Contribution of the Utilization of Non-Timber Forest Products to Farmers' Income in Forest Management Unit

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Abstract. Forest Village Community Organizations (*Lembaga Masyarakat Desa Hutan* - LDMH) Samudro Wonoasri and LMDH Tangkil Indah is an institution in partnership with Perhutani that has utilized the potential of non-timber forest products (NTFPs) in plots 66A and plots 46B. This study aims to determine the contribution of NTFPs to farmers' income in both locations (plots). Data collection on respondents was carried out using a comprehensive census technique. The total number of research respondents was 180 people, with 85 farmers in plot 66A RPH (*Resor Pengelolaan Hutan* - Forest Management Resort) Sumberkembang and 95 farmers in plot 46B RPH Lebakharjo. The results showed three dominant types of non-timber forest products used by farmers, namely coffee, cloves, and bananas. Meanwhile, the contribution of NTFPs to the average income yr^{-1} of farmers in the 66A RPH Sumberkembang plot is 79.07 %. The contribution of NTFPs to farmers' average income yr^{-1} in the 46B RPH Lebakharjo plot obtained a percentage of 93.58 %. The average income yr^{-1} for all farmers in both locations (plots) of the study shows that NTFPs contribute significantly to the economy and that all farmers are highly dependent on the presence of non-timber forest products (NTFPs).

Keywords: Increase added value, improve economy, low-income households, perhutani, reducing carbon emission.

1 Introduction

Non-timber forest products (NTFPs) are one of Indonesia's most abundant natural resources and have excellent prospects for development [1, 2]. The existing NTFP potential is also found in the Forest Management Unit (*Kesatuan Pengelolaan Hutan* - KPH) area, KPH Malang, East Java, Indonesia. Non-timber forest products are generally a by-product of a tree, for example, sap, leaves, bark, fruit, or in the form of plants with unique properties such

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as rattan (*Calamus rotang* L.), bamboo (*Bambusa vulgaris* Schrad. *ex* J.C. Wendl.), and others [3]. Collecting non-timber forest products is generally a traditional activity of the people living around the forest. Even in some places, collecting non-timber forest products is the main activity as a source of daily life for the community. For example, the collection of rattan, various wood resins such as the sap of agathis wood, or shorea wood, and others called *damar* (*Agathis dammara* (Lamb.) Rich.) [4–6].

Non-timber forest products have promising development and utilization potential. One of the positive impacts, for example, is reducing the cutting of trees from the forest. Reducing tree cutting can impact reducing the number of carbon emissions [7]. In addition, the utilization of non-timber forest products can provide opportunities for communities around the forest to increase their income, expand employment opportunities, increase added value and state income, as well as equitable regional development through the use of NTFPs [8, 9]. Most importantly, the use of NTFPs tends to improve the economy of low-income households who depend on forest land for their livelihood [10, 11].

Plot 66A RPH Sumberkembang, BKPH (*Bagian Kesatuan Pemangkuan Hutan* - Forest Management Units Section) Sumbermanjing (coordinate point S08°22.632' E112°46.144') and plot 46B RPH Lebakharjo, BKPH Dampit (coordinate point S08°18.931’ E112°50.733’) was once a wilderness that functioned as a local protected area. In mid-1998, considerable looting was carried out by the community around the forest as plantation land. The main goal is to support the economy of the community around the forest. To maintain forest areas, Perhutani (A State-Owned Enterprise in the form of a Public Company (Perum) that has the duty and authority to manage state forest resources on the islands of Java and Madura.) invites the community to plant coffee (*Coffea* spp.) and cloves (*Syzygium aromaticum* (L.) Merr. & L.M. Perry). As a part of its mandate, Perhutani has the authority to grant permission to communities to use forest land for various purposes. For seasonal crops, people choose to plant bananas (*Musa* sp.) to increase short-term income. The establishment of the Forest Village Community Organizations (LMDH- *Lembaga Masyarakat Desa Hutan*) by Perhutani is implementing the cooperation between the community around the forest area and Perhutani. There is no specific reason for choosing the location for coffee and clove cultivation.

The contribution of NTFP utilization to farmers' income in the two research locations (plots) is unknown. So that in this study, the focus of research is to determine the contribution of the use of non-timber forest products to farmers' income in the forest area of plot 66A RPH Sumberkembang BKPH Sumbermanjing and plot 46B RPH Lebakharjo BKPH Dampit, KPH Malang, East Java, Indonesia.

