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Research Paper

Community Perceptions of Human-Long-Tailed Macaque Interactions in Fragmented Urban Landscapes of Palembang

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Abstract
Urban habitat fragmentation promotes interactions between humans and long-tailed macaques (*Macaca fascicularis*), creating social–ecological challenges for wildlife coexistence. Understanding community perceptions is essential for developing coexistence strategies where human activities and wildlife habitats overlap. This study evaluated community perceptions of long-tailed macaques in two fragmented landscapes, TWA Punti Kayu and Bagus Kuning, Palembang, Indonesia. A structured questionnaire was administered to 144 respondents and assessed five perception dimensions: Knowledge, Perceived Disruption Impact, Interaction Intensity, Perceived Security Risk, and Expectation for a Solution. Perception indices were calculated, while differences between locations were analyzed using the Mann–Whitney U test and relationships between perception variables and ordinal sociodemographic characteristics (age and educational level) were examined using Spearman rank correlation, whereas gender and occupation were analyzed using the Mann-Whitney U and Kruskal-Wallis H tests, respectively. Results indicated positive perceptions, with all dimensions classified as high to high in both locations. Perceived Security Risk was the only dimension differing significantly between locations ($p = 0.050$), whereas Knowledge, Perceived Disruption Impact, Interaction Intensity, and Expectation for a Solution showed no significant differences ($p > 0.05$). Correlation analyses revealed weak associations between sociodemographic characteristics and perception variables, suggesting demographic factors played a limited role in shaping community responses. Instead, shared environmental experiences and interaction contexts appeared to exert greater influence on public perceptions. This study contributes to human-wildlife coexistence literature by integrating social and ecological perspectives. Findings demonstrate that coexistence outcomes are shaped by broader social-ecological conditions associated with habitat fragmentation and human activity patterns. Results emphasize site-specific management, including education, feeding regulation, waste management, community engagement, and urban biodiversity planning, to support sustainable human–macaque coexistence.

Keywords
Coexistence, Macaque, Perception, Fragmentation, Landscape, Tolerance

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1. INTRODUCTION

Urban expansion is one of the most significant drivers of ecological change in tropical regions, transforming natural habitats into increasingly fragmented and human-dominated landscapes. Changes in land use, rising human population density, and intensified urban activities have increased anthropogenic pressure on urban biodiversity and altered ecological processes across tropical ecosystems (Zhang et al., 2025). Habitat fragmentation reduces landscape connectivity, restricts wildlife movement, and compresses species distribution ranges, thereby increasing spatial overlap between humans and wildlife. As a consequence, opportunities for direct human-wildlife interactions become more frequent in urban environments (Boakes et al., 2023). These pressures are further exacerbated by the continued loss of tropical forests, which reached approximately 191 million hectares between 2001 and 2018, reducing the availability of natural habitats and resources for many wildlife species (Ma et al., 2023; Zou et al., 2025).

Among urban-adapted wildlife species, the long-tailed macaque is notable for its high ecological flexibility and

ability to exploit anthropogenic resources. habitat fragmentation and declining natural food have prompted macaques to expand their use of human-dominated areas, including residential and tourist areas. These behavioral adjustments not only increase the frequency of interactions between macaques and local communities but may also alter activity patterns, spatial movements, and resource-use strategies (Marty et al., 2020; Thatcher et al., 2023). Such dynamics are increasingly evident in rapidly urbanizing cities across Southeast Asia, where expanding human settlements continue to overlap with wildlife habitats and intensify opportunities for human–macaque encounters (Depret and Sueur, 2025; Lee et al., 2024).

Increasing interactions between humans and long-tailed macaques shape public perceptions of wildlife presence in urban areas and influence the long-term prospects for coexistence in shared landscapes (Puri et al., 2024). As spatial overlap between humans and wildlife increases, human-wildlife coexistence has emerged as a central conservation paradigm that seeks to balance wildlife persistence with human well-being in shared environments. Human-wildlife coexistence is defined as a dynamic condition in which humans and wildlife continuously interact while maintaining their respective capacities to persist over time (Carter et al., 2020; Tampakis et al., 2023). Social tolerance plays a critical role in this process because local communities influence conflict mitigation, conservation outcomes, and urban wildlife management. Consequently, understanding community perceptions is essential for developing strategies that support sustainable coexistence in increasingly fragmented urban environments.

Although human–macaque interactions in urban environments have received increasing scientific attention, most studies have focused on either ecological dimensions (e.g., behavioral adaptation and population ecology) or social dimensions (e.g., public perceptions and human–wildlife conflict). Comparative investigations across urban landscapes with contrasting ecological functions and anthropogenic pressures remain limited, particularly in rapidly urbanizing regions of Southeast Asia where habitat fragmentation increasingly forces humans and macaques to occupy shared spaces (Depret and Sueur, 2025; Lee et al., 2024). Consequently, the influence of landscape context on human-macaque interactions and community perceptions remains insufficiently understood.

This study integrates social and ecological perspectives within a comparative framework to address this knowledge gap. Five perception dimensions: Knowledge, Perceived Disruption Impact, Interaction Intensity, Perceived Security Risk, and Expectation for a Solution were simultaneously evaluated across two urban landscapes with contrasting habitat characteristics and anthropogenic pressures. This study provides novel insights into how landscape context influences community perceptions and coexistence dynamics between humans and long-tailed macaques in fragmented tropical urban environments. Comparisons between an urban conservation-tourism landscape (TWA Punti Kayu) and a highly fragmented urban landscape dominated by residential and religious activities (Bagus Kuning) further clarify the role of landscape characteristics in shaping human-primate coexistence. Conceptually, this study is grounded in the human-wildlife coexistence framework, which views coexistence as a dynamic social-ecological process shaped by interactions among wildlife behavior, landscape conditions, and human perceptions (Carter et al., 2020).

The objectives of this study are to evaluate community perceptions of long-tailed macaques, compare perception patterns between two urban landscapes, and examine the relationships between sociodemographic characteristics and perception dimensions associated with human-macaque interactions. Integrating ecological and social dimensions, this study is expected to contribute evidence-based management strategies that support sustainable human-macaque coexistence in fragmented urban environments.

2. EXPRIMENTAL SECTION

2.1 Study Area

This study was conducted in two locations in Palembang City, South Sumatra, Indonesia: Taman Wisata Alam (TWA) Punti Kayu and the Bagus Kuning area (Figure 1). These sites were purposively selected to represent two contrasting urban landscape types that differ in habitat characteristics, spatial patterns, and levels of anthropogenic pressure. Their contrasting social and ecological conditions provide an opportunity to examine how urban landscape context influences community perceptions of long-tailed macaques.

TWA Punti Kayu is an urban conservation area comprising community activity zones, recreational facilities, and public-use spaces, dominated by pine forest vegetation. Tourism and recreational activities within the area create frequent opportunities for human-macaque interactions, particularly around heavily visited tourist attractions and public facilities where long-tailed macaques are commonly encountered.

In contrast, Bagus Kuning represents a highly fragmented urban landscape, characterized by dense residential areas and intensive religious activities centered on the Bagus Kuning Cemetery. Daily community activities and pilgrim visits create frequent opportunities for interactions between people and long-tailed macaques across a variety of shared urban spaces.

