Contribution of Agroforestry to Total Farmers' Revenue in Long Beluah Village, North Kalimantan Province - Indonesia

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ABSTRACT

Agroforestry in Long Beluah Village can be developed to support welfare and maintain community economic stability. Agroforestry is one of the land management systems that can be offered to solve problems arising from food problems and at the same time provide socio-economic benefits to farmers. This research was conducted to determine agroforestry management and its contribution to the farmer's household economy. The analysis was carried out for four months starting from January-April 2019. As a guide in researching the field, this study used the stages of activities consisting of 1) surveying the research location, 2) selecting respondents, 3) Interviewing and filling out questionnaires, 4) Data collection secondary and supporting information, 5) Processing and data analysis. The results of this study: a) there are types of agroforestry plants belonging to farmers in Long Beluah village consisting of timber plants, plantation crops, fruit trees, perennial understorey, and seasonal understorey. b) The average amount of respondent's revenue from agroforestry farming for Long Beluah Village is Rp. 16,928,329 year^{-1}, the type of fruit tree that contributed the highest to the respondent's average income was water guava, which amounted to Rp. 2,439,529 year^{-1} or 24.03% of the total fruit crop revenue. c) The average number of respondents' revenue from non-agroforestry is Rp. 21,812,132 year^{-1}. Meanwhile, the contribution of agroforestry is 43.70% of the total average farmer revenue.

Keywords: Agroforestry, Long Beluah Village, Revenue, Agroforestry Contribution

1. INTRODUCTION

Most of the Agroforestry Systems in Long Beluah Village follow the traditional agroforestry systems pattern and are carried out across generations. The reason why farmers apply an agroforestry system by combining seasonal plants (short cycle) and tree crops (long process) has become a local culture passed down from generation to generation from their previous ancestors [1]. Traditional agroforestry practices are described in detail in the Lembo system in the Dayak community in Central Mahakam, East Kalimantan [2].

The design originates from plants that grow spontaneously from seeds discarded on agricultural land or maintain and maintain existing regeneration trees, developed by cultivating plants and takes place continuously.

Based on brief observations, most of the community farming systems in the villages of Bulungan District in North Kalimantan Province apply an agroforestry system, so-called "Pula Pekelet" or "Lumaq" by Long Beluah village people who are dominated by traditional tribes "Dayak Kayan" [3]. This traditional agroforestry
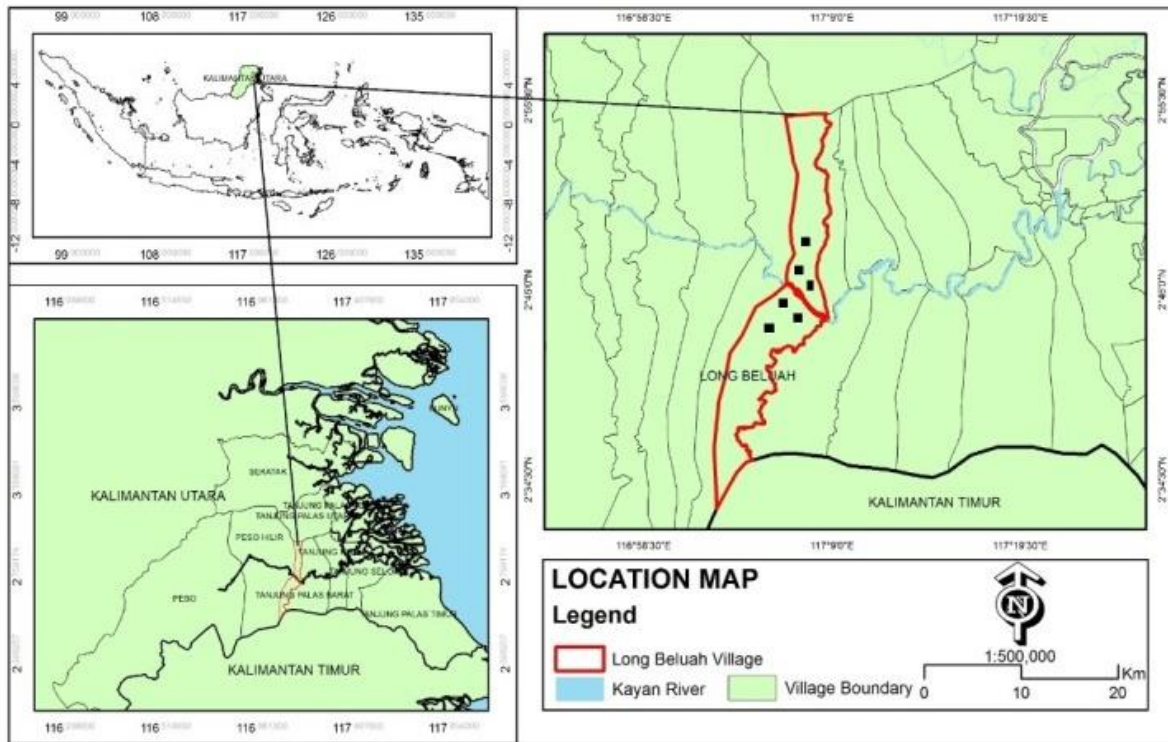
Figure 1 Location studies of Long Beluah village (•) Tanjung Palas Barat Subdistrict, Bulungan District, North Kalimantan Province, Indonesia.

