

## Economic Valuation of Forest Resources from Drinking Water Customers' Point of View: a Contingent Valuation Method Application



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**ABSTRACT:** One of the steps taken to maintain and rehabilitate forest resources is to raise conservation funds from drinking water customers, which can be packaged in an environmental services payment scheme or PES. By taking the case of forest resource management in Central Lombok Indonesia, this study used the Contingent Valuation Method to find possible willingness to pay of drinking water customers for environmental service contributions. This study found that the willingness to pay (WTP) of drinking water customers for environmental service contributions that reflecting the economic valuation of Central Lombok Forest resources was an average of Rp. 3,260 (0.23 USD) per month. Factors that influence the magnitude of such values are The Level of Education, Income, Number of family members, and environmental awareness.

**KEYWORDS:** Forest resource management; Payment of Environmental Services; Conservation; Contingent Valuation Method

### BACKGROUND

Based on data from the Directorate General of Forestry Planning and Environmental Management of the Ministry of Environment and Forestry of the Republic of Indonesia, the results of Indonesia's 2019 forest monitoring show that the area of forested land throughout mainland Indonesia is 94.1 million ha or 50.1% of the total land [1]. This shows that Indonesia is making a significant contribution to the mitigation of world climate change as a positive impact of the existence of its forests.

However, the area of forest cover in Indonesia has decreased continuously over the past 15 years. It is estimated that the average deforestation rate in Indonesia is about 1.5 million hectares per year [2]. Low reforestation is capable of fatal impacts on various fields. One of them is water supply. The Bali-Nusa Tenggara area, which is a tourist icon area in Indonesia, really needs sufficient water supply to support the socio-economic activities of its people.

Lombok Island, located in West Nusa Tenggara Province (NTB), is the most threatened area due to its relatively small area with a population of 3.75 million people [3] which is highly dependent on the ecological benefits of forests, especially for water supply. One of the forests that is the source of water supply on Lombok Island is the Mount Rinjani Forest covering an area of 125,000 ha, significant for the provision of water to the island of Lombok which is inhabited by four million people. More than 175 springs flow from the forest in Rinjani to ten main rivers on the island of Lombok, which support the island's household, farmland, and industrial water needs. Nevertheless, the World Wildlife Fund for Nature (WWF) reports that 5% of Rinjani's forests experience deforestation every year, leading to a water crisis in three-quarters of the watersheds on Lombok Island [4].

In the commercial and non-commercial use of water, a cooperation agreement should be made between conservation area stakeholders and water users in connection with the role of conservation areas as producers of environmental services, namely water providers. Forest ecology that is disturbed because of being continuously used by surrounding communities threatens the sustainability of water supply. This is influencing not only the surrounding residents, but also people who live in the city area.

One of the steps taken to maintain and rehabilitate forest resources is to raise conservation funds from individual water customers, households, or companies that use these forest resources as a form of their responsibility and concern for the environment, which can be packaged in an environmental services payment scheme or payment for ecosystem services (PES) [5].

Based on this background, research on people willingness to pay for environmental service contributions as conservation costs, becomes important to do. The Contingent Valuation Method is one of the methods that can be used to identify the amount

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of willingness to pay the community for the conservation of forest resources that reflects the economic value of these forest resources.

### LITERATURE REVIEW

Some research on natural resource management and environmental services, is presented in this section. Sylviani (2008) [6] examined the distribution of costs and benefits of protected forests as water system regulators. The results of this study show that the compensation received from water service users for the benefits of environmental services is a source of funds that can be used for maintenance costs in protected areas as catchment areas such as in the Rinjani Forest. In order for the mechanism for distributing the value of environmental services to be implemented and run well, it needs to be formulated in a policy and regulation on the use of natural resources.

In terms of PES implementation, Stanton (2012) [7] examined payments for clean water ecosystem services in developed and developing countries. The study is based on an extensive review of the existing literature on PES that analyzes payment schemes in detail, both in developed and developing countries. The conclusion suggests that PES requires strong sacrifices and is appropriate for limited conditions. Despite its limited scope, PES can effectively fill gaps where other policies fail.

Meanwhile, Afifah (2013) [8] analyzed the factors that affect the willingness to pay (WTP) of water customers for water conservation in West Lombok. The average WTP of water customers is IDR 8,100 per month. Factors that significantly affect the WTP partially are income, water use, perceptions of the importance of water conservation, gender, and education.

In terms of improving environmental quality, Prasetyo (2013) [9] examined whether age, education, income, number of family dependents, visit costs, and frequency of visits affected the willingness to pay (WTP) in an effort to improve the environmental quality of tourist villages in Sleman Regency after the Eruption of Merapi. The results of this study show that age, education, income, number of family dependents affect the WTP to improve the environmental quality of tourist villages in Sleman Regency after the Merapi eruption.

