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ARTICLE

ECOLOGY, DISTRIBUTION, AND CONSERVATION CHALLENGES OF THE JAVAN SURILI (*Presbytis comata*) IN JAVA, INDONESIA

[*Tantangan Ekologi, Distribusi, dan Konservasi Surili Jawa (Presbytis comata) di Jawa, Indonesia*]

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ABSTRACT

The Javan surili (*Presbytis comata*), a keystone species in the tropical rainforest ecosystem of Java Island, is facing serious threats from deforestation, hunting, and habitat fragmentation. As an endemic species with a highly restricted, particularly on the island of Java, research on the Javan surili remains considerably limited. Hence, its geographical location and distribution patterns are still not clearly understood. Our literature review aims to determine the current status of the Javan surili and the factors influencing its population decline, as well as to evaluate the effectiveness of various conservation strategies that have been implemented. These findings highlight the importance of a multidisciplinary approach in Javan surili conservation efforts and provide policy recommendations to improve the success of species conservation, especially in its native habitat. Immediate conservation efforts and attention from the primatologist, relevant authorities, and stakeholders are needed to prevent the localized extinction of Javan surili.

Keywords: Conservation, Endemic, Population, Primates, *Presbytis comata*

ABSTRAK

Surili Jawa (Presbytis comata), merupakan spesies kunci dalam ekosistem hutan hujan tropis Pulau Jawa menghadapi ancaman serius dari deforestasi, perburuan, dan fragmentasi habitat. Sebagai spesies endemik dengan distribusi terbatas, terutama di Pulau Jawa, penelitian tentang surili Jawa masih sangat kurang. Oleh karena itu, lokasi geografis dan pola distribusinya masih belum dipahami dengan jelas. Tinjauan pustaka kami bertujuan untuk menentukan status terkini surili Jawa dan faktor-faktor yang memengaruhi penurunan populasinya, serta untuk mengevaluasi efektivitas berbagai strategi konservasi yang telah dilaksanakan. Temuan ini menyoroti pentingnya pendekatan multidisiplin dalam upaya konservasi surili Jawa dan memberikan rekomendasi kebijakan untuk meningkatkan keberhasilan konservasi spesies, terutama di habitat aslinya. Upaya konservasi segera dan perhatian dari ahli primata, otoritas terkait, dan para pemangku kepentingan diperlukan untuk mencegah kepunahan surili Jawa secara lokal.

***Kata kunci**: Konservasi, Endemik, Populasi, Primata, Presbytis comata*

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INTRODUCTION

Comprehensive global evaluations have demonstrated that human-driven activities most notably land-use change, overexploitation, and climate disruption have placed a large share of primate species under significant extinction risk (Estrada *et al*., 2017). In this global framework, Indonesia stands out as a center of tropical megadiversity with exceptionally high primate richness; nevertheless, a considerable proportion of its species are formally recognized as threatened (Condro *et al*., 2021). National records indicated that 45 Indonesian primate species were classified as threatened in 2017, and more recent biodiversity reassessments and taxonomic updates imply that this figure may have risen, highlighting the importance of regularly updated conservation data. Although vulnerability varies among taxa and geographic regions, forest-specialist primates in Southeast Asia are widely regarded as especially susceptible to continuing habitat degradation and the escalating impacts of climate change (Sales *et al*., 2019).

In addition to their conservation relevance, primates hold substantial ecological and scientific significance. Functionally, many species sustain forest structure and dynamics by dispersing seeds across landscapes (Razafindratsima *et al*., 2018) and by contributing to natural regeneration processes (Hanya & Bernard, 2016), thereby enhancing ecosystem stability over time. From a comparative biological perspective, primates also serve as indispensable models for investigating aspects of human evolution, physiology, and disease. Consequently, the decline of tropical primate populations entails not only biodiversity loss but also the erosion of key ecological functions and valuable scientific resources (Oklander & Soto-Calderón, 2024).

Among Indonesia's threatened taxa, the Javan surili or Javan grizzled langur (*Presbytis comata*) represents a pertinent example of these overlapping conservation concerns (Supartono *et al*., 2020). This colobine species inhabits remnant forest ecosystems in West and Central Java, with its distribution extending eastward to the Mount Lawu region. Owing to its restricted geographic range and strong dependence on forest habitats undergoing substantial anthropogenic pressure, *P. comata* provides an appropriate focal species for assessing the consequences of habitat alteration and fragmentation on endemic primates in Java.

