PROS SEM NAS MASY BIODIV INDON
Volume 10, Nomor 1, Juni 2024 ISSN: 2407-8050
Halaman: 65-71 DOI: 10.13057/psnmbi/m100109

Economic values of environmental services of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia

Nilai ekonomi jasa lingkungan Taman Wisata Alam Grojogan Sewu, Tawangmangu, Jawa Tengah, Indonesia

BISMA YOGA HERDANANTA[1], AYU INTAN AFTSARI[1], CECILIANA CHARSYAH[1], ANISA EKA PUTRI ARYANTO[1], MUHAMMAD FIRDAUS WIRAATMAJA[1], AHMAD DWI SETYAWAN[1,2,♥]

[1]Department of Environmental Science, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret. Jl. Ir. Sutami 36A Surakarta 57126, Central Java, Indonesia. Tel./fax.: +62-271-663375, ♥email: volatileoils@gmail.com

[2]Biodiversity Research Group, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia

Manuskrip diterima: 10 Juni 2024. Revisi disetujui: 30 Juni 2024.

Abstrak. *Herdananta BY, Aftsari AI, Charsyah C, Aryanto AEP, Wiraatmaja MF, Setyawan AD. 2024. Economic values of environmental services of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia. Pros Sem Nas Masy Biodiv Indon 10: 65-71.* Grojogan Sewu Recreational Park in Tawangmangu District, Karanganyar District, Central Java, Indonesia is a natural tourism object that provides ecological services for the surrounding environment and meets the community's needs for clean water. This study aims to determine and assess the economic valuation of Grojogan Sewu Recreational Park. The research methods used in this study are quantitative and qualitative. The results showed that the total economic value of Grojogan Sewu Recreational Park was IDR 3,469,883,586/year. The use value contributes the largest economic value, which is 97.8% or around IDR 3,394,368,026/year. Meanwhile, the non-use value of Grojogan Sewu Recreational Park is IDR 75,515,560/year. The value component with the largest percentage is obtained from direct use value in the form of ecological functions in providing clean water sources, contributing 82.5% of the total economic value. These results show that natural tourism parks have ecological functions that provide environmental services and have a relatively high economic value. So, improving the management of Grojogan Sewu Nature Tourism Park is very important to maintain the function of environmental services from the ecosystem.

Keywords: Economic valuation, environmental service, Grojogan Sewu, water provision

Abstrak. *Herdananta BY, Aftsari AI, Charsyah C, Aryanto AEP, Wiraatmaja MF, Setyawan AD. 2024. Nilai ekonomi jasa lingkungan Taman Wisata Alam Grojogan Sewu, Tawangmangu, Jawa Tengah, Indonesia. Pros Sem Nas Masy Biodiv Indon 10: 65-71.* Taman Rekreasi Grojogan Sewu di Kecamatan Tawangmangu, Kabupaten Karanganyar, Jawa Tengah, Indonesia merupakan objek wisata alam yang menyediakan jasa ekologi bagi lingkungan sekitar dan memenuhi kebutuhan masyarakat akan air bersih. Penelitian ini bertujuan untuk mengetahui dan menilai valuasi ekonomi Taman Rekreasi Grojogan Sewu. Metode penelitian yang digunakan dalam penelitian ini adalah kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa total nilai ekonomi Taman Rekreasi Grojogan Sewu sebesar Rp 3.469.883.586/tahun. Nilai guna memberikan sumbangan nilai ekonomi terbesar, yaitu sebesar 97,8% atau sekitar Rp 3.394.368.026/tahun. Sementara itu, nilai bukan guna Taman Rekreasi Grojogan Sewu sebesar Rp 75.515.560/tahun. Komponen nilai dengan presentase terbesar diperoleh dari nilai guna langsung berupa fungsi ekologi dalam penyediaan sumber air bersih, yaitu sebesar 82,5% dari total nilai ekonomi. Hasil penelitian ini menunjukkan bahwa taman wisata alam memiliki fungsi ekologis yang memberikan jasa lingkungan dan memiliki nilai ekonomi yang relatif tinggi. Oleh karena itu, peningkatan pengelolaan Taman Wisata Alam Grojogan Sewu sangat penting untuk menjaga fungsi jasa lingkungan dari ekosistemnya.

