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The Saplings Vegetation and Environmental Factors in Malempo Hamlet of Mallawa Resort, Bantimurung Bulusaraung National Park

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ABSTRACT

This study aimed to determine the composition and structure of sapling vegetation and the relationship of environmental factors with the structure of the vegetation in Malempo Hamlet of Mallawa Resort, Bantimurung Bulusaraung National Park, Maros Regency, which is in three regions of direction, namely South, North, and West. Laying transects were conducted randomly in each regional direction with 5 replications. Each transect was 100 × 5 meters in size, for the tree saplings, in wich they were provided with 5 × 5 meters for 10 plots alternatingly placed. Data collection of vegetation was conducted in the plot by counting the number of each species of tree saplings and determine the canopy space-filling. The composition of sapling vegetation was found 39 species from 28 families. The species of sapling tree with the highest structure of sapling vegetation in the study area based on density, frequency, dominance, and IVI is Celtis philippensis, Ardisia elliptica, Leea indica, Saurauia nudiflora, and Phytocrene macrophylla and the lowest are Cordyline fruticosa, Caryota mitis, Calamus asperrimus, and Arenga pinnata. The canopy, altitude, soil percentage without vegetation, and slope declivity have a relationship with the structure of sapling vegetation.

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Keywords:
Vegetation structure, Important value index, Tree saplings

1. Introduction

Sulawesi island has a rich and diverse flora and fauna [1]. However, most of the biodiversity of this island are under threat of extinction mainly by deforestation, resulting in losing 80 percent of the primary forest [2], and currently, the forest is only located in high elevation areas in the mountains, or in a preservation area [3].

One of the preservation areas in South Sulawesi Province is the Bantimurung Bulusaraung National Park [4]. National Park has characterized by karst hills and higher biodiversity. In this area, there are several wildlife species that are endemic or the natural plant [5].

Bantimurung Bulusaraung National Park has 7 resorts and one of them is the Mallawa resort located in Mallawa district, Maros Regency, South Sulawesi Province [6]. The dependency level of the community living around National Park on ecosystem resources of this national park is quite high. However, the utilization of the forest and all its components including the lower plants often

become a problem for the management parties of National Park due to the conflict of interest [7].

Since Bantimurung Bulusaraung National Park is very important for the preservation of biodiversity and natural resources, the area needs protection and conservation. One approach that needs to be done for supporting the activities is understanding the ecological conditions of vegetation.

The objective of this study was to determine the composition and structure of vegetation from tree saplings as well as the relationship of environmental factors with the structure of the vegetation of tree saplings in Malempo Hamlet, Mallawa Resort, Bantimurung Bulusaraung National Park.

2. Materials and Methods

This study was descriptive research with survey method. This research was conducted in Malempo Hamlet, Mallawa Resort, Bantimurung Bulusaraung National Park, Maros Regency, South Sulawesi. Sampling was conducted in three regions of Malempo Hamlet using the compass directions, namely North, South, and West. The division of the area aimed to provide the sample of tree sapling vegetation that could be able to represent all vegetation in the Malempo Hamlet.

The laying of the transect was conducted randomly with 5 repetitions. Each transect was 100 m × 5 m in size, for the tree saplings, they were provided with 5 m × 5 m for 10 plots alternatingly placed. Thus, there were 5 pieces of transects with 50 pieces of the plot in each good area for the tree saplings. The number of the entire transect in the location of research was 15 pieces.

Tree saplings are all types of tree plants that have a diameter of ± < 5 cm at chest height about 1.30 m from the ground surface [8], the variables observed in this study were the composition and structure of vegetation. Vegetation structure was observed under the parameters, namely density, frequency, dominance, and the Important Value Index (IVI) of tree sapling species in each observation plot in Malempo Hamlet, Mallawa Resort, Bantimurung Bulusaraung National Park.

Factors and the structure of the sapling vegetation. According to Kabacoff [9], the formula used is as follows:

$$Y = a + b_1X_1 + b_2X_2 + ... + b_nX_n$$

Description: Y = dependent variable; X = Independent variable; a = Intercept; b_1 = Change in Y for every 1 time increase in change in X_1; and b_2 = Change in Y for every 1 time increase in change in X_2.

