GUNUNG PENRISSEN
The Roof of Western Borneo
Life from Headwaters to the Coast

GUNUNG PENRISSEN
The Roof of Western Borneo

Edited by
Jayasilan Mohd-Azlan, Andrew Alek Tuen
and Indraneil Das

UNIMAS Publisher
Universiti Malaysia Sarawak
Kota Saramahan

Natural History Publications (Borneo)
Kota Kinabalu

2016
Life from Headwaters to the Coast: Gunung Penrissen Roof of Western Borneo
Edited by Jayasilan Mohd-Azlan, Andrew Alek Tuen and Indraneil Das


First published October 2016.

Copyright © 2016 UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd.
Photographs copyright © 2016 with respective photographers.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the copyright owner.

Frontispiece: Asian Paradise Flycatcher. Photo: Pui Yong Min.

Printed in Taiwan
Foreword .......................................................................................................................... vii  
by Prof. Dato’ Dr. Mohamad Kadim Haji Suaidi

Preface ............................................................................................................................... ix  
by Jayasilan Mohd-Azlan, Awang Ahmad Sallehin Awang Husaini,  
Andrew Alek Tuen and Indraneil Das

Introduction ....................................................................................................................... 1  
by Jayasilan Mohd-Azlan, Andrew Alek Tuen and Indraneil Das

History of Explorations ................................................................................................. 3  
by Indraneil Das

Geology and Geomorphology ......................................................................................... 11  
by Hans Hazebroek

BOTANY
Aroids and other mesophytic flora .................................................................................. 41  
by Wong Sin Yeng

Pitcher Plants .................................................................................................................... 63  
by Chien C. Lee

Rafflesia and its Host Plant ............................................................................................ 69  
by Aida Shafreena Ahmad Puad, Wan Nuur Fatiha, Connie Geri,  
Ramlah Zainudin and Cheksum Tawan

Amorphophallus ............................................................................................................ 73  
by Cheksum Tawan, Isa bin Ipor, Aida Shafreena Ahmad Puad,  
Meekiong Kalu and Simon Angeline

ZOOLOGY
Butterflies ......................................................................................................................... 79  
by Fatimah Abang, Ratnawati Hazali, Wahap Marni  
and Wan Nurainie Wan Ismail

Land Snails and Slugs .................................................................................................... 85  
by Menno Schilthuizen

Crustaceans .................................................................................................................... 95  
by Jongkar Grinang

Fishes ............................................................................................................................... 99  
by Angie Sapis and Jongkar Grinang
Amphibians .......................................................................................................................... 103
by Ramlah Zainudin, Nooraina Atira Alaudin, Najmi Naim,
Muhammad Fadzil Amram, Nur Amirah Md Sungif, Elvy Quatrin anak Deka,
Marly Matleen Augustine Agoh, Sharizzaty Mohd Rais Alwin Yapp Wee Shen,
Amanda Shia Kang Pin, Nurul Adina Ab. Rahim, Nursyamim Hanis Zulkifli,
Tan Yuan Joe and Tham Vivian

Reptiles .................................................................................................................................. 109
by Indraneil Das, Yong Min Pui, Adi Shabrani, Benjamin Karin
and Hans Breuer

Birds ...................................................................................................................................... 121
by Sing-Tyan Pang, Frances Hii Dai Sze, Audrey Voon Mei Fang,
Hanis Damia Elyna Lit, Mary Buloh Balang, Luisa Duya Setia,
Cecilia Emang Ajeng, Rahah Mohd. Yakup, Isa Sait, Mohd Hasri Al
Hafiz Haba, Ch’ien Lee, Jayasilan Mohd-Azlan and Andrew Alek Tuen

Terrestrial Small Mammals ............................................................................................. 137
by Yee Ling Chong, Faisal Ali Anwarali Khan Nur Elfieyra
Syazana Hamdan, Nurshilawati Latip, Rafik Murni, Qhairil
Shyamri Rosli, Muhd Amsyari Bin Morni, Julius William Dee,
Jayasilan Mohd-Azlan and Andrew Alek Tuen

Bats ....................................................................................................................................... 143
by Faisal Ali Anwarali Khan, Nur Syafiqah Shazali, Nurul Farah
Diyana Tahir, Andrew Alek Tuen, Jayasilan Mohd-Azlan,
Mohd Huzal Irwan Husin and Isham Azhar