Keywords: Penilaian ekonomi, jasa lingkungan, Grojogan Sewu, penyediaan air

INTRODUCTION

The potential wealth of natural resources is often not utilized optimally, and there are challenges in reducing the rate of environmental degradation due to economic activities and natural resource utilization (Von Rintelen et al. 2017; Pirmana et al. 2021). Natural resources are important in the country's economic development and growth (Ahmad et al. 2020). In this case, it requires sustainable management of natural resources and support for the use of renewable energy (Surya et al. 2021). Ecosystems provide various benefits of goods and services for humans and other living things (Costanza et al. 2017). Environmental services are divided into four categories, including (i) providing services in the form of direct or indirect food; (ii) regulatory services such as regulation of water, gas, climate, erosion, flooding, and biological processes such as pollination; (iii) cultural services as aesthetic, recreational, spiritual, and educational; (iv) supporting services, namely supporting nutrient cycles,

production, habitat, and biodiversity (Adhikari and Hartemink 2016). Environmental services have a valuable approach to connecting people and nature because ecosystems support a wide range of human benefits. Understanding the relationship between natural and economic systems will lead to excellent, and sustainable ecosystem management (Grizzetti et al. 2016).

Environmental services have an infinitely valuable role in human welfare. Environmental services are considered abundant and free resources (Xie et al. 2017). It results in excessive consumption of ecosystem services and reduced supply (Wang et al. 2019). Steps to mitigate natural resource scarcity can be done by evaluating the value of environmental services to support sustainable management (Xie et al. 2017). Assessment of environmental services can improve and protect the provision of ecological services (Börner et al. 2017). Assessment of environmental services is widely recommended because it can support the decision-making of the management of an ecosystem (Marre et al. 2016).

Grojogan Sewu Recreational Park is a tourist attraction located in Karanganyar District, Central Java Province, Indonesia. The main attraction is a waterfall. In addition to acting as a tourism object, Grojogan Sewu Recreational Park also plays a role in meeting the need for clean water for the surrounding community. Based on the Decree of the Minister of Agriculture of Indonesia No. 264/KPTS/UM/1968, Grojogan Sewu Recreational Park is drained by 2 rivers, namely the Blumbang River in the north and the Samin River, which flows in the south (Kusumaningsih et al. 2022). Grojogan Sewu plays a vital role in clean water resources for the drainage of surrounding communities and communities in the lowlands (Syah 2020). It is related to the abundance of forests in Grojogan Sewu Recreational Park can conserve water and act as a regulator of the hydrological cycle. The existence of forest areas play an important role in the availability of water resources (Pei et al. 2019). The existence of forest areas as good water absorbers can function for water purification and play a role in ecosystem services to meet community needs for domestic and irrigation purposes (Esen et al. 2023). Apart from that, forest areas in Grojogan Sewu Recreational Park have other high ecological functions. The available vegetation has an economic value based on its existence, namely carbon value (Syafruddin and Yurike 2020). Carbon value is the function of forest vegetation as carbon storage, giving rise to a value that can be calculated as an effort to control air pollution.

Grojogan Sewu Recreational Park, which is rich in natural resources, if not appropriately managed, will have an impact on ecosystem imbalances. Awareness and concern for the environment are not only about pollution, but the impact that the environment must face after a change towards environmental degradation (Pásková et al. 2024). The community is an important aspect in regulating and managing the area of ecosystem service providers, so cooperation is needed to overcome potential damage to natural resources. Environmental damage is caused by irresponsible human activities by exploiting natural resources on a large scale (Farrukh et al. 2023). So, if this is done continuously, it will turn protected areas into development areas only concerned with the economy. Grojogan Sewu Recreational Park is an area protected by the government and also a natural tourism area (Kurniasari et al. 2023). The vulnerability to environmental degradation is very high because natural tourism areas become places of human activity that will have an impact on decreasing ecosystem services (Ekonomou and Halkos 2024). So, to support the management of natural resources in Grojogan Sewu, it is necessary to conduct a study on the value analysis of existing environmental services. Therefore, this study aims to determine and assess the economic valuation of Grojogan Sewu Recreational Park. Economic valuation is the approach to the value of natural resources that is most easily applied to the general publicThis research is expected to be the basis for the preservation of ecological service providers' natural resources in Grojogan Sewu Recreational Park.

MATERIALS AND METHODS

Study area

This research was conducted in March 2024 in the Grojogan Sewu Recreational Park area in Beji Village, Tawangmangu District, Karanganyar District, Central Java, Indonesia (Figure 1). Grojogan Sewu is located at coordinates -7.660858, 111.130784 at an altitude of 1022 MASL with annual rainfall variations ranging from 2500-3000 mm/year to 3000-3500 mm/year, which is included in the category of high rainfall. Grojogan Sewu Recreational Park area has an area of 64.3 ha, which is included in part of the Samin watershed.

