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Introduction

Peat swamp forest is one of the unique ecosystems in Southeast Asia, distributing mainly in Sumatra, Borneo and New Guinea (Whitemore 1984). While the floral composition of peat swamp forest has been relatively well studied (Anderson 1961; Bruenig 1990; Posa et al. 2011), the faunal composition has not much studied yet (Whitemore 1984; Gaither Jr. 1994).

Because of the low nutrient content of the peat soil and the low primary productivity, the diversity and abundance of animals in peat swamp forest was considered low (Janzen 1974; Whitten et al. 2000; Posa et al. 2011). However, recent studies showed certain species in peat swamp area were rather abundant. Johnson et al. (2005) and Quinten et al. (2011) indicated that the densities of orangutan and other several species of primate in some peat swamp forests in Borneo and Sumatra were higher than those in adjacent lowland dipterocarp forests. Gaither Jr. (1994) also detected that some understory bird species were more abundant in peat swamp forest of Borneo, although the diversity and total abundance were generally lower.

While the species diversity is low, peat swamp forests have been refuges for various endangered species from lowland forests, which are under greater pressures from logging, hunting and development (Yule 2010). However, the peat swamp forest is now exploited by migrants and concession holders, and converted into large-scale oil palm and acacia plantations (Uryu et al. 2008; Corlett 2009). Some native animals of peat swamp forest may be able to survive in such new habitats (Meijaard et al. 2010), but serious impact on biodiversity may happen as reported in lowland forests in the region (Davies et al. 2001; Chung et al. 2000; Tsukamoto and Sabang 2005; Fitzherbert et al. 2001).

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Giam Siak Kecil and Bukit Batu are unique areas in Riau, Sumatra, Indonesia, which has been declared as a “Biosphere Reserve” by UNESCO in 2009. This Giam Siak Kecil-Bukit Batu Biosphere Reserve (GSK-BB) has an area of 1,787 km² and embraces different land use types on the vast tropical landscape which is dominated by peat land. The reserve is divided into three zones, i.e. Core Area, Buffer Zone and Transition Area (Figure 1). The major part of Core Area is two wildlife reserves that are managed by the Indonesian Forest Department, namely Giam Siak Kecil Wildlife Reserve and Bukit Batu Wildlife Reserve. The other part of the Core Area is protected area (“Kawasan Lindung”) of surrounding industrial tree plantation (“Hutan Tanaman Industri” or “HTI”). The Buffer Zone is mostly managed by four industrial tree plantations under Sinar Mas Forestry. *Acacia mangium* and *Eucalyptus pellita* are planted in the Giam Siak Kecil area and *Acacia crassicarpa* are planted in the Bukit Batu area to supply timber for pulp and paper production by Asia Pulp and Paper. The outmost Transition Area is mostly owned and managed by smallholders as small-scale plantations of oil palm and rubber and for other agricultural purposes.

In this study, we aim to assess and evaluate the status of the species composition of mammals and birds in the different land use types on the peat land in Bukit Batu area of GSK-BB. Mammals and birds are faunal groups commonly used as “flag species” for forest management and conservation (Jonsson and Villard 2009; Roberge and Angelstam 2009).

**Study area**

Bukit Batu area is north-eastern part of GSK-BB. This area is located by the Strait of Malacca, in Bengkalis Regency of Riau Province, Indonesia (Figure 2). The area is about 800 km². The climate of the area belongs to the Zone D (Oldeman *et al.* in Whitten *et al*. 2000), which has three to four consecutive wet months and two to six consecutive dry months. The average annual rainfall in Bukit Batu is about 2000 mm (the average during the last 5 years was 2018.2 mm); the minimum air temperature ranges 23-24 °C and the maximum level ranges 31-33 °C, while the air humidity is always beyond 80% (PT. BBHA 2011, unpublished data).

The major land use types in this area during the study period (2010-2011) are (1) natural peat swamp forest in Core Area, comprising Bukit Batu Wildlife Reserve and the protected areas within surrounding industrial tree plantations (HTI), (2) planted acacia forest in two industrial tree plantations in Buffer Zone, namely PT. Bukit Batu Hutani Alam (BBHA) and PT. Sakato Pratama Makmur (SPM), and (3) agriculture area in Transition Zone. The natural peat swamp forests in Core Area are in both unlogged and logged conditions, but partly include sparse bush or grassland and rubber stands planted along lower stream of the Bukit Batu River. The Bukit Batu Wildlife Reserve was gazetted in 1986.
(SK.MENHUT No. 173 / KPTS-II / 1986) and in 1999 (SK.MENHUT BUN No. 482 / KPTS-II / 1999), but the riverside forest along the lower Bukit Batu River was heavily logged illegally from 2000
to 2009. The tree spices planted in Buffer Zone is mostly *Acacia crassicarpa*, which is suitable species
for swampy soil. There is a network of canals in this plantation that was constructed for water
management and water ways. PT. BBHA and PT. SPM manage a total concession area of 460 km² and
322 km², respectively. The acacia trees are planted in as large as 264 km² (57.3%) and 224 km²
(69.5%), while protected area ("Kawasan Lindung") is established in 104 km² (22.6%) and 34 km²
(10.7%) in the areas of PT. SPM and PT. BBHA, respectively. The acacia trees are harvested in five
years, and nearly 50 km² of planted acacia forest is harvested every year in each plantation. The Buffer
Zone was formerly used for selective logging until 1998 and then converted to the industrial tree
plantations since 1999. Land use types in Transition Area are smallholder oil palm plantation, rubber
garden and rubber jungle, home garden, paddy field, secondary forest dominated by *Macaranga* spp.,
and degraded bush. Most of the residents are Malay and Javanese who inhabit in this area by the 18th
century at the latest. Northern part of the Transition Area has been burned out repeatedly, and most of
the areas are still abandoned as degraded bush.
Figure 1. Remaining natural forests in Sumatra and location of Giam Siak Kecil-Bukit Batu Biosphere Reserve (red square) and Bukit Batu area (black square).

