Contribution of Non-Wood Forest Products to Community Income Around Mount Bromo Forest Areas with Special Purposes

Ana Agustina♥, Miki Satria Wardana, Rissa Rahmadwiati

Forest Management Study Program, Faculty of Agriculture, Universitas Sebelas Maret, Surakarta, Indonesia
♥Corresponding author email: ana.agustina2018@staff.uns.ac.id

Abstract. Utilization of Non-Wood Forest Products (NWFP) by the community is divided into three categories according to economic value, namely the level of subsistence, the level of local use, and commercial. The interaction of the surrounding community with KHDTK Mount Bromo includes various uses of the area in the form of wood and non-wood, including NWFPs. Therefore, it is necessary to study the contribution of NWFPs to the income of the people around KHDTK Mount Bromo. This study aims to assess the potential of Non-Wood Forest Products (NWFPs) in the vicinity of KHDTK Mount Bromo and determine their contribution to the local community's income. This study was conducted from January to March 2023, this study used an interview method with a questionnaire to obtain information from respondents chosen by purposive sampling in Delingan Village, Gedong Village, and Sewurejo Village, Karanganyar Regency, Central Java. The results of this study obtained information that the contribution of NWFPs to the income of the community around KHDTK Mount Bromo was 17.3% in Delingan Village, 5.18% in Gedong Village, and 20% in Sewurejo Village with the largest potential for NWFPs in the three research locations were durian, with an annual yield in Delingan Village of 1,040 kg, Gedong Village of 415 kg, and Sewurejo Village of 1,625 kg. The contribution of NWFPs in rupiah in Delingan Village is IDR 95,815,000/year; in Gedong Village is IDR 54,100,000/year; and in Sewurejo Village is IDR 116,490,000/year. The results of the F-test showed significant results with factors such as the age of the respondent, number of family members, education, land area, and distance from house to land on NWFP's income.

Keywords: contribution of non-wood forest products; economic valuation; utilization of forest products

INTRODUCTION

Non-Wood Forest Products (NWFPs) are derived from various components of plants and animals (Hidayat, 2008; Daşdemir & Söğüt, 2018). NWFPs that are frequently utilized and possess commercial worth encompass latex, fruits, edible plants, essential oils, decorative plants, bamboo, rattan, and other derived materials (Musa et al., 2023). The use of NWFPs is commonly found in communities living around forests (Rahman et al., 2021). NWFPs are utilized by individuals either as their primary means of sustenance or as a supplementary supply (Dinda et al., 2020; Rahman et al., 2021). Based on research by Gurung et al. (2021) shows that around 10% of the world's people depend on the existence of mountain forest ecosystems, one of the forest products that can be utilized is the NWFP group. According to Marshall et al. (2006), NWFPs can account for 7-95% of a family's yearly earnings and serve as a source of food storage in times of financial instability. According to this research, it is established that NWFPs

possess significant potential as they can account for 95% of a family's income. This implies that by employing NWFPs, they can become the primary source of income for the community.

So far NWFPs are thought to have much greater economic value than wood and do not cause forest damage so they do not result in the loss of functions and service values of the forest (Angelsen et al., 2014; Steele et al., 2015; Mugido & Shackleton, 2019). However, NWFPs utilization in the vicinity of forest regions remains suboptimal at present. Information is lacking in the vicinity of the forest due to the fact that forest farmer organizations have not yet been established and not all communities are aware of the benefits of NWFPs.

The Mount Bromo Forest Area Special Purpose (KHDTK) is primarily characterized by the presence of community settlements and gardens that extend along its administrative boundaries. This facilitates direct engagement from members of the local community in the vicinity of KHDTK Mount Bromo. Based on research by Wicaksono et

347

al. (2020), The interaction between the KHDTK of Mount Bromo and the neighboring community encompasses a variety of product (in the form of wood and NWFPs) and service-oriented uses of the area. Product-based benefits include firewood, animal feed, bamboo, fruit, and pine resin; service-oriented benefits comprise access to pure water and arable land. However, this research has not conducted a more comprehensive investigation into the community's utilization of NWFPs in the vicinity of KHDTK Mount Bromo; thus, data regarding the potential application of NWFPs in that area remain unpublished.

This study aims to assess the potential of Non-Wood Forest Products (NWFPs) in the vicinity of KHDTK Mount Bromo and determine their contribution to the local community's income. The findings of this study can serve as guidance for the enhancement of NWFPs in the KHDTK Mount Bromo area, ensuring maximum benefits for the community, management, and government. The objective of this study is to determine the extent of the utilization of NWFPs by the local people residing around KHDTK Mount Bromo, as well as to assess the economic impact of NWFPs to their income.

