



Dynamic Patterns of Primate Responses to Human Actions on Ecotourism Activities in Gunung Gede Pangrango National Park, Indonesia

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ABSTRACT

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Basically, almost all species of animals from the Primates Order (non-human Primates) have quite large potential to be used as tourist objects and attractions. Interactions between tourists and primates must be regulated in such a way that the level of safety, quality of satisfaction and travel experience remains high without causing disturbance to primates. The aim of this research was to evaluate the level of tolerance of primates to disturbances from recreational activities and construction activities for natural tourism facilities in the Gunung Gede Pangrango National Park, West Java Province, Indonesia. The method used for measuring the actions and responses of primates towards visitors was the Avoidance Response method, which is to fill the gap in the lack of quantitative research on the response patterns of wildlife (included primates) to various tourist activities at a tourist destination the avoidance responses method applied with distance intervals of human action. Observers approached primates at varying distances from 25 meters to 0 meters with intervals of 5 meters (25m, 20m, 15m, 10m, 5m, 0m). From the results of observations of the 4 species of primates that were commonly found, they were the Long-tailed macaque (*Macaca fascicularis*) with an abundance index of 30%, the Javan Langur (*Trachypithecus mauritius*) and the Grizzled leaf monkey (*Trachypithecus*) with a moderate abundance index of 9-12% and the Javan Gibbon (*Hylobates moloch*) with a very low abundance index of 1%. In general, the four species at the research location behave or show a threatened and avoidant position. The degree of avoidance response of these four species is indeed different, where the most tolerant to the presence of tourists is the *Macaca fascicularis*, while the most intolerant is *Hylobates moloch*. The *Trachypithecus mauritius* and *Presbytis comata* showed a moderate response between tolerant and intolerant. The result of this research will not only be useful in designing wildlife tourism activities at a destination, but will also be highly beneficial in the process of zonation planning for a new tourist destination.

1. INTRODUCTION

The role and position of primates in conservation and ecotourism development continues to increase sharply from year to year. According to the World Travel & Tourism Council [1], the travel and tourism industry generated 10.4% of the world GDP; 3.9% of this amount, or \$343.6 billion, came from wildlife tourism; this amount is equal to the GDP of Hong Kong or South Africa. Equally significant is the fact that, globally, wildlife accounted for 21.8 million jobs in 2018, or 6.8% of all jobs supported by travel and tourism [1]. Travel agencies, tour companies, governments, local communities, conservation organizations, and tourist groups all have certain impact on the rapidly expanding global wildlife and primate

tourism industry. These various stakeholders not only have economic motives such as business development and tax revenues, but on the other hand they are for community development, wildlife conservation, habitat protection, as well as recreational and educational motives. These organizations work toward a number of goals, including as tax revenue generation, community and economic development, wildlife and habitat preservation, and recreational enjoyment [2].

Wildlife tourism also boosts the local economy by creating jobs, promoting industry, diversifying the economy, and enhancing infrastructure [3]. Wildlife tourism focused on primates is growing unstable in terms of participants and economic impact [4, 5], although there are concerns about the health of the primates visited [6]. The welfare of local people,

the provision of satisfying experiences, and revenue generation [7]. Fennel [8] and Klailova et al. [9] stated that one of the wild tourism programs that is prospective to be developed and has high demand is non-human primate tourism. The existence of primates has succeeded in becoming a motivational factor for tourists to visit a tourist object or destination. The attractive physical form and behavior of primates makes tourists interested in having closer contact with these animals. The primate tourism program is not only able to dynamize the tourism business but is also able to become an instrument for wildlife conservation programs through fundraising activities and conservation education through a series of wildlife ecotourism activities [10].

Basically, almost all species of animals from the Primates Order (non-human Primates) have quite large potential to become tourist objects and attractions. Starting from the size of small primates to large ones and in any location, whether in zoos, conservation areas or other places where these animals are found. Fuentes et al. [10] stated that currently several species of primates that are popular as tourist objects and attractions are monkeys, gorillas, orangutans, Long-tailed macaque (*macaques*) and several species of primates that are almost extinct. In Asia to North Africa and Europe, interactions between tourists and Long-tailed macaque (*Macaca fascicularis*) have become commonplace in wild tourism activities [11, 12]. Interaction with primates can create an unforgettable experience for tourists.

Even though primate tourism activities are able to have a positive impact on tourism development and credit points for conservation activities, on the other hand there are also negative impacts that can impact the preservation of primates and safety for tourists. Many researchers stated that if primate tourism activities are not regulated and managed properly and safely, it will pose health and safety risks for tourists starting from the transmission of disease from primates and aggressive behavior in the form of attacks or bites by primates on tourists [13]. Research by Karim et al. [14] showed that monkeys were positively infected with *Enterocytozoon bienueusi* and had the potential to transmit to humans. Several studies have stated that monkeys can be hosts for various zoonotic diseases, such as tularemia [15], tuberculosis [16], and hepatitis [17]. Conflicts as a result of interactions between primates and tourists, especially Long-tailed macaque have been widely reported by researchers.

Hsu et al. [18] reported that adult male Formosan monkeys (*Macaca cyclopis*) in Taiwan's Shou-Shan National Park were quite aggressive in attacking tourists, especially when the tourist brought food. *Macaques* attacks on tourists also occur in groups of Tibetan Monkeys (*Macaca thibetana*) on Mount Huangshan in China and Barbary monkeys (*Macaca sylvanus*) in Morocco [19, 20]. Djuwantoko et al. [21] also reported conflict in the form of animal attacks due to interactions between tourists and Long-tailed macaque in the Kaliurang Nature Recreation Forest, Yogyakarta, Mount Merapi National Park. In general, interactions between tourists and primates will certainly give rise to conflicts that can threaten the safety of tourists' lives and the preservation of primates.

Interactions between humans and primates and other wild animals have occurred since pre-historic times on earth [22]. Negative human-primate relationships or interactions certainly have consequences for both humans and primates as well as the resources available in nature and their habitats [23]. The negative impacts resulting from human or tourist interactions with primates are not only related to the safety and

health of tourists but also the preservation of the primates themselves. Some primates that are disturbed due to interactions with humans/ tourists will become stressed and their natural habitat will be damaged. Berman et al. [24] reported that the mortality rate for young Tibetan monkeys was quite high due to disturbance by tourist activities. The impact of this interaction is that there is a change in the behavior patterns and habits of primates (time budget) as a result of tourists' interactions with primates. Conflict between humans and primates will have serious global impacts related to sustainable development, food security, urban conservation and landscape conditions [25].

Natural tourism activities, especially those related to wildlife, must make the safety and security aspects of tourists a serious concern. Likewise with the preservation of primates themselves. Interactions between tourists and primates must be regulated in such a way that the level of safety, quality of satisfaction and travel experience remains high without causing disturbance to primates. On this basis, research on the dynamic pattern of primates' response to human actions on recreation and nature tourism activities is urgently needed as a basis for formulating forms of visitor management that are in accordance with the carrying capacity of the environment and primate habitats. The aim of this research is to evaluate the level of tolerance of primates to disturbances from recreational activities and development activities for natural tourism facilities in the Gunung Gede Pangrango National Park, West Java Province, Indonesia.

