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Tree Stand Structure of Surili (*Presbytis comata*) Habitat in the Abi-Karna Forest Block, Tea and Cinchona Research Center, Gambung, Bandung Regency, West Java

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Abstract

Primates play a crucial role in forest conservation through seed dispersal from the fruits they consume. Factors influencing primate presence in their habitat include food availability, the presence of predators, and human activity. This study aimed to analyses the tree stand structure of the surili habitat in the Abi-Karna Forest Block, PPTK-Gambung, Pasir Jambu, West Java. The study was conducted over three days, from May 2-4, 2024, using the line transect method. Parameters measured included the number of trees, tree height (h), stem diameter (cm), crown thickness, crown curvature, and crown width diameter. Data analysis included relative density index, dominance, and tree species diversity. The results showed differences in tree stand structure between the western and eastern zones of the Abi-Karna Forest. The western zone had a higher tree species diversity than the eastern zone, with 2,022 and 1,612, respectively. The dominant tree species in both zones were Rasamala and Puspa. Tree heights in the western and eastern zones were 16-20 m, while tree DBH was 10-30 cm. The dense forest canopy plays acrucial role in providing primary food sources and maintaining ecosystem health. The dense canopy cover in the western zone is more conducive to surili activity than in the eastern zone. The tree stands in the Abi-Karna Forest provide food sources, shelter, and movement routes for surili (*Presbytis comata*) and other primates, such as the Javan langur (*Trachypithecus mauritius*), found in the area.

Keywords: forest block, primates, tree stands.

INTRODUCTION

Primates have significant benefits for forest sustainability, as the seeds from the fruit they consume support the expansion of biodiversity and forest regeneration. The presence of these primates can be a benchmark for forest health, the health of forest populations, and the possibility of other animals remaining in significant numbers (Kinanto *et al.,* 2018). Factors influencing the presence of primates in their habitat include food availability, the presence of predators, and humans (Widiana *et al.,* 2018).

Dietary diversity and behavioral flexibility are key factors in the survival of most animals, as food resource availability often fluctuates spatially and temporally. Among vertebrates, primates are one of the most flexible groups in their diets, a behavior crucial for their long-term survival in human-modified and highly seasonal habitats. This flexibility can support animal survival, as they rely on food resources provided by forest tree species (Misdi *et al.,* 2023).

The vegetation of lower mountain forests is more varied but more frequently experiences human disturbance. Undisturbed forest areas have tree stands with relatively well-developed canopies (Annisa *et al.,* 2022). Tree stands are a crucial component of forest ecosystems, which experience dynamics over time. Tree stand density determines the availability of sufficient growing space for trees, which can be assessed by tree diameter and canopy density. Tree canopies provide food, shelter, sleeping areas, and facilitate movement between trees for primates in their habitat (Wahyuni, 2017).

The primate species found in the Abi-Karna forest block are the surili (*Presbytis comata*) and the Javan langur (*Trachypithecus mauritius*), which are ex-rehabilitated primates released into the Nature Reserve and Abi-Karna forest block. The Abi-Karna forest block is a 10-hectare understory forest. This forest is located in the middle of a tea plantation, fragmented with the nature reserve forest area, so it is important to understand the tree stand structure utilized by primates in the western and eastern lanes of the Abi-Karna forest block, as one of the efforts to preserve and prefer primate habitat.

METHOD

The research was conducted on May 2-4, 2024, located in the Abi-Karna forest block, Gambung Resort, Tea and Cinchona Research Center (PPTK), Pasir Jambu, Bandung Regency, West Java.

