

Economy Valuation of Mangrove Forest Usage in Bangkalan Regency, Madura Island of Indonesia

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ABSTRACT

Generally, ecosystem of mangrove in Indonesia is systematically experiencing degradation as well as in Madura, but this condition does not happen in Bangkalan. There ever happens the decreasing of mangrove forest area number in the period of 1994 to 2002 such as from 1,380.87 ha to 590.05 ha. This condition was opposite from 2002 to 2010, the mangrove forest area number was significantly increasing of 1,575.66 ha, so it is reaching 2,165.71 ha now. It was estimated that the increasing of mangrove forest was caused by real participation of the society and their consciousness to economical value of mangrove forest existence. This research intended to investigate the economical reason from society action for carrying out the conservation of mangrove forest in Bangkalan Regency. Therefore, in depth analysis, this research would carry out the valuation to mangrove forest with the mangrove forest service components included: 1) direct use value such as fire wood and mangrove leaf which was exploited along year; 2) indirect use value such as commodities of oyster, nightshade, crab, shell-fish, and fish which were came from surrounded of mangrove forest area; 3) optional value; and 4) existence value. Based on the economical valuation analysis of mangrove forest in Bangkalan Regency, results showed as follow: 1) direct value was Rp. 2,700.00./ha/year; 2) indirect benefit was Rp. 32,100,000.-; 3) optional value was Rp. 675,000./ha/year; and 4) existence benefit was Rp. 8,150,000./ha/year. Therefore, economical benefit total of mangrove forest reached Rp. 43,625,000./ha/year and it was still higher than the other usage alternative mainly for expansion of residential area number of Rp. 37,000,000./ha/year. These results were as the base reason of society to maintain the existence of mangrove forest as the rational decision economically.

KEYWORDS: economical valuation, mangrove forest, opportunity cost

INTRODUCTION

Indonesia with the length of coastal line reaches 95,181 km [1] has the base asset as shore resources development such as mangrove forest resource. According to Mulyadi [2], shore area of Indonesia has some types of potential environmental services for development interest and even human life. Environmental services include the function of shore area as the recreational and tour place, energy source, educational facility and training, defence and safety, climate regulator, and protection region. The development failure of shore area is often sustainably caused by the society failure in giving the proportional evaluation to some resources mainly natural and environmental resources. Mangrove ecosystem as the main component of natural resources function in shore is often ignored by society. Anybody carries out the cruel action because it is assumed giving less direct economical benefit. As one of the shore ecosystems, mangrove forest in Indonesia has variety types of trees such as mangrove (*Rhizophora spp*), api-api (*Avicennia spp*), pedada (*Sonneratia spp*), and many others [3]. Nowadays, emphasis to the existence of mangrove forest has been very anxious. It was said by Janssen and Padilla [4] that mangrove forest was rapidly decreasing in many places of the world. The result was the missing on most important of environmental resource, economical function and forest productions, tidal wave control, reproduction places of fishes, etc. Function change of mangrove area into dyke, residence, industrial area, etc were as reality that was not avoided again. If the existence of mangrove area can not be maintained, it was been worry there will appear the disasters like coastal abration, pollution from river to the sea will increase because there is no pullutant filter, decreasing of aquaculture zone, losses of many fishes species and fauna that was associated with mangrove ecosystem which would disturb shore ecosystem equilibrium in long term.

Indonesia condition with tropical climate, high rainfall, and includes much calm waters is as ideal environment for mangrove ecosystem growth. According to Gunarto [5], mangrove would fertile grow up in the region of river estuary or estuary where as ending destination of organic particles or sediment of mud that concern from upstream due to erosion. Because of the higher of human activity in shore region and the rapid industrial development, it will make the existence of mangrove ecosystem being incur risk. Conversion of mangrove forest to dyke, agricultural and residential area caused the mangrove forest area was continuously decreasing. In addition, the irresponsible usage of mangrove wood as building material, fire wood, and also charcoal give not less contribution to the mangrove forest damage. As shore ecosystem, the existence of

