

Mangroves Addition as Innovation for Sustainable Tourism

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Abstract

Grand Maerokoco is a tourist site in Semarang, located close to Marina Beach. The presence of mangroves in Maerokoco is expected to protect it from coastal disasters and make it a new attraction. This study assessed the benefits of mangrove addition in Grand Maerokoco according to visitor perception, the economic valuation of mangrove plantations, and its ability to reduce noise. Visitor perception could be known by conducting interviews. The economic valuation measurement employed was TCM (Travel Cost Method). Then, a noise measurement using a sound level meter was conducted to determine the ability to reduce noise. Based on visitor perception, the existence of mangroves in Grand Maerokoco can increase the attraction, increase the number of visitors, make the air cooler and cleaner, reduce the noise, and prevent the entry of coastal floods. The noise known at some point of crowds is still below the threshold standards of the EPA (Environmental Protection Agency), caused by high and dense mangroves in Maerokoco. The potential consumer surplus value per individual per visit is Rp717,792.00. The value indicates that the visitors benefit from environmental services more significantly than the cost incurred. To increase the value of mangroves, they should be utilized for education, agribusiness functions, and maintenance.

Keywords: Mangroves addition, Grand Maerokoco, Economic valuation, Noise measurement, Sustainable Tourism

INTRODUCTION

Mangroves protect the sea currents and sea waves along the coastline (Bohol Tourism Office Organizational, 2006). For instance, Semarang City, one of the cities in Central Java province in Indonesia, has a coastline of 13.6 km, wherein 62.5% of the area is lowland. This geographical feature makes Semarang prone to coastal floods, abrasion, and other natural disasters around coastal areas (Wahyuningtyas et al., 2017). Under these conditions, mangrove forests in coastal areas of Semarang are crucial in shaping the ecology and economy of the city (Diarso et al., 2012).

Maerokoco is a tourist site in Semarang, located close to Marina Beach. This place is known to be a miniature garden that resembles cities and regencies in Central Java. This tourist attraction is often affected by coastal floods and strong winds. Such a condition resulted in some Maerokoco pavilions and infrastructure being unkempt. Consequently, the number of visitors declined (Fatimah, 2008). In order to solve this problem, the government is conducting a revitalization program in 2008 by planting mangroves and repairing the damaged infrastructure. In 2016, the site managers created a mangrove track. It folds the number of visitors as six times as the initial condition. Then, at the beginning of 2017, the management rebranded Maerokoco into the Grand Maerokoco (Hana & Aris, 2017).

Mangroves used as tourist attractions have characteristics that are pretty vulnerable to environmental disturbance. The condition might point to economic inefficiency (Kill, 2015). Therefore, assessing the value or price of the impact of environmental activities is essential. Assessing a tourist area directly determines

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the sights' development (Spacek & Antouskova, 2013). This study aimed to determine the benefits of mangrove addition in Grand Maerokoco according to visitor perception, economic valuation toward mangrove plantation, and its ability to reduce noise in the Grand Maerokoco tourist area.

LITERATURE REVIEW

Eco-Architecture

The eco-architecture concept applies economic efficiency based on the efficient use of natural resources. The purpose of this concept is to reduce environmental damage to achieve profits by reducing excessive source use along with a higher level of public awareness to develop the economy by considering the aspects of environmental sustainability. The eco-architecture approach can promote symbiosis and mutualism among humans and their environment. After that, the mutual benefit and favourable impacts of creating an eco-productive site can happen (Miranda et al., 2017). Plotting mangroves as part of the whole architecture of a site is an example of eco-architecture implementation. It is a response as a building solution that does not disturb ecosystems by integrating the physical mangroves, artificial elements, systems, and the importance of human interaction with the environment (Akhyar et al., 2020)

Mangrove Afforestation

The term afforestation, concerning mangroves, has meaning as it refers to establishing mangroves in areas where mangroves did not previously exist. It is a direct human-induced conversion of non-mangroves to mangrove land through planting, seeding, and/or promoting natural seed sources. In order to be eligible for inclusion, the condition prior to afforestation comprises non-mangrove habitats such as mudflats, seagrass, salt marsh, coral reef, or denuded areas (Song et al., 2023). Non-mangrove habitats can also be man-made sites. It should implement the ecological principle that afforestation on artificial sites is the supplement (China Coastal Wetland Conservation Network, 2020).