Regarding Gunung Gede Pangrango National Park, there are at least five important points that serve as fundamental arguments for the necessity of conducting this research: 1) Gunung Gede Pangrango National Park is one of the oldest national parks in Indonesia (established in 1980); 2) The tropical rain forest ecosystem within the national park is one of the best remaining tropical rain forest ecosystems and must be preserved; 3) Over time, the intensity of regional development around the national park has led to its encirclement, turning it into a biogeographical island; 4) The high market demand for tourism in the national park has resulted in increased visitor pressure on almost all areas of the park; 5) A good understanding of primate response patterns to tourist activities is essential to improve the effectiveness of tourist management and primate ecosystem management.

Given the scarcity of quantitative research on wildlife response patterns, the methodology of this study, which uses the avoidance response applied with distance intervals of human action, can be considered as a novelty of this study. This approach can enrich the body of literature in the fields of primate ecology, tourism visitor management, and national park zonation planning.

2. LITERATURE REVIEW

Tourism activities in natural environments such as forests or other conservation areas will certainly have a disruptive effect on wildlife, especially if the main object of attraction is the wildlife itself. Several scientists have tried to conduct studies on the response and level of disturbance to wildlife by tourist activities using several approaches, most of which are qualitative. Quantitative approaches are still not widely used because it is not clear how to measure the response to impacts on wildlife by recreational/tourism activities [26]. Bateman and Fleming [27] stated that there are at least three types of

approaches to measure wild animal responses to recreation/ tourism activities, namely: 1) Avoidance Responses, 2) Animal Time Budgets, 3) Animal Physiological and Breeding Responses.

The response of wild animals in terms of avoidance when the animal is approached by an observer is a fairly common method used in studies of the level of animal disturbance to recreational activities [28, 29]. This is due to the ease of measuring response variables to a disturbance. Technically, this method is carried out by simulating disturbances to wild animals in the form of actions to which the animals will then respond. The form of action can be in the form of approaching or approaching an animal within a certain distance, whether the animal is alone or in a herd or group [30]. Several types of measurement variables in the form of avoidance responses include: a) Alert Distance (AD). Alert distance is the distance between wild animals and humans at which the animals begin to change their behavior in response to a disturbance. This Alert Distance describes the level of alertness of wild animals when there is interference from predators or enemies. Fernandez-Juricic et al. [31] used Alert Distance to study determining buffer zones in wildlife tourism activities and to determine the maximum distance a visitor can approach wild animals; b) Flight Initiation Distance (FID). The Flight Initiation Distance has been used for various studies on animal responses to disturbances from tourist activities, especially birds [32]; c) The Distance Fled (DF). Distance Fled is the movement of animals from their original location due to a disturbance response. The response is generally in the form of running away to hide to a safe place. This DF method sometimes also includes measurements of running distance, running speed and the amount of energy needed to dissipate.

Animal Time Budgets are the allocation of time used by animals for activities when there is a response to external disturbances. With external disturbances, for example recreational activities, this will result in a decrease in the amount of time animals have to search for food and rest. The time that animals have will ultimately be wasted in remaining silent and alert because of threats from outside. This condition of increased alertness of animals will ultimately affect consumption patterns during activities for animals. Bateman and Fleming [27] stated that many studies recorded the vigilance variable as a measure of the negative response of wild animals to disturbances. This form of alertness can take the form of stopping foraging activities, showing a warning, changing body posture to an upright position or turning the head. Villanueva et al. [33] reported that penguins will show fewer head turns when a human approaches or there is a disturbance. Recreation/ tourism activities involving wild animals as objects of attraction will have a negative influence on the physiological and physical condition of individual animals. Psychologically, animals that experience problems will feel stressed which results in increased heart rate and blood pressure. The stress response influences immune function, with potential consequences for patterns of infection and transmission of disease among and within wildlife, domesticated animals and humans [34]. Threatened wild animals will also have their metabolism disrupted so that individual animals experience obstacles in growth. The presence of visitors will also disrupt the breeding process of animals, both during the fertilization process and during egg incubation in birds [35].

3. MATERIALS AND METHODS

3.1 Study area

With a study area of 253 ha, this research was carried out in Cisarua Resort, SPTN Region IV Tapos; a part of The National Park Management Sector III Bogor, Gunung Gede Pangrango National Park. The study location is located at coordinates 06°42'5.32"-06°44'7.74" South Latitude and 106°54'44"-106°56'35" East Longitude. Administratively located in Sukagalih Village, Sukaresmi Village, and Kuta Village, Megamendung District, Bogor Regency, West Java Province, Indonesia. During a period of approximately 78 days from January 2020 to March 2022, the study was conducted under moderately intense rainfall during the rainy season. The study area is a conservation area with mountain tropical forests as its type of vegetation. At the study site, there are 146 different plant species that are categorized into groups such as trees, undergrowth, ferns, orchids, lianas, and so on. The most common types found were understory plants with 50 species, followed by tree species with 41 species and mushrooms with 23 species. The method for measuring the actions and responses of primates towards visitors is to use the Avoidance Response method. Observers approach primates at varying distances from 25 meters to 0 meters with intervals of 5 meters (25m, 20 m, 15m, 10m, 5m, 0m) as shown in Figure 1. At each interval, action/ distraction simulations are carried out to respond to primates with human body movements and musical sounds. The observation plot is a fixed plot located in the edging area, namely in a forest area containing the composition of stands, regeneration, bushes and thickets.

When it comes to human activities, disturbances can involve one person or three individuals, and when it comes to musical noises, there are low sounds and high/loud sounds. The length of time that primate behaviour varies in response to interference or threat is noted at each observation interval. Three repetitions of each observation were conducted in each plot. For every iteration, the length of the response time to the simulated disturbance was measured in seconds and averaged.

Early and afternoon observations were conducted in this study. Employees with expertise in animal monitoring (D3 and S1 degrees in forestry/ecotourism) were the ones who conducted observations. Four species of primates - the Javan Gibbon (*Hylobates moloch*); the Javan Langur (*Trachypithecus mauritius*); the Grizzled Leaf Monkey (*Presbytis comata*); and the Long-tailed Macaque (*Macaca fascicularis*) - were the subjects of the investigation. A radar diagram representing the dynamics of action and response was created in order to analyse data on how monkey behaviour changed in response to visitor activities.

The significance of the difference between the type of disturbance stimulation and the interference distance from primates was then ascertained using the two-way ANOVA test. Theoretically, two-way ANOVA analysis is intended to examine the effect of two or more different and independent treatment/variables. We considered this necessary for this study because the study-design involves at least 3 different and independent treatments, i.e. the treatment due to the number of people, due to the distance and due to music sound. Through the result of two-way ANOVA analysis, readers will gain better understanding of the of those treatments.

