

Contribution and economic valuation of non-wood forest products from community forest in Plosorejo Village, Karanganyar Regency, Central Java

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Abstract. Community forests can help to mitigate and adapt to climate change by storing carbon and providing ecosystem service. Non-Wood Forest Products (NWFPs) can serve as an adaptation strategy for forest-dependent communities in dealing with climate change. In addition, the availability of food and sources of income can be fulfilled by the existence of NWFPs. Given the significant role of NWFPs in climate change adaptation, this study was conducted to identify the types of NWFPs, evaluate their economic value, and determine their contribution to household income in Plosorejo Village. The data collection method used in the present study was field inventory and interviews with 30 respondents. Based on the obtained results in this study, 26 species of NWFPs developed in the community forest of Plosorejo Village, generate an economic value of 923.2 Million Rupiah per year. The commodity that gave the highest contribution to the economic value of NWFPs was durian, with a value of 630 Million Rupiah per year or 68.24% of the total economic value of NWFPs. The average contribution of the economic value of NWFPs to household income was 58.94%. Educational background and the area of community forest owned show a significant effect on the community income from NWFPs.

1 Introduction

The issue of climate change is increasingly being discussed at this time. There were many impacts arising from this issue, one of which is on non-wood forest products (NWFPs). On the other hand, NWFPs can serve as a safety net for forest-dependent communities in dealing with the impacts of climate change on crop production and other livelihoods [1]. They provide alternative sources of income and food security [1].

Several researchers reported the NWFPs contributions to the household income in Indonesia [2][3][4]. It was reported that in Gempolan Village, Karanganyar Regency, NWFPs from community forest contributed 40.5% to the revenue of community [2]. A similar situation occurred in Mandiangin Barat Village, Banjar Regency where NWFPs contributed 42.94% of the community income [3]. The income generated from NWFPs in

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Halaban Village, Lima Puluh Kota Regency surpasses that of the previous location [4]. NWFPs from community forests contributed 63% of the total income from community forests in Desa Halaban, Lima Puluh Kota Regency, West Sumatra [4].

Based on the description above, NWFPs has importance role and high potency to further development. In addition, further research is needed to study their contribution to community income in other regions. Therefore, the present study was conducted to obtain information and an overview of the utilization of NWFPs by the villagers of Desa Plosorejo. Furthermore, to find out the extent of its contribution to the community total income.

2 Materials and methods

The research was conducted in Plosorejo Village, Kerjo District, Karanganyar Regency, Central Java during March to May 2023. The research location has an average elevation of 515 meters above sea level [5]. In the present study, respondents were determined at 5% by purposive sampling. Samples were taken from respondents who owned community forests and utilized NWFPs. Based on this method, there were 30 people as respondents in this study.

There were two methods of collecting data that used, namely inventory, and interviews. The inventory was carried out by making plots in each respondent's community forest with an area of 0.1 ha (40×25 m). Then, the interviews were conducted to find out local market prices regarding NWFPs, harvesting intensity, or other matters related to research studies.

To calculate the density per hectare of a NWFPs commodity the following formula was used (1)

$$D = \frac{\sum n_j}{A} \quad (1)$$

Where,

D = Density per hectare (individual/hectare)

$\sum n_j$ = Total individual per species

A = Plot area (hectare)

j = Type of NWFP

In addition, to determine the economic value of a NWFPs commodity the following formula was used (2).

$$EV_j = V_j \times P_j \quad (2)$$

Where,

EV_j = Economic value of NWFP (j) (Rupiah/year)

V_j = Volume of harvest (unit/year)

P_j = Price of NWFP (j) (Rupiah)

Furthermore, an analysis was carried out to find out the influence of independent variables (age, length of stay, educational background, number of family dependents, the area of community forest owned, and distance from home to community forest) to dependent variable, namely community income in the form of NWFPs from community forests. Independent variables were tested simultaneously by using F-test. Furthermore, each variable was tested by using the t-test to determine its significance level. The regression equation model was used to determine the effect of the independent variables on the dependent variable (3).

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 \quad (3)$$

Where,

y : Income from NWFPs

a : Regression constanta

$b_1- b_6$: Regression coefficient
 $X_1- X_6$: Age (year) ; length of stay (year) ; Educational background (year) ; Number of family dependents ; The area of community forest owned (m²) ; Distance from home to community forest (km), respectively

3 Results and discussion

3.1 Respondents characteristics

Information on the respondents' characteristics includes sex, age, educational background, length of stay, and the area of community forest owned was showed in Table 1.