Data collection procedure

The data used in this study are primary and secondary data. Primary data were obtained from direct observation and interviews at the study site. Direct observation aims to determine the actual condition of Grojogan Sewu Recreational Park by recording tree species for indirect value analysis. Identification of carbon stock was carried out through plant sampling using the purposive sampling method with a plot size of 20 × 20 m. Carbon stock measurements used one sample plot or demonstration plot, which was dominated by *Pinus merkusii* Jungh. & de Vriese. This plot was strategically located within the forest area of the Grojogan Sewu Recreational Park, ensuring accurate and representative data collection.

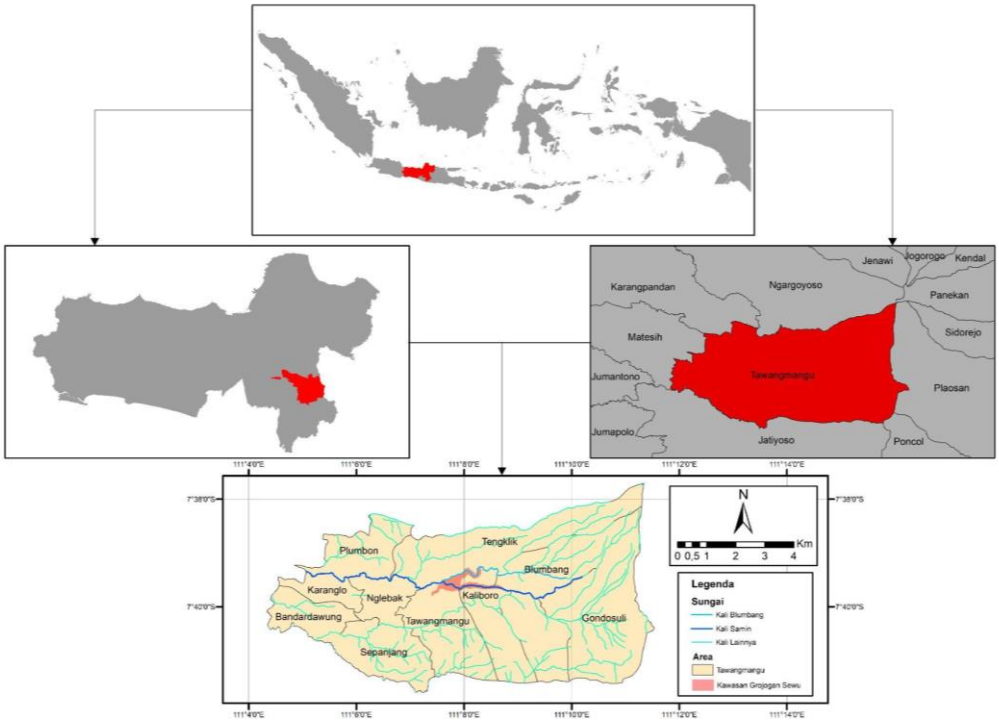

Figure 1. Location of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia

Interviews were conducted with managers, surrounding communities, and visitors at Grojogan Sewu Recreational Park with a total of 45 respondents. Determining respondents used a stratified random sampling method, with the criteria for respondents being those who had visited Grojogan Sewu (Sari et al. 2022). Interviews with managers and the community were conducted to analyze the use value by knowing Grojogan Sewu's natural resources that are utilized by the surrounding community. In contrast, interviews with visitors were conducted to analyze non-use value with questions regarding the identity of respondents, appropriate levy fees, number of visits, travel costs, and voluntary fees that are willing to be paid to maintain the naturalness of Grojogan Sewu. Secondary data are obtained from literature studies relevant to the topic covered. The data obtained are then analyzed quantitatively using total economic value calculations to assess environmental services and described descriptively.

Data analysis

The data obtained are then analyzed quantitatively to calculate the total value of the economic valuation of environmental services and elaborated descriptively to determine the factors that affect the value. The total value of economic valuation consists of use value and non-use value. Use value consists of direct use value and indirect use value, while non-use value consists of the option value, existence value, and bequest value (Sari et al. 2022). The calculation of each value is presented below.

