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VEGETATION ANALYSIS OF MOUNT SIPISO-PISO FOREST AREA, MEREK DISTRICT, KARO REGENCY, NORTH SUMATRA

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Abstract

Mount Sipiso-piso is an Old Volcanic Mountain and part of the Lake Toba Catchment Area (DTA). The location of the Forest on Mount Sipiso-piso is unique because the site of the Forest is at the top of Mount Sipiso-Piso. The area below the mountain is a dense Forest that stands in the peak area of Mount Sipiso-Piso has a role in maintaining water flows in the Mount Sipiso-Piso area, becoming a place for rainwater absorption, and maintaining ecosystem stability so that erosion or landslides do not occur in vulnerable areas. This study aimed to look at the diversity and evenness of Mount Sipiso-piso Forest vegetation types. Data analysis techniques include Important Value Index (INP), Diversity Index (H'), and Evenness Index (E). The results showed that 20 families and 23 plant species from 1539 individuals were found in the field. The Important Value Index (INP) indicates that different individuals dominate the forest community at each level. The index of the diversity of Mount Sipiso-Piso Forest vegetation is categorized as moderate in the saplings, poles, and trees class and the low category in the undergrowth, woody shrubs, and seedlings class. For the species evenness index, the category is expected in the undergrowth and seedling class, the medium type is in the woody shrub and tree class, and the high sort is in the sapling and pole class.

Keywords: Sipiso-Piso Mountain, Forest, Vegetation, Diversity, Evenness.

INTRODUCTION

Forests are part of the environment, which is very important and has a vital role because they have ecological functions, including being a source of germplasm, binding carbon dioxide (CO2) from the air, maintaining water quality stability, maintaining natural water flow, and protecting soil from erosion (Bruijnzeel & Hamilton, 2000). (Christian et al., 2014) said that the forest area functions to maintain the hydrological part of the Forest, preventing the extinction of biota in the Forest.

One of the tropical mountain forests is the mountain forests of Sumatra, which have a more incredible wealth of plant communities than any other region in the world (Whitten et al., 1987). North Sumatra, from Alas to Karo, approximately 390 km, is the center of geological disasters in the form of earthquake centers on land, triggering volcanic eruptions and landslides (BPS Karo, 2015). Forest stands in the peak area of Mount Sipiso-Piso have a role in maintaining water flows in the Mount Sipiso-Piso area, becoming a place for rainwater absorption, and maintaining ecosystem stability so that erosion or landslides do not occur in vulnerable areas.

The diversity of vegetation in an ecosystem has many things that affect it, not only caused by human activities or other living things but can also be caused by the altitude where the vegetation grows itself. (Destaranti et al., 2017) One environmental factor affecting growth is the height at which the vegetation grows itself.

According to (Juanda & Cahyono, 2015), altitude can be divided into three groups, namely: lowland areas which have a height of 0-200 meters above sea level; medium plains areas, which have an altitude of 200-700 meters above sea level, and highland areas which have an altitude above 700 meters above sea level. Mount Sipiso-Piso is included in the highland area category based on the altitude grouping because it is 1414 - 1910 meters above sea level. In this case, Mount Sipiso-Piso is unique where the forest area at the top of the Mount Sipiso-piso where mountains should be generally the higher the area of the mountain, the less diversity and presence of forest vegetation, as stated (Junghuhn, 1850) (Anesta et al., 2020) that the higher the land. Few plants can be cultivated.

The biggest threat to forest ecosystems is humans, which is caused by dependence on timber and non-timber forest resources. These human activities can cause direct or indirect disturbances such as succession processes, pressures, or disorders in forest systems (Kusumo et al., 2016). The diversity of wet highland vegetation on the island of Sumatra is still very high. It needs to be preserved due to the relatively fast rate of deforestation in the Sumatra region (Sodhi et al., 2010). Forests in the Mount Sipiso-piso area also face the threat of deforestation that occurs. One of the threats in the spice-Piso Forest was the fire that occurred in 2016 (Mongabay.co.id, 2016). Mount Sipiso-piso is located at the foot of Barisan hill and is a tourist destination in the Lake Toba area. This area is an area that has very high productivity as an agricultural area and a tourist area. As a place with increased productivity, this area needs to be analyzed to determine the condition of the existing vegetation. This research needs to be carried out to determine the direction of policy and the preservation of vegetation conditions in the Sipiso-Piso Forest area. This research has not been done much before, so the data obtained from this study is beneficial for the sustainable management of the Sipiso-Piso Forest area.

