

Status and Distribution of Non-volant Small Mammals in Universiti Putra Malaysia, Bintulu Sarawak Campus (UPMKB)

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ABSTRACT

This paper presents basic distribution data on non-volant small mammals derived from four sampling periods (2006-2009) in UPMKB. A total of 22 species belonging to families Tupaiidae, Sciuridae, Muridae, Viverridae, Manidae, Tarsiidae, Felidae and Cercopithecidae were captured and recorded. Planted Forest showed the highest number of species (14), followed by Nirwana Forest (11 species), Campus Zone Area (10 species), and Forestry Park (5 species). Two (2) species have been classified as Totally Protected while seven (7) species are protected under the Sarawak Wildlife Protection Ordinance, 1998. Mapping of the total area showed that the Campus Zone Area contained the highest diversity and the number of non-volant small mammals as compared to other sites in UPMKB. Thus, conservation effort of the area should be given higher priority to ensure that the biodiversity of the area is maintained.

Keywords: Distribution, mapping, non-volant small mammals, totally protected species, protected species

INTRODUCTION

The distribution of mammals, especially endangered species, has been used to justify the establishment of new conservation units (Bonvicino *et al.*, 2002). In Borneo, primates have received most attention. Several Bornean conservation units in Sarawak, such as Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park, have been established to protect the endangered primate species. Full attention given on selected flagship mammals, such as tiger, rhino and elephant, resulted in neglecting much less known species, like non-volant small

mammals (weight of < 5kg) which occur in complex communities with exceptional high species richness (Zubaid & Ariffin, 1998; Bernard, 2004; Wells *et al.*, 2004).

On the contrary, research performed on the habitat use by non-volant small mammals in Malaysia and in Borneo is still very limited. This is because the species, which are highly cryptic in their appearance and behaviour, hardly visible to the human observers, and this is also hindered by the dense and evergreen vegetation, apart from the fact that some species are active at night, hiding in burrows or tree holes during the day (Wells *et al.*, 2004).

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Beginner level of research in conserving habitat for non-volant small mammals within the university/campus areas was conducted at Universiti Putra Malaysia Bintulu Sarawak Campus (UPMKB).

The objective of this research was to explore the diversity, distribution and status of the species as UPMKB consisted of lush environment that is rich in flora and fauna. Out of the green area covering about 299.0 ha (42%), 37.3 ha was assigned for Rehabilitation of Tropical Rainforest Ecosystem Project in Sarawak, *Gmelina arborea* and *Acacia mangium* plantations (25.5 ha), oil palm plantation (51 ha), rubber estate (25 ha), Nirwana Forest (secondary forest) (60 ha) and fragments of the secondary forest (100.2 ha). The rest of the area (416.16 ha) consists of the existing and future development areas (Ong *et al.*, 2008).

Due to the large green area, less disturbed and abundance of resources such as foods and nesting areas, it is believed that UPMKB can play an important role as a green lung for Bintulu area. Therefore, determining the diversity, distribution and status of the species could help in the future implementation of proper management and conservation strategies in this area.

MATERIALS AND METHODS

The study sites include Campus Zone Area (CZA), Planted Forest (PF), Nirwana Forest (NF) and Forestry Park (FP). CZA comprised of agricultural area, plantation area, animal farm, mechanization workshop, administration and academic area, Botanical Park, as well as Biopark and waterfall area. Planted Forest covers an area of 3.4 ha, with more than 352,694 indigenous forest trees from 127 species on five planting sites with a total of 119 plots set-up (Mohamad Azani *et al.*, 2003). The Nirwana Forest is a secondary forest that is mostly dominated by species from the family, *Dipterocarpaceae*. Meanwhile, the Forest Park area covers about 40 ha of land and is considered as a lowland secondary forest.

The small non-volant mammals in all study sites were trapped using different sizes (small, medium and large) of live traps that were baited alternately with banana, coconut, jack fruit, peanut butter and chicken parts. The traps were randomly set up on the forest floor, fallen logs and branches of trees from early 2006 until January 2009. The traps were checked between 0700-0900 hours in the morning and 1700-1800 hours in the afternoon. Then, the traps were rebaited and set back at the same locations. All the captured animals were identified, weighed and measured according to the procedure by Payne *et al.* (1985) to aid positive identification. Two camera traps (namely, Digital Ranger S600 CB, and Cam Trak South, Inc., US) were set at 1.5 m above the ground during the study.

