UNIVERSITI PUTRA MALAYSIA

ECONOMIC VALUE OF WATERSHED CONSERVATION OF THE NORTH SELANGOR PEAT SWAMP FOREST, MALAYSIA

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FPAS 2017 2

ECONOMIC VALUE OF WATERSHED CONSERVATION OF THE NORTH SELANGOR PEAT SWAMP FOREST, MALAYSIA

By

BUHARI ABDULKARIM

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

March 2017

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DEDICATION

To my beloved parents

Late Alhaji Abdulkarim Muhammad Diskudo

And

Late Hajiya Rakiyya Muhammad Ladan

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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

ECONOMIC VALUE OF WATERSHED CONSERVATION OF THE NORTH SELANGOR PEAT SWAMP FOREST, MALAYSIA

By

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March 2017

Chairman : Associate Professor Mohd Rusli Yacob, PhD
Faculty : Environmental Studies

Forest resources conservation in recent times has shifted from the conventional command and control practices to more dynamic approach such as payment for ecological services (PES) for sustainable management. Forest ecological services are under estimated in development decisions because existing tools for assessing and valuing ecosystem services often fall short of the needs and expectations of decision makers.Thus, the need for better management options such as PES, to ensure sustainable forest management. PES is a new conservation technique that focuses on incentives payments to land owners or stewards for investing in new land use practice that lead to conservation of specific environmental services. The aim of this study is to estimate the economic value of watershed conservation of the North Selangor Peat Swamp Forest (NSPSF). This forest comprises Sungai Karang and Raja Musa Forest reserves. The forest watersheds provides rich ecological functions like flood control, water supply and purification, biodiversity function, carbon storage, pollution control and sediment retention. In addition, recharge water downstream into *Sungai Bernam and Sungai Tengi* that drains into the agricultural drain land at Barat Laut Selangor irrigation area. However, the watershed is seriously threatened as a result of human activities, coupled with reduction in rainfall (Drought). Consequently, reduce water inflow which poses threat to sustainable supply of water for irrigation and domestic uses in the area. Despite broad recognition of the value of the goods and services provided by the forest watershed, conservation programs in area suffer inadequate funding, hence the need for alternative sources such as PES. To estimate the economic value of this watershed, Contingent Valuation Methods (CVM) and Choice Experiment (CE) was employed. The survey responses of 380 randomly selected farmers and 397 households in the study area were analysed. The result was estimated from a single bounded dichotomous choice contingent valuation (DC-CVM) model and the expected conservation value of the forest watershed from the farmers' WTP was RM7,319,494,383.85/per/year. For the choice experiment analysis multinomial logit model and Random parameter Model was used. The expected conservation value of watershed obtained from the households' WTP was RM13,316,102.38/per/year. The result shows that the estimated total economic value

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of The North Selangor Peat Swamp Forest (NSPSF) for (2016) was RM7,332,810,486.23 billion per year. An important policy implication drawn from the study is that the respondents were willing to pay for improved irrigation and domestic water supply. Therefore, recommend PES as additional conservation funds at the North Selangor Peat Swamp Forest for sustainable conservation and management.

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

NILAI ECONOMI DALAM PEMULIHARAAN KAWASAN TADAHAN AIR DI HUTAN PAYA DI UTARA SELANGOR

Oleh

BUHARI ABDULKARIM

Mac 2017

Pengerusi : Profesor Madya Mohd Rusli Yacob, PhD
Fakulti : Pengajian Alam Sekitar

Pemuliharaan sumber hutan sejak kebelakangan ini telah beralih dari amalan konvensional iaitu, dari perintah dan kawal kepada pendekatan yang lebih dinamik dengan melaksanakan bayaran perkhidmatan ekologi (PES) bagi pengurusan mampan. Perkhidmatan ekologi hutan sentiasa dipandang ringan dalam membuat keputusan pembangunan kerana alat-alat yang sedia ada untuk menilai perkhidmatan ekosistem berada di bawah tahap keperluan dan jangkaan pembuat keputusan. Oleh itu, keperluan untuk pengurusan yang lebih baik diperlukan seperti, PES bagi memastikan pengurusan hutan yang mampan. PES merupakan satu teknik pemuliharaan baru yang memberi tumpuan pada bayaran insentif kepada pemilik atau pengelola tanah untuk melabur dalam penggunaan tanah baru yang membawa kepada pemuliharaan alam sekitar yang khusus. Tujuan kajian ini adalah untuk menganggar nilai ekonomi pemuliharaan kawasan tadahan air daripada Hutan Paya Gambut Utara Selangor (NSPSF) yang terdiri daripada rizab Hutan Sungai Karang dan Hutan Raja Musa. Kawasan tadahan air hutan menyediakan fungsi-fungsi ekologi yang kaya seperti kawalan banjir, bekalan dan penulenan air, fungsi biodiversiti, kawalan pencemaran dan pengekalan sedimen. Di samping itu, mengisi air di hilir Sungai Bernam dan Sungai Tengi yang mengalir ke dalam tanah pertanian parit tersebut di kawasan pengairan Barat Laut Selangor. Walau bagaimanapun, kawasan tadahan air ini terancam teruk akibat dari aktiviti manusia, ditambah pula dengan pengurangan hujan (kemarau). Akibatnya, aliran masuk air berkurangan dan menimbulkan ancaman kepada bekalan air yang lestari untuk pengairan dan kegunaan domestik di kawasan itu. Meskipun kesedaran meluas daripada nilai barang dan perkhidmatan yang disediakan oleh program pemuliharaan hutan tadahan air ini, ia tetap mengalami pembiayaan yang tidak mencukupi. Justeru itu, sumber-sumber alternatif seperti PES adalah diperlukan. Untuk menganggarkan nilai ekonomi tadahan air, Kaedah Penilaian Jangka (CVM) dan *Choice Experiment* (CE) digunakan dalam kajian ini. Maklum balas kajian daripada 380 petani dipilih secara rawak dan 397 isi rumah di kawasan kajian telah dianalisis untuk kajian ini. Hasil dianggarkan daripada model *single bounded dichotomous choice contingent valuation* (DC-CVM) dan jangkaan nilai kesanggupan untuk membayar oleh petani bagi pemuliharaan daripada hutan

