


## TREE SPECIES COMPOSITION OF THE LOWLAND FOREST IN BUKIT BAKA BUKIT RAYA NATIONAL PARK, EAST KALIMANTAN, INDONESIA

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### ABSTRACT

SUSANTI, R., GIRMANSYAH, D., PRATAMA, B. A. & JAKALELANA, S. 2026. Tree species composition of the lowland forest in Bukit Baka Bukit Raya National Park, East Kalimantan, Indonesia. *Reinwardtia* 25(1): 31–40. — Tree species diversity and structural characteristics in the lowland forest of Bukit Baka Bukit Raya National Park (TNBBBR) were examined to assess the overall floristic diversity of this conservation area. A survey was conducted at the national park boundary with PT. Sari Bumi Kusuma, a forest company concession in East Kalimantan. Data were collected using transect plots of 50 × 10 m at 100 m elevation intervals across three locations (Km. 37, Km. 39a, and Km. 39b), for a total of eight plots. All trees with a diameter at breast height (DBH) ≥ 10 cm were measured and identified. We recorded 352 trees inside the plots, representing 138 species and 35 families, with a total basal area of 24.7 m<sup>2</sup>/0.4ha. The dominant families in terms of basal area are Dipterocarpaceae and Myrtaceae. We found 79 Dipterocarpaceae trees, representing 22.4% of individuals, in the surveyed area. In terms of species richness, Dipterocarpaceae composed 21% of the species. There were seven genera (*Dipterocarpus*, *Dryobalanops*, *Hopea*, *Shorea*, *Rubroshorea*, *Richetia*, and *Anthoshorea*) and 29 species. *Shorea* was the richest genus among them. *Shorea laevis*, *Rubroshorea leprosula*, and *R. dasyphylla* were the most common species found in Dipterocarpaceae.

**Key words:** Bukit Baka Bukit Raya National Park, Dipterocarpaceae, lowland forest, tree diversity.

### ABSTRAK

SUSANTI, R., GIRMANSYAH, D., PRATAMA, B. A. & JAKALELANA, S. 2026. Komposisi pohon hutan dataran rendah di Taman Nasional Bukit Baka Bukit Raya, Kalimantan Timur, Indonesia. *Reinwardtia* 25(1): 31–40. — Penelitian keanekaragaman jenis pohon dan karakteristik struktur hutan dataran rendah di Taman Nasional Bukit Baka Bukit Raya (TNBBBR) dilakukan untuk mengetahui keanekaragaman floristik umum di kawasan konservasi ini. Survei dilakukan di perbatasan taman nasional dengan PT. Sari Bumi Kusuma, sebuah perusahaan konsesi hutan di Kalimantan Timur. Pengumpulan data dilakukan dengan menggunakan transek berukuran 50 × 10 m pada setiap gradien elevasi 100 m di tiga lokasi (Km. 37, Km. 39a, dan Km. 39b), dengan total delapan transek. Semua pohon dengan diameter setinggi dada (DBH) ≥ 10 cm diukur dan diidentifikasi. Sebanyak 352 pohon tercatat dalam plot penelitian, mewakili 138 jenis dari 35 suku, dengan total luas bidang dasar sebesar 24,7 m<sup>2</sup>. Suku dengan bidang dasar dominan adalah Dipterocarpaceae dan Myrtaceae. Sebanyak 79 pohon Dipterocarpaceae ditemukan, yang mencakup 22,4% dari total kepadatan pohon di area survei. Dari segi kekayaan jenis, Dipterocarpaceae menyusun 21% dari total jenis yang ditemukan. Terdapat 7 marga (*Dipterocarpus*, *Dryobalanops*, *Hopea*, *Shorea*, *Rubroshorea*, *Richetia*, dan *Anthoshorea*) dan 29 jenis, *Shorea* merupakan marga yang paling beragam dibandingkan dengan marga lainnya. *Shorea laevis*, *Rubroshorea leprosula*, dan *R. dasyphylla* adalah beberapa jenis Dipterocarpaceae yang paling umum ditemukan.

**Kata kunci:** Dipterocarpaceae, hutan dataran rendah, keanekaragaman pohon, Taman Nasional Bukit Baka Bukit Raya.

## INTRODUCTION

Bukit Baka and Bukit Raya National Park (TNBBBR) is one crucial conservation area within the Heart of Borneo Conservation Initiative (Persoon & Ossenweijer, 2008; Sloan *et al.*, 2019). Like other conservation areas across the globe, this national park also faces various threats, including habitat destruction and deforestation (Austin *et al.*, 2019), illegal activities, including logging, poaching, and mining (Alfon, 2014; Manik, 2007). In 2020, an estimated 461,588 ha of forest in Kalimantan were degraded. Between 2001 and 2016, oil palm plantations, timber expansion, and large-scale plantations (Austin *et al.*, 2019) were the major drivers of deforestation in Kalimantan. Despite the pressure it faces, this national park continues to play an important role, not only in conserving flora and fauna but also in providing ecosystem services.