2 Materials and methods

The research was carried out March 12 to April 20, 2021 located in the forest area of plot 66A BKPH Sumbermanjing (Sidoasri Village, Sumbermanjing Wetan District, Malang Regency, East Java, Indonesia, coordinate S08°22.632' E112°46.144') and plot 46B of BKPH Dampit (Sumbertangkil Village, Tirtoyudo District, Malang Regency, East Java, Indonesia, coordinate S08°18.931’ E112°50.733’) as research objects. The tools used in the study were notebooks and writing utensils, questionnaires, and handphone cameras. While the materials used were respondents, namely farmers, in two plots, namely plot 66A with 85 people and plot 46B with 95 people. So, the total number of respondents is 180 people. Plot 66A has a land area of 31.75 ha, while plot 46B has 53 ha. Data collection on respondents was carried out using a comprehensive census technique.

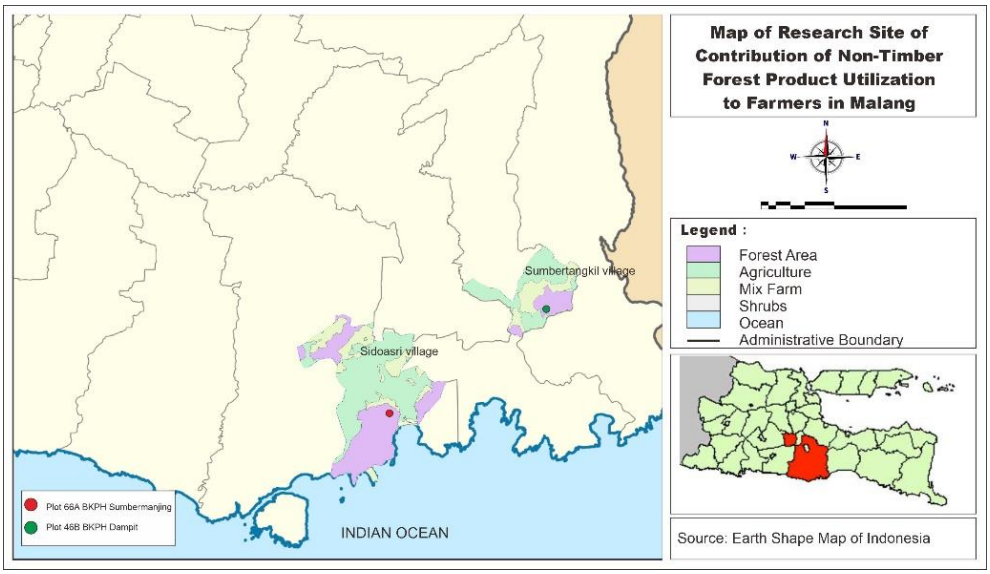

Fig. 1. Research site map.

The variables collected from the respondents in this study were the volume of NTFPs and the respondents' characteristics. Furthermore, the composition of utilization per group of NTFPs, the average contribution per group of NTFPs, the average contribution of total income yr^{-1} from NTFPs, and the B/C ratio.

Calculation of the contribution of NTFPs can use the formula proposed by Murniningtyas [12]. The calculation of the first NTFP contribution can use the calculation of the production value, which is described in Equation (1):

$$\text{Production value} = \text{number of products} \times \text{product price} \quad (1)$$

Furthermore, the total contribution of NTFPs for each type of group used by the respondents was calculated by Equation (2):

$$x = n1 + n2 + n3 + n \quad (2)$$

Where,

x = total contribution of NTFPs per species group yr^{-1}

n1, n2, n3, n = NTFP contribution per species group yr^{-1}

To calculate the average contribution per group of NTFP species [13] in Equation (3):

$$M = \frac{\Sigma xi}{n} \quad (3)$$

Where,

M = average NTFP contribution per species group yr^{-1}

xi = total contribution of NTFPs per species group yr^{-1}

n = number of respondents

To calculate the contribution of NTFPs of all types, the equation can be used, as in Equation (4):

$$T = x1 + x2 + x3 + n \quad (4)$$

Where,
T = total contribution of NTFPs of all types per yr
x1, x2, x3, n = NTFP contribution per species yr^{-1}

