

Forest Use Types of Mammals in the Pasoh Forest Reserve and Adjacent Forest Fragments

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INTRODUCTION

Species richness and biodiversity are the most distinctive features of the tropical rain forest in Southeast Asia. Recently, however, high economic growth has caused extensive land use change (e.g. plantation, residential area), exceeding timber extraction. Thus, these forests have been disturbed on a large scale through human activities, resulting in fragmentation and internal disturbance of the remaining forests. In order to propose a wildlife conservation plan in a tropical landscape, we firstly tried to determine how forest mammals use different forest types. We focused an area which includes primary and secondary forest patches, and secondary forest fragments around agricultural fields, pastures, clearcuts, silvicultural plantations, and residential areas. We conducted camera-trapping in the Pasoh Forest Reserve and adjacent fragmented forests to reveal actual species composition of mammals in different forest types. Secondly, we also reported that invasion of domestic animals and poaching remains high in the reserve.

MATERIALS AND METHODS

To understand the main forest habitats of small to large-sized mammals, camera trapping was carried out from September to November 2002 (total 69 days) and from March 2003 to November 2004. We used cameras with a built-in infrared motion sensor, built-in flash, and an automatic quartz timer. Each camera (Sensor Camera, Fieldnote, Marif. Co. Ltd., Iwakuni, Yamaguchi, Japan) was wrapped tightly in a thin, transparent polypropylene bag to protect it from water, and the wrapped cameras were placed inside plastic boxes open to the air. Color print film (ISO 400) was used in each camera. Although Miura *et al.* (1997) and Yasuda (1998) used the fruits of over 70 tree species to focus on small frugivorous mammals, we installed the cameras on the mammal trails not to shorten the frugivorous mammals. The cameras were installed in four different forest habitats: primary forest, regenerating forest, along forest edges, and in small isolated forests. The primary and regenerating forests were inside the Pasoh Forest Reserve. Three cameras were installed in the core area of the reserve near the 50-ha permanent ecological plot. Three cameras were installed along a nature trail in the regenerating forest. Three cameras were installed along the edges of the Pasoh and Seriting forest reserves (the latter is 10 km southwest from the Pasoh reserve). Four cameras were installed in the isolated forest west of the Pasoh Forest Reserve within oil palm and rubber plantations. Films were collected and reloaded and the cameras were maintained every two to three days.

We compared the species compositions of the four forest habitats by results of camera trapping that captured mammals divided by the length of time during which the camera was installed.

Table 1 Habitat patterns of mammals in the Pasoh FR implied by the camera-trapping. -: 0 photo; +: 1~5 photos; ++: 5~10 photos; +++: 11 > photos. Camera trapping was carried out from September to November 2002 (total 69 days) and from March 2003 to November 2004. Camera trap detected mammals of 27 species, and we classified three user types: (i) general users (found in both forest fragments and Pasoh FR), (ii) forest fragment users (only found in forest fragments), (iii) forest users (only found inside Pasoh FR), and (iv) invader species (not forest mammals).

Common name	Forest fragments	Pasoh FR			Serting FR*
		Edge	Secondary	Primary	Secondary
Pig-tailed macaque	+++	+++	+++	+++	+
Wild boar (pig)	+++	+++	+++	+++	+
Crab-eating macaque	+++	++	+	+	+
Common treeshrew	+++	-	-	+	++
Spiny rat	+	-	+	+	+
i Moonrat (gymnure)	+	-	++	-	+
Short-tailed mongoose	+	-	+	+	-
Banded palm civet	+	-	+++	+	-
Long-tailed giant rat	+	-	+	++	-
Leopard cat	+	-	-	+	-
Sunda pangolin	+	-	-	+	-
Grey-bellied squirrel	++	-	-	-	-
Large Indian Civet	+	-	-	-	-
Yellow-throated marten	+	-	-	-	-
ii Banded leaf monkey	+	-	-	-	-
Masked palm civet?	+	-	-	-	-
Shrew-faced squirrel	+	-	-	-	+
Common palm civet (Toddy cat)	+	-	-	-	-
Long-tailed porcupine	-	+	++	+	-
Barking deer (Indian muntjac)	-	+	-	+	-
Lesser Malay mouse-deer	-	+	+	++	+
iii Dusky leaf monkey	-	-	+	-	-
Common porcupine	-	-	+	+	-
Banded linsang	-	-	+	+	-
Malayan tapir	-	-	-	+	-
ii Three-striped ground squirrel	-	-	-	-	++
Asiatic brush-tailed porcupine	-	-	-	-	+
Domestic cattle	-	-	-	+	+
iv Domestic dog	++	+	+	-	+

* The Serting forest reserve is 10 km southwest from the Pasoh FR.

