

Economic Valuation of the Mangrove Forest in Metinaro Coastal, Timor-Leste

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Abstract

The coastal area mangrove ecosystem is one of the natural resources with an important role viewed from the ecosystem, economic, and social points. The natural resources have an economic potential as the place to get wood, spawning ground, nursery ground, and feeding ground for fish and other marine biotas, as well as sea wave breaker and protector of sea water intrusion into the land. This study was aimed at analyzing economic valuation of the mangrove forest total ecosystem in Metinaro Coastal, Timor-Leste, which was done on the first of December, 2014 until the first of January, 2015. This study was a descriptive qualitative research using a survey method. The data collected have the aspects of direct values (firewood, building wood, palm leaves, fish, shrimps, and crabs), indirect values, choice, and existence, and the use of mangrove forest ecosystem as the source of livelihood. Based on the total economic valuation of the mangrove forest in Metinaro with the area of ± 249.88 ha has the values of about Rp.19599.75, Rp.24,739,600, Rp.508,000, Rp.47,729,775, Rp.25,387,300, and Rp.13,360,400 million in terms of direct value as firewood, direct value as house building materials, direct value as palm leaves, direct value as direct value as fish, direct value as shrimps, and direct value as mangrove forest ecosystem respectively every year. The indirect use value (something that restrains or resists abrasion) is Rp.4,584,700 million a year, choice (biodiversity), Rp.6985 thousand/ha/year, existence (willingness to pay the existence of mangrove forest) Rp.12,395,200 thousand/ha/year. In general, the total economic value is Rp.149,002,750 every year and this becomes the reference for the government to determine the policy of managing and using the mangrove forest.

Keywords

Economic, Valuation, Mangrove, Use Value

1. Introduction

Metinaro is a unique area in managing mangrove forest compared to other areas in Timor Leste. The uniqueness is known based on the fact that the location is surrounded by hills but has a mangrove forest with the area of 249.88 ha which spreads along a coastal line. The mangrove forest gives benefits to the local community, ecologically, and economically and socially. The forms of uses of the mangrove ecosystem made by the local community as in other coastal areas in developing countries are as the source of firewood, the place for catching games, fish, crabs, shrimps, building materials, landfill, and place to raise livestock.

Metinaro people see the mangrove forest as public property which can be made use of freely that its preservation is ignored. Generally, the mangrove forest is used as the place that provides food, timber, and healthful material and an environment which can be differentiated into five functions, i.e., physical, biological, chemical, economical, a recreational, and scientific a place to do a research. The people are aware that the economic value of the mangrove forest ecosystem is high enough that the area becomes the main target of various exploitative activities and this makes it shrink in size from time to time. Hamilton and Snedaker (1994) in Dahuri et al., (2004), notes that around 58 direct and indirect products can be obtained from mangrove which includes firewood, building material, fertilizer, paper raw material, food material, materials for medicine and drink, household equipment, textile raw material, leather, wax, and a place for recreation. In the last 8 years period (2006-2014) degradation occurred in the ecosystems such as mangrove forest, barrier reef, sea grass as the supports of the main marine biotas on Metinaro beach. Three main biotas (mangrove, barrier reef, and seagrass) of the supports of marine biotas have undergone significant enough degradation (Talakua, 2013). As the triggers are the opening of a new area in Metinaro beach as shrimp, fish, crab ponds and the exploitation of mangrove wood. On the one hand, the mangrove forest ecosystem degradation in Metinaro has reached a critical level. On the other hand, the resources of the mangrove forest are potential in supporting the welfare of the people and the productivity of the surrounding areas. Thus, there is a need to consider the economic value of the mangrove forest to obtain the benefit and cost of the resource in terms of money which take the environmental aspect into account. The total economic value is the instrument which is seen as an appropriate instrument to calculate profits and losses for household welfare as the effect of natural resource allocation (Talakua, 2013). Furthermore, the valuation of total mangrove forest resource is done through all functions and benefits of the forest both marketable and nonmarketable, which form the effort to improve information which can give the contribution to the management of sustainable mangrove forest. In terms of total economic value, the management of the mangrove forest is very important for raising income for the welfare of Metinaro Coastal community, in every area and nation, the welfare of the community is always the main concern in today's

