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Preface: Sriwijaya International Conference on Basic and Applied Sciences 2021 FREE

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Preface: Sriwijaya International Conference on Basic and Applied Sciences 2021

The 2nd Sriwijaya International Conference of Basic and Applied Sciences 2021 (2nd SICBAS 2021) is an annual scientific conference organized by the University of Sriwijaya Palembang, Indonesia. Our main aim has been to provide an attractive plaform for the students, researchers and acdemicians to discuss novel ideas and share it with the delegates parts of the world. And also, the advancement of technological approaches and engineering methods may simplify the existing problems from previous findings. We hope the original notions from the researcher may inspire the other experts to develop, modify, or even combine the proposed method with the existing method for resulting in more efficient procedures.

The conference was held on 2 November 2021 via online mode and was hosted by Faculty of Mathematics and Natural Science, University of Sriwijaya, Palembang-Indonesia. Therefore, this event was themed “Sciences Development in the New Era”. The conference was addressing the practical engineering application in Mathematics & its Applications, Physics and Apllied Physiscs, Biotechnology, Chemical Engineering, and Ocean Engineering. We received more than 100 papers from various research and educational institutions around the world (Brazilia, England, Egypt, Japan, Malaysia, Bangladesh, and Indonesia). Out of the 96 presented papers, 75 full papers were selected for inclusion in this conference proceedings.

The conference includes altogether 5 Keynote sessions and 7 parallel sessions. We sincerely thank the speakers, committee members, reviewers, and volunteers, who contibuted so magnificently to the success of the conference. We tried hard to ensure that the conference would be well organized. We are grateful to the presenters and participants for their valuable contributions. We extend our very best wishes to you wherever you may be around the world.

Dr. Muhammad Said, M.T.
On behalf of the Organising Commette
Conference Chair

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Economic valuation of clean water ecosystem services as the impact of opening forest areas into upland coffee plantations Buay Pemaca of South Ogan Komering Ulu Regency: By replacement cost method FREE

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Economic Valuation of Clean Water Ecosystem Services As The Impact of Opening Forest Areas Into Upland Coffee Plantations Buay Pemaca Of South Ogan Komering Ulu Regency: By Replacement Cost Method

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Abstract. The existence of forests is very important for the survival of human life. Forest provides many benefits such as providing water sources, producing oxygen, place where millions of flora and fauna live, besides that forests also play a role as an environmental balancer and prevent global warming. The clearing of forest areas into upland coffee plantations in Buay Pemaca District greatly affects the biophysical conditions of the environment, especially hydrological conditions and water management arrangements. highland coffee plantations are characterized by various topophysiographic and biophysical factors, such as relatively steep slopes, soil sensitivity to landslides and erosion, relatively high rainfall, and others. Mistakes in the management and utilization of land resources in this area can cause damage or biophysical stress in the form of degradation of soil fertility and the availability of clean water. The purpose of this study was to determine the economic valuation of the need for clean water that must be paid by the community as a result of the clearing of forest areas into highland coffee plantations in Buay Pemaca, South Ogan Komering Ulu Regency. The method used is descriptive method using the economic valuation method of replacement cost (Replacement Cost). The number of samples was 270 samples are 5 villages, namely Mekarjaya Village, Sinar Napalan, Durian Sembilan, Danau Jaya and Sido Rahayu. The results of the study found that the use of clean water at the study site was 59,088 m^3 per year with the water sources used were wells and hill water. The cost of installing water is IDR 205,500,000 or an average of IDR 3,828,027. The amount of replacement cost that must be paid by the community for the clean water needed by the community is IDR 395,601,600 or an average of IDR 7,349,121.

Keywords: Ecosystem services; economic valuation, clean water needs.

INTRODUCTION

The existence of forests is very important for the survival of human life, in addition to providing benefits or services provided by ecosystems such as providing water sources, producing oxygen, where millions of flora and fauna live, forests also play a role as an environmental balancer, and prevent global warming. However, everything is disturbed, especially the ecological function of the forest due to human activities . Natural forests have water storage capacity that is integrated with five types of ecosystem services, namely wood production service providers, water supply, carbon storage, soil conservation and water retention [1]. Natural forest has a relatively high value of regulatory services, but the highest overall ecosystem service benefits are owned by mixed plantations with coniferous and broadleaf plantations [2].

