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The Traditional Agroforestry System and Community Welfare: Evidence from Dulamayo, Indonesia

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Abstract Traditional agroforestry plays a crucial role in supporting the livelihoods of local communities, enabling individuals and groups to maximize their potential and make well-informed decisions. The productivity of a successful agroforestry system relies on its adaptability and responsiveness to changing circumstances. Therefore, this study aims to evaluate the well-being of the Dulamayo community by examining the performance of their traditional agroforestry system. The assessment of the traditional agroforestry system in Dulamayo was conducted through qualitative description and multiple linear regression calculations. The findings of the study indicate the existence of two types of traditional agroforestry systems in Dulamayo. The first type focuses on fruit production, while the second type involves the production of sap from sugar palm trees in addition to fruits. These systems serve various purposes for food, firewood, medicinal plants, timber for carpentry, complementing traditional and ritual events, and producing items for sale. The estimated productivity value of these systems is US$ 244,482.27 per year. The regression performance model for traditional agroforestry indicates that the independent variable of feelgood source most significantly influences the performance of traditional agroforestry. Farmers' knowledge and awareness regarding the management of traditional agroforestry, particularly for fulfilling their family's food needs, are often quantified in terms of money. They are not aware of the crucial importance of the value of tree types in agroforestry, such as being a source of firewood for cooking, a food source, and traditional herbal medicines. This is within the regression model as an independent variable influencing the performance of traditional agroforestry in Dulamayo.

Keywords Traditional Agroforestry, Agroforestry Characteristics, Community Welfare

1. Introduction

Agroforestry is widely recognized as a sustainable approach to land resource management, combining the cultivation of long-lived trees with short-lived crops or fodder to support livelihoods across generations [1]. These systems, traditionally established by local communities, hold social value and enable harmonious coexistence with nature over time [2,3]. There is an inseparable interaction between sustainable environmental and cultural systems, as the cultural system categorizes society based on environmental characteristics, establishing a causal relationship between the two.

The impact of agroforestry practices on the environment is significant, contributing to increased biological production, improved water quality, and enhanced habitat for the community, thereby providing a better source of livelihood. Achieving these benefits requires collective thinking and concerted actions, mobilizing the potential of all individuals

in the local community [4,5]. The characteristics of both individuals and the community influence the land productivity of agroforestry systems through institutionalized commitment, cooperation, collective action, and positive interdependence [6]. The use of agroforestry land also supports adaptive management initiatives [7].

In the Gorontalo region, the people refer to rain-fed or dryland agriculture as "ilengi" in the local language. Traditionally, ilengi is divided into two categories. The first category involves planting monoculture systems with short-lived crops like maize as the main crop. The second category encompasses mixed gardens or agroforestry systems dominated by long-lived tree species. In the Dulamayo community, which consists of three villages covering an area of approximately 8,613 hectares, the agroforestry system is prevalent. The landscape in this area is hilly to mountainous, with 80% of the topography characterized as steep and very steep. As a result, the vegetation structure resembles a secondary forest [8]. The dominance of trees in this agroforestry system indicates its potential for long-term sustainability and production maintenance [9].

The traditional agroforestry system in Dulamayo provides significant benefits to the community and farmers, supporting their livelihoods, fulfilling the needs of families and society. These needs include food sources, medicinal plants, materials for rituals or customs, wooden building materials, and more, thereby improving welfare and reducing poverty rates. The production of fruits or sap from trees can generate substantial cash income, offering economic benefits without depleting the resource base.

From an ecological perspective, traditional agroforestry in Dulamayo plays a crucial role in protecting the water system and conserving natural resources, ensuring their value for future generations. These agroforestry practices reflect well-documented customary processes, highlighting the consistent environmental management by local communities [10]. Therefore, the objective of this study is to assess the welfare of the Dulamayo community by analyzing farmers' knowledge of the direct benefits of various plants in traditional agroforestry land and examining the most influential benefit values on farmers' well-being in the traditional agroforestry system in Dulamayo.

