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Distribution and Habitat Characteristics of the Lutung Dahi Putih (*Presbytis Frontata*) in the Senakin Mining Area of PT Arutmin Indonesia

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Abstract: *Presbytis frontata* is a primate species listed as vulnerable due to population decline. This study aims to identify the distribution and habitat characteristics of *Presbytis frontata* using presence data obtained through direct field surveys and interviews with local communities. The presence data included geographical coordinates and remote sensing data, which were later analyzed using QGIS software. The research results indicate various land use types around the habitat of *Presbytis frontata*, including rubber plantations, secondary forests, mixed gardens, dryland agriculture, and mining areas. The primary food sources for this primate species include rubber leaf shoots, Banyan leaves, Mahang leaves, Kayu Kacang leaves, Alaban leaves, Solanaceae genus plants, Kaliandra leaves, tarap leaf shoots, tarap fruits, kapok leaf shoots, and other fruits. The study notes that the distance of *Presbytis frontata* habitat from roads ranges from 40 to more than 500 meters, and from rivers ranges from 50 to more than 500 meters. The presence of nearby water streams also affects the distance to other water sources, ranging from very close to near. *Presbytis frontata* lives in habitats with air temperatures ranging from 20°C to 32°C, air humidity between 76% and 95%, and elevation above sea level, ranging from 5 to 85 m. This research provides insights into the habitat characteristics of *Presbytis frontata* in this region, which can be a basis for conservation efforts to protect this primate species in fragmented and human-disturbed environments, such as coal mining.

Keywords: environmental variables, habitat characteristics, *Presbytis frontata*, Senakin.

印尼有限責任公司 阿魯特明·塞納金礦區白額葉猴(大使保重) 的分佈及棲地特徵

摘要：前葉猴是一種因族群數量減少而被列為脆弱的靈長類動物。本研究旨在利用透過直接實地調查和當地社區訪談所獲得的存在資料來確定葉猴的分佈和棲息地特徵。存在數據包括地理座標和遙感數據，隨後使用地理信息系统軟體進行分析。研究結果顯示了葉猴棲息地周圍的各種土地利用類型，包括橡膠種植園、次生林、混合花園、旱地農業和礦區。此靈長類動物的主要食物來源包括橡膠葉芽、榕葉、麻杭葉、紅豆葉、阿拉班葉、茄科植物、卡蓮葉、塔拉葉芽、塔拉果、木棉葉芽和其他水果。研究指出，葉猴棲息地距離道路40米至500多米，距河流50米至500多米。附近水流的存在也會影響到其他水源的距離，範圍從非常近到很近。葉猴生活在氣溫20°C至32°C、空氣濕度76%至95%、海拔5至85m的棲息地。這項研究深入了解了該地區葉猴的棲息地特徵，這可以為在煤炭開採等破碎和人類幹擾的環境中保護這種靈長類物種的保護工作奠定基礎。

关键词：環境變數、棲息地特徵、額葉猴、塞納金。

1. Introduction

Presbytis frontata is a protected animal besides proboscis monkeys and hirangan monkeys. According to the IUCN Red List, this primate falls into the category Vulnerable (VU) I Appendix II CITES and is included in the protected category (Number P.106/MENLHK/SETJEN/KUM.1/8/2018) and is endemic to Kalimantan.

The lack of research in primates, especially animals endemic to Kalimantan, namely *Presbytis frontata*, is an opportunity for researchers to add scientific data that supports this animal. The lutung dahi putih has the scientific name *Presbytis frontata*, but it has another name in English, namely *White-fronted Langur, White-faced Langur*, or *White-fronted Leaf Monkey*.

Presbytis frontata has VU status, or Vulnerable, due to an estimated population decline of more than 30% over the last 30 years and is likely to continue in the future due to overexploitation, habitat destruction, degradation from oil palm expansion, and other threats, including hunting for its meat and use as a traditional medicine [16].

This species is diurnal and arboreal, active during the day, and spends most of its life in trees. Usually, small groups consist of one adult male and 2-3 females in the wild. The estimated area of activity is more than 100 ha [16]. *Presbytis frontata* has a habitat in lowland primary forest, riparian forest, and upland forest, and is sometimes found in secondary forest and plantation areas [7]. As primate populations continue to decline, there is an increasing need for systematic surveys to track long-term changes in primate population distribution, abundance, and trends [8].

