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Research Article

DIVERSITY AND COMPOSITION OF VEGETATION IN JOMPI PROTECTED FOREST, SOUTHEAST SULAWESI, INDONESIA

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Abstract

Biodiversity in Indonesia is large and diverse. This biodiversity is the diversity of plants spread across various regions and forests. Forests themselves have several different types and functions, the most common of which is protected forests. One of the benefits of having protected forests is maintaining the environment and air quality. The reason for the need to conduct a forest habitat inventory. There are several potential areas, especially for plants, which can be utilized in the field of forest conservation.The purpose of this study was to examine the biological conditions and vegetation compilers include: density, frequency, dominance, and importance index in the Jompi Protected Forest, Muna Regency, Southeast Sulawesi. This study used the vegetation analysis method in a single plot measuring 100 x 100 m2, which was divided into 25 subplotst. The study was conducted from January to March 2024. Based on the findings, which encompassed 48 species and 28 families, the two species with the highest Importance Value Index were Tectona grandis (67,58%) and Gluta rengas (47,37%). In contrast to other types, a high Importance Value Index indicates that these species are better adapted to the individual environmental conditions. The level of diversity in the Jompi Protected Forest, based on these values is categorized as high with a diversity index (H>3.07) in the Protected Forest area. Furthermore, the abundance index can be categorized as moderately abundant in the seedling phase, E > 0.63) while the abundance index in the tree phase is classified as high with a value (E > 0.67).

Keywords: species diversity, important value index, jompi protected forest

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INTRODUCTION

Indonesia is a country that is a haven for one of the most important biodiversities in the world, both from an economic, educational, and knowledge perspective (Erfanifard et al., 2025). When compared to other countries, Indonesia has a much better and more abundant diversity of plants and animals. Indonesian forests also have a type of environmental system that is closely related to the composition of plants and the richness of fauna in both regions (H. Wang et al., 2025). Species diversity is a method used to study the composition and arrangement of plants within a specific structure that represents the general population (Ullah et al., 2025). Quantitative information about the composition and structure of a particular plant community can be utilized for vegetation analysis (Bravo et al., 2025). The role of vegetation in a specific ecosystem is generally associated with the balance of carbon dioxide and oxygen in the air, as well as improvements in the physical, chemical, and biological properties of the soil and its aeration (S. Chen & Li, 2025). Although vegetation in a particular location generally has a positive impact, its effects vary depending on the structure and composition of the vegetation growing in the area.

In addition, more significant biodiversity to the potential of vegetation in an ecosystem is very important in regulating CO2 and O2. Biodiversity also plays an important role in improving soil properties, which can reduce soil water levels (Rajala et al., 2025). The potential in a particular ecosystem because vegetation will usually provide many beneficial impacts; however, the structure and composition of the ecosystem will be greatly influenced by these impacts alone (G. Wang et al., 2025).Vegetation refers to a group of plants living together in a specific area. This life mechanism involves mutually beneficial interactions among plant individuals and other organisms, forming a system that is alive, growing, and dynamic (Luo et al., 2025). The structural elements of vegetation are characterized by growth, stratification, and canopy coverage (Rathaude et al., 2025). Data such as species, diameter, and height are essential for vegetation analysis to determine the key indices of forest composition (Werner et al., 2025). Information regarding the structure and composition of specific plant communities can also be obtained through vegetative analysis .

Research on diversity, conducted by Liu et al., (2025) conducted with the title Estimation of the Potential of Medicinal Plants in the Jompi Protected Forest, Muna Regency, Southeast Sulawesi. The results of the study concluded that there were 76 species of diversity that were most widely utilized by the general public, with 24 species having high diversity. Furthermore, another study entitled “Characteristics of Medicinal Plant Users in the Jompi Protected Forest, Muna Regency, Southeast Sulawesi” describes the characteristics of respondents who use medicine based on factors such as age, education, income, number of family members, local knowledge, and livelihood (Gamarra Ruiz Díaz et al., 2025). This is closely related to the use of herbal medicine as a traditional medicine that can be used to treat various diseases it causes.

The diversity in the Jompi Protected Forest is essential to consider, as forests themselves are a critical component of ecosystems, influencing the surrounding environment (Rahmsdorf et al., 2025). The investigated vegetation analysis include relative dominance, absolute dominance, relative frequency, absolute frequency, relative density, absolute density, and importance value index (L. Chen et al., 2025). As well as the species diversity index (H'), species abundance index (E) and species richness index (DMg). Landscapes with more vegetation positively impact the ecosystem's ability to function on a larger scale. So that in the end it can help with sustainable forest management and conservation now and in the future (Budniak & Zięba, 2025). Therefore, if biodiversity continues to increase, it will further enrich the ecological diversity. As the heart of Raha City, Jompi Protected Forest stands as one of the greenest forested areas across Raha. Based on these considerations, research on vegetation analysis in the Protected Forest of Wali Village, Watopute District, Muna Regency, is necessary.

RESEARCH METHOD

Research Design

This study adopts a quantitative research design focusing on plant species diversity and ecological interactions within the Jompi Protected Forest (Koh et al., 2024). The study uses vegetation analysis methods to assess species composition, diversity, and dominance in a forest ecosystem, using established biodiversity indices and the importance value index.

Research Target/Subject

The research targets the plant species within the Jompi Protected Forest, located in the Wali Subdistrict, Watopute District (Kiri et al., 2024). The study focuses on evaluating plant species diversity across a 100 x 100 m² plot divided into 25 smaller subplots, analyzing various ecological parameters such as density, frequency, and dominance.