2. Materials and Methods

This research was conducted from September 2021 to July 2022 in the Dulamayo community, in the villages of Dulamayo Barat, Dulamayo Selatan, and Dulamayo Utara, located in the Telaga and Telaga Biru Districts, Gorontalo Regency, Indonesia. Secondary data were collected from relevant government and non-government institutions to complement primary data on the biophysical aspects of the area, population, facilities, infrastructure supporting community activities, and others. Primary data were collected from a selected group of respondents using the purposive sampling method. This method was intentionally designed to involve the heads of families who owned agroforestry land. As a descriptive study, the minimum sample size followed guidelines representing 10% of the total population [11]. The population in the three villages was 1,544 households, so a total of 154 households were selected as samples from the three regions.

Data collection was carried out through three stages: interviews using questionnaires, in-depth interviews with key informants (community leaders, and village government officials), and Focus Group Discussions (FGD). In the FGD, a quantitative approach was employed using the Pebble Distribution Method. In this method, discussion groups comprising 10-15 individuals were asked to allocate 100 pebbles among labeled and illustrated cards based on their perceived 'importance' values (Table 1). This allocation was done concerning the types of trees and non-tree elements in the traditional agroforestry system [12].

To determine the most influential direct benefits of various plants on the performance of farmers in achieving farmer welfare in traditional agroforestry land, a quantitative analysis method, namely multiple linear regression formulation, was employed. Six variables were identified as factors influencing the performance value of traditional agroforestry farmers (Table 1).

Table 1. Uses of plants

No	Categories	Use value
1	As a Food Source	Primary and secondary food sources
2	Source of Medicines	Medicine and health
3	Source of Carpentry Wood and Tools	Poles and boards for houses, fences, agricultural tools, hunting tools, rice pounders, handles for various tools
6	Source of Firewood	Used for producing fire
8	Source of Ritual/Customary Materials	Parts of the plant are used in ceremonies, clothing or jewelry
9	Source of Income	The part of a plant that is harvested and can be sold to earn money

3. Result

3.1. Benefits of Traditional Agroforestry

Traditional agroforestry practices not only provide ecological benefits but also play a crucial role in safeguarding sustainable water management systems and conserving natural resources. In a study conducted by Liswanti [13], the evaluation of the traditional Dayak community's way of life revealed that forest resources and agroforestry directly or indirectly form the primary foundation sustaining their livelihoods. Similarly, in Dulamayo, the presence of gardens with traditional agroforestry systems yields significant benefits to support the current and future well-being of families (see Figure 1).

Respondents in the Dulamayo community actively optimize the utilization of land resources under the agroforestry farming system. These activities, including agricultural production and the utilization of non-timber forest products such as fruits and latex, provide substantial benefits without compromising the foundational natural resources. Furthermore, the potential for environmental sustainability in the future is evident, where environmental services can help maintain their natural forest landscapes. Traditional agroforestry practices in Dulamayo are not just about preserving ecological sustainability but also contribute positively to the well-being and future of the community.

3.1.1. As a Food Source

Traditional agroforestry plays a crucial role in supporting food security, where food sources are obtained from various physical parts of plant species such as stems, fruits, leaves, bark, and roots (tubers), as outlined in Table 2. Food security can be achieved through the production of seasonal or annual crops, ensuring a reliable food supply, or through the sale of produce. Various types of food crops are cultivated with a sustainable approach, serving both subsistence and commercial purposes [15-17]. At the subsistence level, the production of food crops is utilized for the direct needs of the family, while at the commercial level, the sale of produce provides an additional source of income.

Furthermore, different types of food crops also play a crucial role in providing support for ecosystem services, such as plant canopies that can reduce surface water runoff or aid in the pollination process [14]. The canopies of plants in agroforestry help reduce surface runoff, maintain soil fertility, and enhance overall environmental conditions. By maintaining a balance between economic and ecological aspects, traditional agroforestry practices manifest as a sustainable and beneficial agricultural system for the community. Table 2 shows the types of plants that have been identified as food sources.