2.2 Methods

2.2.1 Research Design

This study employed a quantitative cross-sectional survey design combined with descriptive, comparative, and correlational analyses to evaluate community perceptions of long-tailed macaques across two urban landscapes in Palembang City. A cross-sectional approach was selected because it enables the assessment of respondent characteristics and

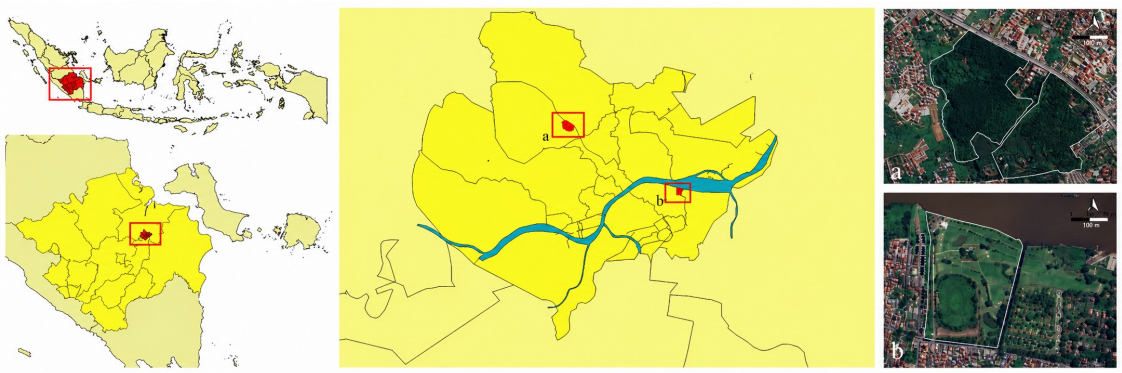

Figure 1. Study Locations: (a) TWA Punti Kayu and (b) the Bagus Kuning Area, Palembang City, South Sumatra Province

community perceptions within a single observation period without repeated measurements (Setia, 2016).

Descriptive analysis was used to characterize respondent profiles, study site conditions, and community perceptions of long-tailed macaques. A comparative analysis assessed differences in community perceptions between TWA Punti Kayu and Bagus Kuning, whereas a correlational analysis examined relationships between respondents' sociodemographic characteristics and perception variables. Community perception was treated as the dependent variable and operationalized into five constructs: Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), Perceived Security Risk (X4), and Expectation for a Solution (X5). Independent variables consisted of respondents' sociodemographic characteristics, including gender, age group, educational level, and occupation. These variables were analyzed to evaluate variation in community perceptions across the two study locations.

2.2.2 Respondents and Sampling Procedures

Respondents were selected using purposive sampling based on criteria aligned with the study objectives. Eligible participants were individuals who had experienced direct interactions with long-tailed macaques and had lived in the study area for at least five years. These criteria were intended to ensure sufficient familiarity with local human-macaque interactions and the presence of long-tailed macaques within the surrounding environment. Sample size was determined using the Slovin formula with a 10% margin of error based on the estimated population living around the study sites. This level of precision was considered appropriate for an exploratory comparative study aimed at assessing community perceptions while accommodating respondent heterogeneity and field access constraints. The sample size was calculated using Equation (1). The calculation yielded 69 respondents from the TWA Punti Kayu area and 75 from Bagus Kuning.

$$n = \frac{N}{(1 + Ne^2)} \quad (1)$$

where:
(n) = sample size
(N) = population size
(e) = margin of error (10%)

Data were collected through face-to-face interviews using a structured questionnaire. To ensure consistent administration of all questions, minimize variation in respondent interpretation, and maintain a uniform understanding of each questionnaire item, all interviews were conducted directly by the researcher. Respondent characteristics included gender, age group, educational level, and occupation. Associations between these sociodemographic variables and community perceptions of long-tailed macaques were subsequently evaluated across the two study locations.

2.2.3 Questionnaire Validation

Prior to the main survey, a pilot test was conducted with 30 respondents who were not included in the final study sample to evaluate the clarity, consistency, and comprehensibility of each questionnaire item. This preliminary assessment was intended to identify potential ambiguities and ensure that the instrument could accurately measure community perceptions before being administered in the main survey.

The questionnaire was designed to evaluate community perceptions of interactions between humans and long-tailed macaques as a socio-ecological phenomenon within urban environments. The questionnaire consisted of 20 perception items grouped into five constructs: Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), Perceived Security Risk (X4), and Expectation for a Solution (X5). The questionnaire items used to measure each perception construct are presented in Table 1.

Community perception was operationalized into five constructs: Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), Perceived Security Risk (X4), and Expectation for a Solution (X5). These constructs were developed to assess ecological knowledge, perceived impacts, interaction experiences, risk perceptions, and community support for the management of human-wildlife interactions.

Table 1. Questionnaire Items Used to Assess Community Perceptions of Long-Tailed Macaques

Construct	Code	Questionnaire Item
Knowledge	X1.1	I can recognize the unique characteristics that distinguish long-tailed macaques from other primates.
	X1.2	I know the natural habitat of long-tailed macaques.
	X1.3	Long-tailed macaques have diverse feeding habits.
	X1.4	Long-tailed macaques play an important ecological role in forest ecosystems.
Perceived Disruption Impact	X2.1	Long-tailed macaques frequently damage crops or vegetation.
	X2.2	The presence of long-tailed macaques negatively affects local livelihoods.
	X2.3	Long-tailed macaques make residents feel uncomfortable in their surroundings.
	X2.4	Long-tailed macaques disrupt daily community activities.
Interaction Intensity	X3.1	I frequently observe long-tailed macaques around my neighborhood.
	X3.2	I have experienced direct encounters or close contact with long-tailed macaques.
	X3.3	I am familiar with the behavior of long-tailed macaque groups in this area.
	X3.4	Human–macaque interactions have become increasingly frequent.
Perceived Security Risk	X4.1	The presence of long-tailed macaques threatens public safety.
	X4.2	I feel unsafe when long-tailed macaques are present near residential areas.
	X4.3	I am concerned that macaques may attack or injure people.
	X4.4	Economic losses caused by macaque activities are burdensome for local communities.
Expectation for a Solution	X5.1	A management plan is needed to address human–macaque interactions.
	X5.2	Long-tailed macaques should be managed using safe and humane approaches.
	X5.3	Residents should receive information about macaque ecology and behavior.
	X5.4	Residents affected by macaque-related damage should receive appropriate support

The constructs were adapted to represent practical dimensions of community perception in urban human-macaque interactions and were evaluated empirically through validity and reliability testing.

Instrument validity was assessed using Pearson Product-Moment analysis through Corrected Item–Total Correlation (CITC) to evaluate the consistency of relationships among items within each construct. An item was considered valid when its correlation coefficient exceeded the critical r-table value at a significance level of 0.05. Reliability was evaluated using Cronbach's Alpha coefficient, with values greater than 0.70 indicating acceptable internal consistency. The results of the validity and reliability analyses for all constructs are presented in Table 2.

All questionnaire items met the validity criteria, with Corrected Item-Total Correlation values ranging from 0.426 to 0.897. In addition, all constructs demonstrated satisfactory reliability, with Cronbach's Alpha values ranging from 0.805 to 0.906. These results indicate that the instrument was both valid and reliable for assessing community perceptions of human-macaque interactions in urban environments.

Responses were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The resulting scores were used in descriptive, comparative, and correlational analyses to evaluate community perceptions at both study sites. Social tolerance was inferred from composite scores across all perception constructs, reflecting the level of community acceptance of long-tailed macaques in urban environments.

