E-ISSN 2723-4959

Vol. 7 No. 2 December 2026

BIOFAAL JOURNAL



PATTIMURA UNIVERSITY

BIOFAAL JOURNAL

E-ISSN 2723-4959
Volume 7 Number 2 | December 2026

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BIOFAAL JOURNAL

Research Article

Article History:
Received : September 27, 2026
Revised : November 11, 2026
Accepted : November 14, 2026
Available online : November 19, 2026
Published : December 1, 2026

Key words:
Water catchment area, tree vegetation, Soya Village

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Cite this article:
Tatuhey, R., Tuhumuri, E & Sahertian, D. C. (2026). Tree Species Composition, Diversity, and Dominance in the Catchment Areas of Soya Village, Ambon City, Indonesia. *Biofaal Journal,* 7(2):137-150.
https://doi.org/10.30598/biofaal.v7i2pp137-150

Tree Species Composition, Diversity, and Dominance in the Catchment Areas of Soya Village, Ambon City, Indonesia

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Abstract
Water catchment areas are crucial for sustaining water resources, a function strongly supported by tree vegetation. Tree enhances infiltration and retain rainfall, enabling affective water storage and continuous water flow. This study aimed to identify tree species contributing to catchment function and to assess the Important Value Index (IVI), species diversity index, and dominance index of tree vegetation in the water catchment area of Soya Village, Ambon City. A combined qualitative and quantitative approach was employed was used to analyze the structure of tree vegetation across three zones of Soya Village, namely Kayu Putih, Kayu Tiga, and Kopertis Water Catchment Areas. A total of 26 tree species were recorded. Based on the Important Value Index, dominant species in the Kayu Putih area consisted of Coconut *(Cocos nucifera* L.*) (62.451%),* Sago *(Metroxylon sagu* Rottb.*) (57.809%),* Santol tree *(Sandoricum koetjape* (Burm.f.) Merr.*) (32.754%),* and Marian plum *(Bouea macrophylla* Griff.*) (30.371%).* In the Kayu Tiga area, dominant species were Sago *(M. sagu* Rottb.*) (74.350%),* Santol tree *(S. koetjape* (Burm.f.) Merr.*) (46.023%),* and Sugar Palm *(Arenga pinnata* (Wurmb) Merr.*) (38.691%).* Meanwhile Kopertis area was dominated by Narra tree *(Pterocarpus indicus* Willd.*) (53.086%),* Marian plum *(B. macrophylla* Griff.*) (43.254%),* Sugar Palm *(A. pinnata* (Wurmb) Merr*) (33,575 %),* and Santol tree *(S. koetjape* (Burm.f.) Merr.*)* (30.042%). The tree species diversity index in the Kopertis and Kayu Tiga areas was classified as moderate, while that in the Kayu Putih area was categorized as high. Meanwhile, the dominance index in all three catchment areas was categorized as low.

INTRODUCTION

Indonesia is one of the world's tropical countries and harbors exceptionally high levels of biodiversity (Von Rintelen et al., 2017; Widyatmoko, 2018). This remarkable biodiversity is shaped by a combination of factors, including tropical climatic conditions, geological history, speciation processes, archipelagic characteristics, and the diversity of ecosystems. Maluku Province is one of the regions recognized for its rich biodiversity, particularly its distinctive flora and fauna and diverse vegetation types, which play important roles in maintaining ecosystem balance (Awan, 2017). Vegetation diversity constitutes a major component of environmental quality and contributes substantially to the maintenance of ecological functions within watersheds (Maridi et al., 2015).

A watershed is a geographical area delineated by ridgelines, mountains, or artificial boundaries such as roads and embankments, within which rainfall is collected and ultimately

conveyed toward a common outlet (Andawayanti, 2019; Atmajayani, 2022). Within a watershed, the catchment area represents an integrated ecological system extending from upstream to downstream areas and comprising interacting components of soil, vegetation, water, and human activities (Yumansyah et al., 2021). As an integrated ecosystem, a watershed performs critical ecological functions by regulating water flow, maintaining soil stability, and supporting the sustainable use of natural resources. Consequently, watersheds serve as strategic planning units for the sustainable management of forest, soil, and water resources (Ratag et al., 2012).

Ambon City encompasses five major watersheds, namely the Batu Gantung, Batu Gajah, Wai Tomu, Batu Merah, and Wae Ruhu watersheds, most of which are located within the Gunung Sirimau Protected Forest. This area also encompasses settlements, including Soya Village. The continued protection of this forest is expected to maintain its hydrological functions, particularly in regulating water flow, facilitating water infiltration and storage, and providing clean air for the residents of Ambon City (Latuihamallo & Putuhena, 2016).

