THE COMPOSITION AND DIVERSITY OF PLANT SPECIES IN UPSA OF DULAMAYO UTARA TELAGA BIRU GORONTALO DISTRICT

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ABSTRACT

This study aims to determine the composition and diversity of plant species in the Dulamayo Utara Natural Resources Management Unit (UPSA), Telaga Biru District, Gorontalo District. The method used in this research is the roaming method for exploration of plant species. The research found that there are 24 types of plants in the UPSA area, namely *Aleurites moluccanus*, *Bambusa vulgaris*, *Ceiba pentandra*, *Cinnamomum verum*, *Musa × paradisiaca*, *Myristica fragrans*, *Piper aduncum*, *Citrus × aurantiifolia*, *Citrus sp*, *Cordyline fruticosa*, *Euphorbia pulcherrima*, *Ficus ampelas*, *Ficus septica*, *Gliricidia sepium*, *Lantana camara*, *Nicotiana tabacum*, *Psidium guajava*, *Ricinus communis*, *Durio Zibethinus*, *Ficus sp*, *Helianthus annuus*, *Mallotus sp*, *Mangifera indica*, and *Syzygium aromaticum*. The H 'value of plants at the tree, sapling, and seedling levels was 1.88; 2.32; and 2,38, indicating a moderate level of diversity. This value indicates that the evenness at the tree, understorey, and seedling level is stable. Species Richness (R1) of plants at the tree, sapling, and seedling levels, respectively 1.47; 1.94; 2.1, belongs to the low category.

Keywords: *Plant Species, Species Composition, Species Diversity*

INTRODUCTION

Indonesia is a country renowned for its biodiversity (Utami, 2017; Ningsih, 2019) and has a crucial position in the global biodiversity map. Additionally, in a global range, it, along with Brazil and Zaire, is the top-three countries with the largest biodiversity (megadiversity countries). Around 17% of the total global bird species live in Indonesia (1,531 species), 381 of which are endemic (Triyono, 2013).

Diversity constitutes a community with distinctive characteristics. Diversity enacts for all living creatures, and hence we have flora diversity as well. Plants are a type of basic understorey vegetation, except for tillers. Understorey vegetation encompasses grasses, herbs, shrubs, and ferns (Destaranti, 2017).

One of the Indonesian regions with high biodiversity is Gorontalo Province, specifically its forests. According to Ismaini *et al*., 2015, the forest is a mediator facilitating humans and other living creatures to build a mutual relationship with natural factors, including ecological processes, and is a unit of the cycle which supports living. As an ecosystem, forests should be maintained for their quality and quantity using a conservation approach. The exploitation of the forest ecosystem is

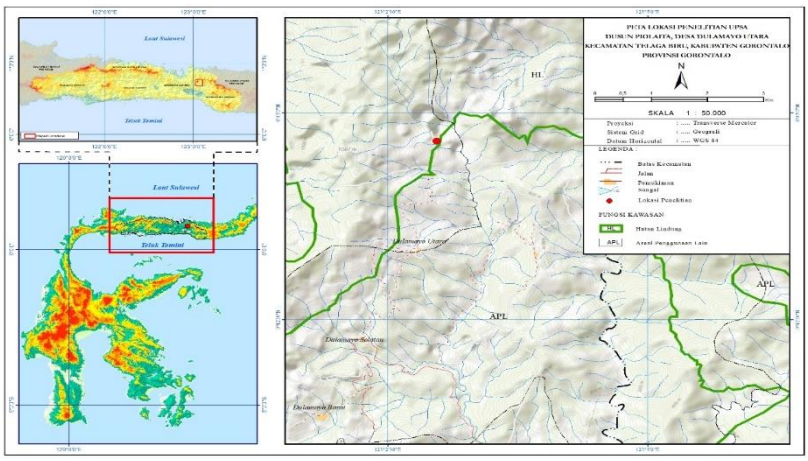
allowed as long as the presence of its entire functions is taken into consideration. Forests play an imperative role in our lives as natural resources (Sutrisna *et al*., 2018) and confer socio-economic functions as well as environmental ones (Sianturi, 2001; Mukhamadun *et al*., 2008: Miura *et al*., 2015; Hartoyo, et al., 2019). Forest management favoring one function will breed deforestation. Frequent and uncontrolled forest degradation decreases the abundance of biodiversity in Gorontalo Province. Local communities have transferred forests into agricultural lands and plantations they use to cater to daily needs.

Meanwhile, the forest in Dulamayo Utara has an abundance of plant species, whose identities are yet to know. The village has now been a Natural Resources Management Business Area (UPSA) because of its natural potentials and beautiful natural landscapes. Its unidentified species draw our interest in carrying out research on plant species diversity in UPSA of Dulamayo Utara Telaga Biru Gorontalo District.