The Javan surili (*Presbytis comata*) is subject to a rigorous legal framework in Indonesia, primarily governed by the Ministry of Environment and Forestry Decree No. 106/2018 (Supartono *et al*., 2016a). This regulatory mechanism serves as the foundation for its protection, which is further operationalized through the Director General of KSDAE Decree No. 180/2015. The latter specifically prioritizes the species for a targeted 10% population increase (Latifiana & Handayani, 2019), reflecting a shift from passive protection to active population management. Despite these domestic efforts and its inclusion in CITES Appendix II, the species' global conservation status remains precarious (Nijman, 2017). Currently, the Javan surili is classified as Vulnerable on the IUCN Red List (as of 2022), a designation that highlights its ongoing susceptibility to extinction.

The efficacy of these legal protections, however, is continuously challenged by anthropogenic pressures (Subhan, 2021). While regulations aim to mitigate population decline through habitat preservation and anti-poaching enforcement, the species still faces significant threats from illegal hunting and environmental pollution. Most critically, habitat fragmentation driven by land-use change remains the primary driver of its decline, as it restricts the primates to isolated forest patches, thereby increasing their vulnerability to genetic bottlenecks and human interference (Manansang & Sinaga, 2024). Consequently, the persistence of these threats suggests a gap between regulatory intent and real-world enforcement, necessitating more localized conservation strategies to bridge the divide.

The population of the Javan surili is experiencing a critical decline, with estimates suggesting a reduction of over 50% across the last three generations primarily due to anthropogenic habitat fragmentation and illegal hunting (Supartono *et al*., 2016b). As an endemic arboreal primate, the extirpation of *P. comata* is projected to trigger significant ecological cascades; specifically, its role as a specialized seed disperser for primary forest trees is fundamental to maintaining the floristic diversity and successional dynamics of Java's remaining tropical rainforests (Santosa *et al*., 2020). Despite its ecological importance, the formulation of robust conservation strategies is currently impeded by a lack of precise spatial and behavioral data. While the species' presence across protected

and non-protected landscapes is documented, there remains a critical knowledge gap regarding its fine-scale habitat use, seasonal home range dynamics, and altitudinal distribution patterns under shifting climatic conditions (Saputra *et al*., 2023). Addressing these specific empirical voids is essential for identifying viable ecological corridors and ensuring the long-term persistence of the species.

Despite its status as an endangered endemic primate, the Javan surili (*Presbytis comata*) remains understudied, particularly regarding its long-term population trends and habitat requirements. This review synthesizes research conducted between 2015 and 2025 a decade marked by significant land-use changes in Java and the implementation of new national conservation frameworks to identify critical knowledge gaps in the species' ecology, genetic diversity, and distribution. By consolidating recent data, this paper moves beyond general conservation rhetoric to provide a precise evidence base for operational management plans. Ultimately, this review serves as a strategic framework to bridge the gap between academic findings and on-the-ground conservation actions, ensuring the persistence of *P. comata* and the functional integrity of Java's remaining tropical rainforest ecosystems.

MATERIALS AND METHODS

The article is prepared with a synoptic review approach to Javan Surili-related articles (Figure 1). A comprehensive search was conducted across Google Scholar and ScienceDirect for records published from inception through December 2025, utilizing specific search strings such as ("Presbytis comata" OR "Javan Surili") combined with keywords including "population," "habitat," "ecology," "distribution," and "conservation." To ensure reproducibility, studies were selected based on explicit inclusion criteria: peer-reviewed empirical research, technical reports, and relevant books focusing on the species' ecological and conservation status in both English and Indonesian. Conversely, duplicates, non-peer-reviewed opinion pieces, and studies mentioning the species only incidentally were excluded. Data extraction was performed using a qualitative synthesis approach, where results were coded and compared across geographical scopes and timeframes to identify core thematic trends and potential research biases, ultimately enriching the discussion through a rigorous integration of relevant ecological literature.