Geographic Information Systems (GIS) are applicable in modeling the distribution of wildlife using the species distribution modeling approach [22]. Data on *White-fronted Langurs* in the form of distribution and population in more detail, including those in conservation areas and those outside of them, are critical for conserving these species or better forest management. Changes that cause damage to their habitat impact changes in their area distribution and their sufficient food sources, which affect their ability to survive [36].

This study aimed to obtain data and information about the distribution and characteristics of the habitat of *Presbytis frontata* existing in the research area. This research is essential because, in addition to this animal being unique, rare, and protected, data on its existence is also necessary to preserve nature with its habitat adjacent to plantations and mining areas. The benefit of this research is that it can be applied as a reference to manage the population and habitat of the *White-fronted Langur* in particular.

2. Materials and Methods

2.1. Research Locations

This research was conducted around the coal mining area of PT Arutmin Site Senakin (Fig. 1), Kotabaru, South Kalimantan. Research implementation started in September 2021 and continued until October 2021. Several points of existence *of Presbytis frontata*, including rubber plantations and durian gardens belonging to the community in Tamiang Bakung Village, Sangsang Village, Sembilang Village in the Wisma Garuda Dugan area Camp and in the reclamation area of PT Arutmin Indonesia Senakin.

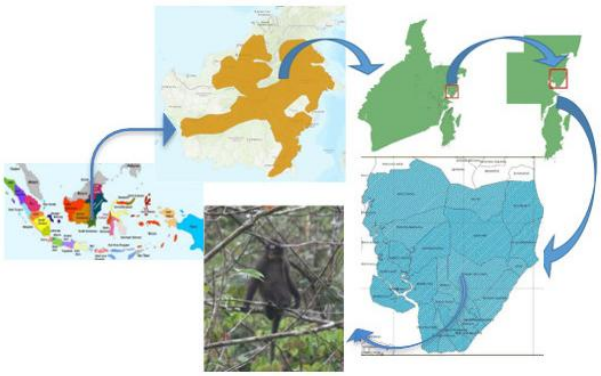

Fig. 1 Scatter research of *Presbytis frontata* (Developed by the authors)

2.2. Data Distribution

Identification of distribution and population by looking for points of presence or presence of animal species is done using direct exploration methods [8]. Each point where the lutung dahi putih locates is recorded with GPS, both direct encounters obtained in the field and indirect encounters obtained from information from residents or from field guides.

2.3. Environmental Variables

Environmental variables used in this study include the following:

2.3.1. Data on Altitude and Slope

The altitude and slope data were derived from DEMNAS (National Digital Elevation Model) data downloaded from the BIG (Geospatial Information Agency) website http://tides.big.go.id. Data were processed using QGIS. The altitude map is grouped into five classes with intervals, namely 0–50 meters above sea level (masl), 50–100 masl, 100–150 masl, 150–200 masl, and altitudes above 200 masl. Afterwards, in processing the slope data, the slope class is divided into five, namely 0-8%, 8-15%, 15-25%, 25-40%, and > 40%.

2.3.2. NDVI (Normalized Difference Vegetation Index) Data

NDVI is a method to identify vegetation conditions and calculate the green plant canopy index using remote sensing multispectral data. Based [31], the classification of Landsat 8 NDVI values is divided between 2.00–0.00 clouds and water, 0.00–0.21 non-vegetative, 0.21–0.42 not dense, 0.42–0.63 sufficient and dense, and 0.63–0.85 dense. The NDVI maps are from Landsat 8 data downloaded from the USGS website *http://earthexplorer.usgs.gov* processed using QGIS software. The analysis process uses the formula (Band 5 – Band 4/Band 5 + Band 4).

2.3.3. Distance Data from Roads and Rivers

Distance data from rivers and roads are grouped into five classes, namely 0-50 m, 50-100 m, 100-250 m, 250–500 m, and more than 500 m, processed using QGIS software.

2.3.4. Land Cover Data

Land cover data at the study site were obtained from the Geospatial Information Agency RBI Map shp data downloaded from the BIG (Geospatial Information Agency) website http://tanahair.indonesia.go.id. The data are then processed using QGIS software.

