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Economic Valuation for Water Resources Development

Firman Hidayat'[1]

[1]Faculty of Forestry of Muhammadiyah University Sumatera Barat

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Abstract

Watershed management is seen as a cost centre that does not provide tangible economic benefits for the development and improvement of people's welfare. Market mechanisms fail in assessing the overall resource. But this time there has been a change in the economic valuation of the environmental benefits and natural resources indispensable for policymaking and economic analysis of project activity. This prompted the study conducted with the aim of assessing the total economic value of ecosystem services and water resources to assess the ability of users to pay for water resource development DAS Mahat Hulu, with a replacement cost calculation methods and contingency. Users or beneficiaries in this study is limited only to the rice farmers in the upstream, floating net cages farmers, tourists reservoirs, power users <450 watts and power users> 450 Watts. Respondents were selected by random sampling multistory. A number of respondents adjust existing population. The results prove that the total economic value of water resources is very large upstream watershed Mahat is Rp. 53.72 M / yr or Rp. 1,882,636. per ha comprising Rp.51.38 economic value and willingness to pay (WTP) Rp. 2:34 M / yr. WTP value this year is much greater than the Reforestation Fund Kabupaten Lima Puluh Kota 5 (budget year) is only Rp. 1.5 M. Percentage is paying too high at 89.5%, although its value is still low compared with the VAT tax liability by 10% while only 4.5% WTP. Total economic value can be used as the value of the minimum compensation when land in the watershed will be converted. In addition, this value can be the basis of the performance appraisal watershed management more accountable. Increase the total economic value of watershed performed a good and healthy while decreasing the total economic value of the watershed shows the performance of the watershed down and unhealthy

Keywords; *total economic value, economic valuation, reforestation fund, contingency*

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I.INTRODUCTION

Currently estimated at 13% or 62 of 470 watershed basin in Indonesia in critical condition. To address these critical watersheds, diverse soil and water conservation activities in watershed management is long overdue (Priyono and Cahyono, 2003). Failure during this watershed as a result of the excessive emphasis on the biophysical aspects of the social aspect. As a result, watershed management is less public support, because it does not provide tangible economic benefits, are less able to cope with degraded land, and is considered failed. One thing overlooked by experts on the watershed is important economic resource values in the watershed (Dixon and Easter. 1986). Application of environmental economics into a policy for the protection and improvement of the environment, including watershed management has some problems, such as the identification and quantification of environmental impacts, valuation of environmental costs and benefits and the discount factor (discounting factor). The environmental impact of watershed management has a high complexity, difficulty in integrating and quantifying the effect (especially off-site) and assessment attachment relationships impact upstream and downstream. This difficulty may occur due to the watershed management programs often encountered the upstream and downstream separation program so rarely integrated management of the gains obtained downstream to upstream management advantages. Experience in Costa Rica, in which the payments

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service has been running through watershed continue to be studied further in order perfect and a valuable lesson for Indonesia in towards an era in which recognition and reward are given to those who can be a provider of environmental services watershed although it is thought the reduced availability of water is considered as it is not inviolable (unalienable rights).

Economic benefits of a resource assessment are one of the factors that determine the sustainability of resources. The low resource prices result in a less efficient allocation in which the rate of production or extraction becomes larger than it should be. Adger et al. (1995) argue that the error in calculating the number of goods and services produced by forests (for example) to encourage the use of forest damage. Further stated that market transactions do not provide a complete picture of the total economic value of resources. Ecosystems (including ecosystem in the watershed) provides a variety of valuable goods and services for human well-being. Goods and services should be quantified and measured by the size of the public. This is the focus of resource, and environmental economics is how to assess the environmental benefits in monetary terminology (Venkatachalam, 2006).

Quantification of ecosystem goods and services is important to ensure the social recognition and approval of the public in managing ecosystems (Wilson and Carpenter, 1999) and resource. If quantification is considered useful and necessary input in decision-making, the quantification and economic valuation approach should be selected and performed. Value of the economic benefits of protection and watershed management rarely quantification was not carried out in full or in whole. There are only a few economic valuations of watershed benefits, such as Acharya and Barbier (2000).