As the primates studied have relatively large home ranges, the observation process cannot be conducted through permanent plots. Instead, it must use such kind an "accidental

sampling" approach, with the observation areas focused on the 8 areas known as the play zones of the primates (as shown in Figure 2). Using this approach, the observer waits for the primates to presence at the observation points and only begins the treatment once the primates have adapted to the observer's presence at those points.

The limitations of time and budget mean that the observation pattern can only be conducted using a "semi-parametric" approach, so the resulting data cannot be fully analyzed through parametric calculations. Consequently, a two-way ANOVA analysis is considered the best option to meet the desired quantitative requirements.

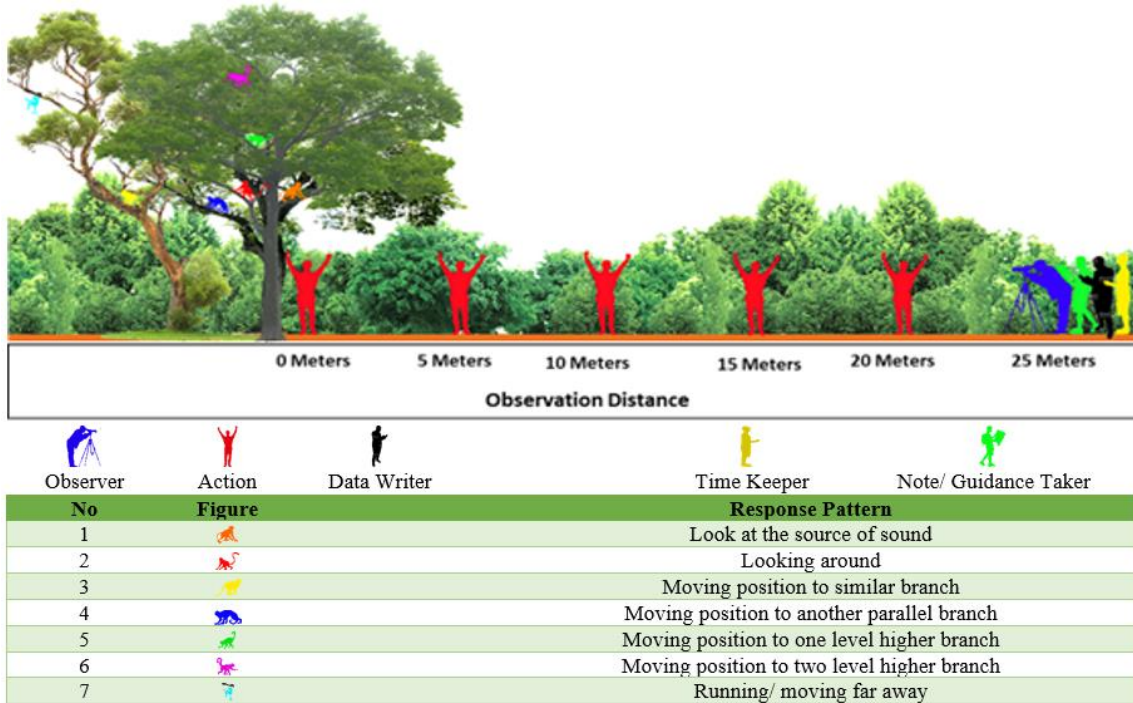


Figure 1. Observation method diagram of primates' action and response

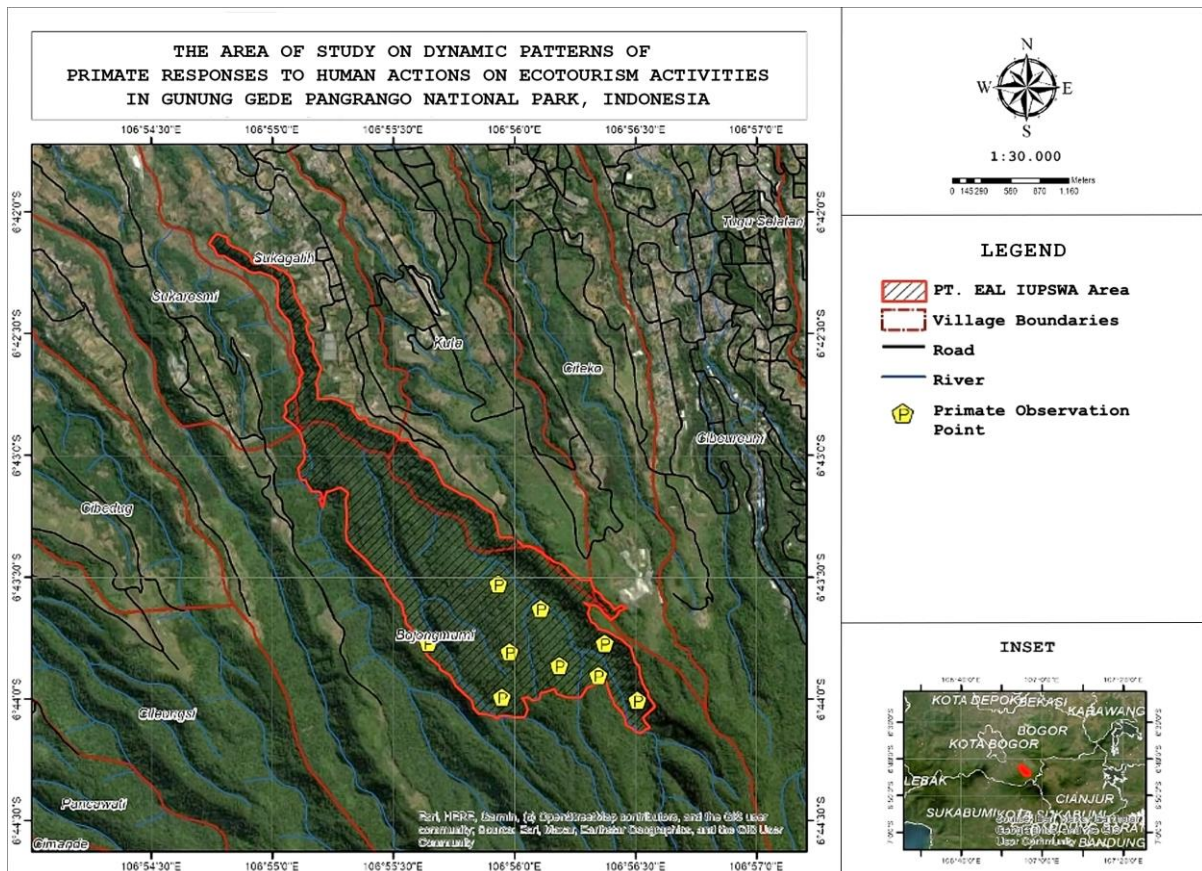


Figure 2. Research location

4. RESULTS AND DISCUSSION

4.1 Result-1 (General description of primate animals)

At the research location there are 4 species of primates, namely: 1) Javan Gibbon (*Hylobates moloch*); 2) The Javan Langur (*Trachypithecus mauritius*); 3) Grizzled leaf monkey (*Presbytis comata*); 4) Long-tailed macaque (*Macaca fascicularis*). A taxonomic description of primates and their abundance is presented in Table 1.