Figure 2. Bukit Batu area. Red lines indicate the border of the two industrial tree plantations (HTI), whereas green line indicates the border of the Core Area. Areas surrounded by yellow lines are protected area (“Kawasan Lindung”) of the HTI. There are several villages (red circle) along the coast.
Figure 3. Major vegetation types in study area. (From top left) Primary (A) and logged (B) natural forest in the Wildlife Reserve, protected area (C) and planted acacia forest (D) in industrial tree plantation (HTI), resident areas of Desa Sukajadi (E) and Desa Temiang (F).
Methods

Mammal surveys

1. Camera trapping for large mammals
Inventory of middle and large-sized terrestrial mammals was conducted using camera-trap. We chose four plots in the natural peat swamp forest in Bukit Batu Wildlife Reserve, three plots in protected areas within the industrial tree plantation, and three plots in the planted acacia forest (Figure 4). In each plot, we selected five random points inside 500m radius circle and set automatic digital cameras with infrared sensor (Bushnell Trophy Cam, Model 119435) at each point. A camera was set on a tree, 50-100 cm above the ground. The field-of-view of a camera was 2-7 m². The batteries and memory cards were changed every 3-5 months. The recorded animals were identified based on Payne et al. (2005), Duckworth et al. (2009), Sunquist and Sunquist (2002), and Wilson and Mittermeier (2009). The cameras were set from November 2010 to October 2011. The total working camera-days were 671-1316 camera-days in each plot.

![Figure 4](image)

**Figure 4.** Study site of mammal camera trapping. Yellow dots indicate plots in which five camera points were set randomly.

2. Live trapping and mist-netting for small mammals
Non-volant small mammals such as rats, squirrels, and treeshrews have been surveyed using live traps in protected areas in the industrial tree plantations in April 2011. Volant mammals, particularly bats were trapped using mist nets in the protected area and the Wildlife Reserve in April and October 2011 (Figure 5). The live trap was a wire cage measuring 25 cm x 10 cm x 10 cm, with a baited hook connected to the door. We used fried coconut smeared with peanut butter as bait to attract animals. We
established two line-transects and placed 25 baited traps on each transect with interval of 10-15 m. Traps were checked every day in the morning and the baits were replaced when necessary. Each transect was surveyed for eight consecutive nights. The mist-net we used was 12 m long, 2.6 m high and has mesh sizes of 34 and 36 mm. It was supported with 4 shelves and operated at ground level (Figure 6). Four mist-nets were set up at two points in protected area for eight nights and four mist-nets were set up at one point in the Wildlife Reserves for one night. The mist-nets were checked in the morning (at about 6:30 am) and in the evening (between 7:00 to 10:00 pm).

Trapped animals were taken to the camp for detailed examination. Each individual was given identification number, weighed, and measured. The measurements taken for ground and arboreal small mammals were head and body length, ear length, tail length, and hind foot. For bats, we measure the forearm length and tibia length. Immediately after the identification and measurement, most individuals were brought back to the respective capture site and released. Several individuals were taken to Cibinong and processed as scientific museum specimens. These specimens were kept in 8% formaldehyde, but the livers were taken out and preserved separately in 96% ethanol (pro-analysis) for further genetic studies. All voucher specimens are now deposited at the Division of Zoology, Research Center for Biology, Indonesian Institute of Sciences at Cibinong.

Figure 5. Study site of live trapping (blue triangle) and mist-netting (red star).
3. Observation and Interview
Most mammal species of tropical forest ecosystems are difficult to observe directly, since they are sparse, relatively not abundant, very elusive and nocturnal. We therefore combined our trapping effort with indirect observation based on footprint, marking, feces, and other signs, and interview with local people of Desa Temiang.

Bird Surveys
1. Point-counting
Direct observation of bird using point-count method was conducted along twelve transects. There were three transects in the Wildlife Reserve, planted acacia forest, rubber jungle and residential area respectively (Figure 7). Four points were set at interval of 250 m along each transect and every bird species that was seen or heard within 25 m radius for 20 minutes were record. At each point, survey was done in the morning (6:00-10:00) and in the evening (14:00-18:00). The survey was conducted in March, May, and October 2011.

Figure 6. A series of five mist-nets set in the protected area of HTI.
Figure 7. Study site for bird survey by point counting. Green hexagons indicate transects with four observation points.

2. Mist-netting

Mist-nets were also used to record understory bird communities. We set up 14 mist-nets in the protected area of HTI in April 2011 and 20 mist-nets in the Wildlife Reserves in October 2011. The mist-nets were operated for three days in each observation site. The mist-nets were checked every hour from about 5:30 to 17:00. Caught birds were identified, measured, photographed, ringed and released. For future identification purpose, we attached metal ring with identification number on it (Figure 8).

Figure 8. Metal ring with specific code was attached on bird tarsus

Nomenclature

Mammals

Identification and taxonomical order followed Francis (2008), Rowe (1996), and Payne et al. (2005)

**Birds**


**Results and Discussion**

**Mammals**

In total, 19 species of middle and large-sized mammals were detected using camera trapping, and five species (mostly primates) were observed directly and eight species were caught by live trapping and mist-netting. In addition, even though we could not find direct clue of the presence in this study, the inhabitation of Sumatran Tiger (*Panthera tigris sumatrae*) in this area was no doubt as locals and plantation workers informed. Among the detected species, Hairy-nosed Otter (*Lutra sumatrana*) is a new distribution record of the species.

There were several middle mammal species whose inhabitances are not confirmed; Western Tarsier (*Tarsius bancanus*), White-thighed Surili (*Presbytis siamensis*), Siamang (*Symphalangus syndactylus*) and Fishing Cat (*Prionailurus viverrinus*). Further study is necessary on these species. Comparing with camera-trapping, the efforts made for live trapping (400 trap nights) and mist-netting (68 mist-net days) were insufficient; therefore more small mammal species are expected to be discovered if we continue the survey.

Giesen and Balen (1991) conducted biodiversity survey in Giam Siak Kecil Wildlife Reserve of GSK-BB where mineral soil is more dominant. In comparison with their findings, we did not detect Sambar Deer (*Rusa unicolor*), Asian Elephant (*Elephas maximus*), and Tapir (*Tapirus indicus*) in this study area. It is also notable that we did not detect other common species in Sumatra such as Barking Deer (*Muntiacus* sp.) and Porcupine (*Hystrix brachyura* and *Trichys fasciculata*). Peat swamp forest is considered to be not good habitat for these species.

In this study, species composition in planted acacia forest was quite different from that in natural peat swamp forest, despite the fact that they stood side by side. Among the 19 species we detected by camera-trapping, 13 species were detected only in natural forest (Wildlife Reserve and protected area), while species detected only in acacia forest is only Common Palm Civet (*Paradoxurus hermaphroditus*). The species that were detected only in natural forests include many endangered and elusive species such as Sun Bear (*Helarctos malayanus*), Clouded Leopard (*Neofelis diardi*) and
Marbled Cat (*Pardofelis marmorata*), indicating the irreplaceable value of the remaining natural forest.

**Birds**

A total of 172 species of birds was recorded from 204 mist-net days, 3,720 minutes of point count survey, camera-trapping and other observations. It covers 43.3% of 397 resident bird species recorded in Sumatra (MacKinnon and Phillipps 1993).