A catchment area functions as a terrestrial system that captures, stores, and conveys rainfall through river networks and tributaries (Pande, 2020). As an important source of springs and surface water, catchment areas depend strongly on vegetation cover, particularly tree-layer vegetation, to maintain their hydrological functions. Tree root systems enhance water infiltration into the soil, reinforce soil structure, and reduce erosion, thereby contributing to the long-term sustainability of water resources (Widiyono, 2010). However, climate change, coupled with increasing water demand resulting from population growth and human activities, may intensify the risk of water scarcity if it is not accompanied by adequate conservation measures. Therefore, conserving vegetation within catchment ecosystems is essential for sustaining spring-water resources while minimizing the adverse effects of water-resource exploitation (Nabu et al., 2024).

Vegetation comprises the plant communities that occupy a particular area and reflects the composition, structure, and distribution of species within an ecosystem (Kent, 2012). From a hydrological perspective, vegetation plays a critical role as a major component of catchment areas and supports the functioning of the hydrological cycle (Pitopang, 2012). Previous studies have demonstrated that large trees can make substantial contributions to spring-water conservation. The presence of large trees can enhance rainfall infiltration by increasing soil porosity and water-retention capacity. Infiltrated water subsequently moves into deeper soil layers, where it may reach relatively impermeable layers and contribute to groundwater storage, thereby helping maintain the continuity of spring discharge (Nita et al., 2024). Trees also regulate water fluxes through transpiration by absorbing water through their root systems, transporting it to the canopy, and subsequently releasing it into the atmosphere as water vapor. Conversely, the reduction of tree cover caused by logging can diminish the capacity of soils to absorb and retain water, thereby increasing drought risk and impairing the hydrological functions of the surrounding landscape.

These conditions are of particular concern in the Gunung Sirimau Protected Forest, especially in Soya Village. The conversion of forest areas into settlements and agricultural land has reduced the extent of forest cover that functions as a catchment area (Ombudsman, 2021;

Latumahina et al., 2025). In response to these pressures, the government has implemented various management measures aimed at restoring the ecological functions of the protected forest, including maintaining soil, water, and climate regulation while conserving plant and animal diversity, ecosystem types, and unique natural resources that have undergone degradation (Hastuti et al., 2021).

Previous studies have demonstrated that trees, particularly large-sized trees, play a crucial role in supporting hydrological functions by enhancing water infiltration, improving soil porosity, facilitating groundwater storage, and regulating the hydrological cycle through transpiration (Nita et al., 2024). However, these studies have not specifically identified the tree species occurring within the Soya Village catchment area or examined how their vegetation composition and structure contribute to maintaining the hydrological functions of the area as a catchment system. Furthermore, land-use conversion into residential areas and agricultural land within the Gunung Sirimau Protected Forest may alter the composition, diversity, and dominance patterns of tree vegetation. Although various forest management and ecological restoration efforts have been implemented, quantitative information on the condition of tree vegetation in the Soya Village catchment area remains limited, particularly regarding the Importance Value Index (IVI), species diversity index, and dominance index. Therefore, a more detailed assessment of these vegetation parameters is necessary to provide a comprehensive understanding of the composition and structure of tree communities within the catchment area.

Therefore, this study aimed to identify tree species that contribute to the functioning of the catchment area and to quantify the Important Value Index (IVI), vegetation diversity index, and dominance index of the tree layer in the Soya Village catchment area, Ambon City.

RESEARCH METHODS

Study Design and Study Area

The study was conducted in April 2023 in Soya Village, Ambon City, Indonesia. This study employed a combination of qualitative and quantitative approaches to characterize the structure and composition of tree-layer vegetation within catchment areas in Soya Village, Ambon City. The study was conducted in three catchment areas, namely Kopertis, Kayu Putih, and Kayu Tiga (Figure 1).

