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# Vegetation Structure of The Sumatran Rhino Habitat In The Kapi, Leuser Ecosystem Area, Aceh Province

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**Abstract**

The Sumatran rhino (*Dicerorhinus sumatrensis*) is one of the most critically endangered large mammals, with fewer than 100 individuals remaining. Habitat quality plays a vital role in ensuring its survival and reproduction. The Kapi area within the Leuser Ecosystem Area (LEA) is considered one of the potential remaining habitats for this species, yet data on its vegetation structure is limited. This study aimed to analyze and describe vegetation conditions in Kapi by examining species composition, similarity, diversity, evenness, and importance value index (IVI). Vegetation data were collected from October to December 2021 using randomly distributed sample plots across all vegetation strata. A total of 98 plant species from 37 families and 7,394 individual plants were recorded, comprising 67 species in the tree stratum, 43 species in the pole stratum, 42 species in the sapling stratum, and 43 species in the seedling stratum. Species similarity was highest between sapling and pole strata (63.53%) and lowest between sapling and tree strata (45.87%). Seventy-nine plant species from 29 families were identified as rhino food plants. Diversity was highest in the tree stratum (H'=3.32) and lowest in the seedling stratum (H'=2.88). Evenness peaked in the pole stratum (E=0.83) and was lowest in the seedling stratum (E=0.76). IVI analysis indicated different dominant species in each stratum.

**Keyword**: Sumatran rhino, Leuser Ecosystem Area, Vegetation

## INTRODUCTION

The sumatran rhino (*Dicerorhinus sumatrensis*) is considered the most primitive species among all existing rhinoceroses. Genetically, it shares a closer evolutionary relationship with its ancestor, *Coelodonta antiquititas* (Goossens et al., 2013). In Indonesia, the distribution of sumatran rhino populations is currently restricted to several key habitats: The Leuser Ecosystem Area (LEA), Bukit Barisan Selatan National Park (BBSNP) and Way Kambas National Park (WKNP), all located on the island of Sumatra. Additionally, populations of sumatran rhino have also found on the island of Kalimantan, specifically in regencies of Kutai Barat and Mahakam Ulu, East Kalimantan Province (Kementerian Lingkungan Hidup dan Kehutanan, 2019).

Currently, the number of remaining sumatran rhino individuals is estimated at only 90-100 (Nardelli, 2019). According to the 2015 Population Viability Analysis (PVA), the sumatran rhino population has declined by 75% over the past 25 years (Miller et al., 2015). This population decline is attributed to multiple threats. According to (Nardelli, 2019) and (Miller et al., 2015) illegal hunting and habitat loss are among the primary drivers contributing to the drastic decline in the sumatran rhino population. This condition makes the species one of the most critically endangered large mammals in the world. Currently, the species is listed as critically endangered (CR) by the International Union for Conservation of Nature (IUCN) Red List (IUCN, 2019). The increasingly precarious status of its population has made the conservation of the sumatran rhino a top priority at both national and international levels.

One of the primary factors determining the success of sumatran rhino conservation is the availability of suitable and sustainable habitat. According to (Morrison et al., 2006), a suitable habitat must provide the necessary resources, such as food, water, forest cover and environmental conditions that enable a species to survive and reproduce. However, as threats to natural habitats continue to escalate, many potential habitats have experienced a decline in quality.

The Leuser Ecosystem Area (LEA) is the largest conservation landscape in Sumatra and serves as a primary habitat for four key species: sumatran rhino, elephant, tiger and orangutan (Abdulhadi et al., 2014). Within the LEA, the Kapi region has been identified as one of the potential habitat pockets for the sumatran rhino. According to (IUCN, 1997), this area was once estimated to support a relatively high population of sumatran rhino, possibly even higher than average population in other regions. The indicates that, historically, the Kapi region possessed favorable habitat conditions and played a significant role in the past distribution of the species.