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tadahan air adalah RM7,319,494,383.85 setahun. Untuk analisis *Choice Experiment*, model logit multinomial dan model random parameter telah digunakan. Nilai jangkaan kesanggupan untuk membayar bagi pemuliharaan daripada hutan tadahan air yang diperolehi daripada isi rumah adalah RM13, 316,102.38 setahun. Hasil kajian menunjukkan bahawa anggaran jumlah nilai ekonomi Hutan Paya Gambut Utara Selangor (NSPSF) untuk (2016) adalah RM7,332,810,486.23 bilion setahun. Implikasi penting yang diperolehi daripada kajian ini ialah responden sanggup membayar untuk bekalan dan pengairan air domestik yang lebih baik. Oleh itu kami mengesyorkan PES sebagai dana pemuliharaan tambahan di Hutan Paya Gambut Utara Selangor untuk pemuliharaan dan pengurusan mampan.

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ACKNOWLEDGEMENTS

Alhamdulillah, All Praise be to Almighty Allah, the Most Gracious and Most Merciful for giving us the life, strength and determination to complete this study.I would like to express my deepest gratitude to Assoc. Prof. Dr. Mohd Rusli Yacob, Chairman supervisory committee and Assoc. Prof. Dr. Ahmad Makmon Abdullah and Assoc. Prof. Dr. Alias Radam members of the supervisory committee, for their excellent supervision, great encouragement and good support.

I also wish to express my heartfelt thanks to my beloved family. Thank you so much for your understanding, patience and support during the study. I would also like to thank Isa Kaita College of Education, Dutsin-ma Katsina State Nigeria, and the Tertiary Education Trust Fund for the opportunity and financial support given to me during the study.

My thanks also goes to University Putra Malaysia, and the Faculty of Environmental Studies for providing the necessary facilities and the enabling environment throughout the study. Same goes to the enumerators especially Mohd Naim bn Yahaya and his group for the data collection. I also appreciate the support from Integrated Agriculture Development Area (IADA) Selangor, Department of Environment (DOE) and all that contributed to the success of this study.

Finally, thank you to all my friends who have been giving me invaluable help and support during the study especially Abdullahi Adamu, Danladi Yusuf Gumel, Salisu Atiku and all of you that are too numerous to mention. May Allah reward you abundantly.

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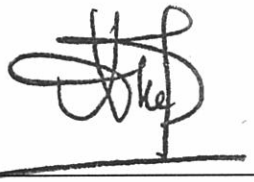

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LIST OF ABBREVIATIONS

AVE	Average Variance Extract
CA	Conjoint Analysis
CBD	Convention on Biological Diversity
CE	Choice Experiment
CFA	Confirmatory Factor Analysis
CR	Contingent Ranking
CR	Contingent Rating
CRP	Conservation Reserve Program
CVM	Contingent Valuation Method
DCM	Discrete Choice Method
CS	Compensating Surplus
CV	Compensating Variation
EV	Equivalent Variation
ES	Ecological Services
ERP	Ecological Restoration Program
FAO	Food and Agriculture Organization
FRIM	Forest Research Institute, Malaysia
FDPM	Forest Department. Peninsular Malaysia
HEP	Hydro Electric Power
HP	Hedonic Pricing
IADA	Integrated Agriculture Development Area
ICDPs	Integrated Conservation & Devt. Project
IFAD	International Fund For Agriculture

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IIA	Independence Irrelevant Alternative
ITTO	International Tropical Timber Organization
JPNS	Jabatan Perhutanan Negeri Selangor
LR	Likelihood Ratio
MEA	Millennium Ecosystem Assessment
ML	Maximum Likelihood
MNL	Multinomial Logit
MRS	Marginal Rate of Substitution
MTIB	Malaysian Timber Industrial Board
MU	Marginal Utility
NEP	New Environmental Paradigm
NOAA	National Oceanic Atmospheric Administration
NRM	Natural Resource Management
NSPSF	North Selangor Peat Swamp Forest
NTFPs	Non-timber Forest Product
PES	Payment for Ecological Services
PWS	Payment for Water Services
RM	Ringgit Malaysia
RP	Revealed Preference
RUM	Random Utility Models
RUPES	Rewarding Upland Poor for the Environmental Services
RUT	Random Utility Theory
SLDP	Sloping Land Development Program
SFM	Sustainable Forest Management
SP	Stated Preference