All the original sites where the animals were captured were revisited and geographically positioned using Garmin GPS Handheld receiver. In determining the distribution area of non-volant small mammals in UPMKB, their recorded data were geo-referenced and registered in ArcView GIS. Meanwhile, maps showing the locations of the occurrences of non-volant small mammals in that area were also established.

RESULTS AND DISCUSSION

A total of 152 non-volant small mammals were recorded during this study period. At the same time, eight (8) families comprising of 22 species were identified, with most of the animals caught using live traps (Table 1). The two most frequently caught species were *Callosciurus notatus* and *Rattus tiomanicus jolarensis* which accounted for 24.34% and 15.80% of all the captures, respectively. The existence of *Felis bengalensis* and *Macaca nemestrina* was recorded via camera trapping. In addition to this, three families (*Manidae*, *Tarsiidae*, and *Viverridae*) and three species (*Manis javanica*, *Tarsius bancanus* and *Viverra zanguesana*) were added to the diversity list through the observation in PF area. Eight individuals of *T. bancanus* were captured in the NF area. The animals were found trapped in the mist nets

TABLE 1

The list of non-volant small mammal's occurring at four study sites during four sampling periods from 2006 to 2009. (Conservation status: TP= Totally Protected; P= Protected; NP= Not Protected; based on Sarawak Wildlife Protection Ordinance, 1998)

No.	FAMILY/Species/Local Name	Conservation Status	N	CZA	PF	NF	FP
	TARSIIDAE						
1	<i>Tarsius bancanus</i> (Western tarsier)	TP	9	0	1	8	0
	SCURIDAE						
2	<i>Ratufa affinis</i> (Giant squirrel)	TP	2	2	0	0	0
3	<i>Callosciurus notatus</i> (Plantain squirrel)	NP	37	28	2	6	1
4	<i>Callosciurus prevostii caroli</i> (Prevost's squirrel)	NP	4	2	1	0	1
5	<i>Callosciurus adamsi</i> (Ear-spot squirrel)	NP	3	0	3	0	0
6	<i>Rhinosciurus laticaudatus</i> (Shrew-faced ground squirrel)	NP	5	1	2	2	0
	TUPAIIDAE						
7	<i>Tupaia gracilis</i> (Slender treeshrew)	P	1	1	0	0	0
8	<i>Tupaia minor</i> (Lesser treeshrew)	P	5	3	0	2	0
9	<i>Tupaia tana</i> (Large treeshrew)	P	16	5	2	1	8
	MURIDAE						
10	<i>Sundamys muelleri</i> (Muller rat)	NP	12	0	9	3	0
11	<i>Rattus tiomanicus jolensis</i> (Malaysian field rat)	NP	24	23	0	1	0
12	<i>Rattus argentiventer</i> (Rice field rat)	NP	1	0	0	1	0
13	<i>Rattus baluensis</i> (Summit rat)	NP	9	7	2	0	0
14	<i>Maxomys alticola</i> (Mountain spiny rat)	NP	2	0	1	0	1
15	<i>Maxomys rajah</i> (Brown spiny rat)	NP	8	0	0	8	0
16	<i>Rattus rattus</i> (House rat)	NP	8	6	1	1	0
17	<i>Niviventer rapit</i> (Longtail mountain rat)	NP	1	0	1	0	0
18	<i>Sundamys infraluteus</i> (Mountain giant rat)	NP	1	0	0	0	1
	FELIDAE						
19	<i>Felis bengalensis</i> (Leopard cat)	P	1	0	1	0	0
	VIVERRIDAE						
20	<i>Viverra zibetha</i> (Malay civet)	P	1	0	1	0	0
	MANIDAE						
21	<i>Manis javanica</i> (Pangolin)	P	1	0	1	0	0
	CERCOPITHECIDAE						
22	<i>Macaca nemestrina</i> (Pig-tailed macaque)	P	1	0	0	1	0
	Total species, s		22	10	14	11	5
	Total individual, N		152	78	28	34	12

which were used to capture bats. Giant squirrel, *Ratufa affinis*, was only recorded in the CZA through the observation.