The floristic information concerning this national park is quite limited, in contrast with the ample information available on animal diversity. There are only a few publications on the plant diversity of this park, most of which are reports. The most comprehensive botanical survey was conducted in 1992–1995 and successfully identified 1,054 plant taxa from 357 genera and 132 families in TNBBBR (Jarvie *et al.*, 1998). The other research was conducted for specific taxa, such as palms (Rustiami, 2013), Pandanaceae (Keim *et al.*, 2011), *Rubroshorea leprosula* (old name: *Shorea leprosula*) (Habeahan *et al.*, 2017), and the most recent publication is regarding invasive species (Abduh *et al.*, 2021), medicinal plants (Mariani *et al.*, 2023), and heath forest diversity (Rifanjani *et al.*, 2023).

The forest in TNBBBR can be classified as a lowland forest, with specific areas dominated by Dipterocarpaceae, forming a Mixed Dipterocarp Forest. Within the lowland Dipterocarpaceae forest in Borneo, Slik *et al.* (2003) identified five central floristic regions characterized by distinct genera. However, the absence of comprehensive published floristic studies in the TNBBBR area has resulted in its exclusion from previous publications. The most recent tree monitoring survey in the national park was conducted in 2010 and 2012 at seven locations (Abduh *et al.*, 2018). This study aims to expand upon previous monitoring efforts by adding additional sites and providing a comprehensive overview of the floristic information in TNBBBR.

The objective of this study was to assess the tree structure, composition, and diversity in the lowland forest of TNBBBR. Additionally, the study provides information on the floristic composition, with particular emphasis on endangered, endemic, and protected tree species. Understanding the structure, composition, and diversity of

trees, as well as the floristic information on key species, is essential for sound, sustainable management of the conservation area.

## MATERIALS AND METHODS

### Study Area

Bukit Baka Bukit Raya National Park (TNBBBR) is a conservation area located in the heart of Kalimantan, Indonesia. Administratively, this national park is located in Central and West Kalimantan Province, covering 181,090 ha. The national park is located between 112°12'12.345"E–112°56'31.295"E longitude and 0°28'41.32"S–0°56'22.252"S latitude. Several major rivers that flow into the West and East Kalimantan regions flow through this national park. The area's topography is predominantly steep, particularly within the Schwaner mountain range.

The data collected for this study were obtained in 2014 at the northwest border of the national park, within a private concession, at elevations of 300–500 m above sea level (m asl). The company, PT. Sari Bumi Kusuma (SBK) began operations in 1978, when the national park was designated a nature conservation area covering approximately 50,000 ha. The lowland forest in which the study was conducted is in relatively good condition and is abundant in various Dipterocarpaceae species.

Data were collected at four locations (see Fig. 1), selected based on accessibility. At two locations (Km. 37, and Km. 39a), three 50 × 10 m plots were established, each separated by a 100 m elevation gain. At locations Km. 39b and Km. 39c, only one plot was established, for a total of eight plots and an area of 0.4 ha. Plot elevations varied from 300 m asl to 500 m asl (see Table 1). Within these plots, every tree with a diameter greater than 10 cm (DBH ≥ 10 cm) was measured. A rapid field identification was conducted, and representative samples of all recorded taxa were collected. Specimens that could be identified in the field, as well as representative trees of the same taxa, were collected and preserved as a herbarium specimens.

### Species Determination

Initial species identification was conducted in the field by local people using local names. Formal identification was conducted in the Herbarium Bogoriense, National Research and Innovation Agency (formerly the Indonesian Institute of Sciences). Fertile specimens were preserved as herbarium collections, while sterile specimens were kept as voucher specimens at Herbarium Bogoriense. We identified 75% of individuals at the species level, 13 at the family level, and 26 could not be identified. Unidentified specimens were assigned separate numbers and treated as distinct individuals.

The most recent taxonomical name is used following Plants of the World Online (<https://>