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SPSS	Statistical Package for the Social Science
SYABAS	Syarikat Baketan Air Selangor
TCM	Travel Cost Method
TEV	Total Economic Value
TPB	Theory of Plan Behaviour
TNS	Taman Warison Negari Selangor
TRA	Theory of Reason Action
UN	United Nations
UNCED	United Nations Conference on Environment and Devt.
WCF	Water Catchment Forest
WTA	Willingness to Accept
WTP	Willingness to Pay

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

Forest resources management in recent times has shifted from the traditional conservation and restoration practices to a more dynamic approach for sustainable management. This is because forest resources are continuously losing their capacity to provide the basic goods and services that are fundamental to human livelihood, due to the threat to ecosystem as a result of human activities and other variables such as climate change (Rands et al., 2010). For Example, during the first decade of this century, global net forest loss totalled over 5 million hectares or 31% of the world's land total, with 13 million hectares being completely destroyed on a yearly basis (FAO, 2011b).

This phenomenon is still an on-going scenario in most of the developing countries in the tropical regions, (Kaplowitz et al., 2012). Asian countries particularly Indonesia, Myanmar and Malaysia are facing reduction of forest at about 70% forest loss, and even if the forest are to survive, they are often logged or degraded (Laurance, 2007). The annual rate of forest loss in Southeast Asia is about 898,000 hectares (FAO, 2011b). Illegal logging adds to the problem that happens continuously. The World Bank estimated that this problem has amounted between US$10 to 15 billion of lost revenue per year (Li et al., 2008). Thus, forest goods and services are increasingly becoming scarce despite its importance.

Forest Ecosystems provide a range of services that are of fundamental importance to human well-being, health, livelihoods, and survival (Costanza et al., 1997; MEA, 2005; TEEB, 2010); As development increases with demand for natural resources, more forest lands are replaced with cropland, commercial plantation and infrastructures to accommodate the excessive growth of the world's population. Despite increasing recognition of the importance of ecosystems and biodiversity for human welfare, they continue to decline at an unprecedented rate (MEA, 2005). In many cases the losses are irreversible, posing a serious threat to sustainable development and to human well-being in general (Loreau, 2010).

In view of this, ecologists and economists have made considerable effort to increase the understanding of the importance of ecosystems so that this is better reflected in decisions that affect their maintenance and service provision. Since these services greatly benefit the human population, any change in their quality or quantity will also affect human welfare. To be able to quantify these benefits and costs and to get a better picture of the values of the different ecosystems, there is a need to assign economic value to the goods and services they provide. Quantifying these values will also allow us to assign payment mechanisms to the ecosystem services that can provide a solution to conservation financing. Conservation financing refer to the process of raising,

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handling and managing capital to support natural resource conservation and management including land, water, forest, coastal area, agriculture land, urban areas and lake and rivers.

Many of the ecosystem goods such as timber, food and fuel get traded on established markets. This means they have agreed market prices, consequently well-defined values. But ecosystems through their existence also provide valuable services like water cycling, pollination and recreation that though are necessary for human survival, but do not appear in the markets and have no assigned monetary value.

The Millennium Ecosystem Assessment (MEA (2005) argues that human activities have altered the ecosystem more rapidly and intensively in the last 50 years than any compassionate period in human history, this is basically to meet up the growing demand for food, shelter, timber, water, fibre, and fuel in struggle for economic development, especially in developing countries. Consequently, resulting in the decline of the forest ecological resources.

Similarly, rapid urbanization and population increase, especially in developing countries such as Malaysia are often associated with urban sprawl, resulting in the declining of forested areas, increased pressure on food security, increase in water demand, the loss of biodiversity, etc. Population growth in the urban areas has also generated pressure on the sustainability of natural resources, forest ecosystems and environmental conditions.

