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ECONOMIC VALUATION OF ECOSYSTEM SERVICES FOR COMMUNITY-BASED PES: A CASE STUDY OF ULU TAMPIK WATERFALL, MALAYSIA

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Abstract

The degradation of forest ecosystems due to expanding development and unsustainable land use continues to threaten the provision of essential ecosystem services. This study evaluates the economic value of ecosystem services at Ulu Tampik Waterfall (UTW), Malaysia, to inform the design of a community-based Payment for Ecosystem Services (PES) scheme. Employing the Contingent Valuation Method (CVM) using a dichotomous choice–double-bounded format, the study estimates the mean willingness to pay (WTP) between RM12.51 and RM30.89, generating a projected annual revenue of RM60,048 to RM148,272. Complementing the valuation, the stakeholders' analysis was also applied to assess community engagement in conservation and livelihood enhancement. Results indicate that community-based PES can effectively support biodiversity conservation, improve household income, and contribute to state revenue. This research underscores the critical role of economic valuation and inclusive management strategies in advancing sustainable forest resource governance towards more enforceable roles, standards, and rules for future reference and service quality for the economic value of ecosystem services.

Keywords: Payment for Ecosystem Services, Economic Valuation, Contingent Valuation, Forest Policy, Malaysia

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INTRODUCTION

Forest management has recently shifted from the conventional conservation and restoration practices to a more dynamic approach for sustainable management. This shift takes place because the capacity of forest resources continuously weakens in order to provide goods and services that are fundamental to the livelihoods of local communities. Human activities and other factors have threatened forest ecosystems, especially in developing countries like Malaysia. Addressing this phenomenon, the Malaysian Government has continuously intensified efforts to reduce forest loss due to forest clearance or the conversion of forested lands to other land uses, including converting forest areas for agricultural purposes and other land use changes. Based on this scenario, introducing the payment for ecosystem services (PES) scheme is deemed fitting.

Moreover, the concept of ecotourism development has become increasingly popular in Malaysia (Manohar et al., 2020). With its promising prospects, ecotourism development in terms of the development and conservation of forests provides valuable opportunities that benefit the local communities (Wood et al., 1991). A well-planned and properly managed ecotourism programme can provide sustainable returns for the local communities. Therefore, the PES scheme is deemed as one of the most effective solutions to achieve the following two aims: (1) to generate financial support for the local communities; (2) to conserve the forest ecosystems (Wunder 2005).

Thus, the current study aimed to estimate the economic value of environmental services and to establish the Payment for Ecosystem Services (PES) scheme for the local communities in Janda Baik as financial incentives to be involved in the environmental conservation is to establish the Payment for Ecosystem Services (PES) scheme in creating financial incentives. Focusing on the Ulu Tampik Waterfall (UTW), which is one of the nature ecotourism sites in Malaysia, this study consisted of two phases. The first phase focused on estimating the value of environmental services or determining the price to be paid for environmental services, while the second phase focused on the development of the PES scheme in terms of design and implementation.

LITERATURE REVIEW

Valuation of an Environmental Good

Total economic value (TEV) is a useful concept to measure the economic value of an environmental good. The TEV of an area can broadly be divided into two types: use and non-use values. The direct-use values are derived from the direct uses of the environmental goods for recreation, tourism, natural resource harvesting, hunting, gene pool services, education and research. These activities can be commercial, meaning they are traded in a market or non-commercial, meaning there is no formal or regular market in which they are traded. The values

of commercial uses will generally be a straightforward process of directly obtaining market-priced values. Valuing non-commercial uses is more complex and entails a range of techniques which solicit values for goods and services of a roughly similar nature from other markets (Mohd Shahwahid, 2005).

Non-Market Valuation Methods

Revealed-preference methods infer the value of non-market goods by studying the actual behaviour in a closely related market. The normally used methods are hedonic pricing (HP) and travel cost (TCM). HP and TCM are the most well-known and extensively used to estimate the benefits of non-market valuation, such as ecotourism and recreational opportunities (Hanley, 2001). However, the stated-preference method assesses the values of non-market goods by using individual stated behaviour in a hypothetical setting. The method includes choice modelling and contingent-valuation methods (CVM). In most applications, the CVM has been the most commonly used approach, directly asking respondents whether or not they would be willing to pay a certain amount of money to realise the level of the non-market good described (Bateman and Willis, 1999).

