

HELM FIELD GUIDES

Birds of Borneo

SECOND EDITION



Susan Myers

Birds of
BORNEO

Sabah, Sarawak,
Brunei and Kalimantan

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Back (top to bottom): Red-breasted Parakeet (Richard Allen),
Whitehead's Spiderhunter (Richard Allen), Bornean Leafbird (Richard Allen),
Rail-babbler (Richard Allen)

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Clouds partially obscure Borneo's highest mountain, Mount Kinabalu, Sabah.

INTRODUCTION

Geography

Borneo is a very large continental island – a body of land that lies on a continental shelf. With an area of 748,168 km² or 288,869 sq. miles (slightly larger than Texas), it is the world's third largest island, after Greenland and New Guinea, respectively. It lies east of Sumatra and the Malay Peninsula, north of Java, south of the Philippines and west of Sulawesi, in the centre of maritime South-East Asia. The island straddles the equator in a key position on the edge of the South-East Asian region adjacent to the interchange zone ('Wallacea') with the Australasian region. It is divided among three countries – Brunei, Malaysia and Indonesia. The provinces of Kalimantan, Indonesia, occupy the major portion of the island's surface area, *c.*73%, while the states of Sabah and Sarawak belong to Malaysia and occupy approximately 26% of the area. Brunei occupies just 1% of the area of Borneo.

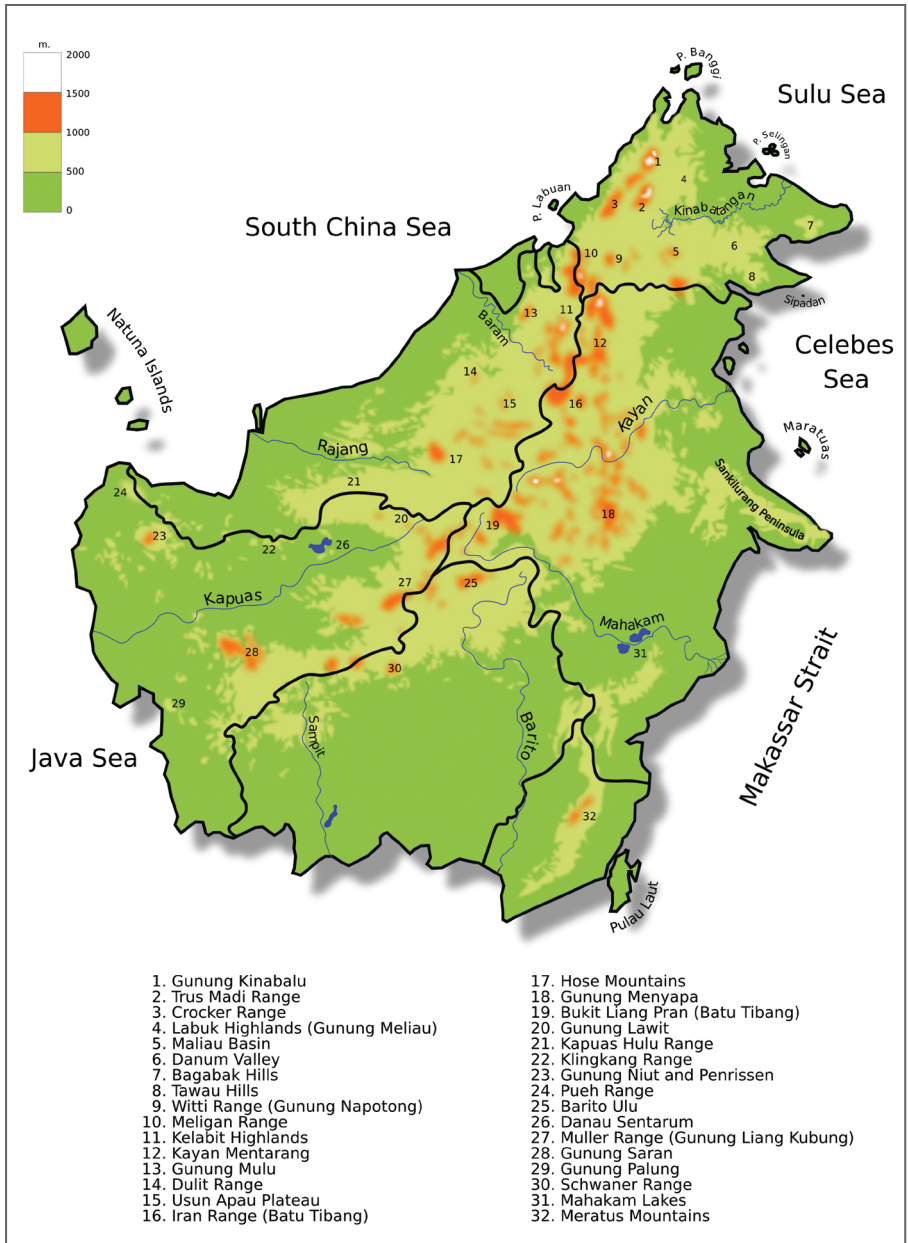
The South-East Asian region comprises Indochina and the Thai-Malay Peninsula on the mainland and the Indo-Malayan archipelago, or Maritime South-East Asia, which extends south and east of the mainland. Geologically, the Thai-Malay Peninsula and much of the Indo-Malayan archipelago lies on the Sunda Shelf, an extension of the continental shelf of South-East Asia. The term 'Sundaland', or Sundaic Region, refers to the Thai-Malay Peninsula, as well as Sumatra, Java, Bali, Borneo, Palawan and many smaller islands on the Sunda Shelf. 'Sundaland' is distinct from most of the Philippines, which are largely oceanic and of volcanic origin, and from the islands of Wallacea (Sulawesi, the Moluccas and the Lesser Sundas), which lie east of Wallace's Line on the Sahul (Australian) continental shelf.

While much of Borneo is low-lying – well over half of its area land lies below 150 m – a central mountain range extends from Sabah in the north, in a south-westerly direction along the border between Sarawak and Kalimantan, to roughly the centre of Borneo. This range incorporates the Crocker and Tama Abu Ranges, the Kelabit Highlands including Gunung Murud, and Iran Range. From there a western chain extends to the Kapuas Hulu and the somewhat more isolated Pueh Ranges in West Sarawak. A south-western chain extends from the Kapuas–Mahakam Rivers divide to the Muller and Schwaner Ranges in West and Central Kalimantan, while a south-eastern chain extends from around Barito Ulu to the rather isolated Meratus Mountains, and an eastern chain extends to the Sambaliung Mountains on the Sangkulirang Peninsula. There are further outlying ranges including the Brassey Range, Tawau Hills, Trus Madi Range, Gunung Mulu and the Dulit Range.

The central ranges and outliers are generally relatively low. At 4,095 m, Gunung Kinabalu is Borneo's highest peak and is also the highest mountain between West Papua and the Himalayas; few other peaks on Borneo exceed 2,000 m, with the highest mountains all in Sabah. These also host the largest number of endemic species, and they feature several bird species with strange distributions. Throughout Borneo a vast network of rivers rise from the interior mountains and fan down to the coast. The largest of these river systems is the Kapuas in Western Kalimantan, with a length of 1,143 km. Other larger systems include the Mahakam in West Kalimantan, the Rajang in Sarawak, and the Kinabatangan in Sabah. These extensive waterways are important not only for wildlife, but for transport, trade and tourism. Most of the human settlements on Borneo are concentrated on the coastline and along the rivers.