Direct Use Value (DV)

Direct Use Value (DV) is the value obtained from the direct benefits of an ecosystem (Utomo et al. 2020). This Direct Use Value can be consumptive or non-consumptive. Example of consumptive is drinking water, while non-consumptive is nature-based recreational activities (Pascual et al. 2017). The direct economic value in this study is water use, which is calculated using the following formula (Kusumaningsih et al. 2022):

$$NART = RTPA \times JA \times KP \times HAS$$

Where:

NART= Economic value of household water use (IDR/household/month)

RTPA= Number of water-using households

JA = Average number of family members (person/household)

KP = Average household water consumption (m^3/household/month)

HAS = water price equivalent to *PDAM* (*Perusahaan Daerah Air Minum* or State-Owned Water Supply Company)'s price (IDR/m^3)

Indirect Use Value (IDV)

Indirect Use Value (IDV) is obtained from the indirect use of ecosystems or goods (Pandelaki et al. 2020). The indirect economic value in this study is the function of vegetation as a carbon store. The calculation of carbon stocks was carried out by estimating the value of carbon stocks from plants that dominate at the study site, namely *P. merkusii*. The value of *P. merkusii carbon stock* was obtained from research conducted by Rahmadwiati et al. (2022). The carbon storage value is calculated using the following formula:

$$Trees/ha = TreesX.10{,}000/(L\ plot)$$

Where:
TreesX= Number of trees in one plot
L plot= Area of plot (m^2)

$$NTrees = \frac{Trees}{ha} \times A$$

Where:
Ntrees= Number of all trees in the study area
A= Area of study area (ha)

$$Carbon\ Stock\ (Mg) = Carbon\ Stock\ (Mg/Individu) \times NTrees$$

Where:
Ntrees= Number of all over trees in the study area

$$IDV = Carbon\ stock\ (Mg) \times Carbon\ price\ (Rp/Mg)$$

Where:
IDV= Indirect Use Value (IDR)

Option Value (OV)

The concept of option value can be interpreted as the potential direct and indirect use of a natural system in the future (Rizal et al. 2018). The value of options comes from consumers' willingness to pay to enjoy the beauty of Grojogan Sewu as a tourist attraction (Novizantara et al. 2022). The formula used is as follows:

$$OV = \Sigma BP \times n$$

Where:
OV= Option value (IDR/year)
ΣBP= Willingness to Pay (IDR)
N= Number of visits/year

Existence Value (EV)

Existence Value (EV) is the value of an asset because it is an important resource to be conserved (Aguarón et al. 2016). This value is obtained by using respondents' willingness to pay to protect natural resources (Rizal and Dewanti 2017). The formula used is as follows:

$$EV = \Sigma WTP \times n$$

Where:
EV = Existence value (IDR/year)
ΣWTP = Willingness to Pay (IDR/ha/year)
n = Area of study area (ha)

Bequest Value (BV)

Bequest value is related to efforts to maintain natural heritage for future generations (Rizal et al. 2018). The value comes from the benefits of tourism or recreation objects that will be passed on to future generations, which are calculated using the Travel Cost Method formula as follows:

$$BV = \Sigma TCM \times n$$

Where:
ΣTCM: Travel cost (IDR/year)
N: Amount of travel cost (person/year)

Total Economic Value (TEV)

Total economic value is the sum of all the values described above using the following formula:

$$TEV = DV + IDV + OV + EV + BV$$

Where:
TEV= Total Economic Value (IDR/year)
DV= Direct Use Value (IDR/year)
IDV= Indirect Use Value (IDR/year)
OV= Option Value (IDR/year)
EV= Existences Value (IDR/year)
BV= Bequest value (IDR/year)

RESULTS AND DISCUSSION

Use value of Grojogan Sewu

Direct use value

This usage value is based on the water utilization conditions of Grojogan Sewu Nature Park, which is used by the surrounding community to meet clean water needs and domestic needs. Based on Table 1, it is known that the economic value of water utilization of Grojogan Sewu Nature Park is IDR 238,565,600.00/month. If the value is accumulated for a year, then the total economic value becomes IDR 2,862,787,200.00. Based on the results of research by Kusumaningsih et al. (2022), it is known that the number of households using domestic water in Grojogan Sewu Nature Park is 650 households, with an average number of members in each family of 4 people, while the average household water consumption is 32.77 m^3.

Indirect use value

Indirect use value is based on the calculation of carbon storage as an environmental service produced by Grojogan Sewu Recreational Park (Tabe 2). The dominating plant in the area is (*P. merkusii*). The number of stands of *P. merkusii* in the Grojogan Sewu Recreational Park area, with an area of 64.3 ha, is 27,328 trees. Each tree can produce carbon storage of 0.038 Mg/individual (Rahmadwiati et al. 2022) so all stands of *P. merkusii* in the Grojogan Sewu Recreational Park area have carbon storage of 1,038.45 Mg/ha (Table 2). Based on the 2021 Carbon Rates published by The Organization for Economic Cooperation and Development (OECD), the lowest carbon price is 30 euros per ton or around IDR 511,901/ton (Sari et al. 2022). The calculation results show the value of carbon storage services in the Grojogan Sewu Recreational Park area of IDR 531,580,826.00/year.