Willingness to Pay

The value of WTP will eventually show whether the visitors are satisfied with the current entrance fee or prefer another value they are willing to pay (Loomis and White, 1996). However, the new value might not represent a true WTP of visitors because some individuals might state what they believe is a fair price rather than what they would pay. The empirical work of Mitchell and Carson (1995) looked at the issue of the effect of question sequence concentrated almost entirely upon whether a broader definition of a public good will reveal what the authors call "component insensitivity". If there is component insensitivity, then a broader description of the good (or more of it) will not yield a higher WTP value than a narrower description of the good (or less of it).

Payment for Ecosystem Services (PES)

Studies on PES in Malaysia are primarily at the conceptual and pilot stages. Mohamed et al. (2012) studied watershed conservation at Hulu Langat, Selangor. Krishnan et al. (2017) studied household involvement in pioneering PES in Langat River Basin. Abdulkarim et al. (2017) studied the PES scheme on water conservation for agricultural irrigation in Peat Swamp Forest, Selangor, and Zaiton et al. (2020) also studied the concept of PES on watershed conservation for domestic water in Perak. Therefore, this study not only focuses on valuing ecosystem services but also develops the PES scheme for forest conservation and ecotourism benefits to the local community. Furthermore, to the Author's

knowledge, this study was the first attempt to implement the PES Scheme in Malaysia.

PES has attracted increasing interest as a mechanism to translate external, non-market values of the environment into real financial incentives for local actors to provide such services (Engel et al., 2008). According to Savy and Turpie (2004), a PES scheme can develop in one of two ways: either at least one set of stakeholders recognises a noticeable depletion in resources, leading to true demand, or a particular aim is identified, usually concerning the protection or management of national resources and a PES system is introduced to create a market for the service. For PES to work, it must provide a "win-win" opportunity for both the supplier and service buyers. The buyer covers the cost of provision, which must be (1) lower than any alternative method by which the buyer might secure the same service and (2) sufficient to ensure that the alternatives, for example, conversion of land to alternative use, are less economically attractive (Emily et al., 2014).

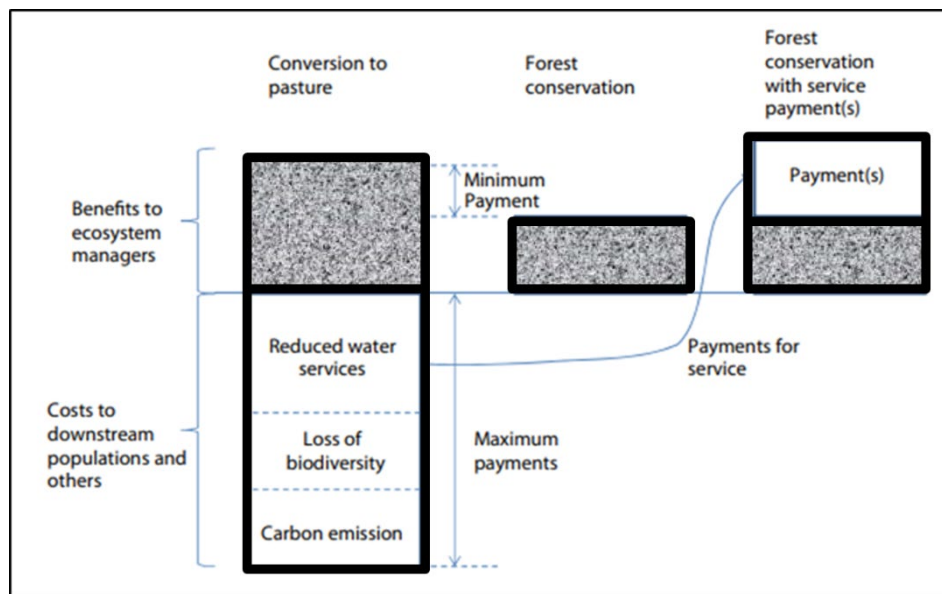


Figure 1.1: Structure for Payments Under PES
Source: Engel et al., 2008

RESEARCH METHODOLOGY

Description of Study Site

Ulu Tampik Waterfall (UTW), which is located at Janda Baik, Bentong, Pahang, Malaysia, was selected as the study site. This location is an approximately 45-

