Species richness and evenness of tree-level plants in the Bohulo camp tourism area

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Abstract. This study aims to analyze the vegetation community structure at the tree level, focusing on species richness and evenness, in the Bohulo Camp and Eat Tourism Area, Gorontalo, which has high megabiodiversity potential. This analysis is important for measuring the health and stability of the secondary forest ecosystem. The method used was an exploratory survey through direct observation on November 16, 2025, collecting data on the number of individuals for each tree species. The research results showed that the tree stratum displayed the most dominant species richness. The Margalef Richness Index (R1) was recorded at 5.2748, indicating substantial taxonomic heterogeneity from a total of 202 individuals. Furthermore, the Evenness Index (E) reached a very high value of 0.9565. This value reflects a proportional and balanced distribution of individuals among species, confirming the absence of significant single-species dominance. The combination of good richness and evenness resulted in a Shannon-Wiener Diversity Index (H') of 3.2209, classifying the tree-level vegetation as a stable, established ecosystem component that plays a vital role as a biodiversity buffer in the tourism area.

1 Introduction

Indonesia is a megabiodiversity country because it has abundant flora and fauna, so the forest has land overgrown with trees or woody plants, either of a single species or mixed, which can create a microclimate around it. The forest's role is essential because, besides being a repository of natural resources, it also functions to maintain the ecological balance needed by humans. The role of the forest becomes vital for the life of living beings as it serves as an ecosystem buffer [1].

The biodiversity present at the Bohulo Camp and Eat Tourism Area has enormous potential to be preserved and conserved, but it also requires serious efforts in managing species diversity. This aligns with the opinion of [2], who emphasizes the importance of habitat management to support biodiversity in areas utilized by humans.

Species diversity analysis plays an important role in assessing species variation in a forest community. The results of this analysis can be used as a basis for conservation efforts and

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forest area management. Some commonly used ecological parameters include the Shannon and Wiener index and the Simpson index. Vegetation functions as a habitat indicator, and vegetation can be used as a basis for considering land use plans. Information regarding species composition, diversity, and evenness is very important for management [3].

This index (H') is one of the most widely used vegetation parameters in ecological studies, as the data derived from its calculation serve as a comparison between one ecosystem and another. The index can be used to evaluate the impact of environmental disturbances, both abiotic and biotic factors, on community structure, and also provides an overview of the successional stage and stability of a vegetation community [3].

Species richness is the total number of species, whereas evenness is the distribution of abundance (for example, the number of individuals, biomass, and so on) among the respective species [4]. Indicators of tree species diversity within forest biodiversity have been identified as criteria for forest ecosystem sustainability. Tree species diversity serves as a measure of forest health. According to [5], forest health reflects the condition of a forest ecosystem capable of effectively performing its primary functions.

2 Research methods

2.1 Location and time of research

The research method used was an exploratory survey, which involved direct observation at the research site. Data collection employed an exploratory technique, carried out by exploring every location within the area containing vegetation. Data were collected throughout the Bohulo Camp and Eat Tourism Area, Dulamayo Village, Telaga District, Gorontalo Regency, during field practice activities conducted by the research team on November 16, 2025.

2.2 Research design

This research employed a field observation method, conducted on November 16, 2025, in the Bohulo Camp and Eat Tourism Area, Dulamayo Village. The main focus of the study is to analyze the vegetation community structure at the Tree Level, which includes the analysis of species richness and evenness. This approach was chosen to provide an objective description of the biodiversity conditions at the site through numerical data, without applying any special treatment to the observed objects.

To ensure the smooth collection of field data, a number of instruments and materials were used in an integrated manner. Stationery and observation sheets were used as the main instruments to record local names, scientific names, and count the number of individuals. Furthermore, a camera (for documentation) was utilized to record the morphological characteristics of the plants as valid visual evidence.

2.3 Data Collection

The analysis of tree-level vegetation data was carried out by calculating diversity, evenness, and species richness indices based on the number of individuals of each species recorded in the field. This calculation aims to assess the level of tree species diversity and to identify the stability of the vegetation community within the studied area. The evenness index is used to measure how evenly individuals are distributed among species, allowing the identification of whether the community is dominated by particular species or if the

population is more evenly distributed. In addition, the species richness index is calculated to describe the total number of recorded plant species as an indicator of variation in vegetation composition within the research area.

These three parameters were analyzed integratively to obtain a comprehensive understanding of the tree community structure in the Bohulo Camp Tourism Area, encompassing species composition, number of species, distribution patterns, and the level of vegetation diversity. The analytical findings serve as the basis for assessing the ecological condition of the area and provide information on the abundance and sustainability of tree-level vegetation at the research site.

3 Results and discussion

Based on the vegetation analysis results in the Bohulo Camp and Eat tourism area, the tree stratum shows the most dominant species richness compared to the two other vegetation layers. The Species Richness Index (R_I) at the tree level was recorded at 5.2748, which is the highest value compared to the understory stratum (R_I = 1.7894) and seedlings (R_I= 1.3029). This value reflects the high species variation that can adapt and grow in the local environment. From a total of 202 individuals observed, various types of trees were identified, including fruit plants and hardwood species, indicating that the Bohulo Camp area has ecological conditions that support the simultaneous survival of various types of trees.

