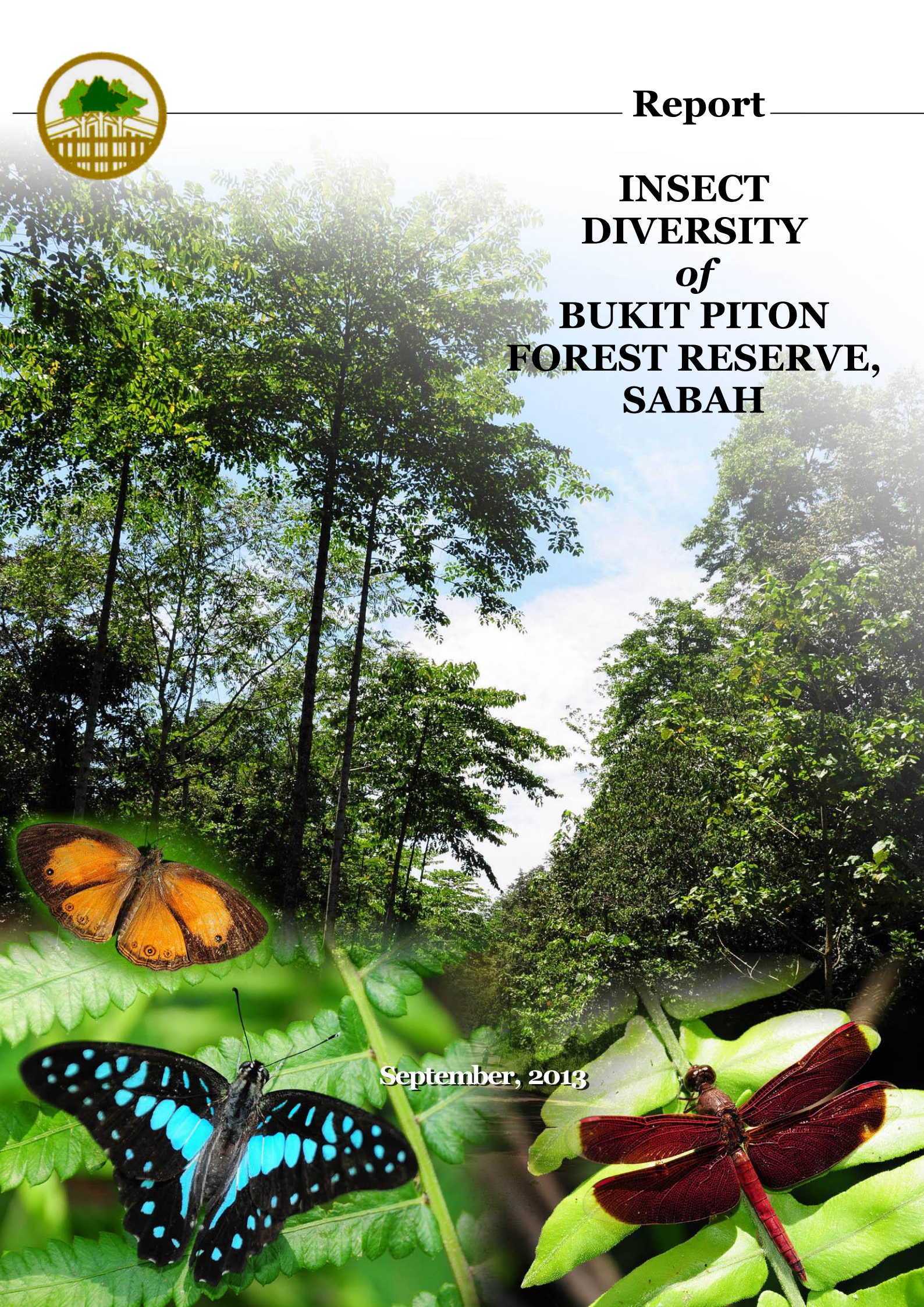
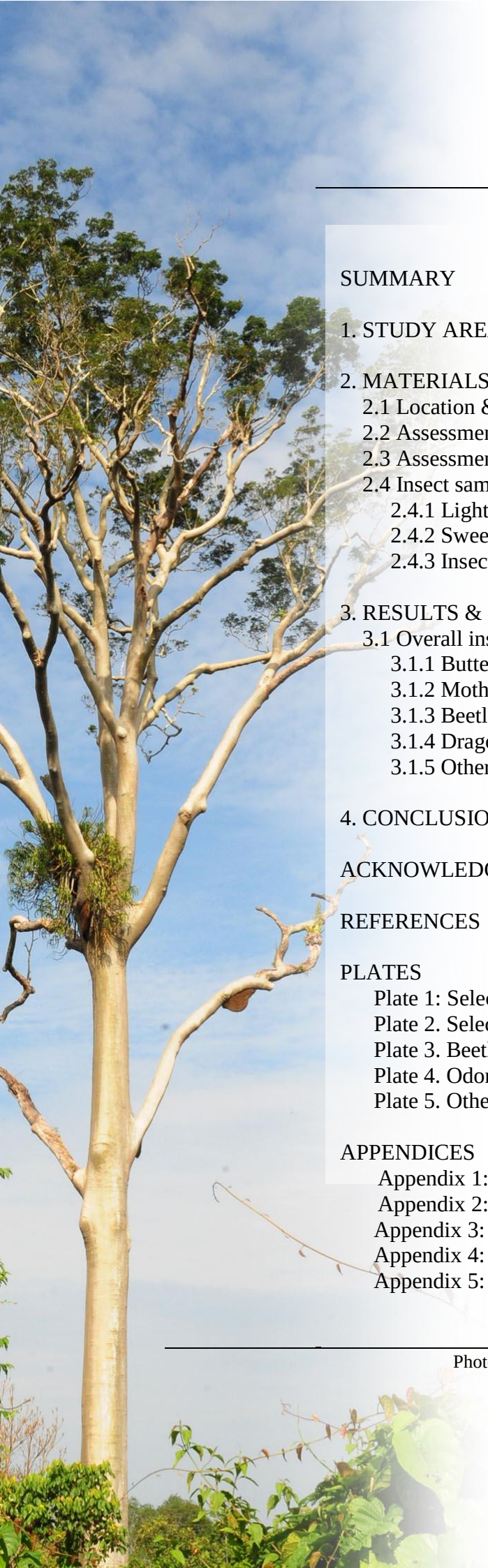
Report

