

Use of forest in state land along Upper Thomson Road by Raffles' banded langurs *Presbytis femoralis* (Martin, 1838) in Singapore

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Abstract. The Raffles' banded langur (*Presbytis femoralis*) is Critically Endangered in Singapore, and is being considered for the Critically Endangered status globally based on molecular, morphological and distribution data, which elevate it from a nominate subspecies to species. Preserving its remaining habitats in Singapore and maintaining sufficient canopy connectivity between forest fragments are important for ensuring that the langurs are able to travel safely between food resources and in the search of mates. Based on field observations from citizen scientists and researchers, as well as historical records, we have identified the forests along both sides of Upper Thomson Road, adjacent to the Central Catchment Nature Reserve, as part of an important habitat of the Raffles' banded langurs. As the langurs use the rain trees (*Samanea saman*) along Upper Thomson Road to cross between the forest fragments, we emphasise the importance of maintaining sufficient canopy connectivity whilst ensuring the safety of human and vehicular traffic. We further call for the continued preservation and protection of the forest currently used by the Singapore military next to Upper Thomson Road adjacent to the former Tagore or Lentor forests. The monitoring of wildlife such as the langurs by citizen scientists demonstrates that collaboration between researchers and volunteers can enhance the collection of scientific data, which can better inform conservation strategies.

Key words. primate, *Presbytis femoralis*, Singapore, fragmented habitat, canopy connectivity, roadkill

INTRODUCTION

Singapore is home to three species of non-human primates: the Sunda slow loris, *Nycticebus coucang*; the long-tailed macaque, *Macaca fascicularis fascicularis*; and the Raffles' banded langur (RBL), *Presbytis femoralis*. The RBL is regarded as nationally Critically Endangered (Lim et al., 2008) and globally Vulnerable (Nijman et al., 2008). However, based on molecular, morphological and distribution data, which elevate it from nominate subspecies to species (Ang et al., 2019), and its small population size (60 individuals in Singapore and ca. 250–300 individuals in southern Peninsular Malaysia), it is currently being considered for globally Critically Endangered status (Ang et al., in press).

In Singapore, the RBLs are only found in the Central Catchment Nature Reserve (CCNR), which includes the Nee Soon freshwater swamp forest, a part of an important habitat of RBLs (Ng & Lim, 1992). Besides the core areas of CCNR, its surrounding buffer forests such as Windsor Nature Park and Thomson Nature Park are also vital feeding grounds of RBLs (Ang & Jabbar, 2019; A. Ang, S. Jabbar, V. D'Rozario & J. Lakshminarayanan, pers. comm.). The RBLs also visit a small patch of forest in state land used by the military under the Singapore Ministry of Defence (MINDEF). The human public is prohibited from entering this plot of land, and explicit warnings are posted on large signboards planted at intervals along the edge of the forest. This area is separated from the CCNR and the Thomson Nature Park by Upper Thomson Road (UTR) (Fig. 1). The UTR is a six-lane dual carriageway with a central divider with rain trees (*Samanea saman*) on the sides and along the road median. To reach the state land, the RBLs use the interlocking canopies of the roadside trees and the trees on the central road divider as crossings.

The RBLs are arboreal primates that do not usually descend to the ground to travel unless they have to cross between forest fragments without sufficient canopy connectivity (A. Ang, S. Jabbar, V. D'Rozario & J. Lakshminarayanan, pers. comm.). In Singapore, there have been two records of road incidents involving RBLs, once in 2011 on UTR at Lamp-post 296, and the other in 2017 on the Bukit Timah Expressway. Both individuals did not survive. As the branches of rain trees are brittle and twigs are prone to dieback due to infection by fungus (National Parks Board, 2019), they require regular trimming for safety. Hence there were periods of time when canopy connectivity along UTR was lost, prompting RBLs to descend to ground level to cross UTR, which we believe was the reason for the first roadkill instance of RBL.

To assess the use and importance of the forests on both sides of UTR for RBLs in Singapore, we document our observations and those from citizen scientists, and historical records, and discuss the results.