The value of environmental goods and services can be categorized into: (1) value is used (use-value), and (2) the value of the unused (non-use value). The option value is based on how much an individual assessment willing to pay (willingness to pay) of an option to protect the environment. Bequest value is based on the individual's understanding of the benefits of a resource in the future. Existence value is based on the understanding of the existence of these resources. Many studies conducted on the use-values with a limited method. This study aimed to assess the total economic value, and willingness to pay environmental services for users in the watershed Mahat Hulu. At the approach of total economic value, of goods and services in the watershed will be calculated in monetary terms, both tangible and intangible thoroughly. The general method of assessment of an existing program that benefits both the market value and are not presented in Figure 1

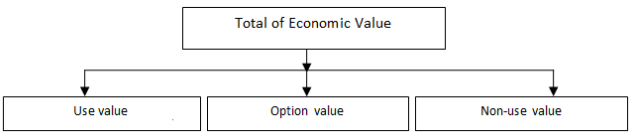

Fig.1 Total economic value of environmental services (Tietenberg.T, 2003)

II. METHOD

The experiment was conducted in the Mahat Hulu watershed (28,535 ha) as part of the Mahat watershed governance administratively located of Mahat Hulu in the Lima Puluh Kota District, West Sumatra Province. Its downstream were in Kampar district in Riau Province. Mahat Hulu catchment basin located at 0 0 05 '25" - 0 0 04' 33" South latitude and 100 0 29 '10" - 100 0 34' 19" East Longitude. Materials used such as; map RBI, administrative boundary map, population distribution map, land use map, and interview material to respondents in the form of questionnaires and tools stationery office

The data collected in this study are primary and secondary data, primary data of socio-economic data (value / economic benefits of water), which is directly obtained through interviews of questionnaires that have been prepared. Meanwhile, secondary data such as demographic data, the data farmers wetlands, floating net cages the data owner, the data traveller reservoirs, as well as data obtained from customers PLN Lima Puluh Kota district Government and relevant agencies Kampar through agencies.

Mainly used for primary data analysis with contingent valuation technique (contingency method) or willingness to pay (willingness to pay).

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In practice, using this method is that the user (user) directly asked their willingness to pay to obtain and use water, to dig deeper into the information environment of users, it will use a list of questions (questionnaire) in accordance with the intended respondent. The number of respondents varies and is considered sufficient when it represents.

DAS produce goods and services that can be marketed, and some can not be marketed. Marketable products are direct benefits that can be felt from a watershed management system, for example, agriculture, fishing, timber and non-timber forest products, both commercial and non-commercial. Indirect use-value is derived from direct use. Indirect benefits are perceived benefit indirectly to the goods and services produced by a watershed, for example, barrier erosion, sedimentation, hydrological water providers, and soil-forming. In addition, there is also the option value, existence value, and the value of its inheritance is not yet affecting the sustainability of watershed resources.

Techniques to calculate the total economic value and the valuation of resources has been much described and for the case of Indonesia, among others, by (Sihite, 2001) and Suparmoko (2008). In general, the total value of upstream water catchment Mahat is formulated as follows:

TNA = UV + OV + NUV or TNA = (DUV IUV +) + NUV + OV in which:

TNA = total value of water whereas, UV = use-value, DUV = direct use value (direct use values), IUV = Indirect use value (the value of direct useless), OV = option value (value selection), and NUV = non-use value (value not in order)

In this study only indirectly the value of water is used for electric power, cage fish farming, irrigated fields, and tours of the watershed reservoirs Koto Panjang Mahat Hulu. In connection with this study the value of non-use of water catchment Mahat Hulu does not count, this is due to the high level of subjectivity in the evaluation process, so it is feared will lead to bias in the determination of planning decisions Mahat Hulu watershed management based on its economic value.

Estimating the value of water Mahat Hulu watershed. Based on the scope of the value of water restrictions to be calculated, the total value of water to be counted formulated as follows:

Total Value of Water

TNA = NAL + NAI + NAS + NAW

TNA = total value of water

NAL = value mains water

NAI = Value water fish

NAS = Value paddy water

NAW = Value tourist water

Estimating the value of PLN customer water use formula is as follows:

NAL = (RT x KRT x HLR)

NAL = Customer Value PLN (USD / year)

RT = Number of Households Subscribers PLN

KR = Consumption Per House Ttangga electricity (KWH / month))

HLR = TDL Price (USD / KWH) for Household

Estimating the value of water fish cage farmers is formulated as follows:

NAI = (BIK x HIK x JMK) / harvest

BIK = Weight of fish

HIK = price of fish / kg

CTR = number of cages

Calculated for each harvest and subsequently in total for 1 (one) year management.

