Conservation Malaysia
A Bulletin Supporting Plant and Animal Conservation in Malaysia
ISBN 1823-7975
Issue No 19 (2014)

CENTRAL FOREST SPINE:

AN OVERVIEW AND HOW GERIK WAS CHOSEN FOR THE PILOT PROJECT

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Habitat fragmentation is the breaking-up of natural habitats into unconnected parts that occurs either naturally by climatic or geological processes or by human activities. Activities such as land clearing for non-forest land uses usually impact large areas over a short period of time.

Forest fragmentation and habitat loss have been identified as one of the serious threats occurring in Malaysia today especially with regards to biodiversity conservation. The loss of forest biodiversity also threatens our food supplies, ecotourism opportunities and other essential ecological functions.

Realizing the need to overcome this crucial issue which is particularly critical in Peninsular Malaysia's forests, the Government of Malaysia has committed to enhance the connectivity of the fragmented forests through the establishment of a network of ecological corridors. This is reflected in one of the National Physical Plan 2 (NPP2) policy statements which states that "A Central Forest Spine (CFS) shall be established to form the backbone of the Environmentally Sensitive Area (ESA) network". This was approved by the National Physical Planning Council (NPPC) on 13 August 2010.

Under this initiative, four main fragmented forest complexes will be reconnected to create the CFS spanning the north to the south of Peninsular Malaysia. These complexes, namely, (i) Main Range–Bintang Range–Nakawan Range; (ii) National Park–Eastern Range; (iii) South East Pahang–Tasik Chini–Tasik Bera Wetlands; and (iv) Endau Rompin State Park–Kluang Wildlife Reserve are shown in Fig. 1. In NPP 2, it is estimated that CFS will cover 5.3 million hectares or 40% of the total area of the peninsula. Of this, 80% is Permanent Reserved Forests (PRFs). To facilitate the restoration of connectivity and continuity of these four forest complexes, the CFS Master Plan was prepared by the Town and Country Planning Department (TCPD) in 2010 with the main objective to establish a viable and contiguous or connected conservation area comprising both forest and non-forest areas that will be maintained as the green lung of the ESA network in Peninsular Malaysia.

Fig. 1: CFS Complexes

The implemention of CFS does not merely focus on the development of ecological corridors and connectivity but also consists of other components such as:

(i) Maintaining forested areas;

(ii) Sustainable Forest Management (SFM) practices; and

(iii) Forest rehabilitation programmes.

Fig. 2. A group of elephants preparing to cross the Gerik–Jeli Highway.

The Federal Government through the Ministry of Natural Resources and Environment (MNRE) has selected Primary Linkage 2 (PL–2), namely Belum–Temengor Ecological Corridor (BTEC) in Gerik as the first CFS project in the peninsula. An initial allocation of RM 60 million was approved by the Cabinet in April 2011 for the implementation of the BTEC over the period 2012–2015. BTEC was chosen for the following reasons, among others:-

(i) It has one of the highest population of elephants, tigers and gaurs in Peninsular Malaysia;
(ii) High activity of elephant movement across the highway (Fig. 2);
(iii) It is a major hornbill flyway;
(iv) It has been identified as an important corridor for tigers under the National Tiger Action Plan for Malaysia 2008–2020;
(v) It forms part of the important transboundary biodiversity conservation area of Royal Belum State Park–Hala Bala Wildlife Sanctuary and Royal Belum State Park–Bang Lang National Park;
(vi) There are areas with potential for development into ecotourism destinations, mainly for the observation of big mammals, hornbills and other birds; and
(vii) There are high incidences of human-wildlife conflict.

Belum (north) and Temengor (south) have been divided by the Gerik–Jeli Highway since the early 1990's. Development of the highway did not take into consideration wildlife needs and therefore this has regularly resulted in problems for both humans and wildlife and has aggravated human-wildlife conflict.

WILDLIFE MONITORING AT THE CFS BELUM–TEMENGOR ECOLOGICAL CORRIDOR

By Sivanathan, E. (siva@wildlife.gov.my) & Tan, C.C.