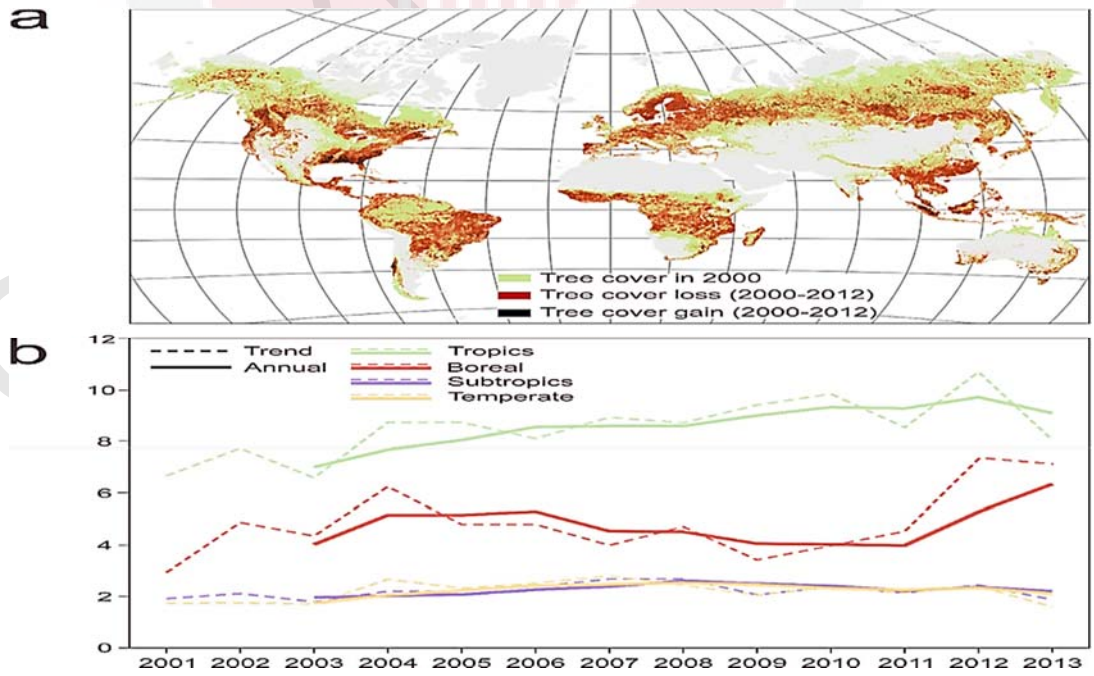

Figure 1.1 : (a) Global forest loss; and (b) biome specific rates of forest loss (Source: (Creed et al., 2016))

More so, timber production in forest catchment areas of Malaysia has also affected many forest ecosystems so much that their ability to adequately contribute to the quality and quantity of ecological services supply such as watershed conservation, biodiversity conservation and recreation area decreased.

There is, therefore, an urgent need not only to protect or conserve the ecosystem potentials, but to restore the lost biodiversity. The problem has prompted policy makers of the 'value of ecosystem service' in environmental management decisions. Therefore, there has been a growing search for concrete solutions. Among the approaches that has been applied often in both developed and developing countries are the economic valuation of the ecological resources and Payment for Ecological Services (PES) approach.

Economic valuation enables us to charge reasonable estimate for environmental services. Valuation of environmental services is regarded as an important tool to assist policy makers in comparing the benefits and costs to the society in formulating conservation and management policies to protect and conserve environmental services. Thus, Payment for Ecological Services is used as a means for conservation activities and supports conservation financing.

Accordingly, Ecological Restoration Program (ERP) as an approach for conservation has been gingered globally, and restoration ecology which is a science of practicing conservation, has also gained broad recognition (Roberts et al., 2009). In view of this, socio economic scholars have passionately promoted the concept of PES as an innovative approach of using economics incentives to address the loss of valuable ecosystem services (Bulte et al., 2008; Engel et al., 2008).

PES is a new conservation technique that focuses on incentive payment to landowners or stewards for investing in new land use practice that lead to conservation or the production of specific environmental services (Engel et al., 2008). Also, Millennium Ecosystem Assessment (2005) defines PES as "the benefits people obtain from ecosystem" which suggests that ground water recharge can be viewed as an ecosystem services provided by a watershed to downstream water users. When the forest in the upper watershed is properly managed to contemporarily provide the said functions, desired conservation objectives can be achieved through PES, which are "voluntary transaction where a well-defined environmental services is being bought by a service buyer from a service provider if and only if the providers secures services provision (Engel et al., 2008).

In addition, PES schemes are designed to produce more efficient environmental outcome by rewarding peoples for their efforts in the protection of environmental services (Zilberman et al., 2008). Payment for Ecological Services is incentives or market remuneration offered to landowners and forest managers in exchange for managing their lands to provide some sort of ecological services. The overall goal of PES is the sustainability of forest conservation, because it a promising policy

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instruments for creating economics incentives for the environmental services to balance up the burden of the provider and the user.

However, the major challenges of PES program is sustainable financing, without a viable scheme and reliable financial source, these projects may fall victims to budget exigencies, especially in fiscal times, hence most PES scheme died after the project pilot stage (Wunder, 2015). More so, some PES schemes may manage the finances of the program wrongly and thus affects the sustainability of the program. To ensure viability of the program, PES schemes can be financed through Intergenerational benefits taxation from beneficiaries as well as the end user of the ecological service. This will ensure effective natural resource conservation, including forest. Against this background, this research will try to study the potentials of Payment for Ecological Services (PES) towards watershed conservation of the North Selangor Peat Swamp Forest

1.1.1 Payment for Ecological Services

The Millennium Ecosystem Assessment (2005) estimated that many of the world's ecosystems are undergoing degradation, and recommended greater use of economic instruments and market-based approaches to effectively manage and conserve environmental services. In this way, payments for Ecological services (PES) are deemed to be able to curb ecological service degradation by creating a market for conservation that internalizes environmental costs and benefits in production and consumption decisions (Bishop, 2015). Some scholars and institutions have proposed PES as a ''win –win'' mechanism for fostering ecosystem conservation.

The ecosystem provides many different kinds of services that contribute to our wellbeing and economic prosperity, from provision of timber and other natural resources, to regulating systems such as carbon storage in soils or water regulation to opportunities for recreation. The fact that these services are often not valued or considered in decision-making is a key factor affecting ecosystem loss and degradation.

The on-going and increasing degradation of ecosystems around the globe has resulted in a search for new approaches to preserve ecosystems and the ecological services that they provide. It is now commonly accepted that people and institutions appreciate natural systems as vital assets, recognizing the central roles these assets play in supporting human well-being, and routinely incorporate their material and intangible values into decision making (Fisher & Brown, 2014).