METHODS

Method of collecting data

The data collection for this study was conducted from January to March 2023, utilizing qualitative research methodologies supplemented with quantitative data. Data gathering employs the interview technique, including questionnaire instruments, to acquire information from participants. Additional supporting data is required, which can be gathered from government entities at both the sub-district and district levels, as well as from sub-district/village institutions. Subsequently, the data is gathered and analyzed before being shown in the format of tables and diagrams. The data was subsequently examined through a three-step process, which encompassed data reduction,

data presentation, and generating conclusions. Data reduction is the process of selectively organizing or directing attention towards the data that is necessary for making conclusions.

The research employed a survey method and complete observers for primary data gathering, specifically utilizing purposive sampling. The selection of the research location was determined by the extent to which the local community relies on forests in the KHDTK Mount Bromo. NWFPs samples are collected by a rolling approach between respondents. In this survey, 30 respondents were assigned to each location, resulting in a total of 90 respondents. The participants in this study were selected from Delingan Village, Gedong Village, and Sewurejo Village, which are adjacent to the KHDTK Mount Bromo. The consideration for determining the location is based on how much the community is dependent on the forest.

Data analysis method

The calculation of the NWFPs contribution for each type by respondents is calculated using the income value calculation, as follows (Ratnaningsih, 2006):

$$X = n_1 + n_2 + n_3 + n_{....} \quad \ldots\ldots\ldots\ldots 1)$$

annotation:

x = total NWFPs contribution per type/year

n1, n2, n3, n.. = NWFP contribution per type/year

The method for calculating the average contribution per category of NWFP is as follows (Ratnaningsih, 2006):

$$M = \frac{\sum xi}{n} \quad \ldots\ldots\ldots 2)$$

annotation:

M = average NWFP contribution per type group/year

$\sum xi$ = total NWFPs contribution per type/year

n = number of respondents

To calculate the contribution of NWFPs for all types of groups, use the following equation (Ratnaningsih, 2006):

$$T = X_1 + X_2 + X_3 + n_{…} \ldots\ldots\ldots 3)$$

annotation:

T = total NWFPs contribution of all types/year

$x1, x2, x3, n.. = $ NWFP contribution per type/year

To calculate the percentage contribution of NWFPs to community's income, use a formula (Ratnaningsih, 2006; Luswaga, 2023):

$$Y_{hbk} = \frac{dh}{(dh + dl)} \times 100\% \ldots\ldots 4)$$

annotation:

Y_{hbk} = percentage of NWFPs from total income

dh = income from NWFPs

dl = income from outside NWFPs

Then an analysis is carried out regarding the economic value of forest products as follows (Dewi, 2018):

Economic value of forest products = total number of items per type x selling price …5)

Economic Value of each type = TPj x Hj …6)

annotation:

TPj = total number of items per type

Hj = selling price

Total economic value = the sum of the economic value of NWFPs for each type (Zega et al., 2011):

NE = NE1 + NE2 + NE3 + Nen ... 7)

annotation:

NE = economic value

NE1, NE2, NEn = economic Value of NWFPs for each type

Determine the economic value of each type of NWFP using the subsequent equation (Zega et al., 2011):

$$\text{Economic Value of each type (\%)} = \frac{economic\ value\ of\ each\ type}{\text{Netotal}} \times 100\% \ldots 8)$$

annotation:

Economic Value of each type (%) = percentage of the economic value of NWFPs

Economic Value of each type = economic Value of NWFPs for each type

Netotal = Total economic value of all types of NWFPs

And to calculate the average economic value obtained by respondents using the following equation:

$$\text{Ne} = \frac{\text{Netotal}}{n} \ldots 9)$$

annotation:

Netotal = total economic value of all types of NWFPs

n = number of Respondents

The objective of multiple linear regression analysis is to ascertain the direction of the link between the independent variable and the dependent variable, specifically whether each dependent variable is positively or negatively correlated. Additionally, it is possible to forecast the value of the dependent variable in the event of a rise or reduction in the independent variable. The multiple linear regression employs the subsequent equation:

$$Y = a + b1X_1 + b2X_2 + b3X_3 + b4X_4 + b5X_{5+}e \ldots 10)$$

annotation:

Y = income from NWFPs

a = constant value

X_1 = respondent's age

X_2 = number of family members

X_3 = level of education

X_4 = land area

X_5 = distance from house to land

e = error

RESULTS AND DISCUSSION

a. Respondent Characteristics

The results of the age distribution of respondents in the three research locations indicate that the majority of participants in this study were individuals in their productive years, ranging from 15 to 64 years old. Specifically, there were 83 respondents, accounting for 92.22% of the total sample. Meanwhile, 7.78% or 7 participants were categorized as unproductive due to being above the age of 64. Age is one of the factors that influences income. The physical strength of an individual can be determined based on their productive age, specifically between 15 and 64 years, and this strength has an impact on their everyday activities. Based on Putri dan Setiawina (2013), An individual's

capacity to perform physical activities is highly correlated with their age. As an individual's age beyond the productive phase, their physical prowess diminishes, resulting in a decline in both production and revenue. Typically, individuals in their prime working years have the potential to generate higher income compared to those who are not in their prime working years.