3. Results and Discussion

3.1. Distribution and Habitat Characteristics of *Presbytis Frontata*

Tropical rainforests are excellent habitats for biodiversity, but they are currently undergoing intensive economic development. Specifically, the island of Kalimantan has lost more than 56% of its original lowland forest due to natural resource exploitation, wildfires, and illegal logging. The tropical rainforests in Kalimantan are home to 16 primate species, which serve as excellent 'umbrella' taxa for conservation initiatives. The genus *Presbytis* (Colobinae) is quite widespread throughout Kalimantan, with four endemic species (*P. frontata, P. chrysomelas, P. hosei, and P. rubicunda*), but they remain relatively understudied [10]. There are at least seven protected areas in Malaysia, one of which is the Lanjak-Entimau Wildlife Sanctuary [7]. This study is in line with previous research [2], which identified these two monkey individuals as White-fronted Langurs (*Presbytis frontata*) based on the white patches on their foreheads, distinguishing them from other primates in the area, such as the Maroon Langur (*Presbytis rubicunda*) found in the Bukit Santuai region, East Kotawaringin, Sampit, Central Kalimantan. [9] stated that *Presbytis frontata* is present in South Kalimantan, specifically in their study in the Cantung Watershed of Kotabaru Regency.

Based on the results of the identification in the field carried out in the Camp Dugan area as well as the coal mining reclamation area and several surrounding villages, such as Tamiang Bakung Village, Geronggang Village, and Mangga Village, the existence of *Presbytis frontata* was found directly. As for other locations, such as in Beriam Village and Sembilang Village, as informed by residents and guides, none were found during checking.

Based on research in the field, 30 coordinate points were obtained (Fig. 2). Of these 30 points, there were 8 coordinate points for the location of this species directly (Table 1), while the other 22 were based on information.

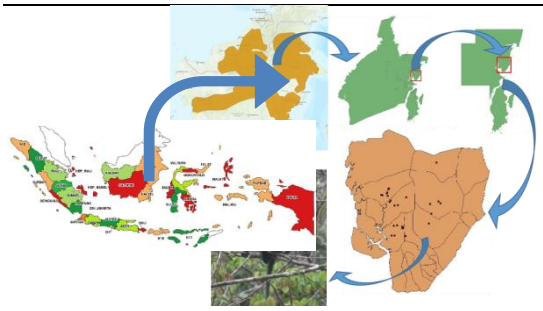

Fig. 2 Scatter distribution of *Presbytis frontata* (Primary data processing in 2022; developed by the authors)

Table 1 Habitat distribution and characteristics of *Presbytis frontata* (Primary data processing in 2022; developed by the authors)

