



Bukit Durang



HIDDEN JEWEL OF ULU SUAI, SARAWAK

BIODIVERSITY AT A GLANCE

EDITED BY:

Jayasilan Mohd-Azlan and Aida Shafreena Ahmad Puad



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2023

Bukit Durang
Hidden Jewel of Ulu Suai, Sarawak
Biodiversity at a Glance

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Bukit Durang
High Conservation Value Forest

This book aims to enlighten and educate stakeholders and to present some information on species distribution to the nature enthusiast. This volume draws its material from various scientists' research and experience in this area. The images illustrated on colour plates reveal the potential of this area as an interesting site for naturalists as well as for researchers.

The introductory chapter gave insight into the importance of the High Conservation Value forest and set the scene for this book. The plant component chapters showcased the complex and unique structure of the flora diversity in the Bukit Durang area. The wildlife aspects of this book covered species from an array of taxa that includes both invertebrates and vertebrates (amphibians, fish, birds & mammals). The High Conservation Value forest is also home to several endemic species, as well as species of conservation importance. The social element chapter contributes to the history of Bukit Durang while the final chapter wraps the way forward for biodiversity conservation.

The research in Bukit Durang was made possible by the generosity of Wilmar Plantations Sdn Bhd (formerly known as PPB Oil Palm Sdn Bhd), who provided funding to Universiti Malaysia Sarawak for said research. This project is aimed to assess the selected biotic diversity i.e plant, invertebrate and vertebrate groups.



Orange-bellied Flowerpecker (*Dicacum trigonostigma*).

This common species having a wide distribution have been reported up to Kelabit highlands. In Bukit Durang area, they have been mist-netted and spotted foraging in the understory. This omnivorous species has been reported to feed on seeds of 'Senduduk' *Melastoma malabathricum*, small insects as well as pollen and nectar.

© Photo: Badiozaman Sulaiman

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Foreword

Sarawak retains some of the richest biodiversity in the world. It is home to many endemic species of conservation importance. Some of these examples can be found in Sarawak's High Conservation Value forest. From its inception, UNIMAS has put biodiversity and environmental conservation at the forefront of its research niche and agenda by setting up the Faculty of Resource Science and Technology (FRST) and the Institute of Biodiversity and Environmental Conservation (IBEC). With the establishment of these two hubs of knowledge, UNIMAS' commitment increased twofold: firstly, it mapped out the necessary measures to enhance the sustainable management of Sarawak's natural resources and secondly, being in Sarawak, with its vast biodiversity and multi-ethnic population, UNIMAS academics are also continuously collaborating with the local communities, government and non-government agencies as well as national and international researchers to study the conservation of tropical biodiversity and the global environment.

In the pursuit of research excellence, we are challenged by the need to identify

strategic partners. We continuously encourage our academics to explore external sources, especially in engaging private agencies to contribute to the various researches conducted at the University. One such effort has resulted in the signing of an MoA with WILMAR in 2014 with a project titled **"Identification and monitoring of Endangered, Rare and Threatened Species and their habitats in Wilmar's plantations in Sarawak"**. The synergy between WILMAR and UNIMAS is significant; not only that both agencies benefit through the conservation of biodiversity and environment, but it also highlights our rich expertise and skills in research, and at the same time motivates our young research minds who come to UNIMAS to learn about Biodiversity, in order to enhance their experience through industrial training at relevant agencies.

In line with the rapid developments in the oil palm industry and the increasing awareness in the need to conserve resources especially in Sarawak, this work is indeed substantial and considerably impactful in the current context of Malaysia's rich biodiversity and natural resources. The scope of work in this collaboration is an important milestone not



UNIMAS studies shows that many species of conservation importance are thriving in Bukit Durang Conservation Area.
© Photo: Wilmar

only for UNIMAS-industry linkage but also significant for biodiversity conservation and sustainable development in Sarawak.

Given that this book represents but a small sample of the amount of work done by our academics in the realm of biodiversity. I would like to commend the efforts of Wilmar Plantations Sdn Bhd (formerly known as PPB Oil Palms Sdn Bhd) who supported us in collecting information on the biodiversity in some of these areas including Bukit Durang, which forms the material for the book. The work is also expected to be important for stakeholders, for better understanding and appreciation of local biodiversity.

It is my hope that this book will contribute and encourage more people to work in this area, publish more journal articles of this kind and more funders to support in this field. I anticipate that this volume will be useful to stakeholders and for the advancement of the best management practices in general.



Prof. Datuk Dr Mohamad Kadim Suaidi
Vice Chancellor
Universiti Malaysia Sarawak

Message from Wilmar



Wilmar International Limited (Wilmar) was amongst the early adopters of the High Conservation Value (HCV) approach in the oil palm sector, and we carried out HCV assessments of our own operations from as early as 2007. Since then, our approach to conservation has expanded to include High Carbon Stock (HCS) areas, as enshrined in our No Deforestation, No Peat, No Exploitation (NDPE) Policy. Our conservation areas are sanctuaries for many threatened and endangered species, which we strive to protect.