The characteristics of respondents (**Table 1**) based on education in the three research locations have different characteristics. Delingan Village is dominated by respondents with no educational level (46.67%), Gedong Village is dominated by respondents who have completed elementary school (SD) (30%), and Sewurejo Village is dominated by respondents who have completed Senior High School (SMA) (33.33 %). Education can influence a person's economy. This is because with a low level of education, it is difficult for a person to get a decent job because as time goes by the available jobs will look for workers with a high level of education. This difficulty in obtaining work can cause someone to have difficulty in earning an income so that they are unable to meet their living needs. Education at this level impacts an individual's capacity to comprehend and adapt information, particularly in connection to their knowledge of NWFPs. Consequently, education plays a crucial role in shaping one's understanding of the utilization of certain NWFPs.

The distribution of respondents in Delingan Village based on their type of work is primarily comprised of 18 individuals engaged in farming, accounting for 60% of the total. In Gedong Village, the majority of respondents, 11 individuals or 36.67%, are also involved in farming. Conversely, in Sewurejo Village, the dominant occupation among respondents is entrepreneurship, with 11 individuals or 36.67% engaged in this field. The majority of respondents in Delingan Village had incomes below the Karanganyar District Minimum Wage (UMK) (< Rp. 2,207,483), with a total of 25 people. In Gedong Village, 18 respondents had incomes equal to or above the Karanganyar UMK. In Sewurejo Village, the majority of respondents had incomes below the Karanganyar UMK, with a total of 23 people.

b. Contribution of Non-Wood Forest Products

Based on the research that has been conducted, the research results are grouped at each research location. The types of NWFPs in Delingan Village are grouped based on Minister of Forestry Regulation Number P.35/Menhut-II/2007 concerning Non-Wood Forest Products. Based on the data obtained, in Delingan Village there are 3 groups of NWFPs types, namely fruit, starch (carbohydrates), and food plants. The fruit group consists of avocado (*Persea americana*), star fruit (*Averrhoa carambola*), durian (*Durio zibethinus*), water guava (*Syzygium aqueum*), longan (*Dimocarpus longan*), mango (*Mangifera indica*), passion fruit (*Passiflora edulis*), jackfruit (*Artocarpus heterophyllus*) and rambutan (*Nephelium lappaceum*). The starch (carbohydrate) group consists of porang (*Amorphophallus muelleri*), suweg (*Amorphophallus paeoniifolius*), and taro (*Colocasia esculenta*). The food crop group is sugar cane (*Saccharuum officinarum*). Gedong Village has 3 groups of NWFPs, namely fruit, starch (carbohydrates), and bamboo. The fruit group consists of dragon fruit (*Hylocerus undatus*), durian (*Durio zibethinus*), water guava (*Syzygium aqueum*), guava (*Psidium guajava*), lime (*Citrus aurantifolia*), orange (*Citrus sinensis*), longan (*Dimocarpus longan*), lemon (*Citrus limon*), mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), breadfruit (*Artocarpus altilis*), sapodilla (*Manilkara zapota*), and rambutan (*Nephelium lappaceum*). The starch (carbohydrate) group consists of porang (*Amorphophallus muelleri*) and suweg (*Amorphophallus paeoniifolius*). The bamboo group is bamboo (*Bambusa* sp.). In Sewurejo Village there are 3 groups of NWFP types, namely fruit, starch

(carbohydrates), and bamboo. The fruit group consists of avocado (*Persea americana*), durian (*Durio zibethinus*), guava (*Psidium guajava*), longan (*Dimocarpus longan*), coffee (*Coffea canephora*), mango (*Mangifera indica*), sapodilla (*Manilkara* **Table 1**. Respondent characteristics

zapota), and rambutan (*Nephelium lappaceum*). The starch (carbohydrate) group is suweg (*Amorphophallus campanulatus*). The bamboo group is bamboo (*Bambusa* sp.). The total contribution per type of NWFPs in one year is presented in **Table 2**.