From the results, fourteen species of non-volant small mammals were recorded in the PF area, followed by the NF area (11 species), CZA (10 species) and five species were observed in the FP area. In term of diversity indices (Table 2), the results indicated that the total of species was quite different in all the study sites based on the richness index R1. As for species evenness, the distribution of the individuals among the species was shown to be uneven in FP (E=0.69), CZA (E=0.72) and PF (E=0.86) compared to NF (E=0.94). Based on Hill's diversity index, the number of abundant (N_1) and very abundant species (N_2) was respectively higher in PF compared to the other sites. Meanwhile, the Shannon-Weaner diversity index further indicated that species composition was higher in PF (H=2.30), followed by NF (H=2.05), CZA (H=1.74) and FP (H=1.1). This result is similar to that of Wells *et al.* (2006) who found that the diversity of small mammals was significantly reduced in secondary forest with common species recorded in all the study sites.

TABLE 2
Diversity indices of the species of non-volant small mammal at four study sites; Campus Zone Area (CZA), Planted Forest (PF), Nirwana Forest (NF) and Forestry Park (FP)

Indices	Study sites			
	CZA	PF	NF	FP
Species Richness				
No	10	14	11	5
R1	2.07	3.9	2.84	1.61
Species Diversity				
H'	1.74	2.31	2.05	1.10
N_1	5.71	10.08	7.79	3.00
N_2	4.40	8.79	7.38	2.36
Species Evenness				
E	0.72	0.86	0.94	0.68

No = Total number of species; R1 = Margalef index; H = Shannon index N_1 = Measures the number of abundant species present; N_2 = Measures the number of very abundant species; E = Evenness indices

Approximately 8.7% (2 species) of the total non-volant small mammals recorded in this study are totally protected, 30.4% (7 species) are protected, while the remaining are listed in the non-protected status under Sarawak Wildlife Protection Ordinance, 1998.

One of the totally protected species, *T. bancanus*, was captured in NF as well as observed in PF. This species is known as arboreal which uses trees as feeding or sleeping sites (Yustian *et al.*, 2008); it was also found in higher estimated population density in forest with small-scale interspersed plantation (Merker & Muehlenberg, 2000). Therefore, NF and PF can be suggested as suitable places for their habitat as these forests are dominated by a variety of tall tree species with small scale interspersed trees that can facilitate their foraging and sleeping activities. Thus, the two sites are important as tarsier conservation areas in UPMKB.

The other totally protected species, i.e. *Ratufa affinis*, was only recorded in Botanical Garden in CZA. According to Payne *et al.* (1985), *R. affinis* is active in tall trees and descending to the ground only. In the observation carried out in this study, *R. affinis* was found foraging and nesting at the top of big and tall *Acacia mangium* tree in the Botanical Garden as it adapted to the fragmented forest which is buffered by lower secondary forest (Forestry Park) nearby.

Felis bengalensis, *Viverra zangalunga* and *Manis javanica* confirmed present in PF through photographic results of camera trapping and via direct observation. The presence of these species in PF reflects their ecological and habitat adaptation. *F. bengalensis* usually occur in forest and gardens and can also be present in plantations, as they are agile and elusive and have adapted well to their environment (Krieger, 2007). Meanwhile, *V. zangalunga* can occur in the forest and cultivated lands which are adjacent to the forest. *M. javanica*, on the other hand, always recorded the presence in tall and secondary forests, as well as from the cultivated area including gardens (Payne *et al.*, 1985).

Unlike Plantain squirrel, Ear-spot squirrel (*Callosciurus adamsi*) can only be found in PF.