Estimating the value of water to the rice fields using the following formula:

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NAW = LUT x BPA x MT

Naut = value of water for farming rice (Rp / year)

LUT = farm size (ha)

CPA = cost of procurement of paddy water (Rp / ha / season)

MT = rice garden season (season / year)

Estimating the value of water to a tourist destination with Koto Panjang appeal reservoirs using the following formula:

NAW =. HT

NAW = Value water sites (Rp / year)

JP = the average number of monthly visitors (people / month)

BP = costs (USD / person)

HT = admission price (USD / person)

III. RESULTS AND DISCUSSION

Total economic value (NET) watershed water resources Mahat Hulu is the combination of the value of water use for tilapia: 1 rice farming, 2) reservoir tourist 3) floating net cages, and 4) electrical household. The magnitude of the economic value of water resources Mahat Hulu watershed presented in Table 1

Table 1. The total economic value of water resources

No.	Use of Type	Value (USD / M)	%
1	Rice farming	0.676	1.32
2	Tourism reservoir	5.628	10.95
3		9.849	19.17
4	Floating net cages	22.180	43.17
5	Household electricity (> 450) Household electricity (<450)	13.046	25.39
	Number	51.381	100

The data above shows that the economic value contribution consecutive upstream watershed Mahat is the greatest power of the household sector (users with power> 450 Watt and <450 Watts) and then followed by a floating net cage and most low rice agriculture. Power users with power> 450 Watt has economic value for Rp.22.180 M (43.17%) followed by power users with power <450 Watt for Rp.13.046 M (25.39%). Contribution of the economic value derived from the electrical installation of the new value, and the monthly fees in one year, from the second item, turned out to have a monthly levy the highest percentage contribution to the economic value of electricity. Obtained high scores because it is an obligation that must be fulfilled. Forward this value will be higher due to the power sector has become a staple (Table 1).

Economic and population growth will affect the demand for power is increasing, according to Mukhlis and Purnama (2008). Projected electricity demand from 2003 till 2020 was the Department of Planning System PT PLN and Team Energy BPPT, seen that during this period the average electricity demand in Indonesia grew by 6.5% per year with electricity growth in the commercial sector is the highest, which is about 7.3% per year, followed by the domestic sector electricity demand growth at 6, 9% per year. Further disclosed, the magnitude of the average electrification rate in Indonesia in 2003 reached 54.8% in 2008 and estimated to be 63.5%, and by 2013 is expected to increase to 75%. Electrification ratio data for West Sumatra in 2013 is expected to reach 94.3% and reached 56.9%.

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The economic value of water uses third-largest Mahat Hulu watershed from floating net cages in the amount of Rp. 9.849 M (19.17%). Cages procurement costs and production costs are items that cause the high economic value of the environmental services of water users. All it proves that they desperately need water and requires that water is available at all times for the sake of their business, for that they are willing to pay a high enough value and expect forest rehabilitation in the upstream run well.

Tourism reservoirs have a total economic value of 5.628 M (10.95%). In this study, was ranked fourth. It contributed the greatest contribution to it by the replacement cost of transportation and a fishing pole year. This activity will only be a joy but be ready to pay for could keep fishing while travelling. To that end, the upstream region should be maintained properly, forest and land rehabilitation should be done so that this region remains a tourist destination.

The economic value of wetland Rp.0.676 M on (1.32%) is the smallest value of the economic valuation of watershed Mahat Hulu. The greatest contribution of this wetland is the cost of processing and the provision of means to enter the water. While of the ability to pay the cost of replacement water resources relative small because the exchange rate is also small farmers. However, in a survey carried, cultivating the fields will continue to be done by a family staple. To that end, they expect once the water as a key element for the growth of rice they are available at all times.

