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COMPOSITION AND AGE CLASS OF LONG-TAILED MACAQUE (*MACACA FASCICULARIS*) IN THE TROPICAL PEAT ECOSYSTEM (CASE: In Buffer Village Around Orang Kayo Hitam Forest Park)

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ABSTRACT

The long-tailed mcaque (Macaca fascicularis) has a fairly wide population distribution in Indonesia. According to IUCN data, the population of long-tailed macaque is decreasing every year, the cause is a decrease in habitat quality. One of the habitats of long-tailed mcaque which is currently under pressure due to conversion is located in a buffer village around the Orang Kayo Hitam Forest Park (Tahura OKH). This study aims to analyze the composition and age class of long-tailed monkeys. Observation methods were used to observe long-tailed macaque based on morphological characteristics such as coat color and body size. Based on the results of the study, the composition of long-tailed macaque was divided into two groups, the settlementsgroup (KP) and the riverbank group (KS). The number in KP is 8 individuals with an age class of 5 adults, 3 immature while the number in KS is 27 individuals with an age class of 18 adults, 4 immature, 3 juvenile, 1 infants. This condition illustrates that the river border habitat is better than the residential habitat. In addition, adults and adolescents are more numerous, indicating individuals who have a function for reproduction and continue reproduction. This breeding rate is the potential for regeneration of long-tailed macaque and the potential for the regeneration process of peat ecosystems through the role of long-tailed monkeys as pollinators for seed dispersal.

Keywords: *Long-tailed macaque, Peatlands, Composition*

INTRODUCTION

Indonesia has a variety of wildlife species, one of which is primates. The distribution of primates in Indonesia includes the Mentawai Islands, Sumatra, Kalimantan, Java, Bali, Nusa Tenggara, Sulawesi, and other surrounding islands (Comanesi *et al*., 2017). The most common primate animal found is the long-tailed macaque (*Macaca fascicularis*) (Subiarsyah, 2014). The distribution of long-tailed macaques habitats in Indonesia includes the islands of Sumatra, Borneo-, Java, Bali, Lombok, Sumbawa, Flores, Sumba and Timor (Laksana *et al*., 2017; Fauzi *et al*., 2020). One is found in the buffer village of Orang Kayo Hitam Forest Park (OKH Forest

Park), Jambi Province. OKH Forest Park is a peatland that has an area of around 229,703.90 ha and is a buffer area for the Berbak-Sembilang National Park (Napitupuu *et al*., 2018). The fire incident in the OKH Tahura in 2015 caused land cover in secondary peat swamp forest adjacent to oil palm plantations and residents' settlements to burn down to 2,109.5 ha (Tamin *et al*., 2021). On the other hand, according to Harison and Rieley (2018) the flora and leaves in tropical peat ecosystems are the highest among other peat ecosystems. Of course, it has an impact on the survival of primates in it, including long-tailed macaques.

Morphologically, long-tailed macaques have a tail almost the same length as the body, which can be measured from the head to the tip of the tail (Hedriansyah, 2015). Long-tailed macaques have a crucial function for nature (Afifah *et al*., 2022). The ecological role of long-tailed macaques is crucial for the sustainability of plant conservation as seed dispersers for fruit trees (first seed dispersers) prey on insects in efforts to control insect populations (Seponada dan Firman, 2010; Ziyus *et al*., 2019; Hansen *et al.,* 2021; Seidensticker and Suyono, 1980; Corlett and Lucas, 1990; Gumert and Malaivijitnond, 2012). In their habitat, long-tailed macaque eat insects, grass, seeds, flowers, young to old leaves, stems, mushrooms, bird eggs, invertebrates, clay, and skin (Subiarsyah, 2014). Long-tailed macaques are also capable of consuming human food (Hansen *et al*., 2021; Sha, 2013). Long-tailed macaque are not classified as protected animals according to the International Union for the Conservation of Nature and Natural Resources (IUCN) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Jannah and Dewantara, 2019). According to IUCN data, in 2022, long-tailed monkeys belong to the Endangered (EN) category. Based on CITES data, long-tailed macaque are included in the category of appendix II, which means that long-tailed macaque are not yet threatened with extinction. However, if their utilization and control are not considered, they can be threatened with extinction. Primates are not only an indicator of fauna in the forest, but primates have a vital role in forest ecosystem resilience (Atmoko and Agency, 2019). Natural factors and human factors cause conflicts with wild animals, causing habitat fragmentation (Baskaran *at al*., 2013; Wahyuni *et al*., 2020). In addition, other factors that cause primate species to be threatened, such as forest logging, land use change and habitat change (Srimulyaningsih, 2021), forest fires causing land degradation which can cause loss of primate habitat (Rahma et al., 2021). Another threat is the illegal trade of long-tailed macaque, conflicts between individual long-tailed macaques, and even between long-tailed macaques and humans (Siddiq *et al*., 2022; Gumert *et al*., 2012; Risdiyansyah, 2014; Afrizar *et al*., 2015). If this continues to happen, it can hurt forest ecosystems, and another impact is the extinction of primates so that the next generation will not be able to see and know clearly about primates (Rahma *et al*., 2021).