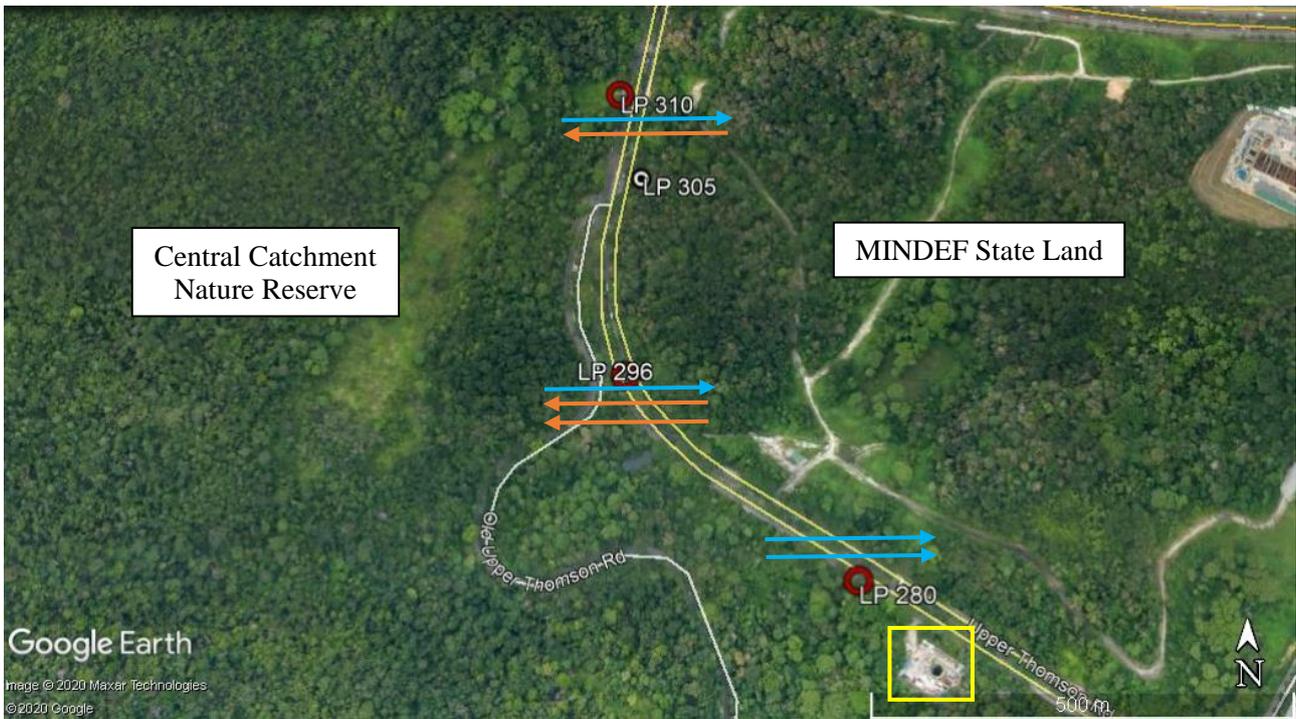


Fig. 1. Aerial view of the area bisected by Upper Thomson Road and Old Upper Thomson Road with the MINDEF state land on the right, the Central Catchment Nature Reserve on the left, and Thomson Nature Park in between Old Upper Thomson Road and Upper Thomson Road. Directions of travel of Raffles' banded langurs across Upper Thomson Road and number of times recorded from the observations reported in this paper are also shown. LP = Lamp post; blue arrow = traveling from west to east; orange arrow = traveling from east to west; red circle = site of observation of crossing; white circle = site of observation at the edge of forest; yellow box = visitor centre of Thomson Nature Park.

DETAILS OF SIGHTINGS

The following are eight observations of RBLs visiting the forest on MINDEF state land, as recorded by the authors and a team of citizen scientists assisting the authors in an ongoing RBL monitoring programme. After the first observation by the authors, the citizen scientists were alerted to look out for RBLs whenever they reached the end of Old Upper Thomson Road (OUTR), adjacent to UTR, during their field surveys (Fig. 1). The locations are identified in relation to individually numbered lamp posts (henceforth referred to as LP) along the sides of UTR. The directions of travel and sighting locations of the RBLs are indicated in Fig. 1.