Larger Mammals ............................................................................................................... 155
by Jayasilan Mohd-Azlan and Sally Soo Kaicheen

HUMAN DIMENSIONS
Human Use of Natural Resources ................................................................................... 161
by Neilson Ilan Mersat, Wong Swee Kiong, Mohd. Azizul Hafiz bin Jamian,
Ahi Sarok, Spencer Empading Sanggin, Mohamad bin Suhaidi,
Peter Songan and Eva Kristin Larry

Ecotourism ......................................................................................................................... 167
by Lo May Chiun, Abang Azlan Mohamad, Chin Chee Hua,
Jason Lim Wei, Law Fung Yee and Ha Shiaw Tong

E-Biodiversity ..................................................................................................................... 173
by Wang Yin Chai, Chai Soo See, Wang Hui Hui and Alvin Yeo Wee

List of Contributors ......................................................................................................... 176
Borneo Highlands, sitting on a mountain plateau above 1,000 m elevation along the Penrissen range, offers serenity with crisp mountain air and encompasses rainforests that host many endemic flora and fauna. These highlands have been identified as an Important Bird Area, recognized internationally and the contiguous forests offer habitat to innumerable species of flora and fauna, many of which are endemic and of conservation importance. “Biodiversity and Environmental Conservation” is one of the three primary research niches of Universiti Malaysia Sarawak, and recognizing this strength, both in terms of expertise and resources, the Ministry of Higher Education, Government of Malaysia, awarded a five-year long research grant under its inaugural Niche Research Grant Scheme (NRGS) to facilitate research and awareness on the biodiversity of western Sarawak.

This illustrated volume was brought out to capture the uniqueness and the beauty of cloud forests and associated habitats in western Sarawak, targeting our readers, the stake holders, visitors and the general public, and hence, avoiding scientific terminology. The rationale here has been, much of the academic outputs, being published in scientific journals, are not easily accessible to the general public, especially to important stakeholders and custodians who need this knowledge.

In the current socio-political climate, it is important to highlight economic values attached to biodiversity and ecosystem services. Raising awareness on our biodiversity is an important first step in meeting the national biodiversity targets and reducing biodiversity loss, and in safeguarding our ecosystems. The conservation biology components of this book will hopefully inspire readers to be more conscious of the great wealth that we have inherited from our forefathers.

It gives me great pleasure to write a few words to introduce this book, containing 19 chapters on our biodiversity, based on the extensive research
of UNIMAS scientists, their students and associates. I congratulate the authors for putting together this interesting work, containing new scientific information, as well as an exquisite selection of illustrations. The selection of images of landscapes, plants, animals and people contained herein permit all to appreciate the beauty and diversity of montane forests and their wealth. I am confident this volume will be useful to all stakeholders, be it the business sector or the wider public, especially our children, all of whom benefit from the services provided by biodiversity.

Professor Dato’ Dr Mohammad Kadim Haji Suaidi
Vice-Chancellor
Universiti Malaysia Sarawak
The tropical island of Borneo is one of the world’s megadiversity regions, its terrestrial habitats represented by a variety of forest types, from dipterocarp forests of the lowlands to the cloud forests of the mountaintops. The presence of special forest types, including peat swamp and karst forests add to the richness of species in plant and animal groups of this vast island.

Bornean forest are at present threatened via unprecedented levels of anthropogenic activities. In the struggle to achieve optimal economic development, it is surely important to consider the requirements of the flora and fauna. Development often alters ecosystems, creates new habitats, at the cost of native plants and animals. Lack of action to mitigate such threats have resulted in significant loss of biodiversity.