RESULTS AND DISCUSSION

In all, 111 species belonging to 11 orders (Pholidota, Insectivora, Scandentia, Dermoptera, Chiroptera, Primates, Carnivora, Proboscidea, Perissodactyla, Artiodactyla, and Rodentia) were considered to be historically potential residents of the Pasoh Forest Reserve. Our camera trap detected mammals of 27 species. According to the results of camera trapping, we classified three user types: (i) general users (found in both forest fragments and Pasoh FR), (ii) forest fragment users (only found in forest fragments), (iii) forest users (only found inside Pasoh FR), and (iv) invader species (not forest mammals) (Table 1).

(i) General users

11 species were found in isolated forest fragments and large area forest reserve. We defined these species as general users. They were found at all of a day (Fig. 1), and considered as having diurnal and nocturnal habits. The most common species were the pig-tailed macaque (*Macaca nemestrina*), long-tailed macaque (*M. fascicularis*), and wild boar (*Sus scrofa*). More than 95% of our photographs were of these three species. The two macaque species were more frequently snapped in camera traps, which accounted for more than 90% of the photographs.

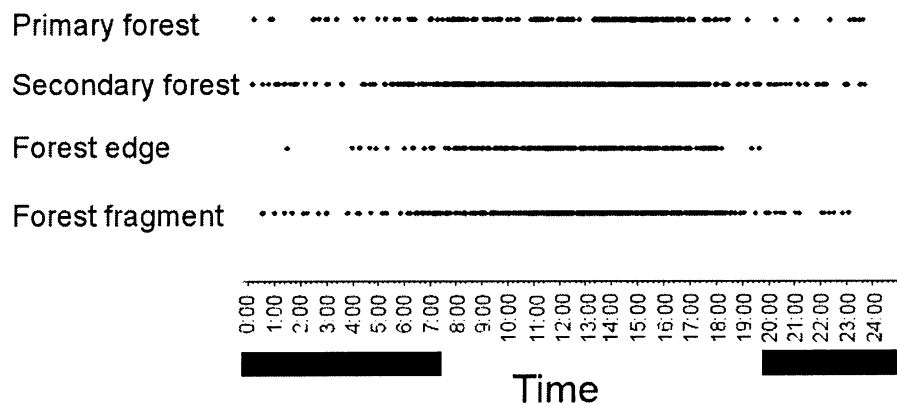


Fig. 1. Trapping time for general users (trapped at primary, and secondary forests and forest fragments). Species composition was shown in Table 1.

(ii) Forest fragment users

Of the 27 species, 7 species were found only in isolated forest fragments. As the forest fragment users, such civets, martens, squirrels were classified. In general, they are small or medium sized mammals and also have high migration ability. They were also found at all of a day (Fig. 2), and considered as having diurnal and nocturnal habits. On the other hand, a banded leaf monkey was found in an isolated forest fragment, but it is often found in Pasoh FR.

(iii) Forest users

Seven species were classified as forest users including porcupines, tapirs and deer. They were medium or large sized mammals and were often found in night time (Fig. 3). It seems likely that they have favorite forest types in the Pasoh FR. For example, Malayan tapir were found in only primary forest area of the Pasoh FR, but Malay porcupines were found in secondary forest area of the Pasoh FR.

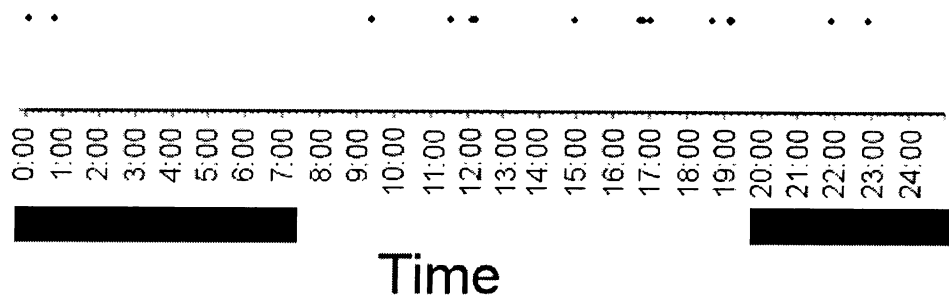


Fig. 2. Trapping time for forest fragment users (trapped at secondary forest fragments only). Species composition was shown in Table 1.