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mangrove naturally can be maintained until decade or hundred years. Noor [6] presented that the death of mangrove naturally does not give significant contribution to the lossing of mangrove area in Indonesia. However, if the emphasis of human to mangrove forest existence can not get attention, it will be fearful that the degradation rate of mangrove resource will be faster than the estimated rate. According to Widigdo [7], in the year of 1999 mangrove forest area number has reductioned to 2.5 millions ha. Mangrove ecosystem damage in Madura was marked by the decreasing of mangrove forest area number in some locations. Khomsin [8] noted that mangrove forest area number in Sampang Regency has reduction from 564.1 ha of 1990 to 373.25 ha of 2003. Suprakto [9] expressed that area number reduction of mangrove in Pamekasan reached 156.66 ha from 1990 to 2002. Based on the previous research result, number area of mangrove forest in Bangkalan Regency was continuously decreasing from year to year. During the period of 1994 to 2002, mangrove forest in Bangkalan Regency has decreased from 1,380.87 ha to 590.05 ha. The higher conversion level of mangrove forest was caused by function change to residential area at surround of Bangkalan city region, Socah, and Arosbaya, but a little part has changed function into dyke such as Klampis District, Sepulu, and Tanjungbumi. It indicated that there was very serious emphasis to mangrove forest existence mainly for the expansion of residential region.

Nowadays, mangrove forest condition in some places of Indonesia indicated very big dynamic. In one side, there was a large scale of mangrove forest conversion to the other interest like residence, industry, and new dyke region, but in the other side, there were many programs of go green program and mangrove forest campaign by government as well as Non Government Organization (Society Empowerment Department, LSM) and the increasing of society organizations consciousness which caused significantly increasing of mangrove area number. Researcher was interesting to see the opposite phenomena with the cases in the other places. If in some places of world, mangrove forest has damaged experienced, but there was opposite condition in Bangkalan Regency. During the period of 2002-2010 there was the mangrove forest area number increasing of 1,575.66 ha, so mangrove forest in Bangkalan Regency reached 2,165.71 ha. The objective of this study was to investigate the economical reason of society action for carrying out the conservation of mangrove forest in Bangkalan Regency.

MATERIALS AND METHODS

The existence of mangrove forest in Bangkalan Regency in the period of 2002-2010 has experienced very significant area number from 590.05 ha to 2,165.71 ha. It was different with the mangrove forest condition in previous period and in the other region which had a trend of area number decreasing. The increasing of mangrove forest area number was caused by the more programs of coastal go green program. In addition, there was consciousness of society and being felt the direct economical benefit of mangrove forest existence. Although the government of Bangkalan Regency has never made Regional Rule (Perda) for protecting mangrove forest existence, but because of society participation at surrounded coast made mangrove forest was remain exist until now even had a trend of increasing.

Society belief of the bigger benefit if mangrove forest was remaining maintained was estimated as the main motivation why they more selected to conservation mangrove forest. In this study there would be investigated the equilibrium of benefit or cost from the management of mangrove forest between the choice of remain maintained or conserved mangrove forest existence. Therefore, it was carried out economical benefit valuation of mangrove forest.

In carrying out valuation, it was known benefit and non benefit value. Benefit value includes direct and indirect benefit value, and selected benefit. But non benefit value includes existence and inheritance value. The evaluation method can be carried out by some approaches and the most realistic is based on the shore society participation. There are two approaches such as benefit and cost approach. Meanwhile benefit approach includes based on actual and substitute market value. It was detail described as in Figure 1.