Forests are a source of biodiversity, if forest damage occurs it can cause a decrease in biodiversity contained in forest areas. The increase in the functionality of an ecosystem and the provision of ecosystem services is a result of the high biodiversity in the forest. The condition of isolated small forests provides a low potential for providing ecosystem services compared to large forests that contain a large number of species [3]. The opening of forest areas causes the loss of important functions, such as hydrological functions, functions of producing wildlife habitats and local plant varieties, including supply, regulation, support and cultural functions. The functions of these ecosystem services can be quantified for example water and biodiversity conservation, soil erosion, carbon sequestration and recreation [4].

The increasing human population causes an increase in human activities so that the need for goods and services from nature increases. This causes nature's ability to provide goods and services to decline. The ability of

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nature to provide goods and services is known as ecosystem services. An ecosystem is a unified system that influences and relates to one another. The condition of the ecosystem itself is an important part of the assessment as a determinant of the capacity of the ecosystem to produce services [5]. Services provided by nature ranging from air and water must be paid dearly by humans if nature is not properly maintained as a source of benefits. However, these ecosystem services in the past were limited to unlimited free goods. But now humans have begun to document the level of ecosystem service degradation [6] where the ecosystem services received by humans have decreased over time even though the dependence on these ecosystem services varies according to the ability of these ecosystems to provide their services, both in the uplands, lowlands and lowlands. lowlands and even coastal areas.

The ecosystem services provided by uplands, lowlands and coastal areas all provide a number of basic life support services. For example, natural capital, namely various benefits obtained by humans freely from nature [7] and commodity goods from plantations, agriculture, and other natural products, such as commodities that are economically profitable[7,8], where welfare man is determined by the fertility and quality of his commodities [9]; [10]. This assessment of ecosystem goods and services has involved ecological complexities (structures and processes) in improving human welfare, directly or indirectly [8,11].

The clearing of forest areas into highland coffee plantations in Buay Pemaca District greatly affects the biophysical conditions of the environment. especially hydrological conditions and water management arrangements. Upland coffee plantations are characterized by various topophysiographic and biophysical factors, such as relatively steep slopes, soil sensitivity to landslides and erosion, relatively high rainfall, and others. Errors in the management and utilization of land resources in this area can cause damage or biophysical stress in the form of degradation of soil fertility and the availability of clean water. Agricultural expansion of wetlands has multiple and complex impacts. Soil surface temperature, hydrology, evapotranspiration are indicators that have the potential to change land cover and wetland status [12]. So far, plantations in the highlands have been watched closely only in terms of their potential, but their threats are rarely considered. The problems faced by farmers in the highlands are actually more complex than plantations in the low and medium lands. The problems faced are the agricultural environmental system (*agroecosystem*), the social system (*agrosociosystem*) and the terrestrial system (*agrogeosystem* [13]. The geological threat posed to upland plantations is very significant both for the farmers themselves and for business sustainability.

It is important to conduct an economic valuation assessment to find out possible policy gaps in increasing the benefits of opening coffee plantations for the community. This economic valuation assessment is carried out by quantifying goods and services of natural resources and the environment into the value of money (monotize). Efforts to provide a quantitative value of goods and services produced by natural and environmental resources based on market values and non-market values can use economic valuation values [14].

Economic valuation is often used to estimate the monetary cost of benefits from natural resources and the environment by using the contingent valuation method (CVM) and hedonic pricing assessment (HPM). The travel cost method (TCM) is difficult to apply to urban areas because there are often limited travel costs in the assessment of these areas [15]. Assessment of natural resources and the environment regardless of the presence or absence of market value can be measured by the willingness to pay to get the commodity. Economic valuation of clean water supply is carried out by the replacement cost method

MATERIAL AND METHODS

This research was conducted in Durian Sembilan Village, Sido Rahayu, Sinar Napalan, Mekar Jaya and Danau Jaya Village, Buay Pemaca District, South OKU Regency. The research location is directly adjacent to the Saka Limited Production Forest (HPT) area, namely Durian Sembilan Village and Danau Jaya, bordering the Saka Production Forest (HP) namely Sinar Napalan Village and bordering the Gunung Raya Wildlife Reserve (HSM) Forest, namely Sido Rahayu Village. Most of the population in the study area are coffee farmers who have a coffee area of 1-5 hectares. The research location can be seen in Figure 1.