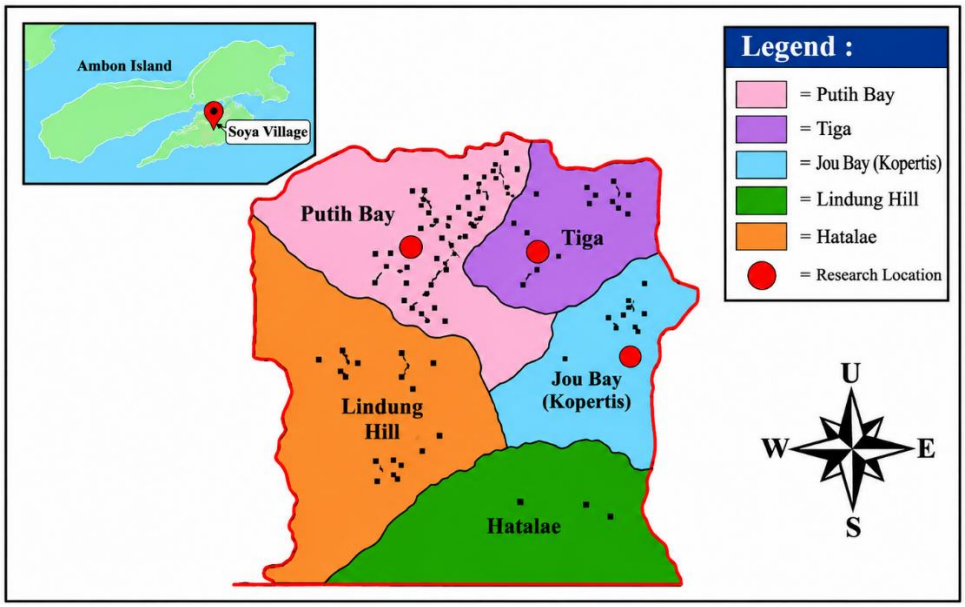


Figure 1. Thmatic map of Soya Villag
(Source: Soya village office)

The research procedures comprised site reconnaissance, establishment of sampling stations, transects and plots, tree data collection, species identification, and quantitative analysis of vegetation structure.

1. Site Reconnaissance
   A preliminary site survey was conducted to obtain an overview of the environmental conditions of the study area. The survey documented relevant site characteristics, including road conditions, the extent of the study area, the locations of water-infiltration zones, and the presence and distribution of water-storage tanks.
2. Establishment of Sampling Stations, Transects, and Plots
   Sampling stations were established based on the distribution of water-storage tanks within the study area. Three sampling stations were selected: Station I in Kayu Putih, Station II in Kayu Tiga, and Station III in Kopertis. At each station, five transects were established, each approximately 300 m long, with an inter-transect distance of approximately 50 m. Along each transect, five observation plots measuring 20 × 20 m were established at approximately 50-m intervals.
3. Tree Data Collection
   Tree data were collected by measuring diameter at breast height (DBH), defined as stem diameter measured at approximately 1.3 m above ground level, following Wu et al. (2019). All trees occurring within each observation plot were recorded, and the number of individuals and species was determined. Representative samples of leaves, flowers, and fruits were collected for subsequent species identification in the laboratory.

Tree species were identified by comparing the collected specimens with the morphological descriptions and identification images provided in relevant taxonomic references, including Flora of Java, Flora Malesiana, and relevant scientific publications. The

taxonomic authorship and nomenclature of each species were subsequently verified using authoritative online taxonomic databases, including the Integrated Taxonomic Information System (ITIS), Plants of the World Online (POWO), International Plant Names Index (IPNI), and World Flora Online (WFO). Collected specimens were documented photographically and prepared as herbarium specimens for reference and further verification.

The numbers of species and individuals recorded in each plot were used to calculate the Important Value Index (IVI), Shannon–Wiener diversity index, and Simpson dominance index as described below.

Vegetation Analysis

1. Important Value Index (IVI)

   The Important Value Index (IVI) was calculated to quantify the ecological importance of each tree species within the community based on its relative density, relative frequency, and relative dominance. The IVI was calculated using the following equation:

$$\mathrm{IVI} = \mathrm{RD} + \mathrm{RF} + \mathrm{RDo}$$

   where:
   RD = relative density (%)
   RF = relative frequency (%)
   RDo = relative dominance (%)

   For tree vegetation, the IVI therefore integrates the contribution of each species to the overall vegetation structure based on its abundance, distribution, and basal-area dominance.

2. Shannon–Wiener Diversity Index (H')

   The Shannon–Wiener diversity index (H') was used to quantify species diversity within the tree community. The index considers both species richness and the relative abundance of individual species within the community. It was calculated using the following equation:

$$H' = -\sum (p_i \ln p_i)$$

   where:
   H' = Shannon–Wiener diversity index
   p_i= proportion of individuals belonging to species *i*
   ln = natural logarithm

3. Simpson Dominance Index (C)

   The Simpson dominance index (C) was used to quantify the degree to which one or several species dominate the tree community. The index was calculated using the following equation:

$$C = \sum (p_i)^2$$

where:

C = Simpson dominance index

p_i= proportion of individuals belonging to species *i*

Higher values of C indicate a greater degree of dominance by particular species within the vegetation community, whereas lower values indicate a more even distribution of individuals among species.