Afforestation has been extensively implemented, usually with the contribution of community volunteers. This process takes a few years and includes the establishment of nurseries, fencing/protection, repopulation, continual monitoring, and community participation. (The Nature Conservancy, 2020). Several studies showed the success of mangrove afforestation on natural lands that previously did not have mangroves. The most extended recorded mangrove afforestation project lasted for 80 years, and the oldest *Rhizophora mangle* ecosystem was in Hawaii, USA, where no mangrove had established itself naturally (Song et al., 2023).

Some afforestation on natural lands is also done in Indonesia. For example, Baros Mangrove Forest, first planted in 1978, was only the lower course of the Opak River, where no plants were around. A group of young people from Baros initiated the plant mangroves as a natural protection fortress for the residents of the southern coast of Yogyakarta. Progressing daily, the mangroves in the lower course of the Opak River are flourishing, making the area greener and more pleasant than ever. It is becoming increasingly picturesque, thus attracting those who wish to explore the mangrove forest (Jati & Pribadi, 2018).

A similar thing happened in the seaside village of Tongke-Tongke in the late '90s. The local communities planted the empty coastal land in Tongke-Tongke with mangroves. The initial purpose was to avoid the coastal floods entering their home, which often reached two feet above the floor. Beyond their expectations, the mangroves have become their additional income through tourism and crab habitat (Beeler, 2016).

Mangroves afforestation is not only conducted in natural environments. Some studies recorded the successful afforestation in man-made sites, such as in Singapore, mainly in China, Kuwait's artificial islands of Sabah Al-Ahmad Sea City, etc. The Sungei Api-Api trial in Singapore furnishes an excellent example of a potentially substantial method for conserving and reestablishing mangroves in urban and surrounding tropical environments. (Ramos, 2018; China Coastal Wetland Conservation Network, 2020; Loughland et al., 2020). Mangrove afforestation has even become a supporting sustainable development system in some Middle Eastern Countries. Gray mangroves have been chosen for the greening of the desert coast on banks of the artificial channel across a sabkha, United Arab Emirates (Tamaei, 2005)

Mangrove afforestation could be attractive in locations where saltwater intrusion has adversely affected agriculture. Mostly, the primary objective of the afforestation program was to create a shelter belt to protect the lives and properties of the coastal communities. It gives important landscape-scale benefits, such as flood mitigation and carbon sequestration. In addition, mangrove afforestation holds some important roles: (a) provide forest products for a range of uses; (b) develop forest shelter-belts to protect life and property inland from tidal surges; (c) inject urgently needed resources into the national economy (i.e. timber and land); (d) create employment opportunities in rural communities; and (e) create an environment for wildlife, fishes, and other estuarine and marine fauna (Lovelock, 2022; Song et al., 2023).

Economic Valuation for Natural Tourism Site

Economic valuation is a research instrument used to quantify the functions of mangrove forests. This instrument is required to determine the policy related to resource management that is economically advantageous and environmentally sustainable. (Jati & Pribadi, 2018). The economic value of natural resources that offer natural beauty is generally non-market or cannot be traded. Therefore, a particular method is needed to assess the economic value of natural beauty. One of them is Travel Cost Method (TCM) (Batubara et al., 2020)

The individual and zonal demand approaches (ITCM and ZTCM) are two TCM techniques. In the last two decades, ITCM has been used more frequently due to the advancement of information technology and its advantage since it can capture visitors' socio-economic characteristics. Variables of age, income, and education are accommodated by this method. This information is difficult to obtain in ZTCM (Batubara et al., 2020; Wubalem, 2023).

A visitor's value to the environment, an unmarketed attribute, can be deduced from the costs incurred at the location visited (Wubalem, 2023). A visitor's travel costs can be seen from transportation costs, entry fees, expenses at the place of recreation, and the cost of time. TCM is built on the consumer demand theory, so consumer surplus becomes a central issue. The known relationship between the number of visits and the amount of costs can be done to estimate the amount of consumer surplus (Batubara et al., 2020).

METHODS

Economic Valuation and Tourist Perception

The study was conducted in Grand Maerokoco in February. The economic valuation measurement employed was the Travel Cost Method. The questionnaire was used as an instrument of data collection, which contained some variables such as the number of visits(y), travel cost(x1), income(x2), distance(x3), age(x4), access(x5), and Maerokoco conditions after the plantation of mangroves(x6). The same questionnaire could also discover tourist perceptions. The sample for those measurements was non-random by using accidental sampling.