No.	Location	Habitat	Population
1	• Camp Dugan is an office and mess for employees of PT. Arutmin Site Senakin • Location coordinates: 414276, 9679379	• Banyan, Mahang, Kayu Kacang, Alaban, genus Solanaceae, and Lindera bushes • Around the camp there are also rubber plantations by residents, which are known in this study as food for *Presbytis frontata* • The distance from the road is about 40 m, and it is close to the camp where there are fruit trees. • The distance from the river is in the far category, which is > 500 m. • The ambient temperature is 31°C	• Location is visited • The location is quite often observed and combed into the forest; however, it was only found once in a banyan tree around the office. *Presbytis frontata* were getting ready to sleep, but when they saw the observer, they immediately moved away. The number seen at that time was 10 individuals.
2	• In Tamiang Bakung, there are several locations for *Presbytis frontata*. Both face-to-face meetings and information from residents. • The location on Mount Kyai is dominated by local rubber plantations, and there are also tarap trees, which, apart from being food (the fruit), are also sleeping trees. Location coordinates: 414810, 9686711 • Rubber plantations also dominate the location near the Dahlia demonstration plots. The coordinates of this location are 411616 and 96855343 • It is still included in the Tamian Bakung Village area behind the residents' houses, with vegetation dominated by rubber plantations. The coordinates of this location are 411434 and 9685796	• The habitat location where *Presbytis frontata* is found, either directly or based on information from residents, is mostly a rubber plantation. • The distance from the trail to the location where *Presbytis frontata* was found is close enough (less than 50 m. • The distance from the river is in the far category, which is > 500 m. • However, the distance to other water sources is quite close because of the flow of water around it. • Temperature is 25°C	• Location is visited • On Mount Kyai, based on directions from the Muara Bakau Group, it was successfully observed that *Presbytis frontata* were eating. It is estimated that this group numbered 12 individuals. • In a location close to the Dahlia Demonstration Plot, observers saw around 5 of *Presbytis frontata* in the afternoon, and the next morning there were another 2. • While other locations behind residents' houses where rubber plantations were not found, based on information from the local community, there are about 5 of them that are usually there.
3	• In the Geronggang area, it is precisely based on the PLN Geronggang. • Behind the building is a community-owned rubber garden. There are also other fruit trees, but they are quite few compared with the rubber garden. • In the afternoon, at coordinates 411974, 9684282 observers spotted a group of *Presbytis frontata*. The next day, observers returned to explore around the area, and at coordinates 412116, 9684477 observers again found a group of *Presbytis frontata*	• Residents' rubber plantations and several existing fruit trees dominate habitat of *Presbytis frontata* in this location. In addition, this species is also found in kapok trees. Around this location, there are tarap trees, which are thought to be sleeping and fodder trees. • Distance from the trail is about 100 m. • The distance from the river is about 250->500 m. • Temperature is around 25°C	• Location is visited • During the exploration at Georanggang, there were two coordinate points from observers who discovered the presence of *Presbytis frontata*. Even though there are two points, it is suspected that they are still in the same group because the distance from these two points is not far apart. • At the first point of the group *Presbytis frontata*, it is estimated that there are 7 individuals, and at the second point, there are three individuals.
4	• In areas that include the company's reclamation, there are several visible points in which *Presbytis frontata* can be seen. • Secondary forest in Mangga Village, which is located close to the Mangga Pit. The coordinates of the	• The location on the border of Mangga Village and Mangga Pit contains secondary forest, community rubber plantations, and rice gardens. • The location where *Presbytis frontata* was observed in Pit 14 is in a secondary forest habitat, and tarap trees are visible.	• Location is visited • In Mangga Village, two of these species were seen, but when they searched again, observers locked track of them. • At Pit 14, observers also glimpsed 2 *Presbytis frontata*.

observer when he saw these species were 421255, 9683992 • Pit 14 in an area with a water source and secondary forest. Its location is at 419342, 9683886 • At the back between Pit 14 and Pit Mangga. The location is 420918, 9684371.	• Behind it, between Pit Mangga and Pit 14, there is a secondary forest with tarap trees as a source of water, as well as the residents' vegetable and fruit plantations. • Distance from the trail between 50 and 500 m. • Distance from the river 50–above 500 m, but there are other sources of water in the vicinity. • Temperature is around 30ºC.	• For the location behind Mangga Pit and Pit 14, information was obtained from the community that owns gardens in that area. It is estimated that there are approximately 15 of these species around that location.

Table 1 offers a comprehensive overview of extensive research conducted on the ecological aspects of the Primate *Presbytis frontata* across three distinct locations: Camp Dugan, Tamiang Bakung, and Geronggang. Each of these locations presents unique characteristics that serve as the basis for an in-depth exploration of this species' habitat, population, and behavior.

Originally intended as an office and dining facility for employees, Camp Dugan has unexpectedly become a significant contributor to our understanding of the ecology of *Presbytis frontata*. The surrounding environment boasts diverse flora, including notable tree species such as Banyan, Mahang, Kayu Kacang, and Alaban, as well as various plants from the Solanaceae and Lindera genera. The presence of locally managed rubber plantations has prompted inquiries into their potential as a food source for *Presbytis frontata*, leading to a thorough investigation.

The research expanded to encompass the Tamiang Bakung area, uncovering multiple locations where *Presbytis frontata* thrives. Primary data collection involved direct observations and insights shared by local residents, providing a comprehensive understanding of the species' habitat, population dynamics, and behavior across diverse locales.

Subsequently, the research shifted its focus to the Geronggang area, with specific attention to PLN Geronggang. This region stands out with its unique habitat, which is characterized by rubber plantations and scattered fruit trees extending beyond the PLN facilities. This phase of the study meticulously examined various ecological aspects of *Presbytis frontata*, including habitat preferences, population dynamics, and behavioral patterns.