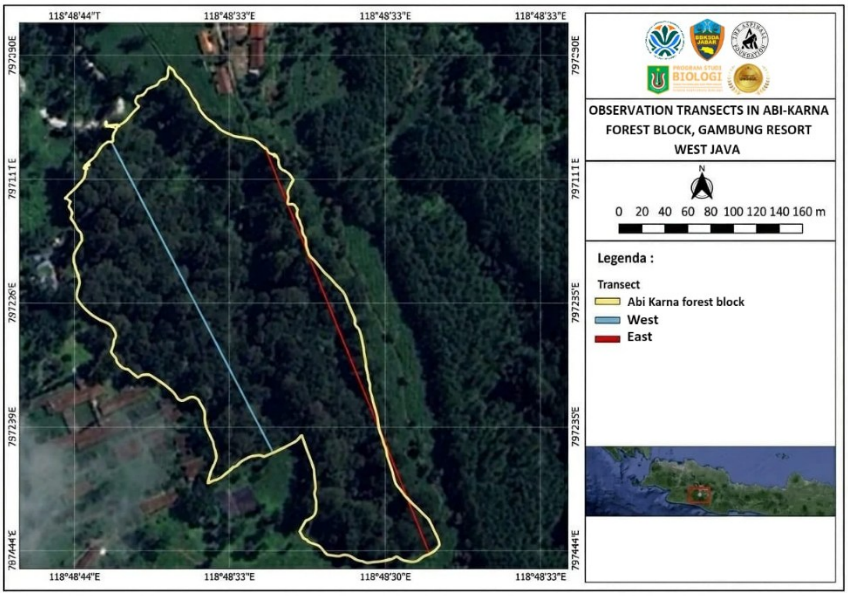

Figure 1. Observation trail in Abi-Karna Forest

The object of this research is a group of surili (*Presbytis comata*) and all types of trees located on the path passed by primates in the Abi-Karna forest block, divided into two paths, namely the western and eastern parts.

Data collection

We colleted data on spatial utilization by determining transect paths (west and east) based on observations of a group of surili ranging on the first day. Surili ranging data was collected by placing waypoints using GPS group positions every 5 minutes. The plots used on each path measuring 20 m x 320 m were used to obtain forest stand structure data using the line transect method (Figure 1). Parameters measured in the field included the number of trees, tree height (h), tree position (m), DBH (cm), vertical position in the form of crown thickness/crown depth, and horizontal position in the form of crown curve/crown radius (west, east, north, south) of each tree in the plot.

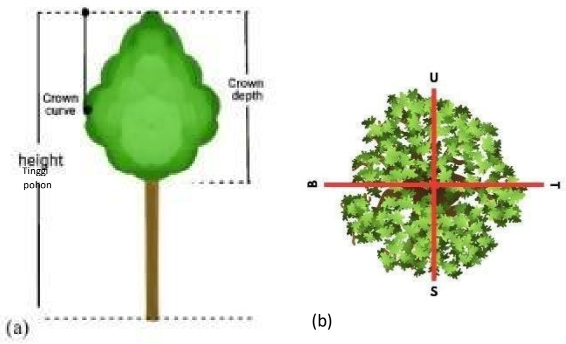

Figure 2. Measurement parameters: (a) tree height, tree curvature, crown thickness and (b) crown radius

Tree height is measured from the ground to the tip of the highest tree trunk. Tree DBH is measured with a minimum size of >20 cm (tree category). Data collection of crown thickness (crown depth) vertically starts from the first branch to the highest branch of the crown, while horizontal data of the crown width diameter (crown radius) is measured on two mutually perpendicular axes, for the crown curve (crown curve) is taken from the outermost crown branch to the highest crown. To obtain a more accurate prediction, measurements of the crown radius projection are carried out on four radii. The parameters measured for each individual tree can be seen in Figure 2. The applications used are Backcountry Navigator, Glama, SEXi-FS, and QGIS (Quantum Geographic Information System).