Brunei is the smallest political unit on Borneo, consisting of two blocks of land on the north-west coast surrounded by the Malaysian state of Sarawak. Another Malaysian state, Sabah, occupies the entire northern part of the island to *c.*07°N. It shares a border with Sarawak and East Kalimantan, and is roughly divided west and east by the northern mountain ranges. Sarawak occupies most of the north-central and west-coastal area, sharing a border with East and West Kalimantan. The border straddles the central and western mountain ranges. Sarawak can be roughly divided into east, central and west. The Indonesian region of Kalimantan is the largest political unit on Borneo and is subdivided into four provinces – East Kalimantan, Central Kalimantan, South Kalimantan and West Kalimantan. Kalimantan remains very poorly known ornithologically.

A number of offshore islands are politically and biogeographically part of Borneo. Some of the most important islands include Mantanani, Banggi and Sipadan (Sabah), Labuan (a Malaysian federal territory), the Maratus (East Kalimantan), Karimata Islands (West Kalimantan), Anambas and North and South Natunas (politically part of Sumatra but closest to West Kalimantan).



Relief map of Borneo showing major mountains and highland areas, and other geographical features.

Geological and climatic history

The composition and distribution of the flora and fauna of Borneo has been largely determined by the geological and climatic history of the Sundaic Region. It is thought that four interrelated factors contributed to patterns of avian diversity in the region. These were (1) the survival of relict populations from the warmer Eocene era through the cold, dry Oligocene and Pliocene eras on mountains, (2) the development of modern South-East Asian genera in the Miocene, (3) the isolation of the Sundaic rainforests from the rest of South-East Asia during the late Miocene and Pliocene, and (4) the periods of Pleistocene glaciation (Sheldon *et al.* 2015).

During the Tertiary and Quaternary periods sea levels rose and subsided as a result of tectonic activity, and later as a result of long periods of alternation between glacial and interglacial eras. Bornean biogeography has been heavily influenced by changes in sea levels during this prolonged period of Pleistocene glaciation. Twenty-one cycles or more of continental glacial development occurred during the Pleistocene, a period of >2 million years known as the Ice Age. Water in the oceans solidified to ice resulting in sea level declines often exceeding 100 m. The most recent period of glaciation caused sea levels to be 120 m lower than they are today, thus a peninsula was formed from Indochina to Borneo and Java surrounded by deeper water. In other words, all of present-day Borneo, Java, Sumatra and mainland Malaysia and Indochina were once part of the same landmass during the Pleistocene glacial period. Pleistocene-era land bridges connected all of the Sundaic islands, fostering waves of migrations of animals and plants that have contributed to species richness. These repeated patterns of periodic connection and isolation have shaped modern-day species distribution and endemism in the entire region.

At this time the climate was also markedly more seasonal than it is today. During the Pleistocene the glacial periods were considerably longer than the interglacial periods, and for the last two million years or so the Sunda Shelf has been exposed above sea level. When sea levels were at their lowest, the land links between the mainland and the Sundaic islands were formed and broken many times. Java, Bali and Palawan were connected less frequently to other islands on the Sunda Shelf. Lower sea levels allowed faunal movements to and from the island and the mainland. Mainland Asia thus became a conduit for the process of speciation as fluctuations in sea level permitted a series of colonisation and isolation events promoting increased diversity on the landmass.

Sea level changes are also thought to have played a particularly important role in the evolution of endemic species on Borneo. Thirty-six (69%) of Borneo's 52 endemic species (see list on page 23) have mainly or exclusively montane distributions. It is thought that during periods of elevated sea level, mountains provided refuge for otherwise lowland populations. These populations diverged genetically while isolated on the remaining peaks, and when sea levels subsided were displaced from the lowlands by invading congeneric competitors. During periods of glacial maxima, temperatures were lower than today, leading to lower montane zones and the spread of many montane species throughout the island.

Today Borneo is an island, but it shares many similarities with the flora and fauna of neighbouring landmasses. Amongst mammals, for example, the majority of lowland species are shared with the main Sundaic islands, while most of the endemic species on the respective islands occur on mountains above 1,500 m.

Climate

Borneo lies between 07°N and 04°S, with the equator passing roughly through the centre of the island. Under the Köppen-Geiger Climate Classification, Borneo's climate is classified as Af or equatorial fully humid. It is a tropical moist climate with heavy rainfall in all months and high humidity. Temperatures are stable, rarely fluctuating more than 10°C, with means of 25°–35°C in the lowlands throughout the year.

Borneo is influenced by two monsoonal systems. The north-west monsoon, from November to April, is wetter than the so-called dry south-east monsoon from May to October. Monthly rainfall generally exceeds 200mm but peaks in November, with a second peak in April. June–August are the driest months, but even then rainfall is never less than 100mm a month. Rainfall is generally higher in North Borneo (defined below under 'Range & status') and lowest on the east coast where the influence of the north-west monsoon is weaker, as most of the rain has fallen in the central mountain ranges. These mountain ranges also influence climate locally. In the lowlands the warm, ever-wet climate supports large expanses of rich lowland evergreen rainforest.

Biodiversity

Due to the island's unique geology and climate, the flora of Borneo is amongst the most diverse in the world with 10,000–15,000 species of flowering plants and 3,000 species of trees, many of them endemic. Almost 300 species of the economically significant dipterocarp trees occur, more than half of which occur only on Borneo. This complex geological and climatic history has also led to a correspondingly rich and diverse fauna. There are more than 280 species of mammals, 440 species of freshwater fishes, almost 300 species of reptiles, and more than 650 species of birds. Moreover, a high percentage of each of these groups is endemic, in other words, they are unique to Borneo. There are at least 44 endemic mammals, 100 amphibians, almost 100 reptiles and 52 birds. In the last eight years alone, more than 123 species have been newly described from Borneo. These include such exotic creatures as the world's largest insect – a giant stick insect *Phoebiticus chani*, a colour-changing flying frog *Rhacophorus penanorum*, a long-tailed slug *Ibycus rachelae*, a freshwater prawn *Macrobrachium kelianense* and a new orchid *Thrixspermum erythrolomum*.

Much of Borneo's fauna is shared with the South-East Asian mainland and the Sundaic islands, but there is relatively little overlap with islands to the north and east. The fauna, especially in the lowland rainforests, is characterised by a remarkable diversity and endemism. The island has the highest endemism of all islands on the Sunda Shelf.

Borneo has some of the oldest rainforests in the world, and has probably had continuous rainforest for at least 60 million years since the Cenozoic era, also known as the Age of Mammals. Lowland rainforest covers most of the island, with an estimated area of 427,500 km² (165,100 sq. miles); these rainforests are amongst the richest in the world with a biodiversity rivalling those of the Amazon and New Guinea.

Flora

There is an exceptionally high floral diversity comparable to that of New Guinea or the Amazon and greater than that of the entire African continent, with up to 15,000 species of flowering plant. Almost 35% of flowering plants are endemic to the island. Floristic richness and forest type are largely dependent on soil type and elevation.

Dipterocarp trees are most abundant in South-East Asia, and especially on Borneo where the biologically diverse forests contain upward of 1,200 tree species. Dipterocarps often account for half of all canopy trees.



Liana vines entwine dipterocarp trees, Sabah.