The Bukit Durang Conservation Area (BDCA) which is located in our Saremas Group of estates, adjacent to Niah, is an important conservation site in our Sarawak operation. Since 2014, our research collaboration with the Universiti Malaysia Sarawak (UNIMAS) has provided us the necessary insights into the biodiversity of the area. The findings from the systemic monitoring done by the UNIMAS researchers alongside our team on the ground are discussed in this book. The findings from this book provide

some scientific evidence that the BDCA, although fragmented and surrounded by palm oil plantations, is a hidden biodiversity jewel.

While we remain guided by our biodiversity commitments, we are cognizant that we are limited by our knowledge and expertise in conservation efforts. Through collaborations with various strategic partners such as research institutes and universities like UNIMAS, we have been able to leverage scientific knowledge, and build capacity to help us strengthen the management of our conservation areas. Further cooperation with the local communities also helps us to ensure the survival of our conservation areas. For example, our partnership with the local longhouse communities in Saremas has enhanced the management of our conservation area. We recognize that local communities play an important role in the protection of our conservation areas and supporting conservation efforts on the ground.



Insectivore bird species plays an important role in regulating pest insects in oil palm plantations.
© Photo: Wilmar

I would like to extend my heartfelt gratitude to UNIMAS for collaborating with us to gather the findings on the BDCA and making this book the first publication by a Malaysian university to document the biodiversity in a Wilmar conservation area. We believe that real and lasting change on the ground can only be achieved through

a multi-stakeholder effort, and we look forward to continued collaboration and partnership in the years ahead.



Jeremy Goon
Chief Sustainability Officer
Wilmar International Limited

Preface

JAYASILAN MOHD-AZLAN
& AIDA SHAFREENA AHMAD PUAD

Sarawak is located in one of the world's unique biodiversity regions, it boasts a variety of habitat types, including a mix of dipterocarp forests with distinctive inhabitants. These habitats are often transformed into agriculture including oil palm plantations. However, the expansion of plantations to meet the global demand for vegetable oils should not be at the expense of our biodiversity and rural communities. It is important that oil palm growers play a significant role in sustainable development by being environmentally responsible and promote the conservation of natural resources and biodiversity. Therefore, biodiversity is one of the top agenda for Sarawak, whereby the state is determined to conserve and protect its biodiversity. This project sits in line with the University's niche area of biodiversity and environmental conservation and Sustainable Community Transformation.

As more global companies are being committed to 100% RSPO-certified palm oil, growers in Malaysia particularly in Sarawak need to be proactive to

produce sustainable oil palm which in turn can result in significant returns and be economically transformative for this industry. As such, High Conservation Value (HCV) areas within oil palm plantation concessions should not be regarded as low value. In line with the rapid developments in the oil palm industry and the increasing awareness of the need to conserve resources, especially in Sarawak, biodiversity in remnant forests such as Bukit Durang should not be ignored and is indeed substantial and considerably impactful in the current context of Malaysia's rich biodiversity and natural resources.

We are especially thankful to the Wilmar team comprising Mr Jeremy Goon, Mr Simon Siburat, Mr Gurcharan Singh, Mr Kiaw Che Weng, Mr Asrif bin Mahmud, Mr Chang Sip Woon, Mdm Perpetua George, Ms Chin Sing Yun and Ms Ginny Ng for their support in the project. We also extend our gratitude to the staff of Wilmar Plantations Sdn. Bhd, namely, Mr James Wong, Mr Edward Enggu Anak Setu, Mr Joanes Anak John, the late Mr Golan Anak



▲
Crested Fireback. © Photo: Jayasilan Mohd-Azlan

Mat, Ms Marcie Elene Marcus Jopony and Mr John Alit. The following colleagues helped with the reviews of manuscripts: Professor Cheksum Supiah Tawan, Professor Indraneil Das, Associate Professor Dr Ruhana binti Hassan, Associate Professor Dr Wong Sin Yeng, Associate Professor Dr Wong Swee Kiong, Dr Badrul Azhar Md. Sharif, Dr Jayaraj Vijaya Kumaran, Dr Mohamad Fizl Sidq bin Ramji, Mr Muhamad Ikhwan bin Idris and Ms Lisa Lok Choy Hong. We would also like to thank Research, Innovation and Enterprise Centre, Institute of Biodiversity and Environmental Conservation and the Faculty of Resource Science and Technology, UNIMAS, for logistical and administrative support. We owe a special debt of gratitude to Mr Badiozaman Sulaiman for providing images of species (Birds & Insects) that we have used in this work. Finally, we thank Wilmar for

the page layout and UNIMAS Publisher for arranging its publication. We would also like to thank Forest Department Sarawak and Sarawak Forestry Forestry Corporation for their research permits.