community development. The community is expected to guard and preserve the mangrove forest ecosystem in order its exploitation is sustainable to achieve Timor-Leste community welfare in general and Metinaro community in particular. Based on the explanation in the background above, the aim of this study is to analyze the total economic value of the mangrove forest and the environment in Metinaro Coastal, Timor-Leste, so that a method to manage the mangrove forest ecosystem which is economically and environmentally viable can be found.

2. Methods of Research

2.1. Time of Research

This research was done on the first of December 2014-the first of January 2015 in Metinaro Sub District, Timor-Leste.

2.2. Equipments and Materials

2.2.1. The Equipment

The maps used in this study were among others, the geographical map of the earth morphology or the map of the area) with the scale which was adjusted to the area of the study.

2.2.2. The Materials

A writing book and ballpoints and some other materials used to record and to know the social, economic and cultural aspects of the local community.

2.3. Population and Sample

2.3.1. Population

In qualitative research, the relation between population and sample is very close, since the population is the whole objects that are studied (Suyanto & Sutinah, 2005). Thus, the population in this study was all the people (4631) who live in Metinaro, Timor-Leste.

2.3.2. Sample

Some of the people in Metinaro who use the mangrove forest directly.

2.4. Sampling Technique

This study used the purposive sampling technique to draw a sample on the site of study. Purposive sampling is a sampling technique to select a sample of data sources with a certain consideration (Sugiyono, 2010). Then, this certain consideration, for example, those persons are regarded the people who know best about what is expected, or maybe they are the authorities so that it will make it easier for the researcher to explore objects/social situations under investigation. Thus, in this study, the sample was selected, taken and believed to make it easy for the researcher to obtain data expected. The sample consisted of some people who directly accessed the mangrove forest in Metinaro, Timor-Leste studied.

2.5. Types of Data

2.5.1. Primary Data

The primary data were obtained directly through a field survey method from the people who accessed the mangrove forest ecosystem directly. The researcher used quantitative descriptive study.

2.5.2. The Type of Secondary Data

The secondary data came from the village office and other related offices.

2.6. Sources of Data

2.6.1. Primary Data Source

The primary data were obtained directly from the site of research in the form of accurate information coming from the first source, usually the respondents. An interview is a form of verbal communication, thus a kind of conversation aimed at obtaining information (Nasution, 2003).

2.6.2. Secondary Data Source

Secondary data do not come from the first source which is the means to answer questions studied, but from related offices and mass media.

2.7. Technique of Data Collection

The technique of data collection is a method which can be used by a researcher to collect data (Mihidin & Abdulrahman, 2007). Data are facts or information about a certain incident which can be used as material to arrange information which is reliable, and the information is expected to give information which is supported by facts and accurate data about a certain incident which is believed to be true. The questionnaire was used to collect social economic data. It is a technique of data collection in the form of posting written questions through a list of questions that have been prepared first which have to be answered by respondents (Mihidin & Abdulrahman, 2007). The respondents in this study consisted of 93 heads of families who have been selected at random, with the reason that the respondents can directly access the mangrove forest as their source of incomes.

2.8. Technique of Data Analysis

2.8.1. Total Economic Value (TEV)

This approach was used to add up the total economic use identified and quantified. According to Suzana et al. (2011), the total economic value of the mangrove forest is the sum of all uses of the mangrove forest identified and qualified. The total use was found by using the following equation.

$$TEV = DV + IV + OV + EV...$$

Note:

TEV = Total economic value (NET)

DV = Direct value (ML)

IV = Indirect value (MTL)

OV = Optional value (MP)

EV = Existence value (ME) (Suzana, et al., 2011)

The technique of computation was used to value a natural resource so that the total economic value is the addition of all the economic values of the mangrove forest ecosystem with the result of data processing from various users that exist in Metinaro area as follows:

2.8.2. Direct Use (ML)

Direct use is the value resulted from the direct use of the mangrove forest as fish caught, firewood, and tourism (in Rupiah) (Fauzi, 2002).

$$ML = ML_1 + ML_2 + ML_3 + \dots + ML_n$$

Note:

ML = Direct Use

ML₁ = Direct use of firewood

ML₂ = Direct use of building material

ML₃ = Direct use of palm leaves

ML₄ = Direct use of fish

ML₅ = Direct use of shrimps

ML₆ = Direct use of crabs

2.8.3. Indirect Use (MTL)

Indirect use is the value felt indirect about the goods and services produced by a resource and environment (Fauzi, 2002). According to Fahrudin (1996), the indirect value of a mangrove forest is obtained from the ecosystem indirectly like as something that restrains or resists abrasion. Mayudin (2012) states that indirect value consists of the use as something that restrains or resists abrasion, prevents sea water intrusion, and supplies fertile soil, which can be written mathematically as follows:

$$MTL = MTL_a + MTL_i + MTL_b + MTL_e$$

Note:

MTL_a = Indirect use as the blocking of Coastal abrasion

MTL_b = Indirect use as the prevention of seawater intrusion

MTL_b = Indirect use as the supplier of fertile soil

MTL_e = Indirect use as mangrove ecotourism. But reforestation becomes very important in Metinaro today.

2.8.4. Optional Use

According to Fahrudin (1996), the optional use is a value that shows someone's willingness to pay to preserve the mangrove ecosystem for future use. While according to Ruitenbeek (1991), this value is approached by referring to biodiversity value of the mangrove forest in Indonesia, that is, 1500/km²/annually or USD.15/ha/annually.

$$ME = \sum_{i=1}^n \frac{ME_i}{n} \quad (\text{insert in rupiah})$$

Note:

ME = existence use

ME_{*i*} = existence use for the *i*th respondent to the *n*th respondent.

n = total number of respondents (persons) (Hiarley, 2009).

2.9. The Conversion of All Uses and Functions into Rupiah

After all of the uses can be identified, then it is quantified into money (rupiah) with the following values as follows.

2.9.1. Market Value

Market value by computing the economic value of the commodities that can be used from the mangrove resource. According to Hiarley (2009), the market value approach is used for the components of the resource that can be sold, for example, mangrove wood and fish.

2.9.2. Nondirect Price

To value the biological component (the provision of feed) and to value the use of physical component (wave breaker).

2.9.3. Contingent Value Method (CVM)

This approach is used to quantify/compute the optional value of a component of resource which cannot be sold in the market, for example, the existence value. According to Fauzi (2002), the last step of CVM is done by converting the means of the sample. This process involves the conversion of the mean of the sample into the mean of the whole population, one of the examples is the conversion of the sample mean into the mean of the number of households in the population (N), in this case, the population of Metinaro district.

3. Results and Discussion

Mangrove forest ecosystem in Metinaro has given many economic uses to the surrounding community who have lived there for a long time. According to the results of survey and questionnaire data, there are some types of use obtained by Metinaro community from the mangrove forest ecosystem, and this use can be grouped into 4, i.e., direct use, nondirect use, optional use, and existence use, and as the consequence, the result of the survey and questionnaire about various uses obtained from the mangrove forest ecosystem is discussed below.

3.1. Direct Use Value

The mangrove forest ecosystem has an important role and functions as the economic resource and ecological resource for human life (Zulkarnaini & Mariana, 2016). The direct use is the result obtained by the community as the result of direct interaction with the natural resource to meet the people's needs and the resource is used as the source of livelihood. Based on the result of questionnaire, in general, the direct use of the mangrove forest obtained by the people of Metinaro consists

of the use of the forest products and the use of fishery which is included in 6 (six) categories of use which are obtained in a larger quantity by the people, based on the order of details of the direct use which include:

