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Distribution and Status of the Rare Plants Found in Mount Sibela Bacan Nature Reserve



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**Abdurasyid Tolangara^{*1}, Hasna Ahmad², Said
Hasan³, I Nengah Korja⁴**

*1Khairun University, Faculty of Teacher Training and
Education, Biology Education, Indonesia*

*2Khairun University, Faculty of Teacher Training and
Education, Biology Education, Indonesia*

*3Khairun University, Faculty of Teacher Training and
Education, Biology Education, Indonesia*

4Tadulako University, Faculty of Forestry, Indonesia

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ABSTRACT

Introduction. There are a lot of rare plant species can be found in Mount Sibela nature reserve, Bacan District. However, they start to vanish since people living around the area make use of them without permission. Therefore, it is necessary to investigate the distribution and status of the rare plants. Method. This study was conducted from June to August 2017 in a mount sibela nature reserve. Line transect sampling technique was employed to collect vegetation based on its Tree Level. Conclusion. Research findings show that there are four plant species distributed randomly in Mount Sibela nature preserve. They include *Vitex parviflora* Juss., *Pericopsis mooniana* (Thw.) Thw., *Pterocarpus indicus* Wild., *Agathis dammara* (Lamb.). In addition to that, two species are spread in groups. They are *Mangifera altissima* Blanco and *Aglaia smithii* koord. The status of *Vitex parviflora* Juss will be probably changed from "rare/vulnerable" (Vu) into "rare on the inhibited areas". Meanwhile, *Pterocopsis moontiana* (Thw.) Thw., then *Pterocarpus indicus* Wild and *Aglaia smithii* Koord. will soon change its status from "rare/vulnerable" (Vu) into "critical" (CR) due to its decreasing population (the amount of the individuals) and inhabited areas.



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INTRODUCTION

Indonesia is one of the countries in the world which has the highest number of biodiversity which is also known as the mega-biodiversity country. Its natural wealth has been used to support national development and the forests have served a role as the lungs of the world which have to be sustained [7].

Biodiversity in Indonesia comprises plants, animals, and microorganisms. Sakura [5] explains that millions of plants, animals, and microorganisms can naturally live in varied communities and ecosystems. Among them are rare species. In Indonesia, however, the population of the rare plants has been decreasing. Therefore, conservation efforts are needed to protect both the number of the individuals and the diversity so that their extinction can be avoided [3].

The population has characteristics including a) population density which is represented by the average number of population individuals living in a certain area. Population density is also determined by birth rate, mortality, and migration; b) population growth; it is indicated by the amount of the members. If the number of the population decreases in nature, it can be concluded that the species is being endangered [6].

According to Wiens [9], individuals from a particular population are more likely to stay in the same area despite their habitat diversity and revolutionary consequences. In a stable environment condition, similar genomes will live much longer. This pattern, however, tends to turn down genetic diversity so that the population is no longer able to provide responses to rapid nature transformation. This condition, thus, stimulates population changes of a certain species.

Some rare plant species have been found in Mount Sibela nature reserve. The results of a survey, unfortunately, indicate that people living nearby make use of the plants without getting any permission from the conservation management. If this continues to happen, the plants could probably start to vanish. Therefore, this study was aimed to investigate the distribution and status of the rare plant's population.

MATERIALS AND METHODS

The present study was conducted from June to August 2017 in Mount Sibela nature reserve, Bacan District. Line transect sampling technique was employed to collect vegetation. Transects were created in every region of Mount Sibela nature reserve. They were created on

the left and right side of linear stubs (as the axis). The length of every transect was 100m, the width was 50 m, and the distance between transects was 20 m. An observation plot of 10 X 10m was put along the transects.

Materials used were: an altimeter, a diameter tape, global positioning system (GPS), garden scissors, herbarium labels, plastic bags, newsprint, and alcohol 70%. Observed plants included endangered trees and saplings. The stem diameter of the trees was ($\varnothing > 20$ cm) and the stem diameter of the saplings was ($\varnothing = 10-20$ cm). The stem diameter was measured from ± 130 cm above ground level or 20 cm above the flood start point. The vegetation parameters covered a number of species, a number of individuals for each population (density) and diameter of the trees and saplings, (domination) by referring to the formula suggested by Hilton-Taylor [2]. The individuals were identified further for species determination.