Value of Willingness To Pay (WTP) of Water Resources

Willingness to Pay (WTP) is the individual's willingness to pay an environmental condition or valuation of natural resources and natural services in order to improve the quality of the environment. WTP calculated how far each individual or society to pay or spend money in order to improve the environmental conditions in order to conform to the required standards. Value of each user's willingness to pay for water shows the level of concern of every user of water for environmental sustainability that can ensure their comfort in order to enjoy uninterrupted water.

Based on the concept of economics, that economic value includes the concept of usability, satisfaction or pleasure derived by the individual or the society is not limited to the goods and services that gained of buying and selling, but all the goods and services that can provide benefits for human welfare. So that both public goods and private goods will benefit the community. Thus the presence of water as an ecological benefit is essentially also an economic benefit because if disrupted ecological functions will lead to disadvantages or the loss or damage caused by the disaster.

It thus also related to the availability of water is not always maintained regardless of the condition of the natural resources that govern the presence of water. In general, the presence of water that can be used can not be separated from the function. If watershed degraded the quality, quantity and distribution of water would be too distracted. To keep the watershed continue to work with the natural resources should be maintained. Watershed conditions that have been disturbed should be fixed. Forest and land rehabilitation measures immediately.

Programs should be developed, and funds should be provided as well as integrated institutions should be set up to make this happen. The allocation of funds for the rehabilitation/improvement of hydrological functions that are conserving water resources then WTP is needed. In detail, the value of willingness to pay (WTP) rehabilitation costs are presented in Table 2

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Table 2 WTP value forest and land rehabilitation costs

No.	Type of Use	Value (USD / M)	(%)
1	Rice farming	0,029	1.24
2	Tourism reservoir	1.11	47.73
3	Floating net cages	0,014	0.6
4	Household electricity (> 450)	0.705	30.14
5	Household electricity (<450)	0.481	20.56
	Total	2,341	100

Contribution to the willingness to pay tourist reservoir forest and land rehabilitation costs Mahat Hulu is a watershed; greatest Rp. 1:11 M or 47.73% of the total WTP. Proving that the hydropower dam has become a tourist destination, both Riau and West Sumatra communities. Tourist destination not only enjoys the natural scenery is also fishing. The second reason is that they are willing to pay in order to encourage a well-maintained environment (Table 2).

The power users were still willing to pay more in addition to the fees already incurred each month. Households with power> 450 Watts has accumulated contribution for forest and land rehabilitation of Rp. 0705 M (30.14%) and home power users <450 Watt Rp.0.481 M (20:56%). The rehabilitation finance of household electrical value less than reservoirs tourist, meanwhile the value of economic, tourist household electricity is much greater than the reservoir tourist, this is because users generally assume that household electricity they use is already paid through accounts each month for it all needs related to other operations is the government's obligation in this regard state electricity company.

Willingness to pay of water users for paddy rice is Rp.0.029 M (1.24%) values were calculated for 2 (two) times the processing of rice in 1 (one) year. Production, in general, enjoys themselves with family, even if they are selling is in the form of rice. Income derived from rice farming is not sufficient for a decent living. Because of the difference in selling hem with small production costs. But for the sake of availability of sustainable water and land to rehabilitate the farmers aware of important and are willing to pay.

Farmers depend floating net cages all their lives from hydroelectric reservoirs. A productive effort which has been running from 2002 developed so rapidly. This is evident from the data cages development from year to year. They realize that the quality and quantity of water in the reservoir must be continued. For that, they are willing to pay to help keep forest land and conservative treatment, which will be utilized on any upstream farmers yields, which in this case all three (3) months and calculated for 1 (one) year. WTP values floating net cages farmers Rp 0.014 M (00:06%), it's nominal individually large enough, but the overall look small because the number of farmers is also at least compared to other users.