Non-use value of Grojogan Sewu

Option value

The option value is the value of options obtained from the value of potential utilization that can be perceived by individuals in the future, both direct and indirect utilization (Zegeye et al. 2023). In this study, the value of the choice of Grojogan Sewu Nature Park is the willingness of visitors to pay retribution. Based on Table 3, the option value of Grojogan Sewu Nature Park is IDR 2,665,260 per year. The calculation of the option value is obtained from the number of multiplications between the total value of willingness to pay the levy and the number of visitors per year at Grojogan Sewu Nature Park.

Existence value is the value of willingness to pay visitors obtained from visitors' views on the benefits of the existence of an ecosystem in terms of sociological, economic and ecological services (Sourokou et al. 2023). The value of existence in Grojogan Sewu Recreational Park is an additional value that can be provided by visitors for management and utilization so that naturalness is maintained. Based on Table 4, the existing value of Grojogan Sewu Recreational Park is IDR 56,005,300/year. The results of the calculation of the existence value are obtained from the number of multiplications between the total levy value that matches the number of respondents with the area in Grojogan Sewu Recreational Park.

Bequest value is the value of utilizing natural resources for future generations (Yeh et al. 2018). This value can be obtained from the value of tourism potential that is inherited for future generations. Based on Table 5, the bequest value of Grojogan Sewu Recreational Park is IDR 16,845,000 per year. The results were obtained from the number of multiplications between travel costs and the number of visits each respondent had at Grojogan Sewu Recreational Park.

Total economic value of Grojogan Sewu Recreational Park

According to Rizal et al. (2018), the total economic value is obtained from use value and non-use value, namely the sum between Direct Use Value (DUV), Indirect Use Value (IUV), Option Value (OV), Existence Value (EV), and Bequest Value (BV). Based on Table 6, the total economic value of environmental services in Grojogan Sewu is IDR 3,469,883,586/year. Use value has a percentage of 97.8% of the total economic value, which is IDR 3,394,368,026, consisting of direct use value and indirect use value. Non-use value has a percentage of 2.2% of the total economic value, which is IDR 75,515,560, consisting of the option value, existence value, and bequest value. The highest economic value is obtained from the contribution of direct use value in the form of clean water provision, amounting to IDR 2,862,787,200/year or 82.5% of the total economic value. The lowest economic value is obtained from the option value component, with a value of IDR 2,665,260 or about 0.1% of the total economic value of Grojogan Sewu Recreational Park.

Table 1. Direct use value of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia as freshwater supplier

Household	Member/Household	Use/Member (m^3/month)	Price (IDR/m^3)	Total (IDR/month)	Total (IDR/year)
650	4	32.77	2,800.00	238,565,600.00	2,862,787,200.00

Table 2. Indirect use value in Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia as carbon storage

Carbon stock								
Trees/Plot	Plot area (ha)	Trees/ha	Area of study area (ha)	All over trees	Carbon stock (Mg/Individu)	Carbon stock (Mg)	Carbon price (IDR/Mg)	Carbon stock value (IDR)
17	0.04	425	64.3	27,328	0.038	1,038.45	511,901	531,580,826

Table 3. Option value of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia as tourism site

Respondents	Willingness to pay (IDR)	Number of visits	Option value (IDR/year)
45	871,000	68	2,665,260

Table 4. Existence value of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia

Respondents	Willingness to pay (IDR)	Area	Existence value (IDR/year)
45	871,000	64.3	56,005,300

Table 5. Bequest value of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia

Respondents	Number of visits	Travel cost	Bequest value (IDR/year)
45	68	16,775,000	16,845,000

Table 6. The total economic value of Grojogan Sewu Recreational Park, Tawangmangu, Central Java, Indonesia

Component	Economic value (IDR)	Percentage (%)
Use value		
Direct use value		
Clean water provision	2,862,787,200	82.5
Indirect use value		
Carbon absorption (*Pinus merkusii*)	531,580,826	15.3
Total use value	3,394,368,026	97.8
Non-use value		
Option value		
Attractions	2,665,260	0.1
Existence value		
Protection of natural resources	56,005,300	1.6
Bequest value		
Recreation/tourism potential	16,845,000	0.5
Total non-use value	75,515,560	2.2
Total economic value	3,469,883,586	100