RESULTS AND DISCUSSION

Tree Vegetation

Based on the data obtained from the watershed areas in each study site in Soya Village, 25 tree species were recorded in the Kayu Putih area, 22 species in the Kayu Tiga area, and 15 species in the Kopertis area. Overall, 26 tree species were recorded across the watershed areas of Soya Village (Table 1).

Table 1. Tree vegetation in the Soya Village watershed areas

No.	Local Name	Scientific Name	KP	KT	Kpts
1	Clove	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	✓	✓	✓
2	Water apple	*Syzygium aqueum* (Burm.f.) Alston	✓	–	✓
3	Malay apple	*Syzygium malaccense* (L.) Merr. & L.M. Perry	✓	✓	✓
4	Cajuput	*Melaleuca leucadendra* (L.) L.	✓	✓	–
5	Angsana	*Pterocarpus indicus* Willd.	✓	✓	✓
6	Moluccan albizia	*Falcataria moluccana* (Miq.) Barneby & J.W. Grimes	✓	✓	–
7	Java chestnut	*Inocarpus fagifer* (Parkinson) Fosberg	✓	✓	–
8	Santol	*Sandoricum koetjape* (Burm.f.) Merr.	✓	✓	✓
9	Langsat	*Lansium domesticum* Corrêa	✓	✓	–
10	Sugar palm	*Arenga pinnata* (Wurmb) Merr.	✓	✓	✓
11	Coconut	*Cocos nucifera* L.	✓	✓	✓
12	Sago	*Metroxylon sagu* Rottb.	✓	✓	✓
13	Mango	*Mangifera indica* L.	✓	✓	✓
14	Gandaria	*Bouea macrophylla* Griff.	✓	✓	✓
15	Durian	*Durio zibethinus* L.	✓	✓	✓
16	Breadfruit	*Artocarpus altilis* (Parkinson) Fosberg	✓	✓	✓
17	Jackfruit	*Artocarpus heterophyllus* Lam.	✓	✓	–
18	Gondal	*Ficus fistulosa* Reinw. ex Blume	✓	✓	–
19	Cempedak	*Artocarpus integer* (Thunb.) Merr.	✓	–	–
20	Casuarina	*Casuarina equisetifolia* L.	✓	✓	✓
21	Rambutan	*Nephelium lappaceum* L.	✓	✓	✓
22	Avocado	*Persea americana* Mill.	✓	✓	–
23	Tropical almond	*Terminalia catappa* L.	✓	✓	–
24	Mangosteen	*Garcinia mangostana* L.	✓	✓	–
25	Bilimbi	*Averrhoa bilimbi* L.	✓	–	–
26	Dammar	*Agathis dammara* (Lamb.) Poir.	–	–	✓
Number of species per watershed			**25**	**22**	**15**

Note: KP = Kayu Putih; KT = Kayu Tiga; Kpts = Kopertis. ✓ = species recorded; – = species not recorded.

Based on the inventory of tree vegetation in the Soya Village watershed areas (Table 1), a total of 26 tree species were identified across the three observation sites, namely the Kayu Putih, Kayu Tiga, and Kopertis watersheds. The Kayu Putih watershed exhibited the highest species richness, with 25 species, followed by the Kayu Tiga watershed with 22 species, whereas only 15 species were recorded in the Kopertis watershed. These differences in species richness reflect variations in ecological conditions among the study sites, which may be influenced by habitat characteristics, the intensity of anthropogenic disturbance, and land-use patterns. The relatively high species richness in the Kayu Putih watershed suggests that this area retains comparatively favorable habitat conditions capable of supporting a diverse assemblage of tree species, including both naturally occurring vegetation and cultivated plants managed by local communities. In contrast, the lower number of species recorded in the Kopertis watershed may indicate a more homogeneous vegetation structure or changes in land cover that have contributed to reduced species diversity. Padila (2025) reported that habitat heterogeneity is one of the major factors determining species diversity because greater habitat variation provides more opportunities for different plant species to establish and persist. Within a watershed context, high vegetation diversity plays an important role in enhancing water infiltration, maintaining soil stability, reducing surface runoff, and supporting water availability throughout the year.