minute drive from the city centre of Kuala Lumpur. The surrounding area of UTW in Compartment 51, Lentang Forest Reserve (LFR) is generally unique, and it serves as an exciting recreational area. In terms of topography, this study site is located within the Titiwangsa Range. LFR is a hilly area, with an altitude between 600 m and 800 m above sea level. The main physical element of LFR is its unique, clear waterfall. UTW and its surrounding area represent a popular leisure site for the residents of Janda Baik and visitors, both locals and foreigners, as presented in Figure 1.

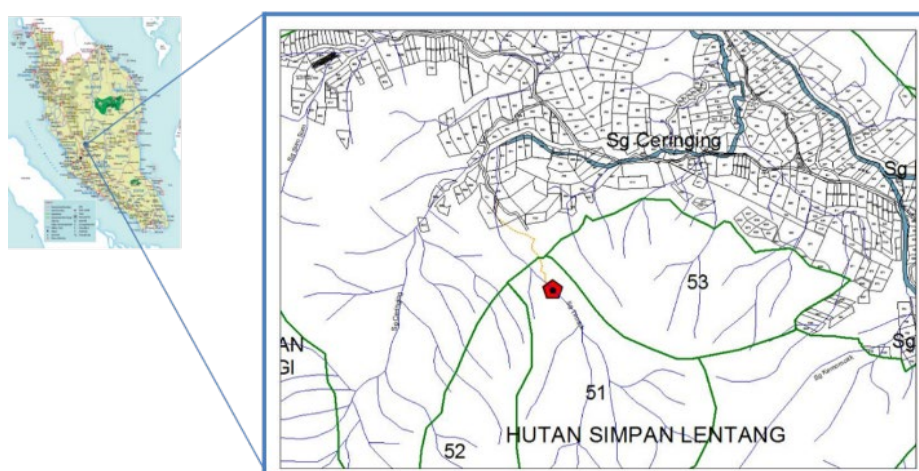


Figure 1.2: Location of Study Site at Janda Baik, Pahang

Estimation of the Economic Valuation

As previously highlighted, this study consisted of two main phases. The first phase involved the economic valuation of the study site as a nature tourism area. The economic benefits of preserving the study site were estimated based on public preferences. In particular, this study measured whether visitors would pay for the conservation of natural resources. Meanwhile, the second phase of this study focused on the development of the PES scheme. This phase first explored the involvement of the local communities in managing the project area, assisting in the conservation activities, and improving their livelihoods (Kurniati et al., 2024). This phase also focused on developing organisations at the community level that can be actively involved in the management of the project area.

The contingent evaluation method (CVM) was used to quantify public preferences. Through this method, the net economic value of non-market goods and services to individuals can be quantified by measuring the consumer surplus (Walsh, 1986). The “willingness to pay” (WTP) for the conservation of natural resources, which serves as an indicator of demand, was also used. This method

enables people to express how they would act if they were to be placed in certain contingent situations. As for the current study, the maximum WTP to preserve UTW was determined.

In particular, the double-bounded dichotomous choice was used in this study. This format provides a single dollar amount offer and a simple response of either “yes” (take it) or “no” (leave it). The obtained responses were measured as this study’s dependent variable, with the dollar amount (WTP) for the changing environment and other relevant data as the independent variables. There were four models for estimating WTP for each sample.

Questionnaire Design and Sampling Procedure

A structured questionnaire survey was used in this study. The developed questionnaire survey was designed and divided into four sections. CVM that involved a double-bounded dichotomous choice (DBDC) format was applied. This particular format allowed the respondents to choose the amount of WTP. All respondents were also required to indicate “yes” or “no” for the question related to WTP. The question presented six different bid prices for the respondents to select: RM 2.00, RM 5.00, RM 8.00, RM 10.00, RM 15.00, and RM 20.00.