To calculate the percentage contribution of NTFPs to people's incomes, the Equation (5) is used:

$$\text{yhbk} = \frac{\text{dh}}{(\text{dh}+\text{dl})} \times 100\ \% \quad (5)$$

Where,
yhbk = NTFP percentage of total income
dh = income from NTFP
dl = income from outside NTFP

Furthermore, the analysis of the balance of revenues and costs or the B/C ratio proposed in Equation (6) [14].

$$\text{R/C ratio} = \frac{\text{TR}}{\text{TC}} \quad (6)$$

Where,
R/C = Return cost ratio
TR = Farming revenue (IDR)
TC = Total cost of farming (IDR)
Criteria,
B/C > 1, Farming is worth working on
B/C < 1, Farming is not worth working on
B/C = 1, Farming is break even

3 Result and discussion

The description of the characteristics of farmers in the research location is known through the interview method with a questionnaire instrument. The variables in this study include gender, age, last education, number of family members, number of family members who are still in school, land area, the composition of NTFP commodity utilization and quantity of NTFP commodity utilization by farmers, average contribution of income from NTFP commodity group, the average contribution of income yr^{-1} to total income, average total income yr^{-1}, average total expenditure yr^{-1} and the B/C ratio.

Farmers who became respondents were dominated by the male gender (99 %). Many male farmers are because the type of work on the land is heavy work with dryland conditions. In terms of age, the most dominating age of respondents is between the ages of 51 yr to 60 yr. This follows Malang Regency in [15], which states that the productive workforce in Sumbermanjing sub-district who chooses to migrate outside the region is relatively high. Data on farmers' cultivated land in BKPH Sumbermanjing and BKPH Dampit are presented in Table 1.

Table 1. Farmer's land area.

Plot 66A RPH Sumberkembang BKPH Sumbermanjing		
Land area (ha)	**Amount (people)**	**Percentage (%)**
0.25	57	67
0.25 to 0.50	19	22.3
0.50 to 0.75	4	4.8
0.75 to 1	3	3.6

Continued on the next page.

Table 1 continued.

> 1	2	2.3
Total	**85**	**100**
Plot 46B RPH Lebakharjo BKPH Dampit		
Land area (ha)	**Amount (people)**	**Percentage (%)**
0.25	34	35.8
0.25 to 0.50	32	33.7
0.50 to 0.75	17	17.9
0.75 to 1.0	8	8.4
1.0 to 1.50	2	2.1
> 1.50	2	2.1
Total	**95**	**100**

Source: processed primary data, 2021

Based on the data presented in Table 1, it is known that land use rights by respondents with the smallest land area is 0.25 ha and the largest land area is 1.50 ha. In BKPH Sumbermanjing, an area of 31.75 ha is managed by 85 farmers, so the average land area managed is 0.37 ha for each farmer. Meanwhile, in BKPH Dampit, 53 ha of land is managed by 95 farmers. The average land area managed by farmers in the BKPH is 0.55 ha for each farmer. The permission granted by Perhutani is usually in the form of a permit or lease agreement that outlines the terms and conditions of land use, including the duration of the lease, the specific area of land to be used, and the activities that are permitted on the land. The use of forest land by communities may include activities such as farming, agroforestry, livestock grazing, and forest product harvesting.

The difference in the land area owned by farmers is not due to the distribution factor of Perhutani, but the farmers themselves get it from their parents by continuing to use the NTFPs on the land. The area of land can be a reference for determining the amount of yield at harvest. The larger the area of land owned, the more the costs incurred at production can be affected. Farmers in both BKPHs in utilizing land, do not only plant one NTFP commodity. In practice in the field, some farmers utilize land with a combination of two types of commodities. Table 2 shows the number of NTFP commodities grown by farmers during 2020.

Table 2. Quantity of NTFP commodities used by farmers in 2020.

Plot 66A RPH Sumberkembang BKPH Sumbermanjing		
Number	**NTFP commodities**	**Quantity yr^{-1} (kg $bunch^{-1}$)**
1.	Coffee	25 799
2.	Clove	11 855
3.	Banana	2 094
Plot 46B RPH Lebakharjo BKPH Dampit		
Number	**NTFP commodities**	**Quantity yr^{-1} (kg $bunch^{-1}$)**
1.	Coffee	85 453
2.	Clove	909
3.	Banana	4 408

Source: processed primary data, 2021

Farmers in both plots developed NTFPs by planting coffee, cloves, and bananas. Farmers in the two research locations (fields) did not only use one NTFP commodity; some were combined. Based on the data presented in Table 2, both locations have the potential for non-timber forest products (NTFPs) in the form of coffee, cloves and bananas. The three types of

NTFPs utilized by forest village communities generally have the same maintenance methods, such as fertilizer application, weeding, aeration, and pest eradication.

