

Socio-Ecological Study of Forest Gardens: Traditional Management and Vegetation Diversity by the Dayak Pitap Community

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ABSTRACT

There is still little knowledge about community-based forest management techniques. This knowledge can be used as a scientific basis for making strategies and policies to mitigate environmental management in order to remain sustainable. Community-based (traditional) forest management techniques are still carried out by the Dayak Pitap community living in Langkap Village, Balangan Regency in the form of forest gardens. The purpose of this study is to analyse the management and utilisation of forest gardens and the vegetation structure of forest gardens carried out by the Dayak Pitap community. Research on the management and utilisation of forest gardens used semi-structured interviews and participatory observation. Sampling was conducted using purposive sampling method. Data collection techniques for vegetation diversity were carried out by analysing the importance value index. The results showed that the management of forest gardens by the Dayak Pitap community is divided into 4 namely preparation of land, procurement of seeds, planting, and maintenance. Forest garden utilisation is carried out subsistence and commercially. Vegetation diversity in Langkap Village obtained 68 types of vegetation from seedling to tree level with

the dominant species being *Hevea brasiliensis* and *Durio zibethinus*. The condition of this forest garden is categorised as semi-natural because despite human intervention, the forest garden can still regenerate itself naturally. However, the high dominance of cultivated species means that the pressure on natural vegetation is high enough that mitigation is needed to balance the growth of superior commodities with local species.

Keywords: Agroforestry, Biodiversity, Forest Garden, Social-Ecologist, Traditional Management

INTRODUCTION

Indonesia has a very rich biodiversity and culture [1], one of which is on the island of Borneo. Kalimantan Island has rich biodiversity including endemic species and unique species that only live in Kalimantan forests [2]. In order to maintain this rich diversity, proper management is needed so that diversity can be sustainable. Management of biodiversity (forests) has been done even before technology was as sophisticated as it is now. The management is usually traditional and local wisdom. Knowledge of traditional ecology plays a very significant role in forest conservation. This knowledge has been passed down from generation to generation, with local

communities and biodiversity being mutually dependent [3]. Forest management activities by local communities yield varying results, and the most successful in the long term involve planting the types of crops needed to generate income, along with fruit trees for consumption. This results in an agroforestry system in the form of forest gardens.

Forest gardens are a form of traditional agroforestry that have great potential to support climate change mitigation efforts. This system resembles the structure of natural forests with diverse vegetation composition [4], thereby contributing to the conservation of biodiversity. Forest gardens not only serve as ecological buffers but also have economic value for rural communities. Scientific studies on forest garden management and vegetation structure analysis in forest garden systems at the local level are still limited, particularly in South Kalimantan.

The Meratus Mountains stretching across South Kalimantan are an important ecosystem with high biodiversity. One of the communities that depends on this ecosystem is the Dayak Pitap indigenous community in Langkap Village, Tebing Tinggi Subdistrict, Balangan Regency. The Dayak Pitap indigenous community has been managing forest gardens for generations as part of their local wisdom in meeting economic needs and maintaining ecosystem balance.

Forest gardens support the livelihoods of the people of Langkap Village, as they are the source of income for most of the community. People living around forest areas have a mythological and realistic

awareness of forest management and want to continue to enjoy the positive benefits of the forest. The lives of communities around the forest, both directly and indirectly, are highly dependent on the forest, in order to maintain the sustainability of the forest as a lifeline for the surrounding communities. The community establishes forest gardens as providers of food and energy, settlements, and various forest products used as income sources—whether for sale, personal use, or exchange with other goods [4].

Comprehensive research analyzing the management and utilization of forest gardens and the vegetation structure of forest gardens in Langkap Village is still lacking. This research needs to be conducted to fill this gap and provide scientific information that can support community-based climate change mitigation strategies.

MATERIALS & METHODS

Research Location

This research was carried out in the Forest Garden Area in Langkap Village, Tebing Tinggi Subdistrict, Balangan Regency, Indonesia. The main objects of this research consisted of two parts, namely the Dayak Pitap community living around the forest garden area and the vegetation in the forest garden. This research was conducted over a period of 5 (five) months, which included literature review, preparation of a research proposal, data collection, data verification in the field, data analysis and final report writing. The map of the research location can be seen in Figure 1.

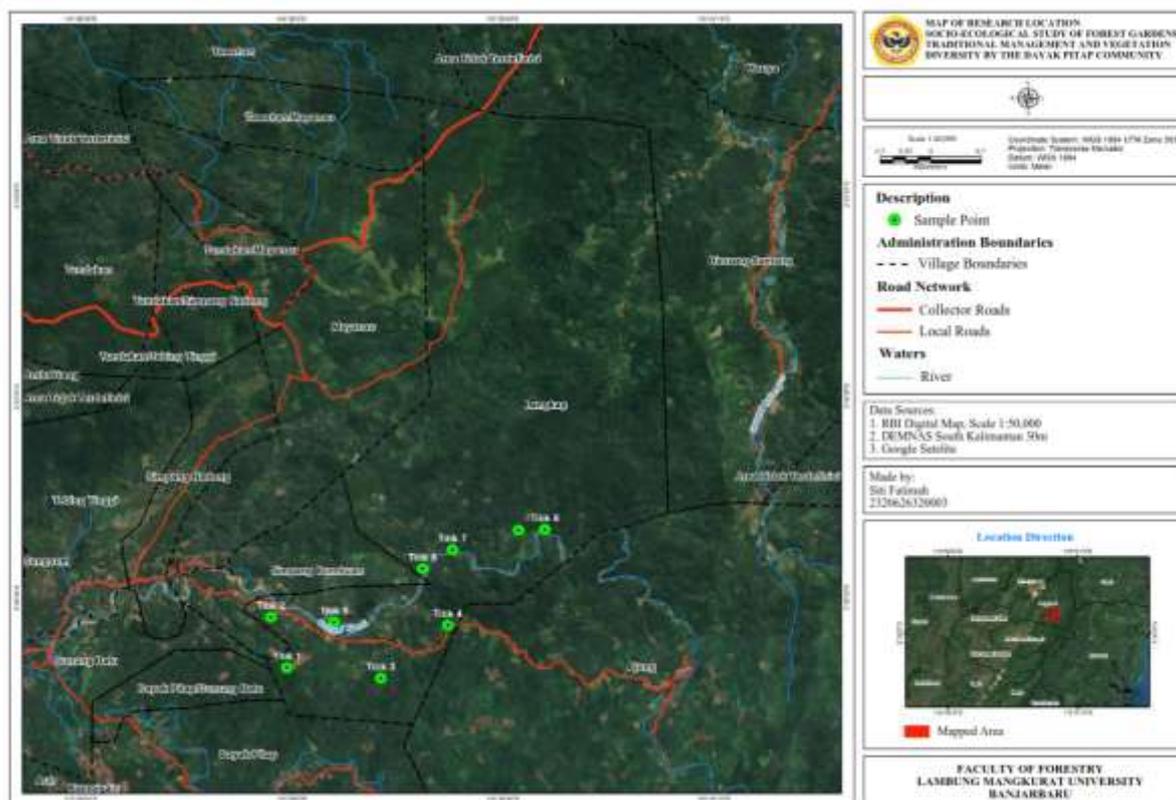


Figure 1 – Map of Research Location in Langkap Village

Research Procedure

The types of research data collected were divided into two categories: primary and secondary data. The primary data collected in this study includes interviews and direct observations of forest garden management by the community. Interviews were conducted using a semi-structured technique with purposive sampling, while observations were conducted using participatory observation. Participatory observation allows researchers to capture information that may not be revealed through interviews [5]. The forest garden management activities analyzed in this study include land preparation, seedling procurement, planting, maintenance, and harvesting. The forest garden management system in this study is divided into two types: subsistence and commercial. Data on the structure of forest garden vegetation diversity was collected using purposive sampling with observation plots. The size of the observation plot was 2 x 2 m for the seedling level, 5 x 5 m for the sapling level, 10 x 10 m for the pole level, and 20 x 20 m

for the tree level, with a total of 9 observation plots for each vegetation level. The observation plot can be seen in Figure 2.