Biodiversity is considered a national heritage and currently is on the top of the Malaysia’s national agenda, whereby the National Policy on Biodiversity 2016–2025 highlights the need to conserve the country’s biodiversity and to ensure that its components are exploited in a sustainable manner for the progress and socio-economic development of the nation and its people. Recognizing the importance of biodiversity and in line with the national agenda, the Ministry of Higher Education, Government of Malaysia awarded Universiti Malaysia Sarawak a grant under its inaugural Niche Research Grant Scheme (NRGS), entitled “Biodiversity of western Sarawak: Life from headwaters to the coast”. This project sits comfortably in the UNIMAS research niche area of biodiversity and environmental conservation, and investigates patterns of species turnover with stream order, gradients and elevation, and regional habitat diversity, from Tanjung Datu National Park, located at the western-most tip of Borneo, to Batang Ai National Park in the south-west of Sarawak State. Information on plant and animal taxa of conservation significance are critical for long-term planning and conservation, particularly in choosing vital highland sites as components of the protected areas system and for endangered species conservation.

Information on how human communities interact with biodiversity is not divorced from such research, and is a strong component of biodiversity function, revealing the dependence of humans on natural resources and showcasing how humans fit into a landscape mosaic.
Within the auspices of this project, a scientific expedition took place in September 2015 that complements our ongoing long-term research in the Borneo Highlands area of Gunung Penrissen. The expedition, assisted by local communities of the area, involved over 50 staff, research associates and students from UNIMAS, including team members from projects within the aforementioned NRGS umbrella. The geology and geomorphology chapter reveals interesting facts on the origin and evolution of the geological features of the Gunung Penrissen area, while the floral components demonstrates the richness of the family Araceae including *Amorphophallus*, one of the world’s largest unbranched inflorescence, *Nepenthes* and *Rafflesia*. The faunal studies include the butterflies, stream invertebrates such as crabs and shrimps, land snails and slugs, fishes, frogs, lizards, snakes, turtles, birds, bats, rodents, shrews and larger mammals. The human and social component of the book describes the use of natural resources by the local community and ecotourism. Finally, the information technology aspect includes the making of an e-biodiversity platform. The scholarly output of these individual research projects will be published in academic journals receiving peer-review in due time. This volume, on the other hand, makes available some of the more significant outputs for local stakeholders, management authorities and for the general public.

This second exploration marks the progress of the five-year project that started in Tanjung Datu National Park, and will continue towards the east in the years to come. The next study location is the Santubong Peninsular. This richly-illustrated volume is part of series of publication on each of the targeted study area within western Sarawak. It is hoped that nature enthusiast and those who are interested about tropical biodiversity will find this book beneficial.

Finally, we hope that this work will contribute to enhancing available knowledge and awareness on our national heritage and biodiversity.

Jayasilan Mohd-Azlan
Awang Ahmad Sallehin
Andrew Alek Tuen
Indraneil Das
Introduction

Jayasilan Mohd-Azlan, Andrew Alek Tuen and Indraneil Das

Gunung Penrissen in western Sarawak forms the topic of the present volume. A sandstone massif, it towers 1,329 m above sea level, the mountain forming the boundary between Malaysia’s Sarawak State and Indonesia’s Kalimantan Barat Province. The Penrissen Range lies adjacent to the karstic features of the Bau Limestone formation, the Range is drained mainly by Sungei Semadang and forms the headwaters of Batang Kayan. Much of the lowland vegetation has been lost for over a century, even at the time of the 1899 expedition lead by Robert Shelford (1872–1912), then Curator of the Sarawak Museum. Today, unlogged forests survive on steepest slopes and on the summits of Penrissen and other hills of the Range.

The area has a long history of agriculture, especially rice, although rubber and pepper are also grown in all except the steepest terrain. Extraction of metallic and non-metallic minerals may also comprise a threat to the landscape in the future, and there is some trade in petrified wood from the Penrissen region. Major development projects commenced in the Gunung Penrissen area in the last decade, with the view of promoting ecotourism and golf-tourism, the environmental effects of which remain largely unstudied. The 2,071 hectare resort, now operational close to the summit, was planned by a Hawaii-based consortium, and included an ambitious plan of development, including removal of most of the native vegetation, some of which has been replaced with an 18-hole golf course and a 25 acre area of flower garden and theme parks. Baseline information on Penrissen’s biodiversity is, however, meagre, impeding informed conservation and management decisions.

Curiously, Penrissen continues to lie outside the protected area system of Sarawak, although listed among the Important Bird Areas of the world by BirdLife International. While associated with the removal of native vegetation, the golf and country resort now presents an ideal launching site for further explorations of these mountains. The specific researches described in this volume were undertaken while based here and at various other, more basic forest camps and during home stays with the indigenous people, especially from the village of Anna Rais. To these people, this volume is dedicated.