Data analysis

Data analysis was conducted to determine the diversity and abundance of tree species utilized by Surili and Lutung primates in the Abi-Karna forest block.

a) Relative Density

Density is the number of individuals of each species found in a sample plot. The density of each plant species is calculated using the formula:

$$KR = \frac{Density\ of\ species}{Density\ of\ all\ species} \times 100\%$$

b) Relative Frequency

Frequency is the number of occurrences of each species found in all sample plots created. Species frequency can be calculated using the formula:

$$FR = \frac{frequency\ of\ species}{frequency\ of\ all\ species} \times 100\%$$

c) Relative Dominance Index

The dominance index is used to determine the dominance of a particular species in a community. The Simpson dominance index (Krebs, 1989) is used:

$$DR = \frac{dominance\ of\ species}{dominance\ of\ all\ species} \times 100\%$$

d) Importance Value Index

This importance value index indicates the dominant species at the research site. To calculate the importance value index, the following formula is used:

$$\mathrm{IVI} = R\mathrm{D}\ (\%) + R\mathrm{F}\ (\%) + R\mathrm{Dom}\ (\%)$$

e) Diversity Index

After obtaining the INP results for each type, the diversity index for each plant species is calculated. The diversity of a plant community can be determined using Shannon-Wienner information theory ($\hat{\mathrm{H}}$). The purpose of this theory is to measure the level of order and disorder in a system. The diversity index is determined using the formula:

$$H = -\Sigma pi\ ln\ pi$$

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The results obtained can then be categorized into:

- If H < 1 then diversity is low.
- If H 1 < H < 3 then the diversity is moderate.
- If H > 3 then diversity is high.
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RESULT

Data collection of surili habitat trees was carried out based on observations of the surili's daily roaming area, to obtain data on feeding trees and sleeping trees, which was carried out on the first day of data collection. Based on the surili ranging data, the western and eastern routes of the Abi-Karna Forest were taken to determine the preferred habitat types of surili and langur in the Abi-Karna Forest area (Figure 3).

Figure 3. Condition of the west route (a) and east route (b) in the Abi-Karna Forest

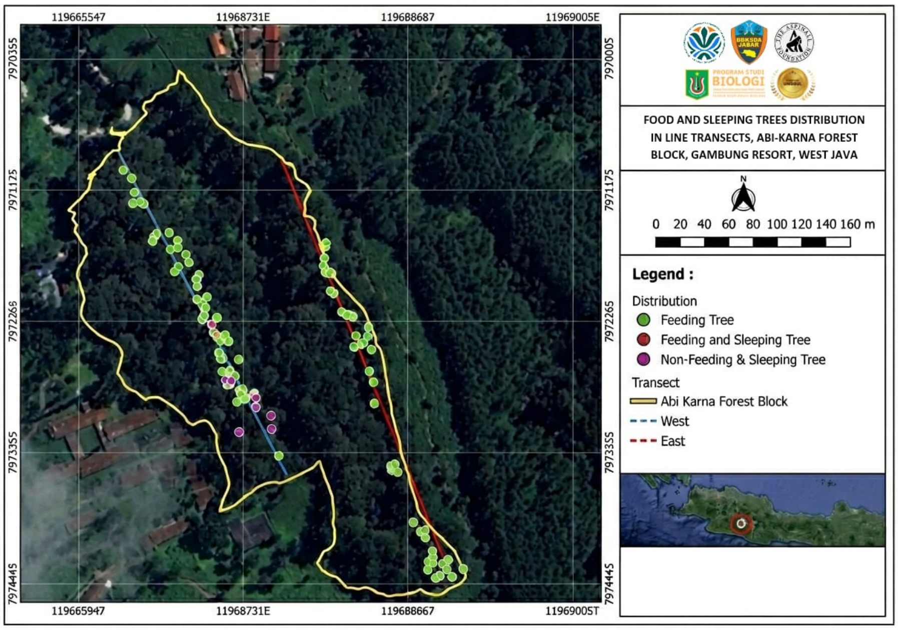

Figure 4. Distribution of feeding trees and sleeping trees in the Abi-Karna Forest

High vegetation density, species diversity, and abundant food availability cause the surili to utilize more vertical space (tree canopy thickness) than horizontal space (crown width) (Figure 3).