Population size is unknown in tourism studies, so there is no sampling frame. Then, the number of samples refers to the Durbarry formula (2017):

$$n = \frac{Z^2 \sigma(1-\sigma)}{E^2}$$

$$n = \frac{1,96^2 \times 0,5 (1-0,5)}{(12\%)^2}$$

$$n = 66,94$$

Based on the formula, the minimal sample size needed was 67 visitors. However, the validity of statistical test results can be improved by adding the number of samples (Habiby, 2017). Therefore, this study used 69 respondents. As those measurements used non-random sampling, not all population members are equally likely to be selected (Pajo, 2017). Criteria of visitors, which could be defined as respondents, were the visitor has visited Maerokoco before and after the mangroves plantation and must be aged 15-60 years.

After data was collected, data was processed and calculated using the TCM method. TCM is one of the methods of economic valuation of indirect measurement. This study, conducted by Spacek and Antouskova (2013), used TCM with an individual approach. The advantage of this method is that the result becomes

relatively more accurate than the zoning approaches. The outline of the calculation with TCM can be seen in the scheme below.

Data that has been collected were changed to a multiple linear regression model. The multiple linear equations were obtained from processing the individual data of TCM, converted into Trip Generation Function (TGF), followed by Thill and Kim (2005). The variables other than the number of visits and travel expenses in this regression equation are assumed to be fixed, i.e., the average value (Thill & Kim, 2005). Calculating economic surplus and the potential economic value of mangrove resources followed (Gailis, 2014) by first calculating the integral of TGF. Those results can determine the appropriate sustainable management and development strategies.

Noise Measurement

The sampling method for noise measurement was grab sampling. Measurements were made at four sampling points in the Grand Maerokoco area, which became a crowded visitor spot, spaced 20m, 50m, 75m, and 120m away from the mangrove area. Samples were taken with an integrated sound level meter. The noise level was done following Payne (Payne, 2008) that automatically every ten seconds in five minutes at each location until the Leq value was identified

RESULT

Data that has been collected were changed to a multiple linear regression model. Multiple linear compound regression analysis results are presented in Table 1.

Table 1. Summary of Compound Regression Analysis

Variable	Average	Coefficient	t value	F value
Constant		2.245	2.121	2.962*
x ₁	113905.80	0.000	-1.227	
x ₂	1644927.54	0.000	-1.020	
x ₃	23.26	-0.026	-2.650	
x ₄	25.94	0.003	0.122	
x ₅	17.30	-0.027	-0.675	
x ₆	17.24	0.071	1.94*	
Y	2.01			

*significant at the 5% level

Source: Research Processed Results, 2018

Table 1 shows that all independent variables jointly affect the dependent variable at the 5% level. Only the variable of X6 (Maerokoco condition after mangroves addition), which individually affects the number of visits, is at the 5% level. Several facts which are interpretation of the regression function and perception of visitors: 1) the number of visits increased when travel costs were low; 2) the number of visits increased in visitors with low income; 3) the number of visits increased in Maerokoco location close to place of residence; 4) the number of visits increased in adult population; 5) the number of visits increased even though accessibility is inadequate, and; 6) a better condition of Maerokoco by mangroves addition can improve the number of visits.

Inadequate accessibility did not discourage tourists from visiting. Reasonable travel costs for most middle-low income people and the existence of mangroves are two essential reasons why Maerokoco remains the chosen tourist area. As shown in Table 1, mangroves addition (x6) is the only variable that individually determines the number of visits. This condition implies that mangroves have a crucial role in restoring the presence of Maerokoco.

All respondents agreed that visitors are more interested in sightseeing after the mangroves planted in Maerokoco than before without mangroves. New attractions in the area exploit the elements of mangroves, such as mangrove tracks using antique lamps on the sides and roving around by boat. Such an arrangement provides a new atmosphere, making the Maerokoco even more crowded. The positive correlations of

environment quality in Maerokoco with the number of visits, as shown in Table 1 (X6), imply that mangroves have a crucial role in restoring the environment of Maerokoco. The answers to the questions in the questionnaire for the variable X6 can be used to assess the qualitative environment in Maerokoco. It is known from Table 2 below.

Table 2. Summary of Qualitative Environmental Assessment

Variable	Value	% visitors
Temperature	Cool	98,55
Air cleanliness	Clean	89,86
Coastal flood protection	Exceclence	92,75
Noise	Quiet	79,71

Source: Research Processed Results, 2018

The visitors got comfort to linger in there. Most respondents acknowledged that the existence of mangroves gets Maerokoco cooler (98,55% of respondents) and helps the environment by reducing air pollutant substance levels (89,86% of respondents). The quality of air comes from the number of mangroves that are huge and have dense leaves, which can absorb pollutants and produce oxygen so that the air produced is cleaner, more relaxed, and fresher (Dobson & Ryan, 2000). In addition, the existing mangrove vegetation also skirts almost the entire Maerokoco area, as it prevents damage to the pavilions due to coastal floods. The benefit is directly felt by most of the respondents (92.75%).