RESEARCH METHODS

Research Area and Time

This research was conducted in the Natural Resources Management Business Area (UPSA) of Dulamayo Utara Telaga Biru Gorontalo District Gorontalo Province. Administratively, the UPSA is bordered with Atinggola in the north, I Bunia in the south, 3 Baru in the east, and protected forests (4 Botuwombato) in the west. This research was performed in October 2020-February 2021. The research area is demonstrated in Figure 1.



Gambar 1. Research Area

Research Materials and Instruments

Research instruments were a Global Positioning System (GPS), roller meter, flagging tape (colored ribbon/rope), magnifying glass, Canon EOS 550D camera, stationery, litmus paper, soil tester, lux meter, clinometer, altimeter, Salinity Conductivity Temperature (SCT), baskets, labels, and plastic bags. Research materials were tally sheets, materials for making an herbarium (carton paper, alcohol, spiritus, raffia, hanging labels, plastic

bags, strings, glue), and a guidebook for identification.

Data Collection Technique

The research method was the cruise method for plant species exploration. Data collected were primary and secondary. The first data type, including plant species, the number of species, the number of individuals, tree diameter, tree height, the height of the point where the sample tree was located, and the ordinate of the location of the sample tree, were collected in the field. Meanwhile, the second one, covering climate data, was collected from literature studies of the previous research findings, e.g., landforms, topography, and land use based on vegetation cover using satellite imagery.

Research Stages

1. Preparation. This stage encompassed field observation, data collection method determination, and preparation of the instruments used in field data collection.
2. Data collection. This stage included plant inventory, plant identification, vegetation composition, and biodiversity analyses (diversity index, evenness index, and richness index of the plant species found in the research area).

Data Analysis

1. Plant species composition

Data of each plant species from plant inventory and identification in the research area were inputted to the table so each of the plant species which lived in different habitats could be examined.

2. Plant species diversity

a. Species diversity index

Plant species diversity was investigated using the Diversity Index (H') (Shannon and Wiener, 1963; Fachrul 2012).

$$H' = -\sum_{i=1}^{S} \text{pi } ln \text{ pi}$$

Where:

$\text{pi} = \frac{\text{ini}}{\text{N}}$

H' = Shannon-Wiener Diversity Index

S = Number of species

Ni = Number of individuals within a single species

Ln = Natural logarithm

N = Total number of the individuals of species found

The higher the H', the higher the species diversity. Shannon-Wiener Diversity Index was defined as follows:

i. H' > 3: high diversity
ii. 1 ≤ H' ≤ 3: moderate diversity
iii. H' < 1: low diversity

b. Species evenness index

To study the species evenness index, we used the Pielow evenness indices formula (Ludwig and Reynolds, 1988).

$$E = H'/\ln S$$

Where:

E = Evenness index

H' = Shannon-Wiener Diversity Index

c. Species richness index (R_1)

For the species richness index, the Margalef formula was deployed here.

$$R_1 = \frac{(S-1)}{(\ln(N))}$$

Where:

R_1 = Richness index
S = Number of species found
N = Total number of individuals

RESULTS AND DISCUSSION

A. Plant Species Composition

Referring to the data of plant species composition in UPSA of Dulamayo Utara, 24 plant species are found, i.e., *Aleurites moluccanus, Bambusa vulgaris, Ceiba pentandra, Cinnamomum verum, Musa* × *paradisiaca, Myristica fragrans, Piper aduncum, Citrus* × *aurantiifolia, Citrus* sp, *Cordyline fruticosa, Euphorbia pulcherrima, Ficus ampelas, Ficus septica, Gliricidia sepium, Lantana camara, Nicotiana tabacum, Psidium guajava, Ricinus communis, Durio Zibethinus, Ficus* sp, *Helianthus annuus, Mallotus* sp, *Mangifera indica,* and *Syzygium aromaticum.* The predominant plant species are flowers, vegetables, spices, herbs, and secondary crops. Several fruit trees are also found but are currently still in the sapling and seedling phases. They are *Durio Zibethinus, Mangifera indica*, *Citrus* sp, *Psidium guajava,* and *Musa* × *paradisiaca.* Plant species composition found in the research area is exhibited in Table 1.