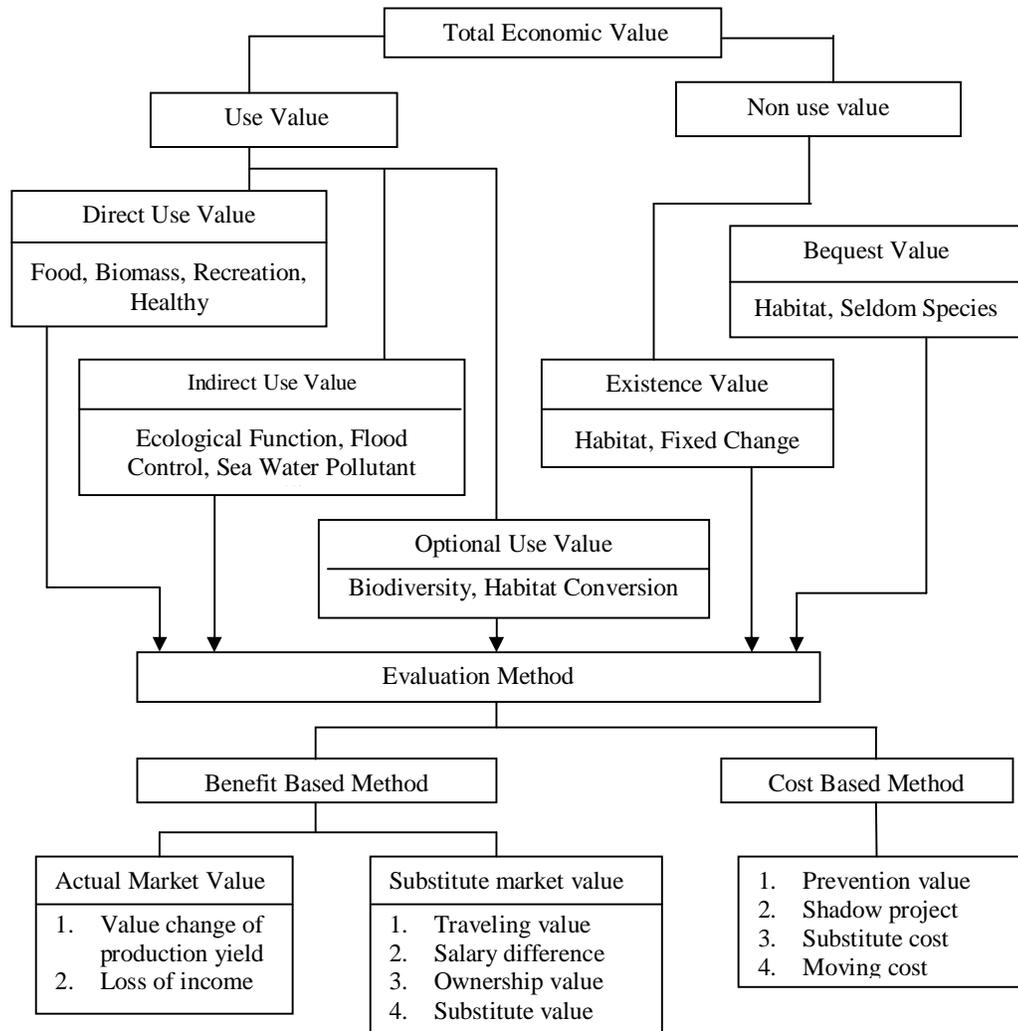


Figure 1 Economical Benefit Valuation of Mangrove Forest Resources

This study was conducted in Pejagan Village, Bangkalan Regency. The reason to select this place because this village is the closest with city expansion region and it is assumed as the most susceptible of mangrove forest conversion to the other interest like residential area or expansion of industrial area. Activity of field study was carried out on October 2011 to December 2011. This activity intended to observe objective condition of mangrove forest existence. Observed area included Pejagan Village District of Bangkalan City.

This study used primary and secondary data. Primary data was directly obtained from selected important society who knew more about dynamic cronology of mangrove forest development. Secondary data was collected from Bangkalan Regency in Number in 2010 and Fishery and Oceanology Dines Report of Bangkalan Regency in 2010. Components of mangrove forest services which were evaluated included: 1) direct benefit value such as exploited fire wood along year by society; 2) indirect use value such as nightshade, crab, shellfish, and fish which were came from surrounded of mangrove forest area; 3) optional value; and 4) existence value. For analysis of direct and indirect use of goods type that has been had market, it was used the assumption of goods value due to the local value, but for analysing environmental service value of mangrove forest, it was formerly carried out to identify the existance and optional value.

Analysis of existence use used the method of cost approach. Coast was meaned as cost potency which had to be spended by society if there was house damage caused by topan wind to society residences where were faced with free sea. In this case, the existence of mangrove forest was needed by society in protecting society residences from the topan wind.

Optional value (MP) is as the value which indicates someone preparation to pay for the maintenance of benefit in front period. Selected benefit value is estimated due to biodiversity value of mangrove forest of

Indonesia such as US \$ 1 500/km²/year or US \$ 15/ha/year [10]. This value is analyzed based on the average of change value of US\$ to Rupiah on research date. Then for analysing total benefit of mangrove forest is as follow:

Total of benefit value = DV + IV + OV + EV
 Note: DV : direct use value
 IV : indirect use value
 OV : optional value
 EV : existence value

RESULTS AND DISCUSSION

Pejagan Village has costal length of 3,000 m with the average of mangrove forest width of 300 m. Therefore, this village has the area number of mangrove forest of 600,000 m² or 60 ha. The society take benefit for the existence of mangrove forest as follow:

1. The resistor of hitting out tight wind and wave which comes from sea direction to society residence
2. To find cucumber, oyster, nightshade, and crab. Then, cucumber and nightshade was made becoming crisply bake by the society.
3. To take the fire wood.
4. Mangrove leaf is for goat weft.