About 79.71% of respondents agreed that adding mangroves can reduce the noise level in the Maerokoco. Although Grand Maerokoco is close to Ahmad Yani Airport's runway, aircraft noise did not disturb visitors. Table 3 shows that the noise known at some point of crowds is still below the threshold standards of the EPA (70 dB for recreation). The physical features of mangroves in Maerokoco are high and dense. According to Dobson and Ryan (Dobson & Ryan, 2000), the condition of such trees can reduce 5-10 dB of noise.

Table 3. Noise Level at Each Sampling Point

Sampling point	Distance to mangrove area (m)	Leq (dB)
A	20	40,64
B	50	45,54
C	75	49,66
D	120	50,20

Source: Research Processed Results, 2018

After the coefficients of all variables from the multiple linear analysis (Table 1), TGF could be created, as shown on the visitor demand curve below.

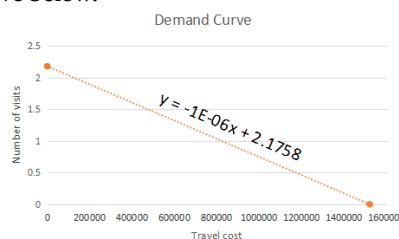


Figure 1. Demand curve.

Source: Research Processed Results, 2018

Based on the integral calculation of TGF, with the lower limit being the lowest travel cost of Rp10.000,00 and the upper limit being the highest travel cost of Rp670.000,00, it is known that consumer surplus value amounts to Rp1.435.584,00/individual/year. The average number of tourists visited in the past year is twice as many; thus, the potential consumer surplus value was Rp717.792,00/individual/visit. This value is greater than the average actual cost incurred by visitors, which is merely Rp113.906,00/individual/visit.

When comparing the actual value of consumer surplus and the actual value incurred by visitors, it can be seen that visitors get the benefits of environmental services more significantly than the cost incurred. Based on these calculations, it can be seen that the presence of mangroves in Maerokoco is a great attraction for visitors. However, the potential of mangroves still has room for improvement, and it is still untapped at 15.87%. The value can be increased by utilizing mangroves for education, agribusiness functions, and maintenance to maintain their existence.

CONCLUSION

The existence of mangroves in Grand Maerokoco can increase the attraction, increase the number of visitors, make the air cooler and cleaner, reduce the noise, and prevent the entry of coastal floods. The potential consumer surplus value per individual per visit is Rp717,792.00. The value indicates that the visitors benefit from environmental services more significantly than the cost incurred. Utilizing mangroves for education, agribusiness functions, and maintenance is suggested.

REFERENCES

- Akhyar, M., Ernawati, R., & Suriani, E. (2020). Perancangan fasilitas wisata edukasi mangrove di Pantai Timur Surabaya dengan pendekatan ekologi arsitektur. *Mozaik*, 10(10), 1-8.
- Batubara, I.K., Yulinda, E., & Warningsih, T. (2020). Economic valuation of tourism Pasumpahan Island West Sumatera with travel cost method. *IOP Conf. Ser.: Earth Environ. Sci.*, 430(012024), 1-7. doi:10.1088/1755-1315/430/1/012024.
- Beeler, C. (2016). One man is planting mangroves in Indonesia to stave off tragedy (online). Boston: The World. <https://theworld.org/stories/2016-12-23/one-man-planting-mangroves-indonesia-stave-tragedy>
- Bohol Tourism Office Organizational. (2006). Marine habitats and coastal resources. Biodiversity Conservation and Ecotourism Framework Plan of Bohol, 2(5), 9-17.
- China Coastal Wetland Conservation Network. (2020). Report on China Mangrove Conservation and Restoration Strategy Research Project: Executive Summary.
- Diarto, D., Hendrarto, B., & Suryoko, S. (2012). Partisipasi masyarakat dalam pengelolaan lingkungan kawasan Hutan Mangrove Tugurejo di kota Semarang. *Jurnal Ilmu Lingkungan*, 10(1), 1-7. doi:10.14710/jil.10.1.1-7
- Dobson, M., & Ryan, J. (2000). Trees and shrubs for noise control. *Arboricultural Advisory and Information Service*, 1-7.
- Durberry, R. (2017). *Research Methods for Tourism Students* (1st ed.). London: Taylor & Francis Ltd, 145-157. doi:10.4324/9780203703588
- Fatimah, N. (2008). Pengelolaan dan pengembangan pariwisata budaya di kota Semarang (studi kasus terhadap obyek wisata Maerokoco). *Forum Ilmu Sosial*, 35(1), 82-90. doi:10.15294/fis.v35i1.1304
- Gailis, J.A. (2014). *A Consumer Surplus Estimate of Peace and Love Festival in Borlange: A Travel Cost Approach* (2-3 ed.). Sweden: Hogskolan Dalarna Project, 3-19.
- Habiby, W. N. (2017) *Statistika Pendidikan*. Surakarta: Muhammadiyah University Press.
- Hana, S., & Aris, W. (2017). Jelajahi "tracking mangrove" di Puri Maerokoco (online). Jawa Tengah: Antara News. <https://jateng.antaranews.com/berita/159607/jelajahi-tracking-mangrove-di-puri-maerokoco>