3.2. Direct Use as Firewood

Wood is one of the fuels used by the people in Metinaro, usually as the main fuel since oil is expensive and difficult to find. According to the people of Metinaro, one of the types of wood which can produce a high temperature and lasts long is mangrove wood. The species which are often used by the local people as firewood are *Rhizophora* sp., *Bruguiera* sp., and *Ceriops* sp. The species that are felled to produce charcoal is generally *Rhizophora* spp. since it has a high enough calory while-while for firewood almost all trees are used (Setyawan & Winarno, 2006). The people who get firewoods from the mangrove forest usually use it for their household requirements and some of them are sold. The people of Metinaro get the woods Twice to three times a week with 4 to 6 bundles at a time. The price of a bundle of firewood as fixed by the local community is USD.0.24 or equivalent to Rp.3175, thus according to Bloomberg Dollar Index on Tuesday on the 16th of December 2014 at 09:04, the exchange rate was Rp.12,700/1US\$, thus the value of mangrove firewood can be seen in **Table 1**.

Table 1. Direct value as firewood.

No.	Description	Unit	Total	Average
1.	Number of respondents	person	93	93
2.	Price per unit	Rp/bundle	USD.0.25 cent/bundle	Rp 3175
3.	Value	Rp/year	USD.1543.5 cents/year	Rp 19,599,275 a year

Source: Primary data in December 2014.

3.3. Value of Wood as Building Materials (House or Fence)

Based on the result of the questionnaire about the use of mangrove wood for house construction from all the respondents, not all of the people use mangrove as their building material, and to build a unit of the house the quantity varies depending on the size of the house built. The people of Metinaro regularly take building wood with a frequency 4 to 5 times a year, sometimes 6 - 7 times in a year depending on the need. If the people use mangrove wood, they fix a price at US\$2.00 and is equal to Rp.25,400 for wood with a small diameter, at USD.10 or 127,000 for a medium size and at USD.15.00 (Rp.190.500) at the minimum each piece. Mangrove wood for house construction is more durable compared to other kinds of wood and this makes the people choose mangrove wood to build a house. For building materials, in addition to using *Rhizophora* spp, people also use *Sonneratia* spp. and *Bruguiera* spp. (Setyawan & Winarno, 2006). The mangrove wood used to build a house can last for more than 5 years, this makes the people of Metinaro have no problem when it comes to the need for wood. Although the use of mangrove wood becomes less frequent today, mangrove wood is still used for

garden fences and for making animal pens which are increasingly more common. This can be seen in **Table 2**.

Table 2. Direct value of house building material.

No.	Description	Unit	Total	Average
1.	Number of respondents	Person	93	93
2.	Number of use	a) large piece	>6	6 - 8 pieces
		b) medium piece	>30	30 - 40 pieces
		c) small piece	>60	60 - 85 pieces
3.	Price/unit	a) large piece	15 dollars	Rp.1,143,000 up to Rp.1,524,000
		b) medium piece	10 dollars	Rp.1,143,000, up to Rp.1,524,000
		c) small piece	2 dollars	Rp.1,524,000 up to Rp.2,159,000
4.	Cost for taking	Expenditure	5 dollars	Rp.63,000-
5.	Duration of use	Year	>5 years	-
6.	Value	Rp per year	USD1948	Rp 24,739,600 per year

Source: Primary data in December 2014.

3.4. Direct Use of Palm Leaves

Economically, the people of Metinaro are still below the poverty line and that is why they choose palm leaves as their house roofs since the price are cheap, they are easy to make, and the people are comfortable enough and are in the habit of using them as house roofs. Especially to protect them from hot temperature during the day time. Based on the questionnaire distributed to the respondents, not all of them use palm leaves as house roofs, since some of them use corrugated irons as house roofs. Not all the people who use palm leaves use them as house roofs but some use them as kitchen roofs. The number of palm leaves used by the people for houses is great enough, depending on the size of the houses and the kitchens built at USD.0.50 cent (Rp.6350) a ready to use the leaf. Every time palm leaves are taken as roofs, the people can use up to 7 big bundles (70 leaves) of palm leaves. Every time the people buy them they usually spend about USD\$.5.00 (Rp.63,500) for buying fuel, cigarettes, betel nut, and food. The palm leaves used by the people for house roofs can last up to 3 years. This can be seen in **Table 3**.