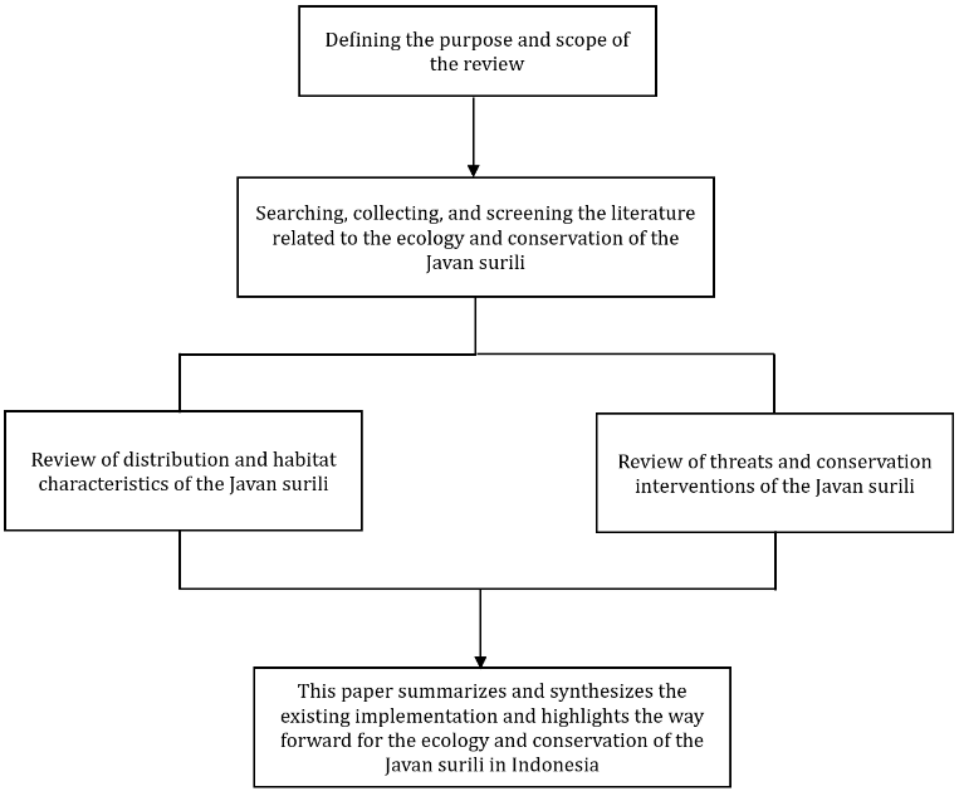

Figure 1. Stages in conducting the review (*Tahapan dalam melakukan peninjauan*).

RESULTS AND DISCUSSION

Current Geographic Distribution

The geographical distribution of the Javan surili (*Presbytis comata*) is characterized by a highly fragmented and localized pattern across the Indonesian island of Java, primarily concentrated in its western regions (Widiana *et al*., 2018a). This endemic primate is currently documented in approximately 33 distinct forest patches (Figure 2), reflecting a significant contraction from its historical occupancy areas due to intense anthropogenic activities over decades. Its distribution stretches from the primary forests of West Java eastward to the slopes of Mount Lawu, which marks the species' known easternmost boundary at the border of Central and East Java (Nijman, 2017). These populations are largely isolated from one another because the intervening landscapes lack the necessary forest connectivity required for natural dispersal and genetic exchange (Maurice *et al*., 2019). Several studies have been conducted on Javan surili found in several areas on the island of Java (Table 1).

Table 1. Several locations where Javan surili were found (*Beberapa lokasi di mana Surili Jawa ditemukan*).

Location (*Lokasi*)	**Reference** (*Referensi*)
Forest area, Kuningan Regency	(Prasetyo *et al*., 2017); (Supartono *et al*., 2020)
Mt. Burangrang Nature Reserve	(Subhan, 2021)
Mt. Ciremai National Park	(Kusumanegara *et al*., 2017); (Santosa *et al*., 2020)
Mt. Gede Pangrango National Park	(Dharma *et al*., 2024)
Mt. Halimun Salak National Park	(Septiani *et al*., 2024)
Mt. Merbabu National Park	(Latifiana & Handayani, 2019); (Saputra *et al*., 2023)
Mt. Sawal	(Sulistyadi, 2020)
Mt. Slamet	(Setiawan *et al*., 2010); (Abimanyu *et al*., 2020)
Kamojang, Garut Regency	(Widiana *et al*., 2018a)
Situ Patengan Nature Reserve	(Widiana *et al*., 2018b)