INSECT DIVERSITY *of* BUKIT PITON FOREST RESERVE, SABAH



September, 2013



CONTENTS

Photo (content page): Wild Honeybee nest, *Apis dorsata* on *Koompassia excelsa*.

INSECT DIVERSITY OF BUKIT PITON FOREST RESERVE, SABAH

Prepared for the District Forestry Office, Ulu Segama-Malua Forest Reserves

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SUMMARY

An insect diversity survey was carried out from 22nd to 24th of August, 2013 in Bukit Piton F.R. This is a Class I Forest Reserve (Protection), covering an area of 11,612 ha. The nocturnal insect diversity was moderate. The Shannon Index was 3.6 while Simpson Index was 64.8 and Fisher Alpha Index was 99.5. However, the number of species recorded was low, with a mean number of 41.5 species. It is among the lowest species number sampled (within a one-square-metre), compared to other forest sites.

Only one endemic species was recorded and it is a locally common Three-horned Beetle, *Chalcosoma moellenkampi*. All other insects recorded are common species.

As no other insect survey has been conducted in this forest reserve in the past, this pioneer data will serve as baseline information for other research work in future. The insect species recorded provide value-added information for this FSC-certified forest reserve.

Note: The identification of some insects is still tentative and subject to confirmation. This report will be further improved with comments from various experts.

1. STUDY AREA & PURPOSE OF STUDY

Bukit Piton Forest Reserve (formerly known as northern Ulu Segama) is located in east Sabah, along the upper part of the Ulu Segama River (Figure 1). It forms part of the Ulu Segama-Malua F.Rs., formerly gazetted under a Class II (Commercial) Forest Reserve. In March, 2012, it was regazetted as Protection Forest Reserve (Class I), covering an area of 11,612 ha. The vegetation is mainly logged-over lowland mixed dipterocarp forest. This area is known to have high concentration of orang-utan population.

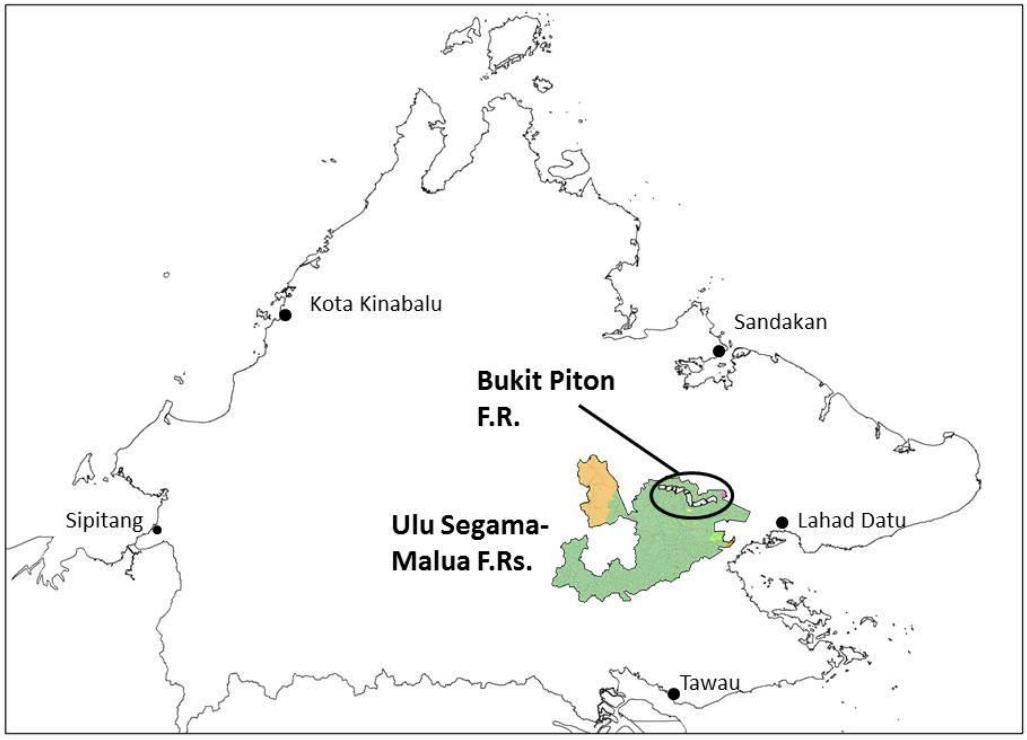

Figure 1: Location of Bukit Piton F.R. (circled) in Sabah.