A carnivorous pitcher plant (*Nepenthes stenophylla*) in Bako National Park, Sarawak.

They do not depend on animals or the wind to disperse their seeds; instead, their winged seeds are heavy and 'helicopter' to the ground close to the parent tree. Mature trees may not reproduce for 3–10 years and then suddenly blanket the forest floor with their seeds in a cyclical mode of reproduction known as masting.

Many species of dipterocarps flower and fruit synchronously. Within the forest, these trees all begin to flower over the same two-month period, requiring a further four months for the fruits to mature. Then, within four to five weeks, all of the fruits fall. Once on the forest floor, they immediately begin to germinate. Several species, such as hornbills, are so dependent on these fruits that they rarely breed during non-masting years. On Borneo some animals such as parakeets, pigs and orang-utans even migrate in search of masting forests.

Other plants of note on Borneo include the world's largest flower, *Rafflesia arnoldii*, along with eight other species in the genus; these are parasites that attract pollinators by emitting an odour reminiscent of that of rotting meat. Carnivorous *Nepenthes* pitcher plants, so-called for the shape of their modified leaves, reach their peak diversity on Borneo, where more than 30 of the world's 80 species occur. Many have evolved fascinating mutual relations with small mammals, frogs and a number of invertebrates.

Borneo is also the place where the genus *Mitrephora*, of the custard apple family, reaches its maximum diversity. Three new species in this genus were described from Sabah and Sarawak as recently at 2000. Palms (in the family Palmae) are also especially diverse on Borneo, with the genus *Pinanga* reaching its greatest diversity here with a total of 120 species, 45 of which are endemic. Borneo is also one of the world's great centres of orchid diversity with perhaps as many as 3,000 species and new ones are described regularly. Many are endangered, however, due to many of the usual conservation problems, but also as a result of illegal collecting.



Rafflesia flowers can reach a metre in diameter; this one is only about half that size, Mount Kinabalu, Sabah.

THE HABITATS OF BORNEO

Borneo lies in the Indo-Malay realm and has two major terrestrial biomes – Tropical and Subtropical Moist Broadleaf Forest and Mangroves. Within these biomes, the island can be divided into seven ecoregions (according to Wikramanayake *et al.* 2002), units of land that contain distinct assemblages of species, natural communities and environmental conditions. These are:

- Borneo Peat Swamp Forests (86)
- Southern Borneo Freshwater Swamp Forests (89)
- Sundaland Heath Forests (90)
- Borneo Montane Rainforests (95)
- Borneo Lowland Rainforests (96)
- Sunda Shelf Mangroves (107)
- Kinabalu Montane Alpine Meadows (108)

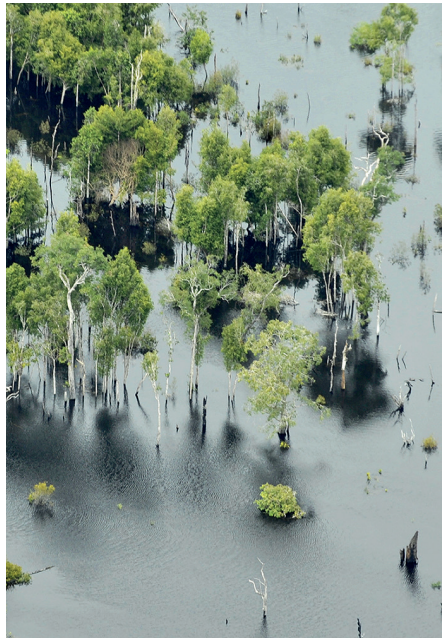
Three of these ecoregions (Borneo Montane Rainforests, Borneo Lowland Rainforests, and Kinabalu Montane Alpine Meadows) are considered globally outstanding in terms of species richness and endemism. The ecoregion with the highest biodiversity is the lowland rainforest (the number of dipterocarp species is one and a half times greater than that of the Malay Peninsula and two and a half times that of Sumatra). The rate of endemism is correspondingly the highest. After these three ecoregions the next richest in the Indo-Pacific is Bornean Peat Swamp Forest.

Peat Swamp Forest

This forest type is largely absent from Sabah but there are large expanses further south, mostly near the coast, especially in Central Kalimantan. Large areas of peat swamp forest can be found around the Mahakam Lakes in East Kalimantan and the Kapuas Lakes in West Kalimantan. Peat swamp forests form when sediments build up behind mangroves as rivers drain to the coast. They are rain-fed, and the soils are nutrient deficient and acidic with a resultant lower species diversity than that of lowland dipterocarp forest, but a handful of species are commoner in peat swamp forest. Bornean peat swamp forests are some of the most speciose of this type in the Indo-Malay realm. However, few plant or animal species are endemic to peat swamp forest and there is some overlap with the flora of heath forests. Of the birds, only Javan White-eye *Zosterops flavus* and Hook-billed Bulbul *Setornis criniger* are near-endemic to this forest type. Peat swamp forest is a key habitat for the endemic primate, Proboscis Monkey *Nasalis larvatus*, and the remarkable Asian Arowana *Scleropages formosus*, a unique species of fish.

Southern Borneo Freshwater Swamp Forests

This ecoregion is restricted to Kalimantan, mostly inland of the south-west coast with some smaller areas in the centre. These forests are associated with coastal swamps, inland lakes and rivers, and cover flat and low-lying alluvial plains. The waterlogged forests are characterised by regular flooding with a resultant high pH permitting a higher degree of productivity. These taller forests are therefore more diverse than



Freshwater swamp forest, Danau Sentarum National Park, West Kalimantan.

peat swamp forests but exhibit a range of structures and floristic diversity, from quite depauperate to a richness rivalling that of lowland rainforests. Faunal diversity correlates with floristic diversity. Primate densities can be high and up to 360 bird species have been recorded in this forest type including several species of hornbill, but with only one near-endemic, Javan White-eye.

Sundaland Heath Forests (Kerangas)

Known in Borneo as Kerangas, a local Iban name for heath forest (literally 'land which cannot grow rice'), this forest type is characterised by poor soils and low plant diversity. It is found in scattered areas throughout Borneo, but mostly in Kalimantan, and is usually found on plateaux, ridges and raised beaches. It is characterised by well-drained, sandy and acidic soils with a low, uniform and single-layered canopy. Soils of this ecoregion originated from ancient eroded sandstone beaches stranded by uplift or falling sea levels during Pleistocene glaciation periods. The flora is not species-rich but many species of palm occur, along with many carnivorous plants that grow in response to nitrogen-poor soils. Various species of sundew, bladderwort and *Nepenthes* pitcher plants are found. As with peat swamp forest, many of the plants have toxic leaves. The low plant diversity is reflected by a low diversity of birds, generally less than half that of lowland dipterocarp forests.