system has been developed from their local culture. It can improve the community's standard of living, so this needs to prove whether agroforestry indeed contributes to the source of farmers' revenue.

Revenue itself is an indicator of the farmer's economy because its income will determine his life needs. The source of household income for farmers could be obtained from on-farm income, off-farm, and non-farm income. An agroforestry system's benefits can provide farmers with socio-economic services and increase productivity due to different yields to increase farmers' income [4]. Therefore, it is essential to do this research to know the income of agroforestry farmers and how much agroforestry contribution from farmer respondents in Long Beluah Village.

2. MATERIALS AND METHODS

2.1. Place and Time

This research was conducted in Long Beluah Village, Tanjung Palas Barat Subdistrict, Bulungan District, North Kalimantan Province, Indonesia. Graphically the village of Long Beluah is located at 2.731033 (2°43'51.72"N) and longitude 117.11471 (117°6'52.96"E). The research was carried out for four months starting from January-April 2019, starting from field orientation to data processing.

2.2. Sample Determination Method

Determination of the sample or respondent is done by the purposive sampling method. The number of respondents was determined based on the Slovin Technique [5,6]. The Slovin formula used is:

$$n = \frac{N}{N(e)2 + 1} \tag{1}$$

Where:

n = number of respondents sampled in the study

N = number of farmers in the group members in the study area

e = error limit (15%)

1 = constant number

Respondents were selected using purposive sampling based on community participation who implemented the agroforestry system. The number of respondents obtained was 34 farmers who owned the gardens.

2.3. Research Activity Stages

As a guide in researching the field, this study uses the stages of activities consisting of:

a. Initial survey of research locations

The research location's initial survey was conducted to determine the research location's general conditions and explore prospective respondents' selection purposively according to the method. In this initial survey, researchers also held an audience with local customary leaders and village heads related to the research location.

b. Explanation of the research plan to respondents

All selected respondents were collected and then explained the research plan and a specific explanation of the procedures for filling out the research questionnaire.

c. Interviewing and filling out questionnaires

The researcher was assisted by several data collection team members who conducted direct interviews with the respondents and guided them in filling out the questionnaire.

d. Retrieval of secondary data and supporting information

Secondary data and supporting information were obtained from the village head, the Forestry Service of North Kalimantan Province, and literature studies through books and research journals.

e. Processing and analysis of data

Primary data obtained from direct interviews and questionnaires were recapitulated and analyzed quantitatively.