Research Procedure

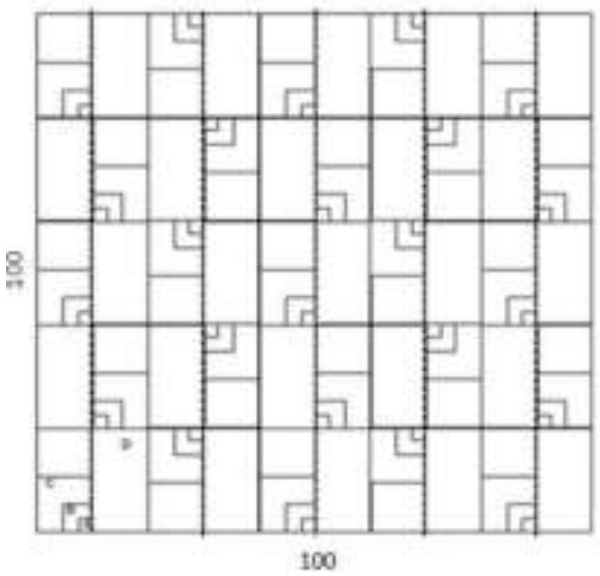
The study was conducted from January to March 2024. Data collection began with site preparation, including marking observation plots and identifying species. Field observations followed, where vegetation analysis was carried out using established indices to measure diversity and dominance (Ruruh & Suma, 2024). The data collected were analyzed for ecological interactions and biodiversity patterns within the forest.

Instruments, and Data Collection Techniques

The instruments used for data collection included measuring tapes, raffia strings, machetes, a compass, a GPS unit, writing tools, and a camera for documentation. The Vegetation Analysis method was employed to assess species diversity within the observation plots. Data collection involved measuring parameters such as density, frequency, dominance, relative density, relative frequency, relative dominance, Shannon-Wiener diversity index, evenness index, and richness index. This method allows for a quantitative evaluation of the forest ecosystem and its biodiversity, providing a basis for ecological monitoring and forest management strategies.

Data Analysis Technique

The determination of plot-shaped sample units in the field was conducted purposively. These plot-shaped sample units were established in vegetation ecosystem types with relatively minimal human activities that could cause damage. The layout of the plot-shaped sample unit is illustrated in Figure 1.



Description:
Seedlings (2 m x 2 m),
Saplings (5 m x 5 m),
Poless (10 m x 10 m), and
Trees (20 m x 20 m).

Figure 1. Vegetation analysis observation plot

Plant species identification was carried out through a series of activities, including general species identification obtained from vegetation analysis to determine plant species diversity. This was then followed by applying formulas such as:

Density

Density is the number of individual organisms per unit area. To simplify the analysis process, density is often represented by the notation D (Maes et al., 2024). The comparison of the density of a species with the density of all species, expressed as a percentage, is called relative density (RD). The calculation can be performed using the following formula:

$$\text{Density (D)} = \frac{\Sigma \text{ individual of a species}}{\text{Area in square meters}}$$

$$\text{Relative Density (RD)} = \frac{\text{Density of the species}}{\text{Total density of all species in the area}} \times 100\ \%$$

Frequency

Frequency in ecology is used to express the proportion between the number of samples containing a particular species and the total number of samples (Hussain et al., 2024). Frequency represents the intensity at which a species is found during observations of organism presence in a community or ecosystem. Species frequency (F) and relative species frequency (FR) can be calculated using the following formulas:

$$\text{Frequency (F)} = \frac{\Sigma \text{ all the subplot samples}}{\Sigma \text{ a species was found in the subplot}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{F a species} \times 100\ \%}{\text{F total all of species}}$$

Dominance

Dominance can also be referred to as cover area. Cover area (coverage) is the proportion between the area covered by a plant species and the total area of the habitat (Indriyanto, 2017). The cover area of a species (C) and the relative cover area of a species (RC) can be calculated using the following formulas:

$$\text{Coverage (C)} = \frac{\text{The best area of a species}}{\text{The area of the sample plot}}$$

$$\text{Relative Coverage (RC)} = \frac{\text{D a species} \times 100\ \%}{\text{D total all of species}}$$

Important Value Index (IVI)

IVI is a quantitative parameter used to indicate the level of dominance (degree of control) of species within a plant community (Wiyanto & Faiqoh, 2015). The Important Value Index can be calculated using the formula: IVI = RD + RF + RC

Shannon-Wiener Diversity Index

High species diversity indicates that a community has high complexity due to the high interactions among species within the community (Roces-Díaz et al., 2025). The determination of plant species diversity is performed through analysis using the Diversity Index based on the Shannon-Wiener method (H'), which is calculated as: $H' = -\sum ni/N \ . \ Ln\ ni/n$. After calculating the H' value, it is categorized using diversity indicators to assess the abundance or availability of a species within a community. The diversity indicators are as follows: H > 3 is high abundance; H 1 ≤ H ≤ 3 is moderate abundance and; H < 1 is low abundance.

Index of Evenness

The Index of Evenness functions to determine the evenness of each species within a community encountered, with the following formula: E = H'/ln S (Baderan et. al., 2021). The evenness level of species within a community is represented by the value of E, as follows: E = 0 < 0,3 low evenness; E = 0,3 - 0,6 moderate evenness and E > 0,6 high evenness.

Margalef Richness Index

The Species Richness Index (Margalef) is used to determine the species richness of each species within a community encountered, with the following formula: DMg = (S-1/Ln (n)). The species richness criteria based on the Margalef Index are as follows: DMg < 2,5 is low richness; DMg 2,5 - 4,0 is moderate richness and; DMg > 4,0 is high richness. After collecting the data, it is tabulated, processed, and analyzed descriptively and qualitatively (Kolisnyk et al., 2025). The data analysis includes the calculation of density, frequency, dominance, importance value index, species diversity index, evenness index, and species richness index.