There was a significant difference of bird species composition between the natural peat swamp forest (Wildlife Reserve and protected area) and the artificially-modified vegetation (planted acacia forest, rubber jungle and resident area). The distinctive species groups in natural forest were Trogons (*Harpactes* spp.), Leafbirds (*Chloropsis* spp.), some Bulbuls (*Setornis criniger, Trcholestes criniger, Ixos malaccensis*), many kinds of Babblers (*Pellorneum capistratum, Trichastoma* spp., *Malacocincla* spp., *Malacopteron* spp., *Stachyris* spp.), and Flycatchers (*Rhinomyias umbratilis, Philentoma pyrhoptera*). Natural peat swamp forest was also home to some winter migrant visitor as *Ficedula zanthopygia, Pericrocotus divaricatus* and *Phylloscopus borealis*. By contrast, the bird fauna in planted acacia forest, rubber jungle and village were more characterized by some open land Bulbuls (*Pycnonotus aurigaster and Pycnonotus goiavier*), Prinias (*Prinia* spp.), and Munias (*Lonchura* spp.). In addition, winter migrant visitor, *Pernis ptilorhynchus* was present mainly in resident area, where it was seen in sheer numbers (more than 100 individuals per day) in March and October. This species is known to pass Rupat Island, north of Bukit Batu area, during their migration (Sukmantoro 2006), and it appeared that Bukit Batu was also situated in their migration route. Some Kingfishers (*Alcedo meninting, Pelargopsis capensis* and *Halcyon smyrnensis*) seem to be more associated with acacia forests and village areas, where they could hunt small fish and other aquatic animals in canals and ponds. The species that were common in all land-use types were Blue-eared Barbet (*Megalaima australis*), Cream-vented Bulbul (*Pycnonotus simplex*), and Red-eyed Bulbul (*Pycnonotus brunneus*).

Compared to the species list in Giam Siak Kecil Wildlife Reserve by Giesen and Balen (1991), 91 species out of the 172 species detected in this study were not recorded by them; these species were
mostly forest species such as Hornbills, Trogons, Babblers, and Bulbuls. On the contrary, 42 species out of 121 species they detected were not observed in our study site; they were mostly raptors, water birds and open-habitat species. We did not encounter water birds as Milky Stork, Storm’s Stork and Lesser Adjutants; possibly because we focused more on the terrestrial habitat, where such species were less likely to be spotted. However, the possibility of the effect of habitat degradation during the last two decades in this area on these endangered species should also be considered. Continuous survey in the Giam Siak Kecil and Bukit Batu area will help to clarify this point.

Danielsen and Heegaard (1995) recorded 192 bird species in primary and disturbed forest on mineral soil in Bukit Tigapuluh area, in the southern part of Riau. Comparing with their result, it seems that some common or not uncommon species out of the 192 species they detected were absent in our study area. The possible reasons of the lack of the species could be (1) the limited effort of our field survey, (2) differences of observers, (3) habitat degradation, and (4) ecological and environmental factors of peat swamp ecosystem. The third and fourth points suggest the importance to understand biodiversity in peat land ecosystems and its response to human disturbance.

Conclusion

Although Bukit Batu area seems to lack some part of common species, we conclude that the natural forest in the Core Area is the home of many forest-dependent mammal and bird species, some of which are at a risk of population decline. Considering that the land uses in surrounding landscape are changing rapidly, there is an urgent need to conserve the forest in the Core Area and to study further about the function and resilience of peat swamp forest ecosystem.

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List of recorded mammals and birds

Mammals

Observed mammal species are listed below with scientific name, English name, distribution, endangered status on IUCN Red List 2011 (IUCN 2011) and some comments on the status of the species in the study area. Detailed presence / absence data is shown in Appendix 1. The species ID in the following section is identical to the ID in Appendix 1.

Family ERINACEIDAE

1. *Echinosorex gymnura*
   - Moonrat
   - Distribution: Burma, Peninsular Thailand and Malaysia, Sumatra, and Borneo
   - Endangered status: Least concern

   Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve).

Family SORICIDAE

2. *Crocidura monticola*
   - Sunda Shrew
   - Distribution: Indonesia, and Malaysia
   - Endangered status: Least concern

   Taken by live trap in natural forest (the protected area).
Family TUPAIIDAE

3. *Tupaia glis*
   Common Treeshrew
   Distribution: Indonesia, Malaysia, and Thailand
   Endangered status: Least concern
   Taken by live-trap in natural forest (the protected area).

Family PTERROPODIDAE

4. *Cynopterus brachyotis*
   Short-nosed Fruit bat
   Distribution: China, India, Laos, Myanmar, Sri Lanka, Thailand, Viet Nam, Malaysia, Singapore, Sumatera, and Sulawesi
   Endangered status: Least concern
   Taken by mist-net in natural forest (the protected area and the Wildlife Reserve).
5. *Balionycteris maculata*
   Spotted-winged Fruit bat
   Distribution: Indonesia, Malaysia, and Thailand
   Endangered status: Least concern
   Taken by mist-net in natural forest (the protected area and the Wildlife Reserve).

6. *Manis javanica*
   Sunda Pangolin
   Distribution: Myanmar, Thailand, Laos, Vietnam, Cambodia, Peninsular Malaysia, Sumatra, Java and Borneo
   Endangered status: Endangered
   Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve).
Family LORISIDAE

7. *Nycticebus coucang*
   Slow Loris
   Distribution: Peninsular Malaysia and Sumatra
   Endangered status: Vulnerable
   This species is arboreal. One accidental photo was taken and also directly observed in natural forest (the protected area).

   ![Image of Nycticebus coucang]

   *Tarsius bancanus*?
   Western Tarsier
   Distribution: South Sumatra and Borneo
   Endangered status: Vulnerable
   One of the authors (YSF) heard a sound like this species in natural forest (the protected area). The local also informed their inhabitance in natural forest. Further study is necessary to confirm their inhabitance. According to IUCN (2011), the species is only known in Southeastern Sumatra and Bangka Island.

Family CERCOPITHECIDAЕ
8. *Presbytis femoralis percura*
   
   Banded Langur / Banded Surili
   
   Distribution: Endemic to Riau (between the Rokan and Siak River)
   
   Endangered status: Near threatened
   
   This species are arboreal. Three accidental photos were taken only at one camera setting-point in the protected area. One of the authors (AM) saw this species a few times in village area (Along the course Bukit Batu River, from the village to the border of BBWR and in rubber jungle in Temiang and Bukit Batu).
   
