Vegetation structure of sapling plant at Bantimurung Bulusaraung National Park Balloci Resort South Sulawesi

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Vegetation structure of sapling plant at Bantimurung Bulusaraung National Park Balloci Resort South Sulawesi

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Abstract: Tropical rainforests are dwindling so that the protected areas of the tropics are very important. Sapling plants as part of the undergrowth plants are an inseparable part of the forest ecosystem and play an important role in the sustainability of the forests, including forests in the tropics. We examine the structure and composition of sapling plants in Bantimurung Bulusaraung National Park, Balloci resort, in two areas, which are Bukit Batu Putih and Gunung Bulusaraung. This national park is one of the protected areas in Province of South Sulawesi, Indonesia. Species with the highest importance value index in Bukit Batu Putih are *Tabernaemontana sphaerocarpa*, *Homalium guianense*, *Micromelum minutum*, *Lepiniopsis ternatensis* and *Melicope lunu-ankenda* with a total of 191.84%, while the lowest are *Planchonella firma*, *Coffea* sp., *Matthaea sancta*, *Ficus pumila* and *Syzygium ingens* with a total of 1.58%. Species in Gunung Bulusaraung with the highest important value index are *Daemonorops longipes*, *Actephilla excelsa*, *Memecylon paniculatum*, *Galbulimina belgraveana* and *Ficus gul* with a total of 126.31%, while the lowest are *Arenga pinnata*, *Pterospermum celebicum*, *Ficus ampelas*, *Antidesma bunius* and *Cyathea contaminans* with a total of 2.68%. The value of Shannon-wiener diversity, Simpson's diversity index, species richness, Pielou's evenness index, and Rarefaction in Bukit Batu Putih is lower than that of Gunung Bulusaraung and only Simpson's dominance index is higher indicating of lower species diversity in Bukit Putih area. The value of similarity index between Bukit Batu Putih and Gunung Bulusaraung is 23.71% indicating that these two areas have a high difference in the structure and composition of sapling plant vegetation.

1. Introduction

Forests are very important for biodiversity [1]. Vegetation research in the tropics focuses more on vegetation structures with tree life forms, while studies that examine the undergrowth plants in which including tree saplings are still very rarely performed [2]. Sapling plants as part of the undergrowth plants are an inseparable part of the forest ecosystem and play an important role in the sustainability of the forests, including forests in the tropics [3].

Tropical rainforests are dwindling so that the protected areas of the tropics are very important [5]. Many areas of the tropics are likely to survive only in protected areas due to the high rate of deforestation [6]. The same is true for forests on the island of Sulawesi that has high biodiversity, as well as some, are endemic. However, at this time the forest is decreasing and remaining only in mountainous areas and protected areas [7].

The Bantimurung Bulusaraung national park (Babul NP) is one of the protected areas in Province of South Sulawesi. Given the importance of Babul NP as a natural resource area that has a unique biodiversity [8] and protected area, it needs protection and conservation. One approach that needs to be done is to understand the ecological conditions of vegetation plants that include plants at the level of the sapling.This study aims to determine the composition and structure of sapling plants in Balloci Resort, Babul NP, Maros District.

2. Experimental Details

2.1. Study Area

The research was conducted at the Tompobulu village, Resort of Balloci, Bantimurung Bulusaraung National Park, District of Maros Province South Sulawesi, Indonesia in March-April 2016. The sampling was conducted in two areas, that was: Bukit Batu Putih (GBP) and Gunung Bulusaraung (GBS). Bukit batu putih has an altitude up to 1,135 m asl while GBS up to an altitude of 1,353 m asl. According to [8] GBS is the highest peak in this national park.

Bantimurung Bulusaraung National Park is one of the national parks located in Province of South Sulawesi, Indonesia and appointed by Decree of the Minister of Forestry of the Republic of Indonesia No. 398/Menhut/ II /2004. This national park is located in two areas of government administration, that is regency of Maros and regency of Pangkep [8]. People around Mallawa resort which is one of the resorts in Babul NP cultivate many orchids obtained from within Babul NP for conservation purposes [9].

2.2. Sampling and Data Analysis

We randomly placed 10 transects with the size of 100 x 5 m in each of the areas. In each transect we made 10 plots with the size of 5 x 5 m. The total number of transects in the study area was 20, composed of 200 observation plots. We counted every sapling in the plot. Each sapling in the plots was measured its crown diameter and then identified to the species level. We collected voucher specimens of each sapling plant. We made identification of scientific name of the species in the field. The sapling plant species that cannot be identified were identified through voucher specimens, using books by [10]. Consultation with local resident and official of Babul NP were also done on the identification activity.