Discussion

The total economic valuation value in the Grojogan Sewu Recreational Park area is IDR 3,469,883,586/year. Based on research conducted by Wubalem et al. (2023) in Lake Tana, Ethiopia, Setiawan et al. (2024) at KPH Way Pisang Gunung Rajabasa, South Lampung Province, and Huda et al. (2022) at Curug Gangsa, Lampung, the total value of economic valuations is IDR 1,085,862,000,000/year, IDR 939,725,328/year, and IDR 2,338,863,463/year, respectively. The economic value of Grojogan Sewu Recreational Park is higher than KPH Way Pisang Gunung Rajabasa and Curug Gangsa, Lampung, but lower than Lake Tana in Ethiopia. The difference in total economic valuation between Grojogan Sewu Nature Park with KPH Way Pisang Gunung Rajabasa and Curug Gangsa, Lampung, lies in the use value component. Residents use river water in Grojogan Sewu Nature Park to meet their daily needs. In contrast, at Curug Gangsa and KPH Way Pisang, water is only used as a tourist attraction that visitors must pay. Furthermore, the economic valuation of Grojogan Sewu Nature Park is far adrift from the economic valuation of Lake Tana. Lake Tana has several interesting features, such as natural qualities that are still very well maintained and cultural and religious values that visitors like. It is different from Grojogan Sewu Nature Park, where the main attraction presented is only the view of the waterfall.

Based on the results of the study, it is known that the Willingness to Pay (WTP) of visitors at Grojogan Nature Park averages IDR 20,738. Based on the results of Cardias and Fandeli's research (2021), the average value of tourists WTP for Ijen Crater Nature Park is IDR 25,000. Based on the results of research by Wairo et al. (2020), it was found that the average value of tourists WTP to visit Lasiana Beach was IDR 37,034, while for Batu Nona Beach, it was IDR 39,512. Through the comparison of WTP values in Grojogan Sewu Recreational Park with other tourist destinations, there are differences in the value of WTP) due to differences in the characteristics of each destination. Several factors cause the difference in WTP value in Grojogan Sewu Recreational Park with other tourist attractions. Based on the results of Cardias and Fandeli's research (2021), tourist satisfaction factors play a key role in increasing the value of Willingness to Pay (WTP).

Several aspects of tourist satisfaction have a positive and significant influence on WTP, namely aspects of tourist attractions, human resources, and destination image. The attraction aspect is a more dominating aspect in reflecting tourist satisfaction in Ijen Crater Nature Park. The tourist attractions in question can be in the form of landscape beauty, variety of attractions, authenticity of attractions, traditional and cultural conditions, places that provide knowledge or education, and cleanliness. The attractions offered in Ijen Crater Nature Park include the phenomenon of blue fire, which is the main attraction for tourists, and the activity of sulphur miners as a form of cultural attraction. Through tourist satisfaction, it states that there is a unidirectional relationship between exogenous variables and endogenous variables. It states that the higher the value of tourist satisfaction from the aspects of tourist attractions, human resources, and destination image, the WTP will also increase. Meanwhile, the attractions highlighted by the Grojogan Sewu Recreational Park are its natural beauty and amazing waterfalls. Other attractions support tourism at the Grojogan Sewu Nature Tourism Park, such as swimming pools and the presence of wild long-tailed macaque (*Macaca fascicularis* Raffles, 1821)).

Based on the results of the study, it can be concluded that the economic valuation value is obtained from use value and non-use value, consisting of Direct Use Value (DUV), Indirect Use Value (IUV), Option Value (OV), Existence Value (EV), and Bequest Value (BV). The total economic value of Grojogan Sewu Recreational Park is IDR 3,469,883,586/year. Direct use value contributes the largest economic value, which is 97.8% or around IDR 3,394,368,026/year. Meanwhile, the non-use value of Grojogan Sewu Nature Park is IDR 75,515,560/year. The largest value is generated from direct use value in the form of ecological functions in providing clean water sources, with a contribution of 82.5% of the total economic value. The results of this study show that Grojogan Sewu Recreational Park has an ecological function that provides environmental services and provides high economic value.

Thus, improving the management of Grojogan Sewu Recreational Park is very important to maintain the function of environmental services from the ecosystem.

REFERENCES

Adhikari K, Hartemink AE. 2016. Linking soils to ecosystem services A global review. Geoderma 262: 101-111. DOI: 10.1016/j.geoderma.2015.08.009.

Aguarón J, Escobar MT, Moreno-Jiménez JM. 2016. The precise consistency consensus matrix in a local AHP-group decision making context. Ann Oper Res 245: 245-259. DOI: 10.1007/s10479-014-1576-8.

Ahmad M, Jiang P, Majeed A, Umar M, Khan Z, Muhammad S. 2020. The dynamic impact of natural resources, technological innovations and economic growth on ecological footprint: An advanced panel data estimation. Resour Policy 69: 1-10. DOI: 10.1016/j.resourpol.2020.101817.