The study was conducted from 22nd to 24th of August, 2013. The base camp was at the Merisuli F.R. checking station, about 3 km from the Lahad Datu-Sandakan highway. The camp is located some 33 km from Lahad Datu town.

The objective of this study was to document the insect fauna of Bukit Piton F.R. as requested by the DFO USM FRs. This is part of the value-added information for USM FRs which is certified under the Forest Stewardship Council (FSC).

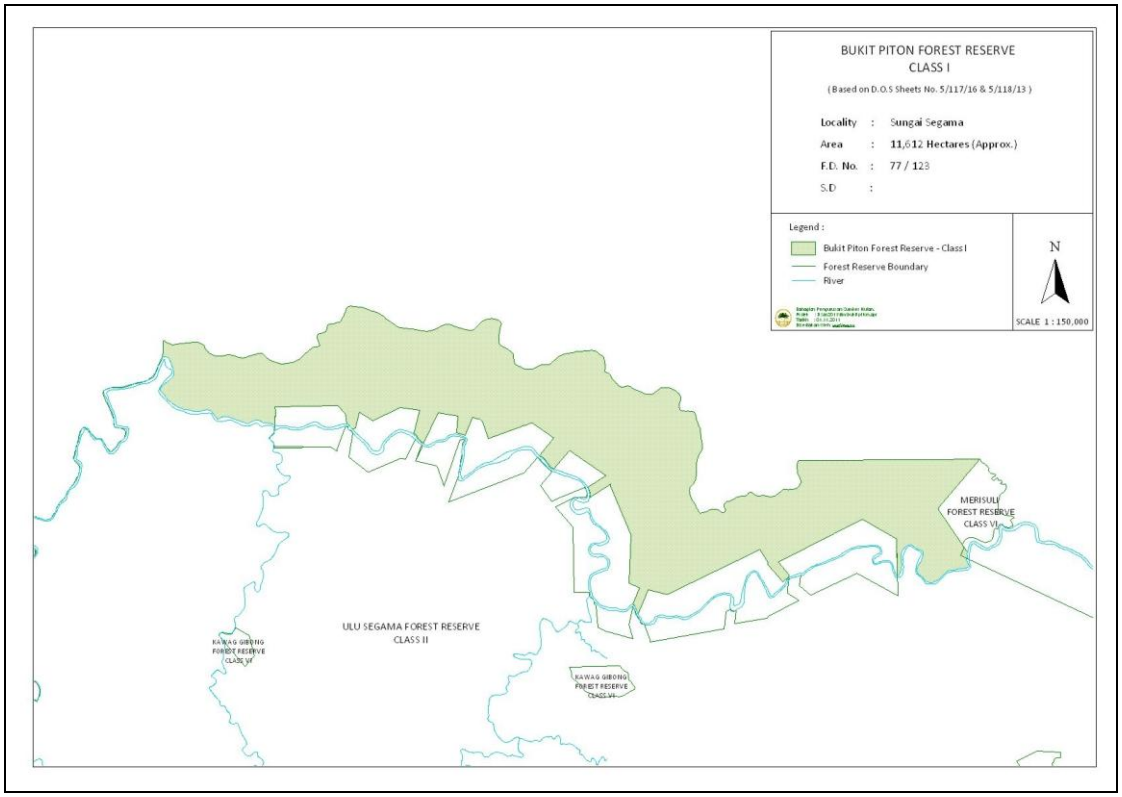

Figure 2: Close-up of Bukit Piton F.R. at the upper part of the Segama River in Lahad Datu.

Figure 3: Part of Bukit Piton F.R. from the ridge at Merisuli F.R.

Figure 4: A degraded forest at Bukit Piton F.R. being planted with various forest seedlings.

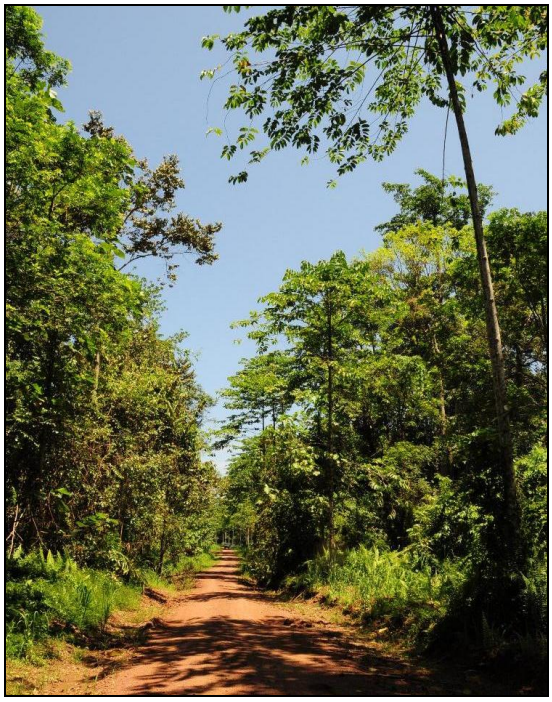

Figure 5: Part of the forest (WWF area) that has been restored with various pioneer species, such as Laran.