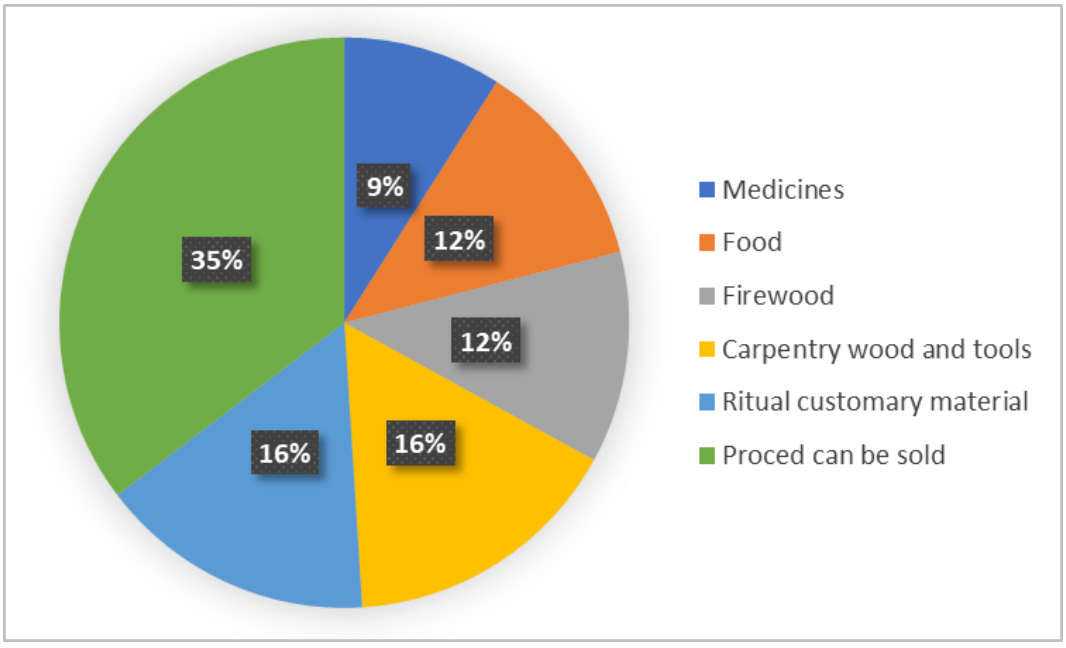

Figure 1. Category Utilization of Traditional Agroforestry in Dulamayo

Table 2. Sources of Food Materials and Plant Organs Utilized in Traditional Agroforestry

No.	Species	Plant Organs	Utilization	Utilization Respond. (%)
1	*Arenga pinnata*	Sap, fruit	Spices, sweets	23
2	*Musa sp*	Fruit	Secondary staple food	35
3	*Aleurites moluccana*	Fruit	Spices	10
4	*Cocos nucifera*	Fruit	Spices, coconut cream	7
5	*Coffea robusta*	Fruit	Drink	4
6	*Citrus × aurantiifolia*	Fruit	Spices, Drink	8
7	*Syzigium aromaticum*	Fruit	Spices	5
8	*Myristica fragrans*	Fruit	Spices	5
9	*Bambusa Sp*	Young stems	Food (vegetable)	3
				100

From an ecological perspective, cultivated plants have a strong relationship with humans as owners, integrated within traditionally practiced agroforestry systems. These systems offer a viable solution to addressing food problems or insecurity in agroforestry farmer households [18-19]. Tree plant species found as food sources also have the potential to restore, improve, or maintain soil quality, increasing carbon sequestration in the soil [20]. Agroforestry represents an adaptation by farmers who recognize the potential to enhance soil fertility and household food security [21].

In this study, plant species such as *A. pinnata, Musa sp*, and *A. moluccana* were predominantly chosen by farmers as food sources. *Musa sp* was identified as a secondary or alternative staple food. Processed young bananas have also been used as a substitute for rice within families, consumed daily as provisions for farmers in the garden. *A. pinnata* was found to be utilized as a seasoning ingredient, with its sap transformed into palm sugar and integrated into various dishes, including sweets and local cakes. This sap can also be fermented into vinegar, imparting a sour taste to food. Furthermore, freshly harvested coconut sap is used as an alcoholic drink, consumed by some, and its fruits serve as a garnish for refreshing beverages. As for species *A. moluccana*, it serves as a source of food ingredients for spices in processed food, accompaniments to staple foods.