The quantity obtained by the farmers of plots of 66A RPH Sumberkembang BKPH Sumbermanjing for coffee is 25 799 kg; clove commodities amounted to 11 855 kg and 2 094 bunches of banana commodities. Meanwhile, the quantity obtained by farmers in the 46B RPH Lebakharjo BKPH Dampit plot for coffee was 85 453 kg; clove commodities amounted to 909 kg; banana commodities amounted to 4 408 bunches. The quantity is obtained based on the total calculation of the yields received by all farmers in 1 yr in 2020. Each NTFP commodity used by farmers has a different average contribution to income. The contribution of income from NTFPs to the average income of farmers is presented in Table 3.

Table 3. Contribution of farmers' average income per NTFP commodity.

Plot 66A RPH Sumberkembang BKPH Sumbermanjing					
Number	**NTFP commodity**	**Price (kg bunches^{-1})$^{-1}$ (IDR)**	**Quantity yr^{-1} (kg yr^{-1})**	**Average income yr^{-1} (IDR)**	**Percentage (%)**
1.	Coffee	22 000	25 799	6 677 000	39.51
2.	Clove	68 000	11 855	9 484 000	56.12
3.	Banana	30 000	2 094	739 000	4.37
Total				**16 900 000**	**100**
Plot 46B RPH Lebakharjo BKPH Dampit					
Number	**NTFP commodity**	**Price (kg bunches^{-1})$^{-1}$ (IDR)**	**Quantity yr^{-1} (kg yr^{-1})**	**Average income yr^{-1} (IDR)**	**Percentage (%)**
1.	Coffee	20 000	85 453	17 990 000	89.81
2.	Clove	68 000	909	650 000	3.24
3.	Banana	30 000	4 408	1 392 000	6.95
Total				**20 032 000**	**100**

Source: processed primary data, 2021

The average contribution of farmers' income to plots of 66A RPH Sumberkembang BKPH Sumbermanjing, the largest average contribution came from clove commodity of IDR 9 484 000 yr^{-1}. This amount is compared to the total income of farmers, which is 56.12 %. The next largest average contribution is coffee at IDR 6 677 000 yr^{-1}. This amount is compared to the total income of farmers, which is 39.51 %. The last one is banana, which is IDR 739 000 yr^{-1}. This amount is compared to the total income of farmers, which is 4.37 %.

The average contribution of farmers' income to plots of NTFPs in plots of 46B RPH Lebakharjo BKPH Dampit, the largest average contribution came from coffee commodities of IDR 17 990 000 yr^{-1}. This amount is compared to the total income of farmers, which is 89.81 %. The next largest average contribution is bananas at IDR 1 392 000 yr^{-1}. This amount is compared to the total income of farmers, which is 6.95 %. The last one is cloves, which is IDR 650 000 yr^{-1} from the total income of IDR 61 812 000 yr^{-1}. This amount is compared to the total income of farmers, which is 3.24 %.

The income referred to in this study is all income received by farmers in both locations (plots) of research based on their activities or activities not deducted by the operational costs incurred. This income is income derived from the results of activities in the forest area (utilization of NTFPs) or all revenues/income received from activities outside the forest area (side jobs) such as farm laborers, traders, breeders, and so on which are further categorized as other income. What is meant by income from forest areas is income obtained by farmers

due to their activities carried out in forest areas, such as from plantation products in the forest, sales of firewood, sales of carpentry wood, and so on [9].

The amount of NTFP contribution to farmers' income illustrates the level of dependence and utilization of farmers on NTFPs. Thus, the higher the contribution of NTFPs to farmers' income, the higher the level of farmers' dependence on these NTFPs. The data regarding the contribution of NTFPs to farmers' income in the two research locations (plots) is presented in the Table 4.

Table 4. Contribution of farmer's average per annual income to total income.