In recent time, there has been a growing interest in mechanisms that can better recognize the value of ecosystem services in practice; payments for ecosystem services constitutes one of such innovative approach. PES is a market-based approach to conservation financing based on the twin principles that those who benefit from environmental services (such as users of clean water) should pay for them, and that

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those who contribute to generating these services (such as upstream land users) should be compensated for providing them (Wunder, 2005a; Wunder et al., 2008).

PES is prominent in that it (i) generates new financing, which would not otherwise be available for conservation; (ii) is likely to be sustainable as it depends on the mutual self-interest of service users and providers, and not on the vagaries of government or donor financing; and (iii) is likely to be efficient in that it conserves services whose benefits exceed the cost of providing them, and does not conserve services when the opposite is true (Whittington and Pagiola, 2012). PES, as one of the new measures, are increasingly being employed in developed and developing countries as an innovative tool for ecological protection and conservation by bridging the gap between the supply and the demand for environmental services and channelling financial flows from beneficiaries to service providers (Liang and Mol, 2013).

PES is a voluntary transaction where a well-defined environmental service or a land use is likely to secure that service which is being 'bought' by a service buyer from a service provider under the condition that the service provider secures service provision (Wunder et al., 2008). PES moves away from conventional state-dominated ecological conservation and environmental protection programs, by involving new non-state actors, new market-based dynamics, and a decentralized approach. As such, PES should be interpreted as part of a political modernization process. In the forest sector, PES has been applied to various environmental services including watershed services, biodiversity, soil erosion prevention, and carbon sequestration at different scales.

Payments for ecosystem services are one of the principal ways in which a market for ecosystem services can be established. They can be essentially defined in terms of payments to land managers and Stewards to undertake actions that increase the quantity and quality of desired ecosystem services, which benefit specific or general users (Jack et al., 2008). PES, effectively, provide incentives to address market failure, by altering the economic incentives faced by land managers or others who can affect delivery of ecosystem services.

PES programs are increasingly becoming popular policy instrument for forest resource conservation in developing countries like Costa Rica, China, and Malaysia. Most PES programs involved downstream users such as water supply utilities, domestic water users etc. in paying upstream land use service provider (Forestry Department) to undertake activities to protect and conserve forest resources. In Malaysia for example, forest ecosystem services (hydrological, biodiversity and carbon functions) serve as water supply source either for irrigation or domestic users and ecosystem service for recreation and carbon emission. Thus, the potential benefits to downstream water users, farmers, visitors include improved water quality, quantity and reliability of water supplies, reduced risk of floods and increased preservation of forest areas for future generations.

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1.1.2 Forest Ecosystem Services and Watershed in Selangor.

The Selangor state is blessed with vast area of forest resources, these includes; Sungai Karang and Raja Musa forest, the Sepang Mangroves, Batu caves, Selangor state forest and Kota Damansara Community forest. The forest provides multiple functions or services, one of which is the protection and conservation of watershed in the water catchment forest. There are 17 Water Catchment Forest (WCF) in Selangor occupying 44, 543 hectares and account for 26% of the total forest cover in the state (Azhar, 2000).

The watershed discharges water to the rivers and dams that supply water to the 33 water treatment plants in the state. The main supplier of water in Selangor is the Syarikat Bakatan Air Selangor Sdn Bhd (SYABAS). It also supplies water to the federal capital of Kuala Lumpur and Putrajaya, with a total supply of 4,635 million litres of daily.

1.1.3 Water Supply and Agriculture in Selangor Malaysia

Agricultural activities, especially irrigation and livestock farming are other major consumers of water in Malaysia. Most of these agricultural areas are located in the North Western part of the country that is, in Selangor state. For instance, since 1990, water consumption for agriculture in the state was 9 billion m^3 accounting for about 75% of total water use. Most of these agricultural activities are within the Selangor state, especially the paddy farmers. The Paddy irrigation water demand is expected to increase to 13.2 billion m^3 by 2020 (Alam et al., 2011).

Irrigation agriculture in this area has expanded and develop very fast from annual cropping into double cropping of paddy to meet the dual objectives of increasing food production and to raise the income levels of the farmers. There are some 564,000 hectares of wet paddy land in Malaysia, of which 322,000 hectares are capable of double cropping (Alam et al., 2011). Farmers in irrigation and drainage areas are required to pay water rates ranging from RM 10-15 per ha which represent less than 10% of the annual recurrent operation and maintenance cost of the water supply (Azhar, 2000; Toriman and Mokhtar, 2012).

1.1.4 Forest and Recreation Sites in Selangor

Selangor state has diverse forest and recreational sites that continue to attract more tourists into the state. The state is blessed with large area of forest resources, some of which are categorized as Recreational forest, permanent forest as well as virgin forest under the management of the Department of Forestry (JPNS) as stated in the National Forest Act 1984. The Selangor state forest park is located in the eastern part of the state which was gazetted in 2005 to be the Selangor State Heritage Park, Taman Warisan Negari Selangor (TNS). This was established to protect the genetic resources, environmental protection and also increasing the economy of the rural sector through the development of ecotourism. Among other factors that promotes the establishment

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of the State forest park is to address the issue of preservation and conservation of biodiversity and the environment. Thus significantly improved the conservation of the biodiversity potentials and also increase state revenue through the eco-tourism sector.