The vegetation composition of the Soya Village watershed areas was dominated by tree species with high economic value, particularly fruit and spice crops, such as *Syzygium aromaticum*, *Durio zibethinus*, *Mangifera indica*, *Artocarpus altilis*, *Bouea macrophylla*, *Lansium domesticum*, *Nephelium lappaceum*, and *Cocos nucifera*. Several species with important ecological functions were also recorded, including *Melaleuca leucadendra*, *Falcataria moluccana*, *Inocarpus fagifer*, *Ficus fistulosa*, *Casuarina equisetifolia*, and *Agathis dammara*. The dominance of these species indicates that the Soya Village watershed represents a traditional agroforestry landscape dominated by multipurpose tree species (MPTS), which provide both economic benefits and ecological functions. This condition is consistent with the characteristics of the *dusung* management system that has long developed on Ambon Island. This agroforestry system is characterized by tree-based land management that maintains a vegetation structure resembling natural forest while simultaneously producing various economically valuable commodities for local communities.

The findings of this study are also consistent with previous studies on forest vegetation structure and agroforestry systems on Ambon Island. Lelloltery et al. (2020) reported that vegetation in the Gunung Sirimau Protected Forest was dominated by a combination of local tree species and economically valuable crops cultivated by surrounding communities. Similarly, Salampessy et al. (2017) demonstrated that the *dusung* agroforestry system on Ambon Island consists of various perennial crops, including clove, nutmeg, durian, gandaria, langsat, breadfruit, coconut, sugar palm, and various other local fruit species as major components of the vegetation structure. The similarity in vegetation composition between these previous studies and the present findings in the Soya Village watershed suggests that the area retains characteristics of the traditional Maluku agroforestry landscape with relatively high species diversity. In addition to providing economic benefits to local communities, the presence of

diverse tree species contributes to watershed hydrological functions by enhancing infiltration capacity, reducing surface runoff, and protecting water-recharge areas.

Compared with the Gunung Sirimau Protected Forest, the tree species richness recorded in the Soya Village watershed was relatively lower than that reported for relatively undisturbed primary and secondary forests. Nevertheless, the number of species was considerably higher than that typically found in monoculture agricultural areas or simple mixed gardens. This condition indicates that the Soya Village watershed represents a transitional landscape between natural forest ecosystems and cultivated land, where community-based land utilization has retained a substantial proportion of the tree vegetation structure. Tuakora et al. (2022) and Mardiatmoko (2022) reported that the buffer zone of the Sirimau Protected Forest is dominated by agroforestry systems with relatively dense canopy cover, which contributes to maintaining the hydrological balance of the watershed.

Importance Value Index

The Importance Value Index (IVI) calculated for each watershed area in Soya Village is presented in Figures 2, 3, and 4 below.

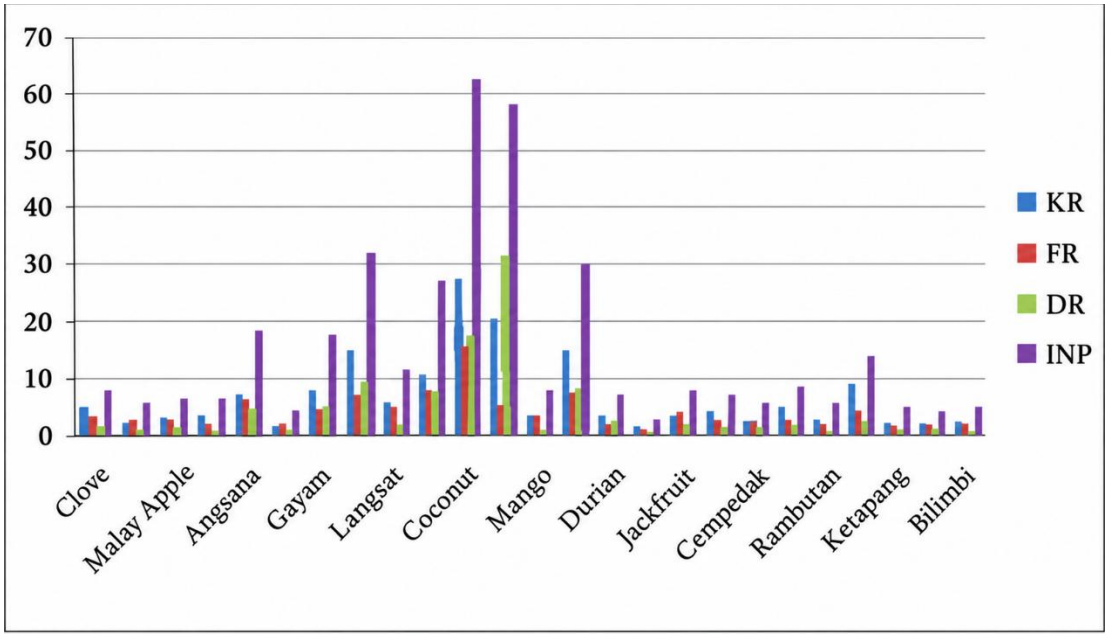


Figure 2. Importance Value Index (IVI) of tree vegetation in the Kayu Putih watershed