Table 3. Direct use of palm leaves.

No.	Description	Unit	Total	Average
1.	Number of respondents	Person	93	93
2.	Number of use	Sheet	7 big bundles	70 sheets
3.	Price per unit	Rp/sheet	USD.0.50 cent/sheet	Rp 444,500-
4.	Cost for taking them	expenditure	USD.5.00	RP 632,500-
5.	Duration of use	year	>3 years	-
6.	Value	Rp per year	USD.35.00-	RP 508 per year

Source: Primary data in December 2014.

3.5. Direct Value of Fish

Some of the people in Metinaro are fishermen with a variation in the frequency of fishing each day, thus the catches also vary from 2 kg to 9 kg at one time. The catch is mostly sold to collectors especially coral fishes like red fish, bubara, garopa since they are expensive compared to pelagic such as gutila/kapas, mop mar, kom-bong, cakalang, nipih, Carden, gabus, etc. The other fishes caught are not sold but are consumed alone or given to their relatives. The prices of fish sold vary depending on whether the collector buys directly in the location of fish caught at the price per kg between USD.2.00 (Rp.25,400) up to USD.25.00 (Rp.317,500). In terms of the selling price for the species of fish, it is cheap enough compared to the price in other places. Because the people are poor, they sell at the price the buyers can afford in order the fish is sold out. In relation to the fund which is not enough for meeting daily needs, the people cannot buy fish containers, ice to preserve fish if it is not sold out, thus they would better sell the catch to the collector at varied prices depending on the species. See **Table 4**.

Table 4. Direct use of fish.

No.	Unit	Total	Average
1. Number of respondents person		93	-
2. Price per unit	Rp/kg	USD 2.00 the cheapest USD 25.00 the most expensive	Rp 25,400 Rp 317,500
3. Value	Rp/year	USD 3758.25	Rp 47,729,775/year

Source: Primary data in December 2014.

3.6. Value of Shrimps

Based on the respondents' response to the questionnaire, the activity to catch shrimps is not regular and is usually done once in a week or depending on when shrimps can be caught since it is difficult to catch shrimps because the mangrove ecosystem as a spawning ground and nursery ground has been damaged. Every time people fish shrimps they can only get 1 - 2 kg, so that on the average with the price for 1 kg at USD.7.00 (Rp 88,900). The expense for every time the people fish shrimps is around USD.1.00 (Rp.12,700) up to USD.5.00 (Rp.63,500). This can be seen from **Table 5**.

Table 5. Direct use of shrimps.

No.	Description	Unit	Total	Average
1.	Number of respondents	person	93	93
2.	Price per unit	Rp/kg	USD.7.00	Rp.88,900/kg
3.	Value	Rp/year	USD.1999	Rp.25,387,300/year

Source: Primary Data in December 2014.

3.7. Direct Use of Crabs

The activity to catch crabs is not regular, but on average, it is done once a week or

depending on the time when they can be caught since it is difficult to catch crabs since the mangrove forest ecosystem as spawning and nursery grounds has been damaged. Every time people catch crabs, they can get 1 to 2 kg only, thus on average with the price for 1 kg at USD.6.00 (Rp.76,200). However, the expense for each time of the activity of catching crabs is around USD.1.00 or (Rp.12,700) up to USD.5.00 (Rp.63,500). This can be seen in **Table 6**.

Table 6. Direct use of crabs.

No.	Description	Unnit	Total	Average
1.	Total of respondents	Person	93	93
2.	Price per unit	Rp/kg	USD.6.00-/kg	Rp.76,200/kg
3.	Value	Rp/year	USD.1052 per year	Rp.13,360,400-per year

Source: Primary Data in December 2014.

Based on the result of analysis of the direct use of mangrove ecosystem in Metinaro, the total direct use value can be quantified as shown in **Table 7**.