The TNS forest state park is the second largest under forestry Department in Peninsular Malaysia (FDPM) with an area of 93.002 ha. TNS include: Gunung Nuang forest, Sg Conkak forest, Sg Tekala forest, Kanching forest, Sg Tua forest, Commonwealth forest, Sungai Sendat forest and Klan Gates Quartz ridge. Apart from the recreational forest gazetted under TNS, there are other recreational forests. These recreational forests are located on the western part of the state, which include: Sg Gobal forest and Kota Damansara community forests. These recreational potentials in the state have continued to attract an influx of tourist both local and foreign and thus provide great prospects to the tourism industry. Tourism sector in Selangor plays an important role towards the economic development in the state.

1.2 Problem Statement

The ecosystem services provided by forests are vital to humanity and cannot be fully replaced by technology. The services provided by forests are threatened and damaged by human activities, making restoration and protection imperative. Economic valuation of forest services is a useful tool, but has limitations and flaws. It is necessary to provide incentives for resource owners to make conservation more desirable.

Environmental resources are viewed as free gift of nature and public goods with imperfect property rights. This leads to unsustainable usage because existing markets failed to value them properly. The failure of society to place a value on nature has resulted in the degradation of ecosystems, a consequent reduction in ecosystem services, and has contributed to a significant decline in biodiversity (Jones-Walter and & Mulder, 2009). This problems are common in developing countries of Africa and Asia.

The lack of comprehensive methodologies for providing economic value for biodiversity and ecosystem services, which can be easily communicated to policy and decision-makers, has also hampered efforts to protect, maintain and enhance habitats and species. (Jones-Walter and & Mulder, 2009). The economic valuation of forest ecosystem services in broad-spectrum, and watershed functions to be specific, are the most pressing and challenging issues confronting environmental economist today. Economist value forest ecosystem services because valuation allow direct comparison with economic value of alternative options, a basis for a cost benefit analysis exercise, this allows room for environmental accounting, natural resource damage assessment and cost benefit analysis (Nijkamp et al., 2008).

The use of non-market valuation techniques as one set of tools that can be used from policy and management point to estimate the net-benefits and identify the demand for services and appropriate payment mechanisms for environmental services like

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watershed function, has contributed toward improved environmental resource conservation despite the cost involved. Environmental valuation are often limited in developing economies because of low household income and the non-monetized nature of sub-economies (Bennett and Birol, 2010).

For example, few studies have been conducted in Malaysia to quantify the real economic value and benefit of environmental goods and services. This could possibly be due to the cost involve and the difficulty in measuring these values as most of the environmental goods and services are not traded in the market. Early studies have applied the Travel Cost Method (TCM) to estimate the benefits of nature-based recreation for instance, Willis et al. (1998); Othman (2000). Others applied Contingent Valuation Method (CVM) example, Mustapha (1993) and Othman (2004) who employed the dichotomous choice and open-ended CV formats to estimate the benefits of lake recreation and non-use values of forest resources, respectively.

Though environmental valuation in Malaysia has gain attentiveness and incorporated into the National Policy on the Environment since 2002. Studies on ecosystem services and watershed conservation in particular using stated preferences are still limited in Malaysia. This study therefore, contribute to the growing literature on ecosystem valuation and watershed conservation in particularly using state preference methods. In addition, Valuation of environmental goods and services especially payment for watershed conservation in the country are at embryonic stage. Early effort by Scholars across fields in Malaysia to value ecological services and other environmental issues include; Yacob,Radam and Rawi (2009) on marine park, Samdin et al. (2010) and Noor et al. (2009) on forested area, , Manaf et al. (2009) Waste Management.

Most of the studies conducted in the countries using CVM and CE were on Biodiversity, ecotourism and recreation, example; Abdullah et al. (2015) and Ng et al. (2017) on Biodiversity, Bhuiyan et al. (2016) and Masud et al. (2017) Ecotourism, (Latiff et al., 2015) on marine park, Arabamiry,Rahim,Radam, et al. (2013) and Kamri (2013) for national parks and Hasan-Basri and Abd Karim (2016) for urban recreation park.

Though Mohamed et al. (2012) valued watershed conservation at Hulu Langat Selangor, and Krishnan et al. (2017) studied household involvement in pioneering payment for ecosystem services in Langat Basin Malaysia, both studies employed the contingent valuation method. In Malaysia, to our knowledge only few applied a choice experiment to value watershed conservation and water service attributes. For example Yacob et al. (2011), assessed community preferences and values relating to alternative water service management with particular concentration on water service improvement, the study convers only Subang Jaya, and does not cover the forest watershed catchment. Similarly, Kamaludin et al. (2016) who focussed on household preferences for improved water services, the study was conducted in Kelantan. Besides most studies dwells directly on users without corporation the non-user. In addition while Yacob et al. (2011) used conditional logit model, Kamaludin et al

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(2016) employed the mixed logit model. This study therefore, focusses on watershed valuation capturing ecological function, water quality and quantity using both CVM and CE at North Selangor Peat Swamp Forest. In addition, the study estimated the watershed conservation values for both the user and non-user, paving way for the total economic value (TEV) for conservation of the watershed.

More so, Payment for ecological services in Asia and specifically Malaysia are mostly at the pilot stage (Khalid et al., 2012; Othman et al., 2004). In view of this therefore, this study focuses on valuing ecosystems services in Malaysia and specifically watershed conservation in North Selangor Peat Swamp Forest. This forest reserve which is the focus of this study is facing serious threats of destruction owing to development and agricultural activities.