Since 2012, the Department of Wildlife and National Parks (PERHILITAN/DWNP) has been carrying out a wildlife monitoring programme along the BTEC around the area of the viaduct which is currently being built at one location across the Gerik–Jeli highway. The objectives of this monitoring programme are:

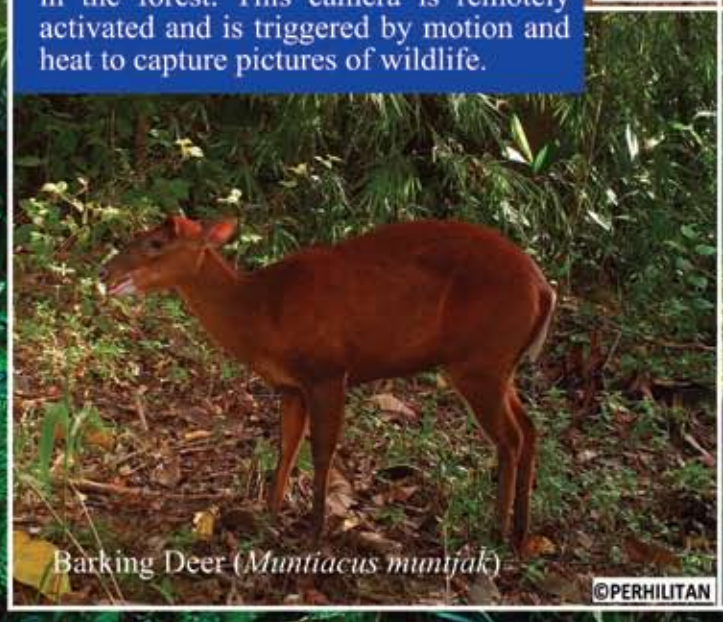
1. To assess the changes in habitat usage by large mammals before, during and after the construction of the viaduct; and
2. To study the activity patterns of large mammals.

Camera traps (Fig. 1) were set up at the study area in the forest between 2012 and 2013 to detect the presence of large mammals. A total of 46 species of animals were detected including large mammals, small mammals, birds and reptiles. Twelve of the fourteen large mammals found in Peninsular Malaysia were photographed during the study period, the exceptions being the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) and Bearded Pig (*Sus barbatus*).

The large mammals found within the study area were:

1. Asian Elephant (*Elephas maximus*)
2. Barking Deer (*Muntiacus muntjak*)
3. Clouded Leopard (*Neofelis nebulosa*)
4. Dhole (*Cuon alpinus*)
5. Gaur (*Bos gaurus*)
6. Leopard (*Panthera pardus*)
7. Malayan Sun Bear (*Helarctos malayanus*)
8. Malayan Tapir (*Tapirus indicus*)
9. Malayan Tiger (*Panthera tigris*)
10. Sambar Dear (*Rusa unicolor*)
11. Serow (*Capricornis sumatraensis*)
12. Wild Boar (*Sus scrofa*)

Fig. 1 A staff member setting up a camera in the forest. This camera is remotely activated and is triggered by motion and heat to capture pictures of wildlife.



Barking Deer (*Muntiacus muntjak*)

Asian Elephant (*Elephas maximus*)

The preliminary results of this study showed that the stretch of state land along the BTEC is very rich in fauna diversity. This finding was presented to the National CFS Steering Committee chaired by MNRE and the State Technical Committee chaired by the Perak State Government. In early 2013, this state land was gazetted as Amanjaya Forest Reserve under the National Forestry Act 1984 and, as a result, may ensure the long term protection and conservation of fauna at the BTEC.

Long-term wildlife monitoring is being conducted to assess changes in the habitat usage by large mammals during and after the construction of the viaduct. It is predicted that habitat usage by large mammals around the proposed viaduct will decline during its construction due to anthropogenic disturbances, but will gradually increase after its completion. The utilisation of the corridor beneath the viaduct by wildlife will be monitored after construction to evaluate its effectiveness. The habitat below and around the viaduct will be managed and enriched to facilitate wildlife movement. In addition, multi-agency patrolling of the reserve and corridor needs to be strengthened to ensure the protection of wildlife.

SMALL MAMMAL MONITORING AT BELUM–TEMENGOR FOREST RESERVES

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Small mammal is, by definition, a mammal species whose adult weight does not exceed 5 kg; examples are rodents, civets, bats and mongooses. Bats represent the largest group of small mammals, comprising more than 40% of the total mammalian fauna, while rodents make up the next most significant number, with at least 50 species recorded in Peninsular Malaysia.

