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FROM ECONOMIC VALUATION TO POLICY MAKING IN FOREST CONVERSION FOR *ELAEIS GUINEENSIS* JACQ PLANTATION

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ABSTRACT

The research objective was to calculate economic values of converting forest to oil palm plantation, to compare economic value of forest before conversion (without project) with oil palm plantation (with project), and to calculate allocation scenario of an efficient, effective and sustainable oil palm plantation. The research was conducted in Pulau Rimau tidal area, South Sumatra. The data collection was stratified random sampling, such as monoculture oil palm and mixed farming (integration between oil palm and cattle fattening). The method was divided into three categories, such as utilization identification, quantifying, and valuing of utilization. Feasibility of forest conversion was calculated using NPV, net BCR and IRR. The research results showed that Pulau Rimau utilization has very big economic role in increasing the society welfare around Pulau Rimau of 16,700 ha. It costs totally around Rp 80,696.20,- Millions. The total economic valuation was calculated by the values of direct use, indirect use, option, bequest and existence. Pulau Rimau conversion to monoculture oil palm had shown NPV of around Rp 11.478.00,- with BCR of 1.16, and IRR 27 %. If Pulau Rimau was converted into mixed farming, its NPV would be Rp 130,143.00,- Millions with BCR of 3.67, and IRR 57 %. Although the highest NPV was given by 100 % conversion of forest, it is still not recommended to apply this scenario in the field. The scenario II or III are very applicable and rational relating to environmental consideration because the indirect use values and existence value were still very dominant compared to other use values.

Keywords: Economic valuation, policy making, forest conversion, oil palm plantation

INTRODUCTION

About four decades ago, the area of Pulau Rimau, South Sumatra (around 40,263 ha) has been reclaimed for transmigration programs. Many changes have occurred due to rapid population growth and behavior patterns in different societies. In the facts, Pulau Rimau tidal area is less suitable for food crops, especially rice. The main failure factors are that Pulau Rimau area is less understood in terms of is its characters and qualities of land and tidal water, thus the reclamation programs tended to be imposed on the socio-economic and biophysical conditions that do not fit the needs of plants(Armanto *et al,* 2008, Armanto *et al,* 2011, Wildayana *et al,* 2008a). At present time, 16,700 ha of the area are given permission to the investors to be managed and developed for oil palm plantations.

Services of ecological system and the natural capital stocks are critical life-support system because it contributed to human welfare both directly and indirectly. This contribution can be "measured" as Total Economic Value (TEV)" through the process known as "Economic Valuation" which increasingly becomes a center of efforts to better integrate the environmental consideration to economic decision making. The integration hopefully will lead toward to sustainable development (Wildayana *et al,* 2011). Economic valuation of the area services and indicator results would facility their integration into economic models, the computation of economic and environmental cost and benefits of agricultural production, assessment of tradeoff and synergies, and, it is hoped, improved policy design. Poor and ambiguous economic valuation would therefore lead to

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misleading assessment of the links, and subsequently poor policy (Beukering *et al,* 2003). Thus the failures of reclaimed tidal areas are not repeated, it needs to do a comprehensive study on the economic feasibility study of oil palm plantations as well as financially approach to business feasibility. Based on the above descriptions, the main objective of the research was to determine and to calculate economic values of converting forest to oil palm plantation, to compare economic value of forest before conversion (without project) with oil palm plantation (with project), and to calculate allocation scenario of an efficient, effective and sustainable oil palm plantation.

RESEARCH METHODS

The research was conducted in year of 2010 and located in Pulau Rimau tidal area (16,700 ha) and its surrounding. Eleven villages were determined as the research area. The research areas represented the dominant ecosystem and their habitants find out life income for their families in Pulau Rimau and its surrounding. Respondents were determined by stratified random sampling (mix farming pattern and monoculture oil palm pattern) with total respondents of 210 households. Fourth stakeholders have been also identified: (1) local community, (2) local government, (3) plantation industry, and (4) national government.

There are two types of data collected, i.e. primary and secondary data. Primary data were taken directly from the research area and observed respondent's answering of questionnaires covering subjects of social, economic and cultural data, direct uses and indirect use gained by societies, cost and uses of agricultural activities. Secondary data were collected from related governmental and private institutions consist of data of population, geographical conditions, administrative, spatial planning and policies of tidal areas. The collected data were processed and evaluated for economic analysis and classified into three steps as follows: (1) Use identification and related functions between components of the land, (2) Quantification of all uses into money values, and (3) Choosing and policy evaluation of oil palm plantation.