Research on primates in peat ecosystems was conducted by Octavianus (2020) regarding the population and Habitat Characteristics of Tarsier (*Cephalopachus bancanus borneanus*) in Punggualas, analysis of the Population of Kalawet (*Hylobates agilis albibarbis*) in Sebangau National Park, Central Kalimantan (Mansjoer, 2009) , habitat deterioration for the Sumatran orangutan (*Pongo abelii*) (Ulfa and Kamal, 2022). Research on long-tailed macaques, namely the distribution and abundance of the long-tailed macaques population in the Sibolangit Nature Reserve (Sembiring *et al*., 2016), the long-tailed macaques population in Tanjung Puting National Park, Central Kalimantan (Gumert *et al*., 2012), the population of long-tailed macaques in the coastal area of the Nipah Pulo Aceh coast (Rahman *et al*., 2022). Based on the literature search results, there has never been a study on the composition and age structure of long-tailed macaquess in the OKH forest park buffer village. This research is vital to support the sustainability of peatland restoration (OKH Forest Park) as long-tailed macaques habitat.

METHOD

This research was carried out in September 2022. The location of this research was carried out in Jebus village which is the buffer village of OKH Forest Park. OKH Forest Park administratively is located in Muaro Jambi Regency and Tanjung Jabung Regency. These observations were made in two types of habitat, namely in settlement areas (Lat 10 20'34.3" S, Long 1040 02'09.6"E) and riverbank(Lat 10 20'57.6", Long 1040 01'18.1" E). This location is directly adjacent to the OKH Forest Park, acting as a buffer village for the conservation area. In addition, the two villages served as ahabitat of long-tailed macaques (*Macaca fascicularis*) to carry out their daily activities after OKH Forest Park experienced significant fires in 2015 and 2019. The conditions of land cover at the study sites have different characteristics. In settlement areas, you can find long-tailed monkeys in yards and gardens. The yard and gardens are dominated by fruit-producing plants or MPTS, such as*Psidium guajava*, *Annona muricata*, *Teobroma cacao*, *Mangifera indica*, *Nephelium lappaceum*, *Lansium domesticum*, and*Durio zibethinus*. There are also oil palm and rubber plantations.

The land covers the river bank and has a tributary of the Batanghari river with trees that grow around it. There are Aro trees with a height of up to 30 m and a tree diameter of 95 cm. besides that, and there is a crepe tree with a height of about 8-9 m with a diameter of about 55 cm. The research location is the Tahura OKH peat ecosystem area which is a conservation area that had five land cover classes in 2012, namely secondary flavors (10,710.35 ha), primary swamps (18.07 ha), shrubs (7,394 ha), open land (1.53 ha) and swamps (109.92 ha). In 2015 Tahura OKH experienced a fire with a high level of damage, causing the peatland to become empty and damaged (Hamzah et al., 201). In addition, the research location has the potential for flooding every year because it is geographically located in the Batanghari river basin. As a result of these conditions, many flora and fauna have disappeared. The research location can be seen in Figure 1