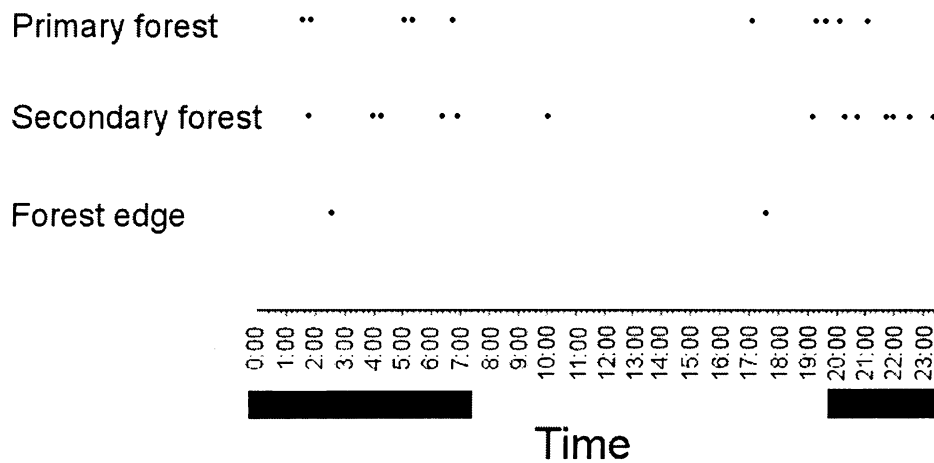


Fig. 3. Trapping time for forest users (trapped at primary, and secondary forests only). Species composition was shown in Table 1.

(iv) Invader species

We need to mention the impact of clearcutting of the oil palm plantation on the fauna of the reserve. Domestic cattle (*Bos indicus*) were observed in the primary forest (Fig. 4a), but this species does not originally live in the primary forest. This is because some domestic cattles were accidentally taken to the forest reserve by local people (Numata pers. comm.). In addition, domestic dogs were also found in the core area of the Pasoh FR (Fig. 4b). They can be an threat to forest mammals.

Concluding remarks

The camera trap is an effective tool to detect small, medium or large sized mammal species including vulnerable species in the Pasoh FR and adjacent fragmented forests. Differences in forest structure may particularly affect arboreal mammals and the insect communities that serve as the food resources for these mammals. Therefore, in order to develop plans for wildlife conservation, the effects of logging on the arboreal mammalian fauna should be considered. Such camera trapping should be combined with ecological studies of arboreal species in focal forests.

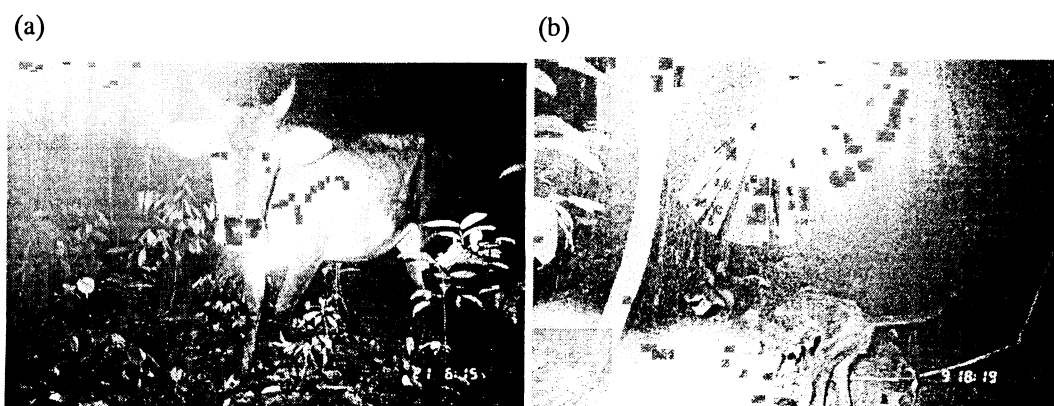


Fig. 4. Invader mammal species detected by the camera trap. (a) *Bos indicus* ; (b) Domestic dog

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RESEARCH OUTPUTS

Publications

Numata, S., Okuda, T., Sugimoto, T., Nishimura, S., Yoshida, K., Quah E. S., Yasuda, M., Muangkhum, K. and Nur Supardi, M. N. (2005) Camera trapping: A non invasive approach as an additional tool in the study of mammals in Pasoh Forest Reserve and adjacent fragmented areas in Peninsular Malaysia. *Malayan Nature Journal* 57: 29-45

Numata S. (2004) Mass flowering of dipterocarps in Peninsular Malaysia. *Flowering Newsletter* 37:32-38 (invited)

Conferences/Symposia

Numata, S. and Matsumoto, J. Reproductive phenology of tropical forests in Peninsular Malaysia: in relation to Monsoon activity. Domestic workshop on GAME for monsoon system studies, Kyoto, July 2004.

Numata, S., Yasuda, M., Nishimura, S., Yoshida, K., Okuda, T., Quah, E. S., Mazlan H., and Nur Supardi M. N. Effects of landscape change on wildlife in Malaysia: A case study in Pasoh Forest Reserve and adjacent forest fragments in Negeri Sembilan, Peninsular Malaysia. IUFRO International Workshop Landscape Ecology 2004, Tsukuba, Japan. October 2004.