Table 1. Importance Value Index (IVI) of the western path in the Abi-Karna Forest

No.	Trees	RF (%)	RD (%)	RDom (%)	IVI (%)	H'
1.	Rasamala	39%	39%	15%	94%	0,367
2.	Afrika	8%	8%	16%	33%	0,205
3.	Silver oaks	10%	10%	11%	31%	0,228
4.	Baros	10%	10%	7%	26%	0,228
5.	Teh	8%	8%	6%	22%	0,205
6.	Surren	5%	5%	8%	18%	0,148
7.	Ki Hiur	7%	7%	5%	18%	0,179
8.	Puspa	5%	5%	6%	16%	0,148
9.	Pasang	3%	3%	6%	12%	0,112
10.	Salam	2%	2%	7%	10%	0,067
11.	Huru	2%	2%	7%	10%	0,067
12.	Hamerang	2%	2%	6%	9%	0,067
	Total	**100%**	**100%**	**100%**	**300%**	**2,022**

Table 2. Importance Value Index (IVI) of the Eastern path in the Abi-Karna Forest

No.	Trees	RF (%)	RD (%)	RDom (%)	IVI (%)	H'
1.	Rasamala	36%	36%	24%	97%	0,368
2.	Puspa	36%	36%	10%	82%	0,368
3.	Kuray	2%	2%	16%	20%	0,082
4.	Kina	6%	6%	7%	20%	0,176
5.	Tebe	4%	4%	10%	19%	0,134
6.	Afrika	4%	4%	9%	18%	0,134
7.	Saninten	4%	4%	10%	18%	0,134
8.	Ki hiur	4%	4%	7%	16%	0,134
9.	Kayu manis	2%	2%	7%	11%	0,082
	Jumlah	**100%**	**100%**	**100%**	**300%**	**1,612**

The distribution of tree heights in the western zone ranges from 16-20 m, while in the eastern zone, tree heights are dominated by heights of 16-20 m and 31-35 m (Figure 5). The highest DBH values for trees in the western and eastern zones are 10-30 cm. The western zone has the highest DBH of 111-130 cm, while the eastern zone has the highest DBH of 131-150 cm (Figure 6). This provides an overview of the vegetation structure of the Abi-Karna forest block, and differences in vegetation profiles between the western and eastern zones can indicate variations in the characteristics of the surili habitat.

