

Javan Leaf Monkey (*Trachypithecus auratus*) Movement in a Fragmented Habitat, at Bromo Tengger Semeru National Park, East Java, Indonesia

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ABSTRAK

Pergerakan Lutung budeng (*Trachypithecus auratus*) didaerah habitat terfragmentasi Taman Nasional Bromo Tengger Semeru, Jawa Timur, Indonesia. Pergerakan lutung budeng di daerah habitat terfragmentasi diamati dengan metode transek. Hasil kajian menunjukkan bahwa ada empat kelompok masing masing beranggotakan 12 (grup A), 16 (grup B), 15 (grup C) dan 12 lutung (grup D). Penelitian yang dilakukan disekitar hunian penduduk, jalan, hutan terdegradasi dan jalan-jalan setapak mengindikasikan bahwa lutung dalam aktivitas hariannya memerlukan waktu 32,82% diantaranya digunakan untuk makan, 30,97% untuk istirahat dan sisanya 31,79 untuk pergerakan perpindahan. Lutung dalam aktivitasnya 50,53% menggunakan wilayah puncak kanopi tumbuhan, 41,99% menggunakan kanopi tumbuhan bagian tengah dan hanya 2,49 % yang menggunakan kanopi bawah.

Kata kunci: Lutung budeng (*Trachypithecus auratus*), habitat terfragmentasi

INTRODUCTION

Most primate species live in tropical forests, (Mittermeier & Cheney 1987; Chapman *et al.* 2006) where 2 major threats are habitat destruction and hunting by human (Mittermeier & Cheney 1987). Alteration of forests into agricultural land, degraded function of the conservation area, are several causes decreasing the primate population. Primate populations, like those other organisms, face the challenges of coping with the dynamic of their habitat, because habitat are continually changing and primate must

adapt to changes in order to survive; failure to adapt dooms species to extinction (Isabirye-Basuta & Jeremiah 2008; Sharkley 1996, Newsome *et al.* 2005).

Habitat loss and fragmentation are associated with fewer resources, greater isolation, and more intense and far-reaching edge effects (Laurance & Bierregaard 1997), and both are considered as major threats to wildlife. Unless the current rate of forest conversion is halted, it is inevitable that more and more primate populations will live in an isolated fragment (Isabirye-Basuta & Jeremiah 2008). Understanding the biology behind the dis

inction between species at risk and more persistent species should help inform conservation efforts (Gibbons & Harcourt 2009).

Coban Trisula are an intensive used areas in Bromo Tengger Semeru National Park, consist of 3 natural waterfalls, and also the habitat for the vulnerable of javan leaf monkey (IUCN 2010). In addition to tourism, this region is also intensively used by local people to take the wood, fodder, mushrooms, honey, medicine and kinds of forest fruits for consumption. The location immediatelies adjacent to the cultivation, split by a highway connecting Bromo and district of Malang and located between Gubugklakah and Ngadas vil-lages. This condition has turned the area fragmented. This study aims to determine the daily movements in the area of Coban Trisula as forms of javan leaf monkey ad-aptation in fragmented habitat.

MATERIALS AND METHODS

The study sites was at Coban Trisula resort conservation area, Bromo Tengger Semeru National Park, at coordinate $08^{\circ} 00'11.5'' - 07^{\circ} 59'52.3''$ LS and $112^{\circ} 51'51.6'' - 112^{\circ} 52'21.4''$ BT, at 1335-1591 m asl, covering 89 hectares. Administratively it is located in the Gubugklakah vil-lage Malang, East Java. This research was conducted in August-December 2009 and January 2010.

The methods used during the study were: 1) Population survey of Javan langurs using Line Transect Method (Strukhsaker 1981) conducted onece each month, and then calculated the av-erage number of individuals found; 2)

vegetation data collected using Point Centered Quarter-Method (Mueller-Dumbois & Ellenberg 1974) only to the level of the tree with a minimum diam-eter of 35cm, measured at breast height, and 3) observations of daily activity of Javan langurs using Focal Animal Sam-pling method (Lehner 1976) by observ-ing the feeding, social, resting and mov-ing.

