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Economic Valuation of Mangrove Forest Ecosystem in Indragiri Estuary

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Abstract

Mangrove forest ecosystem is one of the natural resources of coastal areas that have an important role from the point of social, economic, and ecological. Resource mangrove forests, besides known to have economic potential as a provider of timber resources as well as a spawning (spawning ground), local care (nursery grounds), as well as areas for foraging (feeding ground) for fish and other marine life, it also serves to withstand ocean waves and sea water intrusion towards the ground. This provides consequences for the mangrove forest ecosystem itself, by the increasing levels of exploitation on the environment that is not uncommon to end the severe environmental degradation. This study aims to estimate the economic valuation of mangroves in estuaries Indragiri. Analysis of economic valuation is done by identifying the benefits and functions of mangrove forest resources through the aspects of **direct benefit value, the value of indirect benefits, the value of the benefits of choice and the benefits of existence based on the results of a questionnaire / questionnaire distributed to respondents.** The finding showed that the estimation of *total economic value* (TEV) mangrove forest in Indragiri estuary Rp. 156. 523. 498. 235/year or Rp. 6. 432. 296. 302/ha/year, including direct value, indirect value, option value and existence value.

Introduction

The magnitude of benefits of the mangrove forests ecosystem encourage the high level of its exploitation and usually resulting in degradation of mangrove ecosystems and mangrove forest conversion (Flavo et al., 2011). This is related to the human actions that do not understand the importance of the sustainability of mangrove forests. The human community simply assesses mangrove forests in terms of its economy benefits, without regard to its ecological benefits (Bengen, 2000).

Mangrove forest ecosystem are made up of the mangrove vegetation that grow in the area of beaches and estuaries that are affected by the ocean tides, this ecosystem has a variety of functions (Bengen, 2000). Mangrove forest ecosystems have important benefits and functions as an economic resources and ecological resources for human life. Therefore the existence of mangrove forests should be preserved (Sreeja et al., 2010). Value of mangrove forests ecosystem need to be evaluated to determine the value that would be lost and the potential negative impact for human life if the mangrove ecosystem are degraded (Hoberg, 2011)

Study Area

The study area is located in the mangrove forest of Indragiri estuary, Indragiri Hilir district area of Riau province (Sumatera island) Indonesia.



Figure 1: Geographical Location of the study area and sampling points

Materials and Method

The research was conducted in Indragiri estuary, during March 2015 to May 2015. The research object is the mangrove forest ecosystem and its surrounding communities, as well as the users of mangrove resources, i. e. the rural families, and government agencies. The sampling method in this research is purposive sampling technique. Samples of coastal communities who were interviewed as many as 95 respondents. The respondents are members of communities who make use of mangrove forests, such as the firewood collector and fishermen.

Research variables include: (1) the direct use value, i. e. the value resulting from the utilization of mangrove forests directly, such as fishes and woods. (2) the indirect uses value (benefits), i. e. the value resulting from the indirect utilization of mangrove

forests as a protector of the beach and barrier of sea water intrusion. (3) the options value, namely the economic value obtained from the potencies of direct uses and indirect uses of mangrove forests in the future, its indicator is the biodiversity.

The direct use value of mangrove ecosystems is a value generated from the utilization of a mangrove resources directly. Direct uses is defined as benefits (goods and services) that can be consumed. In the context of the mangrove ecosystem is the result of mangrove forests that are directly used by surrounding communities. In this research, indicator of the direct use are fishes and wood production. Direct uses value of mangrove forests was estimated by the equation: $DUV = \sum DUV I$

Indirect use value is the value of the mangrove resources benefits utilized indirectly by the human society. Indirect use value of mangrove forests can be either physical benefits, namely as the barrier of sea abrasion. Valuation of mangrove forests can physically being estimated with the function of mangrove forests as a abrasion barrier. This estimation used the replacement cost method, i. e. the cost to manufacture the breakwater along the coastline protected by the mangrove forests.