Table 1. Plant Species Composition in UPSA

Family	Genus	Species	Local Name	Number of Individuals
Euphorbiaceae	Aleurites	*Aleurites moluccanus*	Candlenut	15
	Euphorbia	*Euphorbia pulcherrima*	Poinsettia	10
	Ricinus	*Ricinus communis*	Ricinus	10
	Mallotus	*Mallotus* sp.	-	13
Poaceae	Bambusa	*Bambusa vulgaris*	Common bamboo	5
Malvaceae	Ceiba	*Ceiba pentandra*	Kapok tree	7
	Durio	*Durio Zibethinus*	Durian	14
Lauraceae	Cinnamomum	*Cinnamomum verum*	True cinnamon tree	26
Musaceae	Musa	*Musa* × *paradisiaca*	Plantain	11
Myrtaceae	Myristica	*Myristica fragrans*	Nutmeg	22
	Psidium	*Psidium guajava*	Common guava	14
	Syzygium	*Syzygium aromaticum*	Clove	27
Piperaceae	Piper	*Piper aduncum*	Spiked pepper	21
Rutaceae	Citrus	*Citrus* × *aurantiifolia*	Key lime	10

		Citrus sp.	Citrus	16
Asparagaceae	Cordyline	*Cordyline fruticosa*	Ti plant	14
Moraceae	Ficus	*Ficus ampelas*	-	11
		Ficus septic	Hauli tree	24
		Ficus sp.	Bayan tree	11
Leguminosae	Gliricidia	*Gliricidia sepium*	Gamal tree	27
Verbenaceae	Lantana	*Lantana camara*	West Indian lantana	57
Solanaceae	Nicotiana	*Nicotiana tabacum*	Cultivated tobacco	16
Asteraceae	Helianthus	*Helianthus annuus*	Common sunflower	28
Anacardiaceae	Mangifera	*Mangifera indica*	Mango	8
Total number				**417**

Source: Primary data, 2021

B. Plant Species Diversity Index

The plant diversity index in UPSA of Dulamayo Utara Telaga Biru Gorontalo District Gorontalo Province is 1.88, 2.32, and 2.38 at the tree, sapling, and seedling level, respectively. The highest diversity level is achieved by the seedling level, subsequently followed by the sapling one. Diversity in those three plant strata is considered moderate as H' > 1. It is analogous with Fachrul (2012) that H' $1 \leq H' \leq 3$ indicates moderate diversity. The moderate diversity manifests a stable condition of the plant community (proponent substrate and environment parameters) despite interspecies competition as regards food and space.

Wahyuni *et al*. (2017) argue that relatively evenly or almost evenly abundance and no significant dominance found manifest high diversity. Thus, such a diversity level in a research area reflects evenly distributed species in a particular community.

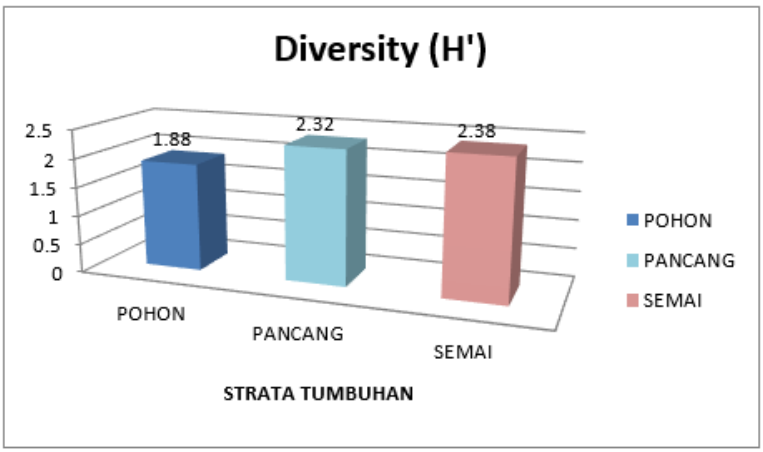


Figure 1. Plant Diversity in UPSA

Figure 1 points out each of the plant strata with their diversity criteria. Understorey plants came with higher diversity at H' of 3.7 than plants at the sapling and seedling levels. Understorey plants are identified for having good adaptability. A good area has stable physical-chemical factor conditions. Community diversity considerably hinges on the number of species and individuals found in the community (Sutrisna *et al.*, 2018). Species diversity in a community will is inclined to be high if the community consists of multiple species without no one dominating. The higher the diversity in an area, the more stable the community therein (Indriyanto, 2012). Additionally, Manurung and Nirawati (2016) contend that a low diversity index presents low species diversity, attesting to a relatively exceptionally different number of individuals of species, bringing about the existence of dominating species.

C. Plant Species Evenness Index

The plant evenness index in UPSA is 0.96, 0.93, and 0.95 at the tree, sapling, and seedling levels, respectively. The index shows off stable evenness at the tree, understorey, and seedling levels.