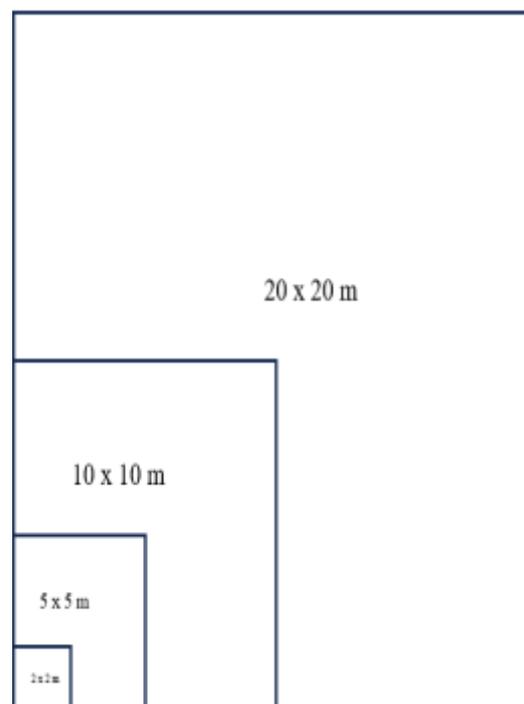


Figure 2 – Form of Vegetation Analysis Observation Plot

The growth rate and types of vegetation in the field, including seedlings, saplings, poles, and trees, are identified based on the criteria proposed by Soerianegara and Indrawan^[6]:

- Seedlings are regeneration individuals with a height of less than 1.5 meters.
- Saplings are regeneration individuals with a height of 1.5 to 3 meters and a diameter of less than 10 cm.
- Poles are regeneration individuals with a diameter ranging from 10 cm to less than 20 cm.
- Trees are woody plants with a height of more than 5 meters and a diameter of more than 20 cm.

Secondary data used in this study include land use maps and climate data to assess the potential growth factors of vegetation, as well as previous related studies.

Data Analysis

1. Analysis of Forest Garden

Management System and Utilization Patterns

The data analysis technique used in this study is qualitative descriptive, which involves several key stages: data collection, data reduction, data presentation, and conclusion drawing. Data obtained from interviews and field observations were first collected and then reduced by selecting relevant information in accordance with the research focus. The simplified data were then presented in the form of descriptive narratives, tables, or diagrams to facilitate interpretation and understanding of the forest garden management patterns practiced by the local community.

The next step involved drawing conclusions based on the presented findings, with results verified through data triangulation, i.e., comparing information from multiple sources or methods to ensure consistency and validity. Conclusions were drawn inductively, providing a comprehensive picture of the forest garden management system and utilization practices implemented by the community, while addressing the overall research questions.

2. Analysis of Forest Garden Vegetation Structure

The vegetation structure of the forest garden was analyzed using the Importance Value Index (IVI). IVI is used to express the dominance or influence of a particular vegetation species in relation to others within a community. According to the Decree of the Minister of Forestry No. 200/KPTS-IV/1994, the criteria for IVI classification are as follows:

- a. Very low dominance: IVI for trees < 60 ; IVI for seedlings/saplings/poles < 40 .
- b. Low dominance: IVI for trees $60 - < 120$; IVI for seedlings/saplings/poles $40 - < 80$.
- c. Moderate dominance: IVI for trees $120 - < 180$; IVI for seedlings/saplings/poles $80 - < 120$.
- d. High dominance: IVI for trees $180 - < 240$; IVI for seedlings/saplings/poles $120 - < 160$.
- e. Very high dominance: IVI for trees ≥ 240 ; IVI for seedlings/saplings/poles ≥ 160 .

The IVI calculation follows the formula proposed by Muhadjir et al.^[7]. For saplings, poles, and trees, the IVI is determined by summing the relative density, relative frequency, and relative dominance for each growth level. For seedlings, the IVI is calculated based on relative density and relative frequency.

RESULT

1. Forest Garden Management System and Utilization Patterns

Forest Garden Management System

The selected informants are rubber farmers or cultivators, which represent the primary livelihood in Langkap Village. The informants range in age from 21 to 54 years. They manage land areas varying from 0.5 to 1.5 hectares. Communities in Langkap Village who manage forest gardens earn an income ranging from IDR 300,000 to IDR 1,000,000 per month. The marketing system for forest garden products remains limited, with most harvests sold only on a small

scale to local collectors in the village. A significant portion of the produce is also used for household consumption, which further reduces the amount available for

market sale. In general, the forest garden management process in Langkap Village follows the sequence described below.

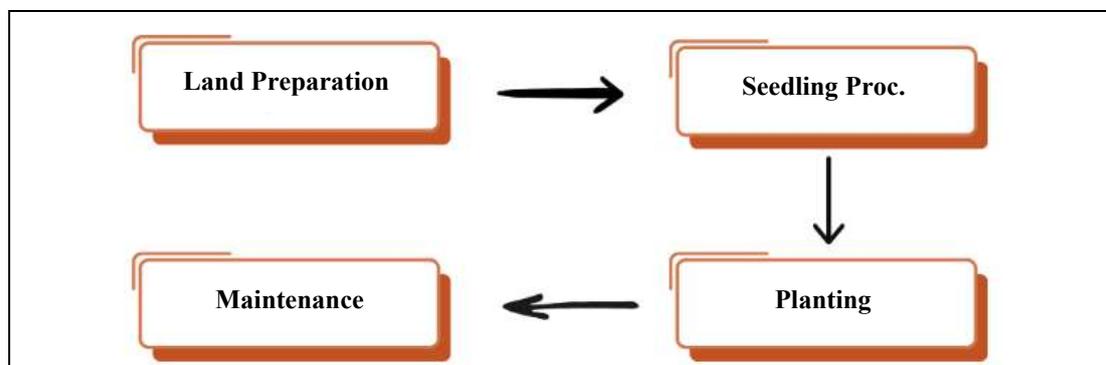


Figure 3 – Stages of Forest Garden Management by the Community of Langkap Village

a. Land Preparation

Land preparation begins with observing soil color, which serves as a primary indicator of soil fertility—the darker the soil, the higher the organic matter content. Other considerations include loose soil texture, soil moisture, proximity to river streams, and land slope. These factors are carefully assessed by the Dayak Pitap community before cultivating the land.

The people of Langkap Village practice a rotational field system (*ladang gilir*), which differs from the conventional shifting cultivation system. This method involves clearing land from previously established gardens using a selective cutting approach. The land used is not new, but rather old plots with unproductive or senescent trees (usually over 10 years old). These trees are selectively felled without damaging surrounding productive vegetation. This system allows land to be reused without relocation, thereby maintaining ecological sustainability and preserving the economic value of existing forest gardens.

b. Seedling Procurement

Seedling procurement in the forest garden management by the community of Langkap Village is carried out through two main methods: utilizing wildlings (naturally regenerated seedlings) collected from the surrounding forest and using improved or high-quality seedlings obtained from outside the village. Both methods are rooted in traditional knowledge and practices passed down through generations and are adapted to the availability of local resources and the specific needs of the community.

c. Planting

The planting pattern used is intercropping, with rubber (*Hevea brasiliensis*) and *jengkol* (*Archidendron pauciflorum*) as the main crops, while *cempedak* (*Artocarpus champeden*), durian (*Durio zibethinus*), and others serve as secondary crops. Planting distances are adjusted to optimize land use, typically ranging from 3 × 3 meters to 4 × 4 meters. Planting is usually carried out during the rainy season to take advantage of sufficient rainfall. The composition of plant species in the forest garden of Langkap Village is illustrated in Figure 4 below.