Table 1. Respondent characteristics

Village	Characteristic	Criteria	Quantity	Percentage (%)
Delingan	Age (year)	30-40	-	-
		40-50	5	16.67
		51-60	14	46.67
		61-70	11	36.66
	Education Background	No educational	14	46.67
		Elementary School	6	20
		Junior High School	2	6.67
		Senior High School	5	16.67
		Diploma	1	3.33
		Undergraduate	1	3.33
		Magister	1	3.33
	Ocupation	Farmer	18	60
		Entrepreneur	5	16.67
		Others	7	23.33
Gedong	Age (year)	30-40	1	3.33
		40-50	9	30
		51-60	12	40
		61-70	8	26.67
	Education Background	No educational	5	16.67
		Elementary School	9	30
		Junior High School	6	20
		Senior High School	7	23.34
		Diploma	1	3.33
		Undergraduate	1	3.33
		Magister	1	3.33
	Occupation	Farmer	11	36.67
		Entrepreneur	8	26.66
		Others	11	36.67
Sewurejo	Age (year)	30-40	-	-
		40-50	12	40
		51-60	13	43.33
		61-70	5	16.67
		No educational	9	30
		Elementary School	4	13.33
		Junior High School	5	16.67
		Senior High School	10	33.33
		Diploma	-	-
		Undergraduate	2	6.67
		Magister	-	-
	Occupation	Farmer	9	30
		Entrepreneur	11	36.67
		Others	10	33.33

Table 2. Total NWFPs contribution per type per year in the three research locations

	Delingan Village		Gedong Village		Sewurejo Village	
No.	Types of NWFPs	Total NWFP contribution per type.year^{-1} (Rupiah)	Types of NWFPs	Total NWFP contribution per type.year^{-1} (Rupiah)	Types of NWFPs	Total NWFP contribution per type.year^{-1} (Rupiah)
1	Avocado	7,870,000	Bamboo	650,000	Avocado	6,930,000
2	Apple	-	Dragon fruit	420,000	Bamboo	2,700,000
3	Star fruit	140,000	Durian	15,025,000	Durian	91,775,000
4	Durian	49,750,000	Water guava	1,080,000	Guava	410,000
5	Water guava	240,000	Guava	300,000	Longan	6,055,000
6	Longan	8,060,000	Orange	400,000	Coffee	7,000,000
7	Mango	1,130,000	Lime	375,000	Mango	125,000
8	Passion fruit	160,000	Longan	8,155,000	Rambutan	660,000
9	Jackfruit	600,000	Lemon	360,000	Sapodilla	595,000
10	Porang	1,375,000	Mangga	400,000	Suweg	240,000
11	Rambutan	1,220,000	Nangka	1,200,000		
12	Suweg	2,440,000	Porang	1,250,000		
13	Taro	80,000	Rambutan	2,518,000		
14	Cane	22,750,000	Sapodilla	1,300,000		
			Breadfruit	1,500,000		
			Suweg	560,000		
Total		**Rp95,815,000**	**Total**	**Rp35,493,000**	**Total**	**116,490,000**

Table 2 illustrates the durian makes the largest overall contribution to the Non-Wood Forest Products (NWFPs) in Delingan Village, Gedong Village, and Sewurejo Village. The annual contributions from durian in are IDR 49,750,000, IDR 15,025,000, and IDR 91,775,000, respectively. According to data provided by the Karanganyar Regency Central Statistics Agency, there were a total of 18 durian trees harvested in Karanganyar District in 2018, resulting a yield of 800 kg. This suggests that durian has significant potential in Karanganyar Regency. The exorbitant price at which durian is sold indicates significant contribution. Durian management, typically through durian plantations (Thorogood et al., 2022) that are cultivated as monocultures, can also impact the extent to which durian contributes to community revenue.

The utilization of durian in these three regions is due to the presence of fertile terrain that is conducive to the cultivation of durian. According to Sariati (2012), the necessary conditions for cultivating durian include an annual rainfall range of 3,000-3,500 mm with a minimum of 1,500-3,000 mm, consistent rainfall throughout the year with dry intervals of 1,500-3,000 mm, a light intensity of 60-80%, and an average temperature of 20-30 ℃. According to Putri (2013), Karanganyar Regency has a tropical climate with temperatures of 22-31 ℃ and rainfall ranging from 1,506-2,722 mm.year^{-1}. Considering the land features, it can be concluded that Karanganyar Regency has highly suitable land for durian cultivation. As a result, a significant number of respondents in the three research areas choose to produce durian.