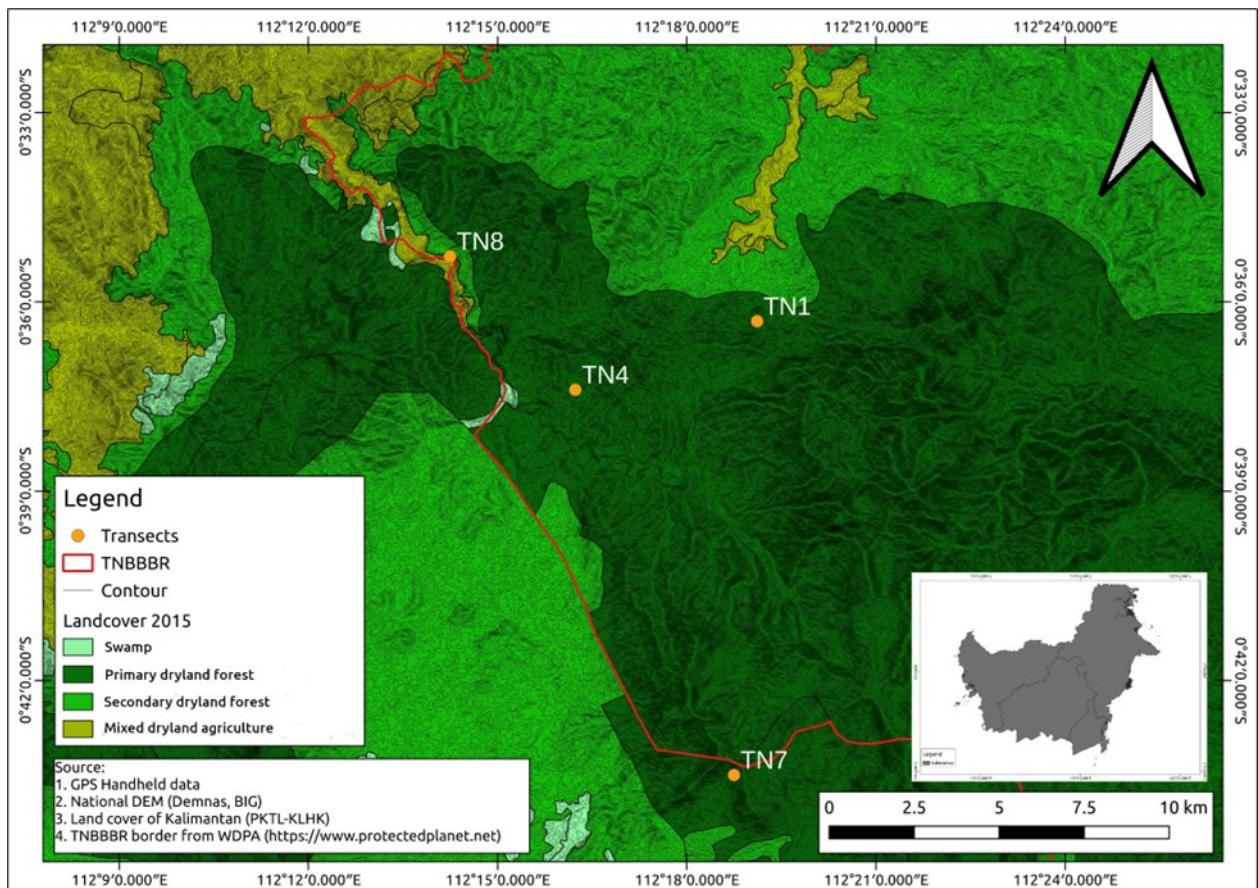


Fig. 1. Study location on the border of TNBBBR with PT. SBK Membalong, 19. Perawas, 20. Kembiri villages.

powo.science.kew.org/) and Ashton & Heckenhauser (2022). In total, 104 individual trees were identified to the genus level, while 36 individual trees (representing 10% of all sampled individuals) belonging to 23 taxa could not be identified at any taxonomic level.

The conservation status of trees, particularly dominant species and Dipterocarpaceae species, is determined based on the criteria set by the International Union for the Conservation of Nature and Natural Ecosystem (IUCN) (International Union for Conservation of Nature, 2025), and according to Government Regulation (PP no. 7/1999) concerning the Preservation of Plant and Animal, as well as Ministerial Regulation No. P. 106/MENLHK/SETJEN/KUM.1/12/2018, which pertains to the Second Amendment to the Regulation of the Minister of Environment and Forestry No. P.20/MENLHK /SETJEN/KUM.1/6/2018 regarding Types of Protected Plants and Animals. Species endemicity is determined based on the results of Sidiyasa's study (Sidiyasa, 2015) and information from the Global Biodiversity Information Facility (GBIF) (GBIF Secretariat, 2023).

### Data Analysis

Tree diversity, structure, and composition were measured for each plot. The collected data were used to determine species dominance through the calculation of Basal Area (BA, as referenced in equation 1) and the density of each species.

$$BA = \frac{1}{4} \pi D^2 \quad (1)$$

Tree diversity was calculated using Shannon-Weaver and Simpson's diversity index, as defined in equations (2) and (3), respectively. The higher index value ( $H'$  and/or  $D$ ) indicates higher diversity within the vegetation.

Shannon Weaver ( $H$ )

$$H' = - \sum_{i=1}^N \frac{n_i}{N} \ln \frac{n_i}{N} \quad (2)$$

Simpson (D)

$$D = 1 - \frac{\sum n_i(n_i - 1)}{N(N - 1)}$$

(3)

Where H' is Shannon Weaver's diversity index. D is Simpson's diversity index.  $n_i$  is the number of individuals of the  $i$  species and N: total number of individuals of all species.

The evenness index (e) is calculated to measure the relative size of the population, as described by equation (4) (Oksanen *et al.*, 2022). This index ranges from 0 to 1, with a value close to 1 indicating that all species are equally represented and the community is in a stable condition. Further, a J value close to or equal to zero suggests that the community is depressed and that a species may potentially become dominant (Ulfah *et al.*, 2019).

Evenness index

$$J = \frac{H'}{\log(s)}$$

(4)

Where H' is the diversity index and s is the number of species.

A Pearson correlation test was conducted to investigate the relationships among elevation, species diversity, basal area, dominance, and number of individuals across plots. The Sorenson-Dice similarity coefficient was also used to determine species similarity in each plot. All data analyses were conducted in R, using the 'vegan' package for vegetation analysis, the 'corrplot' package for correlation testing, and the 'ggplot2' and 'ggpattern' packages for visualization.