3.1.2. Source of Medicines

Traditional agroforestry plays a significant role as a potential source of medicinal plants, a component of traditional medicine [22]. The use of plants as medicine is a priority for people who live in remote areas devoid of ready access to healthcare facilities [23]. Among traditional communities, medicinal plants are easily obtained from the surrounding, thereby providing quick accessibility. Dulamayo community, similar to other traditional communities, is far from access to health services, making agroforestry land a source of traditional medicines, useful for first aid for residents. As an alternative to natural medicine, the identification of efficacious plants needs to be carried out [24]. Several types of medicinal plants that can be found under agroforestry stands are shown in Table 3 based on the interviews and identification of medicinal plants.

Various types of plants that are important and used by the Dulamayo people as a source of medicines include *Syzygium aromaticum* and *Myristica fragrans.* The leaves of type *Coleus scutellariodes* are also used as a remedy for fever, *Oxalis sp* to combat underarm odor, and *Liana sp* leave is used for treating swollen gums.

Table 3. Types of Plants Identified by Farmers as Sources of Medicinal Plant Materials

No.	Species	Utility	The part of the plant used	Utilization of Respond. (%)
1	*Areca catechu*	Tooth booster	Fruit	4
2	*Apium sp*	Reducing uric acid, improving blood circulation, overcoming asthma and bronchitis, as well as lowering high blood pressure	Leaf	4
3	*Coleus scutellarioides*	Reducing cough and for reducing fever	Leaf	10
4	*Hedyotis corymbosa*	Treat dizziness	Leaf	2
5	*Liana sp*	Treat swollen gums	Leaf	8
6	*Myristica fragrans*	For heat reduction	Fruit	21
7	*Mimosa sp*	For heat reduction	Leaf	6
8	*Oxalis sp*	Remove body odor	Leaf	9
9	*Phyllanthus acidus*	Relieve the rash of red spots in children	Root	6
10	*Syzygium aromaticum*	For heat reduction	Fruit	29
				100

Furthermore, *Mimosa sp* leaves are utilized as a hot remedy. The fruits of *A. catechu* can be employed to strengthen teeth, *H. corymbosa* is used to alleviate dizziness, and *Apium sp* is employed for treating tonsillitis in children. The role of women, particularly mothers in agroforestry farming families in the Dulamayo community, is highly significant in sharing knowledge of medicinal plants with future generations. This helps in transmitting information from one generation to another, sharing insights about the cultural practices of medicinal plants, heritage, and their crucial role in preservation and sustainability [25].

Additionally, the active involvement of women in imparting traditional knowledge about medicinal plants contributes significantly to the sustainability of agroforestry practices and local wisdom. Through their role in preserving cultural heritage, mothers in Dulamayo not only fulfill daily functions within the family but also act as catalysts for preserving valuable knowledge about the traditional use of medicinal plants, ensuring its sustainable inheritance to future generations.

3.1.3. Source of Carpentry Wood and Tools

Wood for carpentry is sourced from the vicinity of the agroforestry area, serving as a vital resource for the Dulamayo community. This wood material is generally used for heavy and light construction such as building houses or public facilities for mosques, schools, village offices, and health facilities. Agroforestry systems also function as a source of fuelwood products and construction materials, which contribute to agroecology such as maintaining soil fertility, erosion control, climate change mitigation, and biodiversity conservation [26,27].

In this research, the existence of woody plant species in the Dulamayo community was obtained from two sources, namely deliberate cultivation around the agroforestry gardens and natural growth within the surrounding forested area. The results of identification with respondents provided information that there were 10 types of plants frequently used for wooden building materials, as presented in Table 4.