We thank the Ministry of Higher Education, Government of Malaysia, for supporting our long-term research on the biodiversity of western Sarawak, via a grant under the Niche Research Grant Scheme, NRGS/1088/2013(02). The
same runs between the years 2013–2018, and is administered by the Research and Innovative Management Centre of Universiti Malaysia Sarawak, and we thank Prof. Lo May Chiun, Director, and her staff for ensuring that the project runs without hitch.

At Penrissen, we are grateful to the Borneo Highlands Golf and Country Club for their logistic support of our research. Bernard Tiang Ming Zearl, Manager, Administration and Operation and Mohamad Junaidi Narani, Executive Sales Officer, are singled out for acknowledgements.

The following reviewers read individual chapters: Aaron M. Bauer, Joseph K. Charles, Charles Clarke, Geoffrey Davison, Kelvin John Egay, Noorma Wati Haron, Hans Hazebroek, Kueh Boon Hee, Robert F. Inger, Abdul Latiff, Liew Thor-Seng, Kelvin K. P. Lim, Lim Boo Liat, Datuk Seri Chong Keat Lim, Peter K. L. Ng, Albert Orr, Tan Heok Hui, Jaap Jan Vermuelen, Arthur van Vliet and Mario Marc Antoine Wannier. We thank Anthony Sebastian and the Malaysian Nature Society for sharing their bird records from Penrissen.

To Datuk Chan Chew Lun and his staff at Natural History Publications (Borneo) Sdn Bhd, we owe a debt for jointly publishing this work with UNIMAS Publisher, and for seeing the manuscript through the printers. Genevieve V. A. Gee served as copy editor for the volume.

Finally, we thank our colleagues for preparing manuscripts within the tight schedule that enabled us to bring this contribution out in time.
History of Explorations

Indraneil Das

The earliest mention of the Penrissen Range can be found in the account of Sarawak by Hugh Low (1824–1905; Fig. 1), botanist-explorer-turned administrator, in his 1848 book, ‘Sarawak. Its inhabitants and productions. Being notes during a residence in that country with His Excellency Mr. Brooke’. Low wrote the following passage: “The southern branch of the Sarawak river has its sources in the Gunong Penerissen: the highest land in this part of the island. Penerissen, or Besuah, as it is sometimes called, is a table-topped mountain, about 4,700 feet in height, situated between sixty and seventy miles from the coast in a direct line”. Low provides no description of his ascent but details the village of Sennah (in Padawan) thus: “On the Sarawak, or northern side of the mountain, about four or five miles from its base, is situated, amongst the most beautiful groves of fruit trees, and on either bank of a quiet and crystal stream, the well-built houses of the Sennah Dyaks” (Fig. 1). Low’s field journals mention visiting the mountain in December 1845.

Fig. 1 (left). Hugh Low (1824–1905), British botanist and administrator.  
Fig. 2 (right). Sir Spenser Buckingham St John (1825–1910), British civil servant.
Fig. 3. Reproduction of a woodcut plate from Low (1848), showing a bamboo bridge upstream from the village of Sennah, at the foothills of Gunung Penrissen.
HISTORY OF EXPLORATIONS

LIFE IN THE FORESTS
OF
THE FAR EAST.

BY
SPENSER ST. JOHN, F.R.G.S., F.E.S.,
FORMERLY H.M.'S CONSUL-GENERAL IN THE GREAT ISLAND OF BORNEO,
AND NOW
H.M.'S CHARGÉ D'AFFAIRES TO THE REPUBLIC OF HAVT.

WITH NUMEROUS ILLUSTRATIONS.

IN TWO VOLUMES.
VOL. II.

LONDON:
SMITH, ELDER AND CO., 65, CORNHILL.

M.DCCCLXII.

[The right of Translation is reserved.]