Likewise, Rosalina and Gravitiani (2014) [10] analyzed the willingness of people to pay for policies to improve air quality with the aim of knowing people's awareness of protecting their environment. The willingness to pay of the community is shown by how much the community is willing to pay for the policies offered once a year. The policies offered for the pollution of immovable sources are greening while for the pollution of mobile sources there are four policies. Four policies for immovable source pollution were ranked with AHP analysis in order of infrastructure improvement, greening, replacement of old-engined vehicles, and diversion of congested lanes. The results of the study showed that the WTP level of the community was still low. Factors that affect people's WTP are income and health costs of the lungs, eyes, and nose. Factors such as age, level of education, and distance from pollution to respondents had little effect.

In the field of waste, Widiastuti (2014) [11] analyzed the Willingness to Pay for waste management and preservation program of Citara reservoir in West Java. The method used in this study is the Contingent Valuation Method using the WTP analysis tool. The results of this study showed that the Mean WTP for fishery households was IDR 25,000/month and community households living around the reservoir were IDR 6,000/month. The variables that have a real effect on the WTP value of fishery households are age and environmental quality responses, while for non-fishery households, namely sex, the number of household members, age, education, work, distance from home and responses to environmental quality. The environmental investment cost obtained per year is IDR 195 million which is the ability of the community around the reservoir to contribute to the reservoir conservation program.

In the field of tourism, Sadikin et al (2017) [12] analyzed the willingness of tourists to pay for ecotourism and identified the factors that influence it. This study uses the CVM method to determine the WTP value, as well as regression to determine what factors affect the WTP value. The results showed that the average WTP of foreign tourist respondents was US \$ 54.13, with the economic value of the ecotourism environment and the estimated income from entrance tickets of US \$ 1,208,790/year or IDR 14.50 billion/year. Meanwhile, the average WTP of domestic tourist respondents is IDR 40,650 and the economic value of the ecotourism environment and the estimated income from the entrance ticket is IDR 883,202,550, - Factors that affect the value of WTP, are education, income, the number of family dependents, activeness in environmental organizations and knowledge about ecotourism.

Meanwhile, Ramos et al. (2020) [13] examined the amount of domestic water needs and the value of household willingness to pay (WTP) as economic values that will help support the management of these springs. This research was conducted in December-January 2020 at Pinang Jaya Spring, Bandar Lampung City. The sampling technique uses *purposive sampling* for population determination and *simple random sampling* for respondent selection, with a total of 50 respondents. The amount of household water needs is calculated using the formula for calculating water consumption and willingness to pay water utilization.

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The results showed that the average domestic water used by the community was 48/m<sup>3</sup>/month, while the value of willingness to pay of household water utilization was IDR 34,630/household/month, and the total willingness to pay from the water-utilizing community was IDR 3,324,480/month. This value shows that people are actually very aware of the importance of the economic value of water so they are willing to pay for the sustainability of the water.

On the impact of the PES program, Diswandi (2017) [14] conducted a study on the impact of the PES program on conservation on the island of Lombok, Indonesia. The data comes from in-depth interviews with policymakers. The interview data is then verified through field studies in the form of surveys and focused group discussions (FGDs). The study found that the PES program contributes positively to forest conservation. Within a year, the PES program has been able to support the regeneration of around 1.25% of the total area of damaged forests in the West Lombok region.

### METHODOLOGY

This study is a quantitative study with the household population of drinking water customers in Central Lombok who spread across 12 sub-districts. The samples in this study were determined by random sampling techniques, composed of 310 households who are drinking water costumers of the Central Lombok drinking water company (PDAM).

The assessment of WTP in this study is to measure the economic value of natural resources carried out with a contingent valuation method (CVM) approach, which is a survey-based methodology to estimate how much the community's assessment for goods, services, and comfort (Fauzi, 2021) [15].

The variables that are estimated to affect the WTP value in this study include education level ( $X_1$ ), Age ( $X_2$ ), Income ( $X_3$ ), Number of Family Members ( $X_4$ ), Environmental Awareness ( $X_5$ ) and Quality of Service ( $X_6$ ), which are formulated in the following econometric equation:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6$$

Where

Y= Willingness To Pay

a= Number of Constants

$X_1$  = Education Level

$X_2$  = Age

$X_3$  = Revenue

$X_4$  = Number of Family Members

$X_5$  = Environmental Awareness

$X_6$  = Quality of Service

### RESULT

The economic existence value of the forests for the continuation of clean water availability is reflected by the willingness of the community to pay for environmental services in helping the government carry out forest conservation in the Central Lombok district.