RESULTS AND DISCUSSION

Communnity Diversity Growth

Based on the vegetation analysis conducted in Jompi Protected Forest, 48 species, 28 families, and 348 individuals were identified. The results of the vegetation analysis in Jompi Forest revealed 22 different tree species belonging to 17 families, with a total of 98 individual trees (Table 1). The detailed results of the vegetation species analysis in Jompi Forest are presented in Table 1, as follows:

Table 1. Composition of tree growth levels in Jompi Protected Forest

No	Species Name (Local/Scientific)	D	F	C	RD	FR	RC	IVI
1	Ghontoghe (*Pagium edule Reinw*)	5.0	0.67	0.31	2.04	2.04	0.68	4.76
2	Rengas (*Gluta rengas*)	22.5	3.00	1.41	9.18	9.18	3.04	21.41
3	Kulidawa (*Tectona grandis*)	47.5	6.33	2.98	19.39	19.39	6.42	45.19
4	Damara (*Aghathis damara*)	5.0	0.67	0.31	2.04	2.04	0.68	4.71
5	Sandana (*Santalum album*)	15.0	2.00	0.94	6.12	6.12	2.03	14.27
6	Bhangkali (*Anthocepalus cadamba*)	5.0	0.67	0.31	2.04	2.04	0.68	4.76
7	Mahoni(*Swietenia mahagoni*)	10.0	1.33	0.63	4.08	4.08	1.35	9.51
8	Kusambi (*Sehleichera aleosa Merr*.)	7.5	1.00	0.47	3.06	3.06	1.01	7.14
9	Ninifoo (*Cerbera manghas*)	22.5	3.00	1.41	9.18	9.18	3.04	21.41
10	Dahu (*Dracontomelon dao*)	7.5	1.00	0.47	3.06	3.06	1.01	7.14
11	Meranti (*Shorea spp*.)	2.5	0.33	0.16	1.02	1.02	0.34	2.38
12	Bhake(*Ficus benjamina*)	25.0	3.33	1.57	10.20	10.20	3.38	23.79
13	Tongkoea (*Alstonia scholaris*)	7.5	1.00	0.47	3.06	3.06	1.01	7.14
14	Mimba (*Azadirachta indica*)	17.5	2.33	1.10	7.14	7.14	2.36	16.65
15	Longkida (*Morinda citrifolia*)	7.5	1.00	0.47	3.06	3.06	1.01	7.14
16	Johar (*Cassia siamea*)	7.5	1.00	0.47	3.06	3.06	1.01	7.14
17	Waru (*Hibiscus tiliaceus*)	2.5	0.33	0.16	1.02	1.02	0.34	2.38
18	Ntanga-ntanga(*Jatropha curcas*)	2.5	0.33	0.16	1.02	1.02	0.34	2.38
19	Ghefi (*Instia bijuga*)	15.0	2.00	0.94	6.12	6.12	2.03	14.27
20	Soni(*Averrhoa carambola*)	2.5	0.33	0.16	1.02	1.02	0.34	2.38
21	Saupute(*Gmelina arborea Robx.)*	2.5	0.33	0.16	1.02	1.02	0.34	2.38
22	Kihujan(*Samania saman*)	5.0	0.67	0.31	2.04	2.04	0.68	4.76
		245.0	**32.67**	**15.39**	**100**	**100**	**100**	**300**

In Table 1, the most abundant plant species observed is teak (*Tectona Grandis*) with a density of 47.5. In contrast, five species with the lowest density are *Sorea spp*. (2.5), *Jatropha curcas* (2.5), *Hibiscus tiliaceus* (2.5), *Averrhoa carambola* (2.5), and *Gmelina arborea Robs* (2). Observations in sample plots show that an increase in the number of plots containing a particular species leads to an increase in the frequency of that species. Conversely, if fewer plots contain a specific species, its frequency decreases. While frequency does not directly indicate distribution patterns, it provides insight into the level of species distribution within the studied environment (Maridi et.al., 2015).

This is in line with the statement, that the composition of the growth level of Tectona grandis trees is higher in protected forests due to relatively stable ecosystem conditions, minimal anthropogenic disturbance, and the availability of optimal growing space. Protected forests have a soil and water protection function so that logging activities and land conversion are very limited, which allows for natural regeneration to take place well. Maintained environmental factors, such as soil fertility, light availability, and humidity, support the growth and density of T. grandis stands compared to cultivated or degraded areas (Revathy & Sundarapandian, 2025). Meanwhile, the composition of species with the lowest densities, such as Sorea spp., Jatropha curcas, Hibiscus tiliaceus, Averrhoa carambola, and Gmelina arborea Robx., is generally caused by ecological and competitive factors. These species have low shade tolerance, so they cannot compete with dominant tree species that can grow in closed canopy conditions. Furthermore, some of them are not native species of protected forests, but rather introduced or semi-cultivated plants that are less able to adapt to natural ecosystems (Pinheiro et al., 2025). Limited regeneration factors due to low seed dispersal, low pollinator/disperser preferences, and anthropogenic disturbances also reinforce the low densities of these species.

Density is the number of individuals per unit volume or unit area. In other words, density represents the number of individual organisms within a specific space. According to Smith et al. (2000), the density value of a species in vegetation reflects the total number of individuals of a particular species in a given area. To simplify the density analysis process, the notation "D" is often used. Relative density (RD) is the percentage representing the ratio of the density of a specific species to the density of all other species. Density is categorized into four levels: low (with values between 12 and 50), medium (with values between 51 and 100), and high (with values >201).

Dominance is the ratio of the total habitat area to the area occupied by a specific plant species. Based on the analysis, one species was found to be more dominant than others, namely *Tectona grandis* with a dominance percentage of 6.42%. Conversely, the least dominant species are *Anthocepalus cadamba*, *Shorea spp.*, *Averrhoa carambola*, *Samania saman*, *dan Gmelina arborea Robx.* Each with a dominance of 0.31%, *Tectona grandis* reduces the available growth area (canopy coverage). The vegetative analysis of sapling growth is presented in (Table 2).