Based on the Importance Value Index (IVI), the tree vegetation in the Kayu Putih watershed was dominated by coconut (*Cocos nucifera* L.), with an IVI of 62.451%, followed by sago (*Metroxylon sagu* Rottb.) with 57.809%, santol (*Sandoricum koetjape* (Burm.f.) Merr.) with 32.754%, and gandaria (*Bouea macrophylla* Griff.) with 30.371%. The high IVI values of these four species indicate their substantial ecological roles within the vegetation community, as reflected by their relatively high density, frequency, and dominance compared with those of other species. This pattern indicates that the vegetation structure of the Kayu Putih watershed is largely characterized by tree species that constitute major components of the traditional *dusung* agroforestry system, which has long been practiced on Ambon Island. The dominance of economically valuable species suggests that the vegetation composition of the area has not

been shaped exclusively by natural ecological processes but has also been influenced by community-based management practices that have maintained various productive tree species across generations. Nevertheless, these species provide not only economic benefits through the production of fruits, starch, and other derived products but also contribute to important ecological functions, particularly by maintaining canopy cover, enhancing water infiltration, reducing surface runoff, and maintaining soil stability, thereby supporting the sustainability of watershed functions.

The dominance of coconut (*Cocos nucifera*) indicates that this species is well adapted to the humid tropical environmental conditions of Ambon Island, particularly in areas with good drainage and on slopes. In addition to serving as an important source of income for local communities through the production of fruits, coconut oil, copra, and various other derivative products, the relatively broad canopy and well-developed root system of coconut trees can reduce the kinetic energy of raindrops, enhance water infiltration, and help minimize surface erosion.

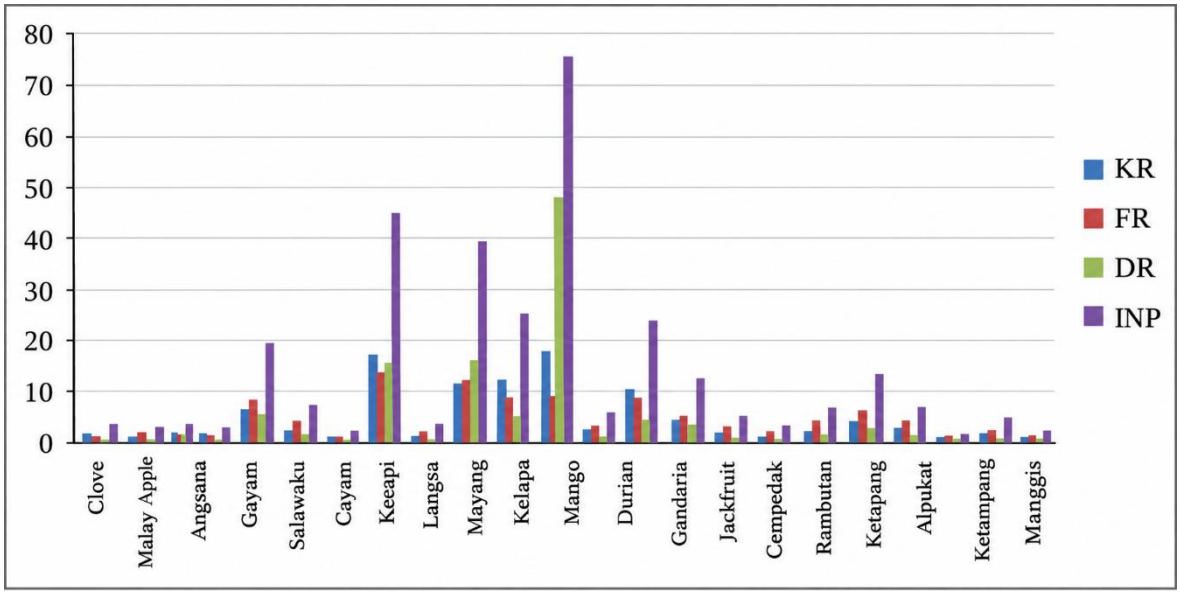


Figure 3. Importance Value Index (IVI) of Tree Vegetation in the Kayu Tiga Watershed

The tree vegetation in the Kayu Tiga watershed is predominantly composed of sago (*Metroxylon sagu* Rottb.), which recorded the highest Importance Value Index (IVI) of 74.350%, followed by kecapi (*Sandoricum koetjape* (Burm.f.) Merr.) with an IVI of 46.023% and sugar palm (*Arenga pinnata* (Wurmb) Merr.) with an IVI of 38.691%. The high IVI values of these three species indicate that the tree vegetation in the Kayu Tiga watershed is dominated by species that exhibit strong adaptive capacity to local environmental conditions and provide substantial ecological and economic benefits to local communities. This vegetation composition also reflects the characteristics of the traditional agroforestry system known as *dusung* in Maluku, a land-use system that integrates food crops, fruit trees, and palms within the same landscape. Such a system contributes to maintaining ecological conservation functions while simultaneously providing economic benefits to local communities.