2.2.4 Data Collection

Data were collected through field observations and face-to-face interviews using a structured questionnaire to assess interaction patterns between humans and long-tailed macaques and community perceptions at both study sites. All observations and interviews were conducted directly by the researcher using standardized recording forms to ensure consistency in observation procedures, data recording, and interpretation throughout the study period.

Field observations were conducted to document habitat characteristics, anthropogenic activities, and patterns of human-macaque interactions at both study sites. Anthropogenic activities were classified into three categories: tourism, domestic community, and religious. These included tourist visits, use of public spaces, community mobility, provisioning practices, residential activities, and visits to

Table 2. Results of the Validity and Reliability Testing of the Research Instrument

Construct	Variable Code	Number of Items	Corrected Item–Total Correlation Range	Cronbach's Alpha
Knowledge	X1	4	0.743–0.807	0.895
Perceived Disruption Impact	X2	4	0.426–0.897	0.842
Interaction Intensity	X3	4	0.562–0.730	0.824
Perceived Security Risk	X4	4	0.644–0.871	0.906
Expectation for a Solution	X5	4	0.575–0.802	0.805

Note: All constructs met the validity criterion (Corrected Item–Total Correlation > 0.30) and the reliability criterion (Cronbach's Alpha > 0.70).

religious sites located near macaque habitats.

Observational data were categorized into three components: environmental characteristics, human activities, and human–macaque interactions. Interaction patterns were classified according to interaction type, contact frequency, and interaction intensity observed during the study period. Recorded interactions included encounters in tourism areas, disturbances in residential neighborhoods, shared use of public spaces, food-seeking behavior by macaques, and community responses to macaque presence.

Observations were conducted during the morning and afternoon periods, when human activity levels were relatively high, to capture variation in human–macaque interactions. Observation periods and durations were standardized across study sites and repeated throughout the study to improve the reliability of observational data.

Individual face-to-face interviews were conducted using a structured questionnaire to obtain information on community perceptions of long-tailed macaques, including knowledge, perceived impacts of disruption, interaction intensity, perceived security risks, and expectations for management solutions. Direct interviews were used to minimize response bias and ensure a consistent understanding of questionnaire items among respondents. Environmental and human activity data were initially analyzed separately and subsequently integrated to evaluate relationships among habitat characteristics, anthropogenic activities, human–macaque interaction patterns, and community perceptions across the two study locations.

2.2.5 Data Analysis

All statistical analyses were performed using IBM SPSS Statistics version 26. Descriptive statistics were used to characterize respondent profiles, patterns of human–macaque interactions, and community perceptions at the two study locations. Data are presented as frequencies, percentages, means, standard deviations (SD), and 95% confidence intervals (CI).

Community perceptions of long-tailed macaques were assessed using a five-point Likert scale comprising five dimensions: Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), Perceived Security Risk (X4), and Expectation for a Solution (X5). Responses were scored from 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. These scores were subsequently used to calculate the total perception score and perception index. The total perception score was calculated using Equation (2).

Total Perception

$$\text{Total Score} = \sum_{i=1}^{n} (f_i \times w_i) \tag{2}$$

Where :

f_i = frequency of respondent responses in category i

w_i = Likert score weight for category i

n = number of categories on the Likert scale

The perception index was calculated using Equation (3).

$$\text{Perception Index } (\%) = \frac{\sum_{i=1}^{n} (f_i \times w_i)}{N \times S_{max}} \tag{3}$$

Where:

$\sum_{i=1}^{n} (f_i \times w_i)$ = total score of all responses

N = number of respondents

S_{max} = maximum score of the Likert scale

Perception index values were calculated as percentages of the maximum attainable score and classified into five equal intervals: very low (0-19.99%), low (20-39.99%), moderate (40-59.99%), high (60-79.99%), and very high (80-100%).

Prior to inferential analysis, data normality was assessed using the Shapiro–Wilk test at the 0.05 significance level. The results indicated that perception data were not normally distributed ($p < 0.05$). Consequently, non-parametric statistical methods were applied throughout the analysis. Differences in community perceptions between TWA Punti Kayu and Bagus Kuning were evaluated using the Mann–Whitney U test, which is appropriate for comparing two independent groups with ordinal and non-normally distributed data.

Spearman's rank correlation was used to evaluate relationships between the ordinal sociodemographic variables (age group and educational level) and perception variables. Because gender and occupation are nominal variables, differences in perception scores between male and female respondents were analyzed using the Mann–Whitney U test, whereas differences among occupation groups were analyzed

using the Kruskal–Wallis H test. Perception variables consisted of Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), Perceived Security Risk (X4), and Expectation for a Solution (X5). All statistical tests were performed at a significance level of $\alpha = 0.05$ with a 95% confidence level.

2.2.6 Ethical Considerations

Prior to data collection, all participants were informed about the objectives of the study, interview procedures, and the voluntary nature of their participation. Informed consent was obtained from all respondents before interviews were conducted. Participants were informed of their right to decline participation or withdraw from the study at any time without consequence. All personal information was treated confidentially and anonymized during data processing and reporting. Data were used exclusively for research purposes and stored securely to protect participant privacy.

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics

The demographic profiles of respondents at both study sites were dominated by female participants, individuals of productive age, and respondents with a Senior High School educational background (Figure 2).

At TWA Punti Kayu, female respondents accounted for 69.60% of the sample, while males represented 30.40%. A similar pattern was observed in Bagus Kuning, where females constituted 74.70% of respondents and males accounted for 25.30%. The majority of respondents at both locations belonged to the productive-age category. In TWA Punti Kayu, 71.00% of respondents were between 25 and 44 years old, whereas in Bagus Kuning this age group represented 62.70% of respondents. The proportion of older respondents ($\geq$65 years) was relatively low, accounting for only 1.30% of respondents in Bagus Kuning and absent from the TWA Punti Kayu sample.

Regarding educational attainment, respondents at both sites were predominantly Senior High School graduates, representing 59.40% of respondents in TWA Punti Kayu and 64.00% in Bagus Kuning. Respondents with Bachelor's degrees constituted 29.00% and 16.00% of the samples in TWA Punti Kayu and Bagus Kuning, respectively. Meanwhile, postgraduate education was limited, with only 2.90% of respondents in TWA Punti Kayu holding a Master's degree. In Bagus Kuning, respondents with no formal education represented only 2.70% of the sample.

Occupational characteristics differed between study sites. In TWA Punti Kayu, respondents were predominantly employees working in government, military, police, or private sectors (33.30%), followed by individuals categorized as having other occupations (21.70%) and homemakers (15.90%). In contrast, Bagus Kuning was strongly dominated by homemakers, who accounted for 50.70% of respondents, followed by employees (24.00%) and laborers (12.00%). These findings indicate that respondents in both study areas are primarily engaged in occupations closely associated with residential environments and daily activities conducted within or near local neighborhoods.

The predominance of productive-age respondents and female participants suggests a high level of daily exposure to long-tailed macaques within the urban landscape. Individuals in these demographic groups typically spend substantial time in residential areas, neighborhood facilities, local markets, religious sites, and public open spaces where macaques frequently occur. Consequently, opportunities for direct and indirect interactions with macaques are likely to be greater among these groups. This pattern reflects a substantial spatial overlap between human activities and macaque ranging habitats within fragmented urban environments. Similar findings have been reported in urban wildlife studies, where increasing urbanization and human activities intensify contact between people and wildlife in shared landscapes (Ma et al., 2024).