   Because their distribution range is very small and GSK-BB Biosphere Reserve is the main natural forest in it, this Biosphere Reserve is very valuable to population viability of this species.

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9. *Presbytis siamensis*?
   
   White-thighed Surili
   
   Distribution: Peninsular Malaysia, and Sumatra
   
   Endangered status: Near threatened
   
   One of the authors (YSF) observed a monkey like this species and took a picture in a rubber forest in village area. However, that individuals might be a *Presbytis femoralis percura*. Anothor author (AM) never observed this speices during his stdy in this area for a several years. Futhere study is neccesary to confirm the presence of this spices in this area. According to IUCN (2011), the know distribution range of this spices in Sumatra is east of the Siak river and does not include this area.

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9. *Trachypithecus cristatus*
Silvery Lutung
Distribution: Peninsular Malaysia, Sumatra, and Borneo
Endangered status: Near threatened
Directly observed in natural forest (the protected area) and a rubber forest in village area. One of the author (AM) also saw a dead one hit by a car on Bukit Batu road.

10. *Macaca fascicularis*
Long-tailed Macaque / Crab-eating Macaque
Distribution: Laos, Myanmar, Thailand, Cambodia, Viet Nam, Peninsular Malaysia, Singapore, Sumatera, Java, Nusa Tenggara, Borneo, and Philippine
Endangered status: Least concern
Directly observed in natural forest (the protected areas) and in a rubber forest in village area.

11. *Macaca nemestrina*
Southern Pig-tailed Macaque
Distribution: Peninsular Malaysia, Sumatra and Borneo
Endangered status: Vulnerable
Recorded by camera-trap in all three habitats. Directly observed also in the protected area and village area.

12. *Hylobates agilis*
Agile Gibbon
Distribution: Peninsular Malaysia, and Sumatra
Endangered status: Endangered
Directly observed in natural forest (the protected area of Humus).

_Symphalangus syndactylus?
_Siamang
Distribution: Peninsular Malaysia, and Sumatra
Endangered status: Endangered
An assistant of one of the authors (YSF) observed a monkey like this species in natural forest (the protected area of Makmur). However, another author (AM) never observed this species during his study in this area for several years even though he studied mostly in the village area. Further study is necessary to confirm the presence of this species in this area.

**Family MANIDAE**

13. *Ratufa affinis*
_Pale Giant Squirrel_
Distribution: Peninsular Malaysia, Sumatra, and Borneo
Endangered status: Near threatened
Direct observation in natural forest (the protected area).

14. *Petinomys setosus*
_Termminck’s Flying Squirrel_
Distribution: Peninsular Malaysia, Sumatra, and Borneo
Endangered status: Vulnerable
Taken by mist-net accidentally in early morning in natural forest (the protected area).

**Family MURIDAE**
15. **Sundamys sp.**

Sundamys

Taken by live-trap in natural forest (the protected area).

This species is difficult to identify.

![Sundamys sp.](image)

16. **Maxomys whiteheadi**

Whitehead’s Spiny Rat

Distribution: Peninsular Malaysia, Sumatra, and Borneo

Endangered status: Vulnerable

Taken by live-trap in natural forest (the protected area).

![Maxomys whiteheadi](image)

17. **Maxomys sp.**

Spiny Rat

An individual was taken by live-trap in natural forest (the protected area). This individual is still in analysis to identification.
Family URSIDAE

18. *Helarctos malayanus*
   Sun Bear
   Distribution: Myanmar, Thailand, Cambodia, Laos, Vietnam, Yunnan, Peninsular Malaysia, Sumatra and Borneo
   Endangered status: Vulnerable
   Recorded by camera trap mostly in natural forest (the protected area and the Wildlife Reserve). Footprints and ex-bedding site (a big hole of tree with footprints and urine) were also observed in natural forest (the protected area).

Family MUSTELIDAE

19. *Mustela flavigula*
   Yellow Throated Marten
   Distribution: China, Korea, Nepal, India, Myanmar, Thailand, Cambodia, Laos, Vietnam, Peninsular Malaysia, Sumatra, Java and Borneo
   Endangered status: Least concern
   Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve). Directly
observed in rubber jungle and smallholder’s oil palm plantation.

20. *Lutra sumatrana*
   Hairy-nosed Otter
   Distribution: Myanmar, Cambodia, Vietnam, Peninsular Thailand and Malaysia, South Sumatra, Borneo
   Endangered status: Endangered
   New distribution record
One of the authors (AM) observed a dead individual on Bukit Batu road. Because this species is an endangered species and very little is known about the ecology, further study is necessary.

21. *Viverra tangalunga*
   Malay Civet
   Distribution: Peninsular Malaysia, Sumatra, Java, Borneo, Philippine and Sulawesi.
   Endangered status: Least concern
   Recorded by camera-trap in all three habitats.
22. *Arctogalidia trivirgata*
Small-toothed Palm Civet

Distribution: Myanmar, Thailand, Cambodia, Laos, Vietnam, Yunnan, Peninsular Malaysia, Sumatra and Borneo

Endangered status: Least concern

Only two records in the Wildlife Reserve. Some photos were difficult to distinguish with *Paradoxurus hermaphroditus*.

23. *Paradoxurus hermaphroditus*
Common Palm Civet

Distribution: India, Bangladesh, China, Myanmar, Thailand, Cambodia, Laos, Vietnam, Yunnan, Peninsular Malaysia, Sumatra, Borneo, Java and Philippines

Endangered status: Least concern

Only 3 photos were taken in Acacia forest. Some photos were difficult to distinguish with *Arctogalidia trivirgata*.
24. *Arctictis binturong*  
Binturong  
Distribution: India, Bhutan, China, Myanmar, Thailand, Cambodia, Laos, Vietnam, Yunnan, Peninsular Malaysia, Sumatra, Borneo, West Java and Palawan  
Endangered status: Vulnerable  
Only one photo in natural forest (the protected area).

25. *Hemigalus derbianus*  
Banded Palm Civet  
Distribution: Peninsular Malaysia, Sumatra and Borneo  
Endangered status: Vulnerable  
Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve).
26. *Prionodon linsang*
   Banded Linsang
   Distribution: Malay Peninsula, Sumatra, Borneo and patchily in Java
   Endangered status: Least concern
   Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve).

27. *Herpestes brachyurus*
   Short-tailed Mongoose
   Distribution: Malay Peninsula, Sumatra, Borneo and Palawan
   Endangered status: Least concern
   Recorded by camera-trap only in natural forest (the protected area).