Table 1. Respondent Characteristics.

Characteristics	Category	Quantity	Percentage (%)
Sex	Male	27	90.00
	Female	3	10.00
Age	35 - 44 years old	2	6.67
	45 - 54 years old	13	43.33
	55 - 64 years old	11	36.66
	65 - 74 years old	2	6.67
	> 74 years old	2	6.67
	No formal education	10	33.33
Educational Background	Elementary school	8	26.67
	Junior high school	7	23.33
	Senior high school	5	16.67
	< 35 years old	2	6.67
	35 - 44 years old	2	6.67
Length of Stay	45 - 54 years old	12	40.00
	55 - 64 years old	11	36.66
	65 - 74 years old	2	6.67
	> 74 years old	1	3.33
	1 - 2	14	46.67
Number of Family Dependents	3 - 4	12	40.00
	5 - 6	4	13.33
	< 1 km	21	70.00
Distance from Home to Community Forest	1 - 2 km	9	30.00
	≤ 0,25 ha	15	50.00
The Area of Community Forest Owned	0,26 - 0,50 ha	9	30.00
	0,51 - 1,00 ha	4	13.33
	≥ 1,1 ha	2	6.67

Table 1 shows the characteristics of the respondents who own the community forest in Plosorejo Village. There were 27 male respondents (90%) and 3 female respondents (10%). The low participation of women in forest management was influenced by social perceptions and norms in society [6]. The age distribution of farmers was dominated by the 45-54 year age group with 13 people (43.3%). Farmers aged less than 35 years were not found in this study. This condition might occur due to community forests seem to have less appeal to the younger generation, as compared to other industries [7].

As shown in the Table 1 the majority of respondents (33.3%) were not finished their elementary school/non-educated, which may have an effect on their knowledge. The higher the educational background of the farmer, the wider the insight of the farmer [8]. The length of stay will affect psychological ties, the more physically and non-physically bound they are to the area they live in [9]. There were 76.66% respondents who living in Plosorejo Village for 45-64 years, indicating that most of the respondents were natives to Plosorejo Village.

Based on Table 1, the group of 1-2 dependents showed the majority number (46.67%). The number of dependents in a family affects their cost of living and can impact community forest management [10]. According to the distance between houses and community forests, the majority of respondents live in interface areas. The interface area is a forest area that is in direct contact with the settlement (less than 3 km) [11]. Most of the respondents in the present study owned forest area of ≤ 0.25 ha. This phenomenon is normal on Java Island, where the area of community forest ownership per head of household is less than 0.25 ha [12].

3.2 Identification and the economic value of NWFPs

Table 2 shows scientific name, habitus and density per hectare of NWFPs for each species. There were 26 species of NWFPs cultivated in the community forest of Plosorejo Village and classified into 6 groups (fruit based, rhizome based, grass based, tuber based, sap based, and flower based). The highest and lowest density per hectare of NWFPs species was galangal and melinjo.

Table 2. Identification and the Economic Value of NWFPs.

No	Scientific Name	D	Habitus	v	units	p	E
A.	Fruit based						
1	Durian	1,030	Tree	15,750	pieces	45,000	630,000,000
2	Banana*	2,190	Herb	203	bunch	60,000	12,180,000
3	Avocado*	70	Tree	300	kg	15,000	4,500,000
4	Dog fruit	60	Tree	720	kg	15,000	10,800,000
5	Stink bean	90	Tree	390	bundle	120,000	46,800,000
6	Mango*	40	Tree	270	kg	3,000	810,000
7	Jackfruit	50	Tree	18	pieces	40,000	720,000
8	Mangosteen	20	Tree	100	kg	20,000	2,000,000
9	Rambutan	30	Tree	175	kg	3,500	612,500
10	Longan	20	Tree	50	kg	25,000	1,250,000
11	Snake fruit*	20	Palm	48	kg	10,000	480,000
12	Melinjo	10	Tree	70	kg	15,000	1,050,000
13	Guava*	30	Tree	20	kg	5,500	110,000
14	Pineapple *	40	Herb	40	pieces	6,000	240,000
			Total (A)				711,552,500
B	Rhizome based						
1	Ginger*	6,920	Herb	4,350	kg	7,000	30,450,000
2	Galangal*	7,010	Herb	6,560	kg	2,000	13,120,000
3	Turmeric*	6,120	Herb	2,868	kg	2,000	5,736,000
4	Fingerroot *	50	Herb	80	kg	10,000	800,000
5	Cutcherry *	500	Herb	120	kg	10,000	1,200,000
			Total (B)				51,306,000
C.	Grass based						
1	Elephant Grass *	1,500	Herb	390	bundle	10,000	3,900,000
2	Bamboo	60	Bamboo	18	clump	100,000	1,800,000
3	Lemongrass*	50	Herb	50	kg	2,000	100,000
			Total (C)				5,800,000
D.	Tuber based						
1	Taro*	1,220	Herb	140	kg	3,000	420,000
2	Porang*	380	Herb	120	kg	1,500	180,000
			Total (D)				600,000
E.	Sap based						
1	Rubber	4,290	Tree	20,260	kg	6,000	121,560,000
			Total (E)				121,560,000