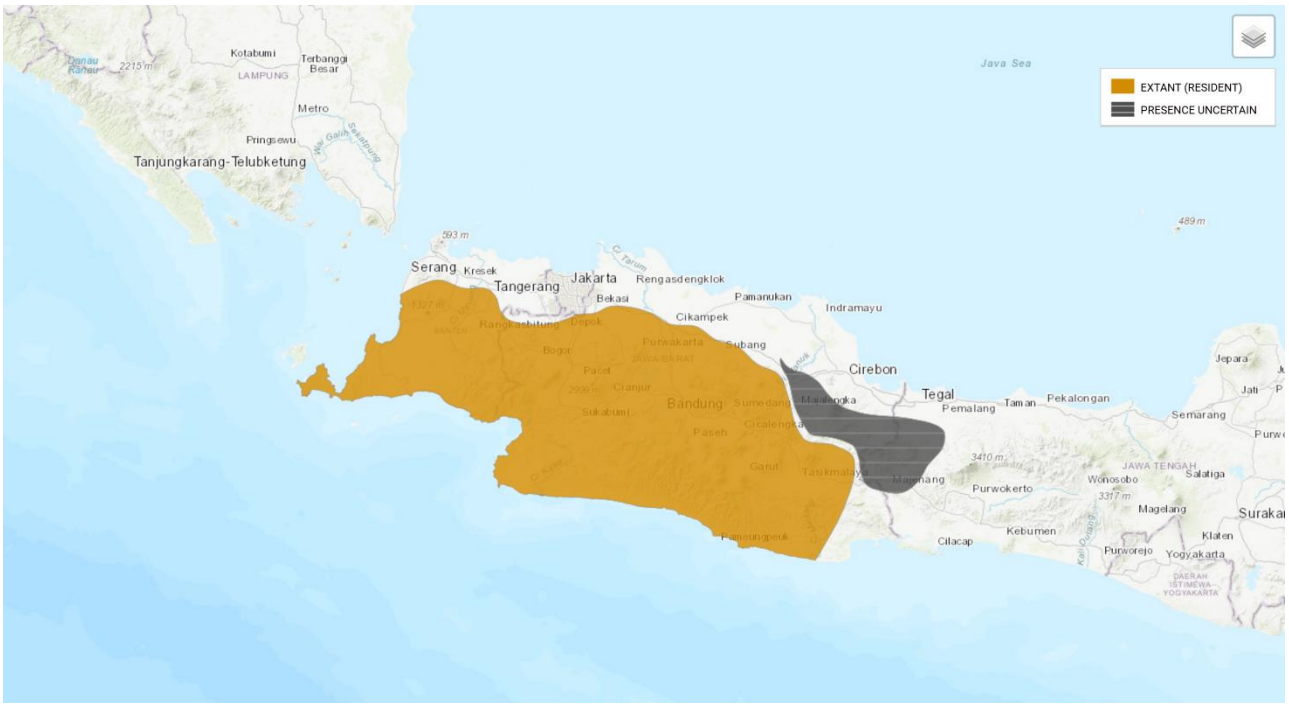

Figure 2. Geographical range of Javan surili on the Island of Java (*Jangkauan geografis Surili Jawa di Pulau Jawa*) (iucnredlist.org).

Recent surveys have confirmed the presence of *P. comata* in several key conservation areas, including Mount Gede Pangrango, Mount Halimun Salak, and Mount Ciremai National Parks. In Central Java, the species persist in rugged terrains such as Mount Merbabu National Park and the forested slopes of Mount Slamet, highlighting its resilience in high-altitude refugia (Latifiana &

Handayani, 2019; Abimanyu *et al*., 2020). However, the presence of the species in some previously recorded forest blocks remains uncertain, requiring updated longitudinal field monitoring to confirm extant populations. The isolation of these habitats has led to the formation of discrete subpopulations that are increasingly vulnerable to the negative impacts of genetic drift and environmental fluctuations (Supartono *et al*., 2020).