For sampling, this study applied the non-probability convenience sampling strategy to obtain insights from a broad population perspective. The face-to-face survey, which involved 322 visitors. All respondents were first briefed on the purpose and objectives of the survey prior to answering the questions. For this study, the sample size estimation was based on the estimated number of visitors to UTW. Based on the number of current visitors, those who came on weekdays and weekends are considered. It is estimated that the number of visitors is 480 people monthly. However, the area will usually be closed in November and December due to weather conditions. The estimated number of visitors per year is around 4,800 people. Therefore, a simplified version of the formula from Yamane (1985) was used to help determine the required sample size of 369 respondents.

Development of PES Scheme

This study adopted the appreciative inquiry (AI) process as a research tool to explore how community involvement in the management of natural areas can improve environmental conservation and the livelihoods of local communities and further develop the community-based PES scheme (Figure 2). The design and development of the PES scheme in this study involved a series of workshops and panel discussions. This approach is suitable for collectivist societies where each member mainly interacts with the members of a specific religious, ethnic, or familial group, and they feel involved in the lives of other members of their group (Greif, 1994).

This study's AI process involved a few steps with certain modifications, which incorporated five phases: grounding phase, discovery phase, dream phase, design phase, and destiny phase. Firstly, the grounding phase involved the inception phase that consisted of rapport building, stakeholder identification, selection of participants, and orientation on this study's objectives and methods. Secondly, in the discovery phase, the selected participants were required to discuss and identify (in terms of clear boundaries) UTW and its surrounding area to be preserved and managed or maintained by the local communities as a community-based PES project.

Thirdly, the dream phase involves co-creating a shared image or vision of the preferred future. All participants were required to discuss and visualise the ideal relationships they would expect for the livelihood, conservation, and tourism programmes. Following that, the design phase serves as the process of drawing community socio-technical architecture to achieve the "dreams". Lastly, the destiny phase addresses how to empower, learn, and adjust or improvise. It represents the time of realising the "dreams" due to work done in the design phase, as well as the moment of continuous learning, adjustment, and improvisation. For the current study, this phase served as the existence phase of the community-based PES scheme and physical translation of its existence as presented in Figure 1.3.