Total use value (NMT) of the soils is calculated using the formula:

$$NMT = ML + ME + MX$$

Where: ML (Direct use value), ME (External value), MX (Existence value)

a. Direct use value

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

Where: ML (Direct use value total), ML_1 (Direct use value, 1), ML_2 (Direct use value, 2), ML_3 (Direct use value, 3), ML_n (Direct use value, n)

b. External use value

$$ME = ME_1 + ME_2 + ME_3 + ME_n$$

Where: ME (External use value total), ME_1 (External use value, 1), ME_2 (External use value, 2), ME_3 (External use value, 3), ME_n (External use value, n)

c. Option value

The option value was calculated indirectly based on the average value of forest biodiversity or ecotourism. The option value was determined by literature study related to research area (Beukering *et al.,* 2003, Costanza, 1997).

d. Existence value

$$MX = [(S1)] \Sigma Mxi] / N$$

Where: MX (Existence value), Mxi (Existence value of respondent, 1), N (Total of investigated respondents)

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e. Bequest value

Bequest value of forest ecosystem was assessed using occupation of society around Pulau Rimau because the society functions as a part of the whole society defense (Hankamrata). Therefore, the bequest value was calculated indirectly using seeding of industrial plant and national defense system or Hankamrata (Beukering *et al.*, 2003).

f. Net Present Value (NPV)

To calculate the present values and all uses as well as use cost of the soils, it was used methods of NPV analyses with a formula:

$$NPV = \Sigma (B_t - C_t)/(1+r)^t$$

$$BCR = (\Sigma B_t / (1+r)^t / \Sigma C_t / (1+r)^t$$

Where: B_t (Uses of the soils and external value, Rp), C_t (Costs expended to the soils uses and external uses, Rp), t (Time period of evaluation, year), r (Discount rate), NPV (Net Present Value), BCR (Benefit Cost Ratio)

RESULTS AND DISCUSSION

1. Identification of Economic Uses of forest

a. Direct Use Values

Direct use values of forest resources consisted of mixed timber, burn wood, durio, bananas and river fishes. Collection of mixed timber based on stumpage value was 31.42 m^3 ha^{-1} in 40 years (Beukering *et al.*, 2003). The production in a year was calculated about 1,963.75 m^3. Harvesting intensities of burn wood were 4-6 m^3 ha^{-1} in a year. The successfully identified five-direct use value has its own market price. The price was directly formed by negotiation with marketing people. All calculated commodities are based on full and direct market price. Assessment method of direct use value was approached with market price. The approach calculated type and amount of direct product, which could be consumed by society in Pulau Rimau area. According to the market price, wood and mixed timber from forest has highly economic values (Table 1).

Table 1. Direct use values of Pulau Rimau

Nr	Use type	Capitalization value in a year	
		Millions Rp	Percentage (%)
1.	Mixed timber	805.20	57.50
2.	Burn wood	576.72	41.19
3.	Rambutan and Durio	1.60	0.14
4.	Bananas and coconuts	0.72	0.05
5.	Fishes	15.80	1.12
	Total Direct Use Value	1,400.04	100.00

b. Indirect Use Values

Indirect use values of forest were calculated for total role of forest ecosystem as erosion prevention, food cycle security and rare flora and fauna habitat. The value assessment was calculated using indirect approach. Calculation of erosion prevention cost was based on needed cost compensation in order to rehabilitate the land if forest ecosystem does not exist (Table 2).

Needed cost of land rehabilitation was on average Rp 1,641 ton^{-1} per ha in a year (Adzemi, 1999). If the land is eroded 15 ton ha^{-1} in a year, the expended cost to erosion management of forest using *Mucuna sp* of 16,700 ha acreage would be Rp 246.16 Millions in a year. Determination of food cycle security was calculated as 15 ton ha^{-1} in a year of forest organic matter, which is similar to compost price (Rp 150 kg^{-1}). Food cycle security was about Rp 22,500.00 Millions in a year.