The dominance of homemakers in Bagus Kuning and the substantial proportion of employees and homemakers in TWA Punti Kayu may further contribute to frequent observations of macaque activity. Respondents who spend considerable time within residential settings are more likely to encounter macaques during routine daily activities. Repeated exposure can facilitate social habituation, whereby wildlife becomes perceived as a normal component of the surrounding environment. Previous studies have shown that repeated encounters with urban wildlife may increase tolerance and acceptance among local communities, particularly when interactions occur regularly and do not result in severe negative consequences (Carter et al., 2020; Karimullah et al., 2022; Poornima et al., 2022).

However, increased familiarity does not necessarily eliminate socio-ecological challenges. Frequent encounters may normalize behaviors such as intentional feeding, food provisioning, and close-range interactions with macaques. Such practices can increase wildlife dependence on anthropogenic food resources, alter natural behavioral patterns, and elevate the risk of human–wildlife conflict in urban settings (Eckardt et al., 2021; Marty et al., 2020). Therefore, although repeated exposure may promote coexistence, it may simultaneously create conditions that encourage maladaptive interactions between humans and wildlife.

The demographic structure observed in this study highlights the importance of considering social characteristics when developing urban wildlife management strategies. Productive age individuals, women, homemakers, and residents whose daily activities are concentrated within residential environments represent demographic groups with the greatest potential for wildlife encounters. Consequently, these groups should be prioritized in community-based conservation initiatives, environmental education programs, responsible waste management campaigns, and public awareness activities de-

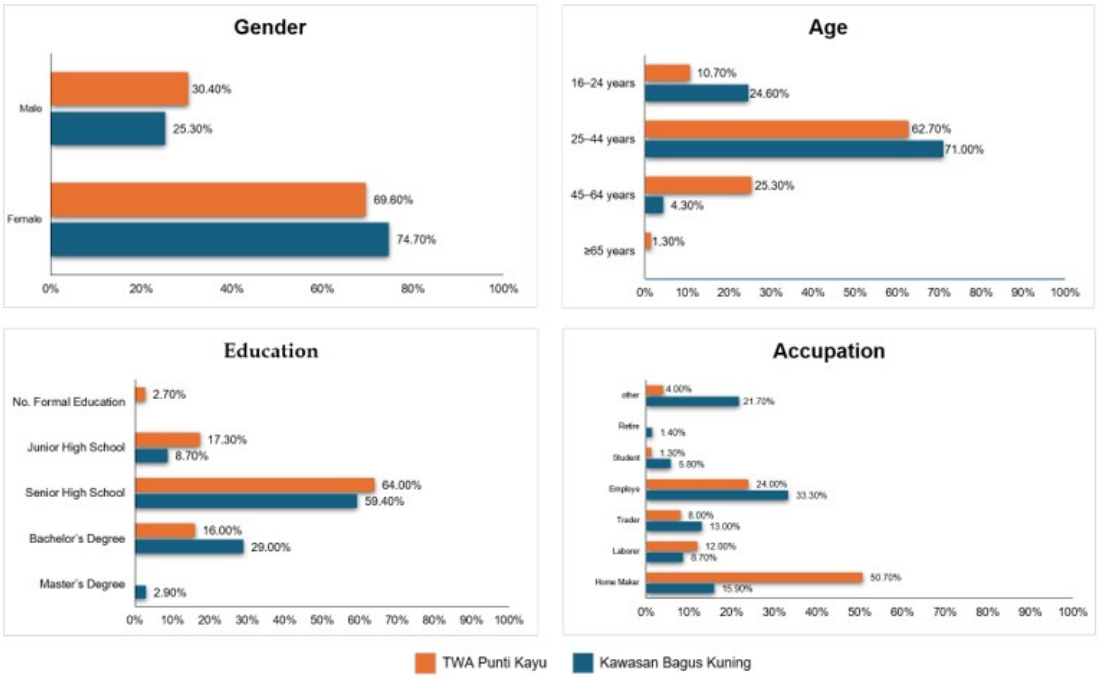

Figure 2. Demographic Characteristics of Respondents in TWA Punti Kayu and the Bagus Kuning: (a) Gender, (b) Age, (c) Educational Level, and (d) Occupation

signed to support sustainable human–macaque coexistence in urban landscapes.

3.2 Public Perceptions

Community perceptions of long-tailed macaques were generally positive at both study sites, with mean scores for all perception variables falling within the high category (Figure 3). Mean perception scores ranged from 3.79 to 4.32, indicating relatively high levels of acceptance despite ongoing human–macaque interactions and perceived risks. Comparison of mean values and their 95% confidence intervals revealed variation between TWA Punti Kayu and Bagus Kuning. Expectation for a Solution (X5) recorded the highest mean score at both locations (4.32 in TWA Punti Kayu and 4.25 in Bagus Kuning), whereas Knowledge (X1) showed the lowest score, particularly in Bagus Kuning. However, it remained within the positive category. These findings suggest that high levels of social acceptance are not always accompanied by equally strong ecological knowledge regarding macaque behavior, spatial ecology, and the consequences of human–wildlife interactions.

Results of the Mann–Whitney U test showed that Perceived Security Risk (X4) was the only perception variable that reached statistical significance between locations ($U = 2134$; $p = 0.050$), with higher scores recorded in TWA Punti Kayu. n this study, statistical significance was defined as $p \leq 0.05$; therefore, the observed p-value of 0.050 was considered statistically significant and interpreted accordingly. In contrast, Bagus Kuning exhibited slightly higher

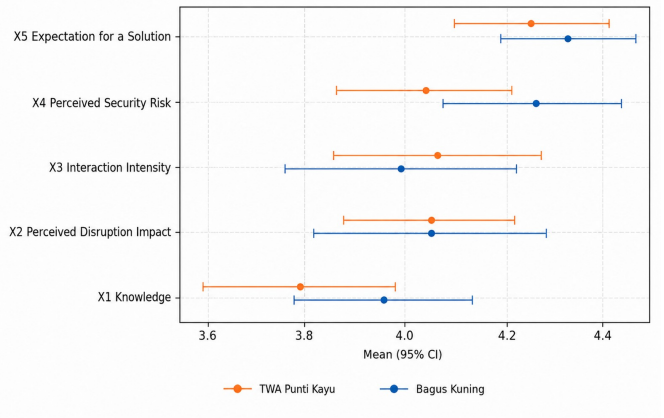

Figure 3. Mean Scores (±95% Confidence Intervals) of the Five Perception Dimensions Assessed in TWA Punti Kayu and Bagus Kuning

Interaction Intensity (X3) values. This pattern suggests that fragmented urban landscapes may facilitate more persistent interactions between people and long-tailed macaques than conservation-based tourism areas where spatial use is regulated through zoning systems (Ligue-Sabio et al., 2026; Zhao et al., 2023). The higher interaction intensity observed in Bagus Kuning is likely associated with the proximity between residential areas, community activity spaces, and macaque habitats, which increases opportunities for daily encounters. In this study, Interaction Intensity (X3) reflects

encounter frequency, interaction proximity, and community responses to macaque presence within residential environments.