Another major threat of the forest is fire, all this are the main cause of biodiversity lost. For example the abundant flora such as Kempas (Koompassia malaccensis), Kedondong (Santiria spp.), Kelat (Syzgium spp.), Durian (Durio carinatus) and Ramin (Gonystylus bancanus) which are common species in the peat swamp forest are now very rare. Also different animals such as Leopard, Tapir and Malaysian sun Bear as well as more than 100 species of fish, which are also facing trends of extinction. In fact, the Raja Musa Peat Swamp Forest Reserve has, over the past ten years, seen more than 500 hectares of the reserve illegally cleared and burnt for farming activities. This has caused major environmental hazards such as haze and the release of thousands of tonnes of greenhouses gases, which contribute to climate change (GEC, 2014). The Selangor State government has recognized the need to conserve this site,

For that reason, the State Government in 2010 through the forest Department has implemented (**Moratorium**) the policy of freezing timber harvesting which means the production will be frozen for the next 25 years. The implications of Moratorium on forest policy tended to the economic role of forest production to generate forest revenue. The implications of this policy impacts directly to the department thereby losing their benefits from the timber volume with annual average of 38,046 m^3 per year from 2001 – 2010. This volume will generate income for the department from forest production with average of RM11.9 million per year, out of the estimated cost of RM 16.5million per year needed for effective forest management (JPNS., 2012). However, with the implementation of moratorium policy, this value (RM11.9 million per year) is lost and the department capacity to manage and conserve the forest ecosystem become limited.

The need for the department to explore other alternative sources of income from the forest resources in order to supplement the cost of forest management, development and conservation of the forest resources become necessary. In fact, for any form of sustainability, they require the introduction of economic incentives to add to the little available funds. Thus, payment for forest ecological services specifically watershed services is a potential mechanism for achieving these objectives.

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Watershed catchments are important sources of water supply for both consumptive and non-consumptive uses. In fact, they supply virtually all of the fresh water used for agriculture, industry, households, and recreation in Peninsular Malaysia. Water catchment forests, covering 270,000 hectares (ha), play a crucial role in sustaining major dams and reservoirs in the country. The total water demand in Malaysia was estimated at 11.6 billion cubic meters (m). Rapid economic growth also implies an increasing demand for water by the industrial sector. Other non-consumptive uses such as irrigation and hydroelectric power (HEP) are important and will continue to increase. The total growth in demand for water (for domestic and industrial uses) in Peninsular Malaysia is estimated at about 10 percent per annum (Mohd Shahwahid et al., 1997; Zaiha et al., 2015)

The role of protected forest cannot be overemphasized because of its multiple functions one of which is a watershed in the Water Catchment Forest. Presently there are 17 Water Catchment Forest (WCF) in Selangor with a total 44,543 hectares constituting 26% of the total forest cover (Azhar, 2000). This area is located within the permanent forest reserves, which have been gazetted as water catchments forest since 1995. The main role of these areas is not only limited to the watershed as a source of water supply in Selangor and the Federal Territory, but also to safeguard the ecosystem and conserve the watershed.

The main source of raw water supply in the area entirely depend on the major rivers and Dams from the watershed, which contributes 96.5% (4,014 MLD) of the total water supply in Selangor. The watershed discharge into the Dams and Rivers become an important water supply for 33 water treatment plants in Selangor(Azhar, 2000). This is one of the many issues that need to be addressed within the context of sustainable forest management and sustainable development of water resources

Despite the importance of forests as a source of water supply from the water catchment areas, water users pay a little amount which does not reflect the real economic value of this resource. There are no incentives to the stewards of the water catchment areas which are critical to the continuous flow of the fresh water supply because forest ecosystem services are viewed as public goods.

Consequently many key ecosystem services are not accounted for at all and therefore risk being under-valued with resulting over use and degradation of these services (Dunn, 2011). In addition, the responsibility of forest department is to protect and preserve the forest resources such as in water catchment forest (WCF) to ensure that it continues to provide sources of water supply to finance the conservation and maintenance cost without imposing charges on raw water supply sources either for both the suppliers and the consumers. Hence the need to initiate a conservation payment as a corporate collective responsibility involving both water suppliers and users.

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1.3 Objectives

The general objective of this study is to evaluate the potentials of Payment for Ecosystem Services (PES) towards effective watershed conservation of the North Selangor Peat Swamp Forest.
This can be achieved through the following specific objects.

1.3.1 Specific Objects

1. To determine the respondent level of perception and attitude towards forest Watershed Conservation.
2. To estimate farmers' willingness to pay for hydrological services of the Forest watershed.
3. To determine respondents' preferred choice of attributes of the forest watershed conservation.
4. To estimate the total economic values of the forest watershed services of the North Selangor Peat Swamp Forest.

1.4 Research Questions.

The following questions are set as a guide towards this research.

- What is the respondents' level of attitude and perception towards forest Watershed Conservation?
- How much is the individual user willing to pay for the hydrological services of the Forest watershed?
- What attribute of the forest watershed is most preferred by the respondents?
- What is the total economic value of the forest watershed services of the North Selangor Peat Swamp Forest?