Geographic distribution is fundamentally governed by ecological adaptation, where factors such as population density, home range size, and food availability dictate habitat occupancy. As an obligate arboreal species, the Javan surili is strictly dependent on continuous tree canopies to facilitate movement across its home range for foraging and mating (Septiani *et al*., 2024). They are unable to traverse open landscapes or areas devoid of forest cover, meaning that even minor infrastructural developments can effectively bisect a population. Consequently, the current scattered distribution underscores the urgent need for landscape-level conservation planning to prevent further localized extinctions within these disconnected forest islands (Bersacola *et al*., 2014).

Habitat Use and Preferences

The survival of *P. comata* is intrinsically linked to specific environmental variables that define the quality and suitability of its remaining tropical rainforest habitats. Key ecological determinants include the presence of dense, multi-layered forest canopies which provide essential security from predators and protection from human disturbances (Supartono *et al*., 2020). Primary and secondary forests are favored because they offer a diverse array of feeding trees and established arboreal pathways for locomotion (Santoso *et al*., 2023). Research indicates that lowland primary forests represent the most optimal habitat due to the superior diversity of food resources found in these climax communities (Mekonnen *et al*., 2018). As shown in Table 2, these environmental factors collectively play a critical role in supporting the survival, reproduction, and overall well-being of the Javan surili.

Table 2. Environmental factors that support the existence of the Javan surili (*Faktor lingkungan yang mendukung keberadaan surili Jawa*).

Environmental factors (*Faktor lingkungan*)	**Description** (*Deskripsi*)	**Reference** (*Referensi*)
Forest type and habitat quality (*Jenis hutan dan kualitas habitat*)	Primary/secondary forests provide dense canopy, security, and diverse food sources (*Hutan primer/sekunder menyediakan kanopi lebat, keamanan, dan sumber pangan yang beragam*)	(Supartono *et al*., 2016c)
Vegetation diversity (*Keanekaragaman vegetasi*)	Provides a wide range of food resources and ecological niches (*Menyediakan berbagai sumber daya pangan dan ceruk ekologis*)	(Supartono *et al*., 2020)
Forest canopy structure (*Struktur kanopi hutan*)	Dense, multi-layered canopy offers feeding sites and protection (*Kanopi padat dan berlapis-lapis menawarkan tempat makan dan perlindungan*)	(Nijman, 2017)
Food resource availability (*Ketersediaan sumber daya pangan*)	Abundance of fruiting and foliated trees sustains daily nutritional needs (*Melimpah pohon berbuah dan berdaun menopang kebutuhan nutrisi sehari-hari*)	(Dharma *et al*., 2024)
Water sources (*Sumber air*)	Streams and rivers provide drinking water and support habitat quality (*Aliran dan sungai menyediakan air minum dan mendukung kualitas habitat*)	(Fithria *et al*., 2023)
Elevation and microclimate (*Ketinggian dan iklim mikro*)	Range between 500–1,500 m supports adaptability to forest conditions (*Jangkauan antara 500–1.500 m mendukung kemampuan beradaptasi dengan kondisi hutan*)	(Supriatna *et al*., 2020)

This species demonstrates a notable degree of ecological flexibility, with distribution records spanning from lowland ecosystems at 225 masl to rugged montane regions (Supartono *et al*., 2016a).

While they typically prefer primary forest interiors, studies on Mount Halimun Salak and Mount Slamet show that surilis frequently utilize forest edge habitats (Abimanyu *et al*., 2020; Septiani *et al*., 2024). According to Setiawan *et al*. (2010), these edge areas are often preferred by the primates because they support a higher abundance and variety of food plants. Nevertheless, this preference for ecotones may inadvertently increase their exposure to anthropogenic threats and heighten the potential for human-wildlife conflict at the forest-agriculture interface (Nugroho *et al*., 2022).

Microclimatic conditions, including temperature gradients and humidity levels, also significantly influence habitat choice and population density across different elevations (Nijman, 2017). On Mount Slamet, a negative correlation has been observed between increasing elevation and monkey abundance, likely due to less favorable atmospheric conditions at higher altitudes (Setiawan *et al*., 2010). Conversely, in Mount Merbabu National Park, some groups have been documented surviving at extreme altitudes ranging between 2077 and 2253 masl (Hidayat *et al*., 2016). These variations suggest that while the species is a forest specialist, its specific habitat use is a complex response to localized resource availability and structural forest attributes.