This book provides pictorial information on the selected species' distribution and richness in the Bukit Durang HCV area. The faunal studies include insects, fishes, amphibians, birds, bats, rodents and some larger mammals. This book intends to share the output of the research with local stakeholders, management authorities and the general public. It is hoped that nature enthusiasts and those who are interested in tropical biodiversity near this region will find this book beneficial. Finally, we hope that this book will contribute to increasing knowledge and awareness of our national pride and heritage.

Bukit Durang forest fragment (994.6 Ha) is the largest forest patch near Saremas. It is a narrow forest (700 m wide) strip (14 km long) of steep forest (slope = 35°) with difficult access.

© Photo: Wilmar

**BUKIT DURANG
CONSERVATION AREA
994.59 Ha**



Introduction

JAYASILAN MOHD-AZLAN, CHIN SING YUN, JAMES WONG, LISA LOK CHOY HONG

The escalation of land use conversion to agriculture is one of the key drivers of the decline in critical ecosystem function and biodiversity. Vast areas of forest in the tropics have been cleared and planted for various agricultural crops including oil palm, which is one of the most important crops in many tropical countries especially Indonesia and Malaysia. The establishment of oil palm plantations is an incredibly intensive process, involving converting native vegetation, usually degraded land or logged over forest to a plantation, often leaving behind fragmented and isolated rainforest in an oil palm matrix.

Sarawak is the last frontier in oil palm expansion in Malaysia, as Sabah and Peninsula Malaysia have been saturated with oil palm plantations. Sarawak currently (year 2021) has 1.58 million hectares of oil palm, representing 26.9% of the total oil palm plantation area in Malaysia (5.9 Million ha). In northern Sarawak, the region of Miri has extensive oil palm plantations representing ~25% of the total area under oil palm in Sarawak. The palm oil industry is the state's third-largest foreign exchange earner after petroleum and liquefied natural gas, hence land is under tremendous pressure for palm development, especially on the NCR land.

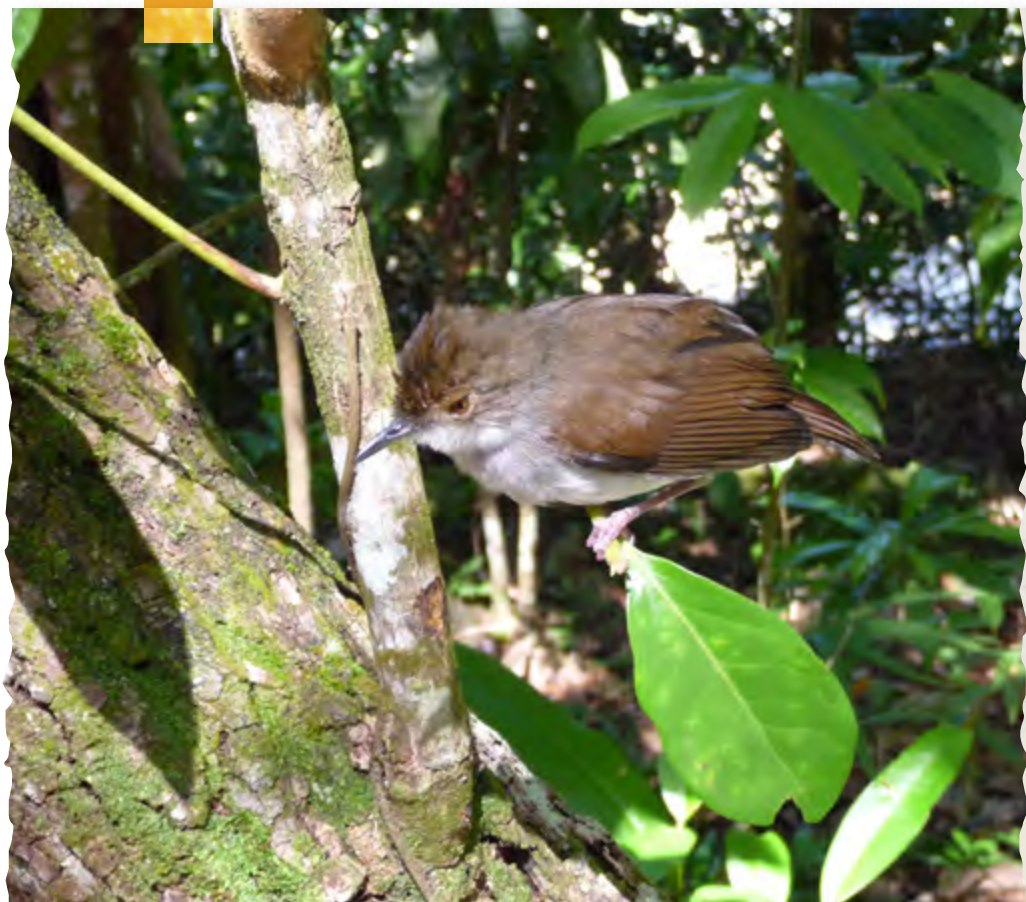
A substantial proportion of Sarawak's biodiversity is endemic to Borneo. However, how the expansion of oil palm estates across the landscape has affected these taxa is unknown. In recent years, best management practices for oil palm plantations on conservation emerged through certification standards such as the Roundtable on Sustainable Palm Oil (RSPO) and Malaysian Sustainable Palm Oil (MSPO) Certification Scheme to ensure sustainable oil palm and biodiversity-friendly plantations.