Family FELIDAE

28. *Neofelis diardi*
   Sunda Clouded Leopard
   Distribution: Sumatra and Borneo
   Endangered status: Vulnerable
   Recorded only one photo by camera-trap in the Wildlife Reserves.
29. *Panthera tigris sumatrae*
   Sumatran Tiger
   Distribution: Sumatra
   Endangered status: Critically endanger

Sumatran Tiger were seen by laborers when they harvested the acacia trees (one individual in the night and 2 cubs in afternoon) when one of the authors (YSF) stayed in the area. However, because they were not detected by camera-trap in spite of our huge study effort (10,988 camera-days in total), the population density is considered very low.

30. *Pardofelis marmorata*
   Marbled Cat
   Distribution: Nepal, India, China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malay Peninsula, Sumatra and Borneo
   Endangered status: Vulnerable

Recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve).

31. *Prionailurus bengalensis*
   Leopard Cat
   Distribution: Nepal, India, China, Korea, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malay Peninsula, Sumatra, Borneo, Java and Philippines
   Endangered status: Least concern
Recorded by camera-trap in all three habitats. A dead individual was observed on Bukit Batu road.

*Prionailurus viverrinus?*

Fishing Cat

Distribution: Nepal, India, Myanmar, Thailand, Laos, Cambodia, Vietnam and Java

Endangered status: Endangered

The presence of fishing cat in Sumatra is questionable (Duckworth *et al.*, 2009) and no photo of fishing cat was taken by camera-trap. However, feces of wild cat with fish scales were founded along a canal, suggesting the presence of this species. Further research is necessary.

**Family SUIDAE**

32. *Sus scrofa & Sus barbatus oi*

Wild Boar & Bearded Pig

Distribution: Europe, mainland Asia, Sumatra and Java (*S. scrofa*), Malay Peninsula and Sumatra (*S. barbatus oi*)

Endangered status: Least concern (*S. scrofa*) & vulnerable (*S. barbatus oi*)

Wild Pig was the most frequently photographed animal in this study area. It was fairly common in all types of land use surveyed in this study. However, in some pictures, it was difficult to identify the species. There were individuals in the pictures that could be readily identified either as the common Wild Boar *Sus scrofa* or the rarer Bearded Pig *Sus barbatus oi*. Other individuals showed similarities
with both. We suspect, they were probably the hybrid between both species. However, there is so far no report about natural hybridization between them in the wild, although it did happen in captivity.

Local people distinguished two types of Wild Pig, namely “Celeng” and “Nangor”. The “Celeng” which is rather smaller and has greyish hide with black fur, could be found everywhere in the area, particularly in gardens and agricultural sites. The “Nangor” which is slightly bigger and has lighter hide with brownish fur, is more likely to be encountered in forested sites. The former and the latter are believed to correspond Sus barbatus and Sus scrofa, respectively.

In addition, local people also mentioned about “Babi Bakau” which literally means “Mangrove Pig”. According to their description, it looked very much like the “common wild pig” or S. scrofa, but much smaller in size. Some said the adult “Babi Bakau” is only about ¾ the size of adult S. scrofa. If the description of the locals was correct, then there might be a ‘variant’ of S. scrofa that is specially adapted to mangrove habitat. Being smaller (and lighter) could be more advantageous in such muddy habitat full of entangling roots. However, this information deserves further verifications.
Family TRAGULIDAE

33. Tragulus kanchil
   Lesser Mouse-deer
   Distribution: Myanmar, Thailand, Laos, Cambodia, Vietnam, Malay Peninsula, Sumatra and Borneo
   Endangered status: Least concern

Two species of mouse-deer (*T. kanchil* and *T. napu*) distribute in Sumatra, but only *T. kanchil* was recorded by camera-trap only in natural forest (the protected area and the Wildlife Reserve). Their footprints were also detected in natural forest (the protected area).
Birds

Observed bird species are listed below with scientific name, English name, Indonesian name, and endangered status on IUCN Red List 2011 (IUCN 2011). Detailed presence / absence data is shown in Appendix 2. The species ID in the following section is identical to the ID in Appendix 2.

HERONS (FAMILY ARDEIDAE)
/ CANGAK

1. *Ardea sumatrana*
   Great-billed Heron  Cangak laut  Least Concern

2. *Ardea purpurea*
   Purple Heron  Cangak merah  Least Concern

3. *Butorides striata*
   Striated Heron  Kokokan laut  Least Concern

4. *Ixobrychus sinensis*
   Yellow Bittern  Bambangan kuning  Least Concern

5. *Ixobrychus cinnamomeus*
   Cinnamon Bittern  Bambangan merah  Least Concern

HAWKS AND EAGLES (FAMILY ACCIPITRIDAE)
/ ELANG

6. *Pandion haliaetus*
   Osprey  Elang tiram  Least Concern

7. *Pernis ptilorhynchus*
   Oriental Honey-Buzzard  Sikep-madu asia  Least Concern
8. *Elanus caeruleus*
   Black-winged Kite   Elang tikus   Least Concern

9. *Spilornis cheela*
   Crested Serpent Eagle   Elang-ular bido   Least Concern

10. *Accipiter soloensis*
    Chinese Goshawk   Elang-alap cina   Least Concern

FALCONS (FAMILY FALCONIDAE)
/ ALAP-ALAP

11. *Microhierax fringillarius*
    Black-thighed Falconet   Alap-alap capung   Least Concern

PHEASANTS (FAMILY PHASIANIDAE)
/ PUYUH, SEMPIDAN, KUAU, MERAK
12. *Melanoperdix niger*
   Black Partridge Puyuh hitam Vulnerable

13. *Lophura erythrophthalma*
   Crestless Fireback Sempidan merah Vulnerable

14. *Gallus gallus*
   Red Junglefowl Ayam-hutan merah Least Concern

15. *Turnix suscitator*
   Barred Buttonquail Gemak loreng Least Concern
RAILS (FAMILY RALLIDAE)
/ AYAM-AYAMAN

16. *Amurornis phoenicurus*
White-breasted Waterhen  Kareo padi  Least Concern

PAINTED SNIPES (FAMILY ROSTRATULIDAE)
/ BERKIK-KEMBANG

17. *Rostratula benghalensis*
Greater Painted Snipe  Berkik-kembang besar  Least Concern

SANDPIPERS (FAMILY SCOLOPACIDAE)
/ TRINIL-TRINILAN

18. *Tringa hypoleucus*
Common Sandpiper  Trinil pantai  Least Concern

19. *Gallinago stenura*
Pintail Snipe  Berkik ekor-lidi  Least Concern

PIGEONS AND DOVES (FAMILY COLUMBIDAE)
/ MERPATI-MERPATIAN

20. *Treron curvirostra*
Thick-billed Green Pigeon  Delimukan puyuh  Least Concern
21. *Treron vernans*  
Pink-necked Green Pigeon  
Punai gading  
Least Concern