Table 3. Economic value of NWFPs in Delingan Village

No.	Types of NWFPs in Delingan Village	Number of Respondents Who Utilize	Number of Harvests per Type of NWFPs in One Year (kg)	Total Economic Value (IDR)	Economic Value of each type (%)
1	Avocado	7	355	7,987,500	8.77
2	Apple	1	0	0	0
3	Star fruit	1	20	140,000	0.15
4	Durian	9	1,040	44,200,000	48.55
5	Water guava	1	30	240,000	0.26
6	Longan	12	415	8,715,000	9.57
7	Mango	5	195	1,267,500	1.39
8	Passion fruit	1	20	160,000	0.18
9	Jackfruit	2	60	600,000	0.66
10	Porang	1	55	1,375,000	1.51
11	Rambutan	8	280	1,120,000	1.23
12	Suweg	6	305	2,440,000	2.68
13	Taro	1	5	40,000	0.04
14	Cane	3	17,500	22,750,000	24.99
Total		**30**	**20,280**	**91,035,000**	**100**

Table 4. Economic value of NWFPs in Gedong Village

No.	Types of NWFPs in Gedong Village	Number of Respondents Who Utilize	Number of Harvests per Type of NWFPs in One Year (kg)	Total Economic Value (IDR)	Economic Value of each type (%)
1	Bamboo	2	50	625,000	1.64
2	Dragon fruit	1	35	420,000	1.10
3	Durian	4	445	16,687,500	43.86
4	Water guava	4	130	1,105,000	2.90
5	Guava	3	95	617,500	1.62
6	Orange	2	50	400,000	1.05
7	Lime	2	55	357,500	0.94
8	Longan	12	415	8,507,500	22.36
9	Lemon	1	45	360,000	0.95
10	Mango	2	60	420,000	1.10
11	Jackfruit	1	80	1,200,000	3.15
12	Porang	1	50	1,250,000	3.29
13	Rambutan	14	730	2,737,500	7.19
14	Sapodilla	3	130	1,300,000	3.42
15	Breadfruit	1	100	1,500,000	3.94
16	Suweg	1	70	560,000	1.47
Total		**30**	**2,540**	**38,047,500**	**100**

Table 5. Economic value of NWFPs in Sewurejo Village

No.	Types of NWFPs in Sewurejo Village	Number of Respondents Who Utilize	Number of Harvests per Type of NWFPs in One Year (kg)	Total Economic Value (IDR)	Economic Value of each type (%)
1	Alpukat	11	335	7,202,500	6.49
2	Bamboo	2	180	2,700,000	2.43
3	Durian	15	1,625	85,312,500	76.90
4	Guava	2	60	390,000	0.35
5	Longan	10	305	6,252,500	5.64
6	Coffee	2	200	7,500,000	6.76
7	Mango	1	25	125,000	0.11
8	Rambutan	7	225	618,750	0.56
9	Sapodilla	4	85	595,000	0.54
10	Suweg	1	30	240,000	0.22
Total		**30**	**3,070**	**110,936,250**	**100**

The average economic value acquired by each respondent in one year from NWFPs in Delingan Village, Gedong Village, and Sewurejo Village, as indicated in **Tables 3**, **4**, and **5**, respectively, is IDR 3,034,500; IDR 1,268,250; and IDR 3,697,875. The NWFPs with the greatest economic value for each respective location are as follows: durian at 48.55% in Delingan Village, 43.86% in Gedong Village, and 76.90% in Sewurejo Village. Durian is the type that has the highest contribution, which is thought to be related to the suitability of the land where it is grown so that the success of the durian fruit harvest is higher than other types. This is in line with research by Indratna et al. (2023) Gempolan Village in Karanganyar Regency has the highest potential for NWFPs, particularly durian. The economic value approach to NWFPs seeks to elucidate the impact of forest resources on community income, particularly for populations residing in close proximity to forests (Hastari & Yulianti, 2018). Once the economic value is determined, it will positively affect the economic development of communities surrounding the forest. Additionally, it will enhance the recognition of the contribution of NWFPs as people will become aware of the economic worth of different types of NWFPs, leading to increased utilization by the community (APHI, 2002). An effective approach to boost community revenue is by implementing agro-tourism, such as the establishment of durian agro-tourism in Gandasoli, Sukabumi (Lestari et al., 2020). After assessing the economic worth of NWFPs at each research location, this information can serve as a useful reference for management of KHDTK Mount Bromo. In addition, cooperation, communication, and coordination are essential factors in achieving improved marketing of NWFPs (Kurniati et al., 2023).

Based on **Table 6**, the contribution of NWFPs in the three research locations varies, with the highest contribution found in Sewurejo Village at 20%. The contribution value is nearly identical to the research conducted by Burhanuddin (2021) on the contribution of NWFPs in Community Forests (HKm) to the income of the community in Kapita Village, Bangkala District, Jeneponto Regency, with a contribution value of 21.71% in that location. Chairan and Aidar (2018) conducted research on the role of NWFPs in generating revenue for the community in Panton Pawoh Village. The research findings indicate that NWFPs accounted for 19.86% of the community's income. Based on these two studies, the contribution of NWFPs in Delingan Village

and Sewurejo Village is quite similar. However, in Gedong Sub-District, the contribution of NWFPs is relatively low. This is because the area receives a significant

amount of money from sources other than NWFPs, which consequently diminishes the value of NWFPs contribution in the region.