Many large oil palm estates preserve and protect forest fragments and define them as high conservation

value (HCV) areas through the HCV assessment. Despite their small size and random distributions, these HCV habitat fragments may secure sufficient biodiversity to maintain essential ecosystem functions and services within the agricultural landscape. The residual HCV habitat fragments in maintaining remnant biodiversity in an intensive agricultural area are essential for improving conservation outcomes in oil palm plantations. In view of this, a series of scientific studies have been carried out

in the HCV area of Wilmar Plantations Sdn Bhd, a subsidiary of Wilmar International Limited, to understand the richness of Sarawak's flora and fauna that lies within. These HCV areas are collectively called Bukit Durang Conservation Area (BDCA). There are limited long-term studies carried out in the HCVs within the oil palm landscape and the result of the studies in Bukit Durang were gathered from 2016 - 2019 which provided details on the biodiversity of conservation areas in Wilmar's estates.

Bukit Durang provides important ecosystem function in an oil palm dominated landscape.



Bukit Durang provides critical habitat and resources for many bird species including forest dependent species.

Bukit Durang is located within the estates of Saremas 2 and Segarmas, also commonly known as Saremas, of Wilmar Plantations. This area is in Ulu Suai which is within the administrative boundary of Sawai Land District, Miri Division, Sarawak. The concessions are bordered by various types of land use including oil palm plantations, smallholder oil palm blocks, secondary forests, orchards and teak plantations. This area lies approximately 149 km from Miri

town. BDCA is a fragmented forest with an area of 994.60 ha. It was developed in the 1980s and HCV are mainly the remnant of the logged-over forest.

This secondary forest is dominated by species from the Family Euphorbiaceae, Leguminosae, Dipterocarpaceae and Moraceae. This includes some essential economic trees such as *Eusideroxylon zwageri*, *Dipterocarpus* spp., *Shorea* spp.,



Wilmar Plantations complex is located approximately 149 km from Miri, the largest city in the northern region of Sarawak.



Bukit Durang Conservation Area.



Dryobalanops spp., *Artocarpus* spp., and *Anisoptera* spp. This thin strip of forest patch also provides crucial habitats to various species of conservation importance. Samplings for mammals, birds, amphibians, fish, insects and plants were carried out from 2014 to 2015.

The studies recorded 39 species of small mammals, 58 species of birds, 24 species of amphibians, 41 species of fish, crayfish and prawns. The presence of various species of conservation importance in the area shows that Bukit Durang is a critical biodiversity refuge that may improve species diversity in an oil palm dominated landscape for conservation and maintenance of ecosystem function.

Bukit Durang is the only remaining forest landscape within the Ulu Suai district surrounded by oil palm plantations. **Therefore, the synergy between empirical research and plantation management should be regarded as a cornerstone for biodiversity conservation in the Wilmar Plantations area in Sarawak.** This modest compilation provides information on the flora and fauna in the Bukit Durang area. This book consists of the findings from eight projects in order to shed some light on the relevant details for biodiversity management in the HCV area of Bukit Durang and provide a biodiversity snapshot of Bukit Durang Conservation Area.

“

This secondary forest of Bukit Durang is dominated by species from the Family Euphorbiaceae, Leguminosae, Dipterocarpaceae and Moraceae. This thin strip of forest patch provides crucial habitats to various species of conservation importance.

The studies recorded **39 species of small mammals, 58 species of birds, 24 species of amphibians, 41 species of fish, crayfish and prawns.** The presence of various species of conservation importance in the area shows that Bukit Durang is a critical biodiversity refuge that may improve species diversity in an oil palm dominated landscape for conservation and maintenance of ecosystem function.



▲ Bukit Durang harbours many ecological and economically important flora and fauna.
© Photo: Wilmar



Insects

RATNAWATI HAZALI, SITI NURLYDIA SAZALI, WAN NURAINIE WAN ISMAIL, ISAAC STIA MARCELLINUS, ANIS NORSYAHIRA MOHD RAFFI, FADZRAHNI TARSHA MOHD USTAR, MOHD ASHRAF ABDUL MUTALIB, NUR SITI AISYAH ZARIMIN, QUMIDDIN AB RAZAK, SITI HANISAH ZAHURI, WAHAP MARNI AND MOHAMAD JALANI MORTADA

Cosmodela aurulenta (Coleoptera: Carabidae), or commonly known as the golden-spotted tiger beetle, is a species commonly found in open areas or in lowlands near riverbanks. The species is 14 to 16 mm in length, the body is dark greenish with three distinctive spots on each sides of the elytra. There is also the presence of pale coloured hairs on the abdomen and legs. The species are known to be opportunistic predators of smaller invertebrates, with characteristic large mandibles and enlarged compound eyes. The species is also observed to show brief flights.