Data on vegetation parameters were analyzed by calculating the population density, domination, frequency, and important value index (in percentage) of each tree using a formula suggested by Cox; Mueller-Dombois and Ellenberg, (1974 in Telangana, [8] as follows. The important value index of a species (IVI in %) = RD_i (%) + Rf_i (%) + RC_i (%). To identify rare plants, distribution patterns of the plants were measured using the law of ranks by Taylor-Philips, [4]. It combined basal area and IVI of each species and it was then checked with rules in Hilton-Taylor [2]. The formula used to calculate the distribution pattern is explained below:

$$b = \frac{a(\text{Log}x^2)(\log S^2) - (\text{Log}x^2)(\log S^2)}{(\text{Log}x^2) - (\log X^2)}$$

Note:

n = number of observed locations

b = distribution pattern

x = average number of a species

S = variance of all species

RESULTS AND DISCUSSION

1. Distribution Patterns

The distribution patterns of the six rare plants are found using Taylor's rank calculation (Table 1). The results of the research show that the distribution patterns of the rare plants are random and live in groups. This is in line with Hilton-Taylor [2] who state that big changes can lead to the extinction of a plant species because most of the individuals live in small groups, which are isolated and separated from their environment. These groups become scarce since they have very little chance to live with other individuals.

Table 1. The distribution pattern, basal area, and IVI of rare plants found in Mount Sibela Nature Reserve

No	Indonesian Name	Scientific Name	Distribution Pattern (Id)	Basal area (m ²)	IVI (%)
1.	Kayu Kula	<i>Vitex parviflora</i> Juss	0.08 (random)	0.66	1.9
2.	Kayu Kuku	<i>Pericopsis moontiana</i> (Thw.)Thw	0.07 (random)	0.54	2.6
3.	Angsana	<i>Pterocarpus indicus</i> Willd	0.06 (random)	0.62	2.7
4.	Embacang	<i>Mangifera altissima</i> Blanco.	2.62 (live in groups)	1.43	3.4
5.	Batukanag	<i>Aglaia smithii</i> Koord.	1.87 (live in groups)	0.82	2.8
6.	Pohon Damar	<i>Agathis dommara</i> (Lamb.)	0.05 (random)	11.24	8.2

Source: Research Data, 2017.

Note: Id <0, uniformed distribution pattern, b = 1, random distribution pattern, b > 1, group distribution pattern. Basal area = area of occupancy of a species, IVI(%) = Important Value Index of a species.

Table 2. List of Eight Rare Plants found in Mount Sibela Nature Reserve

Sr. No.	Indonesian Names	Scientific Name	Category	Source
1.	Kayu Kula	<i>Vitex parviflora</i> Juss	Vulnerable (Vu; A1cd)	(1)
2.	Kayu Kuku	<i>Pericopsis moontiana</i> (Thw.)Thw	Vulnerable (Vu; A1cd)	(2)
3.	Angsana	<i>Pterocarpus indicus</i> Willd	Vulnerable (Vu; A1d)	(1)
4.	Embacang	<i>Mangifera altissima</i> Blanco.	Vulnerable (Vu; A1d)	(2)
5.	Batukanag	<i>Aglaia smithii</i> Koord.	Vulnerable (Vu; A1c)	(2)
6.	Pohon Damar	<i>Agathis dommara</i> (Lamb.)	Vulnerable (Vu; A4cd)	(2)

Note Groombridge and Jenkins [1], Hilton-Taylor [2].

2. Population Status

Research findings show six endangered plants named *Vitex parviflora* Juss., *Pericopsis moontiana* (Thw.) Thw., *Pterocarpus indicus* Willd., *Mangifera altissima* Blanco., *Aglaia smithii* Koord and *Agathis dammara* (Lamb.). The rare status refers to Groombridge and Jenkins [1], and Hilton-Taylor [2] (Table 1.).

Vitex parviflora Juss., or Kayu Kula (Indonesian name) lives with a random pattern. They can be found on 0°44'3" S and 127°32'9" E. This species was first categorized endangered (Vu: A1cd) (Groombridge and Jenkins), [1] since the number of individuals was only 15 in 10,000 m². If it is compared to the area of Mount Sibela nature reserve, then there will be only 100,000 individuals found in 23,024 Ha with 0.66 m² basal area. Important Value Index (IVI) of the species was 1.9% which shows its little importance. Based on IUCN Red List in Hilton-Taylor [2], one of the characteristics of vulnerable (Vu) plants is that if the taxon does not belong to CR (critical) or EN (endangered), but it is likely to disappear in the distant future. The population of the species, in other words, is very small or limited, and the areas inhabited by the population are restricted (less than 100 km²).

Pterocopsis moontiana (Thw.) Thw. or Kayu kuku (Indonesian name) lives randomly on 0°46'4" S and 127°32'11" E. Previous research categorized this species into vulnerable (Vu: A1cd), if it referred to Hilton-Taylor, [2]. It means that there are only 36 individuals in 10,000 m² or 100,000 individuals in 23,024 Ha (Mount Sibela area) of which basal area is 0.54 m². The IVI of this species was 2.6% which indicates that the number of individuals has decreased significantly around 80%. This is in line with IUCN *IUCN Red List* in Hilton-Taylor [2] which mentions that a taxonomic group can be categorized CR (critical) if the taxon is likely to extinct shortly. The extent of occurrence of the species is estimated less than 5000 km² since its population declines continuously and has a random distribution pattern.