Figure 3. (a) The existence of the Javan surili in its natural habitat; (b) Mt. Gede Pangrango National Park is one of the protected areas for the Javan surili *((a) Keberadaan surili Jawa di habitat aslinya; (b) Taman Nasional Gunung Gede Pangrango adalah salah satu kawasan lindung bagi surili Jawa*) (neprimateconservancy.org).

Group Size, Social Structure, and Behavior

The social organization of the Javan surili is primarily characterized by a monandrous system, typically consisting of one adult male and several females (Nijman, 2017). Group size and composition are sensitive indicators of habitat quality, as environmental stressors often force adjustments in social dynamics to maximize survival (Heldstab *et al*., 2021). In stable forest environments with low human interference, such as Kamojang in Garut, surili groups are more widely distributed and maintain consistent social structures (Widiana *et al*., 2018a). However, anthropogenic pressures can lead to smaller group sizes as resource competition intensifies within shrinking and degraded forest fragments.

Behavioral patterns, particularly regarding the selection of sleeping trees and daily activity cycles, are heavily influenced by the structural attributes of the canopy (Mekonnen *et al*., 2018). Tall trees with thick branches are preferred for sleeping to provide adequate support and protection during the night. During the day, the lush canopy of primary forests serves as a vital shield against direct solar radiation, allowing for thermoregulation during periods of rest. In contrast, the segmented canopy of mixed forests often restricts movement, forcing individuals to descend to lower strata to maintain group cohesion (Pranadi *et al*., 2025).

Reproductive success and the long-term viability of these groups are dependent on the continuous availability of specialized habitat needs like canopy cover (Fedyń *et al*., 2021). As a keystone species, the social and behavioral health of *P. comata* populations has cascading effects on the wider tropical rainforest ecosystem. Their role in seed dispersal and forest regeneration ensures that the forest dynamics remain stable over long periods (Zhou *et al*., 2025). Therefore, understanding

the nuances of their social structure is not merely a biological exercise but a prerequisite for developing effective, species-specific conservation strategies in Java.

Feeding Ecology

As a predominantly folivorous primate, the Javan surili's daily nutritional intake is derived from an abundance of fruiting and foliated forest trees. The species relies on a high diversity of vegetation to satisfy its dietary requirements and to fill various ecological niches within the forest (Hendrayana *et al*., 2025). Research in Mount Gede Pangrango National Park has emphasized the importance of selective feeding, where specific plant species are prioritized based on seasonal availability (Dharma *et al*., 2024). This dietary specialization makes the species particularly vulnerable to forest degradation, which often reduces the density of these critical food-providing tree species.

Feeding efficiency is closely tied to the phenology of the forest, as shifts in leafing and fruiting cycles can disrupt the primates' reproductive timing (Sutopo *et al*., 2024). For a folivore like *P. comata*, any significant alteration in forest composition can lead to lower nutritional intake and increased physiological stress. In fragmented landscapes, the compression of habitat forces groups to exploit a narrower range of food resources, potentially leading to malnutrition. Furthermore, the availability of clean water sources from streams and rivers is essential for maintaining both the primates' health and the overall habitat quality (Crowther *et al*., 2022).

The decline in natural food availability has increasingly driven surili groups to forage within agricultural areas, particularly in regions like Kuningan Regency. This shift in feeding behavior often leads to crop-raiding, which precipitates negative perceptions and attitudes toward the species among local farming communities (Supartono *et al*., 2024). Such human-wildlife conflicts are a direct consequence of declining forest quality and the loss of traditional foraging grounds. Addressing these dietary shifts through habitat restoration is therefore a critical component of mitigating conflict and ensuring the species can coexist with human populations.

Movement and Response to Fragmentation

The strictly arboreal nature of *P. comata* means that its movement is entirely contingent upon the presence of a continuous and well-connected forest canopy. Forest fragmentation, driven by land-use change and infrastructure development, acts as a major disruptor to these natural movement patterns (Widyastuti *et al*., 2022). When canopies become disconnected, surili populations are confined to isolated patches, which limits their ability to forage widely and locate mates. Studies in Kuningan show that road corridors and tree felling significantly increase habitat isolation, making the primates more susceptible to human interference.

