at RDC.

1.5 Significance of Research

Factor analysis (FA), choice experiment (CE), and dichotomous choice-contingent valuation method (DC-CVM) were employed to assess visitors' perceptions and willingness to pay (WTP) for Rainforest Discovery Centre by examining their preferences for the management and conservation attributes at Rainforest Discovery

Centre (RDC) through structured closed-ended interviews. Repositioning visitors' expectation and preferences on the attributes' levels of management and conservation at RDC to at least their expectation can be acquired from this study. Therefore, visitors' utilities will be maximised and would anticipate an increased number of visitors in the future. Subsequently, the fund collected from the entrance fee would give hope to manage and conserve to what the current users are experiencing in RDC for the next generation.

Choice experiment (CE) and contingent valuation method (CVM) are economic valuations techniques that are widely employed in emerging countries (Hearne and Santos, 2005; Naidoo and Adamowicz, 2005; Tsi et al., 2008). Malaysia is one of the Southeast Asian countries that has employed the role of economic valuation in the National Policy Environment. Local researchers were intrigued by the economic valuation for environmental services and goods, particularly choice experiment (CE) and contingent valuation method (CVM). For instance, assessing good and services on natural resources and environment in Malaysia has been studied by Siti Aznor and Hanley (2009) and Alias and Shazali (2005) at marine park, Zaiton et al. (2010) and Awang Noor et al. (2009) at forested area, Puan et al. (2006) on highland site, and Kumari (1995) studied the economic value of medical plants in Malaysian forests. Yet, there very few studies were conducted to assess the economic values of the ecotourism site in Malaysia which employed choice experiment (CE) techniques. Comparison between CE and CVM studies in the country, particularly in the East Malaysia, is insufficient. Amongst CE studies conducted particularly in East Malaysia include Gevelt *et al* (2017) and Zander *et al* (2016). Gevelt *et al* (2017) employed CE to assess household preferences for electricity services in two indigenous villages in Sarawak, Malaysia. Meanwhile, Zander et al (2014) used CE to assess the tourist values for Orangutan Conservation in Sarawak. Therefore, this study would contribute to the body of literature in the employment of assessing economic value over diverse conservation and management attributes in the protected areas. The employment of these two approaches for RDC would be the first study to value forest reserve resources in Sabah. RDC management operation can be enhanced by utilising the estimated results produced from the visitors' WTP for management and conservation through the CE approach. This encompasses the cost of maintenance of facilitates, centre development and other operating expenses such as environmental education (EE) programmes at RDC. This research will also enable the benefits of Virgin Forest Reserve (Class VI) to be showcased in state-wide economies. Therefore, an appropriate level of entrance fee charges at RDC can be identified and verified. The authorities of RDC will benefit from this study by utilising the results obtained and strategise the management of RDC. Subsequently, positive impacts will be served to the visitors in such a way that this research would offer balance to the visitors' expectations yet still taking into account the conservation initiatives and development of planning RDC. The estimated results will facilitate the Sabah Forest Department (SFD) to serve better in protecting environmental and improving the services provided at the Rainforest Discovery Centre (RDC). This can be done by restructuring the budget allocation, enhancing protection, and strengthening the existing policy at RDC. The symbiosis relationship between environment and economic valuation is imperative for sustainable growth of a country. Pearce *et al* (1989) quoted that "economies affect environments and environments affect economies," highlighting the support of one another for a long period of time.

1.6 Organisation of Thesis

There are six chapters in this thesis. Chapter 1 presents the introduction of the research, followed by the description of the importance of valuation, the problem statement which leads to this research, three research objectives, and significance of the research. Chapter 2 serves as the background of the study, which consists of information and explanation about the State of Sabah and what drove to the establishment of Rainforest Discovery Centre (RDC). A comprehensive explanation of the study comprises its history and its role in conservation. Chapter 3 presents the literature review of the study. This includes an extensive review of previous studies done using similar economic valuation techniques. This section starts with the basis of total economic value (TEV), followed by the theoretical framework of the study which discusses the CE and CVM. It begins with outlining the steps in the utilisation of CE and CVM which consist of its attributes and levels, data sampling, questionnaire design, experimental design, and data collection. Next, the estimation of data acquired for conditional logit (CL) will be discussed. Finally, the advantages of using CE will be described in this section. Chapter 4 will explain the research methodology in detail. It embodied the stages in selecting the right attributes and levels that will be employed for CE. This section will also include a comprehensive description of CE and CVM. It will be concluded with some takeaway on CE and CVM methodology in brief. Chapter 5 presents the results obtained for the three objectives. Using the three distinct techniques; factor analysis, choice experiment (CE) and contingent valuation method (CVM) all the research objectives will be examined and answered. This section begins with a description on the preparation of the data, descriptive statistics for RDC, followed by the results obtained from factor analysis (FA), CVM, and finally the CE. A summary of the findings concludes this chapter. In Chapter 6, the summary of the study is presented in the beginning of this section, followed by the future policy implication specifically for the policymaker, centre managers, and the visitors at RDC. Finally, the limitations and recommendations for future studies are described in this chapter.

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