RESULTS

Coban Trisula and surrounding are intensif used areas, as ecotourism object. The object were consisting three natural waterfalls, namely upper coban, middle coban and down coban, flows in Lajing river. The management has created semi permanent trail to reach the object, about 600 meters long. The object was opened only in weekend, and visited by tourist about 50 - 100 peoples a day.

Coban Trisula located as the border of Bromo Tengger Semeru National Park, directly connected with localvillagers cultivation. The area is also cut by permanent road connecting Bromo mountain and district Malang and 3 vil-lages that are Ranu Pani village, Ngadas village and Gubugklakah village. Inside the area there are many trail used by lo-cal villagers taking any resources needed. These facilities make villagers and visi-tors can access freely. Inside the loca-tion, there are three natural rivers that is Sadam river, Lajing river and Amprong river.

Illegal cutting for cabin, firewood and cattle food for cows and goat are the biggest contribution to the habitat loss

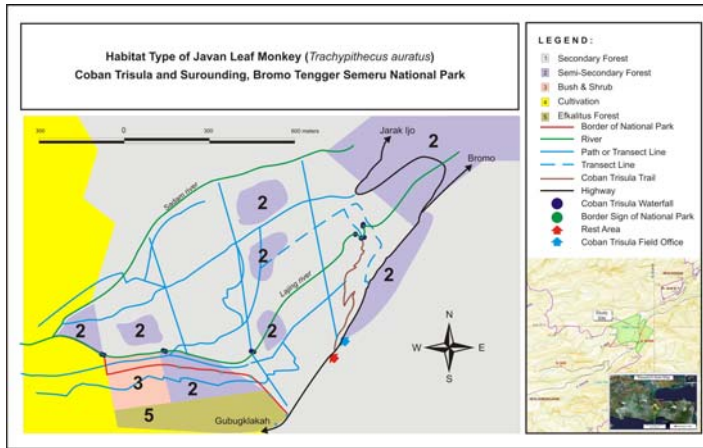


Figure 1. Habitat type of javan leaf monkey (*Trachypithecus auratus*) at Coban Trisula.



Figure 2. Illegal cutting for cabin and cattle food.

and habitat fragmentation inside and outside the area. It was done by local villagers from Gubugklakah village, Tosari village and Duwet village. Illegal cutting is intensive in the dry season, and decreasing in rainy season. It was created a "hole" in the area and formed a liaison at each habitat corridor that is used for moving by Javan leaf monkey to explore the home range.

The population survey was conducted a month over study period. It showed a population density of 55 indi-

viduals that are divided into four groups. Group 1 was up to 12 individuals, group 2 was 12 individuals, group 3 was 15 individuals and group 4 was 16 individuals. Sex ratio is 1:1.5 (19 males and 29 females). The age structure and sex ratio of each group are presented in the Table 1.

The table shows, density of javan leaf monkey at Coban Trisula is 0,6 individu per hectare. The density was higher than in Blok Ireng-Ireng which consisted of 64 individuals at area 428

hectars, means 0,1 individu per hectare. The observation samples consist of group 1 and group 2, while group 3 and group 4 are considered equal. Observations were done on daily behavior, exploiting strata canopies, canopy height and density of trees used in its daily activities.

To determine the density of trees used for moving, feeding and other activities, vegetation analysis was conducted using the Centre Point-Quadrat Method. The density of trees is 228.7 individuals per hectare, the average distance between trees is 7.34 meters, the average tree height is 8.40 meters, average canopy width is 7.13 meters and canopy density is 41.51% (scale 3 of Braun-Blanquet Scale). Species found include Danglo (*Engelhardtia spicata*), Tritih (*Nitrocous* sp), Preh (*Ficus* spp), Anggrung (*Trema orientalis*), Bodak (*Nauclea orientalis*), Blarang (*Maca-*

ranga sp), Dadap (*Erythrina orientalis*), Nyampuh Sentul (*Actinodaphne* sp) and Salam (*Syzygium polyanthum*).