Borneo Montane Rainforests

The mountains of Borneo are like islands in a sea of lowland dipterocarp forests. Over the complex geological history of the island, isolation of these mountains has produced a unique and diverse set of montane species. The Bornean montane rainforests are in the central highlands of the island, above 1,000 m elevation. The montane forests on these mountains are cooler than the lowland forests – every 1,000 m one travels above sea level sees a mean 5°C drop in temperature. Rainfall and humidity are also higher than in the lowlands. These cooler conditions mean that many plants normally found in temperate regions grow here. The montane flora here is derived from Asian and Australian families so that one finds an astoundingly diverse plant life with representatives of the araucarias, heathers, oaks, laurels, myrtles and *Podocarpus*. As one ascends these mountains there is a



Montane rainforest, Mount Kinabalu, Sabah.

corresponding decrease in forest height, with the canopy typically just 10–20 m. The forests are dominated by slender trees with small leaves and relatively flat crowns, and emergents are absent. There is an increased presence of epiphytes; orchids, ferns, mosses, lichens and liverworts are more abundant in montane forests. *Nepenthes* pitcher plants, rhododendrons and orchids are especially diverse in Borneo's montane forests. More than 150 mammal species occur in these forests, making this ecoregion the most speciose montane rainforest in the Indo-Pacific region. In excess of 250 species of resident birds have been recorded and of Borneo's endemic bird species, 36 (69%) are montane. However, species diversity decreases with altitude. The upper montane avifauna has largely Himalayan affinities and it is thought that these species arrived on Borneo during a Pleistocene glacial period when a mainland land bridge connection existed. Gunung Kinabalu is of particular importance, with 64% of Borneo's endemics found here. Montane forests have many features in common with heath forests, exhibiting a similar structure and appearance, as well as having some species of flora in common.

Borneo Lowland Rainforests

This is the second largest ecoregion in the Indo-Pacific. Borneo's stable climatic conditions have given rise to the world's richest assemblage of flowering plants. Research has shown that up to 240 tree species may occur in a single hectare of this remarkable forest, and another 120 species may be found in adjacent areas of a similar size. These forests display a marked stratification and their layers can be roughly categorised as emergent, upper, middle and lower storeys, and forest floor. Commercially valuable dipterocarps dominate the emergents and upper storey. Rainforest birds in particular also show a clear vertical stratification, with several groups specific to the canopy, middle and lower storeys, and the forest floor, respectively. These forests usually have a canopy height of 24–36 m, with emergents including the impressive, smooth-barked *Koompassia* trees of the laurel family, towering up to 65 m. A single family of massive flowering trees, the dipterocarps, dominate this forest. They are so named for their two-winged fruits (actually many have 3–5 wings) and they are supported by huge buttresses to stabilise them in the shallow rainforest soils. Forest trees are often adorned with shade-tolerant lianas and epiphytes – ferns and orchids. Cauliflory, meaning stem flower, is a feature of South-East Asian lowland forests – this is where



The Sapa Babandil River creates a natural break in dense lowland rainforest, Danum Valley, Sabah.



Walkway in lowland dipterocarp forest, Sabah.

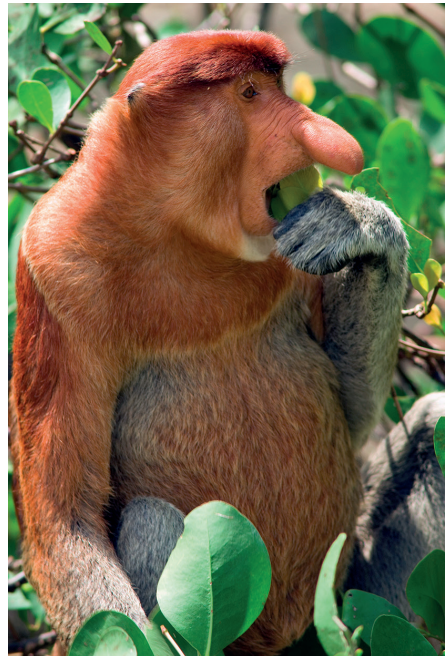
fruits and flowers grow directly on the trunks and larger branches. These types of plant tend to be pollinated by larger animals such as frugivorous bats, arboreal mammals and larger birds.

Lowland rainforests exhibit higher species richness but lower degrees of endemism than montane forests. Avian diversity reaches its peak here. More than 60% of the species on Borneo are confined to this forest type, while almost 80% are dependent on it to some degree. The great structural and floristic diversity combined with the stable conditions exhibited by lowland dipterocarp forest has contributed to this bird diversity.

These lowland dipterocarp forests actually comprise a variety of habitats including remarkable limestone karst forests. Lowland dipterocarp forests are also very important commercially. Historically, they have also suffered the greatest amount of clearance and received the least protection. Borneo's lowland dipterocarp rainforests are the most extensive in the region but they have been much exploited for timber in the last few decades and are rapidly being replaced by plantations, especially oil palm.

Sunda Shelf Mangroves

Borneo's mangroves are considered to be amongst the most biologically diverse on Earth. They have a patchy distribution, mostly on coasts. Five different types are recognised, depending on the dominant plant species, the growth of which is similarly dependent upon associated soils and salinity. Biodiversity and endemism rates are relatively low. Despite this, they



A male Proboscis Monkey (*Nasalis larvatus*) eats the leaves of a mangrove tree in Bako National Park, Sarawak.

are immensely important as they occur at the interface between terrestrial and marine habitats, stabilising coastlines and providing nurseries for numerous species of fish.

A number of bird species on Borneo are largely dependent on mangroves but few are restricted to this habitat type. Frugivores are rare in mangroves, but this forest type is valuable for passage migrants and as roost sites for a number of species. The remarkable Proboscis Monkey is restricted to mangroves and peat swamp forests, where they feed on the young leaves of mangrove trees with the aid of their highly specialised digestive system.

Kinabalu Montane Alpine Meadows

The highest elevations of Mount Kinabalu and the Crocker Range are home to Kinabalu montane alpine meadows, a mix of alpine shrublands and lower forests notable for numerous endemic species, including many orchids. These meadows have been isolated from other mountain chains for many millions of years and are considered to be globally outstanding in terms of species richness and endemism (one of only two in the Indo-Pacific region, the other being the Eastern Himalayan Broadleaf Forests). The slopes of Mount Kinabalu and surrounding mountains support more than 4,500 plant species, including in excess of 750 species of orchids, 600 species of ferns, 13 species of *Nepenthes* pitcher plants (five endemic), and 78 species of figs, 13 of which are endemic to the ecoregion. There is some overlap with this ecoregion and Borneo Montane Rainforests. 326 species of bird have been recorded, 23 of them endemic. One of Borneo's endemics, Friendly Bush Warbler, is confined to Mount Kinabalu and neighbouring Mount Trus Madi.



Crocker Range foothills, Sabah.

THE AVIFAUNA OF BORNEO

The birds of Borneo are essentially Asian in origin, exhibiting many similarities with the Thai-Malay Peninsula and Sumatra, and to a lesser extent Java and Bali. The entire Sundaic region shares the largest proportion of its resident forest birds with Indochina, but Australian, Indian and African influences are also evident. The distribution of birds in Borneo is not uniform and is influenced by habitat, altitude and geological and climatic history. Of the various components of the Sundaic region, Borneo has the third-highest number of species, but the most endemics, the majority of which are montane.

More than 650 species are described in this book, of which c.420 are resident. Of particular interest are the 52 endemics, the majority of which are restricted to Sabah and Sarawak, with some only occurring in Brunei and Kalimantan (although this situation is sure to change as we come to understand the avifauna of Kalimantan better). Additionally, more than 200 endemic subspecies occur on the island.



Black-crowned Pitta.