However, over the past few decades, the ecological integrity of this region has been increasingly threatened by anthropogenic disturbances, particularly most notably the expansion of infrastructure. Beginning 1986, road construction in the Kapi significantly increased. One major development was the construction of the Kutacane-Blangkejeren road, which effectively divided the Leuser Ecosystem Area (LEA) into western and eastern sections. Subsequently, the eastern part became further fragmented by construction of the Blangkejeren-Pining-Lokop road (Putra, 2014). The impact of road development area multifaceted.

Aside from the direct loss of forest habitat, roads also facilitate human access to previously undisturbed areas, leading to increased risk of poaching, illegal logging and other extractive activities. In addition, the presence of roads introduces edge effect that degrade forest quality and alters microclimatic condition (Haddad et al., 2015), further threatens the viability of forest dependent species, particularly the sumatran rhino.

Studies focusing on vegetation structure within the sumatran rhino habitat in the Kapi, Leuser Ecosystem Area still highly limited. The first study on vegetation structure in the Kapi was conducted by (Putra, 2014). The results of the study recorded a total of 242 plant species. In addition to the identified plant data, information on the sumatran rhino's food plants was also recorded from dataset. Based on the 242 recorded plant species, 149 were identified as forage plants for the sumatran rhino.

Based on the background described above, this study aims to analyze and describe the vegetation structure in the Kapi by assessing species composition, species similarity, species diversity, species evenness and the importance value index. Information on the habitat condition of the sumatran rhino, obtained through vegetation analysis, is expected to serve as a scientific basis for management units and policy makers in implementing effective and sustainable wildlife and habitat management program aimed at protecting the sumatran rhino and its habitat in Kapi, Leuser Ecosystem Area (LEA).

**METHOD**

This research was conducted in the Leuser Ecosystem Area, one of the most important conservation areas in Indonesia and critical habitat for key species. The specific study site was in the Kapi region. Administratively, the Kapi region is located within Putri Betung and Pining sub-district of Gayo Lues Regency, with a small portion extending into Aceh Tamiang Regency. On its western side, the Kapi area directly borders Nort Sumatra Province (Putra, 2014). Vegetation data collection was conducted from October to December 2021.

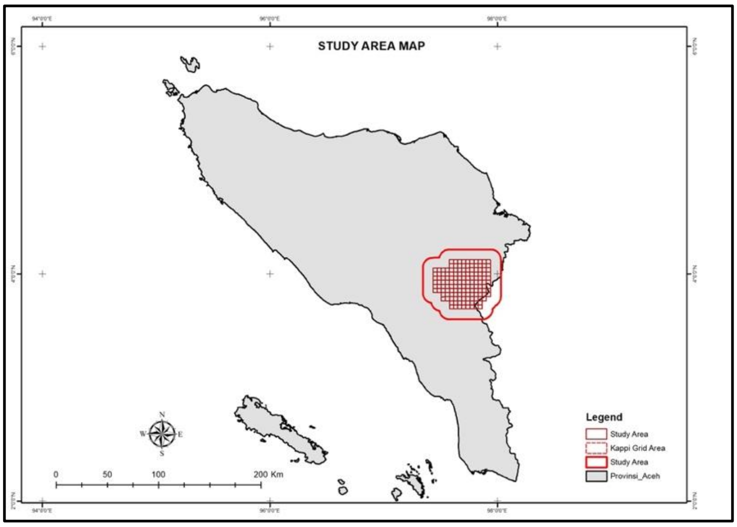


Figure 1. Map of Study Area

The equipment used in this study included: a research map, measuring rope, writing tools, Global Positioning System (GPS), measuring tape, camera, lux meter, soil pH meter, water pH meter, tagging tape, hygrometer, black cloth, ruler, knife and tally sheets. For plant species identification, the study utilized the identification book titled “Jenis-Jenis Pohon Asli di Taman Nasional Gunung Leuser” (Ardi et al., 2021). In addition, the identification and validation of plant species observed in the field involved the assistance of a local expert botanist to ensure the accuracy of species data recording. The identification of food plant species consumed by the sumatran rhino was conducted by cross-referencing finding from previous studies by (Putra, 2014), (Atmoko Tri et al., 2016) and (Awaliah, 2018).