The population determination technique was carried out intentionally with a population of 1,829 households (heads of families) and a sample of 270 families (heads of families). Determination of the sample is done using the formula Kreijce and Morgan (1992) as follows:

$$n = \frac{X^2 N.P\ (1-P)}{(N-1)d^2 + X^2.P\ (1-P)} \quad (1)$$

$$n = \frac{3{,}841\ x\ 1{,}829\ (0{,}5x0{,}5)}{(1{,}829-1)0{,}05^2+(0{,}5\ x\ 0{,}5)} \quad (2)$$

$$n = \frac{3{,}841\ x\ 1{,}829\ (0{,}25)}{(1{,}829-1)0{,}0025+(0{,}25)} \quad (3)$$

$$n = \frac{1.756,29}{4,57+0,96} \quad (4)$$

$$n = 270 \text{ head of familiy} \quad (5)$$

Primary data was collected by distributing questionnaires and in-depth interviews. Some of the questions given to the respondents were regarding the source of clean water used, the cost of installing water, the amount of water used and the replacement costs that must be paid by the respondent. Data were analyzed descriptively using tables and graphs. To calculate the value of benefits that do not have a market value, the substitute value method is used so that the value of resource benefits can be assessed commercially [16]. Valuation of the economic value of the use of clean water using the replacement cost method using the formula:

BP = P x Qd .... (Formula 1)

Note: BP = Replacement cost
P = Water payment fee (IDR / m^3/ yr)
Qd = Amount of clean water used (IDR/ m^3)

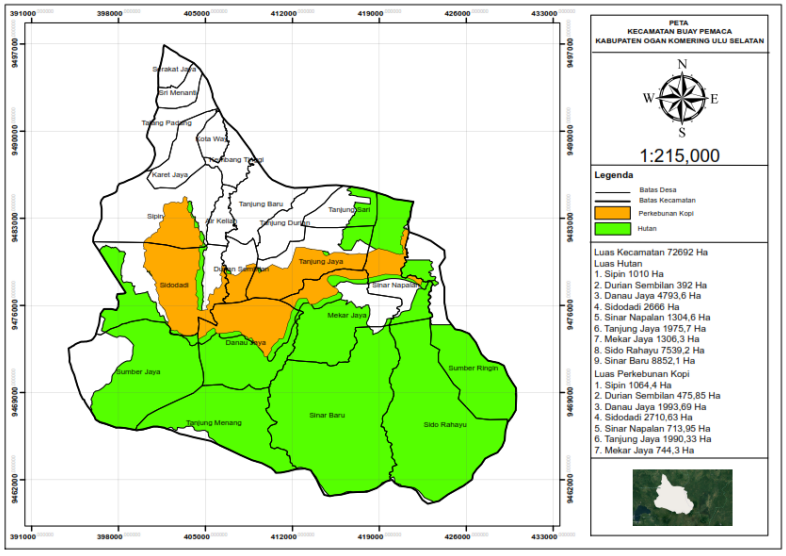

FIGURE 1. Research location map

RESULT AND DISCUSSION

Buay Pemaca is a sub-district bordering the Saka Limited Production Forest (HPT), Saka Production Forest (HP) and Gunung Raya Wildlife Reserve (SM). The vegetation in this area is a upland tropical rain forest ecosystem which has a wavy topography, hilly to mountainous with an altitude of 1,643 meters above sea level and a slope of 15-25%. Soil types are generally reddish brown latosol, old andosol and brown podsolic.

Deforestation activities and the clearing of forest areas into open land, agricultural land and plantations will disrupt the ecological function of the forest. Human activities can cause disturbances that cause most of the vegetation to undergo secondary succession [1]. In addition, the consequences of forest clearing cause soil stability to be disturbed because forest floor covering plants cannot improve soil stability conditions so that they are not able to reduce the speed of water flow through the soil. This is what causes landslides and floods. In addition, a decrease in the ecological function of the forest can cause a reduction in the absorption and storage of carbon from plants in the forest, thus affecting the biodiversity and biological activity of plants.

Other damage caused by the conversion of forest functions is landslides that damage roads and riverbanks. The watershed (DAS) upstream of the Komering River is included in the river border of the South Ogan Komering Ulu Regency which is the research location. Landslides on this river bank greatly affect the condition of river water and mountain water it carries. From the results of interviews with the community in the research location, it is stated

that now the condition of clean water is very bad. The highest percentage of clean water condition which bad is 59.6 percent in Sido Rahayu Village is shown in Figure 2. The description of this very bad water condition is that the water contain mud and the color is brown. This water conditions due to runoff of soil particles carried by water due to landslides from river cliffs.