The Javan gibbon (*Hylobates moloch*) belongs to the family *Hylobatidae*, which are tailless primates. Since 2008 until now the Javan Gibbon has been threatened with extinction [36]. The natural habitat of the Javan Gibbon includes Ujung Kulon National Park, Gunung Gede Pangrango National Park, Mount Halimun, Mount Simpang Nature Reserve, Leuweung Sancang Nature Reserve, Mount Slamet, and the Dieng Mountains [37]. The Javan Gibbon's habitat is now limited to the remnants of rainforest on the island of Java [38]. The Javan Gibbons live in small groups of 3-5 group members. The physical characteristic is that they have front legs that function like hands in humans and are longer than the back legs. Silver gray hair with a black face. Activities mostly in trees (arboreal). At the study location Javan Gibbons were found on several routes, namely the Kina Garden Route and the Pasir Pogor Route. This type of encounter occurs when there are not too many observers/ people, this is because the behavior and instincts of the Javan Gibbon are quite sensitive to human presence. The success of meeting the Javan Gibbon at Bodogol GGPNP is influenced by the number of groups of visitors entering the area. Ladjar [39] stated that the chance for visitors to have the opportunity to meet the Javan Gibbon at Bodogol GGPNP is around 11.59% (n=69). According to Ario et al. [40], the greatest chance of encountering primates is around 57% around the GGPNP canopy bridge. The chance of encountering Javan gibbons on all tourist routes is around 36% [39].

Kappeler [41] stated that the Javan gibbon population density varies from one location to another, influenced by variations in habitat quality and predator activity. The movements of this species of primate are also very fast, so it is quite difficult to document them. When discovered, this species was active in trees in the upper canopy. Apart from direct discoveries, the sound of the Javan Gibbon is also often heard in the morning and evening at the study location. In contrast to other species of primates, the primates live in small groups, resulting in low encounters with these animals. Apart from that, the sensitivity of the Javan gibbon to human presence means that this animal can only be observed at a distance of ± 20 meters. The management has set visitor restrictions according to groups of 1-5 visitors and 5-10 visitors with observation hours divided into groups from 08.00-10.00; 10.00-12.00 and 12.00-13.00 [39].

The Javan Langur (*Trachypithecus mauritius*) is a class of primates from the family *Cercopithecidae*, has a long tail with jet black hair. This primate has two phases during its life, namely the juvenile and adult phases. From the time they are born until they are around six months old, young Javan langurs have golden orange hair, when they grow up their hair will turn black. This species of primate lives in groups, with an average of 7 individuals in one group. Types of food in the form of leaf shoots, fruit and flowers from trees in the forest. During observations, Javan Langurs were found at two times, namely morning and evening on several routes, namely the Pasir Ipis Route, the Pasir Pogor Route and the Barubolang Route. This species of primate is also often found eating and playing on Umbrella trees (*Maesopsis eminii*). The distance to observe this species of primate ranges from 10-20 meters.

Grizzled Leaf Monkey (*Presbytis comata*) is a class of primates from the family *Cercopithecidae*, one of the endemic animals of West Java. According to Supriatna and Wahyono [37], the surili population is most threatened among other primate species, due to the small number of groups, sex ratio, fragmentation and narrowing of habitat. The characteristic of this animal is that it has silvery gray body hair with black markings on the head and white on the chest and stomach. A special characteristic that is easily recognized in Surili is the hair that resembles a crest on the head and a long tail. Surili is a category of group primates with groups usually reaching 5-10 individuals. Types of food include leaf shoots, flowers and several types of fruit in the forest. This species is mostly found active on Umbrella trees (*Maesopsis eminii*). Surili activities can be observed in the morning and evening on several routes, namely the Pasir Ipis Route, the Kina Garden Route and around the camping ground area. Surili is also a species of primate that is very sensitive to human presence. So to observe this type it must be done at a fairly long distance. The closest distance to observe these primates is around ± 20 meters.

Long-tailed macaques (*Macaca fascicularis*) are the most common species of primates at the study site. The way of life of this species of primate is in groups, where in one group there are around 10-15 individuals. This group is dominated by adult monkeys and some are still puppies. Species of Long-tailed macaques found at the study site tend to be very wild and sensitive. This is because there are still at least this primate interaction with humans, so they will quickly stay away when there are humans who approach him. In addition to very high sensitivity, Long-tailed macaque are found in all observation routes at the study site in the morning and evening with eating and playing activities. Unlike other species of primates, this Long-tailed macaques also descended to the forest floor to play and find food. Most Long-tailed macaques are found to be active in Umbrella trees (*Maesopsis eminii*) and Jackfruit trees (*Artocarpus heterophyllus*). Space use patterns of all primates ordo on a tree diagram in foraging and resting habitats are shown in Figure 3.

Table 1. Primates' taxsonomi at research location

No.	Latin Name	Local Name	Ordo	Family	Abundance
1	<i>Hylobates moloch</i>	Javan Gibbon	Primate	<i>Hylobatidae</i>	1%
2	<i>Trachypithecus mauritius</i>	Javan Langur	Primate	<i>Cercopithecidae</i>	12%
3	<i>Presbytis comata</i>	Grizzled leaf monkey/Surili	Primate	<i>Cercopithecidae</i>	9%
4	<i>Macaca fascicularis</i>	Long-tailed Macaques	Primate	<i>Cercopithecidae</i>	30%

Source: Field Survey, 2020.