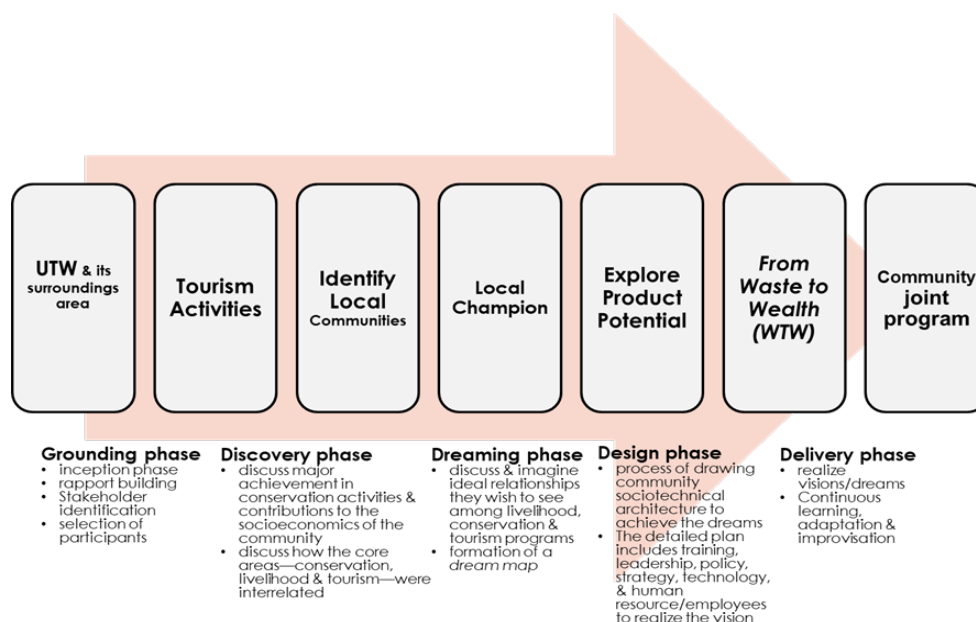


Figure 1.3: Phases and Processes of a Community Development Programme

RESULTS AND FINDINGS

This section presents and discusses the obtained results of this study into four subsections. The first subsection presents the results of the economic valuation study using CVM. Meanwhile, the second subsection discusses the development of financial incentives for the local communities in environmental conservation, focusing on the conservation of natural resources. The third subsection deliberates the institutional and legal framework of the community-based PES scheme and its implementation with the active involvement of the local communities. The economic contribution and its impact on various stakeholders through the development and implementation of this community-based PES scheme are discussed in the final subsection.

Estimation of the Mean of WTP

In this study, the mean of WTP was estimated based on Logistic, Bivariate Probit, Ordinary Least Squares (OLS), and Tobit models. Table 1 presents the calculated mean and median values according to these different approaches. As for positive responses of WTP, the mean of WTP was found to be rather close to the median of WTP for the Logistic model. The estimated mean of WTP recorded RM 23.05. As for the Bivariate Probit model, the mean of WTP ranged from RM 23.83 to RM 30.89, which was slightly higher than the recorded mean of WTP for the Logistic model. On the other hand, the Tobit model recorded a lower estimate (RM 17.03) than the recorded estimate for the Logistic model. The OLS model provided the lowest estimate at RM 12.51.

Table 1: Means and medians of WTP for different models

Model		Mean of WTP (RM)	Median of WTP (RM)
Logistic	Initial bid	23.05	22.95
Bivariate Probit	Initial bid	23.83	22.86
	Follow-up bid	30.89	28.92
Open-ended OLS		12.51	N/A
Tobit		17.03	N/A

Source: Own Survey and Author's Calculation

The aggregation of WTPs for the conservation of UTW for recreation and ecotourism was determined based on the resultant outcomes of the multiplication of individual WTPs by the number of visitors to UTW. Table 2 presents the yearly calculated conservation values or benefits for UTW based on the mean of WTP for the respective models.

Table 2: Estimated benefits (in RM) for the conservation of UTW based on WTP for different models

Estimated Number of Visitors to UTW (in 2018)	Logistic	Bivariate Probit		OLS	Tobit
	Initial bid	Initial bid	Follow-up bid		
	WTP = 23.05	WTP = 23.83	WTP = 30.89		
4,800	110,640	114,384	148,272	60,048	81,744

Source: Own Survey and Author's Calculation

Determination of the Marketable Value

The price for an ecosystem service is ultimately determined by what the buyer is willing to pay and what the seller accepts and delivers. In regulated markets, WTP is often mandated. Meanwhile, in voluntary PES deals, WTP is open to negotiation. Based on the results of the economic valuation study, the values of WTP ranged from RM 12.51 to RM 30.89 per person per visit, as presented in Table 2.

The obtained results showed high economic value for the environmental conservation activities of UTW among the participating visitors who came for the purpose of leisure or recreation. Using the estimated data on the number of visitors to UTW in 2018 ($n = 4,800$), the aggregate value was expected to be between RM 60,048.00 and RM 148,272.00 per year. The promotion and future development of basic facilities were expected to increase the number of annual visitors. In other words, visitors do not mind paying a certain amount of entrance fee if the UTW and its surrounding area are protected and preserved for the benefits of the present and future generations.

ANALYSIS AND DISCUSSION

Institutional and Legal Framework of PES Scheme

A part of the Tampik river basin, Janda Baik, Pahang (30 hectares), is leased and managed by the local communities under a local community group, specifically Sahabat Alam Tampik Janda Baik (SATJB) Association. As for the current study, the Pahang Forestry Department cooperated with SATJB Association for the implementation of “joint management” to manage the UTW environment. The developed concept of joint management and benefit-sharing is presented in Figure 3. In particular, the members of the SATJB Association were assigned to a community-based PES project of managing the recreational and ecotourism activities at the 30-hectare UTW environment in the Lentang Forest Reserve.