We looked for the expenditure, income, and contribution of agroforestry, which are calculated by:

1. Investigating and Quantifying Agroforestry Income [7].

$$I_{af} = \Sigma\ R_{af} - \Sigma C_{af} \tag{2}$$

Where:

I_{af} = income from agroforestry activities (IDR year^{-1})

R_{af} = revenue from agroforestry activity products (IDR year^{-1})

C_{af} = expenditure for management of agroforestry activities (IDR year^{-1})

2. Investigating and Calculating income from non-agroforestry activities [7].

$$I_{naf} = \Sigma\ R_{naf} - \Sigma C_{naf} \tag{3}$$

Where:

I_{naf} = total income from non-agroforestry activities (IDR year^{-1})

R_{naf} = revenue each from non-agroforestry activities (IDR year^{-1})

C_{naf} = expenditure on non-agroforestry activities (IDR year^{-1})

3. Calculating the Contribution of Agroforestry (CA) [8].

$$CA = \frac{Revenue\ from\ Agroforestry}{Total\ revenue}\ x\ 100\ \% \tag{4}$$

3. RESULT AND DISCUSSION

3.1. General Conditions of Research Location

In general, Long Beluah Village has a flat to wavy topography. Hilly area, with an altitude reaching 15-120 m above sea level. At the same time, the flat areas are along the river. According to soil mapping, the most dominant soil type is podzolic. The characteristics of the soil solum are relatively thick (90-180 cm), the color of the soil is reddish-brown to yellowish-brown with a real horizon, textured from sandy loam to clay, pH ranges from 4.0 to 5.5, moderate to slow permeability, and easy erosion sensitivity [9].

3.2. Agroforestry System

The village's agroforestry is a complex system with irregular spacing. It comprises various types of woody plants, plantation crops, fruit trees, perennials, and understory crops. Agroforestry is an integrated land system that combines trees with various crops, carried out either together or in rotation to produce optimal and sustainable land use [10]. The types of agroforestry plants belonging to farmers in Long Beluah village consist of:

a. Timber plants such as acacia (*Acacia mangium*), Lamtoro (*Leucaena leucocophala*), areca nut (*Areca catechu*), meranti (*Shorea* sp.), Bengkirai (*Shorea laevis*), gamal (*Gliricidia sepium*).

b. Plantation crops such as coffee (*Coffea* spp.), Coconut (*Coconus nucifera*), sugar palm (*Arenga pinnata*), and cocoa (*Theobroma cacao* L).

c. Fruit crops such as durian (*Durio zibethinus*), lai (*Durio kutejensis*), kuweni (*Mangifera odorata*), petai (*Parkia speciosa*), jackfruit (*Artocarpus heterophyllus*), breadfruit (*Artocarpus altilis*), avocado (*Persea americana*), jengkol (*Archidendron pauciflorum*), water guava (*Syzygium aqueum*), duku, langsat (*Lansium domesticum*), rambutan (*Nephelium lappaceum*), orange (*Citrus* spp.), Longan (*Dimocarpus longan*).

d. Perennial crops such as cayenne pepper (*Capsicum frustescent*), banana (*Musa* spp.), Pineapple (Ananas comosus), papaya (*Carica papaya*), pepper (*Piper ningrum*), and grass.

e. Seasonal root crops such as betel (Piper beetle), red betel (*Piper ornatum*), bangle (*Zingiber montanum*),

ginger (*Zingiber officinale Rosc*), galangal (*Kaempferia galanga*), turmeric (*Curcuma domisticae*), red ginger (*Zingiber officinale var. rubrum*), ginger (*Curcuma zanthorrhiza*), eggplant (*Solanum lycopersicum*), sweet potato (*Ipomoea batatas*), cassava (*Manihot utilissima*) and peanuts (*Arachis hypogeae*), green beans (*Vigna radiata*), corn (*Zea mays*), tomatoes (*Solanum lycopersicum*), cucumber (*Cucumis sativus*), bitter melon (*Momordica charantia*), pumpkin (*Cucurbita*), melon (*Cucumis melo*), watermelon (*Citrullus lanatus*), long beans (*Zingiber officinale*), green beans (*Phaseolus vulgaris*), rice (*Oryza sativa*).