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Rare flora and fauna habitat was approached using replanting cost and loss of tourism potency. It is assumed that there are 10 people with expended cost of Rp 75,000 per person. This tourism cost was relatively low because condition of tourism forest in the research area is only 5.25 % and Pulau Rimau is easily burned especially in dry season

Table 2. Indirect uses value of Pulau Rimau forest

Nr	Use type	Use value in a year	
		Millions Rp	Percentage (%)
1.	Erosion prevention	246.16	0.65
2.	Food cycle security	22,500.00	59.61
3.	Rare flora and fauna habitat	15,000.00	39.74
	Total Indirect Uses Value	37,746.16	100.00

Calculation of indirect use value as function of rare flora and fauna habitat can be done by calculation of tree seed existing, land rehabilitation using replanting and its maintenance. It was Rp 1.5 Millions ha^{-1}. Therefore, for forest acreage of 16,700 ha, it would cost Rp 15,000.00 Millions. Use of rare flora and fauna habitat was based on calculation of tourism loss in a week (around 10 people). They spent on average Rp 75,000. The indirect uses value of forest ecosystem was totally Rp 37,746.16 Millions. This result showed that indirect uses value is twenty seven times higher than direct uses value (only Rp 1,400.04 Millions). This indicates that forest ecosystem plays very important economic role.

c. Option Values

The option values of forest were calculated using biodiversity uses of forest ecosystem. This cost was around US $ 45.5 ha^{-1} in a year (Rp 455,000,-) if Pulau Rimau is well-maintained in relatively natural condition (Beukering *et al.*, 2003). The option value of Pulau Rimau (16,700 ha) is Rp 1,137.5 Millions in a year.

d. Bequest Values

Assessment of such values used replacement cost. The assumption calculation was approached by constructing supporting street and road to connect area of 25 km. It needed cost of Rp 20 Millions km^{-1}, thus, the total cost was Rp 500 Millions in a year. In addition, it is possible that the society developed industrial forest crops to be sold. If it was assumed that 140 seeds ha^{-1} could be developed by price of Rp 2,000 per seed, it would be collected about Rp 280,000 ha^{-1}.

e. Existence Values

The existence values of forest were calculated using Contingent Valuation Method (CVM). This method was applied to select 24 people as purposive respondents. Respondent determination was based on society characteristics surrounding Pulau Rimau. Value differences given by respondent were caused by differences of individual demography, income and education level. Three questions for the given models were described as follows:

1) Open questions were used to collect directly existing value of forest according to respondents.
2) Multiple choice questions were used as second alternative if respondent opinions could not be collected. For this purpose, there were 9 given choice questions starting with values of Rp 500,000 ha^{-1} until Rp 5,000,000 ha^{-1}.
3) There were questions of agree or disagree statements, which will be given values of Rp 1,000,000 ha^{-1}. Respondents were expected to give answers of the questions.

In the facts, all respondents had given opinions through the first method. The average respondent evaluation to forest existing was Rp 3,500,000,- ha^{-1}. The total existence value of forest was Rp 8,750 Millions per a year. Based on education level, there was a trend that higher education level will give also higher evaluation to the ecosystem.

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2. Quantification of Economic Uses of Pulau Rimau

Quantification of economic uses of forest explains total economic value of forest. It was Rp 80,696.20 Millions per cultivated area of 16,700 ha or Rp 8.07 Millions ha^{-1} (Table 3). The economic values of Pulau Rimau was dominated by Indirect uses value (46.77 %), Existence value (43.38 %), Option value (5.64 %), Bequest value (2.48 %), Direct uses value (1.73 %), and respectively. The highest position of Indirect uses value (46.77 %) was caused that this area belongs to conservation area for wild flora and fauna, erosion prevention and food cycle security. The second highest position of Existence value (43.38 %) was due to awareness of local society. They know that Pulau Rimau is able to support their day-by-day-life; therefore they keep Pulau Rimau using local indigenous technology.

Table 3. Quantification of each forest uses in Pulau Rimau

Nr	Use kind	Value	
		Millions Rp	Percentage (%)
1.	Direct uses value	1,400.04	1.73
2.	Indirect uses value	37,746.16	46.77
3.	Option value	4,550.00	5.64
4.	Bequest value	2,000.00	2.48
5.	Existence value	35,000.00	43.38
	Total Economic Value	80,696.20	100.00

The total economic value shows the present conditions, it can change becoming smaller or higher depending on future and environment condition. Based on the field observations, direct use valued by the society around Pulau Rimau is just enough to support their daily living.