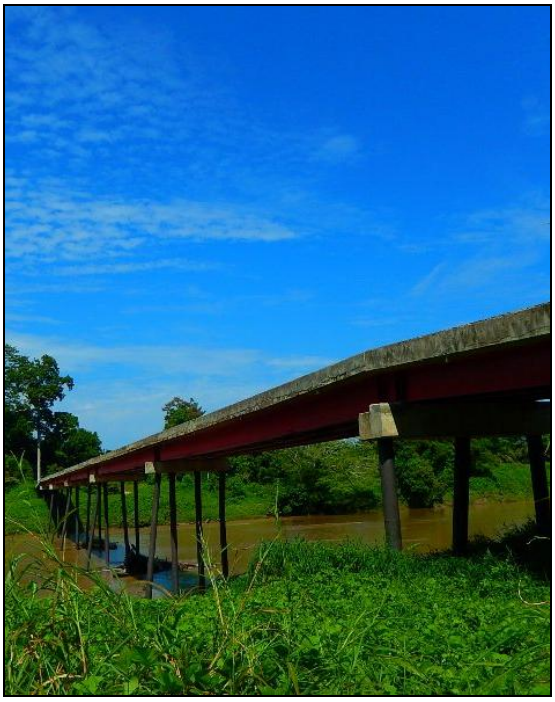

Figure 6: A concrete bridge across Segama River, connecting Bukit Piton F.R. with the main Ulu Segama forest.

2. MATERIALS & METHODS

2.1 Location and GPS points

A GPS gadget (Model: Garmin GPSMAP 60CSx) was used for recording locality of latitude and longitude. The GPS reading was taken according to WGS 72 (Datum Map) and in decimal degree hddd.dddd˚ position format.

Table 1. Details on POI during the survey. All data were downloaded from GPSmap 60CSx Garmin.

No.	Point of interest, POI	Lat	Long	elevation
1	Merisuli Office (Base camp)	5.14723	118.14288	51
2	Agop Office (Light-trapping site)	5.13168	118.05538	121
3	Bridge - Segama River	5.15753	117.97954	67
4	WWF Field Centre	5.19171	117.9551	82
5	Group Photo	5.18951	117.96236	93

2.2 Assessment using Google earth programme

Google Earth programme is a powerful tool in assessing real time images of places of interest. This programme allowed other affiliates file to be incorporated during the assessment e.g. Garmin GPS data .gdp. Investigating the real time images (images are subject to available given update) on places of interest could be benefiting the surveyors in understanding the real geographic picture in terms of road accessibility, elevation, in-place development progress and identifying good forest coverage. Figure 6 showed the incorporated data of GPS tracks with the addition of infogram (geometric attributes, elevation, slope, distance & etc) in the 4 localities. These are useful information in reporting areas that have been covered during the survey.

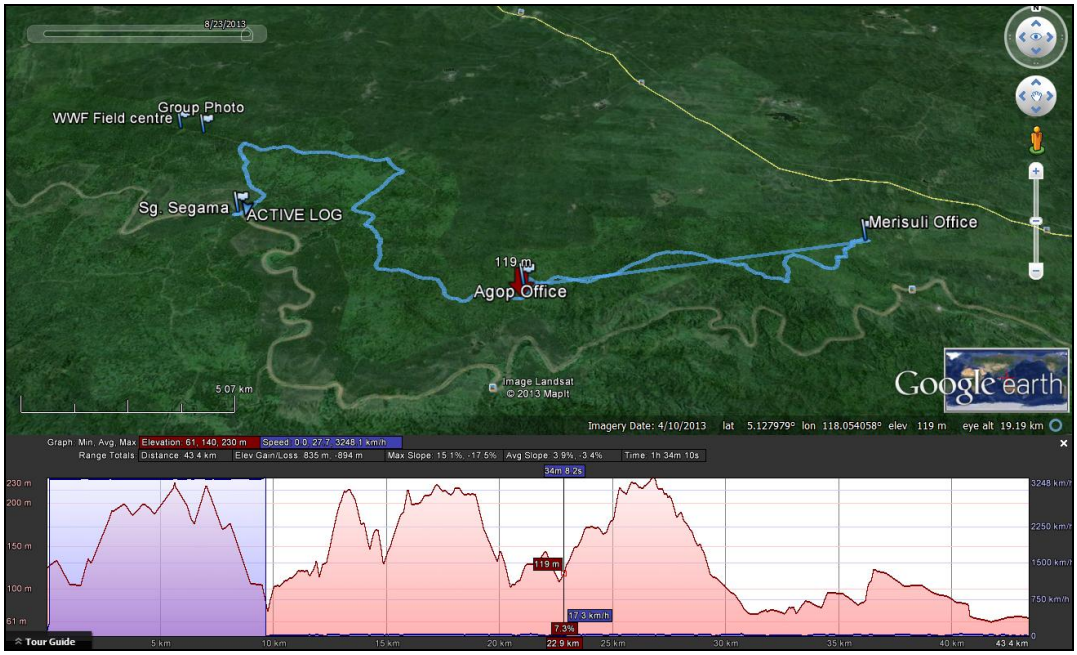

Figure 7: Road transect and distances within the survey area in Bukit Piton F.R.

2.3 Assessment by DIVA-GIS

DIVA-GIS is a free software programme that can be downloaded from the internet. It provides in-depth information for mapping and geographic data analysis. With the addition of the department's shape file info maps on location of forest reserves, soil association, elevation and river lines, all these data are useful in planning field work.