DISCUSSION

Canopy level used by javan leaf monkey were different from any activities. During the observations, canopy level used by javan leaf monkey is presented in the Figure3

The charts shows (Table 2), canopy used at top level are 50,53%, at middle level are 41,99% and lower canopy used 4,98%. It seems associated with the habit of javan leaf monkey as arboreal primate. Utilization of canopy level was associated with the height and canopy density, and diversity of tree species such as feeding trees, shelter and so forth. For example, Preh (*Ficus* spp), was used as a feeding trees, resting and social activi-

Table 1. Population, age structure and sex ratio of javan leaf monkey at Coban Trisula and surrounding

No	Groups	Population, age structure and sex ratio					Total
		Adult		Sub-adult		Juvenile	
		Male	Female	Male	Female		
1	Group 1	3	6	2	-	1	12
2	Group 3	2	4	1	1	4	12
3	Group 2	3	6	3	2	1	15
4	Group 4	3	6	2	4	1	16
	Total	11	22	8	7	7	55

Table 2. Height and canopy density (in average) of trees at core area in home range.

Item/ Activities	Resting		Feeding		Social		Sleeping	
	Height (m)	Canopy Density (%)	Height (m)	Canopy Density (%)	Height (m)	Canopy Density (%)	Height (m)	Canopy Density (%)
Group 1	23.86	47.95%	24.77	53.33%	26.47	57.35%	27.67	58.33%
Group 2	24.08	47.88%	20.87	45.00%	25.00	52.78%	25.57	52.86%
Overlapping	25.11	53.42%	23.55	54.50%	28.92	55.00%	29.20	59.50%

ties, also as moving trees to other areas. Equitable form of branching, 45% canopy density, 20 meters height and shape of the rounded canopy javan leaf monkey used top, middle and lower canopy level. But, Anggrung (*Trema orientalis*), average height 20 meters and a canopy density 25%, more often utilized as a resting trees and social activities at the middle canopy. While types of Bodak (*Nauclea orientalis*), with the same height and canopy density 40%, more often utilized as resting trees social activities on top, middle and lower canopy level. During observations, sometimes javan leaf monkey found above the ground to find insects, consuming sev-

eral species of plants and shrubs around the river, some areas where there are no human activities.

Daily activities of javan leaf monkey, showed on Figure 4

Average percentage of daily activity of javan leaf monkey for rest and social activities amounted to 30.97%. Both activities were performed in the same span of time before afternoon (07.30 - 10.00 am) and in the afternoon (12.00 - 14.30 pm). Social activities that were found during the observation is grooming and playing, but no breeding activity had been found. Foraging and eating approximately 31.82% & were performed by all individuals' javan leaf

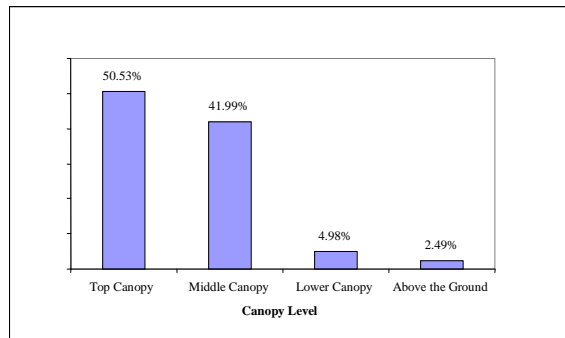


Figure 3. Percentage of time budget in javan leaf monkey daily activity

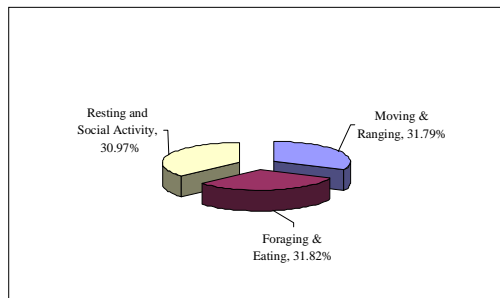


Figure 4. Canopy level used by javan leaf monkey

monkey in the morning (06.00 - 07.30 am) and afternoon periods (14.30 - 17.00 pm). While moving activity and ranging is approximately 31.79%, which is performed in the morning, afternoon and evening at the home range in each group.