Plant species data collected during sampling were recorded on tally sheets. Data collection was carried out using a sample plot method, with plots randomly selected within the Kapi area. This method involved establishing transect with observation plots at 100-meter intervals, totaling 36 plots, consisting of: 2m x 2m plots (A) for recording seedling, 5m x 5m plots (B) for sapling, 10m x 10m plots (C) for pole and 20m x 20m plots (D) for tree (Indriyanto, 2006). The vegetation sampling plots are illustrated in Figure 2.

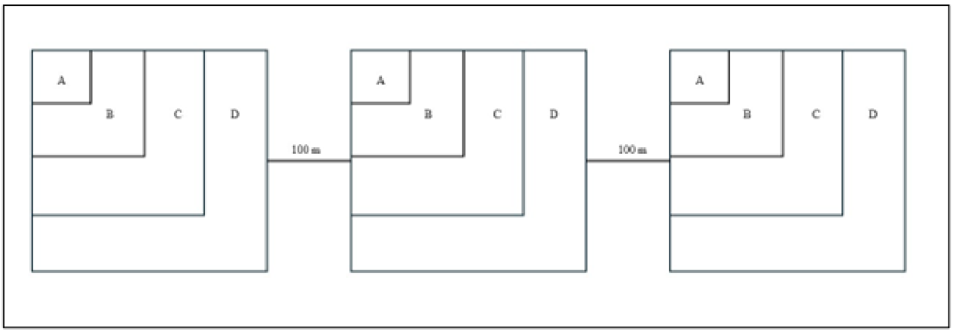


Figure 2. Vegetation Sampling Plot Design

The vegetation types found within the plots were identified, recorded, and documented. In addition to plant data collection, this study also involved recording coordinates points, collecting environmental data within the sampling area and documenting field observation.

The vegetation analysis conducted in this study included the calculation of the similarity index, species diversity index and species evenness index. The similarity index was used to determine the degree of similarity in plant species composition across different vegetation strata. The formula used for this analysis follows (Sorensen, 1948):

$$\mathrm{SI} = \frac{2c}{a + b}\, x\ 100\%$$

**Description:**

SI = Similarity Index
a = Number of plant species in vegetation stratum A
b = Number of plant species in vegetation stratum B
c = Number of plant species shared between vegetation stratum A and B

The criteria used to interpret the similarity index area as follows: an SI value > 50% indicates a similarity in species composition between vegetation strata, while an IS value < 50% indicates a difference in species composition.

Vegetation diversity within an ecosystem can be quantitavely commonly assessed using the Shannon-Wiener diversity index, which accounts for both species richness and evenness in a community (Odum, 1959). The index is expressed by the following formula:

$$\mathrm{H} = -\sum \mathrm{Pi}.\ \ln \mathrm{Pi}$$

Description:

H’ = Shannon-Wiener Index
Pi = ni/N
ni = Number of individuals of the i-th species
N = Total number of vegetation individuals of all species

Diversity index classification:

H’ < 1 = Low diversity
1 < H’ < 3 = Moderate diversity
H’ > 3 = High diversity

According to (Krebs, 1989), the evenness index can be used to calculate the evenness of individual abundance for each species. The species evenness index of vegetation within an ecosystem can be calculated using the following formula:

$$E = \frac{H'}{\ln(S)}$$

Description:

| | | |
|---|---|---|
| E | = | Evenness index |
| H' | = | Diversity index |
| S | = | The number of species identified |

The value of the vegetation species evenness index ranges from zero to one. According to (Fachrul, 2012), a value approaching one indicates that the species within a community are more evenly distributed, whereas a value approaching zero signifies an uneven distribution of species within the community.