Plot 66A RPH Sumberkembang BKPH Sumbermanjing			
Number	**Source of income**	**Average income yr^{-1} (IDR)**	**Contribution percentage (%)**
1.	NTFP	16 900 000	79.07
2.	Another income	4 473 000	20.93
Total		**21 373 000**	**100**
Plot 46B RPH Lebakharjo BKPH Dampit			
Number	**Source of income**	**Average income yr^{-1} (IDR)**	**Contribution percentage (%)**
1.	NTFP	20 032 000	93.58
2.	Another income	1 376 000	6.42
Total		**21 408 000**	**100**

Comparing income on NTFPs and other results, it can be said that the contribution of income from NTFPs for farmers in the two research locations (plots) is quite significant and gives a real contribution to farmers' income. The percentage gain given by NTFPs to the average income yr^{-1} contribution of farmers for the two research locations (plots) shows that more than half of the respondents' total income (79.07 %) and almost entirely fulfilled (93.58 %) originates and depends from NTFPs. It also shows that farmers in both locations (plots) of the study are highly dependent on the existence and products of the forest. This means that local communities are dependent on NTFPs if they have access to better non-farm activities and agricultural land. It also found that agricultural land is significantly and positively correlated with the NTFPs income [16, 10]. The average total income per yr, average total expenditure per yr, and B/C ratio of farmers are presented in Table 5.

Table 5. Average total income per yr, average total expenditure per yr, and farmer's B/C ratio.

Plot 66A RPH Sumberkembang BKPH Sumbermanjing		
Average total income yr^{-1} (IDR)	**Average total expenditure yr^{-1} (IDR)**	**B/C ratio**
21 373 000	14 485 000	1.47
Plot 46B RPH Lebakharjo BKPH Dampit		
Average total income yr^{-1} (IDR)	**Average total expenditure yr^{-1} (IDR)**	**B/C ratio**
21 408 000	15 753 000	1.35

The table above shows that farmers' average total income yr^{-1} in plot 66A RPH Sumberkembang BKPH Sumbermanjing is IDR 21 373 000 yr^{-1}. Meanwhile, the average total expenditure yr^{-1} is IDR 14 485 000 yr^{-1}. The B/C ratio obtained for all farmers in the 66A plot of RPH Sumberkembang BKPH Sumbermanjing is 1.47. The value of the B/C ratio is obtained from the average total income yr^{-1} divided by the average total expenditure yr^{-1}. The B/C ratio with a value of 1.47 means that the business is profitable and feasible to continue in the future. B/C ratio can be used to assess business decisions, examine the worth of public investments, or assess the wisdom of using natural resources or altering environmental conditions [17, 18].

Data from farmers plots 46B RPH Lebakharjo BKPH Dampit shows that the average total income yr^{-1} obtained by plots 46B RPH Lebakharjo BKPH Dampit is IDR 21 408 000 yr^{-1}.

For the average total expenditure yr^{-1}, it is obtained IDR 15 753 000 yr^{-1}. The B/C ratio obtained for all farmers plots 46B RPH Lebakharjo BKPH Dampit is 1.35. The B/C ratio with a value of 1.35 means that the business is profitable and feasible to continue in the future. The criteria for the feasibility of farming are further explained by Widyaningsih and Achmad [19], where: if the B/C value > 1, then the farming activity can be said to be feasible or simply the farming activity is profitable, whereas if the B/C value < 1 then the farming activity is feasible. Farming activities can be said to be unfeasible, or simply the farming activities suffer losses, and if the B/C value = 1, then farming activities can be said to be a break-even point (no profit or loss).

4 Conclusions

Based on the study results, it can be concluded that farmers in plot 66A of RPH Sumberkembang obtain the highest average income yr^{-1}, which is found in clove commodities with a percentage of 56.12 %. The lowest is in banana commodities with a percentage of 4.37 %, while respondents in plot 46B RPH Lebakharjo obtained the highest average income yr^{-1} for coffee with 89.81 %, and the lowest was on cloves with a percentage of 3.24 %. Meanwhile, the contribution of NTFPS to the average income yr^{-1} for farmers in the 66A RPH Sumberkembang plot was 79.07 %. On the other hand, the contribution of NTFPS to the average income yr^{-1} of farmers in the 46B RPH Lebakharjo plot was 93.58 %. Thus, it can be concluded that the average income yr^{-1} for all farmers in both locations (plots) of the study shows that NTPS has a significant contribution to the economy and that all farmers are highly dependent on the existence and products of the forest.

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