3.3. Income Agroforestry Farming

Agroforestry farmer respondents' income is calculated in the last year based on the source of revenue and the farming business's cost. Payment from agroforestry is calculated from timber, food crops, estate crops, medicinal plants, and livestock on land owned by farmers. Data on income, expenses, and respondent revenue are presented in Table 1.

Table 1. Average revenues, costs and income of respondents from Long Beluah village agroforestry farming

No.	Source	Average (IDR year^{-1})
1.	Agroforestry Farmers' Revenue	
	a. Wood	1,411,765
	b. Fruit Plants	10,152,706
	c. Crops	4,522,706
	d. Plantation crops	2,854,824
	e. Medicinal plants	1,381,976
	f. Livestock	2,223,529
	Total Revenue	22,547,506
2.	Agroforestry Farming Costs	
	a. Labor costs	1,658,118
	b. Agricultural Equipment and Materials Costs	2,210,824
	c. Etc	1,750,235
	Total cost	5,619,176
3.	Income (Revenue - Costs)	16,928,329
	average per month	1,410,694

Table 1 shows that overall agricultural revenue derived from agroforestry is greater than agroforestry farming costs. In other words, it can be said that agroforestry financing is lower. The interviews explained that agroforestry farming, cultivation techniques are not as intensive as monoculture farming, especially in terms of plant care, so that the financing of agroforestry farming does not require high costs. The average amount of farm costs for each respondent in Long Beluah village is IDR 5,619,176 year^{-1}.

Table 1 also shows that the use of agroforestry land owned by respondents provides benefits that can meet the community's economic needs. This can be seen from the respondents' income in Long Beluah Village, IDR 16,928,329 year-1 or IDR 1,410,694. Following [11,12], agroforestry is the right choice in using land owned by the community / farmers because it can provide revenue in the short term for daily living costs obtained from seasonal crops and long-term income as savings from forestry commodities.

Table 2. Average Amount of Respondents Received from Fruit Crops in Agroforestry Systems

No.	Commodity	Revenue (IDR year^{-1})	Percentage (%)
1	Durian	1,900,588	18.72
2	Elai	727,941	7.17
3	Mango	170,294	1.68
4	Petai	626,471	6.17
5	Jackfruit	101,647	1.00
6	Breadfruit	561,176	5.53
7	Lamtoro	31,765	0.31
8	Avocado	19,059	0.19
9	Jengkol	121,765	1.20
10	Guava water "Honey"	2,439,529	24.03
11	Duku	1,921,765	18.93
12	Langsat	486,000	4.79
13	Rambutan	716,471	7.06
14	Orange	304,412	3.00
15	Longan	23,824	0.23
	Total	10,152,706	100
	Average per month	846,059	

The respondent's annual revenue for agroforestry products from Long Beluah village as the most significant contributor was the revenue from fruit trees, amounting to IDR 10,152,706 as described in Table 2. Types of fruit trees that contributed the highest to income was water guava "honey", amounting to IDR 2,439,529 year^{-1} (24.03%) because water guava "honey" is a leading fruit commodity in Bulungan Regency, North Kalimantan Province [13].

3.4. Non-Agroforestry Income

The level of dependence of agroforestry farmer communities in Long Beluah village on the forest area is relatively high, as reflected by various land use activities. The interviews indicated that most respondents said they did not only rely on their revenue from agroforestry but also from non-agroforestry activities, including having a side job.