We calculated the crown cover which is the value of dominance [11]. Important value indices (IVI) is calculated by the following formula:

$$IVI = \text{relative density} + \text{relative frequency} + \text{relative dominacy}$$

where IVI is importanta value index [11].

We calculated Shanon-Wienner Diversity index (H'), Species richness (S) [12], Simpson dominance index (D), Simpson diversity index (λ) [13] Pielou's evenness index (E) [14]. We also specify the rarefaction value [15] and make Rank abundance curve [16] of the vegetation in both regions.We assessed the similirarity between BBP and GBS using Sorensen index of similarity (SI) [11].

3. Results and Discussion

The total plant families found throughout the study sites were 29, with a total of 54 species. There were 15 families and 27 species found in BBP. In GBS, the number of families found as many as 25 with the number of species as many as 48, however, one species can not be identified in this area.

The dominant family in BBP in terms of the number of species is Rutaceae which has 4 species, while Lauraceae, Myrtaceae, Rubiaceae each has 3 species. The dominant family in GBS is Myrtaceae with 5 species, and Euphorbiaceae, Lauraceae, Myristicaceae each is having 4 species, while in this area Rubiaceae and Rutaceae each is having 3 species.

Table 1. Species that included in the 10 species with highest importance value in BBP and GBS, Babul NP.

Bukit Batu Putih (BBP)				
Species	Rde	RFr	RDo	IVI
Tabernaemontana sphaerocarpa	17.898	17.850	24.198	59.947
Homalium guianense	17.118	9.789	12.560	39.467
Micromelum minutum	12.438	13.436	13.108	38.982
Lepiniopsis ternatensis	20.813	7.678	1.504	29.994
Melicope lunu-ankenda	4.392	5.950	13.104	23.447
Pavetta indica	7.020	9.597	6.560	23.176
Gastonia serratifolia	4.721	5.758	9.729	20.208
Actinodaphne macrophylla	6.199	5.950	2.492	14.641
Psidium guajava	2.874	5.182	2.612	10.668
Actinodaphne sp.	1.642	1.919	3.635	7.196
Gunung Bulusaraung (GBS)				
Species	Rde	RFr	RDo	IVI
Daemonorops longipes	11.021	7.627	22.299	40.947
Actephilla excelsa	17.544	8.475	9.807	35.825
Memecylon paniculatum	5.218	7.345	7.019	19.582
Galbulimina belgraveana	6.838	4.379	5.203	16.419
Ficus gul	4.274	6.356	2.907	13.536
Actinodaphne macrophylla	4.723	5.085	3.489	13.297
Pavetta indica	5.758	4.802	2.719	13.280
Allophylus cobbe	4.004	3.955	5.110	13.068
Knema cinerea	2.969	4.944	4.320	12.232
Lepiniopsis ternatensis	4.184	4.802	2.488	11.474

Rde=Relative density, RFr = Relative frequency, Rdo = Relative dominance, IVI = Important value index. Species in each area were ranked by their IVIs.

The plant families that only found in BBP are Araliaceae, Meliaceae and Salicaceae which make up 20% of families in BPP. The plant families that only found in GBS are Sapindaceae, Annonaceae, Arecaceae, Clusiaceae, Cyatheaceae, Anacardiaceae, Fagaceae, Himantandraceae, Malvaceae, Melastomataceae, Pandanaceae, Pentaphylacaceae, Phyllanthaceae. These families comprise 52% of sapling families in GBS.

The family of Myrtaceae can be found abundantly in Australia, Southeast Asia, South and Central America, and is also distribute in some area of Africa [17]. This family is found as the largest constituent of small trees in an old-growth coastal temperate rain forestof Chiloe´ Island, Chile [18], and forest with open canopy will greatly reduce its presence [19].

Table 1 shows 10 species that have the highest IVI in BBP and GBS. Tabernaemontana sphaerocarpa was a species with the highest IVI in BBP (59.947%), this species also has the highest frequency and largest canopy cover. The species with the highest density value was Lepiniopsis ternatensis, although its crown cover was the lowest compared to the other 9 species. The species with the highest IVI in GBS was Daemonorops longipes (40.947%) and was also a species with the largest crown cover. The total percentage of IVI of 5 species with the highest IVI in BBP was 191.84% and in GBS was 126.31%. Pavetta indica and Actinodaphne macrophylla were belonging to species that have IVI highest of 10 both in BBP and GBS, and there were no species belonging to species with IVI highest of 5 both in the study site.

The IVI value of *D. longipes* is the highest in the GBS area because the density, frequency, and dominance value of this species also have a high value. An altitude of 1200 m asl, environmental conditions affect the density of rattan rods and vertical structures. Species *D. longipes* has low tolerance to low temperatures. Cold environments may suppress high growth of rattan [20], therefore we didn't find this species that growth very hight at the study sites. The growth of rattan that tends to creeping causes the canopy cover to be large.