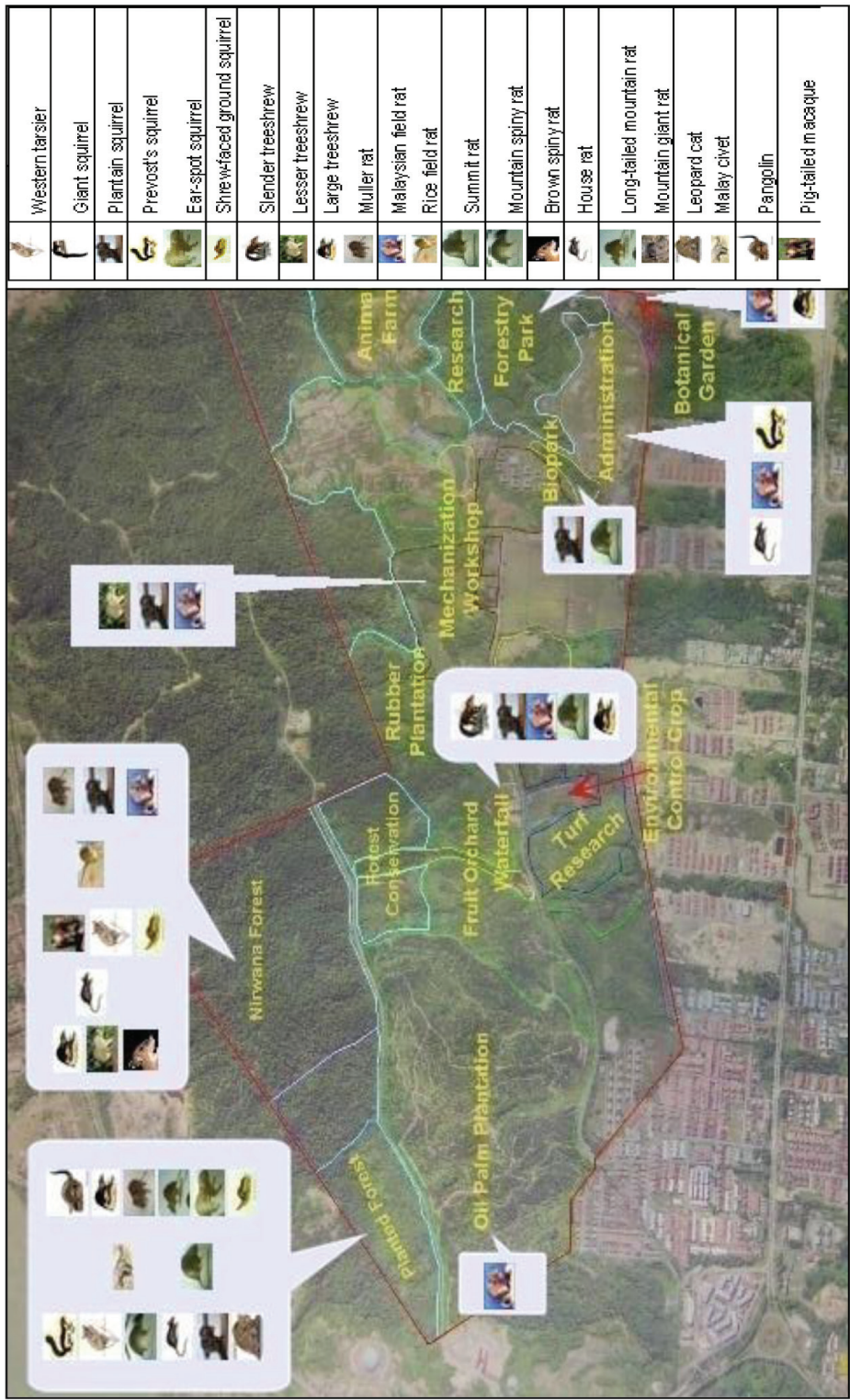


Fig.1: A mapping distribution of non-volant small mammal species in UPMKB; Campus Zone Area, Planted Forest, Nirwana Forest and Forestry Park

This species is particularly active in small trees (Payne *et al.*, 1985) and some part of PF consists of this type of habitat. Meanwhile, *Tupaia gracilis* was recorded in the forest area, as well as gardens and plantations (Payne *et al.*, 1985), suggesting that this particular species could adapt to the disturbed habitats such as CZA. *Rattus argentiventer* and *Maxomys rajah* were trapped in NF. According to Nowak (1991), *R. argentiventer* resides in cultivated areas, such as rice field and grasslands and they are dependent on rice fields and plantation. The presence of this species at NF may be due to the habitat edge effect as NF is located near oil palm plantation. Meanwhile, *M. rajah* occurs predominantly in tall secondary forest and their diets are almost identical (Payne *et al.*, 1985; Wells *et al.*, 2006). *Niviventer rapit* has been found in PF as this species is active in small trees (Payne *et al.*, 1985).

Pig tailed macaque, known as *Macaca nemestrina*, was recorded by the infrared censored camera in NF and this particular species was commonly encountered near the forest fringes and while crossing the road to the oil palm plantation during the day. This species is usually found in hilly forests, and they sometimes enter plantations or gardens that are located adjacent to lowlands forest where they cause considerable damages to grain and fruit crops (Payne *et al.*, 1985). This result is also supported by the finding of an earlier study which suggested that *M. nemestrina* spends substantial time on the ground compared to the species of other primates (Mohd Azlan, 2006).

CONCLUSIONS

Mapping distribution of non-volant small mammals has revealed that UPMKB has a potential to be used as a suitable buffer zone; this is particularly because as the planted forest, the rehabilitated forest has been found to be rich in species diversity and all the hot spots highlighted on the map should be monitored, protected and managed according to the development plans set for the campus development.

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