The important value index (IVI) is used to determine the level of dominance of a plant species at each growth stage (Indriyanto, 2006).This index is calculated based on three main components, they are: relative density (RD), relative frequency (RF) and relative dominance (RDo). Accordingly, the formula for calculating the IVI is as follows (Mueller-Dombois & Ellenberg, 1974):

$$IVI = RD + RF + RDo$$

Description:

| | | |
|---|---|---|
| IVI | = | Important value index |
| RD | = | Relative density |
| RF | = | Relative frequency |
| RDo | = | Relative dominance |

According to (Fachrul, 2012), relative density, relative frequency, and relative dominance are calculated using the following formulas:

$$\text{Relative Density (RD).} \quad = \frac{Number\ of\ Individuals\ of\ a\ species}{Total\ number\ of\ individuals}\ x\ 100\%$$

$$\text{Relative Frequency (RF)} \quad = \frac{Frequency\ of\ species}{Sum\ frequency\ of\ all\ species}\ x\ 100\%$$

$$\text{Relative Dominance (RDo)} = \frac{Dominance\ of\ species}{Dominance\ of\ all\ species}\ x\ 100\%$$

**RESULT**

**1. Species Composition**

This study recorded 98 plant species across all vegetation strata, namely the tree, pole, sapling and seedling layers. The species belong to 37 families, with a total of 7.394 individual plants. The detailed number of species and individuals in each vegetation stratum is presented in Table 1.

Table 1. Number of Species and Individuals in Each Vegetation Stratum

| Vegetation Stratum | Number of Species | Number of Individuals |
|---|---|---|
| Tree | 67 | 469 |
| Pole | 43 | 2.655 |
| Sapling | 42 | 3.765 |
| Seedling | 43 | 505 |

Based on the data in Table 1, the tree stratum has the highest number of plant species, but the lowest number of individual plants compare to the other vegetation strata. Conversely, the sapling stratum has the fewest plant species but the highest number of individual plants among all strata.

Table 2. Number of Common Species Between Vegetation Strata and Similarity Index

| Vegetation Strata | Number of Common Species | Similarity Index (%) |
|---|---|---|
| Seedling-Sapling | 21 | 49,41 |
| Seedling-Pole | 23 | 53,49 |
| Seedling-Tree | 26 | 47,27 |
| Sapling-Pole | 27 | 63,53 |
| Sapling-Tree | 25 | 45,87 |
| Pole-Tree | 32 | 58,18 |

Table 2 presents the number of common species and the similarity index (SI) between pairs of vegetation strata. The results show that the highest similarity index was observed between the sapling and pole strata (63,53), followed by the pole and tree strata (58,18) and the seedling and pole strata (53,49). In contrast, the lowest similarity indices were found between the sapling and tree strata (45,87), the seedling and tree strata (47,27), and the seedling and sapling strata (49,41).

The survival of the sumatran rhino population is highly dependent on the availability of natural food sources within its habitat. This study found that 80,61% of the total identified plant species are those consumed by the sumatran rhino. Detailed in the plant families and the number of species identified as food sources for this species are presented in Table 3.

Table 3. Plant Families and The Number of Species Identified as Sumatran Rhino Food Sources

| No | Plant Families | Number of Plant Species |
|---|---|---|
| 1 | Myrtaceae | 12 |
| 2 | Meliaceae | 8 |
| 3 | Moraceae | 7 |
| 4 | Fagaceae | 6 |
| 5 | Clusiaceae | 5 |
| 6 | Euphorbiaceae | 5 |
| 7 | Lauraceae | 5 |
| 8 | Calophyllaceae | 3 |
| 9 | Myristicaceae | 3 |
| 10 | Annonaceae | 2 |
| 11 | Cornaceae | 2 |
| 12 | Dipterocarpaceae | 2 |
| 13 | Sapindaceae | 2 |