The dominance of sago (*Metroxylon sagu*), with an IVI of 74.350%, indicates that this species constitutes the most influential component in shaping the tree community structure of

the Kayu Tiga watershed. This value suggests that sago exhibits higher frequency, density, and dominance than the other recorded species. Ecologically, sago is well adapted to environments characterized by high soil moisture and possesses a root system that effectively facilitates water infiltration, helps maintain groundwater reserves, and reduces surface runoff.

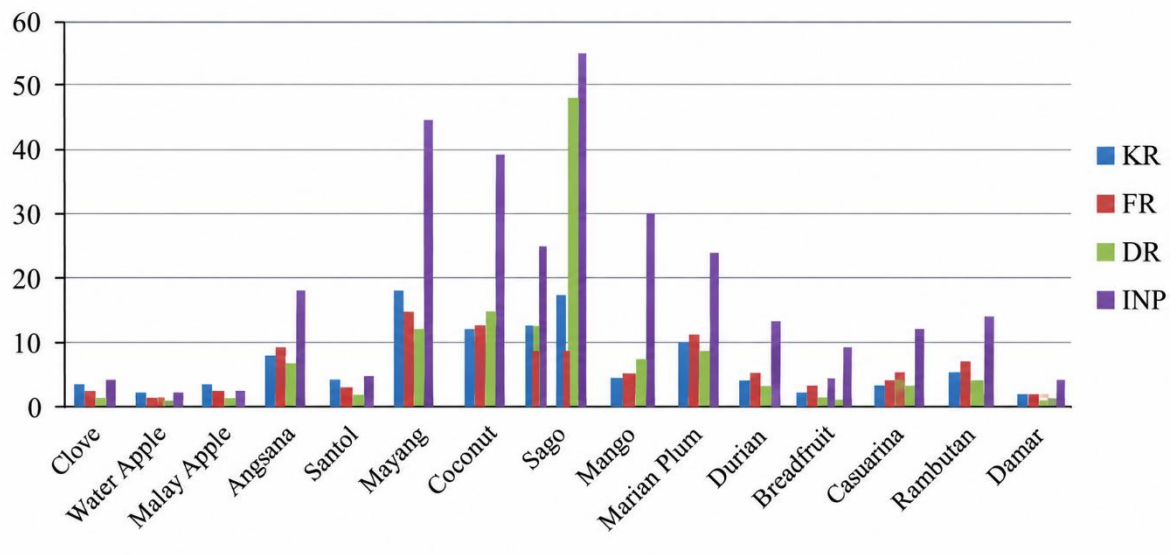


Figure 4. Importance Value Index (IVI) of Tree Vegetation in the Kopertis Watershed

Coconut, sugar palm, and sago belong to the family Arecaceae and possess extensive fibrous root systems that can enhance water infiltration and contribute to maintaining water availability within watersheds. Sago can also serve as a bioindicator of the presence of springs (Botanri et al., 2024). Kecapi, angsana, and gandaria possess leaves and branches that can intercept rainfall, allowing a proportion of precipitation to be temporarily retained within the canopy before reaching the ground. This process also reduces the kinetic energy of raindrops, thereby minimizing their impact on the soil surface (Haqdad et al., 2025).

Diversity and Dominance Indices

The diversity and dominance indices of tree species in each watershed in Soya Village are presented in Table 2.

Table 2. Diversity and Dominance Indices of Tree Vegetation

No.	Watershed	Number of Species	Diversity Index (H')	Category	Dominance Index (C)	Category
1	Kayu Putih	25	3.570	High	0.217	Low
2	Kayu Tiga	22	2.531	Moderate	0.107	Low
3	Kopertis	15	2.400	Moderate	0.105	Low

Based on Table 2, the Shannon–Wiener diversity index (H') and Simpson dominance index (C) indicate that the tree communities across the three watersheds in Soya Village exhibit relatively stable community structures with low species dominance. However, diversity values vary among the sites, reflecting differences in ecological conditions, vegetation composition,

and land-management intensity across the respective watersheds. The Shannon–Wiener diversity index (H') describes both species richness and the relative abundance of individual species within a community, whereas the Simpson dominance index (C) reflects the extent to which one or several dominant species prevail within the community. In general, higher H' values combined with lower C values indicate a more complex and stable vegetation community structure.