Total Economic Value (NET) Utilizing Water Resource Services

The total economic value of water resources is a merger between the total economic value of water every sector added a total willingness to pay (WTP) of each sector. In detail, the total economic value of water resources upstream watershed Mahat presented in Table 3. Table 3 showed that the average percentage of the value of willingness to pay (WTP) of forest and land rehabilitation costs DAS Mahat Hulu from all sectors is (5.47%). How much percentage of the fair value of the willingness of rehabilitation of a total economic value of water resources has been no determination of the value of its guidance due to the amount of compensation given to the users of environmental services

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provider in the economic environment, the value of the benefit is not having market value (non-marketable); it due to the nature of externalities, in which the profits or benefits of environmental management or losses and environmental damage costs are out of the market system. Application of environmental economics in the protection and improvement of the policy environment facing some problems, such as difficulty in identifying and quantifying environmental services, the difficulty of valuation gains and the high cost and the time factor (the discount), including the assessment of environmental services based on people's willingness to pay for better environmental services (compensating variation) or willingness to accept payment when services are obtained more inferior (equivalent variation). However, if the percentage of willingness to pay (WTP) rehabilitation cost is compared with the value-added tax (VAT) on goods or services that are enjoyed by consumers by 10%, then the percentage of willingness to pay (WTP) of consumers beneficiaries of environmental services especially water catchment Mahat Hulu is still very small. As well as research results of Pramod AA (2009) in which the WTP analysis shows that public awareness of the environmental benefits of forests is still low. When compared with the respondent's income in Sub Cisarua WTP value is only 0.18% of their income and in the Mega Mendung District, only 0.21% of the family income. This suggests that the appreciation in Hulu DAS Ciliwung of environmental services is very low. They tend to be short-sighted (myopic view), on the condition that they feel at this moment, and do not consider the risk of the loss of forest for their living environment in the future.

Table 3: Total economic value of water resources

No.	Type of Use	Value oak.(Rp / M)	WTP value (USD / M)	Value oak. Total (Rp / M)	Value of oak. (%)	WTP / EKT (%) *
1	Rice farming	0.676	0,029	0.705	1.31	4:11
2	Tourism	5.628	1.11	6,738	12.54	16.47
3	reservoir	9.849	0,014	9.863	18.36	0.14
4	Floating net cages	22.180	0.705	22.885	42.60	3.08
5	RT power (> 450) RT power (<450)	13.046	0.481	13.527	25.18	3.56
	Number	51.381	2,341	53.722	100	

IV. Conclusion

There are several conclusins made. First, watershed management has many benefits for human well-being; either can be used directly or not directly utilized. Use the value of watershed management that does not directly include the use of water for agriculture, control of erosion, sedimentation, flooding, landslides, air conditioning, waste recyclers and absorbent carbon from the atmosphere. Direct benefits can be consumed by people and could be marketed among other products of food crops, horticulture, medicinal plants and wood. Second, the total annual economic value of water resources Mahat watershed upstream of Rp. 51.381 M, is the contribution of the electricity sector RT (> 450 watts) of Rp. 22.180 M, electric RT (<450 Watts) Rp.13, 056, floating net cages Rp 9.849 M, tourist Rp.5 reservoirs, 628 M, and agricultural wetlands Rp.0.676 M. The amount of total economic value can be used as the minimum value that must be compensated if the watershed land will be converted or utilized as well as a performance assessment basis watershed management more accountable. Increase the total economic value of watershed showed a good performance and a healthy watershed while decreasing the total economic value of the watershed basin showed a decrease in performance and criticality. Third, rehabilitation value of willingness to pay (WTP) of Rp 2,341 M / year, which is the contribution of the electricity sector RT (> 450 watts) of Rp. 0.705 M / yr, Electrical RT (<450 Watts) Rp.0, 481 M / yr, floating net cages Rp 0,014 M / yr, reservoirs tour Rp1, 11 M / yr and wetland agriculture Rp.0.029 M / yr. Penermaan WTP amount is much more than virgin reforestation Bedar Government allocated

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only Rp 1.5 M in 5 years (Rp 300 million / yr) indicates the magnitude of downstream and upstream cooperation opportunities for better watershed management. Fourth, public understanding of environmental services downstream water resources is very high as evidenced by the level of percentage, which agreed to pay more to save water resources average of 89.4%.

As the suggestions, first, the total economic value of the watershed can be used as a minimum value of compensation in land use in the watershed and as a basis for watershed management performance assessment can be justified scientific. Second, the magnitude of the total economic value of watershed resources can be integrated into the calculation of the domestic product and watershed areas that sustainability management

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