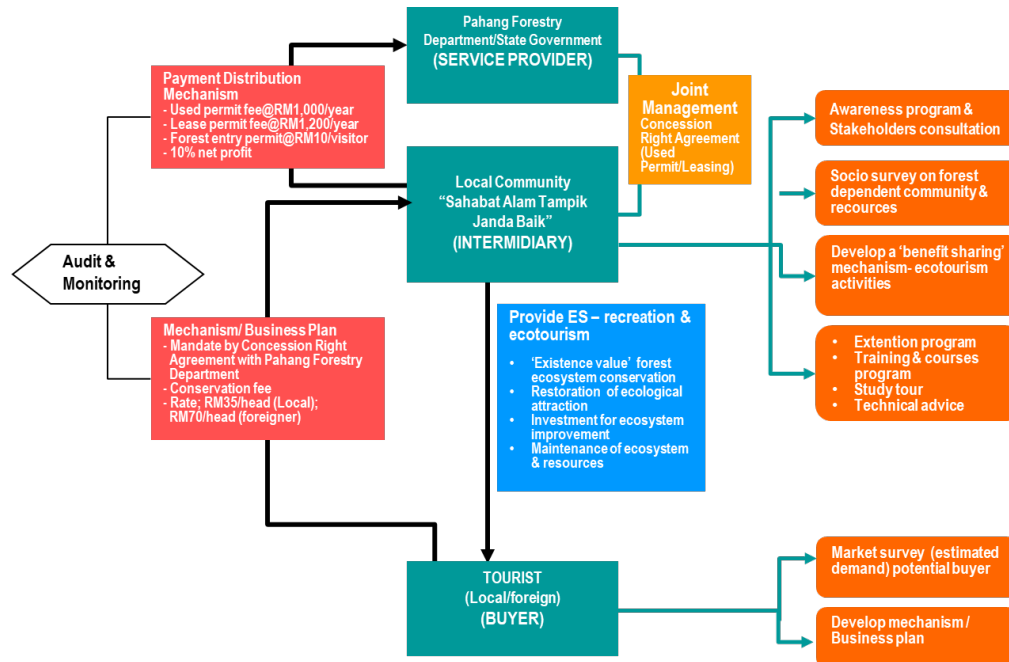


Figure 3: Joint Management and Benefit-Sharing Between the Pahang Forestry Department and the Local Communities in the Community-Based PES Scheme for UTW

Economic Return of the PES Scheme Development—Preliminary Findings

The economic impact of the environmental development of UTW, as a community-based ecotourism project under the PES scheme, on the local communities, specifically the involved members of the SATJB Association, can be observed in terms of household income and job opportunities. The participating members of the SATJB Association received income for their involvement. The ecotourism activities in the UTW environment under this project provided job opportunities and improved the socio-economy. For the management of the UTW ecotourism area, 20 job opportunities were available, including administrative work and fieldwork. Most of these job opportunities were part-time.

In the first year of operation (with an estimated capacity to operate for 10 months in 2018), SATJB Association was estimated to generate a total gross income of RM 153,650.00. To a certain extent, this amount benefited the participating members who were involved in the ecotourism tour packages. Based on the actual number of visitors, a part-time worker was estimated to earn (ancillary income) of RM 477.00 per month. A direct employee can earn up to

RM 800.00 per month. This revenue estimate was determined based on the average number of 439 visitors per month.

The local community group that operated UTW as a community-based PES project was charged with a Used Permit Fee and annual lease fee. Besides that, 10% of the net profit must be remitted to the State Government. Based on the financial cash flow of the SATJB Association from August 2020 to November 2020 (four months of operation), the Association made a payment of RM 20,280.00 to the Pahang Forestry Department and State Government. However, in early 2020, the Association was unable to carry out full operations due to the Movement Control Order (MCO) imposed by the Malaysian Government. Under normal circumstances, the project can contribute up to RM 47,330.00 per year (based on a 10-month operation in one year) as state revenue.