3. Results and Discussion

3.1. The Composition of Tree Saplings

The composition of the vegetation of tree saplings on the entire observation area which was found in the Malempo Hamlet of Resort Mallawa, Bantimurung Bulusaraung National Parkas many as 39 of 28 families. Arecaceae is the family with the highest number of species on the tree saplings, the Aracaceae is allegedly able to grow in many habitats. Siregar [10], said this familyis grown naturally in the

primary forest, secondary forest, including in the formerly wild and thickets cultivation area. They can grow in various circumstances such as a swamp, the dry land of lowlands, dry sandy soil, sandy clay that is periodically flooded, as well as the mountains.

3.2. The Structure of Tree Saplings

The structure of tree sapling vegetation can be seen in figure 1 for the density, figure 2 for the frequency, figure 3 for dominance, and figure 4 for IVI. *Celtisphilippensis* was the species that had the highest density, frequency, and IVI in the South area (figure 1; 2 and 4). *C. philippensis* which is dominant in term sof density, frequency, and IVI in the south area is allegedly due to the area in this direction is lower than the other two areas, (the average altitude is 600 meters above sealevel). Pitopang et al. [11] suggested that *C. philippensis* grows well in lowland forests with an altitude of up to 600 meters above sea level.

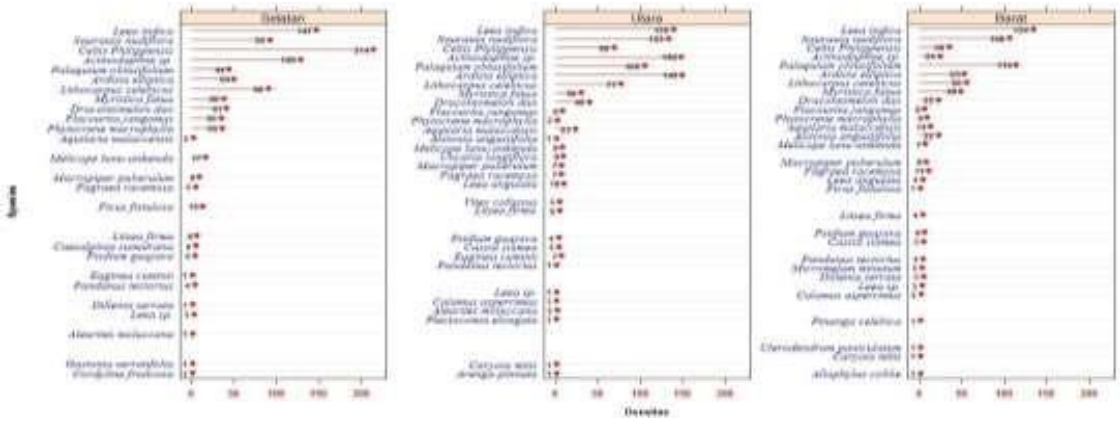

Figure 1. The density of tree sapling speciesin 3 compass-direction areas

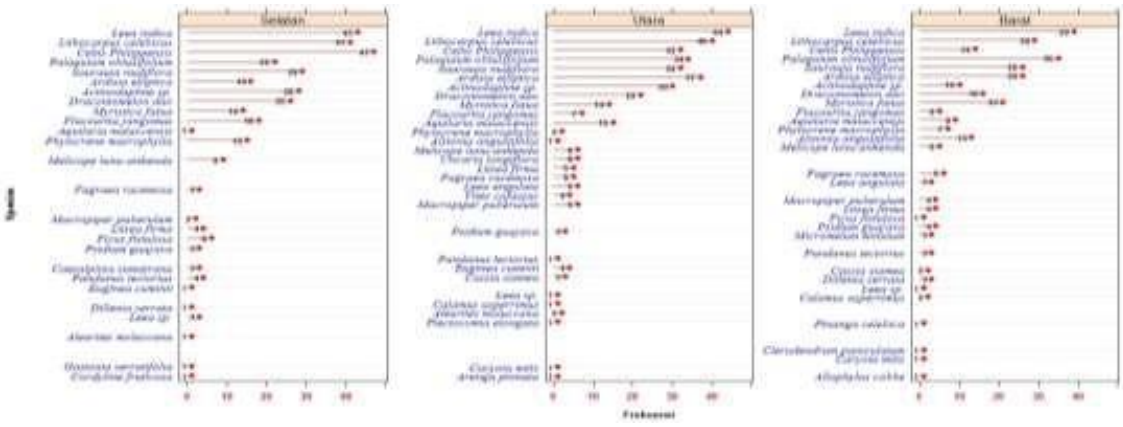

Figure 2. The frequency of tree sapling species in 3 compass-direction areas

Leeaindica was a species density and the highest frequency in the West area. In addition, the frequency of *L. indica* in the North area was also the highest (figure 1 and 2). The discovery of *L. indica* in many habitat ssuggests that this speciesh as many seeds to spread. Lok et al. [12] said that this species grows with seeds to have easier distribution ranging from forest mountain lowlands to the wet forest mountains up to 1700 m above sea level.