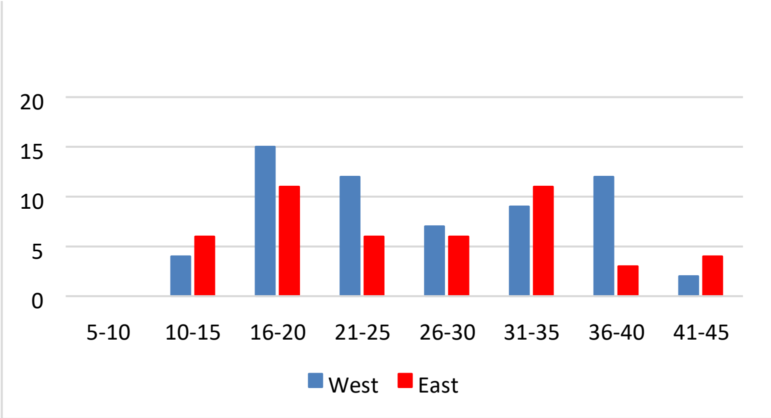

Figure 5. Tree height ranges in the west and east paths

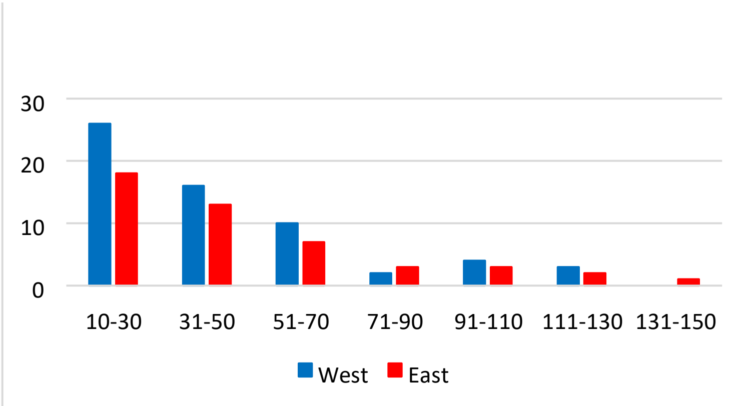

Figure 6. DBH range of trees in the western and eastern lanes

Based on analysis in the Glama application, it was found that the density of the western Abi-Karna forest block ranged from 76.53% - 91.31%, meaning the tree canopy cover was dense, while in the eastern part the forest density ranged from 65.94% - 92.84%, with moderate-dense tree canopy cover (Figure 7 and Figure 8).

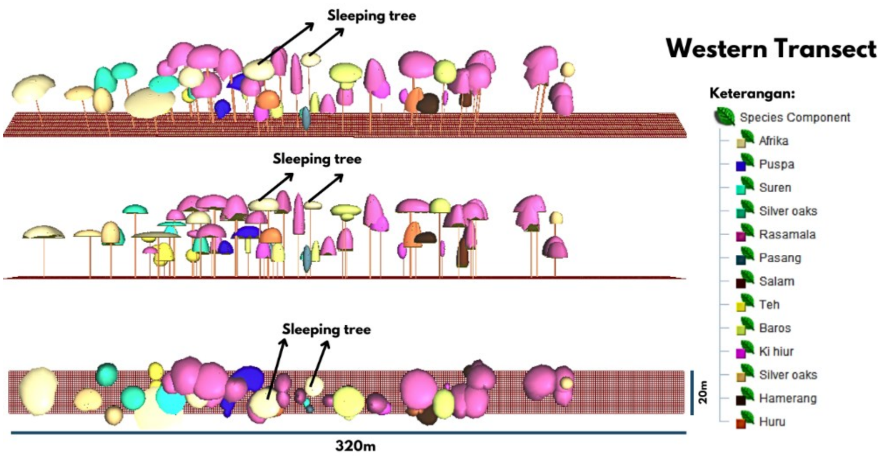

Figure 7. Visualization of the vegetation structure of the western route

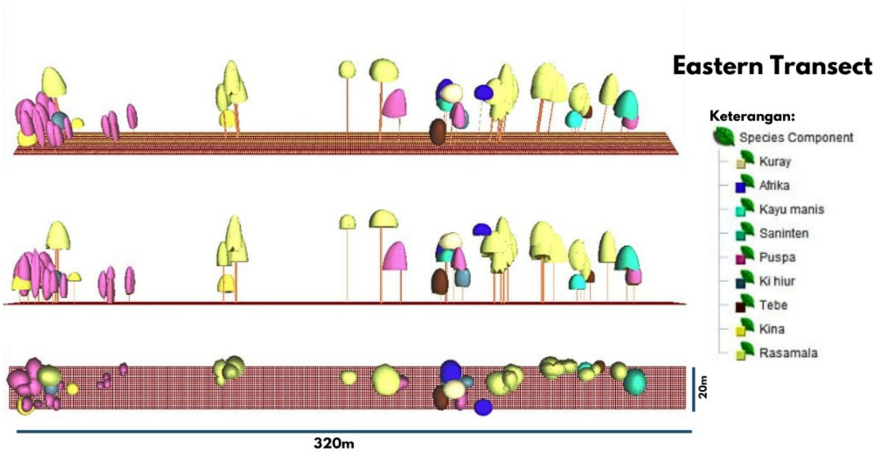

Figure 8. Visualization of the vegetation structure of the eastern route

DISCUSSION

The existence of primates in nature is influenced by the availability of food sources, which can determine the sustainability of the primate population. The quality and quantity of available food also affect the size of the roaming area and the movement behavior of primates (Bismark, 2009). The availability of food sources, sleeping trees, and arboreal movement facilities for primates is determined by the composition of the standing structure and dominant species at the tree level (Bismark, 2012).