The inability of this species to cross even small non-forested gaps means that fragmented landscapes effectively function as cages for the subpopulations. This lack of connectivity prevents the genetic exchange necessary to avoid bottlenecks and maintain the long-term health of the species (Gestich *et al*., 2022). In mixed-use forests, the segmented canopy often forces individuals to shift between tree crowns at lower levels, increasing their visibility to predators (Husodo *et al*., 2019). Over time, these movement constraints lead to a reduction in population viability, as small, isolated groups face higher risks of extinction.

Restoring degraded forest patches and establishing functional habitat corridors are now recognized as the highest conservation priorities for the Javan surili. Enhancing connectivity between protected areas can facilitate natural dispersal and improve the resilience of populations facing future climate shifts. Spatial analyses suggest that a significant portion of the species' range exists outside formal protected zones, highlighting the need for broader landscape management. By integrating production forests and agroforestry into connectivity plans, conservationists can create a more permeable landscape that supports the movement of this arboreal primate.

Threats and Conservation Interventions

Major Threats

The Javan surili (*Presbytis comata*) faces a high risk of extinction as a result of sustained anthropogenic pressures across its limited range on Java Island. Habitat loss driven by deforestation remains the principal cause of population decline, primarily through agricultural expansion, infrastructure development, and illegal logging. Over recent decades, Java has experienced extensive forest conversion, resulting in substantial losses of lowland and montane forests that historically supported viable surili populations (Supriatna *et al*., 2020). Consequently, the remaining habitats are increasingly fragmented and ecologically degraded.

Current assessments indicate that fewer than 1,000 individuals persist in the wild, with population declines exceeding 50% over the past decade (Nijman *et al*., 2022). In parallel, only a small fraction of suitable habitat approximately 4% of the species' historical range remains intact. Such reductions undermine population viability by constraining group size, reproductive output, and juvenile survival. The subspecies *P. comata fredericae* is considered particularly vulnerable due to its restriction to densely populated landscapes and exposure to additional environmental risks (Karyanto *et al*., 2024).

Human disturbance further intensifies these pressures. Road construction, forest-edge expansion, and agricultural encroachment disrupt canopy continuity and restrict arboreal movement (Fernández *et al*., 2020). Empirical studies in Kuningan Regency demonstrate that tree felling and transportation corridors increase habitat fragmentation and exposure to human activity (Supartono *et al*., 2016b; Supartono *et al*., 2016c). Habitat compression has also intensified human–wildlife conflict, as surili groups increasingly forage in cultivated areas, often resulting in displacement or persecution (Supartono *et al*., 2024).

Climate Change Vulnerability

Climate change represents an emerging threat that is likely to amplify existing pressures on the Javan surili. Species characterized by narrow geographic ranges, small population sizes, and limited dispersal capacity are particularly sensitive to climatic variability (Sales *et al*., 2019). Once occupying broader lowland forests, the Javan surili is now largely confined to fragmented montane habitats, which reduces its ability to track shifting climatic conditions (Clink *et al*., 2017).

Projected increases in temperature and changes in precipitation regimes are expected to alter forest structure and species composition in montane regions. For mountain-dwelling primates, climate-driven upslope shifts in suitable habitat may result in spatial compression and isolation, a process often described as the "mountaintop trap" (Korstjens & Hillyer, 2016). Modeling studies predict that under high-emission scenarios, large portions of current primate habitats in Indonesia may become climatically unsuitable by mid-century, including areas located within protected zones (Condro *et al*., 2021).

Climate change may also indirectly affect surili populations through alterations in food availability and habitat quality. Shifts in leafing and fruiting phenology can reduce feeding efficiency and disrupt reproductive timing. For a folivorous primate such as *P. comata*, these changes may lower nutritional intake and increase physiological stress. When combined with habitat fragmentation, climate-related impacts are likely to further elevate extinction risk (Yang *et al*., 2025).

Effectiveness of Protected Areas

Protected areas remain central to Javan surili conservation, as most confirmed populations occur within national parks and nature reserves. Indonesia's protected area network covers approximately 12% of the country's terrestrial land surface and supports a substantial proportion of primate diversity (Yang *et al*., 2024). Parks such as Gunung Gede Pangrango, Gunung Halimun Salak, and Gunung Merbabu function as important refugia by maintaining relatively intact forest structure and lower levels of human disturbance.