CONCLUSION

The current study developed a community-based PES scheme for UTW, which can generally strengthen the community-based practices of forestry activities. The developed PES scheme successfully serves as a development strategy to help improve the socio-economy and livelihoods of the local communities and contribute to the sustainable conservation of forest ecosystems. This effort clearly supports the sustainable use of natural resources with respect to the Sustainable Development Goals and national development policies in environmental and forestry management.

The introduced PES scheme is one of the initiatives and strategies that can improve the efficiency of forest management and biodiversity resources through active involvement and cooperation of the local communities (Azwar et al., 2023). Under such an initiative, the active participation of the local communities can reduce environmental damage and restore forest areas. This study highlighted innovation in a community-based PES scheme involving ecotourism and ecosystem services to support the country's sustainable forest management (SFM). This study proved that effective management under the proposed community-based PES scheme can elevate the socio-economic conditions of the local communities and contribute to the sustainable conservation of forest ecosystems and state revenue simultaneously.

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REFERENCES

- Abdulkarim, B., Yacob, M. R., Abdullahi, A. M., & Radam, A. (2017). Farmers' perceptions and attitudes toward forest watershed conservation of the North Selangor Peat Swamp Forest. *Journal of Sustainable Forestry*, 36(4), 309–323.
- Azwar, H., Hanafiah, M. H., Abd Ghani, A., Azinuddin, M., & Mior Shariffuddin, N. S. (2023). Community-Based Tourism (CBT) Moving Forward: Penta Helix Development Strategy Through Community Local Wisdom Empowerment. *Planning Malaysia*, 21(25). <https://doi.org/10.21837/pm.v21i25.1225>
- Fripp, E. (2014). *Payments for ecosystem services: A practical guide to assessing the feasibility of PES projects*. Center for International Forestry Research.
- Krishnan, D., Ismail, S. M., Kaffashi, S., & Chamhuri, S. (2017). Household involvement in pioneering payment for ecosystem services in Langat Basin, Malaysia. In M. A. Ashraf & W. S. Aqma (Eds.), *Proceedings of the International Conference on Environment Conservation, Clean Water, Air & Soil (CleanWAS)* (pp. 32–34).
- Kurniati, R., Handayani, W., Prabawani, B., Nida, R. S., & Savitri, S. F. (2024). Community Participation, Community Readiness, and Preferences to Promote Edu-Tourism in Mangrove Areas of Teluk Awur Village, Jepara, Indonesia. *Planning Malaysia*, 22(33). <https://doi.org/10.21837/pm.v22i33.1555>
- Manohar, M., et al. (2020). *Ecotourism in Malaysia: Current scenario*. Universiti Putra Malaysia Press.
- Mohamed, N., Shamsudin, M. N., Ghani, A. N. A., Radam, A., Kaffashi, S., Rahim, N. N. R. N. A., & Hassin, N. H. (2012). Willingness to pay for watershed conservation at Hulu Langat, Selangor. *Journal of Applied Sciences*, 12(17), 1859–1865.
- Pagiola, S. (2006). *Payments for environmental services in Costa Rica*. World Bank.
- Mohd Shahwahid, H. O. (2005). Economic valuation methods [Conference presentation]. National Workshop on Economic Valuation for Conservation Management, Johor Bahru, Malaysia
- Walsh, R. G. (1986). *Recreation economic decisions: Comparing benefits and costs*. Venture Publishing.
- Wood, E., Gatz, F., & Lindberg, K. (1991). The Ecotourism Society: An action agenda. In J. Kusler (Ed.), *Ecotourism and resource conservation* (pp. 75–79). Proceedings of the 2nd International Symposium: Ecotourism and Resource Conservation. Omnipress.
- Wunder, S. (2005). *Payments for environmental services: Some nuts and bolts* (Occasional Paper No. 42). Center for International Forestry Research.
- Wunder, S. (2007). The efficiency of payments for environmental services in tropical conservation. *Conservation Biology*, 21(1), 48–58
- Zaiton, S., Marina, T., & Hazandy, A. H. (2020). Payment for ecosystem services (PES) in watershed area: Bintang Hijau Forest Reserve, Perak. *The Malaysian Forester*, 83(1), 38–47.

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