Figure 4 shows that primate feeding trees are spread across both paths along the Abi-Karna forest block. According to Cahyani et al. (2024), primates were found in areas with large and tall trees such as Rasamala and Puspa. By occupying most of the study area, both demonstrated their ability to adapt to environmental conditions throughout the studied area. It is estimated that the Rasamala species with its larger trunk diameter first grew in the study area (Arrijani *et al.,* 2006).

There are 12 tree species with a total of 61 individuals in the western path (Table 1) and 9 tree species in the eastern path with a total of 47 individual trees recorded in Table 2. The type of tree used as a surili sleeping tree is Rasamala. The presence of a plant species in an area indicates its ability to adapt to that habitat and has a wide tolerance to various environmental conditions (Soegianto, 1994). Based on Table 1, the western path states that Rasamala and Africa have the highest INP results, at 94% and 33%. Meanwhile, in the eastern path (Table 2), the highest INP results are Rasamala and Puspa, respectively, at 97% and 82%. According to Saharjo and Cornelio (2011), the higher the INP value of a species, the greater its control over the vegetation community and vice versa.

Surili typically choose sleeping trees with specific characteristics: trees with a narrow horizontal crown width but strong and numerous branches (Sugiarto 2006). Selecting trees with these characteristics makes it easier for the surili to detect predators or other dangers. Trees used as sleeping sites by surili are generally located close to trees used as food sources. When collecting daily roaming data, surili choose sleeping trees that they also frequently consume as food trees.

According to Hidayat (2017), the diversity index of a plant community depends on the number of species and the number of individuals of each type (species richness). The results of data analysis found in the western route have higher diversity when compared to the eastern route. Where the western route has a value of 2.022 (Table 1), while the eastern route is 1.612 (Table 2). The western and eastern routes are both included in the moderate category according to the Shannon-Wienner theory. The difference in diversity values in the western and eastern routes is caused by the topography of the land in the eastern route which has a sloping topography, and many plants that are not included in the tree category.

The canopy or tree crown is composed of leaf and branch components that grow according to the habitat of each tree species/stand that makes up the forest. The canopy structure can be used to represent microclimate conditions and flora and fauna biodiversity. In addition, the canopy also provides an overview of forest productivity and ecosystem health. The denser the canopy (vertical) of a forest, the higher its role as a provider of primary food sources (producers) in the food web in the ecosystem (Dharmawan, 2020). According to Kadri et al. (1992), dense (horizontal) canopy cover is a stand with a canopy cover of > 70%, moderate 40-70%, and rare < 40%. The high percentage of canopy cover is influenced by tree canopy density (Lestariningsih *et al.,* 2022). This is also evidenced by the SEXi-FS analysis, which shows a greater abundance of trees in the western part compared to the eastern part.

Vegetation structure visualization was performed using the Spacially Explicit Individual-based Forest Simulator (SEXi-FS) software. Visualization was performed to compare canopy density on the West and East routes. The West route has a denser canopy density and a greater diversity of tree species (Figure 7) compared to the East route (Figure 8). The dense canopy and abundant diversity of forage tree species on the West route are factors that support primates' daily activities on this route.

Land cover conditions that support the survival of Javan langurs and langurs have a significant impact because natural forests or understory forests provide more food sources and have high vegetation densities. This high horizontal canopy density is very advantageous for langurs in migrating to forage, fleeing threats, hiding from predators, and resting, given that Javan langurs are arboreal primates (Nugroho, 2022).

A good habitat is a habitat that is able to meet the needs of a species. Suitable habitats for surili are selected based on internal and external factors. Internal factors include physiological needs such as social activity and grooming, which influence shelter and food search. External factors include external disturbances, such as the presence of predators and human activity, which can influence surili habitat preferences (Bailey, 1984).

CONCLUSION

The number of species and individual forage trees in the Abi-Karna forest block is higher in the western belt. Similarly, the species diversity and continuous canopy cover are high. Therefore, the western belt is more conducive to primate activity, particularly for the surili (*Presbytis comata*), compared to the eastern belt.

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