Table 1. The characteristics of the forest in each sampling plot.

| Location        | Code | Alt (m asl) | Density* | Num. of Fam. | Num. of Species | Num. of Dipt. | BA**  | Dominant species***  |
|-----------------|------|-------------|----------|--------------|-----------------|---------------|-------|--|
| 1 (Km. 37)      | TN1  | 313         | 52       | 21           | 52              | 11            | 1.77  | <i>Tristania</i> sp.<br><i>Shorea smithiana</i>                                  |
|                 | TN2  | 400         | 54       | 16           | 54              | 10            | 3.03  | <i>Syzygium</i> sp.<br><i>Cleistanthus</i> sp.                                   |
|                 | TN3  | 500         | 53       | 19           | 53              | 15            | 6.24  | <i>Shorea laevis</i><br><i>Baccaurea costulata</i><br><i>Richetia multiflora</i> |
| 2 (Km. 39a)     | TN4  | 315         | 37       | 15           | 37              | 5             | 2.88  | <i>Calophyllum teysmannii</i><br><i>Koompassia malaccensis</i>                   |
|                 | TN5  | 401         | 57       | 18           | 57              | 7             | 3.31  | <i>Garcinia celebica</i><br><i>Anthoshorea virescens</i>                         |
| 3 (Km. 39b)     | TN6  | 500         | 36       | 8            | 36              | 12            | 2.45  | <i>Anthoshorea symingtonii</i><br><i>Rubroshorea dasyphylla</i>                  |
|                 | TN7  | 401         | 31       | 10           | 31              | 8             | 2.97  | <i>Xanthophyllum</i> sp.<br><i>Driobalanops</i> sp.                              |
| 4 (Km. 39c)     | TN8  | 401         | 32       | 12           | 32              | 11            | 2.01  | <i>Koompassia malaccensis</i>  |
| Total in 0.4 ha |      |             | 352      |              | 352             | 79            | 24.67 |  |

\* density: number of trees per 0.4 ha

\*\* BA: total Basal Area of each plot

\*\*\* Dominant species: Two dominant taxa for each plot are listed in descending order of BA

Table 2. Dipterocarpaceae species composition found inside the plots.

| Forest characteristic | Dipterocarpaceae | %    | Non Dipterocarpaceae | %    | Total |
|-----------------------|------------------|------|----------------------|------|-------|
| Number of species     | 30               | 21.0 | 109                  | 79.0 | 139   |
| Density               | 79               | 22.4 | 273                  | 77.6 | 352   |
| Total BA              | 11.08            | 44.9 | 13.59                | 55.1 | 24.67 |

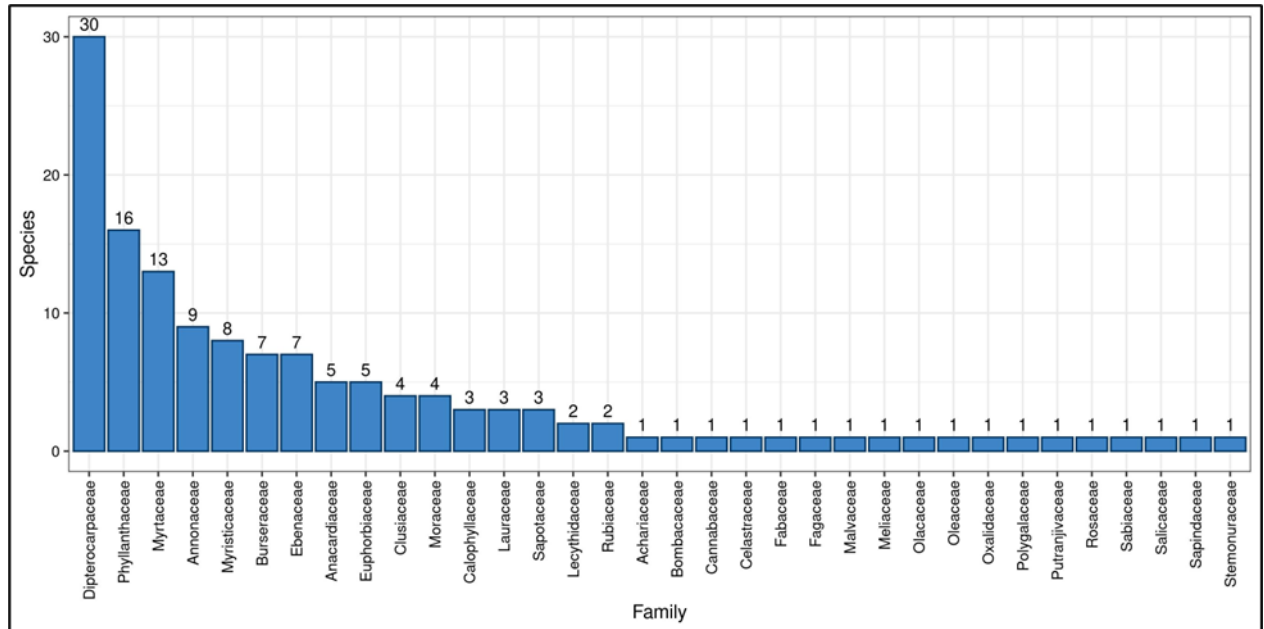


Fig. 2. Species richness at the family level.