Pterocarpus indicus Willd. or Angsana (Indonesian name) which can be found on 0°44'3" S and 127°32'9" E also lives in a random pattern. Previous research findings have proved that this species belongs to vulnerable category (Vu: A1cd) if it referred to Groombridge and Jenkins, [1]. The number of the individuals are estimated around 38 in 10,000 m². If it is compared to the area of Mount Sibela nature reserve, then there will be only 100,000 individuals in 23,024 Ha (basal area = 0.62 m²). In 2,693 m², the IVI of the species is 2.7%

which shows its little importance. IUCN *IUCN Red List* in Hilton-Taylor [2] states that a taxonomic group belongs to CR (critical) group if the population of the species is going to reduce at least 75%. It is predicted that this species can be found in the next 10 years or 3 generations. It also experiences the reduction of the number of regions with a random pattern.

Mangifera altissima Blanco or Embacang (Indonesian name) which lives in groups can be found on $0^{\circ}44'4''S$ and $127^{\circ}32'11''E$. The results of the research on this species conclude that it probably belongs to vulnerable (Vu: A1d) group according to Hilton-Taylor, [1]. This happens because of the number of individuals in 10.000 m^2 are 41. If it is compared to the area of Mount Sibela nature reserve, then there will be only 100.000 individuals in 23.024 Ha (basal area = 1.43 m^2). Converted into 6.211m^2 , the IVI of the species is small (3.4%). According to IUCN *IUCN Red List* in Hilton-Taylor [2], a taxonomic group can be categorized vulnerable (VU) if it does not belong to CR (critical) or endangered (EN), but it will probably soon vanish. The extent of occurrence of this species is estimated less than 5000 km^2 because the species population keeps declining on the inhibited areas. Besides, the distribution pattern of the species shows that it lives in groups.

Aglaia smithii Koord. or Batukanag (Indonesian name) live in groups on $0^{\circ}44'3''S$ and $127^{\circ}32'9''E$. Based on the results of the research, referring to Hilton-Taylor, [2], this species is categorized vulnerable (Vu: A1c). There are 43 individuals in 10.00 m^2 or 100.000 individuals in 23.024 Ha (Mount Sibela nature reserve area) of which basal area is 0.82 m^2 . In 3.562m^2 , the IVI of the species is 2.8% which indicates that it has little importance. According to *IUCN Red List* in Hilton-Taylor [2], a taxonomic group can be categorized vulnerable (VU) if it does not belong to CR (critical) or endangered (EN), but it will probably soon vanish. The extent of occurrence of this species is estimated less than 5000 km^2 because the species population keeps declining on the inhibited areas. Besides, the distribution pattern of the species shows that it lives in groups.

Agathis dommara (Lamb.) or damar trees (Indonesian name) live with a random pattern on $0^{\circ}44'3''S$ and $127^{\circ}32'9''E$. Based on the results of the research, this species can be categorized vulnerable (Vu: A4cd)(Hilton-Taylor, [2]) with 25 individuals found in 10.000 m^2 . When it is compared to the area of Mount Sibela nature reserve (23.024 Ha) which has 11.24 m^2 of basal area, the conversion will result in 48.819m^2 and 8.2% of IVI which shows small importance value. According to *IUCN Red List* in Hilton-Taylor [2], a taxonomic group can be categorized vulnerable (VU) it does not belong to CR (critical) or endangered (EN), but will

probably soon vanish. The extent of occurrence of this species is estimated less than 100 km² and its distribution pattern is to live in groups.

CONCLUSION

Research findings show that there are four plant species distributed randomly in Mount Sibela nature preserve. They include *Vitex parviflora* Juss, *Pericopsis mooniana* (Thw.) Thw, *Pterocarpus indicus* Wild, *Agathis dammara* (Lamb.). In addition to that, two species are spread in groups. They are *Mangifera altissima* Blanco and *Aglaia smithii* koord.

The status of *Vitex parviflora* Juss will be probably changed from “rare/vulnerable” (Vu) into “rare on the inhibited areas”. Meanwhile, *Pericopsis moontiana* (Thw.)Thw. Then *Pterocarpus indicus* Wild and *Aglaia smithii* Koord. Will soon change its status from “rare/vulnerable” (Vu) into “critical” (CR) due to its decreasing population (the amount of the individuals) and inhabited areas.

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