Table 4. Types of Plants Identified by Respondent Farmers as a Source of Carpentry Timber

No.	Species	Utilized plant organs	Utilization	Utilization of Respond. (%)
1	*Palaquium sp*	Stem	Wooden board	18
2	*Swietenia macrophylla*	Stem	- Wood beam	14
3	*Shorea sp*	Stem	- Wood beam - Wooden board	11
4	*Michelia alba*	Stem	Wooden board	7
5	*Cocos nucifera*	Stem	Wood beam	10
6	*Aleurites moluccanus*	Stem	Wooden board	19
7	*Madhuca sp*	Stem	Wood beam	3
8	*Vitex cafassus*	Stem	Wooden board	5
9	*Agathis sp*	Stem	Wooden board	7
10	*Pterospermum sp*	Stem	Wood beam	5
				100

Various plant species play a crucial role as a source of wood for carpentry, extensively utilized by respondents in crafting wooden beams, boards, and walls for constructing houses or public facilities. Traditionally, historical buildings were constructed entirely from wood. However, with the passage of time and the development of road infrastructure, improved access to shops in the sub-district center has made it easier to purchase modern building materials. Despite this shift, certain tree species continue to be favored for carpentry purposes due to their durability, strength, and the aesthetic appeal of their wood fibers. Notable among these species are *Palaquium sp, S. macrophylla, Shorea sp, C. nucifera, and A. moluccana*.

The preference for these specific tree species is often influenced by their inherent qualities, with characteristics such as resistance to decay, robustness, and the visual appeal of the wood grain being primary considerations. *Palaquium sp,* for instance, is valued for its dense and durable wood, making it suitable for various carpentry applications. Similarly, *S. macrophylla, Shorea sp, C. nucifera*, and *A. moluccana* are chosen for their strength and longevity, contributing to the structural integrity of the crafted wooden elements. While modern building materials are more accessible, the continued use of these plant species in carpentry showcases the importance of traditional knowledge and the enduring qualities of certain wood types in construction practices.

3.1.4. Source of Firewood

The ease of consuming fuel for household cooking needs is related to the distance traveled to collect firewood. This correlation holds a particular significance for farming households that adopt agroforestry as their main source of firewood and timber. Therefore, it can be concluded that the accessibility of tree products influences the adoption of agroforestry [28]. Abdu [29] reported that users are willing to pay a high price for firewood obtained from agroforestry-based sources due to the possibility of investing the proceeds from sales in natural resource conservation. Although the government policy encourages the adoption of alternative and efficient cooking fuels such as Liquefied petroleum gas, the use of firewood is still dominant in the rural area of Dulamayo due to its distance from the center of trade and sub-district or district government. This pattern is prominently observed among households, where the demand for firewood from the agroforestry is consistently high to meet cooking needs throughout the year. Table 5 shows the results of discussions with the farmers who use this type of plant as a source of firewood.

The types of plants mostly used by respondents as firewood were *P. caducibracteum, G. sepium, G. floribunda, Castonopsis sp,* and *Glochidion sp*. The part of the plant commonly employed for this purpose are branches and stems. These species are commonly found around agroforestry, growing wild under stands or on former land clearings that have long been abandoned and reverted to young forests. There are types of species growing around the yard of the house, such as *Pometia sp. G. sepium, Ficua sp, Petunga sp,* and *Acacia sp,* which are deliberately planted to facilitate the drying process

3.1.5. Source of Ritual/Customary Materials

The traditional agroforestry formed is supported by norms, values, and rituals or ceremonies that connect humans with farming land through the community. The types of plants cultivated on agroforestry land for local communities have biocultural restoration value, reviving local wisdom and practices as well as intergenerational learning experiences. According to previous

investigations, intangible values are associated with ritual and spiritual importance [30]. The in-depth interviews and focused discussions conducted with farmers show that agroforestry serves as a source for traditional activities in the Dulamayo community, including the use of fruits in wedding processions. Table 6 shows the value of farmers' interests in plant species that are often used for customary activities.