©Photo: Isaac Stia Marcellinus

Introduction

Insects are important components of global biodiversity and play a significant role in ecosystem functioning. The presence or absence of insects is important to the distribution, abundance and diversity of plants and vertebrates, which typically are the premier species in conservation efforts (Miller, 1993). Insects are often used in environmental studies as bioindicators due to their diversity and abundance (Chung, 2013). This study aimed to document the species composition of three main insect groups: butterflies (Lepidoptera), beetles (Coleoptera) and true bugs (Hemiptera) in Bukit Durang High Conservation Value Forest (HCVF). Samplings of insect fauna of Bukit Durang HCVF were conducted from 22-27 January 2014, 24-30 August 2014 and from 4-11 February 2015. Four methods of collection were carried out in this study: (i) modified Pennsylvanian light trap, (ii) aerial-netting, (iii) baited-trap, and (iv) hand-picking.

“

Insects are often used in environmental studies as bioindicators due to their diversity and abundance.

Species Composition of Butterflies

A total of 65 species of butterflies from 42 genera, representing four families including Papilionidae, Pieridae, Nymphalidae and Lycaenidae, were documented (Table 1). This represents about 7% of the total number of 939 butterfly species recorded from Malaysian Borneo (Abang, 2006). The family Nymphalidae with 47 species (72.3%) represented the most speciose

family recorded. The Rajah Brooke’s Birdwing (*Trogonoptera brookiana brookiana*) is the only protected insect species in Sarawak under the Sarawak Wildlife Protection Ordinance 1998. The Rajah Brooke’s Birdwing and Golden Birdwing (*Troides amphrysus flavicollis*) are also listed in Appendix II under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Table 1
LIST OF BUTTERFLY SPECIES RECORDED IN BUKIT DURANG HCVF.

Family/Subfamily	Scientific Name	Common Name
Papilionidae		
	<i>Trogonoptera brookiana brookiana</i>	Rajah Brooke’s Birdwing
	<i>Papilio demoleus</i>	Lime Butterfly
	<i>Arisbe sarpedon sarpedon</i>	Common Bluebottle
	<i>Arisbe doson evemonides</i>	Common Jay
	<i>Balignina neptunus doris</i>	Common Neptune
	<i>Troides amphrysus flavicollis</i>	Golden Birdwing
Pieridae		
Pierinae	<i>Leptosia nina malayana</i>	Psyche Butterfly
	<i>Appias paulina athena</i>	White Albatross
	<i>Saletara panda distanti</i>	Triangle White
	<i>Catopsilia scylla cornelia</i>	Yellow Imigrant
	<i>Eurema hecabe hecabe</i>	Common Grass Yellow
	<i>Eurema blanda blanda</i>	Three Spot Grass Yellow
	<i>Eurema simulatrix tecmesa</i>	Hill Grass Yellow
	<i>Eurema nicevillei nicevillei</i>	Banded Grass Yellow
	<i>Gandaca harina elis</i>	Tree Yellow
	<i>Pareronia valeria lutescens</i>	Wanderer

Family/Subfamily	Scientific Name	Common Name
Nymphalidae		
Danainae	<i>Euploea diocletianus lowii</i>	Magpie Crow
	<i>Euploea mulciber portia</i>	Striped Blue Crow
	<i>Ideopsis vulgaris interposita</i>	Blue Glassy Tiger
	<i>Parantica agleoides borneensis</i>	Black Tiger
	<i>Parantica aspasia aspasia</i>	Yellow Glassy Tiger
Satyrinae	<i>Elymnias hypermnestra nigrescens</i>	Common Palmfly
	<i>Amathusia phidippus phidippus</i>	Palm King
	<i>Discophora necho cheops</i>	Great Duffer
	<i>Coelites euptychioides euptychioides</i>	
	<i>Faunis canens borneensis</i>	Common Faun
	<i>Faunis stomphax stomphax</i>	Banded Faun
	<i>Mycalesis anapita fucentia</i>	Common Bush Orange
	<i>Mycalesis fuscum adustata</i>	Malayan Bush Brown
	<i>Mycalesis horsfieldi hermana</i>	Horsfield’s Bush Brown
	<i>Mycalesis mineus macromalayana</i>	Dark Brand Bush Brown
	<i>Mycalesis orseis borneensis</i>	Purple Bush Brown
	<i>Orsotriaena medus medus</i>	Dark Grass Brown
	<i>Thaumanthis odona panwila</i>	Blue-banded Jungle Glory
	<i>Ypthima baldus selinuntius</i>	Common Five-Ring
	<i>Ypthima fasciata fasciata</i>	Malayan Six-Ring
	<i>Ypthima pandocus sertorius</i>	Common Three-Ring
	<i>Zeuxidia amethystus wallacei</i>	Common Saturn
Nymphalinae	<i>Vindula erota montana</i>	Common Cruiser
	<i>Vindula dejone dejone</i>	Malay Cruiser
	<i>Cirrochroa satellita satellita</i>	
	<i>Cethosia hypsea hypsea</i>	Malayan Lacewing
	<i>Junonia atlites atlites</i>	Grey Pansy
	<i>Junonia orithya metion</i>	Blue Pansy
	<i>Hypolimnna anomala anomala</i>	Malayan Egg-fly
	<i>Hypolimnna bolina philippensis</i>	Great Egg-fly
	<i>Neptis hylas sopatra</i>	Common Sailor
	<i>Neptis duryodana duryodana</i>	Malayan Sailer
	<i>Pandita sinope sinope</i>	Colonel