Numerous surveys of vertebrates have been carried out in the Belum–Temengor Forest Reserves (BTFR) since the Malaysian Nature Society (MNS)'s first expedition to Sungai (Sg.) Halong in Temengor during 1993–1994. The second MNS expedition, launched in May 1998, explored areas surrounding Sg. Tan Hain, Sg. Lebur and Sg. Tiang at northern Belum. These expeditions and surveys were carried out to determine species diversity of plants, vertebrates and invertebrates which were then poorly known in the area. Currently FRIM is monitoring the effects of forest fragmentation on small mammals while WWF has been for several years monitoring the prey-predator relationship with emphasis on the Malayan Tiger (*Panthera tigris*).

Fragmentation of the forest in these areas has been exacerbated by the presence of the Gerik–Jeli highway which separates the Belum and Temengor FRs. In 2013 the Perak Forest Department gazetted approximately 19,000 ha of land along the highway spanning 1.5 km in width and 68 km in length as part of a wildlife corridor – this is named the Amanjaya Forest Reserve. In order to enhance connectivity, a 8 m tall viaduct is being built at one location across the highway. There is a need to monitor changes in small mammal populations before, during and after the construction of the viaduct since the viaduct will also create connectivity for small mammals. From these studies, we hope to understand changes in the small mammal population and their movement patterns, and to prove the effectiveness of the viaduct which can later be proposed for other disconnected fragmented forest areas. This small mammal monitoring project began in 2012 and is expected to complete in 2015.


Brown Spiny Rat (*Maxomys rajah*)


Large Diadem's Roundleaf Bat (*Hipposideros diadema*)


Horsfield's Fruit Bat (*Cynopterus horsfieldi*)


Collapsible cage trap

Moonrat (*Echinosorex gymnurus*)

At least 100 collapsible cage traps are being used to capture small mammals for each sampling session in two plots measuring 1-ha each in Belum and Temengor. These plots are located 500 m inside the forest and away from existing roads. In addition, four line transects, each 300 m in length and equipped with 40 pitfall traps, were set up and 10 mist nets and five harp traps were added to increase catch opportunities. Squirrels, rats and mice are captured using cage traps while mist nets are used to capture fruit bats. Harp traps are effective for insectivorous bats while pitfall traps work well with ground-dwelling mammals and burrowers like the bamboo rat. Banana and oil palm seeds are used alternately as baits for cage traps. These plots and line transects are situated in a hill forest at 700 m a.s.l. Monthly observations began in November 2012. Traps and nets are checked at 1000 hours and 1400 hours daily for six consecutive days. The captured mammals are then measured, identified, tagged and photographed before they are released. Arboreal mammals such as Colugo (*Cyanocephalus variegatus*) and Binturong (*Arctictis binturong*) are observed with binoculars; colugo can usually be seen at 1100 hours on tree trunks while binturong move actively from branch to branch during the same time.

To date, a total of 58 species of small mammals comprising 25 families have been recorded in the area surrounding the viaduct. Of these, squirrels (Sciuridae) were the most frequent, with eight species such as the Plantain Squirrel (*Callosciurus notatus,* 3 individuals) and Three-striped Ground Squirrel (*Lariscus insignis*, 2 individuals), followed by fruit bats (7 species, Pteropodidae). The Short-nosed Fruit Bat (*Cynopterus brachyotis*) was the most common with 32 individuals, followed by Horsefield's Fruit Bat (*C. horsfieldi,* 15 individuals). At least six species of rats (Muridae) were captured such as Brown Spiny Rat (*Maxomys rajah,* 8 individuals), Whitehead's Rat (*M. whiteheadi,* 9 individuals) and Long-tailed Giant Rat (*Leopoldamys sabanus,* 10 individuals). In addition, two Erinaceidae species, i.e., Lesser Gymnure (*Hylomys suillus*) and Rotten Onion Smelling Moonrat (*Echinosorex gymnurus*) were captured. The gymnure is locally known as tikus babi because it has a short tail resembling a pig's. It occurs mainly in hill or montane forest with dense undergrowth. Two species of treeshrews, the Common Treeshrew (*Tupaia glis*) and Lesser Treeshrew (*T. minor*) from Tupaiidae family were commonly caught with 18 individuals and 2 individuals respectively. Arboreal species that were commonly observed include Black Giant Squirrel (*Ratufa bicolor*), Cream-colored Giant Squirrel (*R. affinis*), Prevost's Squirrel (*Callosciurus prevostii*), Spectacled Leaf Monkey (*Trachypithecus obscurus*) and Siamang (*Symphalangus syndactylus*).