Recently, evidence of genetic differentiation across the faunal divide in several groups of species that exhibit no obvious morphological differences has been recognised. This cryptic differentiation has also been identified in other groups including bats and tree-shrews. The most striking avian example of this are the White-crowned *Enicurus leschenaulti* and Bornean Forktails *E. borneensis*. North-east Borneo was never directly connected to the mainland or to the major Sundaic islands, so birds colonising Borneo filtered more slowly north-east through the island to what is now Sabah. In other words, populations of these species in Sarawak are relatively recent Pleistocene invaders from the mainland or Sumatra, whereas the populations of sister taxa in Sabah represent older Bornean lineages.

In the north-east, particularly in Sabah, there are several endemic species and subspecies of lowland birds distinct from their more widespread sister taxa – a surprisingly large number relative to the rest of Borneo, despite the present coverage of continuous rainforest across the entire island. These include White-fronted Falconet *Microhierax latifrons* and Black-thighed Falconet *M. fringillarius*, and Black-crowned Pitta *Pitta ussheri* and Garnet Pitta *P. granatina*. A faunal divide in the vicinity of the border between Sabah on the one hand and Sarawak and East Kalimantan on the other has long been recognised. A picture is emerging that during the early Pleistocene many of Borneo's lowland bird populations were isolated in rainforest refugia due to changes in climate. Later in the era, as wetter conditions returned, these populations came into contact again, probably near the Sabah border. This process is illustrated by the sister species White-rumped Shama *Copsychus malabaricus* and White-crowned Shama *C. stricklandii*. The ancestral form of the shama must have separated into two populations during a drier period of the Pleistocene with allopatric populations of *stricklandii*, probably in the centre-east of the island, and of *malabaricus* further west in the region. When conditions allowed rainforest to once again cover the island, *malabaricus* spread across most of the island, while *stricklandii* retreated to the relatively isolated region of Sabah (Sheldon *et al.* 2015). The same pattern can also be seen in the falconets and the pittas mentioned above.



Dulit Frogmouth.

The origins and distribution of the montane avifauna of Borneo are more complex. A number of genera of Himalayan origin occur, including *Garrulax*, *Yuhina*, *Seicercus* and *Phylloscopus*, as well as endemic monotypic genera including *Haematorthyx*, *Chlamydochaera*, *Oculocincta* and *Chlorocharis*, and endemic representatives of more widespread groups, such as Dulit Partridge *Rhizothera dulitensis*, Red-breasted Partridge *Arborophila hyperythra*, Mountain Serpent Eagle *Spilornis kinabaluensis*, Bornean Swiftlet *Collocalia dodgei*, Whitehead's Trogon *Harpactes whiteheadi*, Bornean Barbet *Megalaima eximia*, Hose's Broadbill *Calyptomena hosii* and Blue-banded Pitta *Pitta arquata*, to name just a few.

There are some perplexing relations between montane and lowland congeners, too. Of note is Streaky-breasted Spiderhunter *Arachnothera modesta* and its close congeneric, the endemic Bornean Spiderhunter *A. everetti*. In the mountains of western Borneo lowland *modesta* is replaced by *everetti*. In Sabah, however, *A. modesta* is absent and *A. everetti* occurs in both the lowlands and mountains (Moyle *et al.* 2011). While Blue-winged Leafbird *C. cochinchinensis* occurs in the lowlands of western Borneo, it is replaced in the north by the endemic Bornean Leafbird *C. kinabaluensis*. In this case, however, lowland *C. cochinchinensis* is absent in Sabah, whereas *C. kinabaluensis* is restricted to the mountains of Sabah and does not occur in the lowlands anywhere on the island. Where two closely related species occupy adjacent elevational ranges on Borneo, the two species are not sister taxa and the lowland species appears to be a recent arrival on the island. It is believed that the endemics are restricted to higher altitudes due to competition from the invaders. In most cases, the montane endemics of Borneo have arisen not through speciation resulting from adaptation to different elevational zones but through geographic isolation. This is illustrated by the fact that most sister taxa of the Bornean montane endemics occur on neighbouring islands, rather than on Borneo: for example, the closest relative of Whitehead's Trogon is Philippine Trogon *Harpactes ardens*; Whitehead's Spiderhunter *Arachnothera juliae* is sister to Naked-faced Spiderhunter *A. clarae* on the Philippines; Bornean Spiderhunter is sister to Streaky-breasted Spiderhunter *A. affinis* on Java; Bornean Swiftlet is sister to Cave Swiftlet *C. linchi* on Java; Fruithunter *Chlamydochaera jefferyi* is closely related to the cochoas on Java and Sumatra; and Mountain Black-eye *Chlorocharis emiliae* is closely related to Mountain White-eye *Zosterops montanus* from the Philippines and Wallacea.

Endemic families and genera

There is a single endemic family, Pityriaseidae, containing a single species, Bornean Bristlehead. Additionally, there are a number of bird genera endemic to Borneo or to Sundaland that occur on Borneo. All five endemic Bornean genera are monotypic (these are in bold). The endemic Sundaic genera are:

Melanoperdix (Black Partridge)
Rhizothera (Long-billed and Hose's Partridges)
Haematorthyx (Crimson-headed Partridge)
Hydrochous (Waterfall Swiftlet)
Rhinoplax (Helmeted Hornbill)
Berenicornis (White-crowned Hornbill)
Reinwardtipicus (Orange-backed Woodpecker)
Caloramphus (Brown Barbet)
Pityriasis (Bornean Bristlehead)
Urosphena (Bornean Stubtail)
Oculocincta (Pygmy White-eye)
Chlorocharis (Mountain Blackeye)
Chlamydochaera (Fruithunter)
Platylophus (Crested Jay)
Platysmurus (Bornean Black Magpie)
Eupetes (Rail-babbler)
Setornis (Hook-billed Bulbul)
Tricholestes (Hairy-backed Bulbul)
Kenopia (Striped Wren-Babbler)



Endemic species

According to IOC (International Ornithological Congress) taxonomy (Gill, F. & Donsker, D. 2015. *IOC World Bird List v 5.3*), there are 52 Bornean endemics. This includes Dusky Munia *Lonchura fuscans* which is commonly listed as endemic although, strictly speaking, it is not as it occurs on some offshore islands belonging to the Philippines; zoogeographically, however, these islands are essentially Bornean. An additional eight species are treated as endemic in some recent publications and these are listed below in parentheses; these splits are not yet widely accepted and are not supported in the peer-reviewed scientific literature.

