Diversity of undergrowth understorey in Sibolangit Nature Park, Deli Serdang Regency, North Sumatra, Indonesia

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Abstract. The Sibolangit Nature Park area is one of the Nature Parks in North Sumatra which has various types of diverse plants ranging from understorey, epiphytes and various endemic tree species. The purpose of this study was to see the diversity of understorey species found in the Sibolangit Nature Park and its benefits. The results showed that there were 27 types of understorey plants from 18 families. Based on the family, the most commonly found were the Araceae family, namely 6 species (22.22%) and Zingiberaceae (11.11%). The understorey has the potential for medicinal plants, ornamental plants, poisonous plants, etc. The results showed that there were 15 species (55.5%) which were included in the category of ornamental plants, 7 species (25.92%) were included in medicinal plants, 1 species of poisonous plants (3.70%), 1 species of spice plants (3.70%), and 1 species (3.70%) protected plants and 2 species (7.40%) could not be explained scientifically. A protected and endangered plant species is Amorphophallus titanum

1. Introduction

Understorey is vegetation that occupies the lower layer of a tree community. The tree community can be in the form of natural forest or plantation forest [1]. The understorey serves as a ground cover that can withstand direct raindrops so as to minimize erosion on the soil surface. In addition to ecological functions, several types of understorey have been identified as plants that can be used as food, medicinal plants, and as alternative energy sources [2]. Understorey plants in a stratified arrangement occupy the lowest layer which has a height of < 4.5 m and a trunk diameter of about 2 cm [3].

Sibolangit is located in Sibolangit Village, Sibolangit District, Deli Serdang Regency, North Sumatra Province. Meanwhile, geographically, Sibolangit Nature Park is located between 98°36’36"-98°36’56" East Longitude and 3°17’50"-3°18’39" North Latitude. Sibolangit Nature Park under management of the Conservation Section II Stabat, Regional KSDA Division I Kabanjahe, North Sumatra Natural Resources Center. Some of the flora that grows in this area are native and some come from outside (exotic plants).
In the Sibolangit Nature Park area, it is also united with the Sibolangit Nature Reserve with a total area of 110 ha. Sibolangit nature park and nature reserve are located at an altitude of 300 to 350 meters above sea level with a wavy topography [4]. Various types of understorey in this area need to be studied to add scientific data on understorey plants in the Sibolangit area. The aims of this study were (1) to analyze understorey vegetation and the diversity of understorey species (2) to determine the potential benefits of understorey plants, (3) to identify protected species in the Sibolangit Nature Park area.

2. Material and method
This research was conducted at the Sibolangit Nature Park, Sibolangit District, North Sumatra Province in 2020. Detailed research locations can be seen on the map below.

![Figure 1. Map of Sibolangit Nature Park](image)

2.1. Understorey Vegetation Analysis
The vegetation analysis carried out in the field includes an analysis of understorey vegetation which is carried out by making plots measuring 2 x 2 meters as many as 62 plots.

2.2. Analysis data

2.2.1. Important Value Index (IVI). Importance value index is a quantitative parameter that can be used to express the level of dominance (level of control) of species in a plant community. Important value index (IVI) is calculated by the formula [4]:

\[
IVI = RD + RF
\]  

Note:
\[RD = Relatif\ Density\]
\[RF = Relatif\ Freuncy\]
\[D = \frac{\text{Number individual of a species}}{\text{Sample plot area}}\]
Frequency (F)

\[ F = \frac{\text{Number plot found of a species}}{\text{Total number of plots}} \]  (3)

Relative Density (RD)

\[ \text{RD} = \frac{\text{Density of a species}}{\text{Total density of all species}} \]  (4)

Relative Frequency (RF)

\[ \text{RF} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \]  (5)

Diversity of species which also shows the level of stability of the vegetation, the following Diversity index of Shannon Wiener [5].

\[ H' = - \left[ \frac{n_i}{N_t} \ln \left( \frac{n_i}{N_t} \right) \right] \]  (6)

Information: \( H \) = Shannon Wiener diversity index
\( N_i \) = Number of individuals of the i-th species
\( N_t \) = Total sum for all individuals

The criteria for the value of the Diversity Index according to [6] are: (a) Low, if the \( H \) value <1, (b) Medium, if the \( H \) value is between 1 and 3, (c) High, if the \( H \) value is> 3.