Plant species *A. catechu, Artocarpus sp, Citrus sp, C. nucifera, P. betle, Bambusa sp,* are widely used in traditional rituals in the Dulamayo community such as birth, celebration of puberty, marriage procession or death procession. The importance of these plants in traditional ritual activities is exemplified by their use during ceremonies, where a variety of fruits are presented, indicating the readiness of the groom to sail the household ship. The abundance of fruit-bearing plants provides economic stability to the bride's family over a long-term period.

The types of *Bambusa sp*, particularly yellow bamboo (*Bambusa vulgaris*), have important customary values. This bamboo is an integral component of each traditional ritual, serving as both a container and traditional ornament that should be provided to decorate a special place reserved for honored guests, who have important positions in the community.

Table 5. Types of Plants Identified by Farmers as Sources of Firewood

No.	Species	The part of the plant used	Utilization Respond. (%)
1	*Piper caducibracteum*	Branches, Stems	25
2	*Garuga floribunda*	Branches, Stems	15
3	*Glochidion sp*	Branches, Stems	10
4	*Castonopsis sp*	Branches, Stems	12
5	*Acacia sp*	Branches, Stems	2
6	*Glicidia sepium*	Branches, Stems	17
7	*Ficua sp*	Branches, Stems	5
8	*Homalium foetidum*	Branches, Stems	6
9	*Petunga sp*	Branches, Stems	6
10	*Pometia sp*	Branches, Stems	3
			100

Table 6. Types of Plants Identified by Farmers as Part of Customary Rituals

No.	Species	The part of the plant used	Activity Traditional Rituals	Utilization Respond (%)
1	*Areca catechu*	Fruit, stem	Birth, celebration of puberty, wedding procession	15
2	*Artocarpus sp*	Fruit	Wedding procession	10
3	*Citrus sp*	Fruit	Celebration of puberty (entering adolescence), wedding procession	16
4	*Cocos nucifera*	Fruit, green leaf	Celebration of puberty (entering adolescence), wedding procession, Procession of death	12
5	*Ananas comosus*	Fruit	Wedding Procession	9
6	*Piper betle*	Fruit, leaf	Birth, Celebration of puberty (entering adolescence), wedding procession	11
7	*Arenga pinnata*	Fiber	Procession of death	3
8	*Bambusa sp*	Stem	Birth, Celebration of puberty (entering adolescence), wedding procession, Procession of death	24
				100

3.1.6. Source of Income

Discussions related to traditional agroforestry as a source of income or products for sale have become a crucial decision for farmers. Table 7 illustrates the general perspectives of farmers regarding the plant parts capable of generating income through sales to collectors. Farmers decide on the types of plants that can generate income based on aspects such as market demand, economic feasibility, and sustainable harvesting practices. The table may reflect a consensus or differences of opinion among farmers regarding the profitability and market value of specific plant types in the agroforestry land system. This decision-making process is highly significant for farmers as it directly influences their income generation strategies and overall economic well-being.

According to the farmers, there are eight types of plants that are most often sold or traded in the Dulamayo community. The parts of the plant that are sold include fruit, except for the type *A. pinnata* where both the fruit and sap juice can be marketed in liquid form or after being processed into palm sugar. The policy of agroforestry farmers in the Dulamayo area is to ensure the fulfillment of family needs. Farmers were able to regulate the types of tree crops planted to regulate the production after sales. Fulfillment of basic needs, specifically food, clothing, and shelter, was the basis for farmers needed to regulate tree species in agroforestry. Due to its family-centric, determining the type of tree is usually discussed together with the housewife. Similarly, Megantara and Prasodjo [18], Belahsen [25] identified a positive complementary relationship between the roles of men and women in decision-making to protect the household needs of agroforestry farmers. This includes determining land allocation and agroforestry crop cultivation systems, at all stages of production, processing, and land conservation.

The percentage of plant species that are the mainstay of the farmers in agroforestry is shown in the following table (Table 7). The dominance of *S. aromaticum* and *A.moluccana* plant species can be attributed to their ease of sales and the relatively high product prices. Specifically, *A. moluccana, T. cacao, Musa sp,* and *A. pinnata* also generate income every week.