These findings suggest that frequent contact with wildlife does not necessarily lead to negative perceptions. In environments where wildlife is regularly encountered, repeated exposure may promote social habituation and increase familiarity with wildlife. Under such conditions, long-tailed macaques may become accepted as a routine component of the urban environment. Similar patterns have been reported in other urban wildlife studies, where tolerance remains relatively high despite concerns related to safety or economic impacts, particularly when communities have a long history of coexistence with wildlife (Ferdin et al., 2025; Spaan et al., 2020).

The higher interaction intensity observed in Bagus Kuning further indicates close spatial proximity between human activity areas and macaque habitats. Such conditions increase the frequency of repeated encounters and strengthen the degree of spatial overlap between humans and wildlife. As a result, coexistence dynamics become increasingly dependent on how both species utilize shared urban spaces (Holzner et al., 2021; Zhang et al., 2026).

In addition to shaping public perceptions, frequent and close-range interactions between humans and long-tailed macaques may also increase the potential risk of zoonotic disease transmission. Urban primates can serve as reservoirs or carriers of various pathogens, including gastrointestinal parasites, enteric bacteria, and viral agents that may be transmitted through direct contact, shared environmental resources, or exposure to contaminated surfaces (Balasubramaniam et al., 2021; Kaewchot et al., 2022). Although no disease-related incidents were documented during this study, the relatively high interaction intensity observed in both study locations highlights the importance of considering public health dimensions within human–macaque coexistence frameworks. Similar concerns have been reported in urban primate populations across South and Southeast Asia, where increasing spatial overlap between humans and macaques has raised concerns regarding pathogen transmission and wildlife-associated health risks (Fernando et al., 2022; Patouillat et al., 2024). Consequently, coexistence strategies should incorporate not only ecological and social considerations but also preventive measures that reduce unnecessary close contact between humans and wildlife while maintaining opportunities for sustainable coexistence. Similar public health concerns have also been documented in urban macaque populations in Malaysia, India, and Sri Lanka, where increasing human–primate contact has intensified opportunities for pathogen transmission in shared urban environments (Balasubramaniam et al., 2022; Dian et al., 2022; Patouillat et al., 2024).

Changes in interaction dynamics may also encourage behavioral adaptation among local communities, including increased caution when storing food, avoidance of direct physical contact, and modifications in feeding-related behaviors. Studies of urban primates in South and Southeast Asia have documented similar patterns, demonstrating that long-term exposure to wildlife can promote social adaptation mechanisms that reduce the likelihood of daily conflicts (Caparrós-Vallcorba et al., 2026; Stevens et al., 2025). These findings suggest that coexistence between humans and macaques is shaped not only by ecological conditions but also by the adaptive responses of local communities.

Relatively low Knowledge (X1) scores, particularly in Bagus Kuning, indicate that community acceptance of urban wildlife is not always supported by a strong ecological understanding of macaque behavior, urban adaptation, or the consequences of human–wildlife interactions. This situation may encourage behaviors such as provisioning, feeding interactions, and close-range encounters with wildlife. In addition to increasing macaque dependence on anthropogenic resources, these practices may alter natural behavioral patterns and contribute to future management challenges. Therefore, strengthening ecological literacy should be considered an important component of coexistence management strategies. Overall, the contrasting characteristics of the two urban landscapes demonstrate how spatial structure and anthropogenic pressures influence community perceptions of urban wildlife. Increased spatial overlap between people and macaques contributes to more frequent interactions and more complex coexistence dynamics within fragmented urban environments (Moesch et al., 2024). In contrast, conservation-based tourism areas such as TWA Punti Kayu benefit from zoning systems that regulate land use, although concerns about wildlife-related risks persist. These findings suggest that community perceptions are shaped not only by interaction frequency but also by previous experiences, familiarity with wildlife, and the broader social-ecological context of each landscape (Ngo et al., 2022).

From a management perspective, coexistence strategies should be tailored to the social and ecological characteristics of each study site. At TWA Punti Kayu, risk mitigation could be strengthened by improving safety communication, installing wildlife interaction signage, and monitoring visitor provisioning activities. In Bagus Kuning, management efforts should prioritize ecological education, regulation of provisioning practices, improved waste management, and greater awareness of safe human–wildlife interactions. Community-based approaches involving residents, site managers, and local government agencies are essential for promoting adaptive and sustainable urban wildlife management (Tampakis et al., 2023).

3.3 Public Perception Index and Coexistence Stability

Perception index analysis indicated that all perception dimensions were classified as high to very high at both study locations. Table 3 presents the perception index values

Table 3. Comparison of Public Perception Indices Regarding the Presence of Long-Tailed Macaques in TWA Punti Kayu and Bagus Kuning

Variable	TWA Punti Kayu (%)	Category	Bagus Kuning (%)	Category	p-value
Knowledge (X1)	73.91	High	69.67	High	0.335
Perceived Disruption Impact (X2)	76.09	High	76.00	High	0.497
Interaction Intensity (X3)	74.64	High	76.33	High	0.681
Perceived Security Risk (X4)	81.16	Very High	75.67	High	0.050*
Expectation for a Solution (X5)	82.97	Very High	81.33	Very High	0.728

Note: *$p \leq 0.05$ indicates a statistically significant difference between study locations based on the Mann–Whitney U test.

and Mann–Whitney U test results for all perception dimensions assessed in TWA Punti Kayu and Bagus Kuning. Mann–Whitney U test results further demonstrated that Perceived Security Risk (X4) was the only dimension that differed significantly between locations ($p = 0.050$), whereas Knowledge (X1), Perceived Disruption Impact (X2), Interaction Intensity (X3), and Expectation for a Solution (X5) showed no significant differences ($p > 0.05$). These findings suggest that communities in both urban landscapes shared broadly similar perceptions of long-tailed macaques despite differences in habitat characteristics and anthropogenic pressures.

The perception index findings reinforce previous results, showing that communities at both study locations exhibit relatively high acceptance of long-tailed macaques. The high scores recorded for Expectation for a Solution (X5) suggest that residents not only accept the presence of macaques but also strongly support efforts to improve the management of human–macaque interactions. This pattern indicates substantial public support for coexistence-based management approaches. Social acceptance is widely recognized as a key determinant of the success of conservation policies, conflict mitigation measures, and wildlife management programs in human-dominated landscapes (Carter et al., 2020; Tampakis et al., 2023).

In contrast, the relatively lower Knowledge (X1) scores observed in Bagus Kuning suggest that public acceptance is not always accompanied by adequate ecological understanding of macaque behavior and human–wildlife interactions. These findings indicate that coexistence stability is supported not only by social tolerance but also by the level of ecological knowledge that enables more adaptive responses to wildlife presence. Previous studies have shown that increased ecological literacy contributes to more realistic perceptions of wildlife and supports long-term coexistence strategies (Poornima et al., 2022; Thatcher and Downs, 2021).

Overall, the consistently high perception index values across all variables suggest that coexistence between people and long-tailed macaques remains relatively stable at both study locations. High levels of social tolerance, combined with strong support for management interventions, indicate that macaques are generally accepted as part of the urban landscape. However, this stability should not be considered static. Changes in anthropogenic pressure, habitat conditions, or the frequency of negative interactions may alter community perceptions over time (Carter et al., 2020; Moesch et al., 2024).

Although coexistence conditions appeared relatively stable at both locations, the social and ecological mechanisms underlying this stability differed between sites. In TWA Punti Kayu, coexistence stability is likely supported by the presence of a conservation area, a zoning system, and relatively controlled tourism activities. In contrast, stability in Bagus Kuning appears to be driven primarily by long-term social adaptation resulting from frequent interactions between residents and macaques in daily life. These findings suggest that coexistence stability does not emerge from a single universal mechanism but is shaped by the specific landscape characteristics and interaction patterns experienced by local communities (Ngo et al., 2022; Spaan et al., 2020).