Fig. 4. Title page of St John’s (1862) travelogue, “Life in the Forests of the Far East”.
Contemporaneous with Low, and often a co-explorer was Sir Spenser Buckingham St John (1825–1910; Fig. 3), British Consul in Brunei between 1848–1858. In his work, “Life in the Forests of the Far East” (1862; Fig. 2), St John erroneously described the mountain as “...above 5,000 feet above the level of the sea”, and in an 1886 article in the Sarawak Gazette, provided a graphic description of his ascent. Starting from Kuching on 6 May 1858, their river route took them to the village of Sennah on 19 May. On 22 May, the team started the ascent, reaching on 27 May, only to find that they had reached the summit of the adjacent Gunung Mesuah!

The botanist-explorer, Odoardo Beccari (1843–1920; Fig. 5) from Florence, was resident of an isolated house called Vallombrosa (named after a Benedictine abbey in the Tuscany region of Italy), at the foothills of the Matang Range, Sarawak, between 1865–1868. Beccari visited Penrissen in 1866 with the intention of collecting plant specimens. Beccari’s botanical collections in South-east Asia and New Guinea were made in collaboration with and financial support from Marquis Giacomo Doria of Genoa (1840–1913), a patron of the Civic Museum of Natural History at Genoa. Beccari did not manage to reach the summit of the mountain, confining his collecting activities at the base. In his 1902 travelogue (‘Nelle Foreste di Borneo. Viaggio Ricerche di un Naturalista’, English translation 1904, ‘Wanderings in the Great Forests of Borneo. Travels and Researches of a Naturalist in Sarawak’), he wrote “It was my intention to start from this place, which has an elevation of about 1,150 feet, for the summit of Gunong Pennerrissen, or as I have also heard it pronounced, “Mengrissen”. This has been considered one of the highest mountains in Sarawak...”. Nonetheless, logistical problems for Beccari became formidable, including unwillingness of the local guides and poor planning. Beccari wrote with a twinge of disappointment, “The Dyaks of Tappo Kakas, for some special motive of their own, showed no wish to guide me up the mountain. On the contrary, they did their best to dissuade me from attempting the ascent, and declared...
Fig. 6. Plate VI from Issel (1874), showing some of Beccari’s collections of Bornean molluscs.
that unheard-of difficulties would beset me on my road to the summit. Most certainly from the village in which I was the way to Mount Pennerrissen was neither short nor easy, as I could see for myself. Besides, I had brought with me only a small quantity of provisions”. Nonetheless, Beccari collected specimens, including molluscs, some of which were presumably from the lower elevations of Penrissen (Fig. 6) and ascended the adjacent Gunung Wa.

An early collector of zoological and geological material from Sarawak was Alfred Hart Everett (1849–1898), civil servant with both the Sarawak Civil Service and the British North Borneo Company, who sold specimens to the European museums and private collectors. In an 1893 paper by the British ornithologist and Assistant Keeper of the Vertebrate Section of the British Museum (Zoology Department), Richard Bowdler Sharpe (1847–1909). An enumeration of bird specimens collected by Everett from “Mount Penrissen and the adjacent hills”. The account lists as many as 60 bird species from Penrissen. Little else is known of localities of sampling, except that one specimen was taken at “900 feet” (corresponding to ca. 274 m, or at low elevation), and one at “3500 feet” (ca. 1,067 m, or near mid-elevation).

Some of the earliest biological material from Penrissen derives from the 1899 expedition lead by Robert Shelford (1872–1912; Fig. 7), then Curator of the Sarawak Museum. These cover various plant and animal groups- ferns, insects, amphibians, reptiles and birds. Shelford’s expedition was reported briefly in the official organ of the state government, the Sarawak Gazette and scientific accounts of the expedition were published in the scholarly Journal of the Straits Branch of the Royal Asiatic Society for January 1900 (Fig. 8) and in greater detail in his 1916 book (‘A Naturalist in Borneo’) that was incomplete at the time of his passing and was posthumously published. The team departed Kuching on 5 May 1899, travelling in three boats up Sungei Sarawak, and reached Pangkalan Ampat the following day. Besides five native collectors and a cook, Shelford was accompanied by Edmund Arthur Wilson Cox (1860–1932), the District Magistrate of Upper Sarawak. As in the earlier expeditions, the
A Trip to Mt. Penrissen, Sarawak.