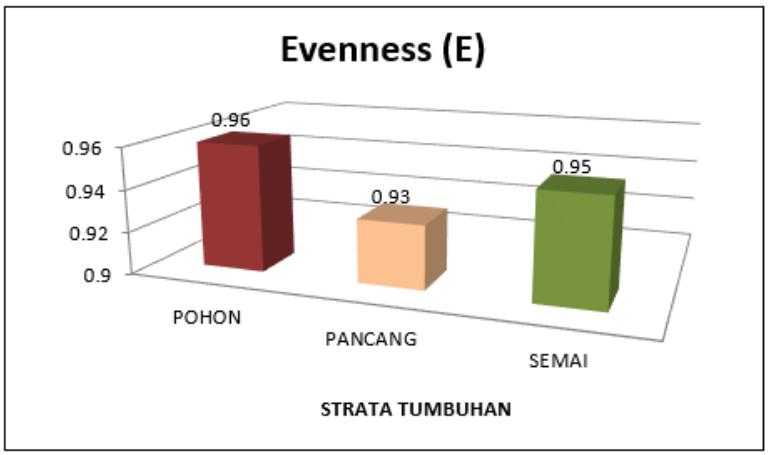


Figure 2. Plant Evenness in UPSA

An evenness index (E) delineates the evenness of the distribution of individuals from organism species which construct a community, as well as community stability. It ranges from 0-1. The lower the E or the nearer the E to zero, the more uneven the organism distribution within a community. On the contrary, the higher the E or the nearer the E to one, the more even the organism distribution (Daget, 1976). Figure 2 signifies a stable plant species evenness index in UPSA and therefore a stable community, whose interspecies population there is considered even, protecting the population from potential threats and allowing it to restore immediately. A community with high diversity will be more resilient against environmental/climate threats. Also, diversity tends to elevate in an older community but is low in a newly-created one (Odum, 1998).

Besides, an evenness index elucidates the evenness degree of the abundance of cross-species individuals. If the respective species have the same number of individuals, the community to where they belong has a maximum evenness index. Meanwhile, a minimum evenness index demonstrates the existence of dominant, sub-dominant,

and dominated species in a community. Because an evenness index ranges from 0-1, the adjacent-to-one index exhibits an even distribution.

D. Species Richness Index

As indicated in Figure 3, the plant richness index at the tree, sapling, and seedling levels is considered low. As posited by Magurran (1988), $R_1 < 3.5$ indicates low species richness, whereas R_1 3.5-5.0 indicates a high one. Considering this measurement, species richness in UPSA is low at a species richness index (R_1) of 1.47, 1.94, and 2.1 at the tree, sapling, and seedling levels, respectively.

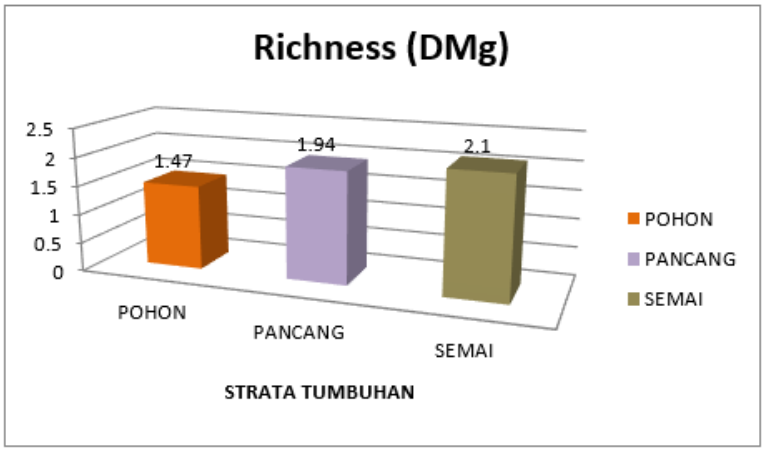


Figure 3. Plant Richness in UPSA

Species richness is the number of species within a community. The more the species found, the higher the richness index. Margalef Richness Index divides the number of species using a natural logarithm function which indicates that the increase in the number of species is inversely proportional to the increase in the number of individuals. It also demonstrates that at large, a community/ecosystem with multiple species will likely have a small number of individuals within each species.

CONCLUSION

24 plant species were found in UPSA of Dulamayo Utara Telaga Biru Gorontalo District Gorontalo Province. The diversity index (H') at the tree level was 1.88 and hence considered moderate. Meanwhile, the diversity index (H') at the sapling and seedling strata was 2.32 and 2.38, respectively, and therefore both are also considered moderate. The evenness index in UPSA at the tree, understorey, and seedling level is 0.96, 0.93, and 0.95, respectively, and thus they are considered stable. Finally, the species richness (R_1) at the tree, sapling, and seedling level is 1.47, 1.94, and 2.1, and hence considered low.

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