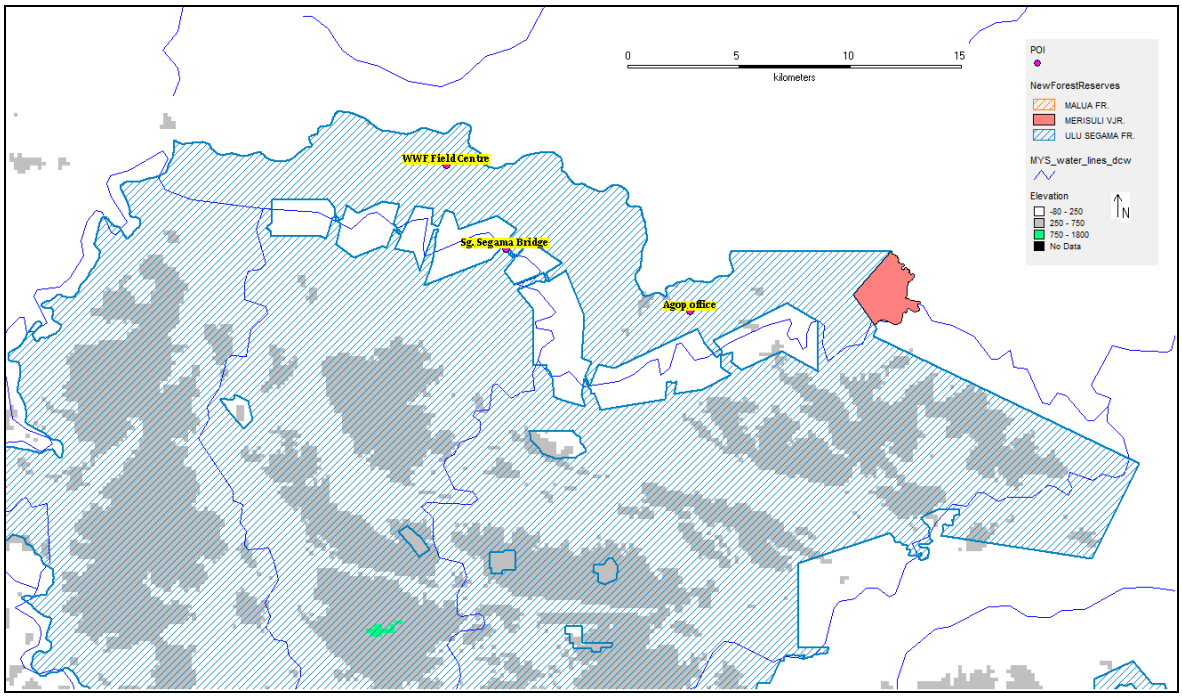

Figure 8: DIVA-GIS projection on point of interest and river lines.

2.4 Insect sampling methods

Light trap was used to sample nocturnal insects while sweep nets and forceps were used to sample diurnal insects.

2.4.1 Light trap

The trap consists of a vertical white sheet (2 X 2 m) illuminated by a 250W mercury-lithium bulb. The trap was set up in an open area facing the forest reserve, from 7:00 to 9:00 p.m. Temperature and humidity were taken with a digital hygrometer.

To evaluate diversity of the sampling area, insect species and individuals (≥ 5 mm) within the 1 X 1 m square of the white cloth were enumerated from 8:30 to 9:00 pm. This is a rapid biodiversity assessment method because by the end of the sampling time, species and individual numbers can be obtained, and the data can be used to calculate diversity indices, i.e. Shannon Wiener, Simpson and Fisher Alpha, using the Species Diversity & Richness version IV (SDR 2006). This method is simple, fast and can be carried out by non-insect specialist. To avoid compounding human error, the same staff was assigned to count the species and individual numbers throughout the sampling period, and also for other sampling sites. Light-trapping was carried out at the Sg. Agop Field Station, with details given in Table 2.

Table 2: Light-trapping site in Bukit Piton F.R.

Sampling site	Coordinates	Elevation (m)	Temp. (^{o}C)	Humidity (%)	Sampling date	Remarks
Agop1	N 05.13167^{o} E 118.05541^{o}	121	25.0	88	22 August	Fine weather without wind. Full moon only visible after sampling period.
Agop2	N 05.13167^{o} E 118.05541^{o} (facing different direction)	121	24.0	90	23 August	Heavy rain in the afternoon. Without moon during sampling period.

2.4.2 Sweep net & manual collection

Sweep nets were used to collect flying insects while other insects were sampled using fine forceps. Butterflies were put in triangle papers while other specimens were put in vials with 75% ethanol solution. Sampling was conducted along the road, open and riverine / stream areas within the forest adjacent to Malua Wildlife Office.

Figure 9: Butterfly and dragonfly sampling team at WWF restoration area within the reserve.

2.4.3 Insect specimens and identification

In this survey, focus was given to certain insect groups, i.e., butterflies, moths, beetles and dragonflies. Only interesting and potential indicator insect species were sampled, as to minimize the workload at the laboratory in preparing the specimens for identification. Photographs were taken with DSLR Nikon D300 and Coolpix S9500 cameras to facilitate identification. Common insects were not sampled but photographs were taken for record purposes.