- 1) On 25 October 2017 at 1020 hours, the authors Andie Ang and Sabrina Jabbar observed one sub-adult male travelling along the edge of the state land forest at LP 305. This individual saw the authors and moved deeper into the forest.
- 2) On 19 November 2017 at 1750 hours, citizen scientist Elizabeth Chew observed three adult RBLs travelling above UTR from the forests on OUTR to the state land forest at LP 310 by using the rain trees at the edges and along the road median.
- 3) On 3 February 2018 at 1810 hours, citizen scientists Alice Early, Steve Early and Richard Hartung saw four adult RBLs feeding on fruits of rambutan (*Nephelium lappaceum*) at the edge of the state land forest at LP 305.
- 4) On 17 June 2018 at 1845 hours, citizen scientists Lan Tianxiang, Susan Knight and John Spencer observed four adult RBLs using the rain trees to cross from OUTR to the state land forest at LP 296.
- 5) On 8 June 2019 at 1040 hours, citizen scientists June Lee, Miranda Thomas and Sian Brooks Gillies observed four RBLs (three adults and one juvenile) crossing from the state land forest to OUTR at LP 310.
- 6) On 6 January 2020 at 0850 hours, the authors Andie Ang and Sabrina Jabbar saw five RBLs (four adults and one juvenile) crossing from the state land forest to OUTR at LP 296. They paused to feed on the cream-coloured inflorescences of wild cinnamon (*Cinnamomum iners*) at the edge of OUTR. One of the monkeys is shown in Fig. 2.



Fig. 2. One of five Raffles' banded langurs that were observed on 6 January 2020 to use the rain trees along Upper Thomson Road to travel between Old Upper Thomson Road and the MINDEF state land. (Photograph by: Andie Ang).

- 7) On 16 February 2020 at 1000 hours, Sophia Sak Baker, a resident of the condominium Meadows @Peirce located along UTR, saw two RBLs (an adult and a juvenile) near the entrance of Thomson Nature Park (TNP), one of them feeding on leaves (unidentified species) before travelling to the state land forest at LP 280 using the rain trees.
- 8) On 24 February 2020 at 0945 hours, author Sabrina Jabbar saw one adult RBL crossing from TNP to the state land forest at the same location (LP 280) and in the same direction as the sighting on 16 February 2020.

DISCUSSION

The first documented occurrence of RBLs at the state land forest along UTR was on 10 December 2005, when Chan Kwok Wai photographed one adult RBL near LP 299. From recent field observations recorded largely by citizen scientists, we document three additional locations where RBLs travel between the forests divided by UTR. At present, we believe that the RBLs in this area are of one group of bachelor males based on group demographics and photographs recorded since 2016. These sightings demonstrate that the RBLs have been using the forests on both sides of UTR for a long time and continue to rely on the area, including for food. The RBLs consume a mix of native and non-native food plant species such as rambutan, wild cinnamon, sea apple (*Syzygium grande*), bat laurel (*Prunus polystachya*) and rubber tree (*Hevea brasiliensis*) (Srivathsan et al., 2016), which can be found in secondary forests in the area (pers. obs.).

The forested areas along the UTR are part of the habitat of the Critically Endangered RBL. It is, therefore, important that we continue to ensure the long-term protection of these wooded areas. This is even more so after the loss of the Tagore/Lentor forest (Nature Society Singapore, 2016) that was adjacent to the state land. Even though the forests within the MINDEF state land are currently preserved for military use, they are not designated as a protected area and are still subjected to detailed planning (see Urban Redevelopment Authority, 2020). While pruning of the rain trees along UTR is necessary to ensure the safety of human and vehicular traffic, it is also important that relevant authorities see that sufficient canopy connectivity can be maintained for the safe crossing of our arboreal wildlife. The installation of artificial structures such as rope bridges, similar to the ones constructed along OUTF next to Thomson Nature Park (Mohan, 2019; Tan, 2019), can also be explored. Lastly, monitoring of wildlife such as the RBL by citizen scientists demonstrates that

collaborations between researchers and volunteers can enhance the collection of scientific data (see Kobori et al., 2016), which can better inform conservation strategies.

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