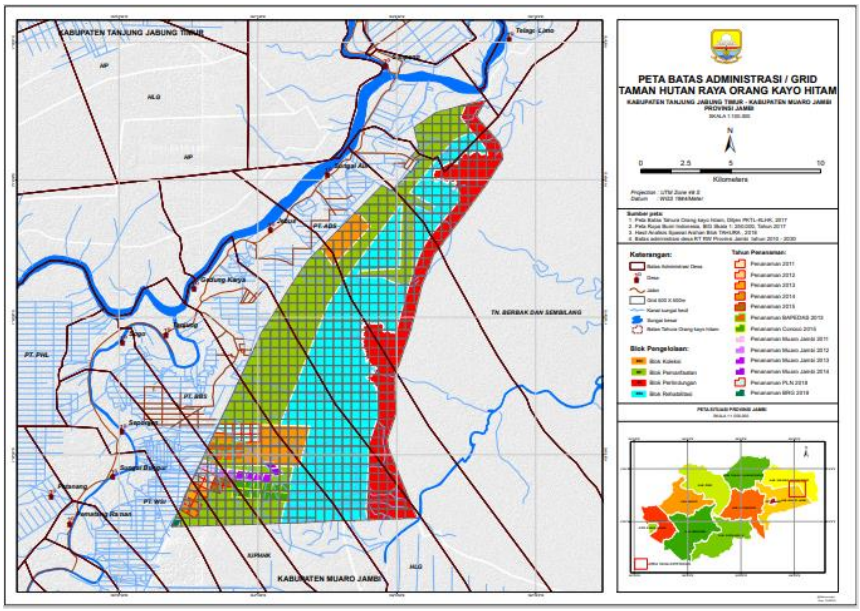

Figure 1. Map of research locations.

The method used in this research is the observation method by walking exploring the locations where long-tailed macaques are found and pausing to record and identify them (Wahyuni *et al*., 2020). The research was conducted two times: in the morning at 7.00-10.00 WIB and in the afternoon at 15.00-18.00 WIB (Rachman et al., 2022). Parameters recorded included the number of groups, the number of individuals in each group, the time of the meeting, the sex ratio, and the age structure observed during the study (Dhaja et al., 2019; Gumert et al., 2012; Soma et al., 2009). The age structure of each individual is divided into four groups, namely adult, immature, juvenile and infants. Individual recording was carried out at each meeting during the observation.

In this study the method of descriptive analysis included the number of individuals in each group, the coordinates of each location that became the habitat of long-tailed macaque and the number of long-tailed monkeys. Quantitative analysis in this study includes:

1. Age structure
   Age structure is a comparison of the number of individuals in each age class of a population. The age structure is divided into age classes, namely infants aged 0-1 years, juvenile 1-4 years, immature 4-9 years and adults 9-21 years. (Sampurna *et al*., 2014).

   Age Structure = Number of Individuals age class / Age interval

2. Sex Ratio
   Sex ratio is calculated from the comparison of the number of males and females (Santoso and Sitorus, 2008)

   S= Y/X

   Explanation:
   S : Sex Ratio
   Y : Number of males
   X : Number of females

RESULT AND DISCUSSION

Long-Tailed Macaque Composition

This study found two groups of long-tailed monkeys that carry out daily activities in the OKH Forest Park buffer village (Table 1). The found first group was in settlements (KL1) and found the second group (KL2) was on the riverbank.

Table 1. Long Tailed Macaque Composition

No	Group	Location	Most Number
1	KL1	Settlements	8
2	KL2	Riverbank	27
Total			**35**

The number of individuals found from each observation location is different. In the first location, located in a settlement, the highest number of individual long-tailed macaques seen during the observation was 8 individuals (KL1). In the settlement, long-tailed monkeys do a lot of activities around the yards of residents' houses because many fruit trees can be used as a food source and support other activities of long-tailed macaque (Tabel 2). In addition, the long-tailed

macaque in the settlement carries out activities of playing, grooming, and moving around trees. At the research location, thickets of bushes are hiding places for long-tailed macaque when they feel uncomfortable with the presence of humans. According to Hidayat's research (2016), in natural habitats, animals will be wary of human existence because they perceive it as a threat. Following the research results, long-tailed macaque immediately hid in the thicket when they realized the presence of humans approaching. Based on the results of research on long-tailed macaque in settlements, they do a lot of feeding activities in the morning and in the afternoon the dominant activity of long-tailed macaque is eating. While the dominant activity carried out by the long-tailed macaque that are on the riverbank in the morning is eating and the dominant activity of the long-tailed macaque during the day is eating (Figure 2).