Table 2. Composition of sapling growth levels in Jompi Protected Forest

No	Species Name (Local/Scientific)	D	F	C	RD	RF	RD	IVI
1	Ghontoghe (*Pagium edule Reinw*)	20.0	0.67	1.26	2.47	2.47	0.94	5.88
2	Rengas (*Gluta rengas*)	70.0	2.33	4.40	8.64	8.64	3.28	20.57
3	Kulidawa (*Tectona grandis*)	230.0	7.67	14.44	28.40	28.40	10.79	67.58
4	Kina (*Cinchona calysaya*)	10.0	0.33	0.63	1.23	1.23	0.47	2.94
5	Damara (Aghathis damara)	10.0	0.33	0.63	1.23	1.23	0.47	2.94
6	*Kadondokaruku (Spondias cytherea)*	10.0	0.33	0.63	1.23	1.23	0.47	2.94
7	Mimba (*Azadirachta indica*)	10.0	0.33	0.63	1.23	1.23	0.47	2.94

8	Kusambi (*Sehleichera aleosa Merr.*)	60.0	2.00	3.77	7.41	7.41	2.81	17.63
9	*Wiolo(Pametia pinnata)*	50.0	1.67	3.14	6.17	6.17	2.34	14.69
10	Tongkoea (*Alstonia scholaris*)	10.0	0.33	0.63	1.23	1.23	0.47	2.94
11	Waru (*Hibiscus tiliaceus*)	50.0	1.67	3.14	6.17	6.17	2.34	14.69
12	*Sora (Diospyros calebica Bakh)*	20.0	0.67	1.26	2.47	2.47	0.94	5.88
13	Bhake(*Ficus benjamina*)	40.0	1.33	2.51	4.94	4.94	1.88	11.75
14	*Kumbowu (Artocarpus elaticus)*	40.0	1.33	2.51	4.94	4.94	1.88	11.75
15	*Bhea(Areca catechu)*	20.0	0.67	1.26	2.47	2.47	0.94	5.88
16	*Usa (Gnetum Gnemon Linn)*	10.0	0.33	0.63	1.23	1.23	0.47	2.94
17	Meranti (*Shorea spp.*)	20.0	0.67	1.26	2.47	2.47	0.94	5.88
18	*Dahu (Dracontomelon dao)*	40.0	1.33	2.51	4.94	4.94	1.88	11.75
19	*Greng romong(Maesa perlaria (Lour.) Merr)*	20.0	0.67	1.26	2.47	2.47	0.94	5.88
20	Katapi (*Terminalia catappa*)	30.0	1.00	1.88	3.70	3.70	3.70	11.11
21	*Lycianthes denticulate (Blume) Bitter*	40.0	1.33	2.51	4.94	4.94	1.88	11.75
		810.0	**27.0**	**50.9**	**100**	**100**	**100**	**300**

In Table 2, at the sapling growth stage, the highest density value is found in teak species (*Tectona grandis*) (230.0) while the lowest is observed in six species: cinchona (*Chinchona calysaya*), melinjo (*Gnetum gnemon Linn*), pulai (*Alstonia scholaris*), neem (*Azadirachta indica*), kedondong hutan (Spondias cytherea) and damar (Aghathis damara) each with a density value of (10.0). A high density value of a particular plant species indicates that the species can adapt well to the environment where it grows, reproduce effectively, and compete successfully with other plants. As stated by Oktaviani et al. (2018), plants with the highest density values tend to thrive because they are well-suited for the habitat and can propagate successfully. Similarly, Birhanu et al., (2025) note that abundant species typically have strong adaptability to environmental conditions, whereas species with lower populations struggle to adapt, resulting in lower average density values.

The frequency value at the sapling growth stage is dominated by the teak species (*Tectona grandis*) with a value of (7.67), while the lowest frequency is observed in six species: melinjo (*Gnetum gnemon Linn*), pulai (*Alstonia scholaris*), *Chinchona calysaya*, damar (*Aghathis damara*), and kedondong hutan (*Spondias cytherea*) each with a value of (0.33). This indicates that species with a broad distribution tend to have higher encounter frequency values. Furthermore, based on the dominance value analysis, the highest dominance is found in *Tectona grandis* with a value of (14.44), while the lowest dominance value is observed in six species: *Aghathis damara*, *Cinchona calisaya*, *Spondias cytherea*, *Azadirachta indica*, *Gnetum gnemon linn*, and *Alstonia scholaris*, each with a value of (0,36). The vegetation analysis of the Poles growth stage is presented in Table 3.

Table 3. Composition of poles growth levels in Jompi Protected Forest

No	Species Name (Local Scientific)	D	F	C	RD	RF	RC	IVI
1	Katapi (Terminalia catappa))	120.0	1.00	7.54	3.95	3.95	3.95	11.84
2	Rengas (Gluta rengas)	480.0	4.00	30.14	15.79	15.79	15.79	47.37
3	*Kulidawa (Tectona grandis)*	520.0	4.33	32.66	17.11	17.11	17.11	51.32
4	*Sampalu (Tamarindus indica L.)*	120.0	1.00	7.54	3.95	3.95	3.95	11.84
5	Damara (Aghathis damara)	40.0	0.33	2.51	1.32	1.32	1.32	3.95
6	*Kihujan(Samania Saman)*	160.0	1.33	10.05	5.26	5.26	5.26	15.79
7	*Kadondo(Spondias cytherea)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95
8	*Mahoni (Switenia mahagoni)*	160.0	1.33	10.05	5.26	5.26	5.26	15.79
9	Kusambi (Sehleichera aleosa Merr.)	200.0	1.67	12.56	6.58	6.58	6.58	19.74
10	Tongkoea (Alstonia scholaris)	80.0	0.67	5.02	2.63	2.63	2.63	7.89
11	*Kolaka(Maranthes coryrnbosa)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95
12	*Sora (Diospyros calebica Bakh)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95