Within the context of corporate reclamation efforts, essential locations where *Presbytis frontata* were identified were pinpointed. These locations encompass a range of landscapes, including secondary forests, locally managed rubber plantations, and rice fields. The presence of tarap trees in specific habitats, particularly Pit 14, hinted at their potential role as a food and water source for these species.

The habitat surrounding Camp Dugan boasts a diverse array of plant species, both native and introduced, such as Banyan, Mahang, Kayu Kacang, Alaban, and members of the *Solanaceae* and *Lindera* families. The proximity to fruit-bearing trees near the camp significantly contributes to the availability of food sources for *Presbytis frontata*. Furthermore, the considerable distance from the nearest road provides a crucial level of seclusion for the species. Distances from the nearest river also serve as a defining characteristic of this habitat, with most locations exceeding 500 m. This result is quite in line with [1], which explains that the distance from the river is mostly at a distance of 1000 – 1500 m. The average recorded air temperature during the observations lingers around 31ºC. The landscape in Gunung Kyai, the location of the camp, is predominantly marked by local rubber plantations and tarap trees, which serve as vital food sources. The geographic coordinates of this site are 414810 and 9686711. Similarly, the area adjacent to the Dahlia demonstration plot has rubber plantations, with coordinates at 411616 and 96855343. Another location behind residential houses in Tamiang Bakung features vegetation primarily consisting of rubber plantations, with coordinates of 411434 and 9685796.

The habitat where *Presbytis frontata* was observed, whether through direct sightings or information from local residents, has rubber plantations. The proximity of the trails to the specific locations where *Presbytis frontata* was observed is relatively close, generally within 50 m. Conversely, the distance from rivers to these locations typically falls within the "far" category, exceeding 500 m. However, proximity to other water sources remains relatively close because of the presence of flowing water in the vicinity. The recorded temperature in this area average around 25°C during observations.

In this specific location, the habitat of *Presbytis frontata* primarily comprises locally maintained rubber plantations interspersed with pre-existing fruit trees. In addition, these primates have been observed in kapok trees. Tarap trees are also present in the area and are believed to serve as both resting places and food sources for these species. The distance from the trails to the specific locations where *Presbytis frontata* was observed ranges from approximately 100 m, providing a certain degree of seclusion. The proximity to rivers varies between 250 and 500 m, with an average air temperature in this area of around 25ºC.

While observations of *Presbytis frontata* in and around Camp Dugan occur relatively frequently, it is important to note that encounters with these primates

are infrequent because of their elusive and cautious nature in the presence of humans. Some noteworthy observations occurred when a group of *Presbytis frontata* was spotted in a banana tree near the office, comprising approximately 10 individuals.

During the study in the Tamiang Bakung area, observers had the opportunity to observe *Presbytis frontata* engaged in feeding activities. An estimated 12 individuals were in the group. In a location near the Dahlia Demonstration Plot, observers encountered approximately 5 *Presbytis frontata* in the evening, and on the following morning, 2 additional individuals were observed. In another location behind residential houses where rubber plantations were absent, according to information from local residents, an average of approximately five individuals could typically be found.

As the research extended to the Geronggang area, successful observations of *Presbytis frontata* were also conducted. At one set of coordinates, a group of Presbytis frontata, comprising 7 individuals, was estimated. On the subsequent day, during further exploration of the area, another group of *Presbytis frontata*, consisting of 3 individuals, was encountered. Additionally, reports from local residents indicated that approximately 15 individuals of *Presbytis frontata* inhabit the area behind Mangga Pit and Pit 14.

These findings are aligned with research [9], which highlighted the dominance of rubber plantations, dry agriculture, mixed gardens, and mining in the distribution of *Presbytis frontata* in the Cantung Watershed. In this watershed, 31 habitat distribution points were identified, with 72 observed individuals of *Presbytis frontata.* The species was found at elevations ranging from 5 to 85 m above sea level, with an optimal temperature range of 20°C–32°C, humidity levels between 78% and 95%, distances from water sources ranging from 200 to 500 m, and distances from roads spanning from less than 200 to 600 m. Rubber plants from community gardens predominated in the areas where *Presbytis frontata* was found, with other plant species in the region including banyan, jabon, kapuk randu, and tarap.