Table 1. Calculation of Total Individuals.

No	Local Name	Class/Family	Species	Number of individuals (Tree Level)
Tree Level				
1	Coconut	Arecaceae	*Cocos nucifera*	5
2	Lemon	Rutaceae	*Citrus × limon*	1
3	Jackfruit	Moraceae	*Artocarpus heterophyllus*	2
4	Awar-awar	Moraceae	*Ficus septica*	5
5	Panimbulu	Urticaceae	*Leucosyke capitellata*	7
6	Wonibopale	Ailanthaceae	*Ailanthus* sp.	13
7	Tohe tutu	Burseraceae	*Canarium asperum*	6
8	Hulumeo	Moraceae	*Artocarpus* sp.	8
9	Avocado	Lauraceae	*Persea americana*	2
10	Kopi arabika	Rubiaceae	*Coffea arabica*	4
11	Pine/Casuarina	Casuarinaceae	*Casuarina equisetifolia*	2
12	Papaya	Caricaceae	*Carica papaya*	2
13	Mahogany	Meliaceae	*Swietenia sp.*	13
14	Matoa	Sapindaceae	*Pometia pinnata*	5
15	Palm	Arecaceae	*Arecaceae sp.*	9
16	Banana	Musaceae	*Musa sp.*	9
17	Bitaula	Calophyllaceae	*Calophyllum sp.*	11
18	Hihito	Sapindaceae	*Koordersiodendron pinnatum*	12
19	Tulalo poni'i	Meliaceae	*Chisocheton caramicus*	13
20	Bangga lo	Myristicaceae	*Myristica sp.*	14
21	maluo Kapok	Malvaceae	*Ceiba pentandra*	8

22	Tohupo	Moraceae	*Artocarpus elastica*	5
23	Mango	Anacardiaceae	*Mangifera indica*	5
24	Molonggoile	Bignoniaceae	*Radermachera sp.*	6
25	Nantu	Myristicaceae	*Myristica / Palaquium sp.*	4
26	Tenggedi	Elaeocarpaceae	*Elaeocarpus cumingii*	7
27	Tapu lo tola	Phyllanthaceae	*Bischofia javanica*	8
28	Pilohibuta	Rutaceae	*Euodia minahassae*	7
29	Loyo	Anacardiaceae	*Dracontomelon mangiferum*	9
amount				202

Table 2. Calculation of Total Individuals.

No.		Number of species	Evenness index	Species richness index
1.	Tree Level	202	0,9565	5,2748

Furthermore, the community structure in the tree stratum also shows a very high level of evenness. This is indicated by the Evenness Index (E) value of 0.9565, which is close to 1, signifying a relatively balanced distribution of individuals among species without extreme dominance by any particular species. Although some species, such as Bangga lo maluo (*Myristica sp.*), recorded the highest number of individuals (14 individuals), followed by Wonibopale (*Ailanthus sp.*) and Tulalo poni'i (*Chisocheton caramicus*) with 13 individuals each, these differences in numbers do not indicate a significant gap. Other species with nearly similar individual counts, such as Hihito (12 individuals), further reinforce the community's homogeneous distribution pattern.

The combination of high species richness and very good evenness values confirms that the tree stratum is the most stable component in the Bohulo Camp and Eat ecosystem. An evenness index in the high category (≥ 0.9) ecologically represents a well-established vegetation community, with balanced interspecies competition, and the ability to show resilience (resistance) to environmental stress and potential disturbances. This statement aligns with Indriyanto (2012), who emphasizes that communities with high evenness tend to be more stable and less susceptible to changes in environmental conditions.

Unlike the understory and seedling strata, which show lower values of richness and evenness indicating greater vulnerability the tree stratum plays an important role in maintaining ecosystem sustainability. The canopy structure formed by mature trees functions to regulate light intensity, spatial competition patterns, and nutrient distribution, allowing the dynamics of the secondary forest ecosystem in this tourism area to continue sustainably.

4 Conclusion

Based on the vegetation analysis conducted, the species richness parameter in the tree stratum shows a Margalef index (R_1) value of 5.2748, which is the highest compared to other vegetation strata in the area.This high richness value, supported by the presence of 202 individuals, indicates that the Bohulo Camp and Eat area has substantial taxonomic heterogeneity at the canopy level. This high diversity of tree species serves as a vital indicator that the vegetation community structure at the study site has sufficient complexity to optimally support the ecological functions of secondary forest

Analysis of individual distribution reveals a highly stable species evenness condition, marked by an evenness index (E) value of 0.9565.This value, approaching the maximum of 1, reflects that the proportion of individuals is distributed proportionally among existing

species, with no single species dominance controlling environmental resources. In the context of community ecology, this high evenness level confirms that interspecies interactions at the tree level are in dynamic balance, theoretically enhancing community resistance to external pressures and intraspecific competition

Integratively, the synergy between high species richness and even distribution at the tree level directly contributes to the elevated Shannon-Wiener Diversity Index (H') value of 3.2209. This figure confirms that the tree-level vegetation in this area falls into the high diversity category, reflecting a stable, established ecosystem with strong environmental carrying capacity as the primary biodiversity buffer in the tourism area.

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