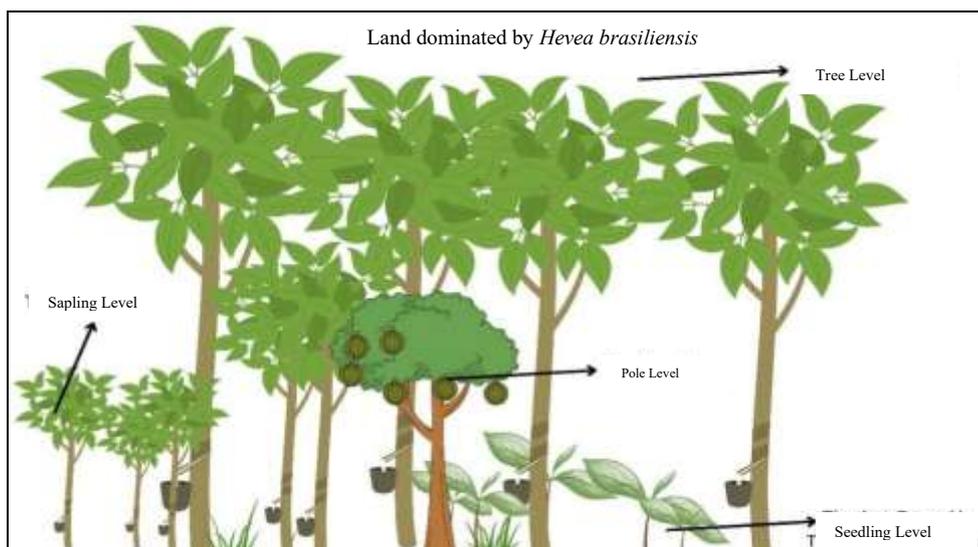


Figure 4 – Composition of Vegetation Dominated by Rubber Plant

In addition, various types of understory vegetation were found, including *mali-mali* (*Leea indica*), *daun salam* (*Syzygium polyanthum*), *birayang* (*Spondias purpurea*), *mahang* (*Macaranga sp.*), *kayu kacang* (*Strombosia javanica*), *bindrang hutan* (*Scleria laevis*), and *jirak* (*Symplocos brandisii*), all of which contribute to the biodiversity of the rubber agroforest. At the tree level, rubber (*Hevea brasiliensis*) is the dominant species, represented by various growth phases. Some rubber trees have reached the tapping stage, which typically occurs between 6 to 9 years of age,

depending on cultivation methods and rubber varieties used.

The rubber-based agroforestry system developed by farmers in Langkap Village not only provides economic benefits but also contributes to land conservation, maintains soil moisture, enhances soil fertility, and plays a role in carbon storage. This planting pattern reflects an agroforestry practice that maintains the dominance of rubber trees while utilizing available space for complementary species that support the sustainability of the farming system. Most of the vegetation conditions in Langkap Village are illustrated in Figure 5.



Figure 5 – Mixed Vegetation Composition (Some Plants Grow Naturally)

d. Maintenance

The maintenance of forest gardens by the Dayak Pitap community in Langkap Village is carried out using traditional methods based on local knowledge passed down

through generations. Maintenance activities primarily involve manual practices, such as periodic weeding using simple tools like machetes or sickles. Weeding is essential to prevent competition from shrubs and

undergrowth that could inhibit the growth of main crops. Spraying is conducted only when plants are affected by pests or diseases.

Forest Garden Utilization System

The community of Langkap Village utilizes forest gardens for daily needs, both for subsistence consumption and commercial purposes. Rubber (*Hevea brasiliensis*) is one of the main crops with high economic value. Its market price varies, with wet rubber selling for approximately IDR 10,000 per kilogram and dry rubber ranging from IDR 13,000 to IDR 15,000 per kilogram. Fruit crops such as *cempedak* (*Artocarpus chamedon*), jackfruit (*Artocarpus heterophyllus*), rambutan (*Nephelium lappaceum*), and others are consumed directly by households, with some being sold locally at the village or

subdistrict level, including at Kamis Market and Mayanau Market. *Pampakin* (*Durio kutejensis*) is one of the multipurpose species, serving both as a food source for the family and as a commodity for sale. Other plants like jengkol, banana, and eggplant are mainly for household consumption, although in some cases, surplus harvests are also marketed. Rubber harvests are typically sold to village collectors on a weekly basis, while fruits are marketed during the harvest season. Household income from forest garden production varies, ranging from IDR 300,000 to IDR 1,000,000 per month, depending on production volume and market prices at the time of harvest. The types of plants found in the forest gardens of Langkap Village and their respective utilization systems are presented in Table 1 below.

Table 1. Plant Species in Langkap Village Forest Gardens and Their Utilization Systems

No	Local Name	Scientific Name	Utilization	
			Subsistence	Commercial
1	Rubber	<i>Hevea brasiliensis</i>		√
2	Jengkol	<i>Arcidendron pauciflorum</i>	√	√
3	Cempedak	<i>Artocarpus integer</i>	√	√
4	Jackfruit	<i>Artocarpus heterophyllus</i>	√	√
5	Rambutan	<i>Nephelium lappaceum</i>	√	
6	Durian	<i>Durio zibethinus</i>	√	√
7	Langsat	<i>Lansium domesticum</i>	√	
8	Chili Pepper	<i>Capsicum annum</i>	√	√
9	Eggplant	<i>Solanum melongena</i>	√	
10	Kapul	<i>Baccaurea macrocarpa</i>	√	
11	Tomato	<i>Solanum lycopersicum</i>	√	√
12	Banana	<i>Musa spp.</i>	√	
13	Ramania	<i>Bouea macrophylla</i>	√	√
14	Terap	<i>Artocarpus odoratissimus</i>	√	√
15	Pampakin	<i>Durio kutejensis</i>	√	√

According to Hafizianor [8], the utilization patterns of forest garden products by local communities can be categorized into two types: subsistence use and commercial use. Subsistence use refers to the utilization of products as food, medicine, or firewood for household needs, while commercial use involves selling the products to generate economic value. As shown in Table 1, only *Hevea brasiliensis* is not utilized for subsistence purposes. In this study, ten plant species were identified as having

commercial value, as they are sold in markets at relatively high prices. Plant species that are not commercially utilized are directly consumed by the Dayak Pitap community for daily needs.

2. Vegetation Structure and Diversity

The results of vegetation analysis at the study site, based on data collected from nine plots measuring 20 × 20 meters, indicate a relatively high level of plant species diversity. A total of 68 plant species were

identified across various growth stages. A summary of the plant species recorded in the forest garden is presented in Table 2.

Table 2. Vegetation Occurrence Levels in the Forest Garden

No	Local Name	Scientific Name	Occurrence Levels				Habitus
			Seedling	Sapling	Pole	Tree	
1	Rengas	<i>Gluta renghas</i>	+	+	+	+	Trees (Woody Plants)
2	Birayang	<i>Spondias purpurea</i>	+	+	+	-	Trees (Woody Plants)
3	Ramania	<i>Bouea macrophylla</i>	+	+	+	+	Trees (Woody Plants)
4	Tarantang	<i>Camptosperma auriculatum</i>	+	-	-	-	Trees (Woody Plants)
5	Palajau	<i>Pentaspadon motleyi</i>	-	+	-	-	Trees (Woody Plants)
6	Sengkayang	<i>Dracontomelon dao</i>	-	+	+	-	Trees (Woody Plants)
7	Kuini	<i>Mangifera odorata</i>	-	+	+	+	Trees (Woody Plants)
8	Temputuk	<i>Camptosperme auriculata</i>	-	-	-	+	Trees (Woody Plants)
9	Hambawang	<i>Mangifera foetida</i>	-	-	-	+	Trees (Woody Plants)
10	Ampalam	<i>Mangifera calappa</i>	-	-	-	+	Trees (Woody Plants)
11	Binjai	<i>Mangifera caesa</i>		-	-	+	Trees (Woody Plants)
12	Kasturi	<i>Mangifera casturi</i>	-	-	-	+	Trees (Woody Plants)
13	Tarap	<i>Artocarpus gomezianus</i>	+	-	-	+	Trees (Woody Plants)
14	Kulidang	<i>Artocarpus lanceifolius</i>	+	-	-	+	Trees (Woody Plants)
15	Luwa	<i>Ficus fistolosa</i>	-	+	+	+	Trees (Woody Plants)
16	Jackfruit	<i>Artocarpus integra</i>	-	-	+	+	Trees (Woody Plants)
17	Tiwadak	<i>Artocarpus champeden</i>	+	+	+	+	Trees (Woody Plants)
18	Mahang	<i>Macaranga sp.</i>	+	+	+	-	Trees (Woody Plants)
19	Rubber	<i>Hevea brasiliensis</i>	+	+	+	+	Trees (Woody Plants)
20	Candlenut	<i>Aleurites moluccana</i>	+	+	+	+	Trees (Woody Plants)
21	High-quality Rubber	<i>Hevea brasiliensis</i>	-	-	+	+	Trees (Woody Plants)
22	Ketupuk	<i>Claoxylon indicum</i>	-	-	+	+	Trees (Woody Plants)
23	Coffee	<i>Coffea arabica</i>	+	+	+	-	Bush
24	Mambaratan	<i>Neolamarckia cadamba</i>	+	+	+	-	Trees (Woody Plants)
25	Bati-bati	<i>Adina minutiflora</i>		+	-	-	Trees (Woody Plants)
26	Rawali	<i>Nauclea subdita</i>	-	+	-	-	Trees (Woody Plants)
27	Patindis	<i>Urophyllum arboreum</i>		+	-	-	Trees (Woody Plants)
28	Merinjahan	<i>Aporosa</i>	+	-	-	-	Trees (Woody Plants)
29	Limpasu	<i>Baccaurea lanceolata</i>	-	+	+	-	Trees (Woody Plants)
30	Kapul	<i>Baccaurea macrocarpa</i>	-	+	+	+	Trees (Woody Plants)
31	Kaminjah	<i>Aporosa benthamiana</i>	+	-	-	+	Trees (Woody Plants)
32	Daun Salam	<i>Syzygium polyanthum</i>	+	-	-	-	Trees (Woody Plants)
33	Jambu Burung	<i>Eugenia sp.</i>	+	+	-	-	Bush
34	Mangobi	<i>Decaspermum fruticosum</i>	+	+	-	-	Bush
35	Langsat	<i>Lansium domesticum</i>	-	-	+	+	Trees (Woody Plants)
36	Surian	<i>Toona sureni Mer</i>	-	+	-	-	Trees (Woody Plants)
37	Ketapi	<i>Sandoricum koetjape</i>	-	-	-	+	Trees (Woody Plants)
38	Rambutan	<i>Nephelium lappaceum</i>	+	+	+	+	Trees (Woody Plants)
39	Tilayu	<i>Erioglossum rubiginosum</i>	+	-	-	-	Trees (Woody Plants)
40	Siwaw	<i>Nephelium sp.</i>	-	-	-	+	Trees (Woody Plants)
41	Birik	<i>Albizia procera</i>	+	-	-	-	Trees (Woody Plants)
42	Jengkol	<i>Archidendron pauciflorum</i>	-	+	+	-	Trees (Woody Plants)
43	Jamai	<i>Instia sp.</i>	-	-	+	-	Trees (Woody Plants)
44	Bayuan	<i>Saraca indica</i>	-	-	-	-	Trees (Woody Plants)
45	Durian	<i>Durio zibethinus</i>	+	+	+	+	Trees (Woody Plants)