Lutung dahi putih (*Presbytis frontata*) is a diurnal and arboreal species. It primarily inhabits lowland primary forests, riparian forests, and highland forests and is occasionally found in secondary forest areas and plantations [7]. Its main food source consists of young leaves, but it also consumes fruits and seeds. This species' normal group consists of 10-15 members. Female langurs have one child per birth [17].

An organism's habitat often contains ecological variables that are necessary for survival [33]. The survival needs of each organism are a collection of ecological characteristics found in the ecosystem that each creature requires to survive [29]. A suitable habitat is one that can meet all of a species' habitat needs for a specific season or throughout the year. Food, canopy cover, and other variables required for wildlife survival and reproductive success are all part of habitat needs [4].

The observed characteristics of the *Presbytis frontata* habitat include elevation, temperature, humidity, and distance from water sources. Another equally important observation in determining habitat characteristics is the types of trees that *Presbytis frontata* often encounters or visits. According to [12], land cover and vegetation are the key elements that can have a direct and considerable impact on habitat characteristics as well as habitat selection and use. The primary reason that a suitable habitat serves as an indicator of habitat characteristics is that it works in tandem with other biotic and abiotic factors such as temperature, humidity, distance from settlements, distance from roads, and distance from water bodies (rivers).

The habitat characteristics of *Presbytis frontata* in these four locations reflect their ability to adapt to diverse environments. Factors such as land use type, food sources, distances to environmental elements, temperature, humidity, and altitude vary, with different adaptations by this species depending on their habitat. This underscores the importance of preserving various habitat types to maintain their biodiversity.

In an environment increasingly threatened by deforestation and human activities, a profound understanding of wildlife habitat characteristics is crucial in biodiversity conservation efforts. *Presbytis frontata* is a species of concern in this context. This protected wildlife species is found around the coal mining area of the PT Arutmin Senakin site and the Cantung River watershed area in Kotabaru Regency, South Kalimantan province. This study explores the habitat characteristics of *Presbytis frontata* in four different locations: Rubber Plantations (Kebun Karet), Reclamation Pit 14 (secondary forest), the border of Mangga Village and Mangga Pit Reclamation, and the Cantung River Watershed area. The gathered data reveal significant variations in land use types, food sources, distances to key environmental elements, and temperature and humidity conditions in each location.

3.2. Comparison of Habitats *of Presbytis Frontata* and *Presbytis* Genus

3.2.1. Rekrekan (Presbytis Fredericae)

[11] stated that the habitat characteristics of *Presbytis frontata* found in this study differ from those of *Presbytis fredericae* (Rekrekan) in the Mount Slamet forest. Rekrekan are mainly found at elevations >600 m above sea level. There are 50 groups, 43 of which are located at a distance of more than 1000 m from human activity. Interactions with human and habitat elements (land use) and environmental factors influence the

presence of Rekrekan in a specific location. Rekrekan prefers a temperature range of approximately 18–20°C. Rekrekan are mainly found on slopes of 25-40 degrees. These primates are frequently encountered on the southern side. Looking at the land cover map, the southern slope's forest position and condition are comparatively well-preserved compared to the northern, western, and eastern slopes, which have already seen degradation and land use changes. The presence of Rekrekan is a component of the type of land cover. These findings imply that primary woods are the most desired and appropriate for Rekrekan's living needs.

3.2.2. Javanese Lutung or Javan Langur (Presbytis Comata)

On the basis of data collected during research on the habitat of white-fronted langurs, the majority were found in rubber plantations, according to [7] on the IUCN Red List. The location where this langur species was found is in secondary forest or lowland plantations, which agrees with [30], whose results indicated that the Javan langur (*Presbytis comata*) is found at an altitude of 225 – 1254 masl or from lowland forest ecosystems to hilly areas. However, [15] on rekrekan (*Presbytis frederica*) in Mount Merbabu National Park found several groups of rekrekan at an altitude of 2077 – 2253 masl.

In addition, as our research found that *Presbytis frontata* lives quite close to the housing of research residents, [30] also indicated that the Javan langurs are not only located in areas far from settlements and roads but are also located close to settlements and roads. In [14], 37 points from the surilii langur (*Presbytis comata*) are mostly located in secondary natural forests, as is the case with research [18], which states that surili langurs prefer secondary natural forest types compared to other forest types. Meanwhile, [11], in research on *Presbytis comata* in Kamojang, Garut Regency, found that surili were still widely found and scattered in areas where the level of human disturbance was still low.