13	Ntanga-ntanga(Jatropha curcas)	200.0	1.67	12.56	6.58	6.58	6.58	19.74
14	Ninifoo (Cerbera manghas)	200.0	1.67	12.56	6.58	6.58	6.58	19.74
15	saupute(Gmelina arborea Robx.)	80.0	0.67	5.02	2.63	2.63	2.63	7.89
16	*Kaporo (Dryobalanops spp)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95
17	*Usa (Gnetum gnemon Linn)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95
18	Djambuari (Syzygium aqueum)	40.0	0.33	2.51	1.32	1.32	1.32	3.95
19	*Paliasa (Molochia umbellata (Hout)stapf.*	200.0	1.67	12.56	6.58	6.58	6.58	19.74
20	Kina (Cinchona calysaya)	80.0	0.67	5.02	2.63	2.63	2.63	7.89
21	*Kadjhawa(Ceiba petandra)*	120.0	1.00	7.54	3.95	3.95	3.95	11.84
22	*Saga (Abrus precatorius Linn)*	40.0	0.33	2.51	1.32	1.32	1.32	3.95
		3,040	**25.33**	**190.91**	**100**	**100**	**100**	**300**

The data analysis results shown in Table 3 reveal that a total of 22 sapling species from 9 families were identified across all observation plots. These findings indicate that each sapling species within the observation plots exhibited varying values for density, relative density, frequency, relative frequency, importance value index, and species diversity. It can be observed that the species with the highest density were *Tectona grandis* (520.0) and *Gluta rengas* (480.0), while the species with the lowest density included *Aghathis damara; Gnetum gnemon linn; Dryobalanops celebika Back.; Syzygium aqueum, Diospyros calebica Bakh, Maranthes coryrnbosa;* and *Spondias cytherea* (40.0).

Frequency refers to the presence level of a species in a given location. According to Indriyanto (2006), frequency is categorized into five classes: Class A (1–20%) very low, Class B (21–40%) low, Class C (41–60%) moderate, Class D (61–80%) high, and Class E (81–100%) very high. Based on the research findings, two species exhibited a very high frequency: *Gluta rengas* (4.0%) and *Tectona grandis* (4.33%). Conversely, the lowest frequency was observed for several species, including *Aghathis damara*, *Spondias cytherea*, *Maranthes coryrnbosa*, *Diospyros calebica Bakh,* and *Dryobalanops celebika Back. (0.33%),* as weel as *Gmelina arborea*, *Cinchona calisaya*, and *Alstonia scolaris* (0.67%). This indicates that the two species, *Gluta rengas* and *Tectona grandis*, were the most frequently encountered across the observation plots. Generally, the frequency of plants in the Jompi protected forest was categorized as very low, ranging from 1–20%, and fell under Class A criteria. The vegetation analysis for seedling growth can be observed in Table 4.

Table 4. Composition of seedling growth levels in Jompi Protected Forest

NO	Species Name (Local/Scientific	D	F	RD	RF	IVI
1	*Kowala (Arenga Pinata)*	2000	2.67	8.60	8.60	17.20
2	Rengas (Gluta rengas)	3000	4.00	12.90	12.90	25.81
3	*Kulidawa (Tectona grandis)*	3750	5.00	16.13	16.13	32.26
4	*Bebele (Canarium hirsutum)*	250	0.33	1.08	1.08	2.15
5	*Bhake (Ficus benjamina)*	2000	2.67	8.60	8.60	17.20
6	*Kihujan (Samania saman)*	250	0.33	1.08	1.08	2.15
7	*Kadondo(Spondias cytherea)*	250	0.33	1.08	1.08	2.15
8	*Mahoni (Switenia mahagoni)*	1000	1.33	4.30	4.30	8.60
9	Kusambi (Sehleichera aleosa Merr.)	750	1.00	3.23	3.23	6.45
10	*Wiolo(Pametia pinnata)*	2000	2.67	8.60	8.60	17.20
11	Tongkoea (Alstonia scholaris)	1000	1.33	4.30	4.30	8.60
12	Dahu (Dracontomelon dao)	750	1.00	3.23	3.23	6.45
13	Djambuari(Syzygium aqueum)	500	0.67	2.15	2.15	4.30
14	Ntanga-ntanga(Jatropha curcas)	1250	1.67	5.38	5.38	10.75
15	Ninifoo (Cerbera manghas)	750	1.00	3.23	3.23	6.45
16	Katapi (Terminalia catapa)	250	0.33	1.08	1.08	2.15
17	*Kaporo (Dryobalanops celebika Back.)*	250	0.33	1.08	1.08	2.15