RESEARCH METHODS

This research was conducted from January to February 2021. This research was born in the Sipiso-Piso Mountain Forest, Merek District, Karo District, North Sumatra Province. Mount Sipiso-piso is located at an altitude of 1414-1910 meters above sea level. Geographically, Mount Sipiso-Piso is situated at 20 56'9.91" N 98^0 32'17.04" LU dan $2^0$55'1.74"-$98^0$32'8.33" LS. For more details, the research area can be seen in Figure 1.

This research is descriptive exploratory research, which describes or describes a condition following its original condition (Suryabrata, 2013). The determination of the sample in this study using a purposive sampling technique is because this method is the most usual method in Sipiso-Piso Forest conditions.

Vegetation data obtained is then analyzed using the Important Value Index (INP), which aims to determine the role of each dominant vegetation class (Equation 1); the Diversity Index (H') seeks to assess the state of succession or community stability (Equation 2), and Evenness Index (E) which aims to describe the distribution of individuals between different species (Equation 3).

$$INP = KR+FR$$
$$INP = KR+FR+DR \text{.....(1)}$$

Information:
KR = Relative Density
FR = Relative Frequency
DR = Relative Dominance

$$H' = -\Sigma\frac{ni}{N}\log\frac{ni}{N} \text{.....(2)}$$

Information:
H'= Shannon-Wiener diversity index (Mangguran, 1998).
ni = Similar Individuals
N = Total Same-Sex Individuals

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$$E = \frac{H'}{H_{maks}} \quad \text{.....(3)}$$

Information:
E = Evenness Index (Odum, 1993).
H_{maks} = Ln S
S = The amount of vegetation

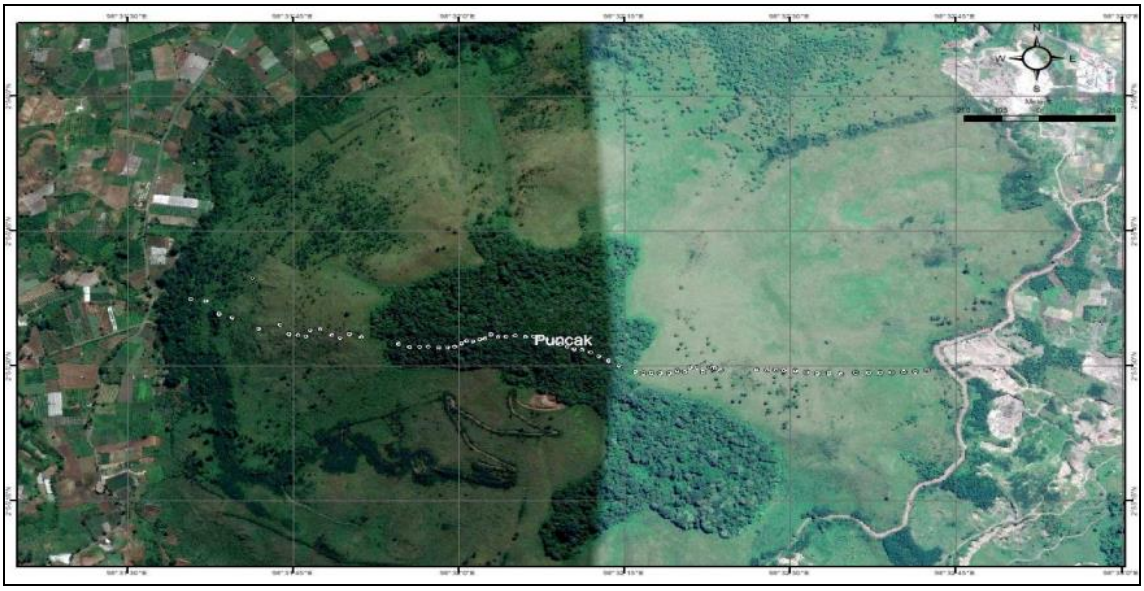

Figure 1. Research Location Area (Source: Data Processing, 2021).

RESULTS AND DISCUSSION

Vegetation of Mount Sipiso-Piso

Vegetation analysis carried out in the Mount Sipiso-Piso forest obtained 30 plots, while the samples taken in the vegetation analysis were undergrowth, woody shrubs, seedlings, saplings, poles, and trees. And received as many as 20 families and 23 species of plants from 1539 individuals.