| No | Plant Families | Number of Plant Species |
|---|---|---|
| 14 | Sterculiaceae | 2 |
| 15 | Anacardiaceae | 1 |
| 16 | Ebenaceae | 1 |
| 17 | Elaeocarpaceae | 1 |
| 18 | Lecythidaceae | 1 |
| 19 | Olacaceae | 1 |
| 20 | Polygalaceae | 1 |
| 21 | Primulaceae | 1 |
| 22 | Putranjivaceae | 1 |
| 23 | Rutaceae | 1 |
| 24 | Salicaceae | 1 |
| 25 | Sapotaceae | 1 |
| 26 | Stemonuraceae | 1 |
| 27 | Theaceace | 1 |
| 28 | Thymelaeaceae | 1 |
| 29 | Violaceae | 1 |
| **Total Species** | | **79** |

The sumatran rhino food plants identify at the study site belong to 29 plant families. These food plant species are dominated by members of the families Myrtaceae (12 species), Meliaceae (8 species) and Moraceae (7 species), as shown in Table 3.

**2. Analysis of Plant Species Diversity Index and Evenness Index**

Based on the result of the calculations, the plant species diversity index (H') and species evenness index (E) showed variation across the different vegetation strata. The H' value for plant species was highest in the tree stratum, followed successively by the pole, sapling and seedling strata. In contrast, the evenness index (E) was highest in the pole stratum, followed by the sapling, tree and seedling strata, respectively (Table 4).

Table 4. Result of Diversity Index (H') and Evenness Index (E)

| Vegetation Stratum | H' | E |
|---|---|---|
| Tree | 3,32 | 0,79 |
| Pole | 3,13 | 0,83 |
| Sapling | 3,02 | 0,81 |
| Seedling | 2,88 | 0,76 |

The result indicates that the seedling stratum has a moderate plant species diversity index. In contrast, the other three strata fall into the high diversity category. This interpretation aligns with the statement by (Fachrul, 2012), which suggest that a plant species diversity index (H') > 3 indicates high species diversity, where a value 1 < H' < 3reflect moderate diversity within a given area.

In addition to assessing the diversity index for each vegetation stratum, it is also important to understand how individuals of each plant species are distributed within the vegetation community. As shown in Table 4, the species evenness index (E) in all strata generally approaches one. This indicates that the distribution of plant species in each vegetation stratum is relatively uniform, with no single species dominating the community.

### 3. Analysis of Importance Value Index (IVI)

The importance value index (IVI) is used to determine the ecological role of plant species within a community. This index is calculated based on the sum of relative density (RD), relative frequency (RF) and relative dominance (RDo) (Bengen, 2000). For plant species in the seedling stratum, the IVI is derived only from the sum of relative density (RD) and relative frequency (RF) (Fachrul, 2012). The results of this analysis are presented in Table 5.

Table 5. Important Value Index (IVI)

| No | Family | Species | Importance Value Index (IVI) | | | |
|---|---|---|---|---|---|---|
| | | | **Seedling** | **Sapling** | **Pole** | **Tree** |
| 1 | Clusiaceae | *Garcinia forbesii* | - | 19,78 | 28,99 | - |
| 2 | Fagaceae | *Lithocarpus hystrix* | - | 24,81 | 26,64 | 54,54 |
| 3 | Fagaceae | *Lithocarpus elegans* | 19,95 | - | - | 19,35 |
| 4 | Fagaceae | *Lithocarpus lucidus* | - | - | - | 18,65 |
| 5 | Lauraceae | *Actinodephne macrophylla* | - | 20,00 | | - |
| 6 | Lauraceae | *Cryptocarya laevigata* | 16,21 | 24,75 | 21,31 | 15,20 |
| 7 | Myrsinaceae | *Ardisia sanguinolenta* | 19,83 | 27,09 | - | - |
| 8 | Myrtaceae | *Syzygium acuminatissimum* | - | - | 21,12 | 17,00 |
| 9 | Myrtaceae | *Syzygium filiforme* | 17,51 | - | 30,05 | - |
| 10 | Stemonuraceae | *Stemonurus secundiflorus* | 24,78 | - | - | - |