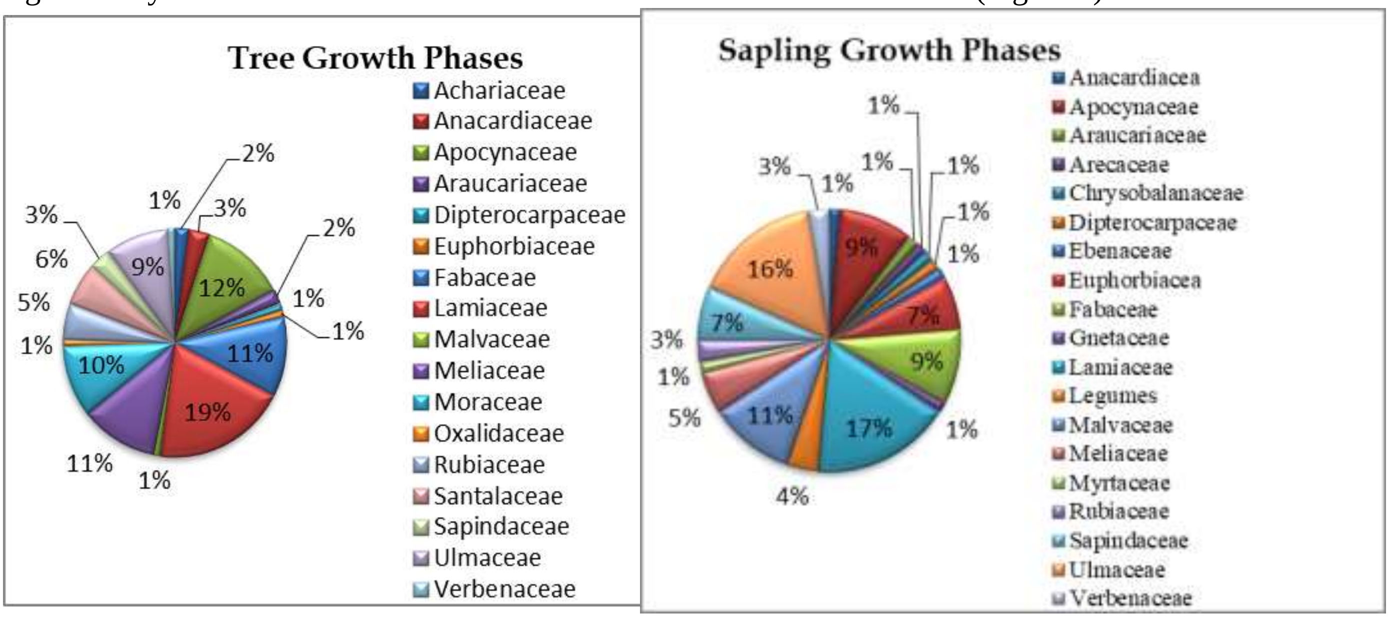
18	Longkida (Morinda citrifolia)	500	0.67	2.15	2.15	4.30
19	Waru (Hibiscus tiliaceus)	500	0.67	2.15	2.15	4.30
20	*Garnicia dioica Blume*	1250	1.67	5.38	5.38	10.75
21	*Walahopa(Glochidion molle Blume)*	1000	1.33	4.30	4.30	8.60
		23,250	**31.00**	**100**	**100**	**200**

Based on frequency data, the results show that the species with the most evenly distributed presence and frequent occurrence in each plot is teak (Tectona grandis), which also has the highest frequency value. Frequency reflects the intensity of an organism species presence observed within a community or ecosystem. This aligns with the statement by Soegianto (1994) that when observations are conducted in sample plots, the more plots where a species is found, the higher its frequency will be. Conversely, the fewer plots in which a species is found, the lower its frequency (Musa et al., 2025). Therefore, frequency effectively indicates the degree of species distribution within the studied habitat, although it does not necessarily reflect the pattern of distribution. Organism species with a broad range of distribution will have a high frequency of encounters.

Density indicates the concentration of plant growth at each observation station. Density is categorized into four levels : low category with values between 12-50%, medium category with values between 51-100%, and high category with values >201%. The highest density in the seedling growth stage was found in the species Tectona grandis (3750) dan Gluta rengas (3000). Meanwhile, the species with the lowest density were Canarium hirsutum, Samania Saman, Spondias cytherea, Terminalaia cattapa and Dryobalanops celebika Back. (250). The research results also identified two species with very high frequencies: Gluta rengas (4.0%) and Tectona grandis (5.0%). On the other hand, the lowest frequency values were observed in species such as Samania Saman, Canarium hirsutum, Spondias cytherea, Terminalaia cattapa, and Dryobalanops celebika Back.(0.33%), as well as Syzygium aqueum, Morinda citrifolia, and Hibiscus tiliaceus (0.67).

Plant species Composition Based on Families

Based on the growth of various families found in the Jompi Protected Forest area, the number of species within each family and the number of individual per species varied significantly. The distribution of individuals across families is illustrated in (Figure 2).