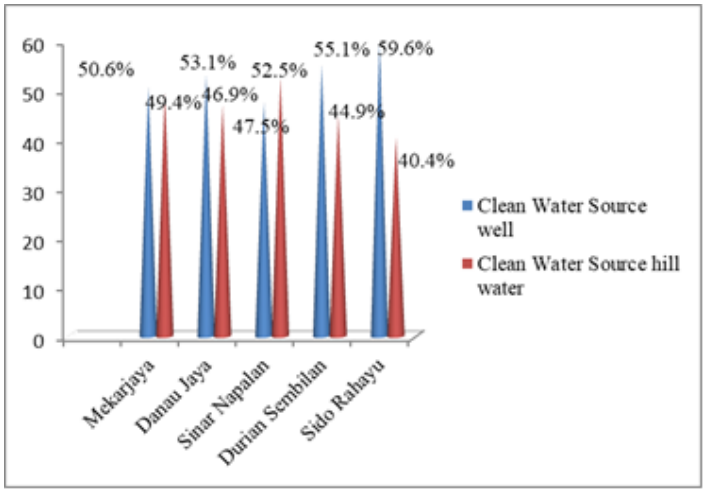

FIGURE 2. Clean Water Conditions Due to Forest Clearing

The source of water used by the community for daily activities is water from wells and hill water. Most of the people use well water as a source of clean water with the highest values, respectively, at the research location, namely 59.6 percent (Sido Rahayu Village), 55.1 percent (Durian Sembilan Village), 53.1 percent (Lake Jaya Village) 50.6 percent (Mekarjaya Village) and 47.5 percent (Sinar Napalan Village) are shown in Figure 2. The water sources used by the community are currently experiencing problems for the last 10 years because the community has cleared forest areas for plantations. In addition to clean water sources, soil fertility conditions have also changed. The impact of soil fertility has an effect on the amount of coffee production produced from farmers' gardens which has decreased so that it has an impact on the income received by coffee farmers.

The handling of raw water sources needs to be improved starting from the behavior of the people living in the upstream of the river by protecting the upstream river from pollution and forbidding the public to litter, including household waste. Logging of forest areas that damage the environment and disrupt the availability of water and water sources. Saving clean water sources is something that must be done especially the declining water supply in the world. Pollution in urban water bodies is a major source of water pollution originating from the irregular disposal of domestic and industrial wastewater which has detrimental effects on human health, recreational opportunities and the environment [15].

Clean water is a form of service or ecosystem service provided by nature that provides direct use value for human life and other living things in the universe. The form of ecosystem services received by humans from nature is decreasing day by day from time to time, even though the level of dependence varies from these ecosystem services. Ecosystem services providing sustainable clean water are very helpful in economic and environmental sustainability and social community [17]. Water regulation, erosion control and water purification are functions of regulatory services provided by nature.

Ecosystems provide resources and services with broad and complex values for the community, one of which is clean water. The community's need for clean water, especially drinking water, is very high. To meet these needs, people are willing to consume bottled drinking water and refilled water because they consider the quality of well water, river water, hill water to be lower than alternative water sources. This is the basis for the high willingness of the public to pay for clean water [18]. This fact shows that the need for clean water is a financial value that needs to be taken into account. For this reason, it is necessary to calculate the financial value of clean water which provides great benefits for living things in the universe. These values can also be used to calculate the value of losses incurred if there is damage to natural resources. This assessment of the loss of environmental damage needs to be carried out as a basis for policy stipulation by the government.

The use of water by public research location can be seen in Figure 3. The highest water usage in a row is 18,768 m^3 (Mekarjaya), 10,812 m^3 (Danau Jaya Village), 10,644 m^3 (Durian Sembilan Village), 10,152 m^3 (Sido

Rahayu Village) and 8,712 m^3 (Sinar Napalan Village). The use of this clean water for daily life such as cooking, washing, bathing etc. The distribution of clean water resources needs to be considered so that the need for clean water for the community can be met to improve regional welfare effectively [19]. Water consumption by the community per liter and the income of the community have a significant effect on the willingness to pay for safe and clean drinking water [20].