Table 5 presents plant species with importance value index (IVI) scores across each vegetation stratum. The table indicates that *Cryptocarya laevigata* from Lauraceae was recorded in all four vegetation strata. When analysed stratum, the species with the highest IVI in the seeding stratum was *Stemonurus secundiflorus* (Stemonuraceae), in the sapling stratum was *Ardisia sanguinolenta* (Myrsinaceae ), in the pole stratum was *Syzygium filiforme* (Myrtaceae) and in the tree stratum was *Lithocarpus hystrix* (Fagaceae).

## DISCUSSION

The survival of the sumatran rhino (*Dicerorhinus sumatrensis*) is highly dependents on the availability of sustainable habitat, particularly vegetation as a source of natural forage. As a solitary herbivore, this species requires extensive forest area with dense vegetation that support a wide range of plant species to meet its daily dietary needs. Vegetation composition in each area not only reflects habitat quality but also serves as an important indicator in determining the suitability of an area for habitation and movement. Therefore, vegetation analysis and the availability of food resources are crucial components in conservation efforts and population management of the sumatran rhino in its natural habitat (IUCN, 1997); (Wibisono et al., 2018))

Plant species composition serves as a crucial indicator for understanding the structure of vegetation communities in each area. In this study, the tree stratum exhibited the highest number of plant species, with 67 species recorded, but also had the lowest number of individual plants, totaling only 469 individuals. This pattern suggests that although species diversity is high in the tree strata, the individual density of each species is relatively low. Such a condition may indicate that the tree stratum has undergone long-term ecological selection, where only species capable of strong competition and adaptation are able to reach and persist at this level of the forest structure.

In the pole and sapling strata, a very high number of individual plants was recorded, although the number of plant species was lower compared to the tree stratum. This pattern suggests the dominance of certain plant species. Species dominance in a particular area may be attributed to several factors, including environmental adaptability, rapid regeneration strategies and tolerance to natural or anthropogenic disturbances. Plant species with highly competitive abilities in utilizing available resources tend to dominate, while those with lower adaptability are often displaced or occur only in limited numbers.

The seedling stratum contained several plant species equivalents to that of the pole stratum (43 species), with a total 505 individual plants. This indicates that the seedling phase represents the most vulnerable stage in the plant life cycle. Several factors influence the presence and survival of seedlings, including high mortality rates, rapid growth dynamic and the impact of natural disturbances or human activities.

Similarity index among vegetation strata can be influenced by various factors, such as environmental conditions and ecosystem disturbances. Environmental factors including sunlight, humidity and temperature can affect the distribution and composition of plant species across strata. According to (Chazdon & Pearcy, 1991), certain plant species can only thrive under specific microclimatic conditions, for example, in the lower vegetation strata where high humidity and low light intensity (sun flecks) prevail. In forest ecosystem, particularly those with dense canopies, sun flecks serve as a crucial light source for the understory layer, as light availability on the forest floor is highly limited. Therefore, the presence of specific species in the seedling or sapling strata does not necessarily correspond to their presence in the pole or tree strata, thereby reducing the similarity index between these layers.

Ecosystem disturbances in the study area can be a contributing factor to the similarity index among vegetation strata. These disturbances may arise from both natural and anthropogenic sources. Anthropogenic disturbances such as land clearing, illegal logging, forest fire and encroachment have the potential to cause the selective loss of certain species. The disappearance of specific species may lead to a decline in species composition similarity between vegetation strata and promote vegetation homogenization.

According to (Putra, 2014), the level of community dependence on the Kapi area is very high. This dependence contributes to increase pressure on the habitat and population of the sumatran rhino, particularly through the degradation of the understory vegetation, which serve as a primary food source. In addition to impacting habitat quality, human activities also affect the natural regeneration of species, resulting in significant difference in species composition among vegetation strata. These differences are subsequently reflected in the low values of the similarity index. This finding is supported by (Connell, 1978), who stated that high levels of disturbance within an ecosystem contribute to the loss of certain species, which in turn leads to changs in community structure.