Table 7. Quantification of direct value of mangrove forest ecosystem.

No.	Types of direct use	Net use value (Rp/year)
1.	Value of firewood	Rp.19,599,275/year
2.	Value of building wood	Rp.24,739,600/year
3.	Value of palm leaves	Rp.508,000/year
4.	Value of fish	Rp.47,729,775/year
5.	Value of shrimps	Rp.25,387,300 year
6.	Value of crabs	Rp.13,360,400/year
	Total	Rp.131,324,350/year

Source: Primary Data in December 2014.

3.8. Indirect Use Value

In addition to direct use of the mangrove forest ecosystem as mentioned above, there is also the use that is not directly felt about goods and services produced by the resources and their environments especially the mangrove forest ecosystem. The responses to the questionnaire about the indirect use of the mangrove forest in Metinaro show that the respondents feel that the mangrove forest restrains abrasion and erosion, but the indirect use actually cannot be measured by the market value but we need to consider the cost approach in conducting a conservation. The use of the mangrove forest as something that restrains abrasion and erosion need to be approached by considering the cost of building a wave breaker (Marhayana et al., 2012). The length of the coast in Metinaro where mangroves grow based on GPS tracking is about 12.000 meters, thus the activity of constructing wave breakers to prevent abrasion and erosion and the reforestation done

along the coast which has undergone a damage is estimated at USD.361.00 or Rp.4,584,700, and if the average age of the wave breaker and the activity of reforestation is 5 years, then based on the result of quantification of the indirect use of the mangrove forest in Metinaro, the total indirect use is USD.361.00 per year or Rp.45,847/ha/year. On the other hand, the ecological benefit, as protection, control and maintenance are very important but the people's concern of it is rather low. The ecological service, including the protection against flood and hurricane, control of erosion, and the maintenance of water quality are very important for the sustainability of the cultivation system (Ronnback, 1999).

3.9. Option Use

Mangkay et al. (2013), option value for mangrove forests being estimated with the benefits transfer method, i.e. by way of estimating the benefit of resources from other places then the benefit is transferred to obtain an estimate of the local resource benefits. In line with the above view, Purnobasuki (1992) in Maedar (2008) states that the benefit value of the option is estimated by referring to biodiversity value of the mangrove forest (*biodiversity*) of the mangrove forests in Indonesia, i.e., USD.1.500/km/year or USD.15/ha/year. Based on the map of the spread of the mangrove forest ecosystem in the area of Metinaro with the total mangrove forest today of 249.88 ha, then if we multiply it with biodiversity of the mangrove forest mangrove di Metinaro st US\$.15/ha/year, then the value of the mangrove forest ecosystem in Metinaro today reaches USD.55.00 or Rp.698,500 per year, thus the total benefit value of the option of mangrove forest ecosystem in Metinaro is USD.0.55 cents/ha/year or Rp.6985/ha/year.

3.10. Existence Value

In addition to some benefits above, there is another benefit which is very important in this study, which is existence value of the mangrove forest in Metinaro. The computation of the existence value is based on contingent value method (CVM) or survey method. According to Pearce (2001), the economic measurement which is relevant is the willingness of individuals to pay for their benefits. The survey was done to find out the people's willingness to pay/WTP for the existence and every benefit obtained from the mangrove forest ecosystem. The result of the survey and questionnaire with 93 respondents shows that 5 respondents are willing to pay for the existence of the mangrove ecosystem while the rest are not willing to pay for the reason that they do not have money to pay it. The percentage of the benefit value of the existence is that from the 93 respondents the ones willing to pay is 5% or 4.65%, thus the people's concern about the existence of the mangrove forest in Metinaro is rather low. This shows that the people have different values concerning the existence of mangrove forest around Metinaro because they have the perception that the area does not belong to anyone and thus they do not need to pay for its existence to the authorized agency. Based on the responses to the questionnaire, the average value of the benefit obtained from the existence

of the mangrove forest in Metinaro is U\$D.976.00-per year or Rp.12.395.200 per year. The area of the mangrove forest in Metinaro existence now is around 249.88 ha, so that the total values of the existence of mangrove forest in Metinaro is around U\$D.9.76. cent /ha/year or Rp.123.952-/ha/year.