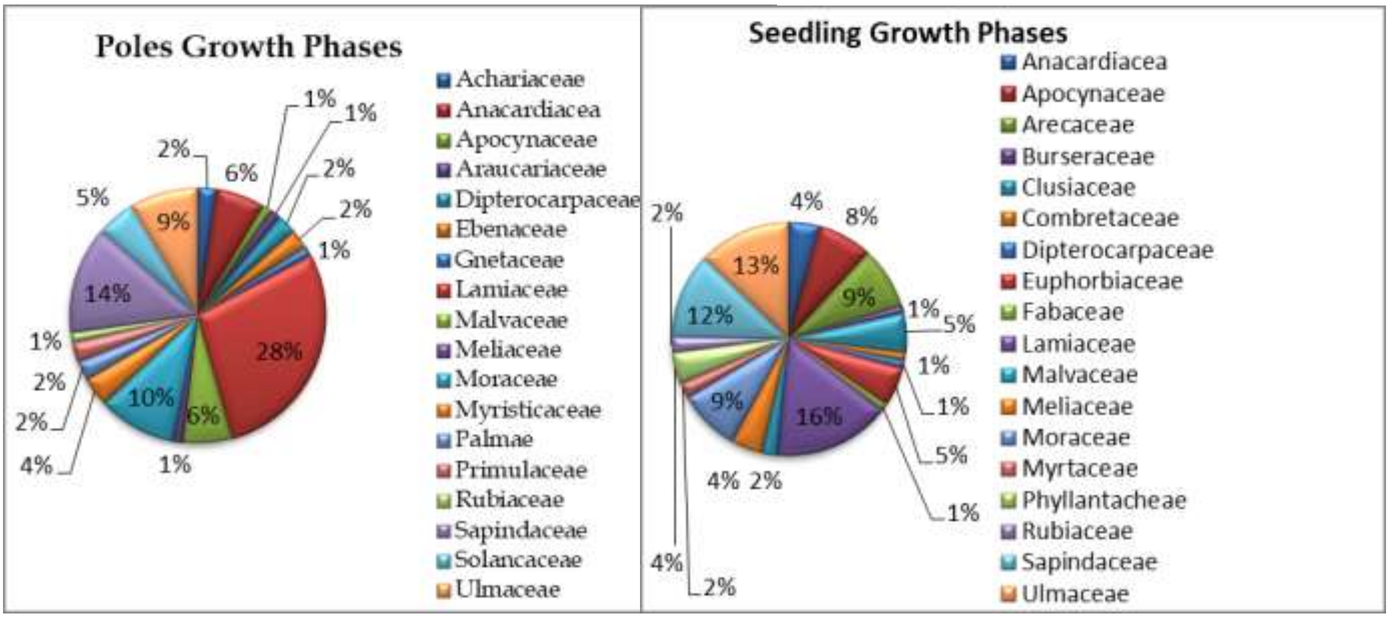


Figure 2. Distribution of Growth Phases by Family

Based on Figure 2, when viewed from the growth stages of trees, Poless, stakes, and seedlings, the tree growth stage is dominated by the families *Lamiaceae* and *Anacardiaceae*. The number of individuals in each family varies significantly. The highest number of individuals comes from *Tectona grandis,* which belongs to the *Lamiaceae* family, with 19 individuals at the tree stage, 23 individuals at the Poles stage, 16 individuals at the stake stage, and 16 individuals at the seedling stage within the *Anacardiaceae* family. This number is significantly higher compared to other plants, which only have between 1 to 9 individuals. The high number of individuals indicates the highest density, where density reflects the number of individuals of a species per unit area.

The dominance of the Lamiaceae family in the tree growth phase of protected forests is generally related to their ecological adaptations, regeneration strategies, and physiological traits. Lamiaceae are known to have a high tolerance to relatively nutrient-poor and dry soil conditions due to their extensive root systems and the presence of secondary metabolites that function as defense mechanisms against herbivores and pathogens. Furthermore, many Lamiaceae species produce large numbers of seeds with high germination rates, making it easier to dominate the early regeneration phase under forest stands (Jia et al., 2025). Furthermore, from an ecological perspective, Lamiaceae is also a pioneer group capable of growing in forest gaps with high light intensity, supporting the success of natural regeneration in protected forests. The allelopathic properties of several Lamiaceae species also influence vegetation composition by inhibiting the growth of competing species, thus strengthening their dominance during the tree growth phase. Therefore, the dominance of the Lamiaceae family in protected forests can be explained by a combination of morphological, physiological, and ecological adaptation strategies that make them competitive in the natural regeneration process.

Similarly, the characteristics of the Anacardiaceae family during the development phase of protected forests are generally due to their high ecological capacity to adapt to the forest environment (Rosas et al., 2025). As a result, they have a good tolerance for low to high light intensities, a high rate of natural regeneration, and a root system capable of coping with extreme conditions. Furthermore, many Anacardiaceae species produce fruits that are favored by animals, which increases the chances of long-term seed spawning through the mechanism of zoochory (seed spawning by animals (Naka & Fatunsin, 2025). Another factor influencing the family's dominance is the hardness and resistance of its wood to biotic disturbances, which results in a higher mortality rate during the relative growth phase. Therefore, the combination of regeneration ability, effective seed dispersal, and ecological adaptation makes Anacardiaceae more competitive than other families during the growth phase.

Important Value Index (IVI)

The Importance Value Index (IVI) is a measure that indicates the role of a plant species presence within a plant community. The value of IVI shows how much influence a species has on the ecosystem. According to (Ma et al., 2025), IVI is categorized as follows: IVI > 42.66 is considered high, IVI between 21.96 and 42.66 is considered moderate, and IVI < 21.96 is considered low. Based on this categorization, the highest IVI values in the Jompi Protected Forest area are found in two species. At the tree stage, *Tectona grandis* has an IVI of 45.19%, categorized as high; at the Poles stage, *Tectona grandis* has an IVI of 67.58%, categorized as high; at the stake stage, *Gluta rengas* has an IVI of 47.37%, categorized as high (>42.66); and at the seedling stage, *Tectona grandis* has an IVI of 32.26%, categorized as moderate (IVI < 21.96). This indicates potential disturbances in the ecosystem. A high IVI shows the species significant role in the community, reinforcing the idea that IVI helps us understand the importance of a species in a community or ecosystem.

Based on the growth stages of trees, Poless, stakes, and seedlings, 22 species were found at the tree stage. Among these, only 4 species dominated, with *Tectona grandis* being the most dominant plant, having the largest Importance Value Index (58.16%). *Ficus benjamina* ranked second with the second-largest Importance Value Index (30.61%); *Gluta rengas* ranked third with an Importance Value Index of 27.55%, and *Cerbera manghas* also had an Importance Value Index of 27.55%. At the Poles stage, 21 species were identified, with 3 species having the largest Importance Value Indices. *Tectona grandis* was the most dominant species, with an IVI of 85.19%; followed by *Gluta rengas* in second place with an IVI of 25.93%; and *Sehleichera aleosa Merr* in third place with an IVI of 22.22%.

At the stake stage, the composition of species included 22 species, with 5 species having the largest Importance Value Indices. *Tectona grandis* was the most dominant species with an IVI of 51.32%; followed by *Gluta rengas* with an IVI of 47.37%; *Sehleichera aleosa Merr* with an IVI of 19.74%; *Jatropha curcas* with an IVI of 19.74%; and *Cerbera Manghas* also with an IVI of 19.74%. At the seedling stage, 21 species were found, among which five species had the largest Importance Value Indices. *Tectona grandis* had the highest IVI of 32.36%; followed by *Gluta rengas* with an IVI of 25.81%; *Arenga pinnata* with an IVI of 17.20%; *Ficus benjamina* with an IVI of 17.20%; and *Pametia pinn* in fifth place, also with an INP of 17.20%.