The majority of sumatran rhino food plant species are dominated by members of the Myrtaceae, Meliaceae and Moraceae. (Martin, 1977) as cited by (Laumonier, 1997), in his study in Gunung Mulu, Sarawak, stated that Myrtaceae is a key characteristic of vegetation in submontane zone. This finding aligns with conditions at the study area, where the sampling plots are located at an elevation of approximately 850-1.650 meters above sea level (m asl). This is supported by (Laumonier, 1997) statement, who categorized the elevation of a region. In that categorization, the submontane zone is stated to be at an elevation of 900-1.400 m asl. In addition, several species of Myrtaceae are also known to thrive in the montane zone, at elevation exceeding 1.400 m asl. This supported by (Culmsee et al., 2011), who documented the presence of Myrtaceae along with genera such as Lithocarpus, Syzgium in tropical montane rainforest in Sulawesi, occurring at elevation between 1.800 and 2.400 m asl. The consistency between vegetation composition and the elevation of the study area with submontane and montane zone characteristics supports the assumption that this area serves as an important habitat for the survival of the sumatran rhino in the Kapi, particularly in terms of availability of natural food sources.

Myrtaceae is one of the largest plant families, comprising approximately 5.500 species grouped into 142 genera. This family is distributed across tropical and subtropical regions (Laumonier, 1997; Wilson, 2011). Myrtaceae is known for its high level of environmental adaptability. According to (Souza et al., 2023), members of this family exhibit a notable tolerance to high temperature. One example is *Psidium myrtoides*, a plant endemic to Brazil that has been shown to withstand elevated tempartures. The results of the study indicated that this species demonstrates potential heat tolerance (with an average temperature of 30,3°C), provided that adequate soil water availability is maintained.

The plant families Meliaceae and Moraceae also emerged as the most dominant forage families in this study. The dominances are likely attributed to their biological and ecological characteristics, which make them highly adaptable and competitive within natural forest ecosystem. Both Meliaceae and Moraceae exhibit high tolerance to environmental conditions such as high humidity and rainfall. Furthermore, their high species diversity and wide distribution across all vegetation strata make these families key components in the structure and functioning of ecosystem in Indonesia, particularly within the Leuser Ecosystem Are (LEA).

(Pennington & Styles, 1975), stated that Meliaceae is one of the plant families widely distributed in tropical regions. In Indonesia, approximately 700 species belonging to 51 genera have been recorded within this family. According to (Mabberley et al., 1995), several species from the Meliaceae family exhibit a high degree of tolerance to open environmental conditions and are therefore commonly found in secondary forest or disturbed areas. Such species include *Toona spp*., *Aglaia argentea* and *Chisocheton tomentosus*.

According to (Berg & Corner, 2007) the Moraceae family consists of 37 genera and includes approximately 1.050 plant species. Meanwhile, (Christenhusz & Byng, 2016) reported that Moraceae comprises 38 genera and more than 1.100 plant species. Members of the Moraceae family are widely distributed, primarily in tropical regions and extend into subtropical zones, with relatively few species found in temperate climates. In general, species from this family occur across a wide elevational range, from lowland areas up to1.500 meter above sea level (m asl). However, at elevation exceeding 2.000 meters, several montane species belonging to the genera Ficus, Streblus and Morus can still be found (Sahromi, 2020). Plant biodiversity is a fundamental concept in the practice of quantifying the ecological status of various biotopes, based on the abundance of identified plant species (Izsák & Papp, 2000). The level of plant species diversity is influenced by species richness and the distribution of species abundance (Magurran, 1988). In line with this, the present study reveals the richness of plant species within the sumatran rhino habitat in Kapi, Leuser Ecosystem Area (LEA). The results demonstrate that the plant diversity varies across different vegetation strata. The index suggest that the seedling stratum exhibited the lowest level of species diversity, while the tree stratum demonstrates the highest.