Family/Subfamily	Scientific Name	Common Name
Nymphalidae		
Nymphalinae	<i>Athyma kanwa kanwa</i>	Dot-dash Sergeant
	<i>Athyma nefte subrata</i>	Colour Sergeant
	<i>Athyma pravara pravara</i>	Lance Sergeant
	<i>Athyma reta reta</i>	Malay Staff Sergeant
	<i>Moduza procris agnata</i>	The Commander
	<i>Tanaecia clathrata coerulescens</i>	Violet-bordered Viscount
	<i>Tanaecia pelea djatata</i>	Malay Viscount
	<i>Euthalia godarti vacillaria</i>	
	<i>Euthalia iapis ambalika</i>	Horsfield's Baron
	<i>Bassarona dunya monara</i>	Great Marquis
	<i>Lexias dirtea chalcenoides</i>	Black Tipped Archduke
	<i>Lexias pardalis dirteana</i>	Archduke
	<i>Charaxes bernardus repititus</i>	Tawny Rajah
	<i>Cupha erymanthis erymanthis</i>	Rustic
Lycaenidae		
Lycaeninae	<i>Arhopala epimuta</i>	Common Disc Oakblue
	<i>Jamides lugine</i>	

Species Composition of Beetles

A total of 62 species of beetles from 53 genera and representing 22 families, were documented (Table 2). The family Scarabaeidae with 14 species (22.6%) represented the most speciose family recorded. Out of these, the largest Three-horned beetle in Borneo, with 50-115 mm in length, *Chalcosoma moellenkampii* is a Bornean endemic. This commonly encountered species occurs in lowland to montane forests.

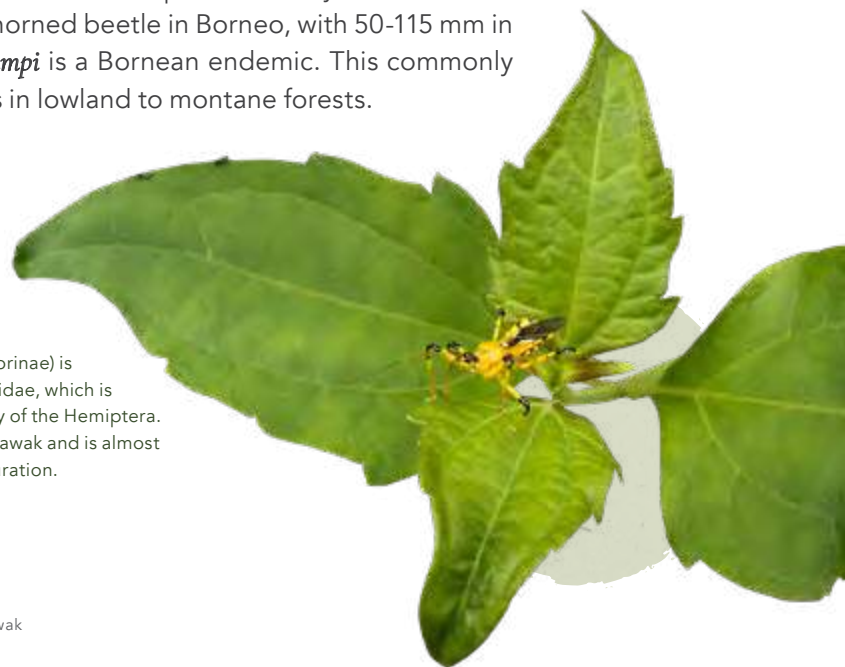


Figure 1
Velinus nigrigenu (Hemiptera: Harpactorinae) is an assassin bug from the family Reduviidae, which is considered the main predaceous family of the Hemiptera. This species is widely distributed in Sarawak and is almost similar to *Cosmolestes picticeps* in colouration.
 © Photo: Ratnawati Hazali

Table 2
LIST OF BEETLE SPECIES RECORDED IN BUKIT DURANG HCVF.