Table 1. Results of Vegetation Analysis

No	Class	Number of Types	Number of Individuals
1	Undergrowth	6	119
2	Woody Shrubs	4	36
3	Seedling	12	665
4	Stake	18	257
5	Pole	16	207
6	Tree	16	255
	Total	-	1539

(Source: Data Processing, 2021).

From the results of the vegetation analysis, it was found that the most common species found at the Sapling level were 18 species; however, most individuals were found in the seedling class, namely 665 individuals. While the fewest species were in the woody shrub class of 4, the most irregular individuals were also found because there were only 36 individuals. Based on the results of vegetation analysis

data, the number of species found in the seedling, sapling, pole, and tree classes is not much different, indicating that the forest ecosystem is still well preserved. As stated by (Dendang & Handayani, 2015), the existence of stable species will maintain the growth and sustainability of the species. However, at the seedling level, the number of individuals is very significant compared to the others. This indicates that the tillers are very abundant. Still, the succession of life to the next stage is limited because they cannot compete with other individuals or are vulnerable to shade.

As stated by (Soegianto, 1994) (Hidayat, 2018) where the existence of an individual shows the ability to adapt and tolerate environmental conditions. The competition will also increase the fighting power of plants to survive, so strong species will suppress weaker species (Kunarso & Azwar, 2013).

Compared with the forest ecosystem of Mount Sibuatan, which is located close to Mount Sipiso-Piso, around 10 km. The diversity of species on Mount Sipiso-piso is very far apart from where on. Mount Sibuaten found 107 types of vegetation (Noviady & Siwi, 2015), while the vegetation of Mount Sipiso-Piso forest is only 23 types of vegetation; this shows that the forest vegetation of Mount Sipiso-piso needs to be maintained so that its species diversity does not decrease because supposedly with the location of Mount Sipiso-Piso and Mount Sibuatan which are close together, the variety of vegetation is not far enough apart.

Important Value Index (INP)

The Important Value Index (INP) aims to determine the role of each dominant vegetation class in a community. Based on the results of the Important Value Index (IVI) study in the Sipiso-Piso Mountain Forest study area, it consisted of undergrowth, woody shrubs, seedlings, saplings, poles, and trees. The Important Value Index (INP) varies for each existing vegetation. For more details, the Important Value Index (INP) can be seen in Table 2 below.

Table 2. Important Value Index (INP) of Mount Sipiso-Piso Vegetation Debt

No	Latin name	Undergrowth	Woody Shrubs	Seedling	Stake	Pole	Tree
1.	Alstonia Pneumatophora	-	-	2.657	2.2068	8.7925	9.7782
2.	Amorphophallus Variabilis	5.527	-	-	-	-	-
3.	Begonia Sp.	11.05	-	-	-	-	-
4.	Celtis tetrandra	-	-	2.055	4.0245	23.558	22.737
5.	Cinnamomum Parthenoxylon	-	-	2.356	-	-	-
6.	Clidemia Hirta	-	123.81	-	2.985	-	-
7.	Cyathea Contaminants	-	-	25.16	26.22	8.0916	-
8.	Dacrydium Elatum	-	-	-	-	-	15.1027
9.	Eragrostis Patula	20,65	-	-	-	-	-
10.	Eupatorium Inulifolium	-	13.095	-	-	-	-
11.	Ficus Benjamina	-	-	-	-	-	10.7336
12.	Ficus Grossularioides	-	-	-	34.269	89.962	14.9636
13.	Garcinia Diosa	-	-	21.35	35.047	69.71	8.58455
14.	Homalanthus Populneus	-	-	-	2.2068	2.3891	-
15.	Macropanax Sp.	-	-	-	-	3.193	-

16.	Madhuca Cuneata	-	-	-	7.3986	17.106	24.5783
17.	Payena Leerii	-	-	2.957	-	2.3891	-
18.	Pinanga Javanica	-	-	125.2	58.127	-	-
19.	Prunus Acuminata	-	-	-	4.4136	9.7411	11.0546
20.	Quercus Gemelliflora	-	-	9.123	16.092	65.069	182.427
21.	Spatholobus Ferrugineus	-	63.095	-	-	-	-
22.	Tectaria Crenata	162.8	-	-	-	-	-
23.	Urtica Sp.	-	-	9.123	7.0094	-	-
	Total	200	200	200	200	300	300

(Source: Data Processing, 2021).