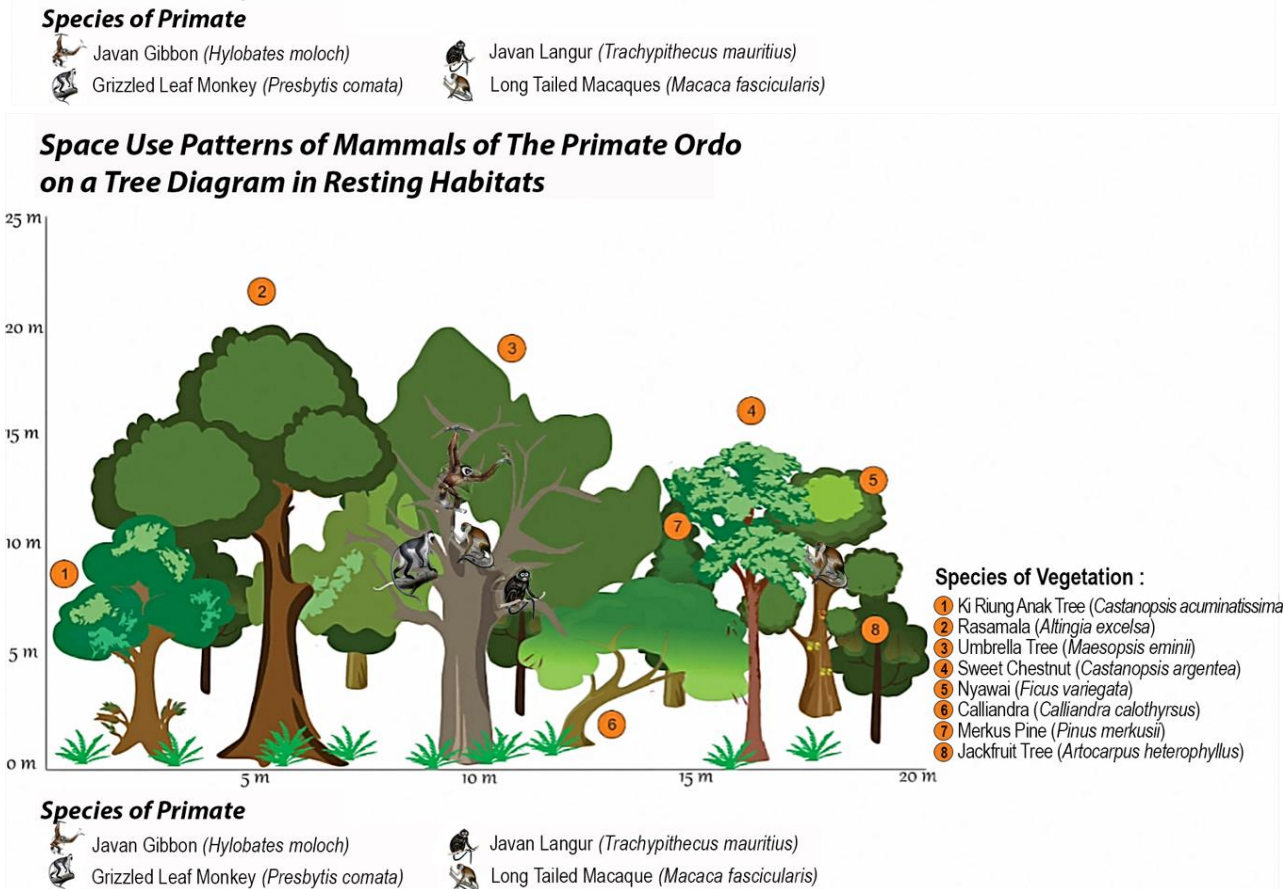
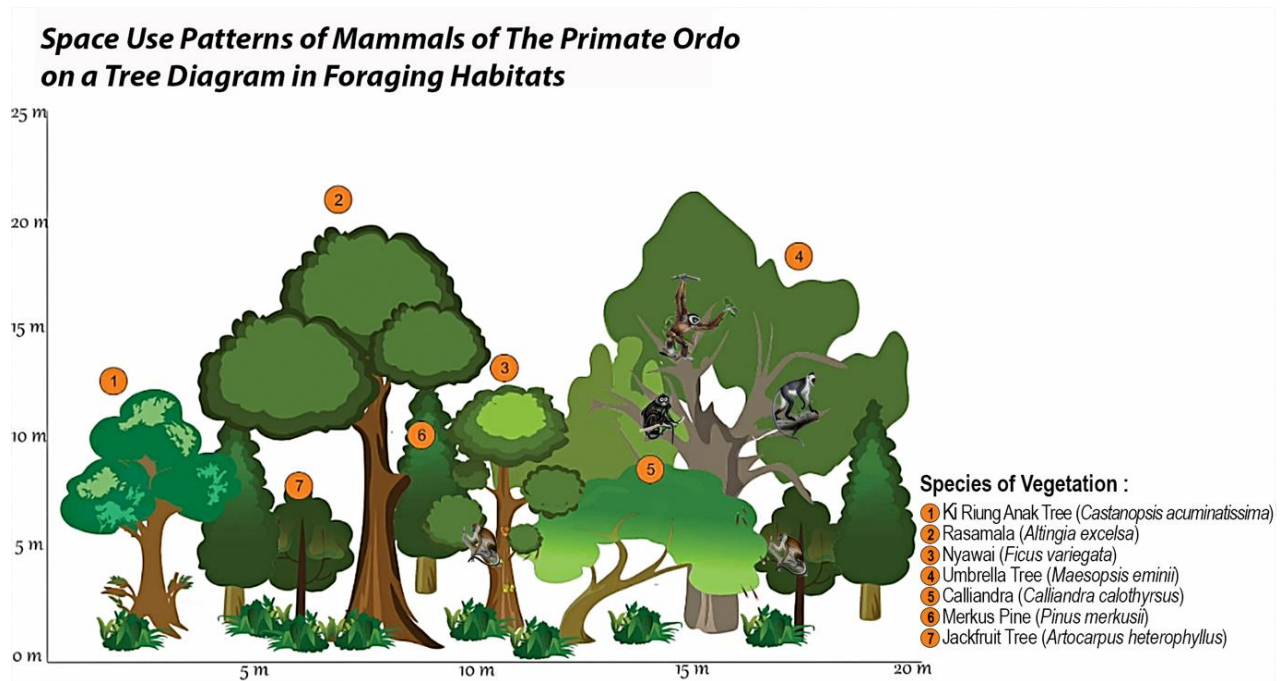


Figure 3. Primates' area utility pattern of having food and rest

4.2 Result-2 (Action and response dynamics of primates to human movement disturbance)

Primates' reaction to movement disruptions caused by human activities takes the form of behavioural alterations that resemble a threatened reaction (Avoidance Response). An alarm response plus a running reaction make up this threatening response (Escape Initiation Response). Figures 4 and 5 illustrate the patterns of behavioural changes in primates in response to interruptions in human activities.

Generally, during morning and afternoon observations, the response pattern of primates to human movement revealed that, at distances of less than 10 meters (0 and 5 meter intervals), the response duration was 0 seconds or intolerant, indicating that the primates reacted to human disturbance by running away or disappearing right away. This interruption can affect one to three people depending on the severity of the disturbance. Some species of primates still do not react to disturbances up to a distance of 10 meters, which is the threshold between tolerant and intolerant responses.