Table 6. Contribution of NWFPs in the three research locations

	Delingan Village	Gedong Village	Sewurejo Village
Non-NWFPs income of all respondents/month (IDR)	38,000,000	54,100,000	38,800,000
Non-NWFPs income per month/respondent (IDR)	1,266,666	1,803,333	1,293,333
NWFPs Income per Year/Respondent (IDR)	3,193,833	1,183,100	3,883,000
NWFPs Income per Month/Respondent (IDR)	266,153	98,592	323,538
NWFP Contribution Percentage (%)	**17.3**	**5.18**	**20**

Multiple linear regression analysis aims to find the influence of two or more independent variables (X) on the dependent variable (Y). The independent variables in this research include age (X_1), number of family members (X_2), education (X_3), land area (X_4), and distance from house to land (X_5). The regression equation formula in the three research locations is as follows:

$$Y = -171910 + 2051.804X_1 + 4986.003X_2 + 86281.2X_3 + 72.08368X_4 + 256.8605X_5 + e$$

From the regression equation above, it can be seen as follows:

1. The constant value of -171910 with a negative sign state that if the variables X_1, X_2, X_3, X_4, & X_5 are equal to zero, so income from NWFPs has decreased by 171910.

2. Regression coefficient value X_1 (age) of 2051.804 with a positive sign state that if the age level rises one unit with the assumption of other independent variables, then the income from NWFPs will increase by 2051.804.

3. Regression coefficient value X_2 (number of family members) is 4986.003 with a

positive sign stating that if the level of the number of family members increases by one unit assuming the other independent variables are constant, then income from NWFPs will increase by 4986.003.

4. Regression coefficient value X_3 (education) of 86281.2 with a positive sign stating that if the level of education increases by one unit assuming the other independent variables are constant, then income from NWFPs will increase by 86281.2.

5. Regression coefficient value X_4 (land area) is 72.08368 with a positive sign stating that if the land area increases by one unit assuming the other independent variables are constant, then income from NWFPs will increase by 72.08368.

6. Regression coefficient value X_5 (distance from house to land) is 256.8605 with a positive sign stating that if the distance from house to land increases by one unit assuming the other independent variables are constant, then income from NWFPs will increase by 256.8605.

The Coefficient of Determination (R-Square) for the dependent variable (income from NWFPs) is 0.217, indicating that the independent variables (age, number of family

members, education, land area, and distance from house to land) collectively account for 21.7% of the variation in income from NWFPs. Based on the research conducted by Hair et al. (2011), there are three groupings in the R-Square value, namely the strong category (> 0.75), the moderate category (0.50-0.75), and the weak category (< 0.25). Based on this, the data from this study is in the weak category (<0.25), where 78.3% is influenced by other variables that were not tested in the research. Lasmini et al. (2022) examines the elements that affect the revenue generated by non-timber forest products (NWFP). These parameters, which are considered independent variables, include labor absorption, the number of family members, and the land area. This research demonstrates that the R-square value is 64.1%, indicating a substantial and significant influence of the independent variable on the dependent variable. The variation in results may be attributed to disparities in respondent characteristics between this particular study and other investigations.

The F test result of 4.655 is greater than the f table value of 2.479 with a significance level of 0.000845 <0.05, so simultaneously the variables age, number of family members, education, land area and distance from house to land have a significant effect on the income variable. After knowing the influence of the independent variables on the dependent variable together, a statistical t test is then carried out to find out whether the independent variables partially have a significant effect on income (dependent variable). The test is carried out by comparing t table and t count, where t count > t table, so the individual independent variables have a significant influence on the dependent variable. The t test results show that only the land area variable has a significant effect on income from NWFPs. This is in line with research Sari & Ratnaningsih (2020); Andika (2021), that the larger the land area, the greater the income received by respondents. Considering that the larger the land, the more

plants will be planted and harvested on that land, which will affect income levels.

NWFPs have the potential to increase community income, especially for communities around the KHDTK Mount Bromo UNS. However, the current phenomenon is that NWFPs are not seen as a source of income due to the lack of information regarding the utilization, selling price and market for these NWFPs, so that continuous efforts and collaboration between stakeholders are needed so that they not only create opportunities for alternative economic sources for the community. Also, the development of NWFPs will support the creation of sustainable forest management.