Family	Scientific Name	Family	Scientific Name
Attelabidae	<i>Apoderus</i> sp.	Endomychidae	<i>Parindalmus quadrilunatus</i>
Bostrichidae	<i>Rhizopherta dominica</i>	Erotylidae	<i>Encaustes</i> sp.
Carabidae	<i>Cicindela sumatrensis</i>	Languriidae	<i>Pachylanguria</i> sp.
	<i>Cicindela</i> sp.	Lampyridae	<i>Pteroptyx</i> sp.
	<i>Cosmodela aurulenta</i>	Lucanidae	<i>Aegus chelifer</i>
	<i>Cosmodela versicolor</i>		<i>Aegus</i> sp.
Cerambycidae	<i>Pheropsophus occipitalis</i>		<i>Ceruchus</i> sp.
	<i>Olenecamptus bilobus</i>		<i>Prosopocoilus occipitalis</i>
	<i>Pterolophia melanura</i>	Nitidulidae	<i>Carpophilus</i> sp.
	<i>Ropica</i> sp.	Passalidae	<i>Aceraius</i> sp.
	<i>Trirachys orientalis</i>	Rutelidae	<i>Mimela maculicollis</i>
Cetoniidae	<i>Glycyphana quadricolor sinuata</i>	Scarabaeidae	<i>Adoretus compressus</i>
	<i>Euselates cineracea</i>		<i>Anomala concha</i>
	<i>Euselates</i> sp.		<i>Anomala matricula</i>
			<i>Anomala viridis</i>
Chrysomelidae	<i>Aulacophora flavomarginata</i>		<i>Apogonia expeditionis</i>
	<i>Chrysolina</i> sp.		<i>Apogonia destructor</i>
	<i>Dicladispa armigera</i>		<i>Apogonia minor</i>
	<i>Lema pectoralis</i>		<i>Chalcosoma caucasus</i>
	<i>Lilioceris</i> sp.		<i>Chalcosoma moellenkampii</i>
	<i>Monolepta</i> sp.		<i>Dipelicus borneensis</i>
	<i>Promecotheca nuciferae</i>		<i>Exopholis hypoleuca</i>
			<i>Oryctes rhinoceros</i>
			<i>Rhomborrhina splendida</i>
			<i>Serica</i> sp.
Cleridae	<i>Necrobia rufipes</i>	Staphylinidae	<i>Paederus</i> sp.
Coccinellidae	<i>Coccinella arcuate</i>		<i>Scopaeus</i> sp.
	<i>Henosepilachna vigintioctopunctata</i>	Tenebrionidae	<i>Tenebroides mauritanicus</i>
Curculionidae	<i>Sitophilus granaries</i>		<i>Tribolium castaneum</i>
	<i>Hypomeces squamosus</i>		<i>Uloma orientalis</i>
Dytiscidae	<i>Copelatus tenebrosus</i>		
Elateridae	<i>Anchastus</i> sp.		
	<i>Agrypnus</i> sp.		
	<i>Melanotus</i> sp.		
	<i>Melanoxanthus</i> sp.		
	<i>Neodiploconus</i> sp.		

Species Composition of True Bugs

A total of four families, four subfamilies, nine genera and 10 species of true bugs were sampled during this study (Table 3). The family Reduviidae with seven species represented the most diverse family recorded.

Table 3
**LIST OF TRUE BUG SPECIES RECORDED
 IN BUKIT DURANG HCVF.**

Family/Subfamily	Scientific Name
Alydidae	
Micrellytrinae	<i>Leptocorisa acuta</i>
Reduviidae	
Harpactorinae	<i>Astinus nebulo</i>
	<i>Cosmolestes picticeps</i>
	<i>Coranus fuscipennis</i>
	<i>Velinus nigrigenu</i>
	<i>Sycanus macracanthus</i>
	<i>Sycanus</i> sp.
	<i>Polididus armatissimus</i>
Pentatomidae	
Pentatominae	<i>Tolumnia maxima</i>
Pyrrhocoridae	
Pyrrhocorinae	<i>Dysdercus</i> sp.

Figure 2
 The *Apogonia expeditionis* (Coleoptera: Scarabaeidae) is a common polyphagous beetle with a length between 9 to 10 mm. This beetle is a pest in oil palm plantations where the adults are known to show irregular chewing on some portions on the edges of the leaves. The species is also known to eat other plant material other than oil palm trees. This species is exclusively nocturnal, feeding all through the night and burying themselves at sunrise. © Photo: Isaac Stia Marcellinus