F.	Flower based						
1	Clove*	220	Tree	1,080	kg	30,000	32,400,000
			Total (F)				32,400,000
			Total (A+B+C+D+E+F)				923,218,500

Notes: *= NWFP that are not mentioned in Ministry of Forestry Regulation No. P35/Menhut- II/2007; D= density per hectare; v= the total volume harvested per year; p= price based on market price approach that collect during interview; E= Economic value/year (Rupiah)

The economic value generated from NWFPs that cultivated in Plosorejo Village was showed in Table 2. Thus, the total economic value of NWFPs on community forest was 923.2 Million Rupiah per year. The economic value was influenced by several factors, such as price, volume (amount), frequency, and type of forest products used which can indicate the level of community dependence on non-timber forest products [13]. When discussing each commodity, the economic value of durian in Plosorejo Village showed the highest value compared to the other commodities.

3.3 NWFPs contribution to the household income

Community income contribution from NWFPs can be determined by comparing the total economic value of NWFPs for each respondent and the total household income. The economic contribution of NWFPs to the total income of the Plosorejo village community has been presented in Table 3.

Table 3. Household Income of Community Forest Farmers in Plosorejo Village.

No	Source of Income	Total (Rupiah/year)	Percentage (%)
1	Total income from NWFPs	923,218,500	58.94
2	Total income outside the utilization of NWFPs	643,200,000	41.06
	Total	1,566,418,500	100.00

The total income from NWFPs was higher than total income outside the utilization of NWFPs. The contribution of income from NWFPs obtained in the present study was higher compared to the other locations, namely Jaranguda Village and Merdeka Village in Karo District, North Sumatra [13]. Income contribution from NWFPs in Jaranguda Village and Merdeka Village were 40.41 and 47.47% [13]. The high contribution of income from NWFPs in Plosorejo Village indicating that the community has a high dependency on the forest.

3.4 Analysis of factors influencing community income from NWFPs

In the present study, the factors that influence the community income from NWFPs in Plosorejo Village was analyzed. Variables that used was taken from the characteristics of the respondents, namely age, length of stay, educational background, number of family dependents, the area of community forest owned, and distance from home to community forest. Those variables were analyzed by using multiple linear regression.

$$y = -77,479,334 + 855,374X_1 + 492,220X_2 + 3,008,273X_3 - 1,507,326X_4 + 4,628X_5 + 64,168X_6 \text{ with } (t_a = -2.221), (t_{x1} = 1.489), (t_{x2} = 1.005), (t_{x3} = 2.865), (t_{x4} = -0,537), (t_{x5} = 4.764), (t_{x6} = 0.009), (R^2 = 0.603), (F = 5.832) \quad (4)$$

Based on model summary, the value of R square was 0.603, indicating that there were strong correlation between all independent variables (age, length of stay, educational background, number of family dependents, the area of community forest owned, and distance from home to community forest) and community income from NWFPs. Based on the F-test, it confidently shows a significant simultaneous influence of the independent variable on the dependent variable.

Furthermore, it is worth noting that the outcomes of the t-test was shown in Equation (4). It was known that only variables X_3 (educational background) and X_5 (the area of community forest owned) have a significant effect on community income from NWFPs. The higher a person's educational background, the more receptive they are to knowledge, information, and innovation from others [14]. Similarly, the area of community forest owned also affects income. With more land, farmers can plant more crops, resulting in higher yields.

4 Conclusion

There were 26 species of NWFPs that were classified into 6 groups with a total economic value of 923.2 Million Rupiah per year. Durian showed the highest contribution in Plosorejo village with a value of 630 Million Rupiah per year. The economic value of NWFPs contributes 58.94% of the total community household income, indicating that the community has a high dependency to the forest. Educational background and the area of community forest owned were two factors that showed significant effect on the community income from NWFPs.

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