CONCLUSION

The contribution of NWFPs to the income of communities around the Mount Bromo KHDTK in Delingan Village, Gedong Village and Sewurejo Village is 17.3% each; 5.18%; and 20%. The average economic value obtained by each respondent in one year from NWFPs in Delingan Village, Gedong Village and Sewurejo Village respectively is IDR 3,034,500; IDR 1,268,250; and IDR 3,697,875. At these three research locations, the same potential NWFP type was obtained, namely durian with annual harvests in Delingan Village, Gedong Village, and Sewurejo Village of 1,040 kg.year^{-1}, 415 kg.year^{-1}, and 1,625 kg.year^{-1} respectively which could be developed as an alternative source of income for the community around the KHDTK Mount Bromo, because it has the highest economic value and is supported by other factors such as land suitability, form of management, and buyer interest among other NWFPs.

ACKNOWLEDGEMENTS

the Forest Management Study Program, Faculty of Agriculture, UNS.

REFERENCES

Andika, S. (2021). Analisis Pendapatan Petani Hasil Hutan Bukan Kayu (HHBK) Mitra Kphp Limau Unit VII Hulu Kabupaten Sarolangun. [skripsi]. Universitas Jambi.

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Börner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental Income and Rural Livelihoods: A Global-Comparative Analysis. *World Development*, *64*, S12–S28. https://doi.org/10.1016/j.worlddev.2014.03.006

APHI. (2002). Harga Patokan Barang-Barang Impor Hasil Hutan Indonesia. *Buletin Hutan Indonesia*, *19*(4).

Burhanuddin, B. (2021). Kontribusi Hasil Hutan Bukan Kayu (Hhbk) Di Hutan Kemasyarakatan (Hkm) Terhadap Pendapatan Masyarakat Desa Kapita Kecamatan Bangkala Kabupaten Jeneponto [Skripsi]. Universitas Muhammadiyah Makassar.

Chairan, & Aidar, N. (2018). Kontribusi Hasil Hutan Bukan Kayu terhadap Pendapatan Masyarakat (Studi Kasus Desa Panton Pawoh). *Jurnal Ilmiah Mahasiswa*, *3*(3), 379–390.

Daşdemir, İ., & Söğüt, T. (2018). The Effects of Non-Wood Forest Products on Rural Development in the Bartın Province. International Scientific and Vocational Studies Congress, 831-838.

Dewi, I. N. (2018). Kemiskinan Masyarakat Sekitar Hutan dan Program Perhutanan Sosial. *Info Teknis Eboni*, *15*(2), 65–77. https://doi.org/https://doi.org/10.20886/buleboni.5155

Dinda, S., Ghosh, S., & Chatterjee, N. Das. (2020). Understanding the Commercialization Patterns of Non-timber Forest Products and Their Contribution to the Enhancement of Tribal Livelihoods: An Empirical Study from Paschim Medinipur District, India. *Small-Scale Forestry*, *19*(3), 371–397. https://doi.org/10.1007/s11842-020-09444-7

Gurung, L. J., Miller, K. K., Venn, S., & Bryan, B. A. (2021). Contributions of non-timber forest products to people in mountain ecosystems and impacts of recent climate change. *Ecosystems and People*, *17*(1), 447–463. https://doi.org/10.1080/26395916.2021.1957021

Hair, J. F., JR, Anderson, R. E., Tatham, R. L., & Black, W. C. (2011). *Multivariate Data Analysis Fifth Edition*. Prentice Hall, Inc.

Hastari, B., & Yulianti, R. (2018). Pemanfaatan dan Nilai Ekonomi Hasil Hutan Bukan Kayu di KPHL Kapuas-Kahayan. *Jurnal Hutan Tropis*, *6*(2). https://doi.org/https://dx.doi.org/10.20527/jht.v6i2.5402

Hidayat, M. (2008). *Menggalakkan Hasil Hutan Bukan Kayu sebagai Produk Unggulan*. UGM Press.

Indratna, A. D., Putri, A. P. I. K. S., Azzahra, E. O., Oktavia, M. S., Widodo, T., Agustina, A., & Pertiwi, Y. A. B. (2023). Potential economic value of non-wood forest products in agroforestry system at Gempolan Village, Kerjo District, Karanganyar Regency: An economic perspective. *IOP Conference Series: Earth and Environmental Science*, *1220*(1). https://doi.org/10.1088/1755-1315/1220/1/012014

Kurniati, D., Hardjanto, H., & Trison, S. (2023). Analysis of Stakeholders' Interest and Influence in Non-Timber Forest Products Marketing: A Case Study in the Forest Management Unit Batutegi, Lampung. *Jurnal Sylva Lestari*, *11*(3), 454–472. https://doi.org/10.23960/jsl.v11i3.718

Lasmini, N., Markum, & Anwar, H. (2022). Tingkat Ketergantungan Petani Terhadap Hasil Hutan Bukan Kayu di HKm Wana Lestari Desa Bukit Tinggi Kecamatan Gunungsari. *Prosiding Seminar Nasional Mahasiswa Kehutanan Indonesia E*, *1*(1), 111–130.