At midday on the 5th of May of this present year of grace, Mr. E. A. W. Cox, of the Sarawak Government service, and myself left Kuching for the upper waters of the Sarawak river on a long talked-of collecting expedition. Our ultimate destination was Penrissen, a mountain of 4,800 feet high, five miles from the “ulu” of the left hand branch of the Sarawak river, and about fifty miles as the crow flies from the sea-coast. The mountain had previously been scaled, in part at least, by Signor Beccari, Mr. A. H. Everett, Dr. G. D. Haviland and Mr. Henshaw, but had never, from a zoological point of view, been thoroughly collected over, so that our hopes of obtaining interesting and valuable results ran high.

Our staff consisted of five Ilyak collectors, Malay and Chinese boys, and a Chinese cook; to convey these, ourselves and our somewhat bulky baggage, three boats were requisitioned, but as events turned out proved insufficient; however the start was fair and through the lower reaches of the river all went well and comfortably. The night was spent in part at the little village of Sibolang, but to catch the tide and to avoid the din of a neighbouring Chinese “wayang,” we re-embarked at 12 p.m. and proceeded quietly on our way till at 6.30 in the morning the first “karungan” or gravel bed was encountered; here we stopped for breakfast and a delightful bathe in the now somewhat rapid river. At 9 we were on again, and soon began to experience some difficulty in progression. The river abounded with shallows and small rapids; up and over these our heavy and heavily-laden boats, which to use a Malay expression “ate much water,” were poled and hauled only with the greatest difficulty and exertion. At the very bad places a general halt had always to be called, whilst the respective crews joined forces and hauled with ropes one boat up at a time. Late in the afternoon we finally won to Segu, and right glad were we to partake of the

Fig. 8. Front page from the *Journal of the Straits Branch of the Royal Asiatic Society* for January 1900, showing Shelford’s report of the Penrissen expedition.
Sennah approach was taken, leading up to the rock overhang referred locally as Batu Tinong on 11 May. The next day, the team climbed to an altitude of “3,400 feet” (ca. 1,036 m asl) and made camp at a small, flat area. Thereafter, Shelford remained at the site, presumably on account of his poor health (being stricken by tubercular hip joints as a child, the disease eventually returning to claim his life before he turned 40), while Cox explored the higher elevations of Penrissen, reaching the summit on 14 May. The team finally brought down their traps and nets and descended on 24 May to the base of the mountain.

The eight-page expedition report had an appendix on the mammals (18 species) and birds (88 species) collected, authored by Shelford, following which were appendices on the plant collection (eight species, including three recognised as new to science) collected, authored by Henry Nicholas Ridley (1855–1956), then Scientific Director of the Singapore Botanic Gardens, and one on the ferns (14 species) by “Bishop Hose” (probably George Frederick Hose, 1838–1922, the Bishop of Labuan and Sarawak). The supplement, which was compiled by Shelford, concluded with a short list (six species) of mosses and hepatics, collected by Alfred Hart Everett (1848–1898), English geologist and administrator from Penrissen and identified by the Finnish botanist, Viktor Ferdinand Brotherus (1849–1929). The following year, Shelford wrote a 14 page account on his butterfly collection from Penrissen in the same journal.

Evident from the description of these expeditions is that knowledge of the biodiversity of Penrissen is fragmentary. Rather limited follow-up studies have been conducted since the time of Robert Shelford, due no doubt to logistical challenges of accessing these ranges in the recent past. These previous studies have suggested a great diversity within plant, invertebrate as well as vertebrate lineages, including frogs, birds and bats, that are waiting discovery.
The Penrissen area is located in West Sarawak, about 45 km south-southwest of Kuching city. Three partly overlapping saucer-shaped sandstone basins with steep rims, known as the Bengoh, Penrissen and Semuti Basins, dominate the landscape (Figs. 2–4). With a maximum width of 15.5 km, the Bengoh Basin is the largest. The core of the Penrissen Basin has been uplifted to become a highland region. This rugged, mountainous highland region was selected as the study area. A spectacular sandstone escarpment (Fig. 1) that limits the study area to the southwest marks the international border with Indonesia (Kalimantan). The escarpment drops several hundred meters down towards Kalimantan via a series of fault steps bounded by near verti-
Fig. 3. Satellite image looking north, clearly showing the three amalgamated saucer-shaped sandstone basins as the dominant landforms of the Penrissen area. In the upper right of the image stands the prominent range of Bau Limestone Formation hills.