Based on the composition of growth stages, *Tectona grandis (*Teak*)* is a plant species with a high Importance Value Index (IVI) at all growth stages, including tree, Poles, stake, and seedling. This indicates that it is a dominant vegetation component in the Jompi Protected Forest. In addition, *Gluta rengas , Sehleichera aleosa Merr, Jatropha curcas, Cerbera manghas, Pametia pinnata, Arenga pinnata* and *Ficus benjamina* are also major components of the vegetation in the Jompi Protected Forest area. The Importance Value Index (IVI) reflects the role of a plant species within the plant community. A high IVI indicates the significant influence of that species on the plant community. According to Indriyani et al. (2017), IVI represents the significance of a species' role in its ecosystem. When the IVI of a vegetation type is high, it plays a crucial role in maintaining the ecosystem's stability. Therefore, the findings suggest that the two species with the highest IVI contribute significantly to the overall stability of the ecosystem. The species with the highest IVI, as indicated by the vegetation analysis based on growth stages, demonstrates their important role within the plant community in the Jompi Protected Forest area.

Diservity Index, evenness, and Species Richness

Species diversity is a characteristic of the community level based on its biological organization (Larsson Ekström et al., 2025). Species diversity can be used to express the structure of a community. It can also be used to measure the stability of a community, which refers to the ability of a community to maintain stability despite disturbances to its components (Dong et al., 2025). In order to estimate species diversity, several diversity indices can be used. The index used in this study is the Shannon diversity index, or Shannon Index of General Diversity (H'). The diversity index value in the Jompi protected forest is 3.07 (Figure 3). This high diversity index is attributed to the fact that the Jompi protected forest has a small number of individuals but a large number of species

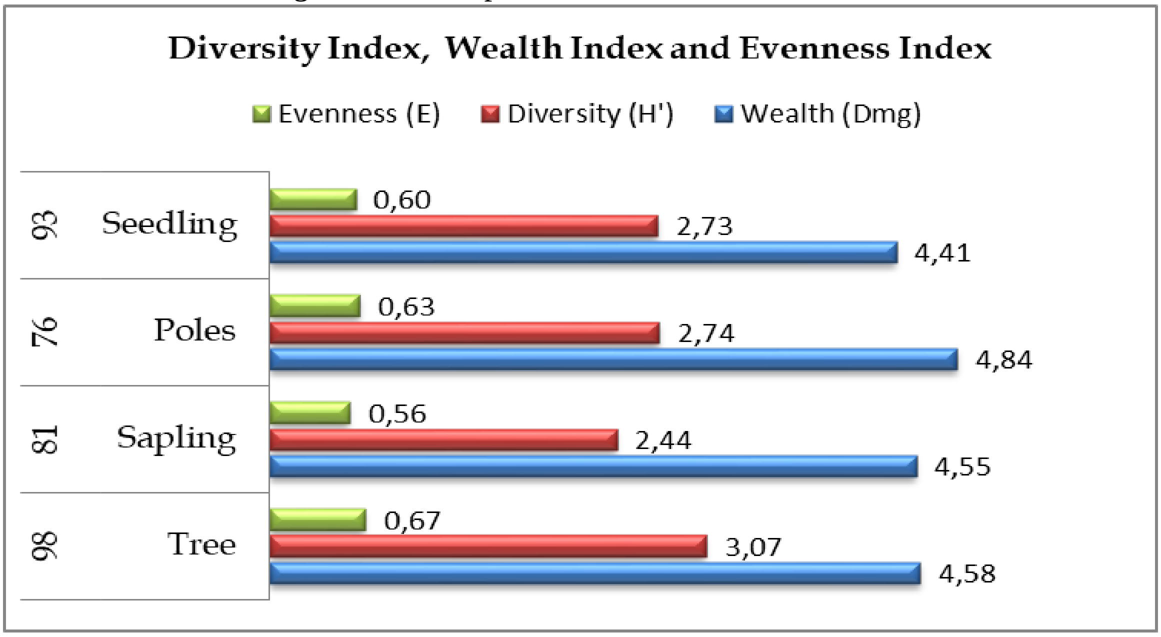


Figure 3. Graph of the Distribution of Species Richness Index (Dmg), Shannon-Wiener Species Diversity Index (H'), and Pielou's Evenness Index (E) at Different Growth Stages.

The research results show that the species diversity index (H') for tree vegetation is 3.07, indicating high biodiversity. Species diversity can be used to describe the structure of a community. According to (Vanguri et al., 2024) diversity indices provide a better estimate of the biodiversity of a location compared to simply counting the number of species. Diversity is a community attribute related to stability, productivity, and trophic structure. The diversity indicated by the diversity index is crucial for maintaining the balance of processes within an ecosystem (Ruiz et al., 2025). High species diversity suggests that a community has high complexity due to the strong interactions between species within the community. A community is considered to have high species diversity if it is composed of many species. Species richness refers to the quantity of species in a community. The number of species present in the field determines the value of the species richness index.

This is also in line with statements, which state that the high level of tree vegetation diversity in protected forests is due to these ecosystems being relatively protected from anthropogenic disturbances such as illegal logging, land conversion, and habitat fragmentation.

These conditions allow for natural succession, balanced ecological interactions, and the formation of microhabitats that support various tree species (Song et al., 2025). Furthermore, protected forests function as conservation areas that maintain microclimate stability, soil fertility, and water availability, thus supporting the regeneration and sustainability of diverse tree communities.

CONCLUSION

There are 48 species in the Jompi Protected Forest, consisting of 16 families at the tree level, 16 families at the Poles level, 15 families at the sapling level, and 16 families at the seedling level. Vegetation diversity shows high diversity at the tree level (3.07), while vegetation evenness at the tree level is 0.67, and vegetation richness at the sapling level is 4.84.

The highest Important Value Index (IVI) is found in two species: at the tree level, Tectona grandis has an IVI of 45.19%, at the Poles level, Tectona grandis has an IVI of 67.58%, at the sapling level, Gluta rengas has an IVI of 47.37%, and at the seedling level, Tectona grandis has an IVI of 32.26%.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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