Table 3. Average revenue, costs and s income of respondents from non-agroforestry farming in Long Beluah village

No.	Source	Average (IDR year^{-1})
1.	Non-Agroforestry Farming revenue	
	a. Monoculture Agriculture	11,232,721
	b. Fishery	323,529
	c. Other revenu	5,391,176
	d. Side job :	-
	- PNS / ASN	1,235,294
	- Fisherman	5,647,059
	- Trader	21,670,588
	- Builder	9,058,824
	Total revenue	54,559,191
2.	Non-Agroforestry Costs	
	a. Food	7,473,529
	b. Clothing	3,688,235
	c. Educationn	9,035,294
	d. Health	1,667,647
	e. Household Facilities	4,235,294
	f. Incidental Costs	1,000,000
	g.Non-Agroforestry Farming	5,647,059
	Total cost	32,747,059
3.	Income (Revenue - Costs)	21,812,132
	average per month	1,817,678

Respondents' revenue originating from non-agroforestry is calculated from monoculture farming, livestock, fisheries, salaries or wages, and other income. Meanwhile, respondents' non-agroforestry cost components are from the cost of food, clothing, education, health, household facilities, incidental expenses, and non-agroforestry or monoculture farming costs. Income after deducting the cost, the respondent's acceptance is obtained. The highest respondent's non-agroforestry income for Long Beluah Village was IDR

21.812.132 year^{-1}. Data on revenues, expenses, and non-agroforestry revenues are presented in Table 3.

Table 3 provides information that the largest revenue contributor to Long Beluah Village is from a side job of trading, namely IDR 21.670.588 year^{-1}. This is because the respondent, apart from farming, also has a side job as a trader. The interviews with respondents who have side jobs as traders found out that the maintenance and harvesting of agroforestry plants are carried out at any time. If activities require a lot of labor, such as planting and harvesting mountain rice, they will pay workers to help. Respondents considered trading as having the advantage of having "cash". The circulation of money was faster, and the income from trading was higher because the percentage of farmer respondents who had a side job by trading was quite dominant, namely 38.23%.

3.5. Contribution of Agroforestry Systems

The difference between the average total revenue and the average total cost is a profit of IDR 38,740,462 year^{-1} for agroforestry farmers in Long Beluah Village. Comparison between income and expense for all respondents in Long Beluah Village can be seen in Table 4.

Table 4. Comparison of average household revenue and cost of respondents

No.	Indicator	Average (IDR year^{-1})
1	Average total Revenue	77,106,697
	Agroforestry Revenue	22,547,506
	Non-Agroforestry Revenue	54,559,191
2	Total Average Cost	38,366,235
	Agroforestry Costs	5,619,176
	Non-Agroforestry Costs	32,747,059
3	Profit (Revenue - Cost)	38,740,462

Table 4 shows that if a comparison is made between the respondent's revenue and cost, it is found that the respondent's income is higher than his expenses. This means that farmers can finance their needs both from agroforestry and non-agroforestry products. An agroforestry system in Long Beluah village can be a better and more profitable alternative to land use. An excellent policy for facilitating agroforestry's contribution is essential. It would make agroforestry continues to provide a positive trend. The percentage contribution of agroforestry and non-agroforestry to the respondent's revenue is presented in Table 5.

Table 5 shows that agroforestry's contribution to farmers' total revenue in Long Beluah Village is relatively high (43.70%). The agroforestry community forest is a side revenue and is incidental with a range of

not more than 10% of total income [14]. But in reality, in the study village, its contribution was far above 10%. This means that agroforestry land in Long Beluah village has a significant role and positively impacts the farmer's economy.

Table 5. Contribution of agroforestry and non-agroforestry to respondent.

No.	Source of Revenue	Total Average Farmers' Revenue (IDR year^{-1})	Contribution to Farmers' Revenue (%)
1	Agroforestry	16,928,329	43.70
2	Non-agroforestry	21,812,132	56.30
	Amount	38,740,462	100.00

4. CONCLUSION

The types of agroforestry crops in Long Beluah are timber, plantation crops, fruit trees, perennial understorey, and seasonal understorey. The average amount of respondent's revenue from agroforestry farming for Long Beluah Village was IDR 16,928,329 year^{-1}, the type of fruit tree that contributed the highest to the average income of the respondents was water guava "honey", namely IDR 2,439,529 year^{-1} or 24.03% of the total fruit crop revenue.

The average number of respondents' income from non-agroforestry was IDR 21,812,132 year^{-1}. Meanwhile, the contribution of agroforestry is 43.70% of the total average farmer income.

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