22. *Ducula aenea*  
Green Imperial Pigeon  
Pergam hijau  
Least Concern

23. *Streptopelia chinensis*  
Spotted Dove  
Tekukur biasa  
Least Concern

24. *Geopelia striata*  
Zebra Dove  
Perkutut jawa  
Least Concern

PARROTS (FAMILY PSITTACIDAE)  
/ BURUNG PARUH BENGKOK

25. *Psittacula longicauda*  
Long-tailed Parakeet  
Betet ekor-panjang  
Near Threatened

26. *Psittinus cyanurus*  
Blue-rumped Parrot  
Nuri tanau  
Near Threatened

27. *Loriculus galgulus*  
Blue-crowned Hanging Parrot  
Serindit melayu  
Least Concern

CUCKOOS (FAMILY CUCULIDAE)  
/ KANGKOK
28. *Cacomantis merulinus*
   Plaintive Cuckoo Wiwik kelabu Least Concern

29. *Surniculus lugubris*
   Drongo Cuckoo Kedasi hitam Least Concern

30. *Phaenicophaeus diardi*
   Black-bellied Malkoha Kadalan beruang Near Threatened

31. *Phaenicophaeus chlorophaeus*
   Raffles's Malkoha Kadalan selaya Least Concern

32. *Centropus sinensis*
   Greater Coucal Bubut besar Least Concern

33. *Centropus bengalensis*
   Lesser Coucal Bubut alang-alang Least Concern

**OWLS (FAMILY STRIGIFORMES)
/ BURUNG HANTU**

34. *Otus lempiji*
   Collared Scops-owl Celepuk reban Least Concern

**NIGHTJARS (FAMILY CAPRIMULGIDAE)
/ CABAK**

35. *Caprimulgus macrurus*
   Large-tailed Nightjar Cabak maling Least Concern

36. *Caprimulgus affinis*
   Savanna Nightjar Cabak kota Least Concern

**SWIFTS (FAMILY APODIDAE)
/ WALET**
37. *Collocalia fuciphagus*  
   Edible-nest Swiftlet  
   Walet sarang-putih  
   Least Concern

<table>
<thead>
<tr>
<th>TREESWIFTS (FAMILY HEMIPROCNIDAE) / TEPEKONG</th>
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</table>
| 38. *Hemiprocne comata*  
   Whiskered Treeswift  
   Tepekong rangkang  
   Least Concern |

<table>
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<tr>
<th>TROGONS (FAMILY TROGONIDAE) / LUNTUR</th>
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</table>
| 39. *Harpactes kasumba*  
   Red-naped Trogon  
   Luntur kasumba  
   Near Threatened |

| 40. *Harpactes diardii*  
   Diard's Trogon  
   Luntur diard  
   Near Threatened |

| 41. *Harpactes duvaucelii*  
   Scarlet-rumped Trogon  
   Luntur putri  
   Near Threatened |

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<tr>
<th>KINGFISHERS (FAMILY ALCEDINIDAE) / RAJA-UDANG</th>
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</table>
| 42. *Alcedo atthis*  
   Common Kingfisher  
   Raja-udang erasia  
   Least Concern |

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43. *Alcedo meninting*
   Blue-eared Kingfisher  Raja-udang meninting  Least Concern

44. *Ceyx erithaca*
   Black-backed Kingfisher  Udang api  Least Concern

45. *Ceyx rufidorsa*
   Rufous-backed Kingfisher  Udang api  Least Concern

46. *Pelargopsis capensis*
   Stork-billed Kingfisher  Pekaka emas  Least Concern

47. *Halcyon coromanda*
   Ruddy Kingfisher  Cekakak merah  Least Concern
48. *Halcyon smyrnensis*
White-throated KingfisherCekakak belukar Least Concern

**BEE-EATERS (FAMILY MEROPIDAE)**
/ KIRIK-KIRIK

49. *Merops philippinus*
Blue-tailed Bee-eater Kirik-kirik laut Least Concern

50. *Merops viridis*
Blue-throated Bee-eater Kirik-kirik biru Least Concern

**HORN'BILLS (FAMILY BUCEROTIDAE)**
/ ENGGANG

51. *Aceros corrugatus*
Wrinkled Hornbill Julang jambul hitam Near Threatened
52. *Aceros undulatus*
   Wreathed Hornbill  Julang emas  Least Concern

53. *Anthracoceros malayanus*
   Asian Black Hornbill  Kangkareng hitam  Near Threatened

54. *Anthracoceros albirostris*
   Oriental Pied Hornbill  Kangkareng perut-putih  Least Concern

55. *Buceros rhinoceros*
   Rhinoceros Hornbill  Enggang cula  Near Threatened

56. *Buceros bicornis*
   Great Hornbill  Enggang papan  Near Threatened

57. *Buceros vigil*
   Helmeted Hornbill  Rangkong gading  Near Threatened

BARBETS (FAMILY CAPITONIDAE)

*/TAKUR*

58. *Megalaima rafflesii*
   Red-crowned Barbet  Takur tutut  Near Threatened

59. *Megalaima mystacophanos*
   Red-throated Barbet  Takur warna-warni  Near Threatened

60. *Megalaima australis*
   Blue-eared Barbet  Takur tenggeret  Least Concern

61. *Caloramphus fuliginosus*
   Brown Barbet  Takur ampis  Least Concern
WOODPECKERS (FAMILY PICIDAE)
/ PELATUK

62. *Sasia abnormis*
   Rufous Piculet  Tukik tikus  Least Concern

63. *Celeus brachyurus*
   Rufous Woodpecker  Pelatuk kijang  Least Concern

64. *Picus vittatus*
   Laced Woodpecker  Pelatuk hijau  Least Concern
65. *Picus puniceus*
   Crimson-winged Woodpecker  Pelatuk sayap-merah Least Concern

66. *Picus miniaceus*
   Banded Woodpecker  Pelatu mearh

67. *Meiglyptes tristis*
   Buff-rumped Woodpecker Caladi batu  Least Concern

68. *Meiglyptes tukki*
   Buff-necked Woodpecker Caladi badok  Near Threatened

69. *Dryocopus javensis*
   White-bellied Woodpecker  Pelatuk ayam  Least Concern

70. *Blythipicus rubiginosus*
   Maroon Woodpecker  Pelatuk pangkas  Least Concern

71. *Reinwardtipicus validus*
   Orange-backed Woodpecker  Pelatuk kundang  Least Concern
BROADBILLS (FAMILY EURYLAIMIDAE) / MADI