Based on Table 2, the Important Value Index (INP) for each class of Sipiso-Piso Mountain Forest vegetation. In the undergrowth class, the highest IVI was in the Tectaria crenata vegetation; in the woody shrub class, the highest IVI was in the Clidemia Hirta vegetation; in the seedling class, the highest IVI was in the Pinanga Javanica vegetation, in the sapling class the highest IVI was in the Pinanga Javanica vegetation, in the pole class INP the highest was in the Ficus Grossularioides vegetation. The highest IVI tree class was in the Quercus Gemelliflora vegetation.

This Important Value Index (INP) shows that the forest floor in the Forest on Mount Sipiso-Piso is relatively closed. This can be seen from the high IVI values of Tectaria crenata, Clidemia hirta, and Pinanga javanica compared to other plants in the same ecosystem; these three plants tend to grow grouped and shade tolerant, making it difficult for other plants to compete. Even though the pole class (Ficus grossularioides) and tree (Quercus gemelliflora) have high IVI values but cannot dominate the other courses, this shows that species that can compete will dominate a community, as stated by (Saharjo & Gago, 2011) that species that can dominate a community are species that can utilize the most resources compared to other species.

Clidemia hirta is also an invasive plant and is included in the world's 100 worst invasive plant species. This raises a suspicion that weeds have biochemical weapons in the form of solid allelopathies to compete in new ecosystems and even defeat native species (Callaway et al., 2005). The allelopathy content in Clidemia hirta indeed threatens the succession of other species, especially tree species that regenerate through seeds, and this is supported by (Ismaini, 2015), who stated that the aqua dest extract of Clidemia hirta leaves is proven to inhibit seed germination and inhibit root and stem growth.

evenness index (E) is used to see the distribution class of a species in a community. The diversity and evenness index of the Sipiso-Piso Mountain debt vegetation can be seen in Table 3 below.

Diversity Index Value (H') and Evenness Index (E)

The diversity index (H') shows the number of species and the number of individuals in a community to maintain its ecosystem's stability. At the same time, the

Table 3. Diversity Index and Evenness Index values in the Sipiso-Piso Mountain vegetation

Kelas	Diversity Index (H')	Evenness Index (E)
Undergrowth	0.6751	0.3239
Woody Shrubs	0.824	0.4313
Seedling	0.8014	0.2749
Stake	1.8148	0.7222
Pole	1.7834	0.6339
Tree	1.2249	0.4858

(Source: Data Processing, 2021).

Based on the data from Table 3, the highest value of the Diversity Index (H') is in the sapling class with a value of 1.8148, and the lowest value is in the lower plant class with a value of 0.6751. From the diversity index value of each type, based on the categories made by Shannon-Wienner, the undergrowth class, woody shrubs, and seedlings are included in the low variety (> 1), and the saplings, poles, and trees class are included in the medium category (1≤H '≤). Based on these categories, it shows that the diversity of forests on Mount Sipiso-piso is very vulnerable to disturbance, especially in the undergrowth class, woody shrubs, and seedlings because of the low diversity index and the sapling and tree classes are also only in the medium category, and there is no class included high category. This is the same as stated (Indriyanto, 2006; Hidayat, 2018), that community diversity is an ability to keep itself stable from disturbing its components. Disturbance or pressure from the environment will cause an imbalance that causes only certain species to survive (Nugroho et al., 2015).

The highest evenness index (E) in the Mount Sipiso-Piso Forest is the sapling class (0.7222), and the lowest is the seedling class (0.2749). Based on the categories made by Odum (1993), the evenness index in the Forest on Mount Sipiso-piso is included in the high category in the saplings (0.7222) and poles (0.6339) class, the moderate category in the woody shrub class (0.4313) and trees (0.4858) and the low category in the undergrowth class (0.3239) and seedlings (0.2749). This classification shows that the evenness of species in each class in the Forest of Mount Sipiso-piso is different. This indicates that the distribution of vegetation growth is still quite good because there are only a few classes (undergrowth and seedlings) in the low category. Homogeneous in several places, such as saplings around the main stand and types of ferns and areca nuts that tend to grow in groups. As stated by (Magguran, 1998) that the distribution of individuals is uneven due to the presence of certain dominant species.

CONCLUSION

This research concluded that Sipiso-Piso Mountain Forest's species diversity is categorized as low in the undergrowth class, woody shrubs, and seedlings, and the medium category in the saplings, poles, and trees class. The evenness of the species varies because the undergrowth and seedling classes are in the low sort, the woody shrub and tree classes are in the medium category, and the sapling and pole classes are in the high category.

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