Despite producing just once annually, *S. aromaticum* plants hold significant value due to their capacity for high-priced sales during harvest or stored and sold when prices are high. Other species that annually contribute to family income are *D. zibethinus* and *L. domesticum*, as fruits produced are sold directly to collectors. This is because of the fresh nature of the fruit harvest, negating the need for additional treatment before sale.

Approximately more than 50% of crop production is sold by farmers, as evaluated from the criteria including commercial farmers. This aligns with the perspective of Widianto [30], which characterizes subsistence and commercial farmers based on their production orientation. When more than 50% of products are consumed by farmers, it is classified as subsistence. However, when over 50% of the products are sold to the market or exchanged, it is classified as a commercial grower. The classification of commercial and subsistence can simply distinguish the purpose of producing goods for sale to the market or self-consumption.

Table 7. Types and Parts of Plants Commonly Sold in Agroforestry

No	Species	The part of the plant used	Utilization Respond (%)
1	*Aleurites moluccana*	Fruit	31
2	*Arenga pinnata*	Sap water, Fruit	20
3	*Syzygium aromaticum*	Fruit	14
4	*Musa sp*	Fruit	9
5	*Durio zibethinus*	Fruit	8
6	*Lansium domesticum*	Fruit	7
7	*Theobroma cacao*	Fruit	7
8	*Coffea sp*	Fruit	4
			100

Table 8. Productivity Value of Traditional agroforestry (US$)

Species	Production Value per Month (US$)	Production Value per Year (US$))	Production Input (US$))	Productivity Value of Traditional agroforestry (US$)
Aleurites moluccana	12.053	144.640	7.232	137.408
Syzygium aromaticum		60.311	5.368	54.943
Coffea sp	201	2.416	217	2.198
Theobroma cacao	136	1.632	163	1.469
Musa sp	909	10.908	654	10.253
Arenga pinnata	2.492	29.900	7.475	22.425
Durio zibethinus		11.030	496	10.534
Lansium domesticum		5.500	247	5.252
	15.791	266.336	21.854	244.482

The value of agroforestry productivity per year is obtained from the multiplication of the productivity value per harvest season by the number of harvests per year for each commodity. The total value of natural resource productivity in the agricultural sector per year is obtained from the sum of the annual productivity values of agroforestry for all commodities.

In Dulamayo, traditional agroforestry systems significantly contribute to crop productivity and the local economy. From Table 8 above, it is evident that plant species such as *A.moluccana, Coffea sp*, and *Musa sp* demonstrate high production values per month and per year. Notably, *A. moluccana* stands out with a productivity value reaching US$137,408, indicating a substantial contribution to monthly and yearly incomes. This reflects the efficiency of the agroforestry system in utilizing available resources and space and integrating tree crops that support other plants.

Furthermore, the presence of species such as *A. pinnata* also makes a significant contribution, with an annual production value of US$22,425. This highlights the diversification of crop yields in agroforestry systems, providing economic stability and long-term sustainability. The table paints a positive picture regarding the potential of traditional agroforestry in supporting the economic well-being of the local community in Dulamayo. A systematic review published in Sustainability reveals that agroforestry practices, a form of traditional agriculture of indigenous communities, contribute to food security, income generation, while also preserving biodiversity [31]. Another study, published in the Environmental Evidence Journal, indicates that agroforestry, which integrates trees species, can mitigate environmental degradation, boost agricultural productivity, augment carbon sequestration, and foster healthy soils and ecosystems. Simultaneously, it provides a stable income and other benefits, contributing to human well-being [32].

3.2. Performance of Traditional Agroforestry

The analysis used in this research to determine the variables influencing the value of agroforestry performance was multiple linear regression analysis. In this approach, six variables were identified as factors affecting the performance value of agroforestry. These included sources of food, traditional herbal medicine, wood for carpentry, firewood, and complementary customary or rituals. The use of dummy variables as indicators for independent variables whose measurement scale was interval, ordinal, and nominal. The results of the regression analysis of agroforestry performance values were presented in Table 9.