- Jati, I.W., & Pribadi, R. (2018). Economic Valuation as an Instrument to Determine The Management Strategy of Baros Mangrove Forest, Bantul, Yogyakarta, Indonesia. *Icenis*, 31(08024), 1-4. doi: 10.1051/e3sconf/20183108024
- Kill, J. (2015). *Economic Valuation and Payment for Environmental Service*. Berlin: Heinrich Böll Foundation, 4-7.
- Loughland, R., Butt, S.J., & Nithyanandan. (2020). Establishment of mangrove ecosystems on man-made islands in Kuwait: Sustainable outcomes in a challenging and changing environment. *Aquatic Botany*, 167, 103273. doi: 10.1016/j.aquabot.2020.103273
- Lovelock, C.E., Barbier, E., & Duarte, C.M. (2022). Tackling the mangrove restoration challenge. *Plos Biol*, 20(10), 1-15, doi: 10.1371/journal.pbio.3001836.
- Miranda, C., Soemardiono, B., & Noerwasito, V.T. (2017) Eco-Architecture: the design of floating culinary tourism center. *IJERT*, 6(2), 159 - 163. doi:10.17577/IJERTV6IS020033
- Pajo, B. (2017). *Introduction to Research Methods: A Hands-On Approach*. Los Angeles: Sage Publications.
- Payne, S.R. (2008). Are perceived soundscapes within urban parks restorative?. *The Journal of the Acoustical Society of America*, 123(5), 3809. doi:10.1121/1.2935525
- Ramos, S.J. & Hesp, P.A. (2018). Mangrove Establishment in an Artificially Constructed Estuarine Channel, Sungei Api-Api, Singapore. In Makowski C. & Finkl C. (Eds.) *Threats to Mangrove Forests*. Coastal Research Library (pp. 419-427), 25. Cham: Springer. doi: 10.1007/978-3-319-73016-5_19
- Song, S., Ding, Y., Li, W., Meng, Y., Zhou, J., Gou, R., Zhang, C., Ye, S., Saintilan, N., Krauss, K.W., Crooks, S., Lv, Shuguo & Lin, G. (2023). Mangrove reforestation provides greater blue carbon benefit than afforestation for mitigating global climate change. *Nature Communication*, 14(756), 1-11. doi: 10.1038/s41467-023-36477-1
- Spacek, J., & Antouskova, M. (2013). Individual single-site travel cost model for Czech Paradise Geopark. *Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis*, 61(7), 2851-2856. doi:10.11118/actaun201361072851
- Tamaei, S. (2005). Study of gray mangrove (*Avicennia marina*) afforestation for greening of desert coasts: Gray mangrove afforestation on banks of artificial channel across a sabkha and the established biotic community. *Japanese Journal of Ecology*, 55(1), 1-9.
- The Nature Conservancy. (2020). *Mangroves* (online). Virginia: The Nature Conservancy Post. <https://www.natureprotects.org/posts/mangroves>
- Thill, J.C., & Kim, M. (2005). Trip making, induced travel demand, and accessibility. *Journal of Geographical System*, 7(2), 229-248. doi:10.1007/s10109-005-0158-3
- Wahyuningtyas, A., Pahlevari, J.E., Darsono, S. & Budienny, H. (2017). Pengendalian banjir sungai Bringin Semarang,” *Jurnal Karya Teknik Sipil*, 6(3), 161-171.
- Wubalem, A., Woldeamanuel, T., & Nigussie, Z. (2023). Economic Valuation of Lake Tana: A Recreational Use Value Estimation through the Travel Cost Method. *Sustainability*, 15(6468), 1-20. doi: 10.3390/su15086468