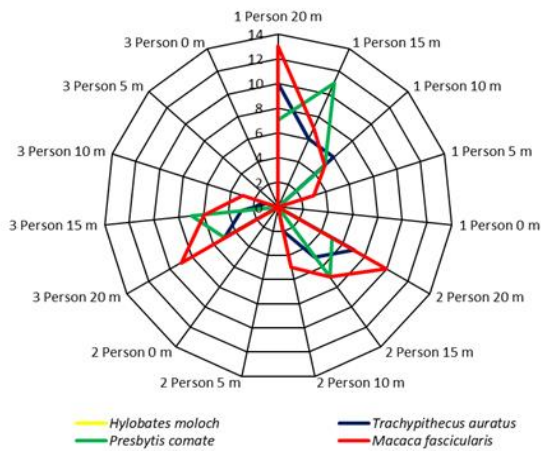


Figure 4. Response pattern diagram of primates to movement disturbance (Morning)

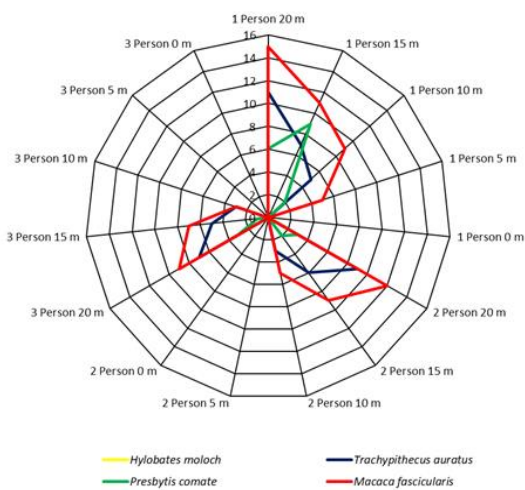


Figure 5. Response pattern diagram to movement disturbance (Daytime)

Ario et al. [40] found that the ideal number of visitors to see primates at Bedogol GGPNP is 1-5 people; because in addition to delivering conservation education material more effectively, the noise level of visitors which can cause fear of animals at the location can be reduced. Furthermore, at a distance of 15 meters to 20 meters, the primates showed a tolerant response with various changes in alert behavior in the form of: 1) looking towards the sound source, 2) looking around, 3) changing position on the same branch, 4) Moving position on a parallel branch, 5) Moving position to another branch that is one level higher, and 6) Moving position to another branch that is two levels higher.

The species of primate with the shortest response time to human disturbance is the Javan Gibbon group, which is around 2-5 seconds for various observation distances and combinations of number of observers. The group of primates whose response duration is rather short, namely <10 seconds, are the Surili primates. The Javan Langur and Long-tailed Macaques are the primate groups that have the longest response time to human disturbance, namely around 1-15 seconds for various observation distances and combinations of number of observers. The ideal number of visitors who have the greatest opportunity to encounter animals is between 1-5 visitors in each group [40].

It is evident from a variety of combinations of observation

distances that the alert response's duration decreases with the proximity of the disturbance source to the primates. The number of viewers also affects the duration of the primate animal's alert response; the more observers there are, the shorter the duration of the alert response. The primate response took a little longer to complete during the day than it did in the morning. The ANOVA test results show that between the disturbance's distance and the number of observers that there is a substantial difference between the primates response times and the disturbance's intensities, as shown in Table 2.

Additionally, Table 3 illustrates the cycles of primates response against disturbances of human activities in different groups of primates.

4.3 Result-3 (Action and response dynamics of primates to musical sound disturbance)

Primates response to sound interference, namely high- and low-volume musical sounds, by changing their behaviour in ways that are nearly identical to those caused by disturbances in human activities. Primates react to musical noise interference by displaying a threatening reaction, also known as an avoidance response, which comprises of an alert response and an escape initiating response. Figures 6 and 7 illustrate the dynamics of how primates behaviour alters in response to musical sound disruptions.

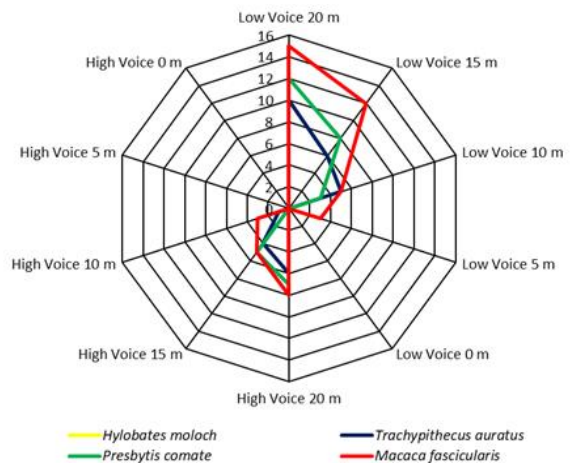


Figure 6. Response pattern diagram of primates to sound disturbance (Morning)

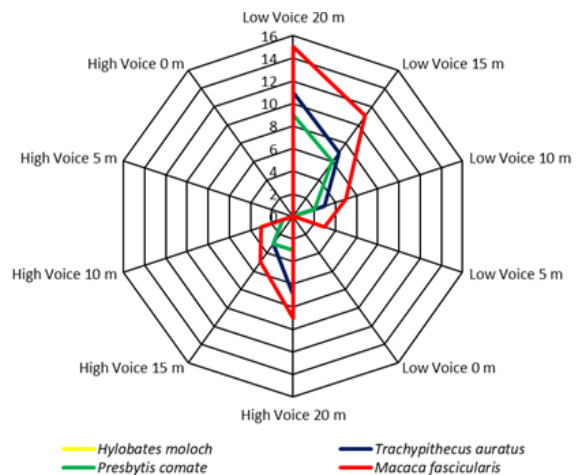




























































Figure 7. Response pattern diagram of primates to sound disturbance (Daytime)

Table 2. ANOVA test: Primates' responses to observer number and distance








Source of Variation	SS	df	MS	F counted	P-value	F crit
Number of observers	88,35	2	44,175	6,260672	0,0027	3,082852
Observer Distance	781,2	4	195,3	27,67876	0,0000	2,45821
Interaction	36,9	8	4,6125	0,653703	0,7308	2,027774
Within	740,875	105	7,055952			
Total	1647,325	119				

Significant : F counted > F table (F crit); P-value <0.05.

Table 3. Action and response dynamics of primates to movement disturbance and observer number

No.	Species of Primates	Time	Action and Response Duration														
			One Person					Two People					Three People				
			20 m	15 m	10 m	5 m	0 m	20 m	15 m	10 m	5 m	0 m	20 m	15 m	10 m	5 m	0 m
1	Javan Gibbon (<i>Hylobates moloch</i>)	Morning	 5	-	-	-	-	 2	-	-	-	-	 1	-	-	-	-
		Daytime	 2	-	-	-	-	 1	-	-	-	-	 1	-	-	-	-
2	Javan Langur (<i>Trachypithecus mauritius</i>)	Morning	 10	 6	 6	-	-	 7	 5	 2	-	-	 5	 3	 1	-	-
		Daytime	 11	 7	 5	-	-	 9	 6	 3	-	-	 7	 5	 3	-	-
3	Grizzled leaf monkey/Surili	Morning	 7	 11	 5	-	-	 5	 7	-	-	 5	 7	-	-	-	
		Daytime	 6	 9	 2	-	-	 3	 2	-	-	 3	 1	-	-	-	
4	Long-tailed Macaques (<i>Macaca fascicularis</i>)	Morning	 13	 7	 5	 3	-	 10	 7	 5	-	-	 9	 6	 3	-	-
		Daytime	 15	 11	 9	 5	-	 12	 9	 5	-	-	 9	 7	 3	-	-

Description:

-  : Looking at the source of disturbance
-  : Looking around
-  : Moving position to similar branch
-  : Moving position to another parallel branch
-  : Moving position to one level higher branch
-  : Moving position to two levels higher branch
-  : Running/ Moving far away

Primate response patterns to musical sound interference were generally observed in the morning and afternoon. At distances of less than 10 meters (0 and 5 meter intervals), the response duration was either 0 seconds or intolerant, meaning that the primates reacted to the disturbance by running or fleeing. This situation can apply to both high and low noises. Some species of primates still do not react to disturbances up to a distance of 10 meters, which is the threshold between tolerant and intolerant responses. Furthermore, at a distance of 15 meters to 20 meters, the primates showed a tolerant response with various changes in alert behavior (Alert response) in the form of: 1) looking towards the sound source, 2) looking around, 3) changing position on the same branch, 4) Move position on a parallel branch, 5) Move position to another branch that is one level higher, and 6) Move position to another branch that is two levels higher. According to Ario et al. [40], if visitors make a sound, the response from primates that are afraid (28%) is greater than the response from animals that are not afraid (21%). This shows that the commotion caused by visitors during their visit has a significant impact on the four primate animals at PPKA Bodogol [40].