46	Pampakin	<i>Durio kutejensis</i>	-	-	-	+	Trees (Woody Plants)
47	Kayu Kumpang	<i>Horsfieldia crassifolia</i>	+	+	-	-	Trees (Woody Plants)
48	Belinjo Hutan	<i>Gnetum gnemon</i>	+	+	-	-	Trees (Woody Plants)
49	Jirak	<i>Symplocos brandisii</i>	+	+	-	-	Trees (Woody Plants)
50	Mampat	<i>Cratoxylon formosum</i>	+	-	+	-	Trees (Woody Plants)
51	Mengkudu Hutan	<i>Fagraea racemosa</i>	+	+	+	-	Trees (Woody Plants)
52	Tengkawang	<i>Shorea macrophylla</i>	+	-	-	-	Trees (Woody Plants)
53	Sirsak	<i>Annona muricata</i>	-	+	-	-	Trees (Woody Plants)
54	Kayu Kacang	<i>Strombosia javanica</i>	+	-	-	-	Trees (Woody Plants)
55	Sungkai	<i>Peronema canescens</i>	-	+	+	-	Trees (Woody Plants)
56	Manggis Hutan	<i>Mesua beccariana</i>	-	+	-	+	Trees (Woody Plants)
57	Pulai	<i>Alstonia scholaris</i>	-	+	+	+	Trees (Woody Plants)
58	Kembayau	<i>Dacryodes rostrata</i>	-	-	-	+	Trees (Woody Plants)
59	Jati	<i>Tectona grandis</i>	-	-	-	+	Trees (Woody Plants)
60	Manggis	<i>Garcinia mangostana</i>	-	-	-	+	Trees (Woody Plants)
61	Kalangkala	<i>Litsea garciae</i>	-	-	-	+	Trees (Woody Plants)
62	Nyatoh	<i>Palaquium rostratum B.</i>	-	-	-	+	Trees (Woody Plants)
63	Surian	<i>Toona sureni Mer</i>	-	+	-	-	Trees (Woody Plants)
64	Mali-Mali	<i>Leea indica</i>	+	+	-	-	Shrub
65	Bindrang Hutan	<i>Scleria laevis</i>	+	-	-	-	Herb
66	Jeruk Purut	<i>Citrus hystrix</i>	-	+	-	-	Bush
67	Karamunting	<i>Rhodomyrtus tomentosa</i>	+	-	-	-	Shrub
68	Undingan	<i>Miloneria capitulate</i>	+	-	-	-	Shrub

A total of 68 plant species belonging to 29 families were recorded in the forest garden of the Dayak Pitap community in Langkap Village. The Anacardiaceae family was the most dominant taxonomic group in the vegetation structure, comprising species ranked from 1 to 12. Key species in this family include *Mangifera indica* (mango), *Mangifera caesia* (binjai) dan *Mangifera foetida* (hambawang). These species were also found to be evenly distributed across all plots. The presence of *Mangifera foetida*, *Mangifera calappa*, *Bouea macrophylla* (ramania) and *Gluta renghas* (rengas) across all strata indicates an active and ongoing natural regeneration process [9].

Other plant species found in the forest garden belong to the Rubiaceae family, characterized by species such as *Neolamarckia cadamba* (mambaratan), *Adina minutiflora* (bati-bati), and *Urophyllum arborescens* (patindis). These species were mostly found in the seedling and sapling strata, with only *Neolamarckia cadamba* reaching the pole stratum. This suggests a strong regeneration pattern, although maintenance up to the mature stage remains limited. The results of the vegetation analysis at the seedling level in the community forest garden of Langkap Village are presented in Table 3.

Table 3. Importance Value Index of Seedling Stratum

No	Local Name	Scientific	D	DR	F	FR	IVI
1	Rubber	<i>Hevea brasiliensis</i>	45000	23%	0.67	11%	34%
2	Daun Salam	<i>Syzygium polyanthum</i>	10000	5%	0.44	8%	13%
3	Birayang	<i>Spondias purpurea</i>	7500	4%	0.33	6%	10%
4	Mahang	<i>Macaranga sp.</i>	27500	14%	0.67	11%	25%
5	Jirak	<i>Symplocos brandisii</i>	2500	1%	0.11	2%	3%
6	Durian	<i>Durio zibethinus</i>	7500	4%	0.22	4%	8%
7	Kulidang	<i>Artocarpus lanceifolius</i>	2500	1%	0.11	2%	3%

8	Mampat	<i>Cratoxylon formosum</i>	5000	3%	0.22	4%	6%
9	Tiwadak	<i>Artocarpus champeden</i>	17500	9%	0.44	8%	17%
10	Ramania	<i>Bouea macrophylla</i>	5000	3%	0.22	4%	6%
11	Candlenut	<i>Aleurites moluccana</i>	2500	1%	0.11	2%	3%
12	Rengas	<i>Gluta renghas</i>	10000	5%	0.33	6%	11%
13	Kayu Kumpang	<i>Horsfieldia crassifolia</i>	5000	3%	0.22	4%	6%
14	Langsat	<i>Lansium domesticum</i>	7500	4%	0.11	2%	6%
15	Undingan	<i>Miloneria capitulate</i>	2500	1%	0.11	2%	3%
16	Rambutan	<i>Nephelium lappaceum</i>	2500	1%	0.11	2%	3%
17	Mambaratan	<i>Neolamarckia cadamba</i>	7500	4%	0.33	6%	10%
18	Tengkawang	<i>Shorea macrophylla</i>	2500	1%	0.11	2%	3%
19	Birik	<i>Albizia procera</i>	2500	1%	0.11	2%	3%
20	Tarap	<i>Artocarpus gomezianus</i>	7500	4%	0.22	4%	8%
21	Mengkudu Hutan	<i>Fagraea racemosa</i>	2500	1%	0.11	2%	3%
22	Tarantang	<i>Camposperma auriculatum</i>	2500	1%	0.11	2%	3%
23	Tilayu	<i>Erioglossum rubiginosum</i>	2500	1%	0.11	2%	3%
24	Kaminjah	<i>Aporosa benthamiana</i>	2500	1%	0.11	2%	3%
25	Merinjahan	<i>Aporosa</i>	2500	1%	0.11	2%	3%
26	Belinjo hutan	<i>Gnetum gnemon</i>	2500	1%	0.11	2%	3%
	Total		195000	100%	5.889	100%	200%

Table 3 shows that there are five dominant vegetation species at the seedling level: *Hevea brasiliensis* (rubber) with an IVI 34%, *Macaranga sp.* (mahang) 25%, *Artocarpus champeden* (tiwadak) 17%, *Syzygium polyanthum* (daun salam) 13%, dan *Gluta renghas* (rengas) 11%. These

species have higher IVI values compared to other species, indicating their significant influence in the ecosystem structure at the seedling stratum. The results of vegetation analysis at the sapling level in the community forest garden of Langkap Village are presented in Table 4.