Planchonella firma, *Coffea* sp., *Matthaea sanct*a, *Ficus pumila* and *Syzygium ingens* are the 5 species with the lowest IVI in BBP with a total of 1.58%, while in GBS the lowest are *Arenga pinnata*, *Pterospermum celebicum*, *F. ampelas*, *Antidesma bunius* and *Cyathea contaminans* with a total of 2.68%.

The value of H', S, λ , E, and Rarefaction in BBP is lower than that of GBS and only D is higher that is 0.10 in BBP and 0.05 in GBS indicating of lower species diversity in BBP area (Table 2). The lower value of species diversity in BBP can also be seen at the rank abundance curve (Fig. 1) where the curve or BBP is shorter than that of GBS. The rank abundance curve also indicates that there are species that are more dominant in BBP and the number of species in that location is less than that of in GBS.

Tabel 2. Value of H', D, S, Rarefaction, λ, and E in BBP and GBS.

	BBP	GBS
H'	2.27	3.03
D	0.10	0.05
S	27	48
Rarefaction	26.70	49
λ	0.89	0.94
E	0.69	0.78

The BBP area has a lower species richness compared to the GBS area. The leastwise of the number of species found in the BBP area probably because this area was a secondary forest making it easier to get interference from humans. Much of BBP area was formerly an agricultural land that could be proved by *Coffea* sp., and elephant grass (*Pennisetum purpureum*) which was found growing in this area where these plants were plantation crops of the residents. [21] aid that many people use natural resources around Babul NP for daily living needs.

The species diversity of BBP area is lower than that of GBP area because its species evenness is also low. This is relevant to [22] that the diversity of vegetation will be higher in an area with a relatively large number of species where the number of individuals is distributed evenly among the species of vegetation.

Sorenson's SI value for sapling vegetation in BBP with GBS is 27.71%. The number of species present in the two regions is so small that it is suspected to cause the SI value to become low.

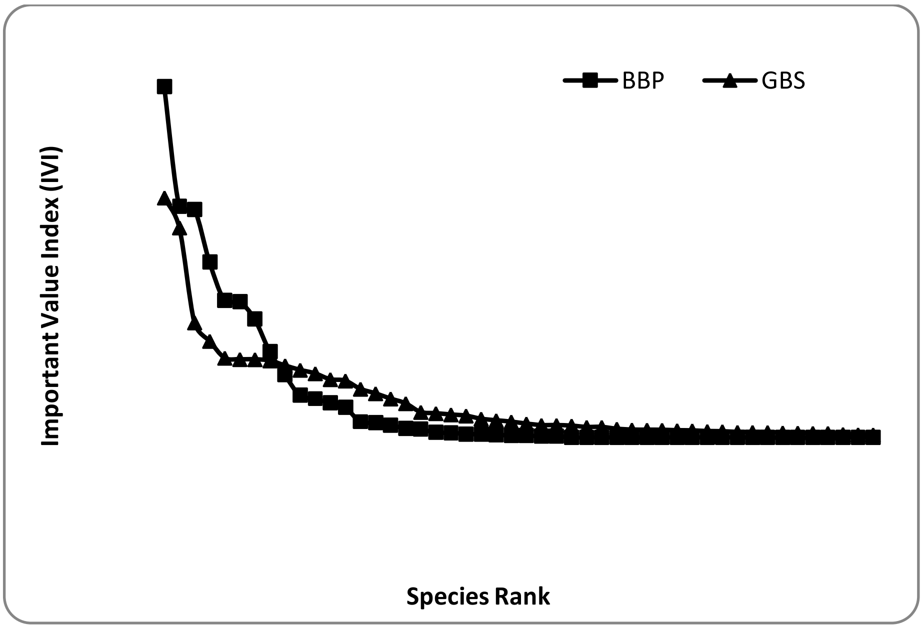

Figure 1. Rank abundance curve of BBP and GBS.

In the area of BBP it was found only 6 species (22.22%) while in GBS it was found as many as 27 species (56.25%) and this condition probably made the structure and composition of sapling vegetation in these two areas relatively different.

4. Conclusion

There is a difference of vegetation composition and structure at the sapling level between the BBP area and the GBS area. In the GBS area there are many species that are only found in that area, whereas in the BBP area, the biodiversity of sapling vegetation is relatively low. As part of Babul NP which is a protected area, sapling vegetation is part of the regeneration within the forest in these two areas, so it needs to be managed with better management in order to preserve the natural resources within the park.

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