Common Name

Hose's Partridge *

Red-breasted Partridge *

[Sabah Partridge

Crimson-headed Partridge *

[Bornean Crestless Fireback

[Bornean Crested Fireback

Bulwer's Pheasant

Scientific Name

Rhizothera dulitensis

Arborophila hyperythra

Arborophila (charltonii) graydoni

Haematortyx sanguiniceps

Lophura (erythrophthalma) pyronota

Lophura (ignita) ignita

Lophura bulweri

Bornean Peacock-pheasant	<i>Polyplectron schleiermacheri</i>
White-fronted Falconet	<i>Microhierax latifrons</i>
Mountain Serpent Eagle *	<i>Spilornis kinabaluensis</i>
Bornean Ground Cuckoo	<i>Carpococcyx radiatus</i>
Dulit Frogmouth *	<i>Batrachostomus harterti</i>
Bornean Frogmouth *	<i>Batrachostomus mixtus</i>
Bornean Swiftlet *	<i>Collocalia dodgei</i>
Whitehead's Trogon *	<i>Harpactes whiteheadi</i>
[Bornean Banded Kingfisher	<i>Lacedo (pulchella) melanops]</i>
Mountain Barbet *	<i>Megalaima monticola</i>
Golden-naped Barbet *	<i>Megalaima pulcherima</i>
Bornean Barbet *	<i>Megalaima eximia</i>
Brown Barbet ¹ *	<i>Caloramphus fuliginosus</i>
Hose's Broadbill *	<i>Calyptomena hosii</i>
Whitehead's Broadbill *	<i>Calyptomena whiteheadi</i>
Bornean Banded Pitta ²	<i>Hydromis schwaneri</i>
Blue-headed Pitta	<i>Hydromis baudii</i>
Blue-banded Pitta	<i>Erythropitta arquata</i>
Black-crowned Pitta	<i>Erythropitta ussheri</i>
Bornean Bristlehead	<i>Pityriasis gymnocephala</i>
Bornean Whistler *	<i>Pachycephala hypoxantha</i>
Black Oriole *	<i>Oriolus hosii</i>
Bornean Green Magpie ³ *	<i>Cissa jefferyi</i>
[Bornean Black Magpie	<i>Platysmurus (leucopterus) aterrimus]</i>
Bornean Treepie *	<i>Dendrocitta cinerascens</i>
[Maratua Bulbul	<i>Pycnonotus (atriceps) hodiernus]</i>
Bornean Bulbul *	<i>Pycnonotus montis</i>
[Pale-faced Bulbul *	<i>Pycnonotus (flavescens) leucops]</i>
Bornean Stubtail *	<i>Urosphena whiteheadi</i>
Friendly Bush Warbler *	<i>Locustella accentor</i>
Bornean Wren-Babbler	<i>Ptilocichla leucogrammica</i>
Black-throated Wren-Babbler	<i>Napothera atrigularis</i>
Mountain Wren-Babbler *	<i>Napothera crassa</i>
Black-browed Babbler	<i>Malacocincla perspicillata</i>
Bare-headed Laughingthrush *	<i>Garrulax calvus</i>
Chestnut-hooded Laughingthrush *	<i>Garrulax treacheri</i>
Chestnut-crested Yuhina *	<i>Yuhina everetti</i>
Pygmy White-eye *	<i>Oculocincla squamifrons</i>
Mountain Blackeye *	<i>Chlorocharis emiliae</i>
Everett's Thrush *	<i>Zoothera everetti</i>
Fruithunter *	<i>Chlamydochaera jefferyi</i>
Bornean Whistling Thrush *	<i>Myophonus borneensis</i>
White-crowned Shama	<i>Copsychus stricklandii</i>
[Maratua Shama	<i>Copsychus (stricklandii) barbouri]</i>
Bornean Forktail *	<i>Enicurus borneensis</i>
Bornean Blue Flycatcher	<i>Cyornis superbus</i>
Eyebrowed Jungle Flycatcher *	<i>Vauriella gularis</i>
Bornean Leafbird *	<i>Chloropsis kinabaluensis</i>
Yellow-rumped Flowerpecker	<i>Prionochilus xanthopygius</i>
Black-sided Flowerpecker *	<i>Dicaeum monticulum</i>

Bornean Spiderhunter ^{4*}	<i>Arachnothera everetti</i>
Whitehead's Spiderhunter *	<i>Arachnothera juliae</i>
Dusky Munia	<i>Lonchura fuscans</i>

¹ Brown Barbet is now split from Sooty Barbet *C. hayii* of the Malay Peninsula and Sumatra.

² Bornean Banded Pitta is now split from Javan Banded Pitta *P. guajanus* of Java, and Malayan Banded Pitta *P. irena* of the Malay Peninsula and Sumatra.

³ Bornean Green Magpie is now split from Javan Green Magpie *C. thalassina* of Java.

⁴ Bornean Spiderhunter is now split from Streaky-breasted Spiderhunter *A. affinis* of Java and Bali.

* Lower and upper montane species

Taxonomy

The entire continent of Asia has long been neglected when it comes to the taxonomy of its avifauna. Happily, in recent years there has been more attention paid to the birdlife of the region and a number of important publications have sought to correct this unfortunate situation. Of particular interest are a number of taxa that have been relatively recently recognised as endemic to Borneo. These are Bornean Frogmouth *Batrachostomus mixtus*, Bornean Leafbird *Chloropsis kinabaluensis*, Bornean Bulbul *Pycnonotus montis*, Bornean Whistling Thrush *Myophonus borneensis*, Bornean Forktail *Enicurus borneensis*, Bare-headed Laughingthrush *Garrulax calvus* and Chestnut-hooded Laughingthrush *Garrulax treacheri*, as well as the four more recently split taxa listed above after the list of endemic species.

Several other taxa require further investigation in respect of their taxonomy; these include the eight species in parentheses in the list above. Further studies of morphology, vocalisations, behaviour and genetics of these species are required to elucidate their taxonomic status. Until these studies have been undertaken, it is considered premature to list them as full species in the context of a non-peer-reviewed field guide.



Blue-headed Pitta.

Breeding

On Borneo, bird breeding seasons are strongly tied in with annual rainfall patterns. In the equatorial tropics, temperatures remain fairly constant year-round but rainfall levels vary widely, thus seasonal breeding in humid tropical forests is a widespread phenomenon. As elsewhere in the tropics, rainfall rather than temperature is the main climatic variable. Borneo experiences very few months of the year with rainfall less than 200 mm and no month ever has less than 100 mm. As discussed in the section on Climate, Borneo's relatively high annual rainfall is heavily influenced by two monsoonal seasons – the north-east monsoon and the south-west monsoon. The north-east monsoon blows from November to February, and these are generally the wettest months. The south-west or so-called 'dry monsoon' is the dryer of the two, occurring from June to September. The climate is driest from roughly March to June (but this may vary from year to year). In addition, many local factors may cause variability in climate, for example, rain shadows and anthropogenic factors. The north-east monsoon tends to soak the east coast, but has less effect on the west coast due to the rain shadow created by the Crocker Range. On the other hand the south-west monsoon has the opposite, albeit weaker, effect of dumping more rain on the west coast. So clearly, climate is not uniform over the entire island and, similarly, breeding behaviour of birds is variable across Borneo. Recent research suggests a peak breeding season occurs from March to May after the period of most prolonged rainfall, but breeding may occur sporadically at any time of year if conditions are favourable. The combination of drier conditions and increased availability of food seems to trigger breeding events.

The whole of the South-East Asian region regularly experiences El Niño events during which time drought affects the area. In recent decades fires, either accidental or deliberately lit, have adversely impacted the ecology of the island, further complicating our understanding of the breeding behaviour of the birdlife. Unlike in temperate zones, moult and breeding cycles are often protracted, so usually overlap broadly. Also, unlike their temperate counterparts, tropical birds tend to have fewer young (smaller broods) that are dependent for longer, and some species often use related helpers at the nest – a phenomenon known as cooperative breeding.

Migration

There are approximately 148 migratory birds that visit Borneo. Of these, most arrive from the north but a smaller number arrive from the Australasian region to the south. As would be expected most of the migrants arriving from the Palearctic and Indomalayan ecozones can be found in the northern part of the island, in Sabah, Brunei and Sarawak, while migrants arriving from the south tend to be found more frequently in Kalimantan.