Table 4. Importance Value Index of Sapling Stratum

No	Local Name	Scientific Name	D	DR	Do	DoR	F	FR	IVI
1	Rubber	<i>Hevea brasiliensis</i>	6400	19%	18.4	21%	1.00	16%	57%
2	Durian	<i>Durio zibethinus</i>	4400	13%	12.64	14%	0.56	9%	37%
3	Mahang	<i>Macaranga sp.</i>	5600	17%	14.68	17%	0.78	13%	46%
4	Mambaratan	<i>Neolamarckia cadamba</i>	400	1%	0.8	1%	0.11	2%	4%
5	Langsat	<i>Lansium domesticum</i>	1600	5%	1.44	2%	0.22	4%	10%
6	Ramania	<i>Bouea macrophylla</i>	1600	5%	2.4	3%	0.22	4%	11%
7	Belinjo Hutan	<i>Gnetum gnemon</i>	400	1%	0.2	0%	0.11	2%	3%
8	Kayu Kumpang	<i>Horsfieldia crassifolia</i>	1600	5%	3.36	4%	0.22	4%	12%
9	Birayang	<i>Spondias purpurea</i>	400	1%	0.24	0%	0.11	2%	3%
10	Rambutan	<i>Nephelium lappaceum</i>	800	2%	2.52	3%	0.22	4%	9%
11	Tiwadak	<i>Artocarpus champeden</i>	800	2%	3.08	4%	0.22	4%	10%
12	Mengkudu Hutan	<i>Fagraea racemose</i>	800	2%	2.72	3%	0.22	4%	9%
13	Manggis Hutan	<i>Mesua beccariana</i>	400	1%	0.72	1%	0.11	2%	4%
14	Bati-bati	<i>Adina minutiflora</i>	400	1%	2.16	2%	0.11	2%	5%
15	Pulai	<i>Alstonia scholaris</i>	400	1%	2.48	3%	0.11	2%	6%
16	Luwa	<i>Ficus fistolosa</i>	400	1%	0.8	1%	0.11	2%	4%
17	Jengkol	<i>Archidendron pauciflorum</i>	800	2%	3.2	4%	0.22	4%	10%
18	Sungkai	<i>Peronema canescens</i>	1200	4%	2.4	3%	0.22	4%	10%
19	Surian	<i>Toona sureni Mer</i>	400	1%	1.04	1%	0.11	2%	4%
20	Kaminjah	<i>Aporosa benthamiana</i>	400	1%	1.28	1%	0.11	2%	4%
21	Patindis	<i>Urophyllum arboreum</i>	400	1%	1.04	1%	0.11	2%	4%
22	Kemiri	<i>Aleurites moluccana</i>	1200	4%	3.04	3%	0.22	4%	11%
23	Jirak	<i>Symplocos brandisii</i>	400	1%	1.56	2%	0.11	2%	5%
24	Palajau	<i>Pentaspadon motley</i>	400	1%	1.04	1%	0.11	2%	4%
25	Limpasu	<i>Baccaurea lanceolata</i>	400	1%	0.24	0%	0.11	2%	3%
26	Rawali	<i>Nauclea subdita</i>	400	1%	2	2%	0.11	2%	5%

27	Bayuan	<i>Saraca indica</i>	400	1%	0.4	0%	0.11	2%	3%
28	Rengas	<i>Gluta renghas</i>	400	1%	2	2%	0.11	2%	5%
Total			33200	100%	87.88	100%	6.11	100%	300%

The vegetation analysis at the sapling level indicates that *Hevea brasiliensis* (rubber), *Macaranga sp.* (mahang), and *Durio zibethinus* (durian) are the dominant species, with IVI values of 57%, 46%, and 37% respectively. These species dominate in terms of the number of individuals, basal

area, and frequency, indicating their strong adaptability to local environmental conditions. The results of vegetation analysis at the pole level in the community forest garden of Langkap Village are presented in Table 5.

Table 5. Importance Value Index of Pole Stratum

No	Local Name	Scientific Name	D	DR	Do	DoR	F	FR	IVI
1	Durian	<i>Durio zibethinus</i>	1200	13%	26	17%	1.11	14%	44%
2	High-quality Rubber	<i>Hevea brasiliensis</i>	500	6%	7	5%	1.00	12%	22%
3	Rubber	<i>Hevea brasiliensis</i>	1200	13%	17	11%	0.78	10%	34%
4	Jackfruit	<i>Artocarpus integra</i>	200	2%	3	2%	0.22	3%	7%
5	Sungkai	<i>Peronema canescens</i>	900	10%	14	9%	0.67	8%	27%
6	Tiwadak	<i>Artocarpus champeden</i>	500	6%	9	6%	0.44	5%	17%
7	Mengkudu Hutan	<i>Fagraea racemose</i>	300	3%	5	3%	0.22	3%	9%
8	Ketupuk	<i>Claoxylon indicum</i>	100	1%	1	1%	0.11	1%	3%
9	Mahang	<i>Macaranga sp.</i>	400	4%	8	5%	0.44	5%	15%
10	Ramania	<i>Bouea macrophylla</i>	300	3%	8	5%	0.22	3%	11%
11	Candlenut	<i>Aleurites moluccana</i>	400	4%	6	4%	0.33	4%	12%
12	Jengkol	<i>Archidendron pauciflorum</i>	400	4%	6	4%	0.33	4%	12%
13	Langsat	<i>Lansium domesticum</i>	800	9%	17	11%	0.56	7%	27%
14	Mambaratan	<i>Neolamarckia cadamba</i>	300	3%	6	4%	0.22	3%	10%
15	Pulai	<i>Alstonia scholaris</i>	200	2%	3	2%	0.22	3%	7%
16	Sengkuang	<i>Dracontomelon dao</i>	100	1%	2	1%	0.11	1%	4%
17	Kuini	<i>Mangifera odorata</i>	100	1%	1	1%	0.11	1%	3%
18	Birayang	<i>Spondias purpurea</i>	100	1%	1	1%	0.11	1%	3%
19	Rengas	<i>Gluta renghas</i>	100	1%	2	1%	0.11	1%	4%
20	Luwa	<i>Ficus fistolosa</i>	200	2%	3	2%	0.11	1%	6%
21	Rambutan	<i>Nephelium lappaceum</i>	200	2%	3	2%	0.22	3%	7%
22	Limpasu	<i>Baccaurea lanceolata</i>	100	1%	1	1%	0.11	1%	3%
23	Jamai	<i>Instia sp.</i>	100	1%	2	1%	0.11	1%	4%
24	Kapul	<i>Baccaurea macrocarpa</i>	100	1%	2	1%	0.11	1%	4%
25	Mampat	<i>Cratoxylon formosum</i>	100	1%	2	1%	0.11	1%	4%
Total			8900	100%	155	100%	8.11	100%	300%

At the pole level, five species were found to dominate the vegetation community within the study area. These species and their corresponding Importance Value Index (IVI) values, ranked from highest to lowest, are: *Durio zibethinus* (durian) at 44%, *Hevea brasiliensis* (rubber) at 34%,

Peronema canescens (sungkai) and *Lansium domesticum* (langsat) both at 27%, and *Hevea brasiliensis* (high-quality rubber) at 22%. The results of vegetation analysis at the tree level in the forest gardens managed by the Langkap Village community are presented in Table 6.