3.11. Total Economic Use of the Mangrove Forest Ecosystem in Metinaro, Timor-Leste

Based on the result of analyses of all values of the mangrove forest ecosystem in Metinaro, Timor-Leste which consist of direct use, indirect use, option use, and existence value, which were then quantified from dollars into rupiahs, then the total economic use is found as shown in **Table 8**.

Table 8. Total economic value of mangrove forest in Metinaro, Timor-Leste.

No.	Type of use	Value (Rp/year)	Value (Rp/ha/year)
1.	Direct use	Rp.131,324,350 per year	Rp.1313243.5/ha/year
2.	Indirect use	Rp.4,584,700 per year	Rp.45,847/ha/year
3.	Option use	Rp.698,500 per year	Rp.6985/ha/year
4.	Existence use	Rp.12,395,200 per year	Rp.123,952/ha/year
	Total	Rp.149,002,750 per year	Rp.1490027.5-/ha/year

Source: Primary Data in December 2014.

Based on **Table 8** above, the total economic value of the mangrove forest is very high. It is very important for the people of Metinaro. Thus it can be said that the value of the mangrove forest ecosystem has the most important role in the community of Metinaro. This result shows that the e function of mangrove has an important role in supporting the local community livelihood (Malik et al., 2015). This corresponds to the respondents' opinion that the existence of mangrove around their village gives a positive impact on their life. One of the impacts that they feel is the stock of firewood and fish which is abundant so that it is known that one of the benefits of the mangrove forest ecosystem is a place to look for firewood and a refuge for fish and other marine animals. It is this that makes some people try to damage the forest but on the other hand, some of them keep and maintain the condition of the ecosystem from a more serious damage.

The total economic value consists of direct value and existence value. The people of Metinaro make use of natural resources inside and around the mangrove forest in a limited way. This can be seen from their condition which is traditional enough with limited human resources and simple implements. When we see direct value and existence value in **Table 8** there is a significant difference, although the people say that the direct value that feels is almost comparable to the existence of the mangrove forest. The people's appreciation of the existence of a natural resource is comparable to the economic value from the direct value that they get. Thus, if the direct value that they get is high, it can ascertain that it will be pro-

portional to the existence value. If the direct value keeps increasing it will decrease the indirect value. When people exploit the resource on a large scale, it will put a pressure on the mangrove natural resource, and if this continues, the mangrove natural resource will be eroded and become extinct. Finally, the direct value will be over together with the loss of the natural resource.

The next proportion is option value, the existence of the mangrove forest as one element in biodiversity which is valued at \$15/ha/year. Considering the area of mangrove forest in Metinaro as large as 249.88 ha, this value is small. It will be different if the value of the biodiversity of the mangrove forest is greater than the value which was set before. Although the option value and the existence value of the mangrove forest in Metinaro are small, however, the mangrove forest as a biodiversity has a very great potential for meeting the need of Metinaro community at present.

4. Conclusion

1) The direct use value of the mangrove forest in Metinaro which is used by the local people directly consists of 6 types, which are: firewood, wood for building material, palm leaves, fish, crabs, and shrimps. The total economic value of the six types of benefit above includes the total direct use value of Rp.131,324,350 per year; the total of the indirect use value of Rp.4,584,700 per year; the total of option value of Rp.698,500/year and the total of existence value of Rp.12,395,200 per year.

2) The ecosystem of mangrove forest in Metinaro with the area of 249.99 ha can produce the total economic value of Rp.149,002,750 per year or Rp.1490027.5/ha/year for the community of Metinaro with the total population of 4631. The high economic value is not proportional to the level of the people's welfare since the money goes more to the meeting of the need for custom or tradition which is relatively higher than for rehabilitation of damage in the mangrove forest ecosystem.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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