The Kayu Putih Watershed exhibited the highest level of species diversity, with 25 tree species, an H' value of 3.570, categorized as high, and a C value of 0.217, categorized as low dominance. The high H' value indicates that the vegetation community comprises numerous species with relatively even distributions of individuals, thereby limiting excessive dominance by particular species. This condition suggests that the Kayu Putih Watershed maintains relatively good ecosystem stability and is capable of performing multiple ecological functions, including soil conservation, hydrological regulation, carbon storage, and habitat provision for diverse organisms. Although coconut (*Cocos nucifera* L.) and sago (*Metroxylon sagu* Rottb.) exhibited relatively high Importance Value Index (IVI) values, the low dominance index indicates that the presence of these species does not substantially reduce overall community diversity. Coverdale and Davies (2023) reported that communities with H' values exceeding 3 generally exhibit complex vegetation structures, relatively low levels of disturbance, and greater ecosystem resilience to environmental changes.

The Kayu Tiga Watershed contained 22 tree species, with a diversity index (H') of 2.531, which falls within the moderate category, and a dominance index (C) of 0.107, classified as low. These values indicate that although the number of species was relatively high, the distribution of individuals among species was less even than that observed in the Kayu Putih Watershed. The dominance of sago, which recorded the highest IVI, may influence the abundance patterns of other species, thereby contributing to the slightly lower diversity observed at this site. Nevertheless, the low dominance index indicates that the vegetation community remains composed of multiple species that contribute to stand structure. This condition reflects the characteristics of the traditional agroforestry system (*dusung*), which can maintain a balance between dominant and associated species and thereby sustain the ecological functions of the watershed. Fahad et al. (2022) reported that agroforestry systems characterized by diverse tree compositions are more effective in enhancing water infiltration, reducing surface runoff, and maintaining soil fertility than monoculture systems.

The Kopertis Watershed contained the lowest number of species, with 15 tree species, an H' value of 2.400, classified as moderate, and a C value of 0.105, representing the lowest dominance index among the three sites. The lower number of species contributed to the lower diversity value compared with that of the Kayu Putih Watershed. Nevertheless, the low dominance index indicates that no single species overwhelmingly controls the community, and tree individuals remain relatively evenly distributed among the species present. This condition suggests that, despite its lower species richness, the vegetation community in the Kopertis Watershed retains a relatively stable structure. Communities characterized by low species dominance generally exhibit more balanced interspecific interactions, which may enhance their capacity to maintain ecosystem stability under environmental changes.

CONCLUSION

Based on the findings of this study, the tree vegetation in the watersheds of Soya Village comprises 26 species, forming communities with distinct characteristics across the three study sites. The Kayu Putih Watershed is dominated by coconut (*Cocos nucifera*), sago (*Metroxylon sagu*), kecapi (*Sandoricum koetjape*), and gandaria (*Bouea macrophylla*), whereas the Kayu Tiga Watershed is dominated by sago (*Metroxylon sagu*), kecapi (*Sandoricum koetjape*), and sugar palm (*Arenga pinnata*). Meanwhile, the Kopertis Watershed is dominated by angsana (*Pterocarpus indicus*), gandaria (*Bouea macrophylla*), sugar palm (*Arenga pinnata*), and kecapi (*Sandoricum koetjape*).

The community structure analysis indicates that the Kayu Putih Watershed has a high level of species diversity, whereas the Kayu Tiga and Kopertis Watersheds exhibit moderate levels of diversity. Nevertheless, all three watersheds have low dominance index values, indicating that no single species overwhelmingly dominates the communities. Overall, the vegetation communities exhibit relatively stable structures with a relatively balanced species composition.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge all parties who contributed to the implementation of this study, particularly the relevant institutions and local communities for providing permission, information, and support throughout the field data-collection process.

DECLARATIONS

Author Contributions

R.T contributed to designing the study, preparing samples and test materials, conducting the study, and preparing the manuscript. E.T and D.E.S contributed to proofreading the manuscript.

Funding

This study did not receive any funding form public, commercial or any external funding.

Declaration of Interest

The authors declare no relevant conflicts of interest related to this study.

Data Sharing Statement

The data used in this are available upon reasonable request and in accordance with established procedures.

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