3.2.3. Lutung Kokah or Sumatean Banded Long (Presbytis Femoralis)

During a firsthand encounter with *Presbytis frontata* in Tamiang Bakung and Geronggang Villages, it was discovered that this animal lives in an area dominated by local rubber plantations, which provide food in the form of rubber leaves and shoots. In addition, there is a tarap lilin tree nearby, which serves as both a food tree and a sleeping tree. Meanwhile, in [26] about kokah or Sumatran Banded Langur (*Presbytis femoralis*) in Riau Province on Sumatra, the presence of this animal is found in rubber plantation habitat, secondary forest, and swamp forest surrounded by oil palm plantations, settlements, and roads.

3.2.4. Kedih or Thomas Langur (Presbytis Thomasi)

Based on the study [32], the kedih population density (*Presbytis thomasi*) at the Soraya research station in the Leuser ecosystem is influenced by the conditions of forest regeneration in the region. The kedish group whose home range is in logged-over forest has a smaller population, whereas the kedish group whose home range is in undisturbed forest has many individuals. Researchers suspect that the availability of food and the presence of predators in the habitat affect the individual animals that exist.

3.2.5. Lutung Banggat or Hose's Long (Presbytis Hosei)

During the research period, *Presbytis frontata* did not share habitat niches with other primate species around the PT Arutmin Site Senakin coal mining site. This also happened in the research [25] that examined *Presbytis hosei* in Sarawak and studied *Presbytis hosei* canicrus on the outskirts of the Baai River close to Pangadan Village, East Kalimantan [27].

3.2.6. Joja or Lutung Mentawai (Presbytis Potenziani)

Based on research [13] on *Presbytis potenziani* on Siberut Island, they found that this species could be in the same habitat as Simias concolor despite being active at different heights. Researchers suspect that these two species can coexist in the same habitat because they have the same food source. Regarding *Presbytis frontata* research, we suspect that the presence of a food source is also one of the factors that determines whether its habitat is different from that of other primates. [24] stated that the density of *Presbytis potenziani* in Siberut, which is located in a peatland forest, was lower than that in lowland forests, which is thought to be due to differences in feed composition and ecology.

3.2.7. Simpai (Presbytis Melalopas)

Feed sources for *P. frontata* are rubber plants and tarap; this was also stated in [19] that rubber plants are a source of feed for *P. melalophos*. [3] also stated that Simpai (*Presbytis melalophos*) in the Cugung Village Forest KPH Protected Model Rajabasa, South Lampung, eats plantation crops such as tarap and rubber. It was also stated that the highest disturbance of simpai based on the activity range is in agroforestry areas where feed resources are abundant. The type of plants disturbed mostly consisted of banana and cocoa. In addition, the intensity of the encounter time is predominantly from 5:00 to 7:45 am. Simpai was rarely seen in the afternoon and could be found again from 4:00 to 5:30 pm.

3.2.8. Red Leaf Monkey (Presbytis Rubicunda)

Research [5] on *Presbytis rubicunda* in East

Kalimantan found the density of these animals to be around 5.35 groups/km^2 within 20km^2 of natural meant forest. Another study [28] on *Presbytis rubicunda* located in tropical pentland forests.