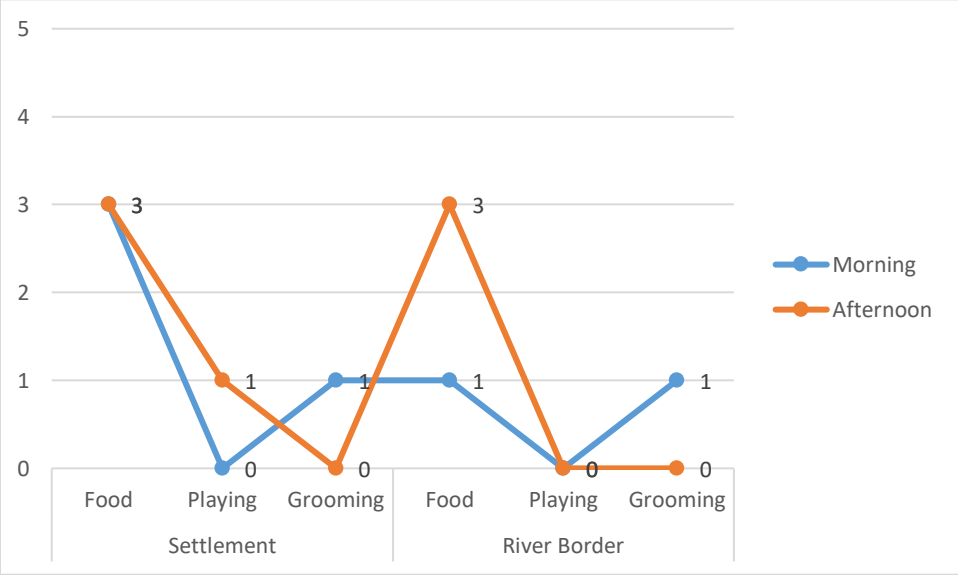

Figure 2. Daily activities of long-tailed macaque

At this location, KL 2 was recorded doing a lot of activities on Aro trees (*Ficus retusa*), such as eating fruit, caring for it, moving around, and playing. In addition, there is a Crepe tree (*Lagerstroemia speciosa*) which is also used as a playground. During observations, it was noted that long-tailed macaque often visited the oil palm plantations to eat and several times went down to see the river to drink.

Table 2. Tree Composition of Plant for Long-Tailed Macaque Activities

No	Species	Settlement			River Border		
		Food	Playing	Grooming	Food	Playing	Grooming
1	*Annona muricata*	√		√			
2	*Theobroma cacao*	√	√				
3	*Psidium guajava*	√					
4	*Mangifera indica*	√	√				
5	*Lancium domesticum*	√					
6	*Elaeis guineensis*	√	√	√	√		
7	*Hevea brasiliensis*	√	√				
7	*Ficus retusa*				√	√	√

8	*Lagerstroemia speciosa*	√	√	√

Long-tailed Macaque Age Structurer

Age structure is the ratio of the number of individuals based on a population's age. According to Sampurna et al. (2014), the age structure is divided into four levels, namely adults (9-21 years), immature (4-9 years), juveniles 1-4 years), and infants (0-1 year). In the site of research, the age structure in the long-tailed macaque group consisted of four levels (Figure 3).