Börner J, Baylis K, Corbera E, Ezzine-de-Blas D, Honey-Rosés J, Persson UM, Wunder S. 2017. The effectiveness of payments for environmental services. World Dev 96: 359-374. DOI: 10.1016/j.worlddev.2017.03.020.

Cardias ER, Fandeli C. 2021. Pengaruh kepuasan wisatawan terhadap *Willingness To Pay* Taman Wisata Alam Kawah Ijen. J Pariwisata Terapan 5 (1): 13-25. DOI: 10.22146/jpt.66157. [Indonesian]

Costanza R, De Groot R, Braat L, Kubiszewski I, Fioramonti L, Sutton P, Farber S, Grasso M. 2017. Twenty years of ecosystem services: How far have we come and how far do we still need to go? Ecosyst Serv 28: 1-16. DOI: 10.1016/j.ecoser.2017.09.008.

Ekonomou G, Halkos G. 2024. Can tourism growth drive environmental improvements in the Eurozone economic space: A panel data analysis. World Dev Sustain 2024: 100139. DOI: 10.1016/j.wds.2024.100139.

Esen SE, Hein L, Cuceloglu G. 2023. Accounting for the water related ecosystem services of forests in the Southern Aegean region of Turkey. Ecol Indic 154: 110553. DOI: 10.1016/j.ecolind.2023.110553.

Farrukh B, Younis I, Longsheng C. 2023. The impact of natural resource management, innovation, and tourism development on environmental sustainability in low-income countries. Resour Policy 86: 104088. DOI: 10.1016/j.resourpol.2023.104088.

Grizzetti B, Lanzanova D, Liquete C, Reynaud A, Cardoso AC. 2016. Assessing water ecosystem services for water resource management. Environ Sci Policy 61: 194-203. DOI: 10.1016/j.envsci.2016.04.008.

Huda A, Abidin Z, Rosanti N. 2022. Valuasi ekonomi pada Wisata Alam Curug Gangsa di Kecamatan Kasui, Kabupaten Way Kanan dengan metode biaya perjalanan (*Travel Cost Method*). J Ilmiah Mahasiswa Agroinfo Galuh 9 (3): 1259-1272. DOI: 10.25157/jimag.v9i3.8394. [Indonesian]

Kurniasari DR, Wibowo LR, Seraphine N, Kurniawan AS. 2023. Healing forests as potential natural resources for visitor health therapy in the post-pandemic period. IOP Conf Ser: Earth Environ Sci 1266 (1): 1-12. DOI: 10.1088/1755-1315/1266/1/012004.

Kusumaningsih DA, Suryaningsih K, Nuryanti DS, Irawan A, Simenes MB, Susilowati I. 2022. Nilai studi ekonomi pemanfaatan air domestik dan irigasi pertanian di Kawasan Taman Wisata Alam Grojogan Sewu. J Wasian 9 (1): 74-85. [Indonesian]

Marre JB, Thebaud O, Pascoe S, Jennings S, Boncoeur J, Coglan L. 2016. Is economic valuation of ecosystem services useful to decision-makers? Lessons learned from Australian coastal and marine management. J Environ Manag 178: 52-62. DOI: 10.1016/j.jenvman.2016.04.014.

Novizantara A, Mulyadi A, Tang UM, Putra RM. 2022. Calculating economic valuation of mangrove forest in Bengkalis Regency, Indonesia. Intl J Sustain Dev Plan 17 (5): 1629-1634. DOI: 10.18280/ijsdp.170528.

Pandelaki L, Rompas RM, Rembet UN, Wantasen AS, Gerung GS, Ngangi EL. 2020. Economic value of seagrass ecosystem in Nain Island, South Minahasa Regency, North Sulawesi, Indonesia. AACL Bioflux 13 (5): 2687-2693.

Pascual U, Balvanera P, Díaz S et al. 2017. Valuing nature's contributions to people: the IPBES approach. Curr Opin Environ Sustain 26: 7-16. DOI: 10.1016/j.cosust.2016.12.006.

Pásková M, Štekerová K, Zanker M, Lasisi T, Zelenka J. 2024. Water pollution generated by tourism: Review of system dynamics models. Heliyon 10 (1): e23824. DOI: 10.1016/j.heliyon.2023.e23824.

Pei S, Zhang C, Liu C, Liu X, Xie G. 2019. Forest ecological compensation standard based on spatial flowing of water services in the upper reaches of Miyun Reservoir, China. Ecosyst Serv 39: 100983. DOI: 10.1016/j.ecoser.2019.100983.

Pirmana V, Alisjahbana AS, Yusuf AA, Hoekstra R, Tukker A. 2021. Environmental costs assessment for improved environmental-economic account for Indonesia. J Clean Prod 280: 1-12. DOI: 10.1016/j.jclepro.2020.124521.