Saurauianudiflora was a species that had the highest IVI in the North and West area (figure 4). S. nudiflora is a species that has the highest IVI in the North and West area. This is presumably because these species have a high level of tolerance to the environment in the observation area each plant speciesh as a minimum, maximum and optimum condition against existing environmental factors [13].

Cordyline fruticosa was a species that had the lowest density, frequency, dominance, and IVI in the South area (figure 1; 2; 3 and 4).The low values of density, frequency, dominance, and IVI of *C. fruticosa* allegedly caused by the area of observation which tends to be closed so that this species is difficult to grow this species grows well in the open area and can be found in lowland forests up to 1900 meters above sea level [14].

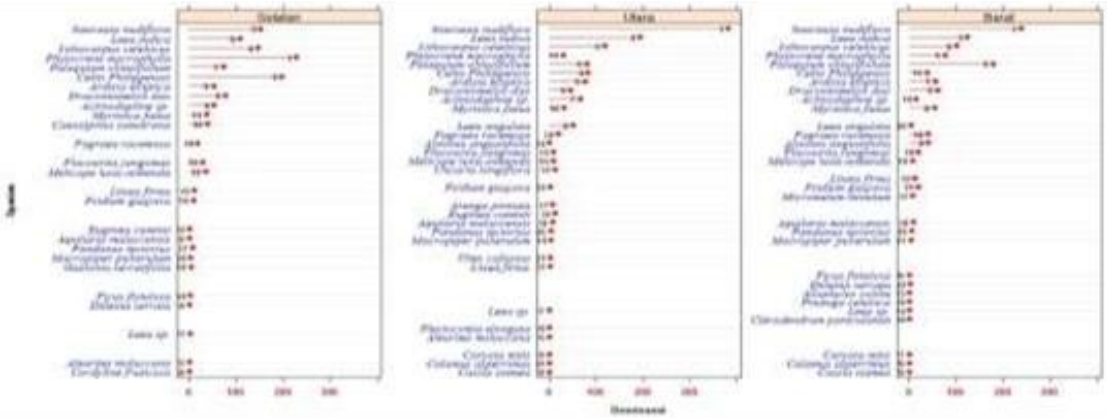

Figure 3. The dominance of tree sapling species in 3 compass-direction areas

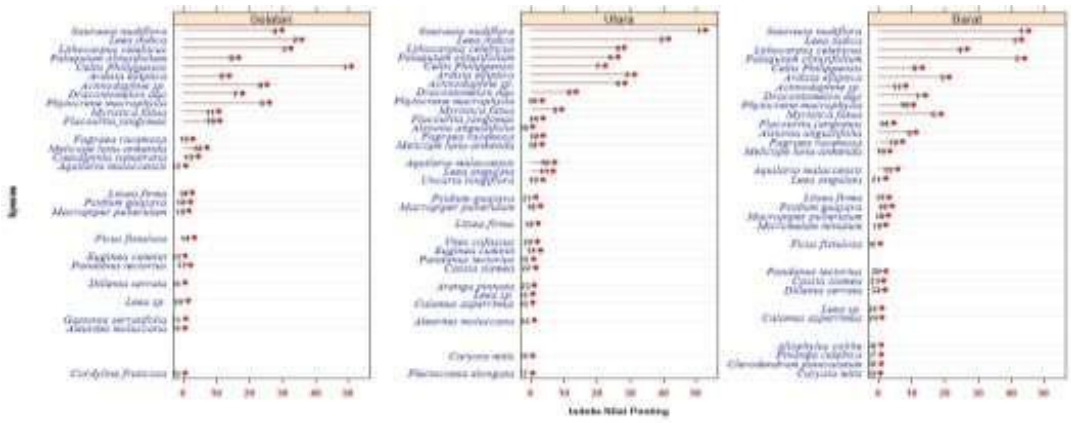

Figure 4. The Important Value Index (IVI) of tree sapling species in 3 compass-direction areas