1.5 Significance of the study

Payment for ecological services is a new conservation technique that focuses on incentive payment to land owners or stewards for investing in new land use practice that lead to conservation of environmental resources. It is an alternative option for ecosystem conservation and recent strategy for sustainable forest management. PES schemes are designed to produce a more efficient environmental outcome by rewarding peoples for their efforts in the protection of environmental services (Lipper et al., 2009).

Payment for Ecological Services are based on Economic Valuation of environmental services proposed to be more practical, cost effective and sustainable option in Natural Resource Management (NRM) than other mechanisms that provide indirect benefits. Among which include Integrated Conservation and Development Project (ICDPs) and the regular conservation programs like Afforestation (MacKinnon and Wardojo,

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2001). Economic Valuation enables us to make fair estimate for environmental services. Valuation of environmental services is regarded as an important tool to assist policy makers in comparing the benefits and cost to the society in formulating conservation and management policies to protect and conserve environmental services.

Therefore, PES is used as means of conservation to supports the financial sustainability of environmental management and conservation. However, the non-market values of the forest resources are viewed as "Public Goods" which are undervalued or not valued at all. Failure to allocate appropriate economic values to these environmental services is the major cause of its destruction. Also with the implementation of the moratorium on timber harvesting by Selangor State, the department capacity to generate revenue for the management and conservation of the forest ecosystem is limited (JPNS., 2012). Therefore, the department needs to explore alternative sources of income from the forest resources in order to generate their income so that it can cover the cost of forest management, development and conservation of the forest resources.

Similarly, water resources management involves the improvement in the quantities of water with an adequate quality through effective development of the watershed. The tendency of water demand in Malaysia was estimated to increase by 60% in 2020 (Cherian, 2009). There is need to control and maintain both the water quality and quantity of the raw water in the rivers to ensure safe quality of water supply because the deterioration of the quality reduces the usability of the resources. More so, the water quality evaluation is mostly based on the condition of the river which is determined by the downstream flow from the forest ecosystem. Hence the need for PES as a promising instrument for effective conservation.

There are very few studies on environmental valuation in Malaysia, and most studies applied revealed preference such as the Travel Cost Method (TCM) (Mohammad Afandi et al., 2013; Raziah, 2003). Hence, the need to expand the scope of environmental valuation in Malaysia through stated preference such as Contingent Valuation Method (CVM) and Choice Experiment Methods (CEM). These technique holds a considerable promise regarding the estimation of environmental values particularly watershed. The Finding of this research (conservation values in RM) can be used to justify additional conservation funds and guide to the allocation of scarce conservation financing.

This research is one of the few studies on Payment for ecological services in Malaysia, and the first research conducted to measure the value of the Sungai Karang and Raja Musa forest from the perspective of watershed conservation. It will also provide a picture to the Forestry Department especially on alternative source of conservation fund from peoples' commitment and their willingness to pay for conservation. It will also recreate awareness amongst the communities within the forest catchment to appreciate conservation as corporate collective responsibility.

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Identifying respondents' willingness to pay and their preferences for the attributes of watershed conservation and management through interviews would provide valuable information to the department of Forestry, Department of Environmental and all other agencies. This information is hoped to reflect a broad range of societal values towards Watershed conservation. In addition, the study would no doubt be useful to policy makers and conservationist like Department of Forestry and all stakeholders in marking informed economic decision on how PES scheme can be used to enhance sustainable Conservation and Management of North Selangor Peat Swamp Forest.

1.6 Scope and Limitation

Environmental Resource Management in Malaysia covers a wide range of programs that include forest conservation, Agriculture and poverty alleviation, erosion control, carbon consumption programs, etc. Therefore, this research focussed on forest conservation and management issues specifically, on Payment for Ecological Services program in Malaysia. The research intends to cover Selangor State forest areas like Sepang Mangroves, Selagor State Park, Kota Damansara Community Forest and the North Selangor Peat Swamp Forest (NSPSF). These forest areas are so wide that the research is limited to Selangor Forest Protected areas, that is, The North Selangor Peat Swamp Forest (NSPSF). This forest covers 73,592 hectres on the Northwest sector of the state of Selangor in Peninsular Malaysia comprising the Sungai Karang Forest Reserve (50,106 hectres) to the North and Raja Musa Forest (23,486 hectres) to the South. This is the largest remaining peat swamp forest on the west coast of Peninsular Malaysia and is critical for biodiversity conservation, water resource management and carbon storage (Parlan, 2001). In addition, the study covers only the hydrological function of the ecosystem and the communities or residence within these two forests protected areas specifically paddy rice farmers at the Barat Laut Selangor irrigation scheme and households within the forest reserve at Kuala Selangor district.

1.7 Organization of the thesis

This research was organized into seven (7) chapters as follows; Chapter one comprises of introduction, problem statement, objectives, significance of the study, scope and limitation of the study. Chapter two focuses on background of the study, basic theories, and ideas on Payment for ecological services and definition terms. Chapter three of this thesis reviewed some related literature. It also focused on the theories and methodology applied by different scholars and authorities in the field, as well as review empirical studies from the relevant literature.

Chapter four dwells on the methodology of the study focusing on data collection procedures, questionnaire design and administration, and the various models employed in this process. Chapter five also dwells on the analysis of the result, discussion and interpretation of the findings and its complication to the existing literature. Chapter six consists of the PES application. Finally, Chapter seven, summary of the research findings, recommendations and conclusions on policy implications of the findings.

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