3. Respondent Characteristics in Cultivating Oil palm Plantation

The dominant agricultural patterns around Pulau Rimau are oil palm plantation only (monoculture) and mixed farming (integration between oil palm and cattle fattening). In this research, both oil palm plantation patterns were described and analyzed. Respondent characteristics consist of education level, age, family's member number, acreage of cultivated land, and distance of houses to oil palm plantation area.

a. Monoculture Oil palm Pattern

The average farmer's age cultivating monoculture oil palm was 34.5 years with education level ranging from primary school (SD) to senior high school (SMU). Their main cultivated land was 2.0 ha till 5.0 ha with an average of 2.5 ha. The member of each family is from 1 to 5 persons with an average of 3.2 persons. The average distance from their houses to their farms is 2.3 km. Local oil palm plantation can be harvested in sixth year after planting. There was 140-oil palm trees ha^{-1} with the distance measurement of 8 m x 8 m. The average oil palm production (latex) was 160 kg ha^{-1} with average price of Rp 5,500 kg^{-1}. The average after-sixth-year income was Rp 4,377,000 ha^{-1} in a year. The most expensive cost for oil palm is the investment for land clearing (land buying, land legalization, making of "guludan" and houses, and some instruments). Operational cost included the cost for buying superior seeds, fertilizer, pesticides, wall, labor cost, harvesting cost, and marketing cost beginning after sixth year. Calculation of RCR, the farmers owning land less than 1,0 ha, showed RCR higher (3.3) compared to those of farmers owning more than 4.0 ha (its RCR is only 1.4). It means that the smaller land is cultivated more intensively than the large land.

b. Mixed Farming Pattern

The average age of the farmers cultivating mixed farming pattern was 43.5 years with education level from secondary school (SMP) to graduate (Sarjana). It means that the farmers

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cultivating mixed farming have higher educated comparing to the monoculture farmers. Cultivated land was ranging from 1.5 up to 3.0 ha with an average acreage of 1.50 ha. Each farmer has family member of 2 to 6 persons with average of 4.1 persons. An average distance from houses to the oil palm plantation is 2.31 km. The mixed farming was in good condition; however, there are some constraints in marketing due to bad transportation. Cattle fattening can be integrated with oil palm as long as the oil palm age more than 5 years and well maintained. After 24 months, cattle fattening can be harvested and sold with average price of Rp 50.000,- per kg. The average income of cattle fattening farmers was Rp 8,540,400 ha^{-1} in a year.

The mixed farming needs input and equipment, cattle, fertilizer, pesticide, and field's labors. This cost is called investment cost and operational cost. The expected yields are Fresh Fruit Bunches of Oil Palm (FFB) and cattle meat. Average (FFB) price received by farmers was Rp 5,500 kg^{-1}. Production per month with average income after sixth year was Rp 12,750,250 ha^{-1} in a year. The farmers owning cultivated land less than 1.0 have RCR of 0.9 and for whole the farmers with cultivated land more than 3.0 have RCR of 3,1. This indicated that the land is used efficiently. Besides that, cattle fattening consumes small amount of water; therefore, this comodity does not compete with oil palm or other crops.

4. The Externality Impacts of Oil palm Plantation Activities

The impacts of monoculture oil palm and mixed farming on agricultural externality are divided into negative and positive impact. The positive impacts are labor adsorption, increasing of transportation flow, and increasing of trade volume value. The negative impact is cost of land rehabilitation and so on (Table 4).

Table 4. Total economic use value (in Million Rp) in Pulau Rimau

Nr	Description	Monoculture Oil Palm	Mixed Farming	Total
1.	Labor adsorption	2,220.00	1,830.02	4,050.20
2.	Transport increase	190.20	182.04	372.24
3.	Trade volume increase	210.40	201.60	412.00
4.	Negative impact	112.32	128.84	241.16
	Total	2,732.92	2,342.68	5,075.60

Total value of labor adsorption was Rp 4,410.2 Millions in a year divided into Rp 2,220.0 Millions in a year by monoculture oil palm and Rp 2,190.2 Millions in a year by mixed farming. Labor adsorption covers the most dominant total economic use value of the externality impacts (around 81.35 %); it is followed by trade volume increase (7.47 %).and transport increase (6.69 %) respectively. All things explained above belong to positive externality impact which covers 95.53 % of totally externality impact.

The negative externality was calculated due to negative impact (soil erosion) of agricultural activities. These are the cost of soil conservation and the cost of soil rehabilitation. Soil rehabilitation cost was on average Rp 2,500 ton^{-1} per ha in a year (Wildayana *et al.*, 2008b). Total cost using *Mucuna sp* was Rp 242.5 Millions in a year or 4.47 % of the totally externality impacts.