72. *Eurylaimus ochromalus*  
    Black-and-yellow Broadbill  
    Sempur-hujan darat  
    Near Threatened

SWALLOWS (FAMILY HIRUNDINIDAE) / LAYANG-LAYANG

73. *Hirundo rustica*  
    Barn Swallow  
    Layang-layang api  
    Least Concern

74. *Hirundo tahitica*  
    Pacific Swallow  
    Layang-layang batu  
    Least Concern

75. *Hirundo striolata*  
    Striated Swallow  
    Layang-layang loreng

76. *Delichon dasypus*  
    Asian House Martin  
    Layang-layang rumah  
    Least Concern

CUCKOO-SHRIKES (FAMILY CAMPEPHAGIDAE) / BENTET-KEDASI

77. *Hemipus hirundinaceus*  
    Black-winged Flycatcher-shrike  
    Jingjing batu  
    Least Concern

78. *Coracina fimbriata*  
    Lesser Cuckoo-shrike  
    Kepudang-sungu kecil  
    Least Concern

79. *Lalage nigra*  
    Pied Triller  
    Kapasan kemiri  
    Least Concern

80. *Pericrocotus divaricatus*  
    Ashy Minivet  
    Sepah padang  
    Least Concern

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81. *Pericrocotus igneus*
   Fiery Minivet  Sepah tulin  Near Threatened

**LEAFBIRDS (FAMILY CHLOROPSEIDAE)**
   / CICA-DAUN

82. *Aegithina viridissima*
   Green Iora  Cipoh jantung  Near Threatened

83. *Aegithina tephia*
   Common Iora  Cipoh kacat  Least Concern

84. *Chloropsis cyanopogon*
   Lesser Green Leafbird  Cica-daun kecil  Near Threatened

85. *Chloropsis sonnerati*
   Greater Green Leafbird  Cica-daun besar  Least Concern

86. *Chloropsis cochinchenensis*
   Blue-winged Leafbird  Cica-daun sayap-biru  Least Concern

**BULBULS (FAMILY PYCNONOTIDAE)**
   / CUCAK-CUCAKAN

87. *Pycnonotus atriceps*
   Black-headed Bulbul  Cucak kuricang  Least Concern
88. *Pycnonotus melanicterus*
   Black-crested Bulbul  Cucak kuning  Least Concern

89. *Pycnonotus aurigaster*
   Sooty-headed Bulbul  Cucak Kutilang  Least Concern

90. *Pycnonotus eutilotus*
   Puff-backed Bulbul  Cucak rumbai-tungging  Near Threatened

91. *Pycnonotus goiavier*
   Yellow-vented Bulbul  Merbah cerukcuk  Least Concern

92. *Pycnonotus plumosus*
   Olive-winged Bulbul  Merbah belukar  Least Concern

93. *Pycnonotus simplex*
   Cream-vented Bulbul  Merbah corok-corok  Least Concern

94. *Pycnonotus brunneus*
   Red-eyed Bulbul  Merbah mata-merah  Least Concern
95. *Pycnonotus erythropthalmos*

Spectacled Bulbul  Merbah kacamata  Least Concern

96. *Setornis criniger*

Hook-billed Bulbul  Empuloh paruh-kait  Vulnerable

97. *Tricholestes criniger*

Hairy-backed Bulbul  Brinji rambut-tunggir  Least Concern
98. *Ixos malaccensis*  
   Streaked Bulbul  
   Brinji bergaris  
   Near Threatened

**DRONGOS (FAMILY DICRURIDAE)**  
/ **SRIGUNTING**

99. *Dicrurus annectans*  
   Crow-billed Drongo  
   Srigunting gagak  
   Least Concern

100. *Dicrurus remifer*  
    Lesser Racket-tailed Drongo  
    Srigunting bukit  
    Least Concern

101. *Dicrurus paradiseus*  
    Greater Racket-tailed Drongo  
    Srigunting batu  
    Least Concern

**ORIOLES (FAMILY ORIOLIDAE)**  
/ **KEPUDANG**

102. *Oriolus chinensis*  
    Black-naped Oriole  
    Kepudang kuduk-hitam  
    Least Concern

103. *Irena puella*  
    Asian Fairy-bluebird  
    Kecembang gadung  
    Least Concern

**CROWS (FAMILY CORVIDAE)**  
/ **GAGAK-GAGAKAN**
104. *Corvus enca*

Slender-billed Crow  Gagak hutan  Least Concern

105. *Pellorneum capistratum*

Black-capped Babbler  Pelanduk topi-hitam  Least Concern

106. *Trichastoma rostratum*

White-chested Babbler  Pelanduk merah  Near Threatened
107. *Trichastoma bicolor*
Ferruginous Babbler  Pelanduk merah  Least Concern

108. *Malacocincla malaccensis*
Short-tailed Babbler  Pelanduk dada-putih  Near Threatened

109. *Malacocincla abbotti*
Abbott's Babbler  Pelanduk asia  Least Concern

110. *Malacopteron magnirostre*
Moustached Babbler  Asi kumis  Least Concern

111. *Malacopteron affine*
Sooty-capped Babbler  Asi topi-jelaga  Near Threatened
112. *Malacopteron cinereum*
Scaly-crowned Babbler  Asi topi-sisik  Least Concern

113. *Malacopteron magnum*
Rufous-crowned Babbler  Asi besar  Near Threatened

114. *Malacopteron albogulare*
Grey-breasted Babbler  Asi dada-kelabu  Near Threatened
115. *Stachyris maculata*
   Chestnut-rumped Babbler Tepus tunggir-merah Near Threatened

116. *Stachyris nigricollis*
   Black-throated Babbler Tepus kaban Near Threatened

117. *Stachyris erythroptera*
   Chestnut-winged Babbler Tepus merbah-sampah Least Concern
118. Macronous gularis  
Striped Tit-Babbler  
Ciung-air coreng  
Least Concern

119. Macronus ptilosus  
Fluffy-backed Tit-Babbler  
Ciung-air pongpong  
Near Threatened

THRUNSHES (FAMILY TURDIDAE)  
/ BURUNG CACING

120. Copsychus saularis  
Magpie Robin  
Kucica kampung  
Least Concern

121. Copsychus malabaricus  
White-rumped Shama  
Kucica hutan  
Least Concern

122. Trichixos pyrropygus  
Rufous-tailed Shama  
Kucica ekor-kuning  
Near Threatened
123. **Turdus obscurus**  
Eyebrowed Thrush  Anis kuning  Least Concern