Photographs of specimens were identified based on the FRC Entomology Collection and various reference materials, e.g. Otsuka (1988 & 2001) for butterflies; Holloway (1983, 1985, 1986, 1988, 1989, 1993, 1996a, 1997, 1998a & b, 1999, 2001, 2003, 2005, 2008, 2009 & 2011) and Robinson *et al.* (1994) for moths; Fujita (2010), Makihara (1999) and Tung (1983) for beetles; Orr (2003) and Tang *et al*. (2010) for dragonflies. Some other insects were identified based on Hill and Abang (2005).

3. RESULTS & DISCUSSION

3.1 Overall insect diversity

As indicated by the diversity index in Table 3, the nocturnal insect diversity was moderate. The Shannon Index was 3.6 while Simpson Index was 64.8 and Fisher Alpha Index was 99.5. However, the number of species recorded was low, with a mean number of 41.5 species. It is among the lowest species number sampled (within a one-square-metre), compared to other forest sites. During light-trapping, the temperature was 24-25^{0}C with humidity of 88-94% (Table 1). The distribution of insect species from the light-trapping is reflected in the species-rank abundance curves in Figure 10. In Agop1, more than 200 specimens of Dryopidae beetles of the same species were recorded but were not counted for the diversity indices because they were less than 5 mm in length. Hence, the diversity indices for Agop1 could have been far lower, and this would affect the mean diversity index for Bukit Piton F.R.

Table 3: Insect diversity within a one-square-metre, as sampled through light-trapping in Bukit Piton F.R.

No.	Sampling site	Species	Ind.	Shannon	Simpson	Fisher Alpha
1.	Agop1	36	45	3.47	66	83.56
2.	Agop2	47	58	3.71	63.58	115.5
	Mean	41.5±7.8	51.5±9.2	3.6±0.2	64.8±1.7	99.5±22.6

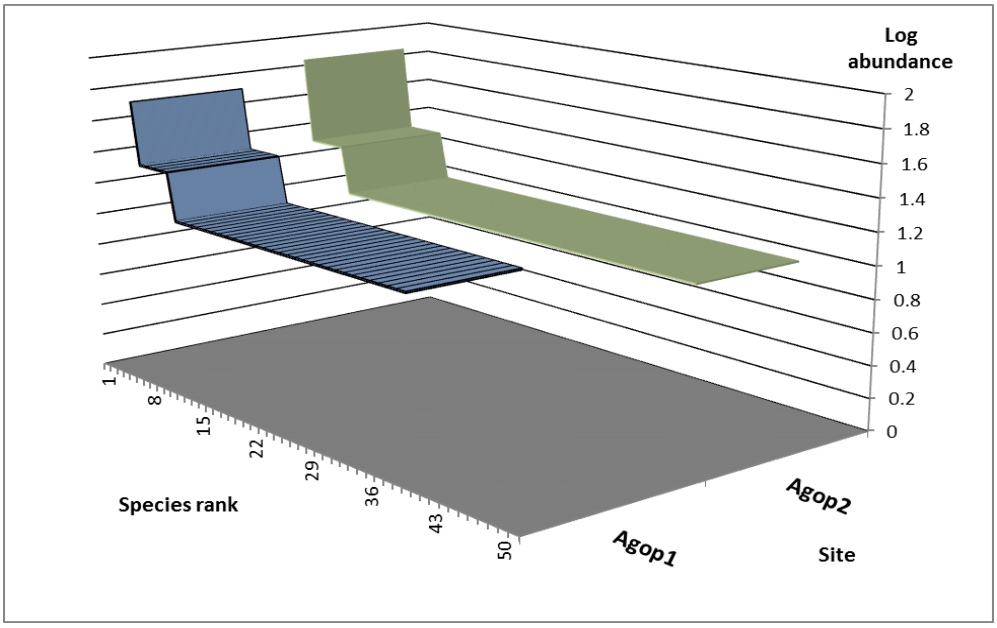

Figure 10: Species-rank abundance curves of the light-trapping site in Bukit Piton F.R.

Only one Bornean endemic species were recorded from Bukit Piton F.R. during the survey. It was the Three-horned Beetle, *Chalcosoma moellenkampi*, which is locally common.

3.1.1 Butterfly (Lepidoptera)

A total of 15 butterfly species were recorded as listed in Appendix 1 with some showcased in Plate 1. All are common species in the lowland area.

3.1.2 Moth (Lepidoptera)

A total of 25 moth species were recorded from this study (Appendix 2) and none of them is endemic to Borneo. Some of the moth species are shown in Plate 2.

3.1.3 Beetle (Coleoptera)

A total of 11 species of macro-beetles were recorded (Appendix 3 & Plate 3). The Bornean endemic but locally common Three-horned Beetle, *Chalcosoma moellenkampi*, is a large beetle recorded in this survey. It is remarkable for its size that can reach a length of about 25–60 mm in the female. As common in some Scarabaeidae, the male is larger than the female, reaching a length of about 60–100 mm. The male has specialised horns on the head and thorax that use to fight with each other to gain mating rights with female.

3.1.4 Dragonfly (Odonata)

Some dragonflies were sighted along the riverine area and beside the road within this forest reserve. A total of 5 species were recorded during this short survey. The Odonata are listed in Appendix 4 and some are shown in Plate 4.

3.1.5 Other insects

Other insects recorded during the survey are listed in Appendix 5 and some of them are shown in Plate 5.