3. Results and Discussion

3.1. Diversity of understorey species

The results showed that there were 27 types of understorey plants from 18 families. Based on the family, the most commonly found were the Araceae family, namely six species (22.22%) and Zingiberaceae three species (11.11%). The understorey has the potential for medicinal plants, ornamental plants and poisonous plants. The types of understorey found in the Sibolangit Nature Park in detail can be seen in Table 1.

There are 18 understorey plants in the study area, namely Araceae 6 species (22.22%), Zingiberaceae 3 species (11.11%), Piperaceae 2 species (7.41%), rubiaceae 2 species (7.41%). Other families which consist of 1 species (3.70%) include Hypoxidaceae, Marattiaceae, Selaginellaceae, Pandanaceae, Musaceae, Begoniaceae, Arecaceae, Asteraceae, Commelinaceae, Fabaceae, Gesneriaceae, Orchidaceae, Dioscoreaceae and Urticaceae. species from the Araceae family are the most common families in the study site. Araceae is one of the dominant tropical families. According [7] araceae is strongly supported as a monophytic group with the inclusion of Lemnaceae, Araceae are most diverse and plentiful in the humid tropics and it is there that richest variety of their life forms is found.

The results showed that there were 15 species (55.5%) which were included in the category of ornamental plants, 7 species (25.92%) were included in the medicinal plants, 1 species of poisonous plants (3.70%), 1 species of spice plants (3.70%), and 1 species (3.70%) protected plants and 2 species (7.40%) could not be explained scientifically. A protected and endangered plant species, namely Amorphophallus titanium. Compare with [8] the present study on wild ornamental plants of Garo Hills, Meghalaya reveals that, there are about 104 species belonging to 91 genera and 38 families.
| No | Local name          | Scientific name          | Family                  | Utilization            | DR  | RF  | IVI | H'  |
|----|---------------------|--------------------------|-------------------------|------------------------|-----|-----|-----|-----|
| 1  | Bunga bangkai       | *Amorphopalis titanium*  | Araceae                 | Not mentioned          | 0.57| 1.30| 1.88| 0.03|
| 2  | Kopi                | *Coffea robusta*         | Rubiaceae               | Medicinal plant        | 3.27| 9.74| 13.02| 0.11|
| 3  | Singkut             | *Curculigo capitulate*   | Hypoxidaceae            | Ornamental plant       | 0.57| 1.30| 1.88| 0.03|
| 4  | Paku gajah          | *Angiopteris avecta*     | Marattiaceae            | Ornamental plant       | 0.19| 0.65| 0.84| 0.01|
| 5  | Sirih merah         | *Piper porphyrophyllum*  | Piperaceae              | Ornamental plant       | 0.57| 1.30| 1.88| 0.03|
| 6  | Cekala redam        | *Zingiber loezingii*     | Zingiberaceae           | Not mentioned          | 1.54| 3.25| 4.79| 0.06|
| 7  | Cekala              | *Zingiber eliator*       | Zingiberaceae           | Spices and medicinal   | 4.23| 3.90| 8.14| 0.13|
| 8  | Leka - leka         | *Globba pandula*         | Zingiberaceae           | Medicinal plant        | 1.35| 3.25| 4.60| 0.06|
| 9  | Paku akar - cupak   | *Selaginella sp.*        | Selaginellaceae         | Ornamental plant       | 3.85| 7.14|11.00| 0.13|
| 10 | Cupak              | *Mycetia cauliflora*    | Rubiaceae               | Ornamental plant       | 1.35| 2.60| 3.95| 0.06|
| 11 | Pandan              | *Freycinietta insignis*  | Pandanaceae             | Ornamental plant       | 0.19| 0.65| 0.84| 0.01|