Although the seedling stratum contains a relatively similar number of plant species compared to the sapling and pole strata, its diversity index is considerably lower due to the smaller number of individuals. This suggest that the seedling layer exhibits species variation with a relatively low total number of individuals (505 individuals) whereas the sapling and pole strata contain three to four times as many. The tree stratum recorded the highest species diversity index among all strata, indicating a more even distribution of individuals across species and higher level of species composition diversity at this growth stage.

Species richness is a measure of biodiversity that reflects the number of plant species found within a given unit area or specific study site. The evenness index (E), on other hand, describes the relative distribution of individual counts among plant species in each area. Results of the species evenness analysis across vegetation strata revealed that the pole stratum exhibited the highest evenness value compared to the other three strata. This suggest that no single species dominates significantly in this stratum and most species possess relatively balanced individual counts. Conversely, the seedling stratum showed the lowest evenness value. Although still categorized a relatively even, this indicates the potential for dominance by a few specific plant species.

The calculation of the importance value index (IVI) indicates that several plant species from specific families play a dominant role in particular vegetation strata at the study site. Species from Lauraceae, such as *Cryptocarya laevigata*, were evenly distributes across all vegetation growth strata. According to (Rohwer, 1993), members of the Lauraceae are found in tropical region of the Americas and Asia, with a substantial number of species also occurring in Australia and Madagascar. Currently, approximately 50 genera have been recorded, comprising around 2.500 to 3.500 plants species. The even distribution of *Cryptocarya laevigata* across all strata may be attributed to its strong environmental adaptability and high capacity for natural regeneration. (Wu et al., 2025) stated that Lauraceae produces thousands of metabolites that contribute to growth, development and resistance to both biotic and abiotic stresses, allowing species from this family to adapt effectively to dynamic environmental changes.

A plant species may attain a high IVI due to the combined influence of three key components that reflect its dominance within a particular area: relative density (RD), relative frequency (RF) and relative dominance (RDo). Plant species with high IVI values demonstrate their ability to dominate in a given area and reflect a broad range of adaptation and tolerance to local environmental conditions. According to (Soegianto, 1994), the higher the IVI of a plant species, the greater its ecological dominance within a habitat. Such dominance also indicates that the species can effectively utilize the available environmental resources in its surroundings.

## CONCLUSION

In total, 37 plant families comprising 98 species and 7.394 individual plants were recorded across all vegetation strata. In detail, 67 species with 469 individual plants were recorded in the tree stratum; 43 species with 2.655 individuals in the pole stratum; 42 species with 3.765 individuals in the sapling stratum; and 43 species with 505 individuals in the seedling stratum. The similarity index (SI) analysis among vegetation strata varied. The highest species similarity was found between the sapling and pole strata (63,53%) and the lowest was between the sapling and tree strata (45,87%). A total of 79 plant species from 29 plants families were identified as food plant of the sumatran rhino.

Based on the analysis of the species diversity index, the tree stratum exhibited the highest diversity value (H'=3,32), whereas the seedling stratum showed the lowest (H'=2,88). The highest evenness value was found in the pole stratum (E=0,83), and the lowest in the seedling stratum (E=0,76). The highest important value index (IVI) for each stratum was recorded for *Stemonurus secundiflorus* (24.78%) in the seedling stratum, *Ardisia sanguinolenta* (27.09%) in the sapling stratum, *Syzygium filiforme* (30.05%) in the pole stratum, and *Lithocarpus hystrix* (54.54%) in the tree stratum.

The analysis indicate that current habitat condition remains suitable for the sumatran rhino. These presence of structurally organized vegetation strata and high diversity value suggest a stable plant community capable of providing essential ecological function. However, ongoing protection efforts are necessary to maintain the integrity of the vegetation structure and to mitigate external threats that may compromise the sustainability of the sumatran rhino population.

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