Luswaga, H. (2023). Non-Timber Forest Products benefits for community groups and conservation motivation in mountains of Tanzania. *Environmental and Sustainability Indicators*, *18*, 100238. https://doi.org/10.1016/j.indic.2023.100238

Marshall, E., Schreckenberg, K., & Newton, A. C. (2006). *Commercialization of Non- timber Forest Products: Factors Influencing Success: Lessons Learned from Mexico and Bolivia and Policy Implications for Decision-makers*. UNEP World Conservation Monitoring Centre.

Mugido, W., & Shackleton, C. M. (2019). The contribution of NTFPS to rural livelihoods in different agro-ecological zones of South Africa. *Forest Policy and Economics*, *109*, 101983. https://doi.org/10.1016/j.forpol.2019.101983

Musa, F. I., Sahoo, U. K., Eltahir, M. E. S., Abdel Magid, T. D., Adlan, O. E., Abdelrhman, H. A., & Abdelkarim, A. A. (2023). Contribution of non-wood forest products for household income in rural area of Sudan – A review. *Journal of Agriculture and Food Research*, *14*, 100801. https://doi.org/10.1016/j.jafr.2023.100801

Nurul Huda, D., Lestari, R., Rachma, I., Purwanti, D., Fadhilah, Q. G., Huda, D. N., Dinata, A., Budiman, F., & Said, A. (2020). *Arboretum Durio Botanica: Botanical and Conservation Garden of Durian Gandasoli*.

https://www.researchgate.net/publication/342381101

Putri, A. D., & Setiawina, N. D. (2013). Pengaruh Umur, Pendidikan, Pekerjaan terhadap Pendapatan Rumah Tangga Miskin di Desa Bebandem. *E-Jurnal Ekonomi Pembangunan Universitas Udayana*, *2*(4).

Putri, D. (2013). *Analisis Suhu Udara dan Curah Hujan untuk Deteksi Perubahan Iklim Kabupaten KaranganyarTahun 1988-2011* [Skripsi]. Universitas Sebelas Maret.

Rahman, Md. H., Roy, B., & Islam, Md. S. (2021). Contribution of non-timber forest products to the livelihoods of the forest-dependent communities around the Khadimnagar National Park in northeastern Bangladesh. *Regional Sustainability*, *2*(3), 280–295. https://doi.org/10.1016/j.regsus.2021.11.001

Ratnaningsih, M. (2006). *PDRB Hijau (Produk Domestik Regional Bruto Hijau) Edisi Pertama* (1st ed.). BPFE.

Sari, W. P., & Ratnaningsih, Y. (2020). Analisis Pendapatan Petani Hhbk Kayu Putih (Melaleuca Cajuputi) di Hutan Lindung Desa Montong Sapah Kecamatan Praya Barat Daya Kabupaten Lombok Tengah. *Jurnal Silva Samalas*, *3*(1), 7–14.

Sariati, I. (2012). *Pemeliharaan Tanaman Durian*. Departemen Pertanian.

Steele, M. Z., Shackleton, C. M., Uma Shaanker, R., Ganeshaiah, K. N., & Radloff, S. (2015). The influence of livelihood dependency, local ecological knowledge and market proximity on the ecological impacts of harvesting non-timber forest products. *Forest Policy and Economics*, *50*, 285–291. https://doi.org/10.1016/j.forpol.2014.07.011

Thorogood, C. J., Ghazalli, M. N., Siti-Munirah, M. Y., Nikong, D., Kusuma,

Y. W. C., Sudarmono, S., & Witono, J. R. (2022). The king of fruits. *PLANTS, PEOPLE, PLANET*, *4*(6), 538–547. https://doi.org/10.1002/ppp3.10288

Wicaksono, R. L., Rahmadwiati, R., & Apriyanto, D. (2020). Interaksi Dan Ketergantungan Masyarakat Sekitar Terhadap Kawasan Hutan Dengan Tujuan Khusus (Khdtk) Gunung Bromo. *Jurnal Belantara*, *3*(1), 1. https://doi.org/10.29303/jbl.v3i1.421

Zega, S. B., Purwoko, A., & Martial, T. (2011). Analisis Pengelolaan Agroforestry dan Kontribusinya terhadap Perekonomian Masyarakat. *Peronema Forestry Science Journal*.