OLD WORLD WARBLERS (FAMILY SYLVIIDAE)  / BURUNG PENGICAU

124. **Gerygone sulphurea**  
Golden-bellied Gerygone  Remetuk laut  Least Concern

125. **Phylloscopus borealis**  
Arctic Warbler  Cikrak kutub  Least Concern

126. **Orthotomus ruficeps**  
Ashy Tailorbird  Cinenen kelabu  Least Concern

127. **Orthotomus sericeus**  
Rufous-tailed Tailorbird  Cinenen merah  Least Concern
128. *Prinia flaviventris*  
Yellow-bellied Prinia  
Perenjak rawa  
Least Concern

129. *Prinia familiaris*  
Bar-winged Prinia  
Perenjak jawa  
Least Concern

**OLD WORLD FLYCATCHERS (FAMILY MUSCICAPIDAE) / SIKATAN DUNIA LAMA**

130. *Rhinomyias umbratilis*  
Grey-chested Jungle Flycatcher  
Sikatan-rimba dada-kelabu  
Near Threatened

131. *Muscicapa dauurica*  
Asian Brown Flycatcher  
Sikatan bubik  
Least Concern

132. *Ficedula zanthopygia*  
Yellow-rumped Flycatcher  
Sikatan emas  
Least Concern
133. *Muscicapella hodgsoni*  
Pygmy Blue-Flycatcher  Sikatan kerdil  Least Concern

134. *Rhipidura javanica*  
Pied Fantail  Kipasan belang  Least Concern

135. *Hypothymis azurea*  
Black-naped Monarch  Kehicap ranting  Least Concern

136. *Philentoma pyrhoptera*  
Rufous-winged Philentoma  Philentoma sayap-merah  Least Concern
137. *Terpsiphone atrocaudata*
   Japanese Paradise Flycatcher       Seriwang jepang       Near Threatened

138. *Terpsiphone paradisi*
   Asian Paradise Flycatcher       Seriwang asia       Least Concern

WHISTLERS (FAMILY PACHYCEPHALIDAE)
/ KANCILAN

139. *Pachycephala grisola*
   Mangrove Whistler       Kancilan bakau       Least Concern
PIPITS AND WAGTAILS (FAMILY MOTACILLIDAE) / KICUIT DAN APUNG

140. Motacilla flava  
Yellow Wagtail Kicuit kerbau  Least Concern

141. Dendronanthus indicus  
Forest Wagtail Kicuit hutan  Least Concern

142. Anthus novaeseelandiae  
Common Pipit Apung tanah  Least Concern

WOOD-SWALLOWS (FAMILY ARTAMIDAE) / KEKEP

143. Artamus leucorynchus  
White-breasted Woodswallow Kekep babi  Least Concern

SHRIKES (FAMILY LANIIDAE) / BENTET

144. Lanius tigrinus  
Tiger Shrike Bentet loreng  Least Concern
145. *Aplonis panayensis*
   Asian Glossy Starling  Perling kumbang  Least Concern

146. *Acridotheres tritis*
   Common Myna  Kerak Ungu

147. *Acridotheres javanicus*
   Javan Myna  Kerak Kerbau

148. *Gracula religiosa*
   Hill Myna  Tiong emas  Least Concern

SUNBIRDS AND SPIDERHUNTERS (FAMILY NECTARINIIDAE)
/ BURUNG MADU DAN PIJANTUNG

149. *Anthreptes simplex*
   Plain Sunbird  Burung-madu polos  Least Concern
150. *Anthreptes malacensis*
Plain-throated Sunbird          Burung-madu kelapa Least Concern

151. *Anthreptes singalensis*
Ruby-cheeked Sunbird          Burung-madu belukar Least Concern

152. *Hypogramma hypogrammicum*
Purple-naped Sunbird          Burung-madu rimba Least Concern

153. *Nectarinia sperata*
Purple-throated Sunbird       Burung-madu pengantin Least Concern
154. *Nectarinia calcostetha*
   Copper-throated Sunbird  Burung-madu bakau Least Concern

155. *Nectarinia jugularis*
   Olive-backed Sunbird  Burung-madu sriganti  Least Concern

156. *Aethopyga siparaja*
   Crimson Sunbird  Burung-madu sepah-raja  Least Concern

157. *Arachnothera longirostra*
   Little Spiderhunter  Pijantung kecil  Least Concern

158. *Arachnothera flavigaster*
   Spectacled Spiderhunter  Pijantung tasmak  Least Concern

159. *Arachnothera affinis*
   Gray-breasted Spiderhunter  Pijantung gunung  Least Concern
160. *Prionochilus thoracicus*
Scarlet-breasted Flowerpecker  Pentis kumbang  Near Threatened

161. *Prionochilus maculatus*
Yellow-breasted Flowerpecker  Pentis raja  Least Concern

162. *Prionochilus xanthopygius*
Yellow-rumped Flowerpecker  Pentis kalimantan  Least Concern

163. *Prionochilus percussus*
Crimson-breasted Flowerpecker  Pentis pelangi  Least Concern
164. *Dicaeum trigonostigma*  
Orange-bellied Flowerpecker  
Cabai bunga-api  
Least Concern

165. *Dicaeum concolor*  
Plain Flowerpecker  
Cabai polos  
Least Concern

166. *Dicaeum cruentatum*  
Scarlet-backed Flowerpecker  
Cabai merah  
Least Concern

WEAVERS (FAMILY PLOCEIDAE)  
/ PIPIT, MANYAR DLL.

167. *Passer montanus*  
Eurasian Tree Sparrow  
Burung-gereja erasia  
Least Concern

168. *Ploceus philippinus*  
Baya Weaver  
Manyar tempua  
Least Concern

169. *Lonchura leucogastra*  
White-bellied Munia  
Bondol perut-putih  
Least Concern

170. *Lonchura punctulata*  
Scaly-breasted Munia  
Bondol peking  
Least Concern

171. *Lonchura malacca*  
Black-headed Munia  
Bondol rawa

172. *Lonchura maja*
| White-headed Munia | Bondol haji | Least Concern |
### Appendix1. Mammal species occurrence at each land use.

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<tr>
<th>ID</th>
<th>Scientific Name</th>
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Notes:

Uncertain species: *Tarsius bancanus, Prebytis siamensis, Symphalangus syndactylus* and *Prionailurus viverrinus* were not listed

*1* Found footprints and an ex-bedding site

*2* Both species and their hybrids were detected. Some photos are quite difficult to identify

*3* Found footprints

*4* Industrial tree plantation
Appendix 2. Bird species occurrence at each land use.

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Notes:

*1 Industrial tree plantation

*2 Observations out from survey effort listed; these includes camera-trapping and accidental encounter