4. CONCLUSION

From this study, the insect species richness of Bukit Piton F.R. was comparatively low during the sampling period. Only one endemic species was recorded and it is a locally common species. As no other insect survey has been conducted at this forest reserve in the past, this pioneer data will serve as baseline information for other research work in future. The insect data procured during the survey provide supporting information to enhance the conservation of this forest reserve as well as to provide value-added information for this FSC-certified forest.

ACKNOWLEDGEMENTS

We thank the DFO of Ulu Segama-Malua, Indra Sunjoto and his staff for logistics and field support. The FRM Division (Rosila Anthony) and Jumri Abd. Hamid of FRC provided the maps and information. The Deputy Director (R&D), Dr Lee Ying Fah and Head of FRC Insect Diversity Programme, Dr Chey Vun Khen are also acknowledged for their support.

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Plate 1. Selected butterflies sampled from Bukit Piton Forest Reserve (22-24 August, 2013).

Eurema blanda blanda
(Pieridae)

Leptosia nina malayana
(Pieridae)

Graphium agamenon agamenon
(Papilionidae)

Graphium dorson evemoides
(Papilionidae)

Pachliopta aristolochiae
(Papilionidae)

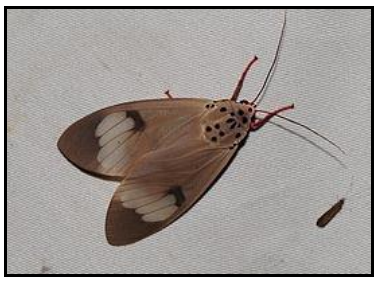
Hypolimnas bolina philippensis
(Nymphalidae)

Mycalesis anapita fucentia
(Nymphalidae)

Neptis sp. 1
(Nymphalidae)

Neptis sp. 2
(Nymphalidae)

Plate 2. Selected moths recorded from Bukit Piton Forest Reserve (22-24 August, 2013).



Amerila astreus
(Arctiidae)

Nyctemera muelleri
(Arctiidae)

Barsine' porphyrea
(Arctiidae)

Comostola nereidaria
(Geometridae)

Rhombocentra semipurpurea
(Geometridae)

Neochera marmorea
(Noctuidae)

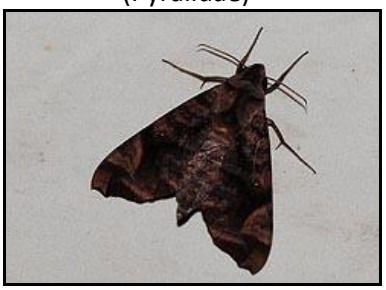
Metaemene atrigutta
(Noctuidae)

Ramadasa pavo
(Noctuidae)

Arthroschista hilardis
(Pyralidae)

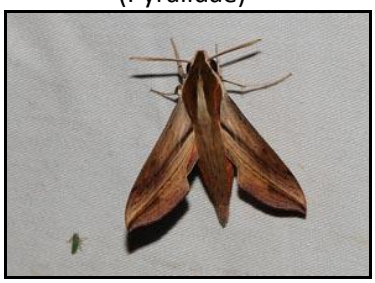
Rhimphalea astrigalis
(Pyralidae)

Xanthomelaena schematias
(Pyralidae)



Acosmerys anceus
(Sphingidae)

Enpinanga borneensis
(Sphingidae)



Hippotion echeclus
(Sphingidae)

Lyssa menoetius
(Uraniidae)

Plate 3. Beetles recorded from Bukit Piton Forest Reserve (22-24 August, 2013).

To be identified later
(Lycidae)

Aceraius sp.
(Passalidae)

Anomala pallida
(Scarabaeidae)

Maladera sp.
(Scarabaeidae)

Plate 4. Dragonflies recorded from Bukit Piton Forest Reserve (22-24 August, 2013).

Agrionoptera insignis
(Libellulidae)

Cratilla ?metallica
(Libellulidae)

Neurothemis fluctuans
(Libellulidae)

Neurothemis ramburii
(Libellulidae)

Plate 5. Other insects recorded from Bukit Piton Forest Reserve (22-24 August, 2013).

'Yellow Assassin Bug'
(Hemiptera)

'Planthopper'
(Hemiptera)

Camponotus gigas
(Hymenoptera)

'Pointed Nose Grasshopper'
(Orthoptera)

APPENDICES

Appendix 1: Tentative butterfly list from Bukit Piton F.R., Sabah (22-24 August, 2013)

No.	Species	Author	Family	Photo
1	*Eurema blanda blanda*	Yata	Pieridae	USM5219
2	*Leptosia nina malayana*	Fruhstorfer	Pieridae	USM5197
3	*Graphium agamenon agamenon*	Linne	Papilionidae	USM5248
4	*Graphium dorson evemoides*	Honrath	Papilionidae	USM5223
5	*Pachliopta aristolochiae antiphus*	Fabricius	Papilionidae	USM5245
6	*Papilio memnon memnon*	Linne	Papilionidae	Spotted
7	*Papilio polytes thesus*	Cramer	Papilionidae	Spotted
8	*Anosia genutia intensa*	Moore	Nymphalidae	Spotted
9	*Hypolimnas bolina philippensis*	Butler	Nymphalidae	USM5180, USM5204
10	*Idea stolli virgo*	Fruhstorfer	Nymphalidae	Spotted
11	*Junonia atlites atlites*	Linnaeus	Nymphalidae	Spotted
12	*Mycalesis anapita fucenta*	Fruhstorfer	Nymphalidae	USM5194
13	*Neptis* sp. 1		Nymphalidae	USM5181
14	*Neptis* sp. 2		Nymphalidae	USM5220
15	Unidentified		Lycaenidae	USM5147

Appendix 2: Selected moths recorded from Bukit Piton F.R., Sabah (22-24 August, 2013).