## RESULTS AND DISCUSSION

### Forest Structure and Composition Characteristics

The study recorded 352 tree samples (Table 1), representing 35 families, 58 genera, and 139 species. The number of species identified in this study is relatively high compared to previous studies in Kalimantan (Pratama *et al.*, 2021; Purwaningsih, 2009). However, other studies conducted with larger plots in Kalimantan (Abduh *et al.*, 2018; Kartawinata *et al.*, 2008; Sheil *et al.*, 2010) have recorded higher tree species diversity compared to the study area. The general assessment of the TNBBBR whole area revealed a total of 1,227 plant species from various types of habitus (herbs, shrubs, and trees) (Abduh *et al.*, 2018).

Dominant species, based on Basal Area, varied across all eight plots with no distinct differences among altitudes (300–500 m asl). Some dominant species could not be identified at the species level due to incomplete samples, but were confidently identified at the genus level. Dipterocarpaceae species predominated the area, including *Shorea laevis*, *Rishetia multiflora* (syn. *S. multiflora*), *Anthoshorea virescens* (syn. *S. virescens*), *Anthoshorea symingtonii* (syn. *S. symingtonii*), *Rubroshorea dasyphylla* (syn. *S. dasyphylla*), and *Dryobalanops* sp. Other

dominant species included *Tristania* sp. and *Syzygium* sp. (Myristicaceae), *Cleistanthus* sp. (Phyllanthaceae), *Koompassia malaccensis* (Fabaceae), *Garcinia* sp. (Clusiaceae), *Calophyllum teysmannii* (Calophyllaceae), and *Xanthophyllum* sp. (Polygalaceae). A total of 30 Dipterocarpaceae species from seven genera (*Dipterocarpus*, *Dryobalanops*, *Hopea*, *Shorea*, *Rubroshorea*, *Richetia*, and *Anthoshorea*) were identified in the study area, comprising 21% of the total tree species identified (Table 2).

Dipterocarpaceae diversity in this area is relatively high compared with the total number of tree species identified within the plot. A total of 84 Dipterocarpaceae species (seven genera) of the total 200 species known in Kalimantan (Purwaningsih, 2004; Indrioko *et al.*, 2006) were found throughout TNBBBR areas (Abduh *et al.*, 2018). Previous studies predicted that Dipterocarpaceae compose approximately one quarter of all trees in most lowland forests in Borneo, with *Rubroshorea* and *Shorea* as the most abundant genus (Ashton 1982; Slik *et al.*, 2003). In this study, *Rubroshorea* accounted for 47% (14 of 32) of the total Dipterocarpaceae species. There was only one species in each of the other genera (*Anthoshorea*, *Dryobalanops*, and *Vatica*), and two species in *Dipterocarpus* and *Hopea*.

Table 3. Diversity index in four sampling locations.

| Index                   | Km. 37 | Km. 39a | Km. 39b | Km. 39c |
|-------------------------|--------|---------|---------|---------|
| Shannon-Weaver ( $H'$ ) | 4.35   | 4.45    | 3.34    | 3.21    |
| Simpson (D)             | 0.98   | 0.99    | 0.96    | 0.95    |
| Evenness (E)            | 0.94   | 0.97    | 0.99    | 0.97    |