Table 9. Regression Analysis Results

Variable	Coeff.	S.E. Coeff.	t	Sig.	Information
(Constant)	17.163	2.672	6.423	0.000	
Source of Food (X1)	0.090	0.050	1.803	0.073	Real impact**
Sources of Medicine (X2)	0.147	0.060	2.436	0.016	Real impact **
Source of Carpentry Wood (X3)	-0.006	0.047	-0.128	0.898	No-real impact
Source of Firewood (X4)	0.320	0.055	5.811	0.000	Real impact **
Sources of Complementary Customary/ Rituals (X5)	0.061	0.068	0.895	0.372	No-real impact
Source of Income(X6)	-0.008	0.076	-0.111	0.911	No-real impact
R Square (R^2)	51%				
R Square (R^2)	49%				
F-statistic	25,329 (sig 0.000)				
Durbin-Watson	1,250				

*Acceptance rate 95%, ** 90%

The model produced in this research was good, as indicated by the R^2 number of 51%. This showed that the performance of agroforestry can be explained by the variety of explanatory variables contained in the model, while the remaining 49% was explained by other variables not present in the model. The F-statistic value obtained was 25.329 with a sig. value of 0.000, indicating that the explanatory variables in the model had a significant effect on the performance value of agroforestry at a significance level of 5%. The Durbin-Watson value obtained was 1.250, indicating that there was no autocorrelation in the model. Therefore, it was concluded that the assumption of freely spreading residuals was fulfilled. The equation model from the results of the regression analysis is as follows:

$$K.AFI = 17.163 + 0.090X1 + 0.147X2 - 0.006X3 + 0.320X4I + 0.061X5 - 0.00817X6$$

In this model, three main factors significantly influence the performance of traditional agroforestry: a source of firewood, a source of food, and traditional herbal medicine. The variable of the firewood source has a significant impact at the 95% level on the performance value of traditional agroforestry because its significance value is less than the α level (0.00 < 0.05). Furthermore, the positive coefficient value indicates that the firewood source significantly affects the performance of agroforestry, and the higher the availability of firewood, the better the farmers' assessment of agroforestry performance. The results of the confidence level calculation (95%) confirm the significant impact of firewood, stemming from its crucial role in meeting household needs. The people of Dulamayo are not fully aware that firewood plays an economic role in households, particularly regarding energy issues. Firewood can be transformed into commodities such as charcoal and briquettes, with the potential for sale. While community awareness of gardens is primarily focused on food needs, this perspective may result in items considered worthless being discarded.

Variables such as a source of food and herbal medicine have a significant impact at the 90% level on the performance value of agroforestry existence. This is indicated by the lower significance value compared to the α level (0.05 < 0.10). The positive coefficient value indicates an increase in respondents' tendency to assess the performance of agroforestry. These results demonstrate that the role of traditional agroforestry as a source of food and herbal medicines is robust, serving as basic needs, especially in relatively isolated conditions.

4. Conclusions

In this research, traditional agroforestry systems were classified into two categories based on their produce: gardens that produced fruit and gardens that produced both fruit and sap water. The study identified eight dominant plant species in these agroforestry systems, including *Aleurites moluccana*, *Syzigium aromaticum*, *Coffea robusta*, *Theobroma cacao*, *Musa sp*, *Arenga pinnata*, *Durio zibethinus*, and *Lansium domesticum*.

The agroforestry systems in Dulamayo served multiple purposes, meeting the welfare needs of farmers' households. These systems provided sources of medicinal plants, food, firewood, carpentry materials, and products that could be sold. Additionally, they played a complementary role in customary rituals and practices.

The research also analyzed the impact of various factors on the performance of traditional agroforestry. The variable "source of firewood" had a significant effect on the performance of agroforestry systems, likely due to the high consumption rate of firewood. Sources of food and traditional medicines also had a significant impact. The F-statistic value of 25.329 with a sig. value of 0.000

indicated that the explanatory variables in the model significantly affected the performance of traditional agroforestry.

These findings highlight the importance of traditional agroforestry systems in meeting the welfare needs of farmers and their households. By understanding the factors that influence the performance of these systems, it becomes possible to enhance their effectiveness and sustainability.

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