In this study, respondents chose whether they were willing or unwilling to pay for environmental services for forest conservation with a predetermined WTP ranging from IDR 2,500 to IDR 10,000. From the survey results, it was found that the average WTP of the PDAM customers for the existence of central Lombok forests is IDR 3,260/month. Meanwhile, the total value of the Central Lombok forest existence from the point of view of respondents in this study which is as many as 310 people is IDR 1,010,000/month.

To analyze the factors that affect the amount of WTP, multiple linear regression analysis is used using STATA software. The method chosen is robust regression, which is a regression method that has cleaned up the problem of classical assumptions. So, the values resulting from this process can already be directly analyzed for estimation. In summary, the results of data processing are presented as follows

$$Y = -0.449 + 0.124 X_1 + 0.001 X_2 + 0.095 X_3 - 0.097 X_4 + 0.046 X_5 + 0.017 X_6 + e$$

(-0,59) (2.54)\*\* (0.26). (1.66)\* (-2.34)\*\* (1.85)\* (-0,91)

F statistic = 3.63\*\*\*

R<sup>2</sup> = 0.0839

The number in brackets is t statistic

\*\*\* Significant at  $\alpha$  1 %

\*\* Significant at  $\alpha$  5 %

\* Significant at  $\alpha$  10%

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## DISCUSSION

The results of this study show that a person's education plays an important role in the amount of economic valuation given to a resource, in this case is forest resources. The higher a person's education, the higher his assessment of forest resources value, which is reflected in the amount of his WTP for the existence of the forest. These results confirm and are in line with the results of previous studies, including those conducted by Sadikin (2017) [12], Prasetyo (2013) [14], Widiastuti (2014) [11] and Afifah (2013) [8]. However, this is contrary to the research of Rosalina and Grafitiani (2008) [10].

Regarding the level of income, the higher a person's income level, the higher the assessment of forest resources will be reflected in the amount of WTP for the existence of the forest. These results are in line with what is described by Rosalina and Grafitiani (2008) [10], Sadikin (2017) [12], Prasetyo (2013) [9], Afifah (2013) [8] but different from Widiastuti (2014) [11].

The number of family members also affects the amount of economic valuation value given to forest resources. The greater the number of family members, the higher the assessment of forest resources value, which is reflected in the amount of WTP for the existence of the forest. The results of this study are the same as Widiastuti (2014) [11], Sadikin (2017) [12], Ramos (2020) [13], Prasetyo (2013) [9]. The results of this study are different from the research results of Afifah (2013) [8] and Rosalina Grafitiani (2008) [10].

A person's Environmental Awareness also affects his or her assessment of forest resources. The higher the level of Environmental Awareness of a person will be the higher the level of assessment and this is reflected in the amount of WTP for the existence of the forest. These results confirm and are in line with the results of previous studies, including those conducted by Rosalina and Grafitiani (2008) [10], Widiastuti (2014) [11] and Afifah (2013) [8]. However, this is contrary to research with the research of Sadikin (2017) [12], Ramos (2020) [13], Prasetyo (2013) [9].

A person's age also affects the amount of economic valuation given to a resource, as the results of this study and previous studies such as Sadikin (2017) [12] and Afifah (2013) [8]. However, there are also studies that conclude that age has no effect on people's assessment of a resource as produced by Rosalina and Grafitiani (2008) [10], Widiastuti (2014) [11], Prasetyo (2013) [9].

Then, the results of this study also show that Service Quality does not play an important role in the amount of economic valuation given to the associated resource, in this case is forest resources. The higher the level of Service Quality, the lower the assessment of forest resources, which is reflected in the amount of WTP for the existence of the forest. These results are in line with Sadikin (2017) [12], Rosalina and Grafitiani (2008) [10], Widiastuti (2014) [11], Prasetyo (2013) [9] and contrast with Afifah (2013) [8].

## CONCLUSION

This study found that the economic valuation of forest resources in Central Lombok from the point of view of drinking water customers which is proxied from the willingness to pay (WTP) for the existence of these forests is an average of IDR 3,260 / month.

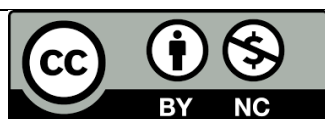
Factors that influence the magnitude of such values are The Level of Education, Income, Number of family members, and environmental awareness. The higher the level of education of a person, the greater his assessment of the existence of forest resources. Likewise with income levels and environmental awareness. People who are increasingly established economically will rate the existence of forests higher and higher. Environmentalists with a level of awareness of the importance of a good environment, will also rate higher for the existence of forests. Meanwhile, the greater the number of family members, the smaller the person's willingness to pay for the existence of the forest.

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