3.3. Efforts to Conserve *Presbytis Frontata*

Presbytis frontata, a highly endangered primate species, requires collaborative efforts to protect it. To preserve the survival of this species, special actions must be implemented to protect its natural environment and support the long-term sustainability of its population. The following steps outline a precise course of action for conserving *Presbytis frontata*: (1) Research and Population Monitoring: It is imperative to conduct thorough research and comprehensively monitor the population of *Presbytis frontata*. These initiatives are essential for understanding the species' population dynamics, its habitat, and identifying potential threats [3]. Habitat Restoration: To ensure survival, the habitat of *Presbytis frontata* must undergo restoration and protection. This objective can be achieved through measures such as curtailing deforestation and rehabilitating damaged forests [3]; (3) Control of Hunting and Illegal Trade: Stringent regulation is imperative to control the hunting and illegal trade of Presbytis frontata, safeguarding the species from the brink of extinction [3]; (4) Public Education and Awareness: Elevating public awareness about the importance of preserving *Presbytis frontata* can significantly contribute to mitigating threats to the species. Outreach campaigns and educational initiatives can play an instrumental role in achieving this goal [3]; (5) International Cooperation: Collaborative efforts on an international scale are indispensable to advocate for the conservation of *Presbytis frontata* and strengthen global conservation endeavors [3]; (6) Empowerment of Local Communities: Empowering local communities can have a pivotal role in heightening awareness about the importance of preserving *Presbytis frontata* and fostering the sustainability of its population [3]; (7) Legal Protection: Legal safeguards are essential to shield *Presbytis frontata* from threats such as hunting and illegal trade, as recognized in [6]; (8) Fundraising: The mobilization of funds can provide crucial support for the conservation of *Presbytis frontata* and bolster the sustainability of its population [3]; (9) Periodic Evaluation: Regular assessments are imperative to ensure the effectiveness of conservation measures and make necessary improvements as warranted [3]. These specified actions collectively constitute a comprehensive strategy aimed at safeguarding this critically endangered primate species and conserving the ecosystems in which it resides [3, 6, 20, and 23.

Although this research provides valuable insights into the ecology of the *Presbytis frontata* , there are several limitations that need to be considered: (1) this study was conducted in only three specific locations, and its findings may not necessarily represent the conditions of the *Presbytis frontata* in other locations; (2) the presence of the *Presbytis frontata* is often challenging to observe because of its elusive nature. Therefore, the observational data on them may be limited. (3) While the study recorded air temperature and distances from rivers, it did not provide detailed information about the impact of weather changes or seasons on the behavior and population of the species.

There are several avenues for further research that can complement this study: (1) Conducting further population monitoring of the *Presbytis frontata* in different locations to gain a more comprehensive understanding of their distribution; (2) Investigating the behavior and social interactions of the *Presbytis frontata* in greater detail, including their group dynamics and responses to changing environments; (3) Examining the impact of landscape ecological changes, including changes in land use such as oil palm plantations, on the habitat and population of this species; (4) Assessing the health of *Presbytis frontata* populations, including threats to their well-being such as hunting and habitat loss; (5) Developing and implementing conservation strategies aimed at protecting and preserving the habitat and populations of the *Presbytis frontata*.

With further research, it is hoped that our understanding of *Presbytis frontata* will deepen and more effective conservation efforts can be implemented to protect this vulnerable species.

4. Conclusion

This research sheds light on the distribution and habitat characteristics of the vulnerable primate species *Presbytis frontata*, which is experiencing a population decline. The study's results disclose various land use patterns in the vicinity of *Presbytis frontata's* habitat, which include the existence of rubber plantations, secondary forests, mixed gardens, dryland farming, and mining regions. In addition, the research identifies the primary sources of sustenance for these primates, which encompass a range of plant species along with rubber leaf shoots. Moreover, the study observes disparities in the distance between *Presbytis frontata* habitat and roads and rivers, and it also underscores the impact of nearby water streams on their access to alternative water sources. These primates are predominantly located in environments characterized by specific temperature, humidity, and elevation parameters. In summary, this study offers valuable insights into the habitat characteristics of *Presbytis frontata* in the proximity of coal mining areas. These findings can serve as a fundamental point of reference for conservation efforts, especially in addressing the challenges faced by this primate species in fragmented and human-altered environments, such as those associated with coal mining activities.

The study's limitations encompass a restricted sample size for *Presbytis frontata* individuals or habitat locations, potentially obstructing the ability to generalize findings to the entire population or other regions. Data collection relies on field surveys and local interviews, potentially introducing bias due to location availability and information accuracy. The timing of data collection affects the findings due to seasonal variations. Genetic analysis, which is crucial for comprehending genetic diversity and health, is absent. While limited environmental factors such as temperature and elevation are considered, the impacts of human activities, such as coal mining, are acknowledged but not thoroughly explored. This study offers a current snapshot without predictive models but lays the groundwork for future research with larger samples, community engagement, conservation strategies, ongoing monitoring, comparative studies, and assessments of climate change impacts.

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