The team is also collecting data on road kills along the highway. To date, at least seven species have been found including Binturong, Common Porcupine (*Hystrix brachyura*), Siamang and Masked Palm Civet (*Paguma larvata*). It is sad to see these precious species killed by passing vehicles when they are crossing the road. This further strengthens the need to establish ecological corridors where animal crossings can take place safely.

Harp trap to capture insectivorous bats.

Common palm civet killed by a passing vehicle

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AVIFAUNA ASSEMBLAGES AT BELUM-TEMENGOR FOREST RESERVES

Shahfiz, M.A. (shahfiz@frim.gov.my), Kaviarasu, M., Rizal, M.R., John, R.T., Fakrul, I.A.F. & Faridatul, N.M.R.

Yellow-bellied Bulbul
(*Alophoixus phaeocephalus*)

Belum–Temengor Forest Reserves is one of the best sites in the country for observation of hornbills. A total of ten species can be found in these reserves such as Plain-pouched Hornbill (*Aceros subruficollis*), Rhinoceros Hornbill (*Buceros rhinoceros*) and Great Hornbill (*B. bicornis*). In fact, the sheer numbers of hornbills that fly overhead daily has been termed the "Hornbill Phenomenon" because hundreds can be counted in a day. In 1993, Davison and his team counted 2,421 hornbills at the Sg. Halong Base Camp within 40 minutes. Hornbills such as the White-crowned Hornbill (*Berenicornis comatus*), Bushy-crested Hornbill (*Anorrhinus galeritus*) and Helmeted Hornbill (*Rhinoplax vigil*) can be seen daily either early in the morning or late in the evening.

Little Spiderhunter
(*Arachnothera longirostra*)

FRIM is currently carrying out surveys of avifauna assemblages around the viaduct. Although this viaduct is intended for mammals, it is also beneficial for birds particularly raptors, swifts and low-flying, understorey birds. Unlike hornbills and raptors, understorey birds such as bulbuls, babblers, pittas, woodpeckers, flowerpeckers and sunbirds fly short distances and stay within the forest canopy cover. The construction of the viaduct would create an additional fly path through which these low flying birds could cross the highway. Raptors (eagles and hawks) live in the forest canopy; the viaduct is a strategic foraging site as their very sharp eyes enable them to locate small mammals particularly rats that cross the highway. Beneath the viaduct, swifts are provided sites to build nests; the presence of nests can be clearly seen at the Sg. Deka viaduct in Terengganu and Sg. Yu in Pahang.

Mist nets were used to capture birds during the day and at least 10 mist nets were set up for each sampling session. A mist net is at least 2 m high and 8 m in length. These nets are set along the trails for six consecutive days and are checked every two hours beginning from 0800 until 1600 daily. The trapping exercise began in November 2012. All birds captured are measured, identified and photographed before they are released. Binoculars are used to observe canopy-flying birds such as eagles, hawks and hornbills.