3.4 Relationship Between Demographic Characteristics and Public Perceptions

Spearman rank correlation analysis was performed to examine the relationships between the ordinal sociodemographic variables (age and educational level) and public perception variables (Table 4). Overall, most correlations were weak, although several statistically significant relationships were identified in TWA Punti Kayu. Age was positively associated with Perceived Disruption Impact (X2) ($\rho = 0.28$; $p < 0.05$) and Interaction Intensity (X3) ($\rho = 0.32$; $p < 0.05$), indicating that older respondents tended to report greater perceived disturbance and more frequent interactions with long-tailed macaques than younger respondents. These findings suggest that accumulated life experience and prolonged exposure to local environmental conditions may influence how individuals perceive human–macaque interactions. Nevertheless, because the correlation coefficients were relatively weak, these associations should be interpreted as general tendencies rather than evidence of direct causal relationships (Hansen et al., 2025).

Educational level was positively associated with Interaction Intensity (X3) ($\rho = 0.29$; $p < 0.05$) and negatively associated with Expectation for a Solution (X5) ($\rho = -0.26$; $p < 0.05$) (Table 4). These findings suggest that respondents with different educational backgrounds may perceive

Table 4. Spearman Correlations Between Ordinal Sociodemographic Characteristics and Public Perception Variables Regarding Long-Tailed Macaques

Demographic Variables	X1	X2	X3	X4	X5
TWA Punti Kayu (n = 69)					
Age	0.12	0.28*	0.32*	–0.10	–0.22
Education	0.00	0.05	0.29*	–0.06	–0.26*
Bagus Kuning (n = 75)					
Age	–0.04	0.00	0.19	0.10	0.22
Education	0.10	0.00	–0.11	–0.13	–0.14

Note: X1 = Knowledge; X2 = Perceived Disruption Impact; X3 = Interaction Intensity; X4 = Perceived Security Risk; X5 = Expectation for a Solution. Values represent Spearman's rank correlation coefficients (ρ) between the ordinal sociodemographic variables (age and educational level) and the five perception dimensions; * indicates a statistically significant relationship at $p < 0.05$.

human–macaque interactions differently. Individuals with higher educational attainment may evaluate wildlife interactions from broader ecological and management perspectives (Karimullah et al., 2022). However, the relatively weak correlation coefficients indicate that educational level accounted for only a small proportion of the variation in community perceptions. In contrast, no significant relationships between age, educational level, and any perception variable were detected in Bagus Kuning, indicating relatively homogeneous perceptions across ordinal demographic groups.

Because gender and occupation are nominal variables, they were analyzed separately using nonparametric statistical tests appropriate for categorical data. Gender was evaluated using the Mann–Whitney U test, whereas occupation was analyzed using the Kruskal–Wallis H test. The Mann–Whitney U test revealed no statistically significant differences between male and female respondents for any perception dimension in either TWA Punti Kayu or Bagus Kuning (Table 5).

These findings indicate that male and female respondents shared similar perceptions regarding knowledge, perceived disruption, interaction intensity, perceived security risk, and expectations for management solutions. This finding suggests that gender did not substantially influence community perceptions, possibly because both male and female respondents experienced similar levels of exposure to long-tailed macaques within the study areas. The Kruskal–Wallis H test likewise revealed no statistically significant differences among respondents from different occupation groups for any perception dimension in either study area (Table 6).

These findings suggest that occupational background had little influence on community perceptions of long-tailed macaques. Respondents from different occupational groups appeared to experience broadly similar human–macaque interactions, suggesting that shared environmental exposure may have played a greater role in shaping community perceptions than occupational differences.

Overall, the results indicate that sociodemographic characteristics explained only a limited proportion of variation in community perceptions toward long-tailed macaques. Significant relationships were detected only for age and educational level in TWA Punti Kayu, whereas no significant differences were identified for gender or occupation in either study area. These findings suggest that sociodemographic characteristics contributed only modestly to variation in public perception and should therefore be interpreted as general social tendencies rather than strong predictors of human–macaque coexistence. Instead, landscape characteristics, habitat conditions, and repeated direct encounters with long-tailed macaques are likely to exert a greater influence on community perceptions. Although this study focused primarily on community perceptions, ecological context was considered when interpreting the findings. Differences in habitat characteristics, landscape fragmentation, anthropogenic activities, and patterns of human–macaque interactions may all contribute to variation in community responses. Collectively, thesse findings reinforce the view that coexistence in urban landscapes is shaped more strongly by shared social–ecological conditions than by individual sociodemographic attributes (Carter et al., 2020; Ngo et al., 2022).

Several limitations should be considered when interpreting these findings. This study focused primarily on community perceptions and relied on field observations to contextualize human–macaque interactions. Quantitative data on macaque behavior, habitat quality, and other ecological indicators were not included in the analysis. In addition, although the nonparametric statistical methods used in this study were appropriate for the dataset's characteristics, they do not allow simultaneous evaluation of multiple social and environmental factors influencing community perceptions. Future studies should integrate behavioral and ecological data, habitat assessments, spatial landscape analyses, and multivariate statistical approaches to provide a more comprehensive understanding of the mechanisms underlying human–primate coexistence in urban landscapes.

3.5 Management Implications for Urban Human-Macaque Coexistence

The findings of this study highlight the importance of developing site-specific coexistence strategies that account

Table 5. Mann-Whitney U Test Comparing Public Perception Scores Between Male and Female Respondents Regarding Long-Tailed Macaques

Location	Statistic	X1	X2	X3	X4	X5
TWA Punti Kayu (n = 69)	U	576.00	431.00	594.00	440.00	511.50
	p-value	0.30	0.31	0.22	0.36	0.92
Bagus Kuning (n = 75)	U	637.00	619.00	575.00	526.50	567.00
	p-value	0.17	0.23	0.57	0.95	0.64

Notes: X1 = Knowledge; X2 = Perceived Disruption Impact; X3 = Interaction Intensity; X4 = Perceived Security Risk; X5 = Expectation for a Solution. Mann–Whitney U test was used to compare perception scores between male and female respondents. No statistically significant differences were found between male and female respondents for any perception variable at either study site ($p > 0.05$).

Table 6. Kruskal-Wallis H Test Comparing Public Perception Scores Among Occupation Groups Regarding Long-Tailed Macaques

Location	Statistic	X1	X2	X3	X4	X5
TWA Punti Kayu (n = 69)	H	2.95	6.06	4.81	2.57	10.53
	df	6	6	6	6	6
	p-value	0.82	0.42	0.57	0.86	0.10
Bagus Kuning (n = 75)	H	6.05	4.67	4.22	1.87	3.49
	df	5	5	5	5	5
	p-value	0.30	0.46	0.52	0.87	0.62

Notes: X1 = Knowledge; X2 = Perceived Disruption Impact; X3 = Interaction Intensity; X4 = Perceived Security Risk; X5 = Expectation for a Solution. Kruskal–Wallis H test was used to compare perception scores among occupation groups. Degrees of freedom (df) equal the number of occupation categories minus one. No statistically significant differences were found among occupation groups for any perception variable at either study site ($p > 0.05$).

for differences in landscape characteristics, anthropogenic pressures, and interaction patterns between humans and long-tailed macaques. Although communities at both study locations generally exhibited high levels of acceptance toward macaques, the persistence of frequent interactions and concerns regarding safety risks indicate the need for proactive management interventions. Similar challenges have been documented in urban primate systems across South and Southeast Asia, where habitat fragmentation, urban expansion, and increasing dependence on anthropogenic resources have intensified opportunities for human–primate encounters and conflict (Depret and Sueur, 2025; Radhakrishna et al., 2025).