Nevertheless, the long-term effectiveness of protected areas is constrained by several limitations. Many reserves are small and spatially isolated within human-dominated landscapes,

restricting dispersal and gene flow among populations. In addition, illegal logging, encroachment, and tourism-related pressures persist within protected boundaries, reducing habitat quality and weakening conservation outcomes (Supriatna *et al*., 2020).

Climate change further challenges the role of protected areas as long-term refuges. Projections indicate that many primate populations within reserves may be exposed to novel climatic conditions by 2050, potentially reducing habitat suitability (Condro *et al*., 2021). These findings suggest that protected areas alone are insufficient and must be complemented by adaptive management and broader landscape-level conservation strategies.

Conservation Planning and Landscape Connectivity

Effective conservation planning is essential to address habitat fragmentation across the remaining range of the Javan surili. As a strictly arboreal species, *P. comata* depends on continuous canopy cover for movement and foraging. Fragmentation disrupts these processes, leading to population isolation and increased extinction risk (Kifle & Beehner, 2022). Restoring degraded forest patches and establishing habitat corridors are therefore key conservation priorities (Rezende *et al*., 2020).

Spatial analyses indicate that a substantial proportion of primate distributions in Indonesia occurs outside formal protected areas, often within mixed-use landscapes (Condro *et al*., 2021). This highlights the importance of incorporating production forests, agroforestry systems, and buffer zones into conservation planning. Enhancing connectivity between protected areas can facilitate dispersal, promote genetic exchange, and improve population resilience under future climate conditions (Carvalho *et al*., 2019; Liu *et al*., 2025).

Given limited conservation resources, management efforts should prioritize high-risk populations and climatically stable refugia (Pinto *et al*., 2023). Proactive investment in connectivity and habitat restoration is more cost-effective than reactive interventions following severe population declines. Integrating biodiversity considerations into regional land-use planning is therefore essential for long-term conservation success.

Community-Based Conservation Initiatives

Community involvement is a critical component of Javan surili conservation, particularly in landscapes where primate habitats overlap with agricultural land and human settlements. Research conducted in Kuningan Regency indicates that crop-raiding by surili groups is closely associated with declining forest quality and reduced food availability in natural habitats (Supartono *et al*., 2024). Addressing habitat degradation is therefore central to mitigating conflict.

Community-based conservation programs that provide tangible benefits have been shown to improve local support for wildlife protection. Initiatives such as alternative livelihoods, conservation incentives, and ecotourism opportunities can reduce pressure on forest resources and foster positive attitudes toward primate conservation (Kolinski & Milich, 2021). Increased awareness of the endangered status of the Javan surili further encourages participation in conservation activities.

Long-term conservation outcomes are more likely when local communities are engaged as active partners rather than passive beneficiaries. Participatory approaches that integrate local knowledge, education, and shared management responsibilities can strengthen conservation effectiveness. Such inclusive strategies are increasingly recognized as essential for biodiversity conservation in human-modified tropical landscapes (Obradović *et al*., 2023).

CONCLUSION

The Javan surili (*Presbytis comata*) now persists in a highly fragmented range across approximately 33 forest patches in Java, with fewer than 1,000 individuals remaining and population declines exceeding 50% in recent decades. The drastic reduction of lowland forests, ongoing habitat fragmentation, illegal hunting, and increasing human–wildlife conflict are identified as the primary drivers of decline, while limited canopy connectivity and weak enforcement reduce the effectiveness of existing legal protections. Critical data gaps including insufficient long-term monitoring, limited

population genetic information, and inadequate climate-sensitive habitat assessments continue to constrain evidence-based management. Urgent conservation priorities therefore include restoring and reconnecting forest fragments through functional canopy corridors, strengthening protected area management, integrating mixed-use landscapes into broader connectivity planning, and implementing community-based conflict mitigation strategies, supported by targeted research to inform adaptive, landscape-scale conservation interventions.

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AUTHOR CONTRIBUTIONS

BAA: creating research concept, collecting research data, drafting the article, final revision of the manuscript; SH: creating research concept, final revision of manuscript.

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