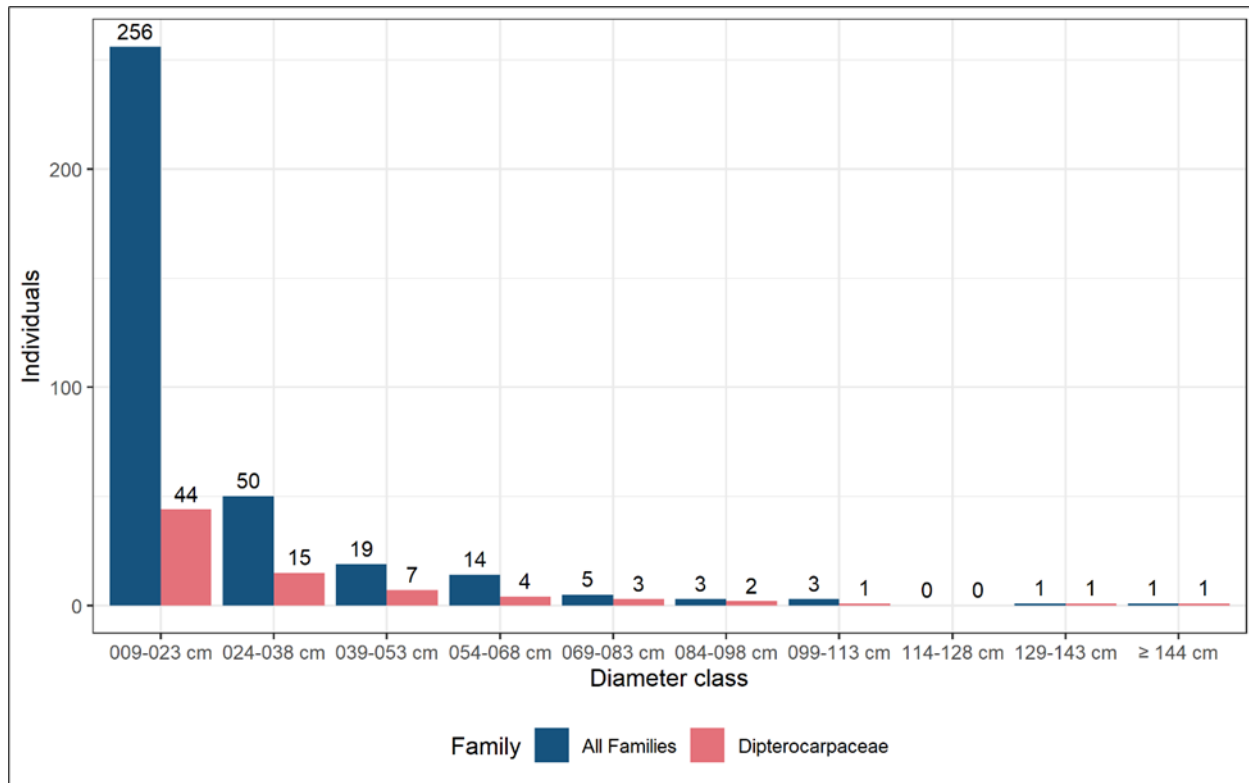


Fig. 3. Number of individuals by diameter class.

Dipterocarpaceae species also had the highest relative abundance (22.4%) among species from other families. The number of individuals per plot ranged from 31 to 57 (Table 1), with an average of 44 individuals per 500 m<sup>2</sup> plot (880 individuals per hectare). The density distribution of all species from each tree family is shown in Fig. 2. Apart from Dipterocarpaceae, other families with high abundance are Phyllanthaceae (*Aporosa* and *Baccaurea*), Myrtaceae (*Syzygium*), Annonaceae (*Polyalthia* and *Goniothalamus*), and Myristicaceae (*Myristica*) (Fig. 2).

The tree density of the studied site (880 trees  $\geq$  10 cm DBH ha<sup>-1</sup>) exceeds the mean stem density reported for lowland dipterocarp forests in Kalimantan, which is approximately 500–550 stems ha<sup>-1</sup> for trees  $\geq$  10 cm DBH (Paoli *et al.*, 2008). Such elevated stem density is therefore more plausibly associated with a history of local disturbance.

Dipterocarpaceae composed 22.4 % of the total tree density in this area, and its DBH ranged from 10 to 160 cm. At the genus level, the most com-

mon tree genera were *Robroshorea* (Dipterocarpaceae), *Syzygium* (Myrtaceae), *Shorea* (Dipterocarpaceae), *Baccaurea* (Phyllanthaceae), and *Diospyros* (Ebenaceae). This result is consistent with the description by Slik *et al.* (2003) that the most common tree genera in the lowland forests of Borneo are *Syzygium* (Myrtaceae), *Diospyros* (Ebenaceae), *Madhuca* (Sapotaceae), and *Dipterocarpus* (Dipterocarpaceae). Although *Madhuca* and *Dipterocarpus* are present in this area, their abundance is low. At the family level, Euphorbiaceae is usually found as the most abundant tree family (Cannon *et al.*, 1994; Sheil *et al.*, 2010; Sidiyasa 2001); however, changes in taxonomical nomenclature (Board of Trustees of the Royal Botanic Gardens Kew, 2019). This leads to changes in family names. *Aporosa* and *Baccaurea*, which are commonly found in the lowland forest of Kalimantan, are now included in the *Phyllanthaceae* family, not Euphorbiaceae. With this change, comparisons of floristic composition are better conducted at least at the genus level.