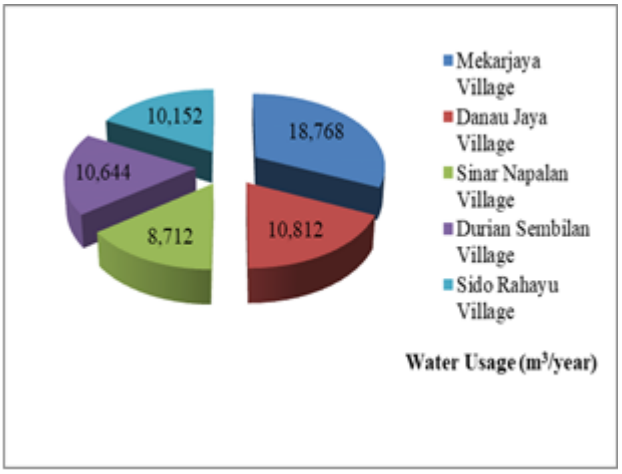

FIGURE 3. Water Usage Needs

Most people use wells as a source of clean water. In addition to wells, the community also utilizes hill water by making pipes from water sources. The cost of making wells and installing hill water is IDR 205,500,000 with an average of IDR 3,828,027 which can be seen in Table 1. The highest cost of installing clean water is IDR. 62,050,000 (Mekarjaya Village). The cost of this installation is the cost of making wells and the cost of installing water from springs, namely hills consisting of wages and equipment purchases can be seen in Figure 4.

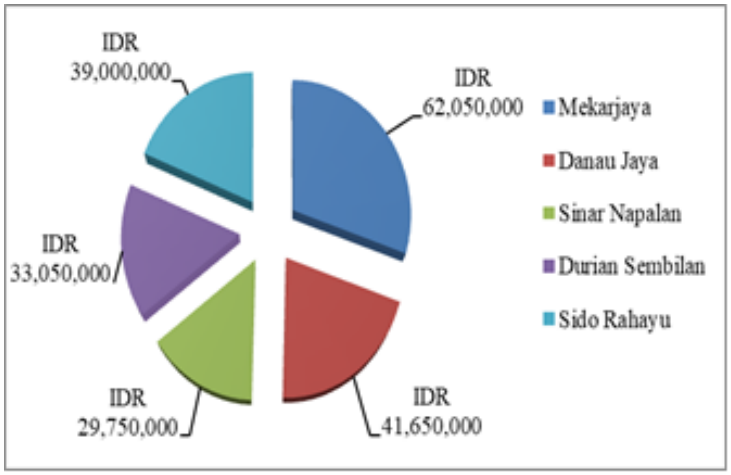

FIGURE 4. Water Installation Fee

The amount of replacement costs that must be paid by the community in the event of environmental damage is IDR 395,601,600 with an average of IDR 7,349,121 with the highest costs is IDR 1,522,494 (Danau Jaya Village), can be seen in Table 1. This replacement cost is obtained from the product of the cost of use water (m^3/ year) with the price of clean water per m^3 (IDR/ m^3) using Formula 1.

CONCLUSION

Logging activities and clearing forest areas into open land and coffee plantations have an impact of damage (erosion) on riverbanks. They made the turbidity of the river and the mountain water increased. From the results of interviews, the community said that 60 percent of the clean water conditions in the research location were very bad. The most clean water used by the community on a daily basis is 18,786 m^3/year, the highest installation is IDR 62,050,000 and the replacement cost that must be paid by the community in the event of environmental damage which results in the provision of clean water being disrupted is IDR 395,601,600 with the average cost is IDR 7,349,121.

TABLE 1. Replacement Cost

No	Village	Installation Costs (IDR)	Average (IDR)	Water Usage M^3/year	Average (%)	Replacement Cost (IDR)	Average (IDR)
1	Mekarjaya	62,050,000	730,000	18,768	31,76	121,980,000	1,435,059
2	Danau Jaya Sinar	41,650,000	850,000	10,812	18,30	74,602,200	1,522,494
3	Napalan Durian	29,750,000	743,750	8,712	14,74	58,957,200	1.473.930
4	Sembilan Sido	33,050,000	674,490	10,644	18,01	71,863,800	1,466,608
5	Rahayu	39,000,000	829,787	10,152	17,18	68,198,400	1,451,030
	Total	205,500,000	3,828,027	59,088	100,00	395,601,600	7,349,121

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