The group of primates with a short duration of response to

musical sound disturbances is the Javan gibbon with a duration of around 1-5 seconds for low and high sound stimulation at various observation distance intervals. The other three species of primates, namely the Javan Langur, Surili and Long-tailed Macaques, have a rather long response duration to musical sound disturbances, namely around 1-15 seconds for various observation distances and levels of musical sound disturbance.

It is evident from the variety of observation distances that the alert response's duration decreases with the proximity of the disturbance source to the primates. The similar pattern holds true for sound disturbance levels, where a primate's alert response lasts shorter the higher the sound disturbance. The primate's response times were somewhat longer throughout the day than they were in the morning. There is a substantial difference between the duration of primates' responses and the severity of the disturbance, as indicated by Table 4, based on the findings of the ANOVA test between the disturbance's distance and the music's volume.










































Furthermore, the dynamics of primate behavior towards musical noise disturbances in various groups of primates can be seen in Table 5.

Table 4. ANOVA test: Primates' response to musical sound disturbance level and observer distance








Source of Variation	SS	df	MS	F counted	P-value	F crit
Sound Level	84,05	1	84,05	13,43265	0,0005	3,977779
Observer Distance	648,425	4	162,1063	25,90739	0,0000	2,502656
Interaction	55,075	4	13,76875	2,200485	0,0777	2,502656
Within	438	70	6,257143			
Total	1225,55	79				

Significant: F counted > F table (F crit); P-value <0.05.

Table 5. Action and response dynamics of primates to musical sound disturbance and observer number

No.	Species of Primates	Time	Action and Response Duration									
			Low Sound					High Sound				
			20 m	15 m	10 m	5 m	0 m	20 m	15 m	10 m	5 m	0 m
1	Javan Gibbon (<i>Hylobates moloch</i>)	Morning	 5	-	-	-	-	 2	-	-	-	-
		Daytime	 2	-	-	-	-	 1	-	-	-	-
2	Javan Langur (<i>Trachypithecus mauritius</i>)	Morning	 10	 6	 5	-	-	 6	 4	 1	-	-
		Daytime	 11	 7	 3	-	-	 7	 3	 1	-	-
3	Grizzled leaf monkey/Surili (<i>Presbytis comata</i>)	Morning	 12	 8	 3	-	-	 7	 5	-	-	-
		Daytime	 9	 6	 2	-	-	 3	 3	 1	-	-
4	Long-tailed Macaques (<i>Macaca fascicularis</i>)	Morning	 15	 12	 5	 3	-	 8	 5	 3	-	-
		Daytime	 15	 11	 5	 3	-	 9	 5	 3	-	-

Description:

-  : Looking at the source of disturbance
-  : Looking around
-  : Moving position to similar branch
-  : Moving position to another parallel branch
-  : Moving position to one level higher branch
-  : Moving position to two levels higher branch
-  : Running/ Moving far away

5. DISCUSSION

The presence of non-human primates in various tourist sites and tourist areas has added value for tourist satisfaction and experience. Primates do have an attractive power that can make tourists interact more closely with these animals. Moreover, several primates whose shapes are cute or adorable will definitely be liked by visitors from various age groups. Primate tourism has various locations ranging from safari parks, zoos, Hindu-Buddhist worship centers (temples), primate rehabilitation centers, to forest areas where their natural habitat is including conservation areas (National Parks, Nature Tourism Parks, Wildlife reserve). The presence of primates in an artificial tourist area can provide additional experiences to visitors even though these primates are not among the main objects and attractions for tourism activities at that location. In contrast to unspoiled tourist areas such as forests, National Parks and other conservation areas, the presence of primates living in the wild is the main attraction for tourists which can provide high levels of satisfaction and travel experience [10, 42].

Fundamentally, humans have a long, complex relationship with wild animals, varying between appreciation, reverence, retaliation, utilization and acceptance [43-46]. Interaction between tourists and primates is something that commonly occurs in various places and tourist attractions. Basalamah et al. [47] said that there is a relationship between encounters with primate species and the number of ecotourism visitors in the Mount Halimun Salak National Park area. Even though the potential negative impact of this interaction is quite large, it seems that tourists are still trying to interact more closely with animals and even make physical contact as much as possible. The threat to the safety and health of tourists when interacting with primates is very high. Starting from the potential spread of disease from primates to aggressive responses from primates in the form of attacks and bites. For primates themselves, the presence of tourists will respond with various kinds of behavior.

The rarer and closer to extinction, the more interesting the wildlife becomes for tourists to see or observe. Of the 4 groups of primates that were found at the study location, it can be said that all of these primates rarely interact with tourists/humans.

On this basis, the wild nature of primates still appears natural so that the response given when there is disturbance is mostly a threatened and alert response. However, what makes the difference is the degree of response of each species of animal in the form of duration or length of time in responding to disturbance actions. The primates that has the longest response time or is said to be the most tolerant of human or tourist disturbance is the Long-tailed Macaque (*Macaca fascicularis*). The groups are known to be tolerant of human interaction, so these animals are often found at various natural tourist attractions even though the number of visitors is quite large. The thing visitors have to be careful of with this Long-tailed Macaque, even though it is close to humans, is the potential for attacks/aggression, especially when tourists bring food. The Long-tailed Macaque will soon approach and snatch food from tourists. The activity of wild animals looking for other food sources outside their natural habitat is thought to be the result of habitat change and climate change, which can trigger an increase in human-animal conflicts and zoonotic threats [48].

The Long-tailed Macaque at the study location are somewhat different in character from these animals in several tourist sites that are already crowded with visitors. Long-tailed Macaque at the study site are more easily disrupted and sensitive because they rarely interact with humans. However, compared to other primate animals found at the study site, Long-tailed Macaque show a more tolerant response. At the observation distance 0 meters almost all species of primates at the study site show a response escape or disappear. Furthermore, at the observation distance of 5 meters, only the Long-tailed Macaques are still tolerant. Study of Hasanah et al. [49] in the Ntori village of Bima Regency shows that about 53% of Long-tailed Macaques populations had a moving behavior, 43% had walking behavior and 10% had running behavior [50, 51].