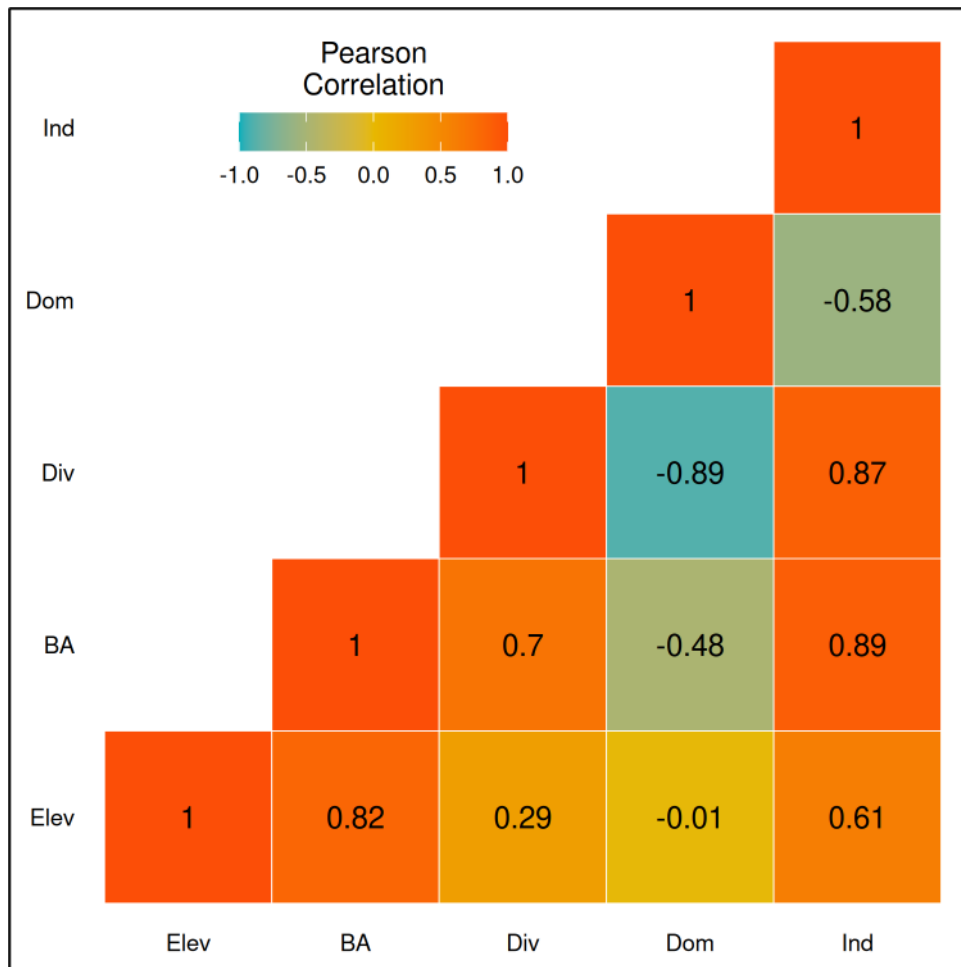


Fig. 4. A Pearson's correlation between elevation (Elev), basal area (BA), Shannon-Weaver's diversity index (Div), Dominance index (Dom), and number of individuals (Ind).

The diversity index indicates that, across the four sampling locations, tree diversity is relatively even (Table 3). The calculation indicates that Km. 39a has the highest tree diversity, whereas Km. 39c has the lowest. All locations were in stable condition based on the evenness index. Previous studies (Cannon *et al.*, 1994; Kartawinata *et al.*, 2008; Sheil *et al.*, 2010) explained that lowland forests in Kalimantan were initially dominated by Dipterocarpaceae species and were known as Mixed Dipterocarp Forest. However, continued pressure on lowland forests in Kalimantan is altering forest diversity (Lawrence, 2004; Qirom *et al.*, 2022). Our study showed that Dipterocarp species continue to dominate the national park boundary in terms of basal area and abundance (Table 2), due to pressure from land-cover and land-use change. *Shorea laevis* is the most abundant species in the dipterocarp family, followed by *Rubroshorea leprosula* and *S. superba*. Most of the trees found inside the plot have a diameter less than 60 cm (Fig. 3); only three individuals have a diameter over 100 cm: *Shorea laevis* (160 cm), *Richetia multiflora* (140 cm), and *Rubroshorea dasyphylla* (110 cm). The diameter distribution of Dipterocarpaceae has an inverse J-curve pattern

(Fig. 3), which suggests possible regeneration of Dipterocarp species in this area.

#### Conservation Status of Tree Species

Using the IUCN classification, the study conducted was able to distinguish Dipterocarpaceae species as Critically Endangered, *Shorea cf. rotundifolia*, and four species Endangered: *Rubroshorea splendida*, *R. uliginosa*, *Shorea sumatrana*, and *Anthoshorea virescens*. None of the sampled individuals are endemic to Indonesia nor protected under Indonesian Government regulation (P.106). Although the diameter distribution of Dipterocarpaceae still shows an inverse J-curve (Fig. 3), a more detailed investigation of density at each growth stage is needed to predict species sustainability.

Indonesia has already released a list of 50 rare plant species (Rugayah *et al.*, 2017) based on a national assessment and the adoption of the International Union for Conservation of Nature (IUCN) Red List criteria. Six Dipterocarpaceae species are included in the list, but none found in this area meet the criteria. IUCN already included 307 plant species in their global conservation assessment, including 16 species Critically Enda-