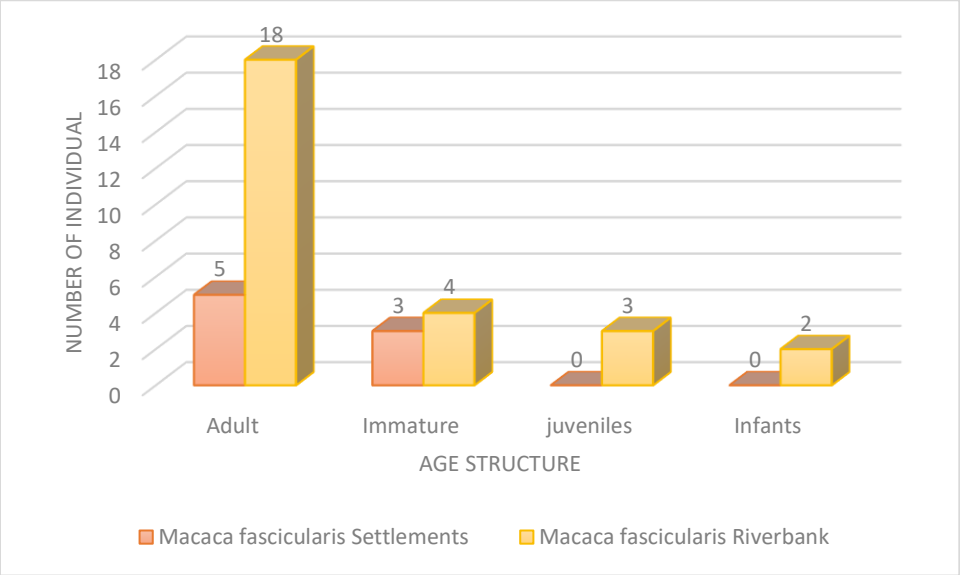

Figure 3. General structure of long-tailed macaque

The results showed that the number of individuals based on the age structure of the two locations where long-tailed macaques were found was different. In residential areas, the highest number was found, 5 adults and 3 immature. Meanwhile, in riverbank locations, the highest number was found, 18 adults, 4 immature, 3 juveniles and 2 infants. Of the two groups, each group was led by a male individual. The male individual leads the group in an effort to protect and supervise his territory (Octavia *et al*., 2017). Male individuals who lead have aggressive behavior that shows themselves as leaders, this is in accordance with research conducted by Bramantya (2014) that alpha males have significant dominant aggressive behavior, sexual behavior, shaking trees, movement, receiving attention, agonistic, and giving more protection of the group compared to other males. Based on their physical characteristics, male long-tailed monkeys have a larger body size than adult females with a large and clearly visible scrotum (Afifah et al., 2022).

Sex Ratio Long-tailed Macaque (*Macaca fascicularis*)

To increase a population is not only assessed through the age structure, but the value of the sex ratio of animals is one of the important issues for good breeding in nature (Maulidia, 2022). In this study, a comparison of the sexes was carried out. Differences in the skes type ratio of long-tailed macaque (*Macaca fascicularis*) can be seen in Table 3.

Tabel 3. Sex Ratio Long-tailed Macaque (*Macaca fascicularis*)

Group	Based on Gender		Sex Ratio
	Y	X	
Settlements	6	2	1:3
Riverbank	17	5	1:3

The number of long-tailed macaque by sex was obtained by calculating the comparison between male and female long-tailed macaque classes and male and female young long-tailed macaque classes. While the long-tailed macaque are not counted. The ratio of male and female long-tailed monkeys in settlements was 1:3 and male and female long-tailed macaque living on riverbanks was 1:3.

Discussion

From the results of these observations it is known that the number of individual long-tailed macaque on the riverbank is more than the number of individual long-tailed macaque in residential areas. The influence of the difference in numbers is due to water sources, food sources, humans and other animals (Sembiring *et al.,* 2016). Other animals can influence the number of a species in a location, this is according to the statement Ziyus *et al.* (2019) other animals as predators as well as competitors will affect the number of individuals in that location. This is also appropriate Fakhri *et al.* (2012) which states that optimal environmental conditions, fiber, abundant food sources are not always an indicator of a place that can be used as a gathering location for individuals, but the absence of competitors or predators can be an indicator of individuals gathering.

Figure 4. Long-tailed Macaque (*Macaca fascicularis*) in resident settlements

Figure 5. Long-tailed Macaque (*Macaca fascicularis*) on the riverbank

There are fewer groups of individuals in residential areas because their presence disturbs local residents, so many local residents often chase away long-tailed macaque that enter their yards. The expulsion of the long-tailed macaque was not carried out without cause. They did this because the local residents felt disturbed by the behavior of the long-tailed macaque, who often stole the eggs of the chickens belonging to the residents, besides that the long-tailed macaque stole the fruits belonging to the residents which were planted in the yard of the house. This activity can be seen in **Figure 4** which shows long-tailed macaque eating on a crepe tree. According to Kamarul *et al*. (2014) long-tailed macaque living in residential areas have smaller roaming patterns compared to long-tailed macaque in the forest, the area that continues to decrease will affect the conditions for animals to move because their habitat is getting narrower (Pratiwi *et al*., 2022), daily activities carried out by long-tailed macaque living in settlements make more movements than resting. Small home ranges and activities that are dominated by moving rather than resting indicate that the available food sources in settlements come from human leftovers or food that is intentionally given by humans (Shad and Hanya, 2013). This matter. The small range of long-tailed macaque in settlements is due to the behavior of residents who often drive away long-tailed macaque because they are considered a nuisance.