5. Uses and Cost Analyses (NPV with Project and without Project)

NPV for mixed farming was Rp 130,143.00 Millions per cultivated area or Rp 13.01 Millions ha^{-1} with BCR of 3.67 and its IRR of 57 %. NPV for monoculture oil palm was Rp 11.478.00 Millions per cultivated area or Rp 1.16 Millions ha^{-1} with BCR of 1.19 and its IRR of 27 % (Table 5). This means that forest conversion is very useful, especially if mixed farming pattern is applied because its NPV, BCR and IRR is eleven times, three times and two times higher than that of monoculture oil palm, respectively.

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6. Scenario of Policy Making Implication

From economic valuation to policy making in forest conversion for plantation can be done using Cost-Benefit Analysis (CBA). Although the highest NPV was given by 100 % conversion of forest, it is still not recommended to apply this scenario in the field. The scenario II or III are very applicable and rational relating to environmental consideration because the indirect use values and existence value were still very dominant compared to other use values (Table 6 and Table 3).

Table 5. Average cost uses analyses of forest conversion to farming in Pulau Rimau

Nr	Description	NPV (Millions Rp) [1)]	BCR [2)]	IRR [3)]
1.	Monoculture Oil palm	11.478.00	1.16	0.27
2.	Mixed Farming	130,143.00	3.67	0.57

Where: [1)] Net Present Value, [2)] Benefit Cost Ratio, [3)] Internal Rate Ratio

Table 6. Use cost analyses of allocation alternatives in Pulau Rimau

Scenario	Land uses (ha)	NPV (Millions Rp)
I (The highest NPV, but not recommended)	16,700 ha (100 %)	130,143.00
II (Strongly Recommended)	12,525 ha (75 %)	97,607.28
III (Recommended)	8,350 ha (50 %)	65,071.52
IV (The lowest NPV, not recommended)	4,175 ha (25 %)	32535.76

CONCLUSION

It can be concluded that Pulau Rimau utilization has very big economic role in increasing the society welfare around Pulau Rimau of 16,700 ha. It costs totally around Rp 80,696.20,- Millions. The total economic valuation was calculated by the values of direct use, indirect use, option, bequest and existence. Pulau Rimau conversion to monoculture oil palm had shown NPV of around Rp 11.478.00,- with BCR of 1.16, and IRR 27 %. If Pulau Rimau was converted into mixed farming (integration between oil palm and cattle fattening), its NPV would be Rp 130,143.00,- Millions with BCR of 3.67, and IRR 57 %. Although the highest NPV was given by 100 % conversion of forest, it is still not recommended to apply this scenario in the field. The scenario II or III are very applicable and rational relating to environmental consideration because the indirect use values and existence value were still very dominant compared to other use values.

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REFERENCES

Adzemi, M.A. 1999. Land evaluation system for *Elaeis guineensis* Jacq. Dissertasion. University of Putra Malaysia, Malaysia.

Armanto, M.E., E. Wildayana and N. Rahmawati. 2008. Linkages of the land suitability with oil palm plantation investment decisions on tidal land. Journal of Scientific HABITAT Vol. XIX(3):193-206, December 2008. ISSN 0853-5167.

Armanto, M.E., M.S. Imanudin and Elisa Wildayana. 2011. Potential Lands for Oil Palm Plantation Development in Tidal Area Pulau Rimau South Sumatra. Proceedings of the National

ISBN 978-979-98938-5-7

Seminar. Vol I:48-56. Western BKS-PTN, 23-25 May 2011, Sriwijaya University, Palembang, South Sumatra.

Beukering, P. van, H. Cesar and M. Janssen. 2003. Economic Valuation of the Leuser National Park on Sumatra, Indonesia. Ecological Economic, Vol 44:43-62.

Wildayana, E., M.E Armanto and N. Rahmawati. 2008a. Agribusiness program development of site specific farming pattern in the tidal land. Journal of Scientific HABITAT Vol. XIX(3): 223-236, December 2008. ISSN 0853-5167.

Wildayana, E., M.E. Armanto and N. Rahmawati. 2008b. The impact of oil palm plantation development towards economic improvement of rural communities in the tidal area (approach *the multiplier effect)*. Journal of Scientific HABITAT Vol. XIX(2):159-168, August 2008. ISSN 0853-5167.

Wildayana, E., M.E. Armanto dan Momon Sodik Imanudin. 2011. Investment Feasibility of Oil Palm Plantation Effort and Cattle Fattening. Proceedings of the National Seminar. Vol II:697-706. Western BKS-PTN, 23-25 May 2011, Sriwijaya University, Palembang, South Sumatra.