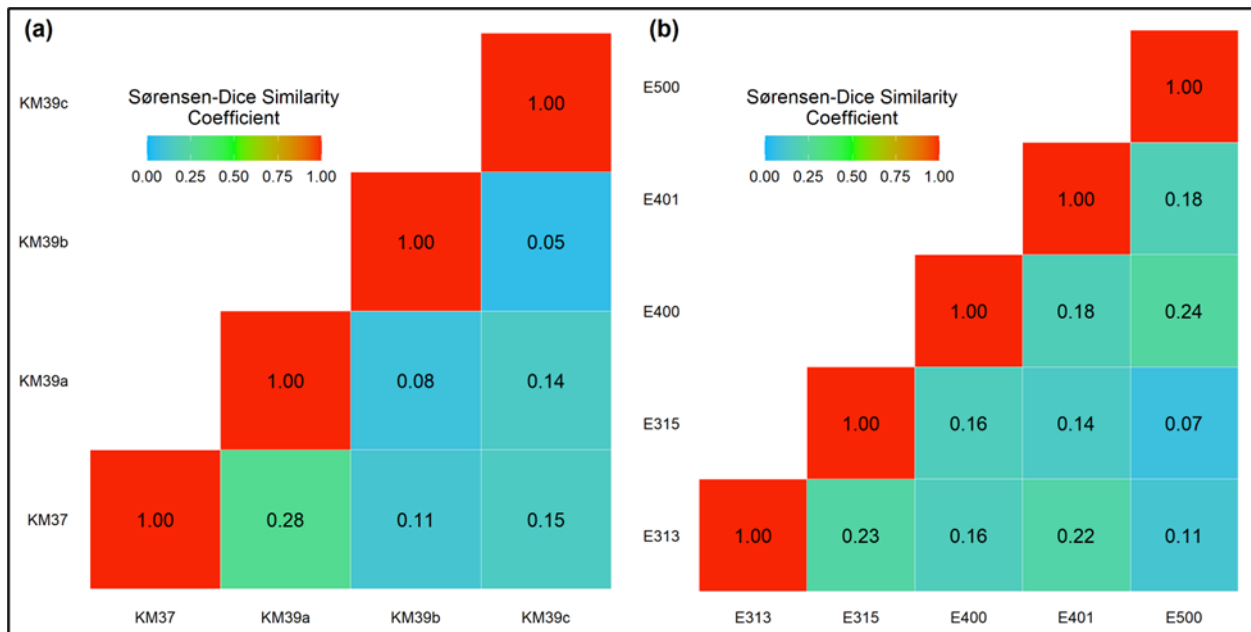


Fig. 5. Sørensen-Dice similarity coefficient. Based on location (a); and elevation (b).

angered (CR), 43 species Endangered (EN), 58 species Vulnerable (VU), 47 species Not Threatened, 111 species Least Concern (LC), and 32 species Data Deficient (DD) (International Union for Conservation of Nature, 2025).

Various conservation efforts are needed to reduce pressure on threatened species. Changing shifting cultivation patterns and intensive farming to agroforestry patterns can be an effort to maintain threatened species amidst changes in land use (Siregar, 2006). Apart from agroforestry activities, efforts to maintain the existence of sacred forests can also be an effort to conserve biodiversity through a social approach (Wadley & Colfer, 2004).

Ex-situ conservation activities, such as botanical gardens or the construction of arboretums or village gardens, are feasible (Marjokorpi & Ruokolainen, 2003). This is especially true for threatened species whose natural habitats are disturbed or severely damaged by natural or human-made disasters.

### Relationship Between Elevation and Abundance of Tree Species

Correspondence Analysis (CA) of floristic composition across plot locations revealed three ecologically distinct clusters (Fig. 4). Cluster 1 was represented exclusively by plot Km. 39b, whereas Cluster 2 comprised Km. 37 and Km. 39a, indicating congruent species assemblages (Jost *et al.*, 2010). Cluster 3 emerged as an outlier, containing only Km. 39c. Dimension 1 (Dim1) of the ordination showed exceptionally high species representation values ( $\cos^2$ ) for *Litsea* sp. ( $\cos^2 = 0.9979$ ), *Hopea* sp. ( $\cos^2 = 0.971$ ), and *Popowia corymbosa* ( $\cos^2 = 0.971$ ). Furthermore, *Richetia cuspidata*, *Rubroshorea pilosa*, and *Rubroshorea sagittata*

(all  $\cos^2 \geq 0.97$ ), all Dipterocarpaceae species, exhibited robust associations with their respective clusters, confirming their diagnostic value as habitat indicators.

A correlation plot indicated that only the basal area showed a strong positive correlation with elevation. Furthermore, basal area was positively correlated with species diversity and individual abundance, but negatively correlated with the dominance index. A similar correlation was observed between the diversity and dominance indices. This is understandable, considering that high species diversity naturally reduces dominance between species (Kunte, 2008; Mortensen *et al.*, 2018).

Furthermore, the Sørensen-Dice similarity coefficient ( $< 0.5$ ; Fig. 5) demonstrated high  $\beta$ -diversity across transects, which means that no transect in this study has a similar floristic composition. In contrast with Brearley *et al.* (2016), the finding of a relatively homogeneous community across a similar gradient in Central Kalimantan. Previous studies (Cirimwami *et al.*, 2019; Negi *et al.*, 2024) prove that differences in altitude tend to change the composition of vegetation and its species richness (Cirimwami *et al.*, 2019; Negi *et al.*, 2024).

### CONCLUSION

Our study recorded 352 trees with DBH  $\geq 10$  cm within 0.4 ha plots, representing 138 species and 35 families, with a total basal area of 24.7 m<sup>2</sup>. The dominant family by basal area and density is Dipterocarpaceae. The study area exhibits high diversity and stable community conditions. This study also found two species in CR status, four species in EN status, and ten species in VU status. There is no similarity between the plots.

## ACKNOWLEDGEMENTS

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## DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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