No.	Species	Author	Family	Subfamily	Photo	Remarks
1	*Amerila astreus*	Drury	Arctiidae	Arctiinae	USM5114	
2	*Creatonotos transiens*	Walker	Arctiidae	Arctiinae	USM5098	
3	*Nyctemera muelleri*	Vollenhoven	Arctiidae	Arctiinae	USM5264	

4	*Spilosoma* sp.		Arctiidae	Arctiinae	USM5266
5	*Adites* sp.		Arctiidae	lithosiinae	USM5138
6	*Barsine' porphyrea*	Snellen	Arctiidae	lithosiinae	USM5148
7	*Cyana inconclusa*	Walker	Arctiidae	lithosiinae	USM5285
8	*Comostola nereidaria*	Snellen	Geometridae	Geometrinae	USM5109
9	*Rhombocentra semipurpurea*	Warren	Geometridae	Geometrinae	USM5140
10	*Spaniocentra sp.*		Geometridae	Geometrinae	USM5122
11	*Antitrygodes divisiana*	Walker	Geometridae	Sterrhinae	USM5125
12	*Cyana* sp.		Arctiidae		USM5100
13	*Asota heliconia*	Linnaeus	Noctuidae	Aganainae	USM5101
14	*Neochera marmorea*	Walker	Noctuidae	Aganainae	USM5116
15	*Metaemene atrigutta*	Walker	Noctuidae		USM5132
16	*Ramadasa pavo*	Walker	Noctuidae		USM5152
17	*Arthroschista hilardis*	Walker	Pyralidae	Pyraustinae	USM5277
18	*Parotis* sp.		Pyralidae	Pyraustinae	USM5276
19	*Rhimphalea astrigalis*	Hampson	Pyralidae	Pyraustinae	USM5144
20	*Xanthomelaena schematias*	Meyrick	Pyralidae	Pyraustinae	USM5102
21	*Acosmerys anceus*	Stoll	Sphingidae		USM5141
22	*Cechenena helops*	Walker	Sphingidae		USM5269
23	*Enpinanga borneensis*	Butler	Sphingidae		USM5139
24	*Hippotion echeclus*	Boisdural	Sphingidae		USM5094
25	*Lyssa menoetius*	Hopffer	Uraniidae		USM5103

Appendix 3: Beetles recorded from Bukit Piton F.R., Sabah (22-24 August, 2013).

No.	Species	Author	Family	Photo	Remarks
1	*Cosmodela aurulenta*	Fabricius	Cicindellidae	USM5121	
2	To be identified later		Dryopidae	USM5095	
3	To be identified later		Hybosoridae	USM5154	
4	To be identified later		Lucanidae	USM5106	
5	To be identified later		Lycidae	USM5278	
6	*Aceraius* sp.		Passalidae	USM5283	
7	*Anomala pallida*		Scarabaeidae	USM5113	
8	*Anomala* sp.		Scarabaeidae	USM5099	
9	*Apogonia* sp.		Scarabaeidae	USM5110	
10	*Chalcosoma moellenkampi*	Kolbe	Scarabaeidae	USM5092	Endemic to Borneo
11	*Maladera* sp.		Scarabaeidae	USM5274	

Appendix 4: Dragonflies recorded from Bukit Piton F.R., Sabah (22-24 August, 2013).

No.	Species	Author	Family	Photo
1	*Agrionoptera insignis*	(Rambur)	Libellulidae	USM5191
2	*Cratilla ?metallica*	(Brauer)	Libellulidae	USM5240
3	*Neurothemis fluctuans*	(Fabricius)	Libellulidae	USM5193,USM5216
4	*Neurothemis ramburii*	(Brauer)	Libellulidae	USM5236
5	*Orthetrum testaceum*	(Burmeister)	Libellulidae	USM5206

Appendix 5: Other insects recorded from Bukit Piton F.R., Sabah (22-24 August, 2013).

No.	Species	Author	Order	Family	Remarks	Photo
1	To be identified later		Hemiptera	Cicadidae	Cicada	USM5127
2	To be identified later		Hemiptera		Assassin bug	USM5146
3	To be identified later		Hemiptera		Plant hopper	USM5290
4	*Apis dorsata*		Hymenoptera	Apidae		USM5160
5	*Camponotus gigas*		Hymenoptera	Formicidae	Giant forest ant	USM5287
6	To be identified later		Hymenoptera	Vespidae		USM5136
7	To be identified later		Neuroptera		Lacewing	USM5273
8	To be identified later		Orthoptera	Acrididae	Short-horned grasshopper	USM5176
9	*Gryllotalpa orientalis*		Orthoptera	Gryllidae		USM5104
10	To be identified later		Orthoptera	Gryllidae	Field cricket	USM5186
11	To be identified later		Orthoptera	Tettiigonidae	Bush cricket	USM5128
12	To be identified later		Orthoptera		Pointed-nose Grasshopper	USM5188
13	To be identified later		Orthoptera		Short-horned grasshopper	USM5254