Daily activities found during observations such as moving from one branch to another and even moving from one tree to another, apart from that they also jump and walk. This is similar to research conducted by (Wulandari *et al*., 2022) daily activities carried out by long-tailed monkeys are moving between branches, climbing, walking on tree branches and moving to other trees. The movement made by long-tailed macaque is an effort made to find food (Wulandari *et al.,* 2022; Purbatrapsila *et al*., 2012), get away from predators, and seek shelter. Another activity carried out by long-tailed macaque is resting by sitting on a branch. **Figure 5** shows long-tailed monkeys that are on the riverbank, moving around in search of food. During rest, there are other activities carried out by long-tailed macaque, namely grooming, this is in accordance with the results of research conducted by Jelantik *et al*. (2017) activities related to resting activities, this sgrooming activity is usually carried out by female long-tailed macaque to other long-tailed macaque.

Based on the graphic image above it is known that the number of individuals is based on the age structure. Age structure can be used to assess the prospects for the development of sustainable populations and can be seen to estimate and assess the success of a wildlife population (Sampurna *et al*., 2014) the more diverse wild animals there are, this will affect the stability of an ecosystem (Sajria *et al*., 2019; Nugraha *et al*., 2021). Observations from the two locations found that the number of long-tailed macaque was different. In residential areas, 24 adults and 8 juveniles were found. Meanwhile, at the riverbank location, 33 adults, 10 immature, 4 juveniles and 2 infants were found. Based on the results of the data obtained, it is known that the number of adult long-tailed macaque is more dominant than infant individuals and juveniles, thus showing a composition like an inverted pyramid. This will have consequences for the sustainability and regeneration of the population. According to Trisnawati (2014) if there are more adult individuals compared to young individuals or children, it is likely that there will be a lot of reproduction, but for a long time. The low number of young individuals and offspring shows only a small number of individual functions in reproduction and continued breeding well (Pramudya *et al.,* 2015). According to Santosa *et al*. (2008) if the number of young individuals is greater than that of adults, this may indicate that the population has increased assuming individual mortality at constant time intervals. If the population of young individuals is lower than that of adults, it indicates a decline in population (Solanki *et al*., 2007; Tsuji *et al*., 2013; Li *et al*., 2015). Based on the sex ratio of long-tailed macaque in table 3, it shows the same number of males and females, this is similar to a study conducted by Baiq Maulidia (2022) who obtained the results of a sex ratio study of long-tailed macaque which had the same number of males and females. Comparisons between the same males and females show that one male can mate with one female so that there is no competition between males and this can have an impact on the long-tailed macaque population in areas that are suspected of not experiencing an increase or decrease in population numbers (Dharma *et al*., 2019).

The composition of the food for each type of animal is determined by the types of plants in its habitat. According to Kinanto *et al.* (2018) food must be available for animals if it is not available or the amount of food needed is less then competition will occur. Based on field observations, there are differences in food sources in groups of long-tailed macaque in Settlements areas and riverbanks. Groups of long-tailed macaque residing in residential areas are known to eat soursop fruit (*Annona muricata*), cacao fruit (*Theobroma cacao* L.), guava fruit and young leaves (*Psidium guajava*) and oil palm fruit (*Elaeis guineensis* Jacq). A group of long-tailed macaque living on the riverbank are known to eat aro wood (*Ficus Retusa*), oil palm fruit (*Elaeis guineensis* Jacq) and the leaves of the crepe saplings (*Lagerstroemia*). According to research conducted by Wulandari *et al.* (2022) long-tailed macaque have a tendency to eat leaves, fruit and flowers. This is different from a study conducted by Anggraeni (2013) which found that long-tailed macaque tend to eat fruit as food. Differences in types of feed are caused by seasonal changes, when there is no fruit season, primates utilize other plant parts such as young leaves, flowers and seeds to meet their food needs (Wulandari *et al*., 2022). The types of feed can be seen in Figure 5. .