| 12 | Uncim               | *Musa sp.*               | Musaceae                | Ornamental plant       | 1.35| 3.25| 4.60| 0.06|
| 13 | Begonia             | *Begonia bracteata*      | Begoniaceae             | Ornamental plant       | 0.39| 1.30| 1.68| 0.02|
| 14 | Salak               | *Salacca zalacca*        | Areceae                 | Medicinal plant, fruit| 0.77| 1.30| 2.07| 0.04|
| 15 | Tengkonde           | *Pholidendron rubescens* | Araceae                 | Ornamental plant       | 0.77| 1.30| 2.07| 0.04|
| 16 | Turpis              | *Homalomena philippinensis* | Araceae             | Ornamental plant       |12.91| 8.44|21.35| 0.26|
| 17 | Rhapidopora         | *Rhadipophora foraminifera* | Araceae          | Ornamental plant       | 3.47| 4.55| 8.01| 0.12|
| 18 | Scindapus           | *Scindapsus sp.*         | Araceae                 | Ornamental plant       | 5.20| 5.19|10.40| 0.15|
| 19 | Sygononium          | *Sygonium podophyllum*   | Araceae                 | Ornamental plant       | 0.77| 2.60| 3.37| 0.04|
| 20 | Kirinyuh            | *Chromolaena odorata*    | Asteraceae              | Medicinal plant        | 0.39| 0.65| 1.03| 0.02|
| 21 |                  | *Forrestia molissima*    | Commelinaceae           | Medicinal plant        | 5.59| 5.19|10.78| 0.16|
| 22 | Tuba                | *Derris eliptia*         | Fabaceae                | Poisonous plant        | 1.35| 1.95| 3.30| 0.06|
| 23 |                  | *Cyrtandra sp.*          | Gesneriaceae            | Medicinal plant        | 1.39| 3.90| 5.82| 0.08|
| 24 | Anggrek hutan       | *Corymborkis veratrifolia* | Orchidaceae         | Ornamental plant       | 1.73| 3.25| 4.98| 0.07|
Types of plants that are included as ornamental plants include Curculigo capitulata, Angiopteris avecta, Piper porphyrophyllum, Selaginella Sp. Mycetia cauliflora, Freycinetia insignis, Musa sp. Begonia bracteata, Philodendron rubescens, Homalomena philippinensis, Raphidophora foraminifera, Scindapsus sp., Syngonium podophyllum, Corymborkis veratrifolia and Tacca chantrieri. Types of plants that are included in medicinal plants include Coffea robusta, Zingiber elatior, Globba pandula, Salacca zalacca, Chromolaena odorata, Forrestia molissima, Cyrtandra sp. and Piper aduncum. According to [8] the ornamental potentiality is mainly due to the good looking habit or plant parts along with the attractive beautiful flowers.

3.2. Important Value Index (IVI)

Important Value Index (IVI) shows the role of the species in a area. The type that has the highest INP means to have the most important role in in that area. This type has the most dominant influence on change environmental conditions and the presence of other species in the area [9]. The highest INP of undergrowth was Elatostema lineolatum (59.99), followed by Homalomena philippinensis (21.35), Coffea robusta (13.02). The lowest IVI were Angiopteris avecta and Freycinetia insignis with respective values (0.84). The value of species diversity (H') is 2.29, this value is included in the medium category. Elatostema is one of the genera used by many indigenous communities in Africa, Asia and Oceania [10].

Based on [10] recorded 30 types of elastomas used by people in the world as used as food, medicine, forage and ornamental or material. According to [10] diversity of understorey species strongly influenced by environmental factors such as such as light, humidity, soil pH, canopy cover and the level of competitiveness of each species.

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