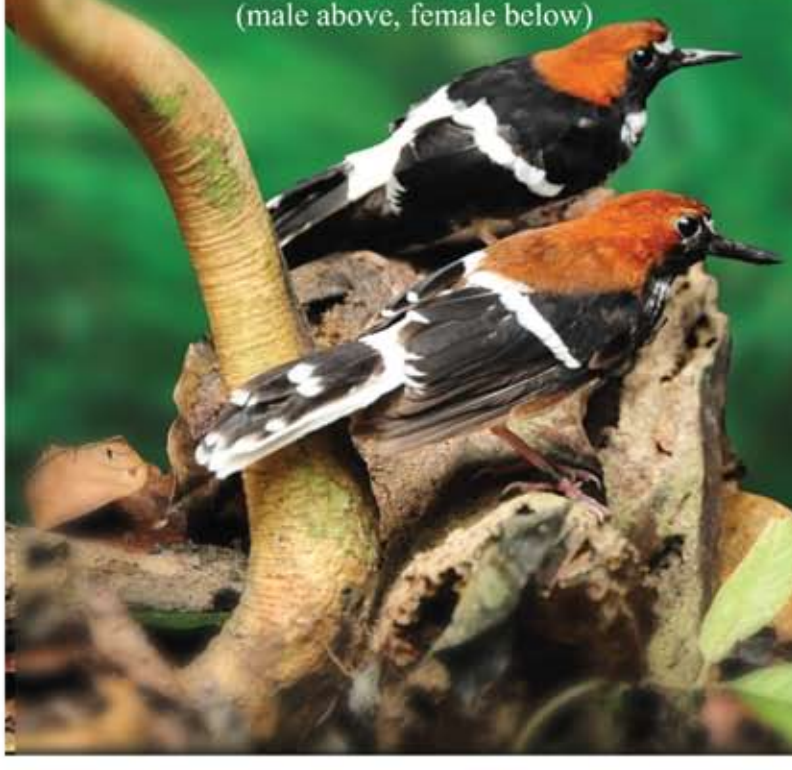
To date, the Malaysian Nature Society (MNS) has recorded at least 304 species of birds from 47 families in BTFR. However, there is no information about how these records were made. Of these 304 species, at least 56 species have been captured since trapping began in this project. Species that were frequently captured are bulbuls such as Spectacled Bulbul (*Pyncnonotus erythropthalmos*), Red-eyed Bulbul (*P. brunneus*), Yellow-vented Bulbul (*P. goaivier*), Grey-bellied Bulbul (*P. cyaniventris*), Black-crested Bulbul (*P. melanicterus*), Yellow-bellied Bulbul (*Alophoixus phaeocephalus*); woodpeckers (Picidae) such as Rufous Piculet (*Sasia abnormis*) and Buff-necked Woodpecker (*Meiglyptes tukki*); babblers such as Black-capped Babbler (*Pellorneum capistratum*), Ferruginous Babbler (*Trichastoma bicolor*), Scaly-crowned Babbler (*Malacopteron cinereum*), Rufous-crowned Babbler (*M. magnum*) and Moustached Babbler (*M. magnirostre*). The rare catches include the Asian Paradise Flycatcher (*Tersiphone paradisi*), Greater Racket-tailed Drongo (*Dicrurus paradiseus*), Black Magpie (*Platysmurus leucopterus*) and Javan Frogmouth (*Batrachostomus javensis*). Species that are often observed and heard are Raffles' Malkoha (*Phaenicophaeus chlorophaeus*), Chestnut-breasted Malkoha (*P. curvirostris*), Banded Cuckoo (*Cacomantis sonneratti*),

Black-crested Bulbul (*Pycnonotus melanicterus*)

Javan Frogmouth (*Batrachostomus javensis*)

Greater Coucal (*Centropus sinensis*), Crested Serpent Eagle (*Spilornis cheela*), Changeable Hawk Eagle (*Spizaetus cirrhatus*), White-bellied Sea Eagle (*Haliaeetus leucogaster*), Great Hornbill (*Buceros bicornis*) and Oriental Pied Hornbill (*Anthracoceros albirostris*).

The need to establish an ecological corridor is exemplified by the road kill of the rare Rusty-naped Pitta (*Pitta oatesi*). This pitta is a new record for BTFR and prior to this, it was known to only inhabit the hill and montane forests of Fraser's Hill (Pahang) and Larut Hills (Perak). This is a new distribution record for the species and now represents the northernmost limit for Peninsular Malaysia. The elevation at which it was found was 778 m a.s.l., which is lower than other known localities. Further north, the species has been recorded in the Hala-Bala Wildlife Sanctuary in Narathiwat Province, South Thailand. Living individuals have yet to be caught since observations began in November 2012. It is indeed a great pity to discover a new record from a road-killed specimen. New bird records continue to be made during each sampling session. The species of birds caught, for example, fruit-eating birds such as bulbuls or insect-eating birds such as babblers, also serve to indicate the flowering and fruiting status of the trees in the forest.



Enicurus ruficapillus
(male above, female below)

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Road crossings: Are butterflies at risk?

Phon, C.-K. (phonchooikhim@frim.gov.my) & Kirton, L.G.

The Purple Sapphire, *Heliophorus epicles*, is very frequently found around shrubs and bushes near the forest edges of the BTFR. It is confined to forested hills above 600 m a.s.l. (Photo credit: Tea, Y.K.)

Have you ever wondered whether a butterfly can be knocked down or run over by a vehicle on the road? Butterflies are agile fliers, and one may think they should be able to avoid being hit by vehicles. In reality, this is not true. Though agile, they often get killed when flying across roads. Road kills are often overlooked because butterflies are much smaller than mammals, birds or reptiles.

For the CFS project in the BTEC, butterflies are one of the target groups for studying the effectiveness of an ecological corridor. Butterflies are selected because they play an important role in pollination, and help disperse plant genes over short to moderate distances. They are also more readily identifiable in the field compared to other insect groups.