Table 6. Importance Value Index of Tree Stratum

No	Local Name	Scientific Name	D	DR	Do	DoR	F	FR	IVI
1	High-quality Rubber	<i>Hevea brasiliensis</i>	350	15%	39.25	19%	1.00	13%	47%
2	Rubber	<i>Hevea brasiliensis</i>	75	3%	3.25	2%	0.33	4%	9%

3	Tiwadak	<i>Artocarpus champeden</i>	225	10%	9.75	5%	0.44	6%	20%
4	Luwa	<i>Ficus fistolosa</i>	75	3%	7	3%	0.22	3%	9%
5	Temputuk	<i>Camptosperme auriculata</i>	25	1%	2	1%	0.11	1%	3%
6	Jackfruit	<i>Artocarpus integra</i>	50	2%	7.25	3%	0.22	3%	9%
7	Hambawang	<i>Mangifera foetida</i>	125	5%	13.25	6%	0.56	7%	19%
8	Ketupuk	<i>Claoxylon indicum</i>	50	2%	3.75	2%	0.22	3%	7%
9	Ketapi	<i>Sandoricum koetjape</i>	50	2%	4.25	2%	0.22	3%	7%
10	Pulai	<i>Alstonia scholaris</i>	25	1%	1.75	1%	0.11	1%	3%
11	Tarap	<i>Artocarpus gomezianus</i>	125	5%	14	7%	0.56	7%	19%
12	Langsat	<i>Lansium domesticum</i>	200	9%	9.5	5%	0.44	6%	19%
13	Candlenut	<i>Aleurites moluccana</i>	100	4%	7	3%	0.22	3%	11%
14	Ramania	<i>Bouea macrophylla</i>	150	7%	14	7%	0.56	7%	20%
15	Kembayau	<i>Dacryodes rostrata</i>	25	1%	1.75	1%	0.11	1%	3%
16	Kulidang	<i>Artocarpus lanceifolius</i>	25	1%	1.5	1%	0.11	1%	3%
17	Ampalam	<i>Mangifera calappa</i>	50	2%	3.25	2%	0.22	3%	7%
18	Durian	<i>Durio zibethinus</i>	150	7%	14	7%	0.44	6%	19%
19	Jati	<i>Tectona grandis</i>	75	3%	8.75	4%	0.33	4%	12%
20	Kapul	<i>Baccaurea macrocarpa</i>	25	1%	3.25	2%	0.11	1%	4%
21	Binjai	<i>Mangifera caesa</i>	50	2%	10.25	5%	0.22	3%	10%
22	Siwaw	<i>Nephelium sp.</i>	25	1%	3.75	2%	0.11	1%	4%
23	Manggis hutan	<i>Mesua beccariana</i>	25	1%	1.5	1%	0.11	1%	3%
24	Pampakin	<i>Durio kutejensis</i>	25	1%	1.5	1%	0.11	1%	3%
25	Kuini	<i>Mangifera odorata</i>	25	1%	1.5	1%	0.11	1%	3%
26	Kalangkala	<i>Litsea garciae</i>	50	2%	11.5	6%	0.22	3%	11%
27	Nyatoh	<i>Palaquium rostratum B.</i>	25	1%	2	1%	0.11	1%	3%
28	Rambutan	<i>Nephelium lappaceum</i>	25	1%	3.75	2%	0.11	1%	4%
29	Kasturi	<i>Mangifera casturi</i>	25	1%	2	1%	0.11	1%	3%
30	Rengas	<i>Gluta renghas</i>	25	1%	1.5	1%	0.11	1%	3%
	Total		2275	100%	207.75	100%	7.89	100%	300%

The results presented in Table 6 indicate that the highest Importance Value Index (IVI) was recorded for *Hevea brasiliensis* (High-quality rubber), with a value of 47%. This was followed by *Artocarpus champeden* (chempedak) and *Bouea macrophylla* (ramania), each with an IVI of 20%. *Mangifera foetida* (hambawang) and *Durio zibethinus* (durian) also exhibited identical IVI values of 19%. These high IVI scores at the tree level serve as key indicators of forest structure and ecological condition.

DISCUSSION

1. Forest Garden Management System and Utilization Patterns

Forest Garden Management System

The Dayak Pitap community in Langkap Village, predominantly engaged in rubber farming, is characterized by a majority of farmers aged 35–40 years and above. This

indicates that forest garden management is primarily undertaken by individuals within the productive age group. The presence of farmers aged over 50 years highlights the persistence of traditional agroforestry practices, sustained through intergenerational knowledge transfer. Land ownership in the range of 0.5 to 1.5 hectares classifies these farmers as smallholders who rely heavily on forest gardens for household subsistence and supplemental income. However, limited land area constrains their production capacity and, consequently, the income generated.

a. Land Preparation

The selection of forest garden sites by the Dayak Pitap community in Langkap Village is primarily based on collective ancestral knowledge passed down through generations. Their forest garden management system integrates cultural values, local ecological wisdom, and

sustainable subsistence needs. Three key rituals form an integral part of the traditional agricultural cycle: *Manugal*, *Mahanyari*, dan *Palas Paung* (also known as *Baharin*). *Manugal* refers to the collective rice planting activity, typically conducted from September to December following land clearing in July. *Mahanyari* is a ritual marking the first harvest, symbolizing reverence for the land's bounty, while *Palas Paung* is a smaller thanksgiving ceremony. *Baharin* a larger-scale variant, includes cultural performances such as the traditional *batandik* dance, serving as a communal celebration of the harvest. These rituals highlight those agricultural practices among the Dayak Pitap are not solely economic but deeply embedded with spiritual meaning and social cohesion.

Comparatively, the Dayak Pitap and the Dayak Meratus in Loksado Subdistrict share similar principles of sustainability, though they differ in land-use phases. Rezekiah et al. [10] describe that the Dayak Meratus practice a rotational land-use system comprising four distinct phases: *pahumaan* (rice fields), *balukar anum* (fallow lands, 3–6 years), *jurungan* (old fallows, 7–12 years), and *kabun buah* (permanent fruit gardens, >15 years). Each phase supports distinct vegetative compositions and facilitates natural successional processes. These systems are governed by customary norms and involve spiritual leaders (*balian*), reinforcing social legitimacy in resource management. Both the swidden farming of the Dayak Pitap and the land rotation of the Dayak Meratus underscore how indigenous knowledge and customary governance serve as foundational elements for sustainable and adaptive forest management in the upland regions of Kalimantan.

Following the harvest, land is not abandoned but is instead transitioned into forest gardens through traditional agroforestry systems. Mixed cropping patterns—featuring *Hevea brasiliensis* and *Archidendron pauciflorum* (jengkol) interplanted with *Durio zibethinus*, *Artocarpus champeden*, *Durio kutejensis*,

and *Lansium domesticum*—produce a stratified vegetation structure resembling secondary forest. This configuration enhances soil moisture retention, reduces erosion, and supports biodiversity conservation.

b. Seedling Procurement

Most farmers in Langkap Village obtain planting materials from naturally regenerated seedlings found around their gardens or along forest edges. These seedlings are carefully uprooted from beneath parent trees to preserve the root system, thus bypassing the need for a formal nursery stage. However, this practice does not apply to high-quality rubber (*Hevea brasiliensis*) clones, which are typically acquired through external purchase. Such clones are commonly grafted or budded and are selected for superior productivity and disease resistance.

The community's approach to seedling procurement reflects an ecologically informed practice rooted in long-term experiential knowledge. Although it does not conform to standardized academic propagation methods, the knowledge applied is highly contextual and adaptive, shaped by site-specific conditions and individual household traditions. This decentralized and flexible model enables farmers to combine natural regeneration with externally sourced planting material according to situational needs. Such practices support the long-term sustainability of forest garden systems by preserving vegetation diversity and ecological functionality.

c. Planting

The composition of forest garden vegetation in Langkap Village, Tebing Tinggi Subdistrict, as illustrated in Figures 4 and 5, reflects a complex land-use system that mimics the structural characteristics of secondary forests. The sapling and pole layers consist of both intentionally planted and naturally regenerated tree species, indicating a sustainable process of ecological succession. The presence of advanced regeneration in these strata

demonstrates the community's ecological stewardship and long-term vision for maintaining forest continuity. Dominant species in the pole layer, such as *Macaranga sp.*, *Durio zibethinus*, *Artocarpus champeden*, *Adina minutiflora*, *Urophyllum arboreum*, and *Gluta renghas* suggest that the land is in an active growth phase, with a trajectory toward medium- to long-term productivity. High-value fruit trees such as *Baccaurea macrocarpa*, *Mangifera caesia*, *Bouea macrophylla*, and *Lansium domesticum* have reached the canopy layer, contributing not only to seasonal income but also to ecological functions such as soil shading, erosion control, and microclimate regulation.