Rahmadwiati R, Wicaksono RL, Apriyanto D. 2022. Estimation and economic valuation of above-ground carbon in Forest Area with the Special Purpose of Gunung Bromo, Karanganyar, Central Java, Indonesia. J Sylva Lestari 10 (1): 116-126. DOI: 10.23960/jsl.v10i1.548.

Rizal A, Dewanti LP. 2017. Using economic values to evaluate management options for fish biodiversity in the Sikakap Strait, Indonesia. Biodiversitas 18 (2): 575-581. DOI: 10.13057/biodiv/d180218.

Rizal A, Sahidin A, Herawati H. 2018. Economic value estimation of mangrove ecosystems in Indonesia. Biodivers Intl J 2 (1): 98-100. DOI: 10.15406/bij.2018.02.00051.

Sari EK, Mulyana A, Antoni M, & Adriani D. 2022. Economic values of environmental services of three forest areas in South Ogan Komering Ulu District, South Sumatra, Indonesia. Biodiversitas 23: 6180-6190. DOI: 10.13057/biodiv/d231212.

Setiawan BDP, Kaskoyo H, Setiawan A, Bakri S, Wulandari C, Safe'i R, Febryano IG. 2024. Perception and economic valuation of way belerang tourism in the Way Pisang Forest Management Unit (KPH) using the Travel Cost Method. J Belantara 7 (1): 1-16. DOI: 10.29303/jbl.v7i1.1018.

Sourokou R, Vodouhe FG, Tovignan S, Yabi JA. 2023. Economic valuation of forest degradation through direct users' Willingness to Pay in Benin (West Africa). Trees, Forests and People 14: 100459. DOI: 10.1016/j.tfp.2023.100459.

Surya B, Salim A, Saleh H, et al. 2021. Economic growth model and renewable energy utilization: Perspective of natural resources management and sustainable development of the Gowa Regency Region South Sulawesi, Indonesia. Intl J Energy Econ Policy 11 (6): 1-23. DOI: 10.32479/ijeep.11676.

Syafruddin YS, Yurike Y. 2020. Valuasi nilai ekonomi karbon mangrove di Kawasan Mandeh Kecamatan Koto Xii Tarusan Kabupaten Pesisir Selatan. J Spasial 7 (1): 30-35. DOI: 10.22202/js.v7i1.4144. [Indonesian]

Syah MJ. 2020. Long-Tailed Macaques (*Macaca fascicularis*) and Humans Interactions in Grojogan Sewu Natural Park (Taman Wisata Alam Gs), Karanganyar District, Central Java Province. Al-Hayat: J Biol Appl Biol 3 (1): 31-36. DOI: 10.21580/ah.v3i1.6069.

Utomo FN, Supyandi D, Syamsiyah N, Ernah E. 2020. Economic value of Bandung Orchid Forest, West Java. Sustinere: J Environ Sustain 4 (2): 79-93. DOI: 10.22515/sustinere.jes.v4i2.102.

Von Rintelen K, Arida E, Häuser C. 2017. A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries. Res Ideas and Outcomes 3: 1-16. DOI: 10.3897/rio.3.e20860.

Wairo CMC, Pellokila MR, Gimin R. 2020. Analysis of Willingness to Pay for Coastal Tourism Services of Lasiana Beach and Batunona Beach with Travel Cost Method Approach. International Seminar on Sustainable Development in Country Border Areas. Environmental Studies Development, November 2020.

Wang J, Zhai T, Lin Y, Kong X, He T. 2019. Spatial imbalance and changes in supply and demand of ecosystem services in China. Sci Total Environ 657: 781-791. DOI: 10.1016/j.scitotenv.2018.12.080.

Wubalem A, Woldeamanuel T, Nigussie Z. 2023. Economic valuation of lake Tana: a recreational use value estimation through the Travel Cost Method. Sustainability 15 (8): 6468. DOI: 10.3390/su15086468.

Xie G, Zhang C, Zhen L, Zhang L. 2017. Dynamic changes in the value of China's ecosystem services. Ecosyst Serv 26: 146-154. DOI: 10.1016/j.ecoser.2017.06.010.

Yeh CC, Lin CS, Huang CH. 2018. The total economic value of sport tourism in belt and road development—An environmental perspective. Sustainability 10 (4): 1191. DOI: 10.3390/su10041191.

Zegeye G, Erifo S, Addis G, Gebre GG. 2023. Economic valuation of urban forest using contingent valuation method: The case of Hawassa City, Ethiopia. Trees, Forests and People. 12: 100398. DOI: 10.1016/j.tfp.2023.100398.