Caryotamitis was one of the species that had the lowest density in the North and West area, while the *C. mitis* was categorized as the lowest IVI species in the West area. *C. mitis* is one of the species which have the lowest density in the Northand West area, and it is also the species with the lowest IVI in the west area. It is allegedly caused by the study area which has a canopy that covered the land so that the light does not get in the forest floor and the soil pH is not in accordance

with its growth habitats. These species require a lot of sunlight that gets to the forest floor and a mount of light obtained determining the growth of a palm species, and the pH which is suitable for the growth of this species range from 6.1-7.8 [10].

3.3. The relationship of environmental factors and the vegetation of tree saplings

The density of tree saplings increased with the low level of canopy filling and the slope declivity which is shown through the following linear regression equation: $Y = 1.478 - 0.002\ X_1 - 0.004\ X_2$; ($p<0.05$; db = 147; $t_{hit1} = -2.051$ and $t_{hit2} = -4.186$; $R^2 = 0.131$); Note: Y = density; X_1 = canopy; X_2 = the slope; The 1.478 value = intercept. The R-value of the canopy and the slope declivity were –0.207 and –0.254 with the density of tree saplings and the relationship of both correlations was relatively low.

The frequency of tree saplings increased with the lower place and canopy filling that was shown through the following equation of linear regression: $Y = 16.308 - 0.012\ X_1 - 0.017\ X_2$; ($p<0.05$; db = 148; $t_{hit1} = -2.741$ and $t_{hit2} = 2.065$; $R^2 = 0.081$); Note: Y = frequency; X_1 = altitude; X_2 = canopy; the value of 16.308= intercept. The R-value between the altitude and the frequency was-0.233 and the correlation was relatively low, while the correlation value of the canopy and the frequency was -0.185 and correlation was considered to be very low.

The dominance tree saplings increased with the higher percentage of soil without vegetation that was shown through the following linear regression equation: $Y = 2.152 \times 10 - 5 + 1.730\ X$; ($p<0.05$; db = 147; $t_{hit} = 2.019$; $R^2 = 0.026$); Note: Y = dominance; X = percentage of soil without vegetation; the Value of $2.152 \times 10 - 5$ = intercept. The R-value between the percentage of soil without vegetation and the dominance was 0.164 and the correlation was considered to be very low.

The regression equation shows that the canopy is the environmental factor that affects the density and frequency of tree saplings. The altitude is also environmental factor that affect the frequency and soil percentage without vegetation that affect the species dominance of tree saplings in the whole observation area. On the filling canopy, the growth ability of the plants is reduced which is thought to affect the abundance and spread of tree saplings, as stated by Whitmore [15] that the intensity of light is one of the factors that highly affect the growth of tree saplings, that may help accelerate the growth of shoots of saplings. Andrian et al. [16] stated that the altitude of a place causing changes in the microclimate in the premises such as light intensity and air temperature. Besides, the soil temperature is influenced by temperature, the light intensity of the sun that enters into the soil, and the water in the soil, so it affects the density, frequency, and dominance of species [17].

4. **Conclusion**

The species of tree saplings found in the Hamlet of Malempo Resort Mallawa Bantimurung Bulusaraung National Park, are as many as 28 families and 39 species. In the south area, the highest density, frequency, and IVI are for *C. philippens is* species, and the highest dominance is for P. macrophylla species, while *C. fruticosa* is a species with the lowest density, frequency, dominance,

and IVI in the south area. In the North area, the species with the highest density is *A. elliptica*, the highest frequency is *L. indica*, dominance and thehighest IVI is *S. nudiflora*, while the lowest density is for *C. mitis*, the lowest frequencyis A. pinnata, dominance and the lowest IVI is for *C. asperrimus*. In the west area, the species with the highest density and frequency is L. indica, the highest dominance, and IVI is *S. nudiflora*, while the lowest density and IVI owned by the *C. mitis* species, the lowest frequency is *C. paniculatum*, and the lowest dominance is *C. asperrimus.* And the density of tree saplings has a negative relationship with with altitude and canopy. The dominance of tree saplings has a positive relationship with the canopy and slope declivity. The frequency of tree saplings has a negative relationship the percentage of soil without vegetation.

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