The vertical structure formed in the forest gardens of Langkap Village reflects traditional agroforestry practices that are carried out without formal technical design, yet still demonstrate integration between ecological aspects and the subsistence needs of the community. Planting patterns are not uniform or monocultural, but are adapted to the contours of the land, with loose spacing between plants, and utilizing natural growing space. The selection of plant species in the forest garden is not random but based on economic, ecological, and cultural considerations. Plants such as *Baccaurea macrocarpa*, *Mangifera caesia*, and *Durio zibethinus* are not only highly valuable during the harvest season but also hold symbolic significance in Dayak Pitap culture as heritage plants. Species like *Hevea brasiliensis* are planted to ensure long-term income, as their sap and wood can be sold or utilized.

Plots 2 to 9 of the complex vegetation structure at the research site show natural regeneration, uniform planting patterns, and continuity of stand structure from bottom to top. The diversity of species at each level indicates that these forest gardens not only generate financial returns, but also support biodiversity conservation and serve as buffer zones for larger forest areas. Traditional forest gardens are one of the most important land use systems for

maintaining ecological functions in the face of climate change and global environmental degradation. These gardens can continue to provide habitat for various species through management that follows sustainability principles. This also enables local communities dependent on forest products and the environmental services they provide to sustain their livelihoods.

d. Maintenance

The forest garden management practices of the Dayak Pitap community are grounded in the principles of ecological balance and sustainability, with minimal reliance on chemical inputs or modern technological interventions. Treatment of individual plants varies; for instance, superior rubber trees (*Hevea brasiliensis*) receive special attention through the application of NPK or compound fertilizers. In contrast, fruit trees are only periodically weeded without any additional fertilization. Post-planting maintenance is carried out minimally, typically only until the harvesting phase. Pest and disease control is rarely practiced, as the community tends to allow their crops to endure pest attacks naturally.

Knowledge of organic fertilizer production remains limited among the Dayak Pitap community. Even among those familiar with the process, usage is infrequent due to constraints in labor and time, as well as limited access to appropriate tools and materials. Moreover, the high cost of chemical fertilizers poses an economic burden, prompting communities to rely on natural soil fertility and allow plants to grow with minimal human intervention.

This low-input and relatively passive management system has demonstrated resilience and has provided sustainable economic returns within a subsistence context. Nevertheless, it holds significant potential for improvement through technical assistance, particularly in the utilization of locally available organic resources such as household organic waste, livestock manure, and leaf litter. Enhancing local knowledge and capacity in this area could support the development of a more productive

agroforestry system, while preserving ecological sustainability.

Forest Garden Utilization System

Utilization of forest gardens by the Dayak Pitap community, as shown in Table 1, is predominantly focused on the harvest of fruits and rubber. A total of 14 plant species are used for subsistence purposes, while 10 species are cultivated commercially, with *Hevea brasiliensis* generating the highest income due to its capacity for daily tapping. Plant selection is guided by household needs as well as cultural values, particularly the intention to preserve these species as a legacy for future generations. The cultivation period for forest garden plants varies, ranging from 10 to more than 40 years.

Despite the abundance of local fruit species in Langkap Village, they have yet to contribute significantly to the local economy. Seasonal harvests are primarily consumed within households or shared among neighbors. A major barrier to enhancing the economic value of forest garden products for the Dayak Pitap people is limited access to broader markets. The community remains reliant on local collectors and markets, resulting in unstable prices that fluctuate with market demand. These low prices fail to reflect the considerable effort invested by the community in maintaining and managing their forest gardens, leading to instances where surplus harvests are left to spoil due to lack of viable outlets.

The limited availability of post-harvest technology and processing facilities also poses a significant challenge in enhancing the economic returns from forest garden products. Value-added products such as banana chips, mangosteen preserves, and packaged petai (*Parkia speciosa*) could substantially increase the market value of forest garden yields. However, these processing practices have not yet been adopted by the Dayak Pitap community due to constraints in knowledge, technical skills, processing equipment, and restricted market

access. Furthermore, information regarding quality standards for horticultural products—particularly those aimed at export or external regional markets—is not readily available to local farmers. As a result, they face difficulties in aligning their production with market demands and expectations.

2. Vegetation Structure and Diversity

The intercropping practices of the Dayak Pitap community reflect a traditional agroforestry system that combines production with conservation^[11]. This strategy reflects the local community's intelligence in managing the landscape to support food needs, household income, and tropical ecosystem conservation simultaneously.

The dominance of vegetation types not only reflects the high species richness in traditional agroforestry systems, but also indicates a strong integration between local knowledge, economic value, and ecological function. Table 2 shows the dominance of the Anacardeaceae family in agroforestry in Langkap Village. Fruits from the Anacardeaceae family are the main source of food for local fauna such as bats, birds, and primates, which naturally aid in seed dispersal^[12]. The Dayak Pitap community also actively cultivates and preserves these fruit species in addition to allowing them to grow naturally. The fruits from these gardens are cultivated and preserved by the community for their own consumption and as an additional source of income.

The Euphorbiaceae family is also an important type of vegetation in helping to improve the community's economy, with plants such as *Macaranga sp.*, *Aleurites moluccana*, *Hevea brasiliensis*, and *Claoxylon indicum*. The *Aleurites moluccana* and *Hevea brasiliensis* species in Table 2 are recorded in all growth strata. This situation highlights the central role of these species in the structure and productivity of forest plantations. Their even distribution also indicates intensive management by the community^[13]. This demonstrates the strong role of these two

species in open areas, which serve to enhance forest regeneration dynamics [14].

The number of vegetation occurrences (Table 2) at the study site was dominated by woody tree species (88.24%). This condition indicates that the area has a relatively intact and layered vegetation structure. The presence of shrubs, bushes, and herbs further enriches the vertical structure and diversity of the understory vegetation. The high presence of large tree strata (61.76%) also indicates that many species have reached maturity, meaning that this condition has been inherited over a relatively long period of time. The presence of seedlings and saplings indicates that the regeneration process is still ongoing in the Langkap Village forest garden. This condition generally reflects that the vegetation community is still actively growing and able to reproduce naturally.

The results of vegetation analysis at all growth levels were dominated by *Hevea brasiliensis*. This dominant species indicates the influence of the surrounding community's cultivation of rubber trees on their agroforestry land. In addition, the presence of this species at all growth levels indicates that it is well adapted to the site conditions [15].

At the seedling and sapling level, pioneer species such as *Macaranga sp.*, which also have high INP values, indicate that the ecosystem in Langkap Village is undergoing a natural recovery process (secondary succession) [16]. Secondary succession occurs after an area has experienced natural or anthropogenic disturbance. Garcia-González's [17] research in Zacualpan, Colima (Mexico), reported that fallow-based agroforestry supports 71% of the species richness of tropical dry forests, as well as maintaining endemic and protected species, as pioneer plants emerge and vegetation cover gradually develops. These findings align with the regeneration patterns observed in the Dayak Pitap community forest garden, where *Macaranga sp.* plays a role in enhancing post-disturbance biodiversity and vegetation structure.

Durian plants (*Durio zibethinus*) also occupy an important position in the vegetation structure because this species is also found at all levels of growth. The presence of durian ecologically reflects that the area has sufficiently fertile soil, sufficient light, and topographic conditions that support growth. The presence of durian trees in the forest gardens of Langkap Village indicates that this species has a high economic and cultural value. The community tends to maintain durian trees in an agroforestry system, so that this species continues to exist and play a role in community building [18, 19].

Species with low Importance Value Index (IVI) scores reflect an imbalance in species dominance within the vegetation community. Several species were recorded in only one or two plots, with a small number of individuals and relatively small stem diameters, thus contributing minimally to the overall vegetation structure. Despite their low contribution, these species are ecologically important for maintaining biodiversity and supporting long-term opportunities for natural regeneration. However, in the long-term ecological process, such conditions may lead to homogenization. Rahayu [20] noted that the dominance of certain species can disrupt natural regeneration processes. This homogenization may reduce ecosystem resilience to disturbances [21].

The condition of forest gardens in Langkap Village, as observed in this study, indicates a semi-natural ecosystem—an area shaped by human intervention yet still maintaining relatively high species diversity. This condition should be preserved through vegetation management strategies that balance the cultivation of economically valuable species with the conservation of local biodiversity. Furthermore, regular monitoring is essential to detect potential declines in the dominance of native species, enabling early intervention when necessary.