The Javan Langur and Grizzled leaf monkey show the degree of medium response or "somewhat tolerant" to the disturbance. While the species of Javan gibbon is very intolerant of human or tourist disorders as evidenced by a very short duration of response to a considerable observation (20 meters). From various studies of interactions between tourists and primates it is stated that the response of primates to tourists can be in the form of avoidance, hiding and being aware of that is likely to continue to attack [52, 53]. Russon and Wallis [54] stated that in general the primate response to tourists is quite diverse ranging from approaching/ docile to avoiding the species of primates, habitat conditions and feed supply. Variations in the response of primates to tourists also occur between species, in one species (age, sex, social status in colonies) and in context or situational such as season, time and tourist behavior. Large primate animals (orangutans, gorillas, baboons), eaters of all/omnivores and are often provided with feed (Long-tailed macaque) will tend to behave closer/docile when meeting tourists. Whereas smaller primates (marmosets, tamarins, squirrel monkeys, bamboo lemurs, proboscis monkeys), like eating leaves and not provided artificial feed will tend to be more on avoiding (avoidance) when interacting with tourists [52, 55].

The avoiding response of primate is almost similar to the response of primates at the GGPNP study site, where the species of Javan Gibbons (*Hylobates moloch*), Javan Langur eat leaves and live wildly. On the basis of these properties, eating the response of these three primates, almost all of them tend to avoid when meeting tourists. In the species of Long-tailed

Macaque (*Macaca fascicularis*) has a response that also tends to avoid because of its wild and accustomed to getting feed from nature, not feed preparations from tourists.

In general, the four species of primates at the study site are behaving or showing threatened and avoiding positions. This condition is somewhat different from the results of the study by Hodgkinson et al. [52] which reported that even though it was in a habitat site, the response of four species of "sympatric" primates to tourists was diverse. The Black-capped squirrel monkey (*Saimiri boliviensis*) tends to run away (flee), the Tufted capuchin (*Apella cebus*) tends to run away and pay attention, Brown-mantled tamarin (*Saginus fuscicollis*) tends to avoid and pay attention, while Colombian red howler (*Alouatta seniculus*) tends to be ignorant and pay attention (monitoring). Of the four species of primates at the study site, the species of Javan Gibbons (*Hylobates moloch*) is the most intolerant of the presence of tourists, while the most tolerant is the primates of the Long-tailed Macaque (*Macaca fascicularis*). Javan Langur (*Trachypithecus mauritius*) and Grizzled leaf monkey (*Presbytis comata*) showed a moderate response between tolerant and intolerant. Various patterns of primate responses to the presence of tourists are very important to be studied in depth given the importance of various primates and other wildlife in the national park. Bertrand et al. [56] conducted research on the influence of the presence of tourists and researchers on fecocorticoid metabolite (FGCM) crested macaques (*Macaca nigra*) with the conclusion Tourism at Tangkoko Nature Reserve.

Underlie the findings in the study above, several efforts that must be made in the management of tourism activities involving primate wildlife attractions in national parks and other natural attractions are: 1) Reducing the number of tourist and ensuring that interactions with primates take place at safe distances; 2) Ensuring that natural tourism infrastructures and facilities are not located within the habitat or home range of primates; and 3) Preserving the diversity and abundance of primate species by providing food and improving the surrounding vegetation. An option to restrict the number of visitors is to choose only those travellers who are knowledgeable about wildlife and/or primate recreation. It is strongly advised that amateur visitors follow all regulations pertaining to engaging in recreational activities with wildlife and travel with an expert guide. Not only must the quantity of tourist be restricted, but so must the distance at which tourist interact with primate animals in order to tolerate changes in the behaviour of the animals in response to disturbances. In order to maximize the experience and satisfaction, it is a need to be carefully taken into account that tourists will typically try to get as close as possible to the wildlife. Muresherwa et al. [57] explained the management strategy of Gorilla Tourism Monitoring in Uganda, including: 1) Fighting corruption; 2) Controlling access and more conservation; 3) Involving more local participation; 4) Developing Infrastructure; 5) Dealing with poaching; 6) Training of Staff; 7) Empowering local.

From the time of construction until visitors using these natural tourism facilities and amenity infrastructures, the national park area as a primates' habitat needs to give careful consideration. There will undoubtedly be a raw material mobilization throughout the construction phase, which may irritate the animals with noise and other issues. Wildlife will also be impacted by the clearing of land and the laying of building foundations. There must be a kind of extra conservation handling to make sure the sustainability of primates and the ecosystem as well.

Primates are the primary attraction and enjoyment for tourists in the national park, therefore their preservation depends on standing densities and sufficient food sources. Planting trees with carefully chosen species that serve as both a source of food and habitat for primates is a strategy to enhance the quality of forest stands that serve as habitats for these animals. Preserving and conserving biodiversity requires habitat protection, raising awareness, and coexisting species [58]. A strategy to accomplish this is by encouraging visitors to take part in conservation efforts within the National Park.

6. CONCLUSIONS

Primate tourism is a very popular form of natural tourism. Interactions between tourists and primates will certainly have a negative impact on both parties. Serious and careful handling is required in organizing tourism activities related to primates. The threat of disease transmission between tourists and primates and changes in primate behavior can have an effect on animal conservation and tourist safety. Primate animals at the research location are generally primates that are still wild and rarely interact with tourists/humans. The response of primates to tourists or humans in general is avoidance. The degree of avoidance response of these four species of primates is indeed different, where the most tolerant to the presence of tourists is the Long-tailed Macaque (*Macaca fascicularis*), while the most intolerant is the Javan gibbon (*Hylobates moloch*). The Javan langur (*Trachypithecus mauritius*) and Grizzled leaf monkey (*Presbytis comata*) showed a moderate response between tolerant and intolerant.

In the future, ideally, similar research should also be conducted in the 14 other resorts within Gunung Gede Pangrango National Park; or at least in resorts that serve as the home range of the primates and experience high visitor pressure and surrounding development intensity, such as the Cibodas and Salabintana Resorts. Meanwhile, good information and knowledge about the distribution points of primates in Gunung Gede Pangrango National Park will not only be highly beneficial in enhancing the effectiveness of tropical rainforest ecosystem management within the national park but will also improve the quality of its primate ecotourism potential. Further, a good understanding of primate response patterns to tourist presence will make the design of primate ecotourism programs in the park more effective, thereby enhancing the quality of experience and satisfaction for visitors engaging in primate ecotourism.

Furthermore, studies on the tolerance levels of primates to recreational activity disturbances can be conducted in other locations than national parks, such as Grand Forest Parks, Nature Tourism Parks, and Wildlife Reserves. Any tourist destination areas experiencing conflicts between primates and humans can also be targeted for such research. The benefits of this study for future nature tourism development include the potential for mitigating primate-human conflicts and optimizing visitor management according to the area's ecological carrying capacity. Additionally, the threat of habitat damage to primates due to tourism activities can be minimized and prevented earlier.

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