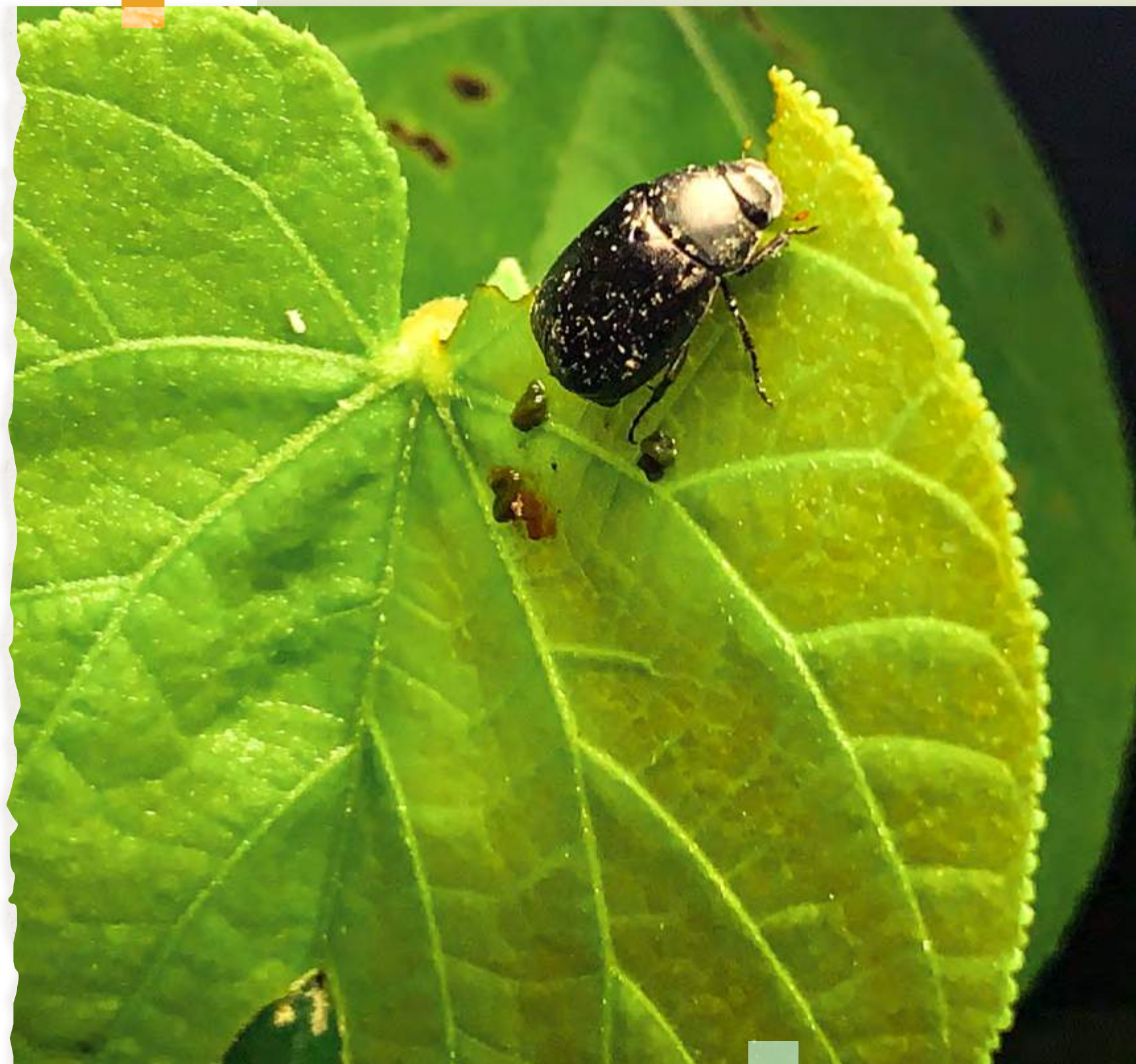




Figure 3
Apogonia expeditionis (Coleoptera: Scarabaeidae)
 © Photo: Siti Nurlydia Sazali

Conclusion

Overall, the documentation of three insect groups, namely, butterflies (Lepidoptera), beetles (Coleoptera) and true bugs (Hemiptera) in Bukit Durang High Conservation Value Forest (HCVF) during multiple sampling occasions has been successfully achieved. It is recommended that further studies should consider other trapping methods such as the Malaise trap, pitfall trap, intercept panel trap and sticky trap which could potentially increase the capture rates of other insect species. Hopefully, the species accounts presented in this pilot project could be useful as a preliminary checklist which could be a kick-start to initiate more comprehensive studies in discovering other insects within Bornean forests.

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References

- Abang, F. (2006). *Butterflies of Malaysian Borneo—A pocket guide*. Kota Samarahan: Universiti Malaysia Sarawak. Pp. 130.
- Bosuang, S., Chung, A.Y.C. & Chan, C.L. (2017). *A guide to beetles of Borneo*. Kota Kinabalu: Natural History Publications (Borneo). Pp. 244.
- Chung, A.Y.C. (2013). Insect diversity and forest management in the tropics. In Kitayama, K. (ed.), *Co-benefits of sustainable forestry: ecological studies of a certified Bornean tropical rain forest*, *Ecological Research Monographs, Springer Japan*. Pp. 83-84.
- Miller, J.C. (1993). Insect natural history, multi-species interactions and biodiversity in ecosystems. *Biodiversity and Conservation*, 2: 233-241.

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Bukit Durang Conservation Area provides opportunities for research and education for better understanding the ecology and to create awareness among stakeholders in Sarawak.

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