Most of Borneo's migrants are shorebirds, which breed in the Nearctic and Palearctic regions, and passerines such as pipits, wagtails, warblers and flycatchers. They spend the northern winter on Borneo or travel through as passage migrants on their way to Indonesia and Australasia. The majority of the migrants are open country birds with a smaller number of forest species. Some will occupy different habitats on Borneo than they do on their breeding grounds, possibly as a way to avoid competition with resident species. There are a number of migrants to Borneo that are also represented by resident populations of the same species. These include Yellow Bittern, Oriental Dollarbird, Crested Honey Buzzard and Asian Brown Flycatcher.

Many migrant species arrive on Borneo on a remarkably consistent calendar, annually arriving over a short time span. This may be tied in with the need to establish territories. Departure times are also fairly consistent, albeit with somewhat less regularity. On the other hand, some migrants have been recorded almost every month of the year (such as Whiskered Tern and Barn Swallow); this is probably due to very late departure dates for some individuals, coupled with early arrivals of others.

Four main migration routes to Borneo have been recognised:

1. Over the South China Sea, via Indochina
2. The Eastern Route via Taiwan, through the Philippines to Sabah
3. The Western Route through the Malay Peninsula
4. The Southern Route from Australasia, via the Indonesian archipelago

The first route represents the greatest distance over water, some 850 km, so relatively few migrant species are thought to arrive this way. The Western Route is considered to account for the majority of visitors and passage migrants. Most arrive in the period from August to October, and depart from March to May, spending the northern winter on the island. Southern migrants such as Sacred Kingfisher, Australian Pratincole and Blue-tailed Bee-eater will spend the southern winter on Borneo from March through to September.

CONSERVATION

The popular and romantic image of an island covered in dense tropical rainforest is no longer reflected in reality now that much of Borneo has been converted to agriculture, in particular palm oil plantations, or its forests have been cut for timber. In addition, forest fires have been an ongoing problem. Since 1973 Borneo as a whole has lost more than 30 percent of its forest cover to fires, logging and plantations.

Almost 40 percent of forest has now been completely cleared, while 34 percent has been selectively logged. Up to 10 percent of Borneo's total area is now converted to oil palm and timber plantations. It is believed that Borneo is losing forest at twice the rate of the rest of the world's rainforests and only relatively small areas of Malaysian Bornean forests remain intact. The destruction of Borneo's forests is bad for the world at large too, as deforestation and fires make a serious contribution to global warming.

Environmental threats

Oil palm plantations

Since the early 1900s, huge areas of the lowland forests of Borneo have been converted to agriculture, and to palm oil plantations in particular. Expansion of palm oil production increased rapidly from the 1960s and continues to this day. It is set to continue into the future as well, due to Indonesia's plan to increase exports of palm oil to 40 million tons by 2020. Malaysia and Indonesia are the world's major producers and exporters of palm oil, which is used widely in processed foods, soaps and personal care products, with a 90% share of the world market. Due to the tremendous wealth that palm oil has generated for the national economies of both Malaysia and Indonesia, the industry now has considerable political influence within both countries. Conversion of forests to plantations on Borneo is without doubt one of the major causes of forest loss, greenhouse gas emissions, and ultimately, to the loss of biodiversity in the region. Oil palm plantations are now believed to account for 32% of Kalimantan's lowland area. It is estimated that more than a third of Kalimantan's lowlands may be converted to plantations by 2020.



Oil palms displacing native lowland dipterocarp forest, Sarawak.



Legal logging in the Danum Valley Conservation Area, Sabah.

Unsustainable logging

Large scale logging began in earnest on Borneo from the 1970s when Malaysia turned to their Bornean states to increase production and when political cronyism in Indonesia was at its height. During the 1980s and 1990s logging was particularly intense with more timber exported than South America and Africa combined. Some 80% of Kalimantan's forests were handed over to timber concessions. Borneo lost 12% or 5.5 million ha of forest cover between 2000 and 2010. In Malaysian Borneo, it is conservatively estimated that only 22% of land cover constitutes forest that has never been logged. In both Malaysia and Indonesia, the forests are often repeatedly logged until they are ecologically unviable and are then deliberately converted to plantations, or 'accidentally' cleared by fire. In Sabah and Sarawak there is strong political and commercial pressure to convert non-productive logged forest to oil palm plantations. As with plantations, logging has contributed to greenhouse emissions, social unrest, and loss of biodiversity.

Mining and other industries

Borneo is very rich in mineral resources with significant deposits of coal, gold, silver, tin, copper and diamonds. As with logging, mining activities are often associated with road construction and pollution, thus further compounding environmental damage. Encroachment of roads due to logging and mining has allowed increased access to ever more remote areas, resulting in a corresponding increase of illegal mining, logging and poaching activities.

Illegal wildlife trade

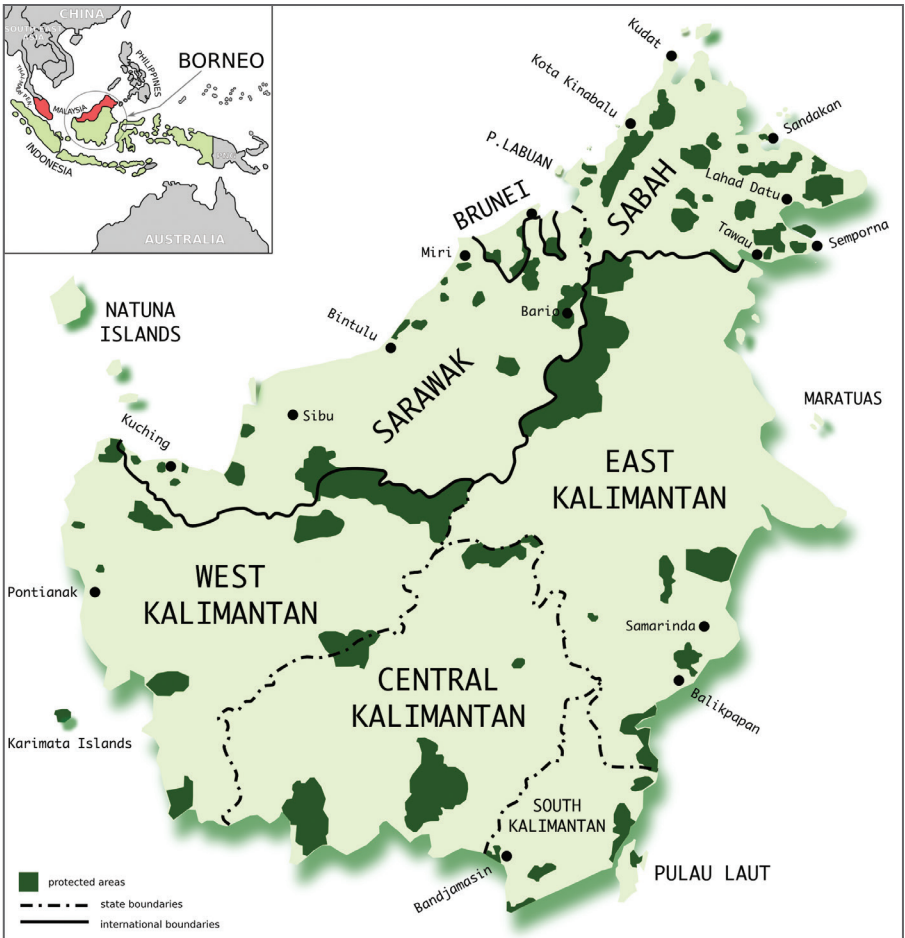
The big business of wildlife trading, only surpassed worldwide by the illicit drugs trade and arms dealing, is a continuing problem on Borneo. At particular risk are Pangolin *Manis javanica* and Orang-utan *Pongo pygmaeus*; the former is traded widely for its meat and supposed health benefits, the latter for the pet trade. It is believed that some 200–500 Orang-utans from Kalimantan enter the pet trade annually. Sumatran Rhinoceros *Dicerorhinus sumatrensis* is now extinct on Borneo due to hunting by poachers for their horns. The cage bird trade in Indonesian Borneo (although not restricted to Indonesia) is also of major concern.