Direct use value

Direct use was felt by society from the existence of mangrove forest such as society could get fire wood and mangrove leaf for goat weft. Fire wood which was collected by society was as branches with diameter of 2 cm until 10 cm and it was sold for trivet burning of cucumber and fish preparation. There were in average of two ships every day from the other village that came to this place for collecting reneck wood being sold back with the value reached Rp. 200,000.- per-ship, so for two ships it reached Rp. 400,000.- per-day.

However, the usage of mangrove leaf for goat weft still included 10 family heads (KK) with quantity of goats were 3 until 5 goats. If every mangrove leaf which was taken by every family head was priced by Rp. 5,000.-, so every day the mangrove leaf which was taken by society reached Rp. 50,000.- per-day.

Indirect use value

During the time, the society has got indirect use from the yields of mangrove forest such as oyster, crab, cucumber, and nightshade. Fishers who collected white and red oyster were 10 persons and each of them succeed to collect 2 kg of oyster with the price of Rp. 5,000.-/kg every day, so in a day mangrove forest was able to produce 2 x Rp. 5,000.- x 10 = Rp. 100,000.-. Fisher as the finder of crabs reached 5 persons and each of them got more than 2 kg of crabs with the price of Rp. 25,000.-/kg every day, so in a day mangrove forest was able to produce 2 x 5 x Rp. 25,000.- = Rp. 250,000.- per-day.

Nightshade and oyster were not taken by local population, but they were taken by other village population to be made as crisply bake. Every day the average of nightshade and oyster which were sold outside of region reached approximate to 10 kg of nightshade and dry oyster with the price of Rp. 150,000.-/kg. Therefore, in a day mangrove forest was able to produce Rp. 1,500,000.- per-day.

The most fishers were fish finder. They found fishes by installing static net at surrounded mangrove forest with average length of 100 m. The net was installed in the morning by 7 persons = Rp. 3,500,000.- When ebb water and then it was taken in the evening. One time of generation, a fisher got in average of 50 kg until 150 kg of some kinds of fishes with the average price of Rp. 7,000.-/kg. The quantity of fishers like that reached 7 persons, so if it was roughly analysed, every day mangrove forest can produce 100 kg x Rp. 5,000.- Although the position of net was rather outside from coast, but the society very believe that the existence of mangrove forest followed to function in production increasing of catching fish because fish number had positive correlation with mangrove forest width. Formerly, when mangrove forest has been more cut down for dyke interest, catching fish by static net was not as much as now.

Optional value

Optional value was estimated based on the variety biodiversity value of mangrove forest in Indonesia such as US \$ 15/ha/year or about Rp. 135,000.- [11]. This number was equivalent with Rp. 675,000.- for the value now by assumption on the change value of rupiah has reached Rp. 9,000.-/\$. If it was valued based on mangrove forest area number of 60 ha, selected benefit value of total mangrove forest reached Rp. 40,500,000.-.

Existence value

To analyze existence value of mangrove forest has to be defined formerly about what benefit could be obtained by society during the time due to the existence of mangrove forest itself. Based on the interview which

was carried out in field to the part of society of Pejagan Village shore of Bangkalan Regency, it was known that the society obtained existence value of mangrove forest due to the two reasons as follow:

1. Their residences were protected from wave destruction and wind attacking which was come from sea direction towards mainland.
2. The existence of mangrove forest helped them to prevent intrusion of sea water so the quality of groundwater in this region was still good enough.

There was used substitute cost for evaluating the two benefits as above. It meant if there was no mangrove forest, the society had potency to have mutual liability of residence improvement cost due to the destruction of wave and wind, and uncomfotability due to the decreasing of grorundwater quality which was consumed for drinking water.