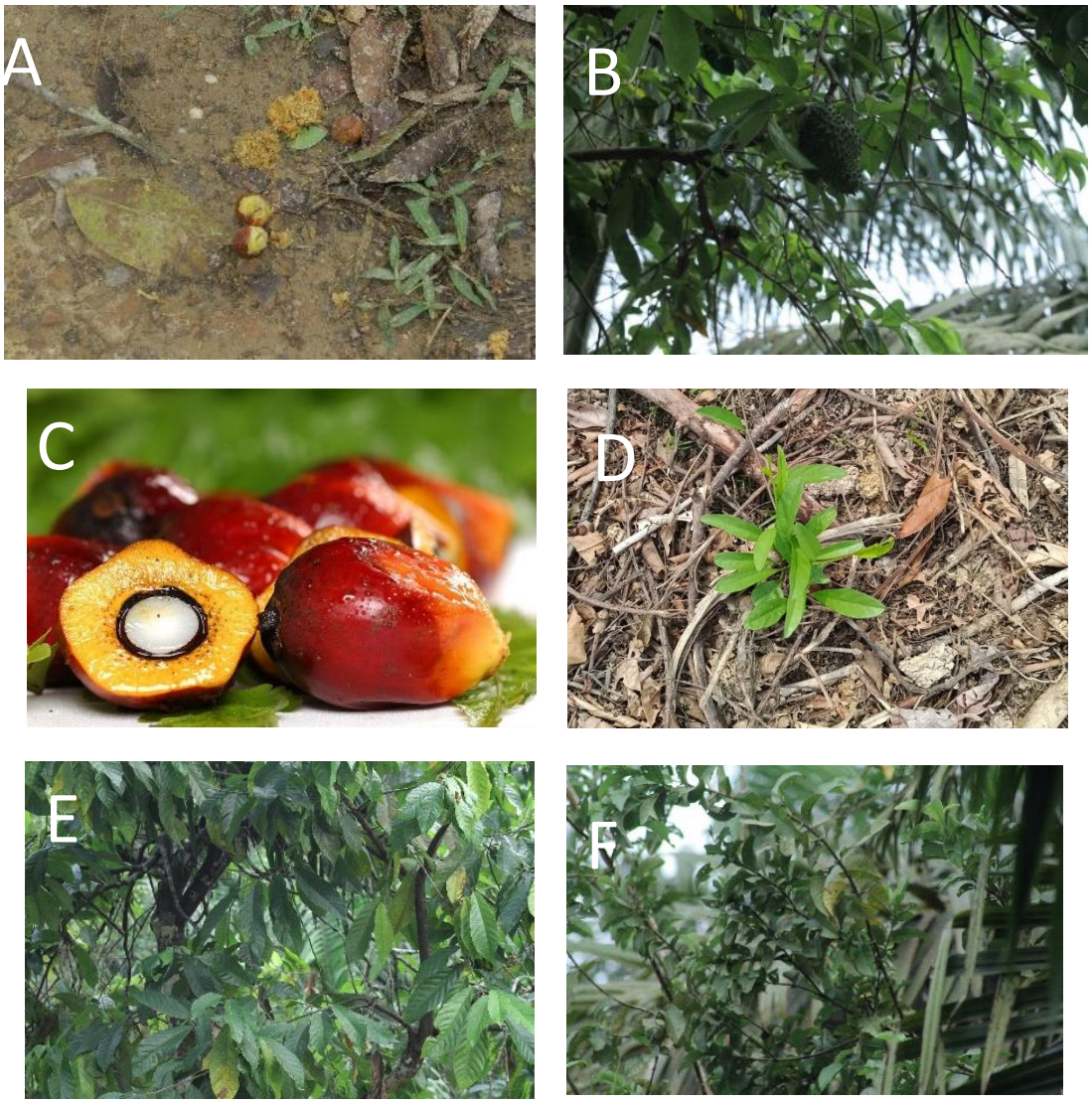

Figure 5. (a) aro wood (*Ficus Retusa*); (b) soursop (*Annona muricata*); (c) cacao fruit (*Theobroma cacao* L.);
(d); crepe tree seedlings (*Lagerstroemia* (e) oil palm fruit (*Elaeis guineensis* Jacq); (f)) guava tree (*Psidium guajava*)

CONCLUSIONS

Two groups of Long-tailed Macaque (*Macaca fascicularis*) were found in settlements (8 individuals) and riverbanks (27 individuals) with different numbers of individuals. The age class in the settlements was recorded as 5 adults, 3 immature, while the age class in the riverbanks was 18 adults, 4 immature, 3 juvenile, 1infant. This condition illustrates that riparian habitat is better than residential habitat. In addition, the number of adults and juveniles was more significant, indicating a reasonable breeding rate. This shows that the process of regenerating the peat ecosystem through the role of long-tailed macaques as pollinators for seed dispersal is starting to recover.

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