Temengor FR is separated from Belum FR by the Gerik–Jeli Highway. Based on observations in the afternoon, the number of vehicles using this highway easily exceeds 200 per hour on a weekday, and this number increases to more than 700 during the weekends. Butterflies generally avoid open spaces. They are also sensitive to movement, sound and air turbulence. In spite of this, many butterflies still fly across the road, possibly in search of nectar and host plants but perhaps also because the road cuts across their dispersal routes and territorial flight paths. Since many are not strong fliers, they risk being hit by vehicles that travel at speeds of up to 90 km/h.

In the months of February, April, June, September and November 2013, butterfly crossings were observed in an 819 m transect along a stretch of the highway at the proposed CFS viaduct site. The number of butterflies killed by passing vehicles was also recorded. The observations were made for three hours between 11.00 a.m. and 3.00 p.m. for 2–3 days each month, giving a total of 13 days. Many butterflies were seen flying across the road with and without traffic. Eleven dead butterflies were found on the road. Based on this number, there could potentially be more than 100 dead butterflies along the 85 km forested stretch of road. Among the dead were common species such as the Changeable Grass Yellow, Magpie Crow, Blue-branded King Crow, Chocolate Tiger, De Nicéville's Lineblue and Common Sailer. These butterflies are known to fly into relatively open habitats. Species such as the Black and White Helen, Common Duffer, Orange Gull and *Poritia phama* that are usually restricted to denser forest areas were also found dead along the roadside.

Depending on the weather, the number of butterflies seen flying across the road ranged from 4–22 individuals per 3-hour observation period, and averaged four per hour. Some butterflies attempted to fly across the road but later turned back because of the vehicles. About 144 crossings and attempted crossings were recorded in 13 days. Among these were species of swallowtails (*Papilio*), blue bottles (*Graphium*), tree-nymphs (*Idea*), judies (*Abisara*) and ceruleans (*Jamides*) that tend to keep to forest cover. These species flew across the highway less frequently. Many butterflies, such as species of oakblues (*Arhopala*) never leave the cover of the forest. In such cases, the highway is a complete barrier.

Extrapolating from the figures obtained through observations, it is estimated that each year more than 50 million butterflies would cross the 85 km stretch of highway that cuts across the forest. Such estimates are however subject to uncertainty due to factors such as seasonality, traffic volume, altitude and weather conditions. While less than one in a thousand would be expected to be killed by vehicles, the potential number of road kills per year along the highway would by no means be small, reaching nearly 30,000.

The study provides evidence that highways limit flight ranges and are a major cause of death for butterflies. By the same reasoning, the highway must also be a barrier and hazard to innumerable other insect species such as dragonflies, beetles and bees, all of which perform valuable functions in the forest ecosystem. To encourage butterflies and other insects to use the proposed viaduct, both the viaduct and buffer zones need to be planted with low forest trees, climbers and flowering shrubs. This will create a flight path for both open-area and forest-dwelling insects, and will play a part in reducing road kills.

Acknowledgements

We are grateful to Forest Department of Peninsular Malaysia for the opportunity to be involved in the project. We thank Dr. Pan, K.A., Shahfiz, A., Kaviarasu, M. and Dr. Saw, L.G., of FRIM, for including the butterfly component in the project. Grateful thanks also go to Nafaruding C.N. and Shaiful Amri, M.S. for the field assistance and to Tea, Y.K. and Khew, S.K. for their photographs.

▼ The Pallid Faun, *Melanocyma faunula*, is often found in the BTFR. It occurs in areas up to 1,500 m a.s.l. (Photo credit: Tea, Y.K.)

▲ The observer witnessed this butterfly (probably the Blue-branded King Crow, *Euploea eunice*) being crushed by a car.

Some common butterflies found dead along the highway.

Some butterflies that are usually confined to the forest, found dead along the roadside.

Common Duffer (*Discophora sondaica*)

Black and White Helen (*Papilio nephelus*)

Poritia phama

Orange Gull (*Cepora iudith*)

The Malayan Oakleaf, *Kallima limborgii*, which occurs in the study area, is confined to dense forest at moderate elevations. It is briliantly coloured above, but resembles a dead leaf when its wings are closed (Photo credit: Khew, S.K.)

▲ *Kallima limborgii*
Photo credit: Khew, S.K.

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