Option value for mangrove forests being estimated with the benefit transfer method, i. e. by way of estimating benefit of resources from other places then the benefit is transferred to obtain an estimate of the local resource benefits. In this study is used the estimation of the biodiversity value of mangrove ecosystems. According to Ruitenbeek in Dahuri, 2003), the value of biodiversity of the Indonesia mangrove forest amounted to US \$ 1, 500/ km². Option Value is estimated using the follow equation :

$OV = US\$ 15/ha \times \text{area of mangrove forest.}$

Existence Value is a value that is already attached to the resource (Fauzi, 2010). This value includes non-use values that can be obtained based on willingness to pay someone to the existence of mangrove forests. The existence value of the scarce species, endangered species, protected species, and the protected natural habitat.

Total Economic Value (TEV). This value is the summation of the entire economic value of mangrove forest benefits that have been identified and quantified. Value of the total economic benefits (TEV) is calculated by the equation:

$TEV = DV + IV + OV + EV$

Results

Based on statistic data user community Indragiri Hilir firewood in homes and industrial and reaches 35% of the number of families recorded in the district of Kuala Indragiri. Economic valuation obtained from the direct benefits of mangrove forest firewood is Rp. 17, 854, 200, 000.-/year. Relevant studies were conducted Olfie *et al* (2011) the gross value of the direct benefits of mangrove wood to reach Rp. 12, 160, 767, 721.-/ year. The difference in value is influenced by broad and exploitation of mangrove user community of the need for wood. Another thing that also affect the value of direct benefits of mangrove wood is available (dominance) of mangrove species that can be used as firewood and lumber such as *S. caseolaris*, *Rhizophora sp*, and *S. alba*.

No	Economic Indicator Value	Value (Rp/year) In each station					Average
		I	II	III	IV	V	
1	Direct Use Value						
	FireWood	26,866,667	15,600,000	7,800,000	9,300,000	20,231,250	15,959,583
	Building Wood	156,000,000	40,950,000	58,240,000	52,945,455	59,800,000	73,587,091
	Nypa leaf	6,864,000	8,493,333	10,816,000	12,290,909	9,244,444	9,541,737
	Crabs	117,000,000	39,780,000	93,600,000	49,725,000	35,100,000	67,041,000
	Crustacea	77,350,000	53,592,500	73,666,667	52,236,364	281,775,000	107,724,106
	Mollusca	24,440,000	0	13,800,000	61,471,429	60,542,857	32,050,857
	Fish	20,475,000	24,570,000	26,162,500	390,162,500	408,362,500	173,946,500
	Total						479,850,875
2	Indirect Use Value						
	Abrasion barrier	35,000,000,000	40,000,000,000	70,000,000,000	96,000,000,000	102,000,000,000	68,600,000,000
	Feeding, Spawning and Nursery	33,520,328,340	113,402,894,594	60,268,644,401	113,402,894,594	113,402,894,594	86,799,531,305
	Total						155,399,531,305
3	Option Value						
	Biodiversity	506,451,375	761,502,113	404,704,838	761,502,113	761,502,113	639,132,510
4	Existence Value						
	Willingness to pay	4,398,571	4,297,600	5,230,437	6,497,450	4,493,667	4,983,545
	Total Economic Value (TEV)						156.523.498.235

Discussion

Total direct use value of the mangrove ecosystem Indragiri is Rp. 479, 850, 875.-. Total indirect use value of mangrove forests are composed of a variety of ecological functions such as the filter of sea water in trusion and the barrier against the coastal abrasion. The value of indirect benefits of mangrove as the abrasion barrier is Rp. 155, 399, 531, 305.-

The option value of mangrove forest ecosystem as the biodiversity storage in the Indragiri estuary is estimated about Rp. 639, 132, 510 /year. Existence value (EV) of mangrove ecosystem includes the value of existence of endangered species, protected species, and the wildlife habitats. The existence value of forest mangrove in Indragiri estuary is estimated about Rp. 4, 983, 545 /ha/year. The total economic value of the mangrove forest ecosystem in the Indragiri estuary is amounted to Rp. 156. 523. 498. 235/year. The mangrove forest ecosystem have the important benefits and functions as the economic and ecological resources for the people that were around. Therefore the existence o f this mangrove forest ecosystem should be maintained as a sustainable development assets.

Conclusion

Total Economic Value (TEV) mangrove forest in Indragiri estuary Rp. 156. 523. 498. 235/year or Rp. 6. 432. 296. 302/ha/year, including direct vakue, indirect value, option value and existence value.

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