In TWA Punti Kayu, management efforts should focus on reducing human behaviors that encourage macaque habituation to anthropogenic resources. Visitor education programs, interpretive signage, and stricter enforcement of feeding prohibitions are particularly important because tourism-related provisioning has been widely recognized as a major driver of behavioral modification in urban macaque populations. Studies in Thailand and Malaysia have shown that repeated visitor feeding can increase macaque dependence on human-derived food resources, alter natural activity patterns, and elevate the probability of aggressive interactions and conflict with humans (Entezami et al., 2024; Zhao et al., 2023). Regular monitoring of visitor activities and macaque behavioral responses should therefore be incorporated into conservation-based tourism management to maintain ecological integrity while minimizing conflict potential.

In contrast, management priorities in Bagus Kuning should emphasize community-based coexistence strategies. Frequent daily encounters between residents and macaques indicate the need for improved household waste management, reduction of anthropogenic food availability, and increased public awareness regarding safe wildlife interactions. Similar approaches have been recommended in urban primate landscapes in India and Sri Lanka, where residential areas adjacent to primate habitats experience persistent human–primate interactions driven by food availability, habitat encroachment, and long-term coexistence dynamics (Jayarathne et al., 2025; Radhakrishna et al., 2025). Community participation is particularly important because local residents directly influence the availability of anthropogenic resources and shape long-term coexistence outcomes. Educational programs should therefore focus not only on conflict prevention but also on improving ecological understanding of macaque behavior and the consequences of provisioning practices.

At the municipal level, human–macaque coexistence should be integrated into broader urban biodiversity plan-

ning and environmental governance frameworks. Establishing wildlife incident reporting systems, strengthening coordination among conservation agencies and local governments, and enhancing habitat connectivity through urban green infrastructure may contribute to more adaptive coexistence management. Experiences from Thailand, India, and Sri Lanka indicate that long-term coexistence is more likely to be achieved when wildlife management is incorporated into urban planning processes rather than implemented solely through reactive conflict mitigation measures (Depret and Sueur, 2025; Radhakrishna et al., 2025). By combining ecological management, community engagement, and evidence-based policy interventions, local authorities can reduce conflict potential while maintaining opportunities for biodiversity conservation within fragmented urban landscapes.

4. CONCLUSIONS

This study demonstrated that communities in both TWA Punti Kayu and Bagus Kuning generally exhibited high levels of acceptance toward long-tailed macaques despite differences in urban landscape characteristics and anthropogenic pressures. Perceived Security Risk was the only perception dimension that differed significantly between locations, whereas Knowledge, Perceived Disruption Impact, Interaction Intensity, and Expectation for a Solution showed similar patterns. Sociodemographic characteristics were only weakly associated with perception variables, suggesting that local interaction experiences and environmental context play a greater role in shaping community responses. This study contributes to the human-wildlife coexistence literature by providing comparative evidence from two fragmented urban landscapes with contrasting ecological and social conditions. The findings emphasize the importance of incorporating social perceptions into urban wildlife management and demonstrate that coexistence outcomes are influenced by local landscape context. From a management perspective, coexistence strategies should be adapted to site-specific conditions through education programs, regulation of wildlife feeding, improved waste management, and community engagement. Future research should integrate ecological, behavioral, and spatial analyses with long-term monitoring to better understand the mechanisms that support sustainable human-macaque coexistence in fragmented urban environments.

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REFERENCES

Balasubramaniam, K. N., N. Aiempichitkijkarn, S. S. K. Kaburu, P. R. Marty, B. A. Beisner, E. Bliss-Moreau, M. E. Arlet, E. Atwill, and B. McCowan (2022). Impact of Joint Interactions with Humans and Social Interactions with Conspecifics on the Risk of Zooanthroponotic Outbreaks among Wildlife Populations. *Scientific Reports*, **12**(1); 11600

Balasubramaniam, K. N., S. Malaivijitnond, T. Kemthong, S. Meesawat, Y. Hamada, S. Jeamsripong, J. Srisamran, M. Kuldee, V. Thaotumpitak, B. McCowan, and E. Atwill (2021). Prevalence of Enterobacteriaceae in Wild Long-Tailed Macaques (Macaca fascicularis) in Thailand. *International Journal of Primatology*, **42**(3); 337–341

Boakes, Z., R. Stafford, I. Bramer, M. Cvitanović, and E. A. Hardouin (2023). The Importance of Urban Areas in Supporting Vulnerable and Endangered Mammals. *Urban Ecosystems*, **27**(3); 883–894

Caparrós-Vallcorba, C., F. V. S. de Abreu, C. Azat, and J. A. Benavides (2026). Global Distribution and Contexts of Interactions Between Humans and Non-Human Primates: A Systematic Review. *People and Nature*, **8**(3); 551–568

Carter, N., M. A. Williamson, S. Gilbert, S. A. Lischka, L. R. Prugh, J. J. Lawler, A. L. Metcalf, A. L. Jacob, B. J. Beltrán, A. J. Castro, A. Sage, and M. Burnham (2020). Integrated Spatial Analysis for Human-Wildlife Coexistence in the American West. *Environmental Research Letters*, **15**(2); 021001

Depret, L. and C. Sueur (2025). Management of Coexistence and Conflicts Between Humans and Macaques in Japan. *Animals*, **15**(6); 888

Dian, N. D., M. A. F. A. Rahim, S. Chan, and Z. M. Idris (2022). Non-Human Primate Malaria Infections: A Review on the Epidemiology in Malaysia. *International Journal of Environmental Research and Public Health*, **19**(13); 7888

Eckardt, W., D. Tuyisingize, Y. van der Hoek, S. Tolbert, T. S. Stoinski, F. Ndagijimana, B. A. Kaplin, A. Mudakikwa, and K. Lukas (2021). A Partnership to Build Scientific Capacity of Rwanda's Future Conservationists: The Memoirs Program. *American Journal of Primatology*, **83**(4)

Entezami, M., F. Mustaqqim, E. Morris, E. S. H. Lim, J. M. Prada, and S. J. Paramasivam (2024). Effect of Human Activity and Presence on the Behavior of Long-Tailed Macaques (Macaca fascicularis) in an Urban Tourism Site in Kuala Selangor, Malaysia. *Animals*, **14**(8); 1173

Ferdin, A. E. J., A. Pathak, M. Kamaludin, B. R. Lamichhane, S. K. Shah, U. C. Aryal, and N. Baskaran (2025). Understanding Residents' Preferences for Adaptive Capacity in Human-Wildlife Coexistence: A Case Study from Nepal's Biodiversity Hotspot. *European Journal of Wildlife Research*, **71**(5); 91

Fernando, S. U., P. V. Udagama, and S. P. Fernando (2022).