Based on the observation and calculation above, it is known that the javan leaf monkey have good adaptability to the state of the fragmented habitat. Utilization of trees were various in daily activities formed important areas and frequently visited, known as core area. Core areas used by javan leaf monkey are closely linked with the height and density of tree canopies. Height of trees was used by Javan langurs to avoid harassment and threats from both human and predator. While the canopy density selected by javan leaf monkey was mainly to protect themselves from sunlight, rain, wind and low temperatures. Utilization of core areas in resting, feeding, social activities and sleeping was different one to another, and are presented in the Table 2 below. In the observation of home range, there is overlapping between home range group 1 and group 2. At each home range of two groups, there are a core area used jointly by the Group 1 and Group 2.

Resting activities were spread on several trees on the top and middle canopy level, on average height of 23.86 meters in home range of Group 1, 24.08 meters in home range of Group 2 and 25.11 meters in overlapping home range. Higher trees were used by javan leaf monkey in circumstances of potential nuisance and threat. When interference or threat appears, javan leaf monkey can

move easily to another tree and hide. The average number of canopy density are 47.95% used by group 1, 47.88% used by the Group 2 and 53.42% in overlapping home range, because Javan langurs are adequately shielded from sunlight, rain, wind, low temperature and relatively hidden from predators.

At feeding activity, the average height of trees that was used by group 1 is 24.77 m, 20.87 m in group 2 and 23.55 m in overlapping home range. The average number of canopy density was 53.33% in Group 1, 45.00% in group 2 and 54.50% in overlapping home range. Canopy height and density associated with the volume of feed that is available, although sometimes javan leaf monkey also moved above the ground to eat insects, several types of shrubs and plants such as kecubung (*Brugmansia* sp), kaliandra (*Calliandra calothyrsus*), mencokan (*Debregeasia* sp).

Social activities carried out during resting time such as grooming, playing and mating. At the core areas, social activities are carried out on trees with an average height of 26.47 m in group 1, 25.00 m in group 2 and in overlapping home range 28.92 m. Canopy density in Group 1 amounted to 57.35%, in Group 2 was 52.78% and in overlapping home range of 55.00%. While playing, javan leaf monkey used top and middle canopy level to practice running, jumping, wrestling and climbing. This activity was carried out by sub-adult and juvenile, occasionally watched by their mother. Sometimes another adult female or males occasionally join into. Grooming and other social activities are often carried

out by two or more individuals, alternately, conducted on middle canopy level or a branching tree or large tree trunks and flat. Another social activity is breeding. However, during observations the social activity was not found.

Javan leaf monkey stopped their activities by entering the sleeping trees at 17:30 to 18:00. Selection of trees to sleep are very important because javan leaf monkey must ensure that the tree has well-height and high density canopies. The average numbers of tree height are 27.67 m in group 1, 25.57 m in group 2 and 29.10 m in overlapping home. Canopy density in sleeping tree of group 1 was 58.33%, group 2 was 52.86% and in overlapping home range were 59.50%. Sleeping trees used were higher and more densely than the height and canopy density trees for other activities. Tree height based on a better sense of security from the threat of predators, whereas high canopy density for shelter from the wind and cold air, and from the rain.

CONCLUSIONS

These observations concluded that javan leaf monkey was able to adapt to the fragmented habitat areas. Height and canopy density of trees have important functions in supporting the daily activities of Javan langurs such as feeding behavior, resting, social activities and moving. Tree height associated with a sense of preferential because they feel safe from harassment and threat of predators. While the density of the canopy allows protecting the body from

sunlight, wind, rain, low temperature as well as a place to hide from threats and predators and human disturbance.

In Coban Trisula Resort, conflict of interest between human and javan leaf monkey could become a serious threat to the existence or the preservation of these animals, which are death and/or displacement to another areas or habitats that are more supportive. Therefore, conservation action to conserve javan leaf monkey has to be taken in the future.

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