It was assumed that in one season (one year) there was one case of tight wind or big wave that damaged most asset of the society mainly residence and yard. Residence damage was only analyzed for the residence where directly faced with sea and the quantity reached 75 units, while asset which was in a part of society yard like chicken and goat stable, wood yard were only belonged to little part of residence, so the substitute cost value was assumed as zero or sticking with residence improvement cost due to the tight wind or big wave. If one house in one season had potential mutual liability of house damage cost reached Rp. 1,000,000.- so it was needed about Rp. 75,000,000.- every year.

Meanwhile, every family had to spend additional budget for buying refill water because of groundwater quality decreasing. There was predicted that about 345 family heads (KK) of Barat Tambak region got this impact. If one KK allocated five gallons refill water every month with the price of Rp. 4,000.-/gallon, so one family had to spend the budget for refill water of Rp. 20,000.-/KK. Total of cost that was needed by all of Barat Tambak Pejagan Village society for buying refill water reached 354 KK x Rp. 20,000.- = Rp. 6,900,000.-/month or Rp. 82,800,000.-/year.

Total value of mangrove forest existence was the amount of the whole economical benefit which included direct and indirect benefit, selected and existence benefit and it reached Rp. 43,625,000.- per-ha per-year as presented in Table 1.

Table 1 Compilation on economical value of mangrove forest in Bangkalan Regency

| Use | Unit | Economical value | | | |
|------------------|----------------------|------------------|-------------|--------------|-------------|
| | | Per-day | Per-month | Per-month/ha | Per-year/ha |
| Direct | Fire wood | 400,000 | 12,000,000 | 200,000 | 2,400,000 |
| | Mangrove leaf | 50,000 | 1,500,000 | 25,000 | 300,000 |
| Indirect | White oyster | 100,000 | 3,000,000 | 50,000 | 600,000 |
| | Crab | 250,000 | 7,500,000 | 125,000 | 1,500,000 |
| | Nightshade, cucumber | 1,500,000 | 45,000,000 | 50,000 | 9,000,000 |
| | Fish | 3,500,000 | 105,000,000 | 1,750,000 | 21,000,000 |
| Optional | | | 40,500,000 | | 675,000 |
| Existence | Wind protection | | 75,000,000 | | 1,250,000 |
| | Intrusion prevention | | 82,800,000 | | 6,900,000 |
| Total | | | | | 43,625,000 |

Comparative analysis

Comparative analysis was intended to know cost value or equilibrium benefit of the need for conversing mangrove forest or conversing it to residential area. Before carrying out comparative analysis, at first there had to analyse economical benefit of the whole possibility to converse it to residential area. According to society information, substitute value of village for every ha of mangrove forest which would be conversed reached Rp. 300,000.-/ha now. But this value was not used because it was as fixed value and the benefit could not be enjoyed by the area owner. The value which was evaluated was how much additional value that was obtained by the owner if the area would be sold back later. Therefore, the comparing was additional value of area or the value difference due to area value change between obtained and sold time. Necessary data was value change per-unit area number per-year.

This information as above was got from Graha Mentari residential which was located side by side with study location. A unit land with the building above it was valued Rp. 80,000.- in 2010, then one year later such as in 2011, it has been valued of Rp. 90,000.-. It meant that there was the increasing of 11.1 % per-year. If obtained value was Rp. 300,000,000.- per-ha, so additional value of the area next year was Rp. 37,000,000.-/ha/year. This value was still under economic value of mangrove forest which reached Rp. 43,625,000.-/ha/year. However, it was clear that the society decision was remained to maintain economically the mangrove forest was true because they remained to obtain the benefit higher than had to converse it.

CONCLUSION

The reason of society to be remained to maintained the existence of mangrove forest was economically as the rational decision because economical benefit value of mangrove forest in Bangkalan Regency reached Rp. 43,625,000.-/ha/year. It was higher that opportunity cost for conversing it to residential area with additional value of Rp. 37,000,000.-/ha/year.

RECOMMENDATION

Based on the results as above, it was recommended to make attention for the next researchers as follows;

1. Researched data was on October 2011 to December 2011. Therefore, it is confused that it can not be more illustrated the dynamic in outside of the month mainly for fishery products which are very influenced by season.
2. Qualitative data which was collected mainly related with the standard size was still less accurate. It was caused by most of fishers were not familiar with international standard size with the unit of kg. Generally they just estimated it.
3. Unit price of catching fish selling was taken in average just for certain fish, whereas type and size of fishes were in variety.

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