CONCLUSION

Forest garden management by the Dayak Pitap community in Langkap Village is conducted using traditional methods rooted in local knowledge. The agroforestry system serves as the primary land-use pattern, with rubber (*Hevea brasiliensis*) is the main commodities intercropped with various fruit trees. Forest gardens are utilized for both subsistence and commercial purposes. Commercial outputs are largely derived from *Hevea brasiliensis* and fruit-producing species. The structure and species composition of forest garden vegetation demonstrate high species richness, with 68 species recorded. The vegetation is dominated by *Hevea brasiliensis*, *Durio zibethinus*, *Artocarpus champeden*, and other high-economic-value fruit trees. The presence of a complete vertical vegetation structure indicates a stable and healthy ecosystem. Importance Value Index (IVI) analysis reveals the dominance of specific species such as *Hevea brasiliensis*, yet natural regeneration continues to occur, reflecting ecological dynamics and long-term sustainability. The existence of these forest gardens should be protected and supported by local governments and relevant stakeholders through legal recognition of community-managed areas. Technical assistance and access to updated market and cultivation information could further support the Dayak Pitap community in enhancing the productivity of forest garden commodities, thereby contributing to improved livelihoods in Langkap Village.

Declaration by Authors

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REFERENCES

1. Ihsan, M., Irawan, B., Iskandar, J. (2024). The traditional ecological knowledge of the local people of Cijambu Village, Sumedang, Indonesia, on the diversity, utilization, management, and conservation of bamboo. *Biodiversitas*, 25 (4): 1754-1770. <https://doi.org/10.13057/biodiv/d250446>
2. Leo, S., Supriatna, J., Mizuno, K., Margules, C. (2022). Indigenous Dayak Iban customary perspective on sustainable forest management, West Kalimantan, Indonesia. *Biodiversitas*, 23 (1): 424-435. <https://doi.org/10.13057/biodiv/d230144>
3. Susanti, R., Zuhud, E. A. M. (2019). Traditional ecological knowledge and biodiversity conservation: the medicinal plants of the Dayak Krayan people in Kayan Mentarang National Park, Indonesia. *Biodiversitas*, 20 (9): 2764-2779. <https://doi.org/10.13057/biodiv/d200943>
4. Hafizianor. (2014). Kebun Hutan (Forest Gardens) Sebagai Teknologi Praktis Dalam Upaya Konservasi Air Dan Energi Masyarakat Dayak Pegunungan Meratus (Forest Gardens A Practical Technology Of Water And Energy Conservation Efforts Dayak Meratus Community). Proceeding Seminar Nasional Teknologi Praktis dalam Upaya Konservasi Air dan Energi.
5. Moleong, L. J. (2018). *Metodologi penelitian kualitatif, cet. XI (Qualitative research methodology, ed. XI)*. Bandung: PT Remaja Rosdakarya.
6. Soerianegara, I & Indrawan, A. (1978). *Ekologi Hutan Indonesia (Indonesian Forest Ecology)*. Institut Pertanian Bogor.
7. Muhadjir, A., Rudy, G. S., & Achmad, B. (2022). Analisis Komposisi Dan Struktur Vegetasi Hutan Sekunder Di Hutan Lindung Gunung Keramaian Desa Ujung Batu Kecamatan Pleihari Kabupaten Tanah Laut (Analysis of Vegetation Structure and Composition of Secondary Forest in the Protected Forest Gunung Keramaian Ujung Batu Village Peleihari Subdistrict Tanah Laut District). *Jurnal Sylva Scienteeae*, 5(6), 985–993. <https://doi.org/10.20527/jss.v5i6.7142>
8. Hafizianor. (2010). *Pola pemanfaatan hasil hutan non kayu oleh masyarakat Dayak di Pegunungan Meratus Kecamatan Loksado Kalimantan Selatan (Patterns of utilisation of non-timber forest products by Dayak communities in the Meratus Mountains, Loksado Sub-district, South Kalimantan)*. Banjarmasin: Lembaga Penelitian Unlam.
9. Rifanjani, S., Nathasya, M. C., Widhanarto, G. O., Afrianti, U. R., & Pius, P. (2023). Komposisi dan Struktur Vegetasi di Ekosistem Hutan Kerangas Resort Rantau Malam Taman Nasional Bukit Baka Bukit Raya (Vegetation Composition and Structure in the Kerangas Forest Ecosystem of Rantau Malam Resort of Bukit Baka Bukit Raya National Park). *Jurnal Hutan Lestari*, 11(4),

- 888–897.
<https://doi.org/10.26418/jhl.v1i1i4.70393>
10. Rezekiah, A. A., Ruslan, M., Kadir, S., & Mahmud, M. (2022). Vegetation composition and structure across land use types in a rotational cultivation system in Meratus Mountain, South Kalimantan, Indonesia. *Biodiversitas Journal of Biological Diversity*, 23(8), 4234–4242. <https://doi.org/10.13057/biodiv/d230847>
 11. Ashton, P. M. S., Gamage, S., Gunatilleke, I. A. U. N., & Gunatilleke, C. V. S. (2001). Restoration pathways for rainforest in southwest Sri Lanka: A review of concepts and models. *Forest Ecology and Management*, 154(3), 409–430. [https://doi.org/10.1016/S0378-1127\(01\)00512-6](https://doi.org/10.1016/S0378-1127(01)00512-6)
 12. Corlett, R. T. (2009). *The ecology of tropical East Asia*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199681341.001.0001>
 13. Mursyidin, D. H., & Setiawan, A. (2023). Assessing diversity and phylogeny of Indonesian breadfruit (*Artocarpus* spp.) using internal transcribed spacer (ITS) region and leaf morphology. *J Genet Eng Biotechnol*, 21(1), 15. <https://doi.org/10.1186/s43141-023-00476-y>
 14. Kala, C. P. (2025). Agroforestry in a changing climate: Challenges, opportunities and solutions. *Ecological Frontiers*, 45(2), 269–276. <https://doi.org/https://doi.org/10.1016/j.ecofro.2024.11.003>
 15. Pratama, F. V., Santoso, D., & Rosni, M. (2021). Analisis Respon Penawaran Karet Rakyat di Kalimantan Selatan (Supply Response Analysis of People's Rubber in South Kalimantan). *Frontier Agribisnis*, 5(2), 178–184. <https://doi.org/10.20527/frontbiz.v5i2.6035>
 16. Wang, K. H., & Hamzah, M. Z. (2019). Annual wood formation of tropical pioneer species related to stem diameters. *Journal of Wood Science*, 65(1), 22. <https://doi.org/10.1186/s10086-019-1801-9>
 17. García-González, I., Molina-Flores, B., & Batis-Colas, M. A. (2024). Secondary succession in fallow agroforestry systems managed in tropical dry forest in western Mexico. *Sustainability*, 16(11), 4760. <https://doi.org/10.3390/su16114760>
 18. Prasetya, A. Y., Qurniati, R., & Herwanti, S. (2020). Saluran Dan Margin Pemasaran Durian Hasil Agroforestri Di Desa Sidodadi (Marketing Channels and Margins of Durian Agroforestry Products in Sidodadi Village). *Jurnal Belantara*, 3(1), 32–40. <https://doi.org/10.29303/jbl.v3i1.315>
 19. Rufaidah, E., Surnayanti, Machya, & Harianto, S. P. (2024). Agroforestry development relies on local wisdom (ecological, economic and social aspects): Case Study from Gapoktan Pujo Makmur, Lampung Province, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 1430(1), 012007. <https://doi.org/10.1088/1755-1315/1430/1/012007>
 20. Rahayu, E. M., Ma'ruf, F., & Syarifuddin, A. (2023). Pengaruh konsentrasi dan frekuensi pemberian ekstrak daun pinus sebagai pengendalian pertumbuhan semai tanaman *Acacia Nilotica* (L.) Willd. Taman Nasional Baluran (Effect of concentration and frequency of application of pine leaf extract as seedling growth control of *Acacia nilotica* (L.) Willd. *Jurnal Hutan Lestari*, 11(2), 301–315. <https://eprints.umm.ac.id/id/eprint/15944>
 21. Isnaningsih, N., & Patria, M. (2018). Peran Komunitas Moluska dalam Mendukung Fungsi Kawasan Mangrove di Tanjung Lesung, Pandeglang, Banten (The Role of Mollusc Community in Supporting the Function of Mangrove Area in Tanjung Lesung, Pandeglang, Banten). *Biotropika: Journal of Tropical Biology*, 6(2), 35–44. <https://doi.org/10.21776/ub.biotropika.2018.06.02.01>

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