Effect of Urbanization on Zoonotic Parasite Prevalence in Macaques. *International Journal for Parasitology: Parasites and Wildlife*, **17**; 1–9

Hansen, M. F., S. Ellegaard, M. M. Moeller, F. M. Van Beest, A. Fuentes, V. A. Nawangsari, C. Grøndahl, M. L. Frederiksen, M. Stelvig, N. M. Schmidt, C. Traeholt, and T. Dabelsteen (2025). Human–Macaque Co-Construction of Behaviours: Sharing Spaces, Sharing Food, Sharing Lives. *International Journal of Primatology*

Holzner, A., K. N. Balasubramaniam, B. M. Weiß, N. Ruppert, and A. Widdig (2021). Oil Palm Cultivation Critically Affects Sociality in a Threatened Malaysian Primate. *Scientific Reports*, **11**(1); 10353

Jayarathne, S. D. Y., C. A. D. Nahallage, and M. A. Huffman (2025). The Costs of Living Side-by-Side with Monkeys: Economic Impacts on Commercial Farms and Property by Toque Macaques and Proposed Deterrent Strategies in Sri Lanka. *Animals*, **15**(3); 366

Kaewchot, S., S. Tangsudjai, L. Sariya, C. Mongkolphan, A. Saechin, R. Sariwongchan, N. Panpeth, S. Thongsahuan, and P. Suksai (2022). Zoonotic Pathogens Survey in Free-Living Long-Tailed Macaques in Thailand. *International Journal of Veterinary Science and Medicine*, **10**(1); 11–18

Karimullah, K., A. Widdig, S. A. M. Sah, and F. Amici (2022). Understanding Potential Conflicts Between Human and Non-Human Primates: A Large-Scale Survey in Malaysia. *Biodiversity and Conservation*, **31**(4); 1249–1266

Lee, S. X. T., Z. Amir, J. H. Moore, K. M. Gaynor, and M. S. Luskin (2024). Effects of Human Disturbances on Wildlife Behaviour and Consequences for Predator–Prey Overlap in Southeast Asia. *Nature Communications*, **15**(1); 1521

Ligue-Sabio, K. D., A. R. Plaza, B. Sabanal, G. F. Oguis, J. Torrefiel, and L. E. Gamalo (2026). Spatiotemporal Patterns of Behavior by Long-Tailed Macaques Macaca fascicularis (Raffles 1821) in a Human-Modified Environment. *Discover Conservation*, **3**(1); 3

Ma, D., B. Abrahms, J. E. Allgeier, Y. Malhi, and N. H. Carter (2024). Global Expansion of Human-Wildlife Overlap in the 21st Century. *Science Advances*, **10**(34); eadp7706

Ma, J., J. Li, W. Wu, and J. Liu (2023). Global Forest Fragmentation Change from 2000 to 2020. *Nature Communications*, **14**(1)

Marty, P. R., K. N. Balasubramaniam, S. S. K. Kaburu, J. Hubbard, B. Beisner, E. Bliss-Moreau, N. Ruppert, M. E. Arlet, S. A. Mohd Sah, A. Ismail, L. Mohan, S. K. Rattan, U. Kodandaramaiah, and B. McCowan (2020). Individuals in Urban Dwelling Primate Species Face Unequal Benefits Associated with Living in an Anthropogenic Environment. *Primates*, **61**(2); 249–255

Moesch, S., T. Straka, J. Jeschke, D. Haase, and S. Kramer-Schadt (2024). The Good, the Bad, and the Unseen: Wild Mammal Encounters Influence Wildlife Preferences of Residents Across Socio-Demographic Gradients. *Ecology and Society*, **29**(3); art6

Ngo, K. M., T. Hosaka, and S. Numata (2022). Attitudes and Preferences of Wildlife and Their Relationship with Childhood Nature Experience Amongst Residents in a Tropical Urban City. *Urban Ecosystems*, **25**; 1427–1438

Patouillat, L., A. Hambuckers, S. Adi Subrata, M. Garigliany, and F. Brotcorne (2024). Zoonotic Pathogens in Wild Asian Primates: A Systematic Review Highlighting Research Gaps. *Frontiers in Veterinary Science*, **11**

Poornima, A., W. Weerasekara, M. Vinobaba, and R. Sivashankar (2022). Community-Level Awareness and Attitudes Towards Human-Monkey Conflict in Polonnaruwa District, Sri Lanka. *Primates*, **63**; 581–590

Puri, M., K. O. Goode, K. L. Johannsen, and E. F. Pienaar (2024). Engaging Urban Residents in the Appropriate Actions to Mitigate Human-Wildlife Conflicts. *Conservation Science and Practice*, **6**(1); e13074

Radhakrishna, S., S. Anand, and A. Sengupta (2025). Differing Trajectories: Understanding Coexistence through the Human-Macaque Interface in India. *International Journal of Primatology*, **46**(6); 1276–1290

Setia, M. S. (2016). Methodology Series Module 3: Cross-Sectional Studies. *Indian Journal of Dermatology*, **61**(3); 261–264

Spaan, D., G. Ramos-Fernández, M. Bonilla-Moheno, C. M. Schaffner, J. E. Morales-Mávil, K. Slater, and F. Aureli (2020). Anthropogenic Habitat Disturbance and Food Availability Affect the Abundance of an Endangered Primate: A Regional Approach. *Mammalian Biology*, **100**(3); 325–333

Stevens, M., S. Rawat, and T. Satterfield (2025). Care, Conflict, and Coexistence: Human-Wildlife Relations in Community Forests. *People and Nature*, **7**(1); 231–246

Tampakis, S., V. Andrea, T. Panagopoulos, P. Karanikola, R. Gkarmiri, and T. Georgoula (2023). Managing the Conflict of Human-Wildlife Coexistence: A Community-Based Approach. *Land*, **12**(4); 832

Thatcher, H. R. and C. T. Downs (2021). The Costs of Urban Living: Human–Wildlife Interactions Increase Parasite Risk and Self-Directed Behaviour in Urban Vervet Monkeys. *Journal of Urban Ecology*, **7**(1); juab031

Thatcher, H. R., C. T. Downs, and N. F. Koyama (2023). Primates in the Urban Mosaic: Terminology, Flexibility, and Management. In T. McKinney, S. Waters, and M. A. Rodrigues, editors, *Primates in Anthropogenic Landscapes: Exploring Primate Behavioural Flexibility Across Human Contexts*. Springer, pages 121–137

Zhang, X., W. Wan, and R. C. Estoque (2025). Impacts of Urban and Cropland Expansions on Natural Habitats in Southeast Asia. *Nature Communications*, **16**(1); 8479

Zhang, Y., W. Ming, Z. Chen, X. Gao, S. Long, X. Shang, L. Dong, S. Li, and L. Zhang (2026). Beyond Compensation: Governing Human-Wildlife Coexistence under

Climate and Land-Use Change. *Ambio*; 1–19

Zhao, Y. Y., A. Wong, S. Alsisto, I. Matsuda, and H. Bernard (2023). Long-Tailed Macaque Reliance on Anthropogenic Food with Potential Conflicts Toward Humans in the Campus of Universiti Malaysia Sabah. *Mammal Study*

Zou, Y., T. W. Crowther, G. R. Smith, H. Ma, L. Mo, L. Bialic-Murphy, P. Potapov, K. A. Gawecka, C. Xu, P. J. Negret, T. B. Lauber, Z. Wu, D. Rebindaine, and C. M. Zohner (2025). Fragmentation Increased in Over Half of Global Forests from 2000 to 2020. *Science*, **389**(6765); 1151–1156