Initiatives

Heart of Borneo Initiative

One of the major conservation schemes on Borneo is the Heart of Borneo Initiative where, in a 2007 declaration, the governments of Indonesia, Malaysia and Brunei have committed to conserve the remaining intact inland forests of the island – an area of approximately 220,000 square kilometres. To a large extent the Worldwide Fund for Nature supports this government initiative, led by WWF-Indonesia and WWF-Malaysia. The WWF considers large-scale agriculture, in particular palm oil plantations, to be the leading cause of deforestation across all regions of Borneo, with secondary causes including small-scale forest conversion, logging, fire, dam building, road development and mining.

The aim of the declaration is to provide a framework of action to protect the forests and wildlife of the area in question through an integrated network of protected areas. These efforts are centred around the five pillars of protected areas, trans-boundary and sustainable natural resource management, eco-tourism and capacity building (creating resources that enhance the ability of people, communities, and institutions to realise shared goals). The HoB Initiative and WWF are also working closely with the business sector as more than 50% of the area concerned lies in private hands.



Protected areas on Borneo.

REDD

Indonesia is the third largest producer of greenhouse gases in the world, due in large part to forest destruction, and is the world's largest deforester. Protection of the remaining forests on Borneo is essential for many reasons – reduction of greenhouse gas emissions, protection of biodiversity, social stability and sustainable economies. With this in mind, a scheme known as REDD or Reducing Emissions from Degradation and Deforestation has been devised which would essentially reward governments, companies and forest owners in developing countries for keeping their forests intact. In the proposal developed in 2005 by the Coalition for Rainforest Nations, five activities were deemed to be necessary:

1. Reduction of emissions from deforestation
2. Reduction of emissions from forest degradation
3. Conservation of forest carbon stocks
4. Sustainable management of forest
5. Enhancement of forest carbon stocks

Due to its high rates of forest destruction and conversion, the province of Central Kalimantan was selected in 2010 for a pilot programme of REDD with a \$1 billion backing by Norway for all of Indonesia. The partnership will feature “the establishment of a national REDD agency, continuation of the development of a comprehensive national REDD strategy, creation of a financing instrument, development of a monitoring, reporting and verification (MRV) framework, and the implementation of a pilot province and a two-year suspension for new concessions on forests and peat lands.” It is recognised that a fair and equitable, as well as a practical and economic, implementation of a scheme that will benefit all parties will be difficult, but efforts continue.



Clearfelling destroys native forest for short-term 'slash-and-burn' agriculture, Sarawak.

HOW TO USE THIS BOOK

Species accounts

In this second edition of *Birds of Borneo*, the taxonomy and nomenclature follow those of the IOC World Bird List version 5.3, 2015 (www.worldbirdnames.org), although the sequence of species has been adapted to achieve a more logical and user-friendly layout of the plates. Alternative English names (Alt.) are given at the end of the species account, where relevant.

The species' overall length is given at the beginning of each account, followed in many cases by a brief general description. A fuller description of each species follows. If not monotypic, the subspecies is identified and the **adult male** is described first, followed by the **adult female**, **first-winter**, **immature** and **juvenile**, if appropriate. In most cases breeding plumage is described first, except for non-breeding visitors to Borneo. Where more than one subspecies occurs, the taxon most likely to be encountered by birders is described first. In many cases, there follows a brief summary of differences between potential confusion species, under the subheading **Similar species**.

HH This subsection gives details of habitat and habits. Generally, habitat types are defined as follows: primary forest has suffered little or no human disturbance; in secondary forest large trees have been removed but there has been some regeneration. Lowland forest is broadly defined as lying at 0–400 m, hill forest at 400–950 m, lower montane forest at 950–1,400 m and upper montane forest at >1,400 m. In most cases altitudinal ranges known from Borneo are given. Habitat types are discussed briefly above on p. 15. In addition, several manmade habitats such as paddyfields, plantations, parks and gardens are mentioned and these need no further explanation. Notes on the behaviour of most regularly occurring species are given in this subsection. Many behaviours provide important identification clues.

Voice Calls and songs are notoriously difficult to describe in words and can only be rendered subjectively. In most cases, where possible, recordings of vocalisations made on Borneo were analysed. The tone and timbre, pitch and frequency, and rhythm and timing are described with adjectives and often with measurements. Increasingly, birders are becoming familiar with sonograms, and descriptions of the frequency in kilohertz (kHz) (i.e. sound-wave cycles per second) are both comprehensible and useful. In many cases, timing is given in terms of notes per second. This is less subjective than some other methods of describing vocalisations.

Status For reasons of space, extralimital range is not usually given and this section simply summarises range and status on Borneo.

The following terms are used to describe the abundance of species on Borneo:

- abundant** – a conspicuous species that occurs in very large numbers;
- common** – occurs in large numbers;
- fairly common** – occurs in fair to moderate numbers;
- uncommon** – found in small numbers;
- rare** – recorded in very small numbers.

Additionally the terms 'local' or 'locally common/uncommon' are used for species that occur in restricted areas but can be common or uncommon there.

Terms used to describe the status of species on Borneo are:

- resident** – a breeding species present throughout the year;
- non-breeding visitor** – usually absent for at least a few months of the year (usually during the Northern Hemisphere summer – June, July, August – but in most cases the period is specified);
- passage migrant** – occurs on passage to breeding or non-breeding areas;
- vagrant** – rare and unexpected, does not occur annually.

'North Borneo' refers to Sabah, Brunei, Sarawak, northern East Kalimantan, and far-north Central and West Kalimantan, while 'South Borneo' refers to South Kalimantan, and southern East, Central and West Kalimantan. The divide can be thought of as occurring roughly at the equator. Generally, distributions within Borneo are given in detail according to state and province, and divisions within those units (E & W Sabah; Brunei; E, C & W Sarawak; E, C, W & S Kalimantan).

Note In some cases, a note is added at the end of the species account to draw attention to recent changes in taxonomy or nomenclature, or to highlight possible future changes.

Abbreviations In the species accounts, points of the compass are given as N, S, E and W. Gunung (mountain) is shortened to G., kilohertz to kHz and seconds to s.

Maps

For each species, known locations were plotted on a map. These points were then connected to produce as accurate a distribution map as possible. As so many species are restricted to particular habitat types or altitude ranges, it is inevitable that a number of birds share similar ranges within Borneo. However, this is a field guide, not a bird atlas, so the maps, while as accurate as possible, are general by their very nature. It must also be understood that bird distribution on Borneo is now heavily influenced by habitat loss, and the maps cannot possibly depict the harsh reality of locally declining bird populations and ranges. Sadly, many species probably already occupy smaller ranges than depicted in the book.

Each map is colour-coded according to the status of the species.



Resident



Non-breeding visitor



Passage migrant



Rare resident/isolated records



Vagrant or non-breeding visitor with isolated records



Uncertain record