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CHAPTER 20

The status of butterfly conservation in Peninsular Malaysia

CHOOI-KHIM PHON* and LAURENCE G. KIRTON

Abstract: A prior overview of the state of butterfly conservation in Peninsular Malaysia written 35 years ago identified two main threats: destruction of natural habitats and human exploitation. It recommended the protection of representative habitats and geographical zones, as well as measures to prevent over-exploitation. This paper reviews the current status of butterfly conservation in Peninsular Malaysia with respect to those recommendations. Currently, species distributions and habitat requirements remain partially known. Conservation status assessments have only recently begun. Forest loss continues, while gaps in the protection of important geographical areas remain. Some progress has however been made in establishing state parks, high conservation value forests and geoparks. Sites known to have high species diversity and rare or narrowly distributed taxa should be designated as Important Butterfly Areas. About 30 butterfly species are listed as being protected by law, but most are abundant and widespread, while some species that need protection are unlisted. There is therefore a need to review the list. Malaysia exports the greatest share of species protected under CITES. In addition, foreign collectors are known to collect large numbers of rare species for exchange or sale, which can adversely affect populations. Measures are needed to prevent over-collecting while encouraging responsible collecting for taxonomic study and habitat data. Climate change is an urgent but little-studied threat to butterfly species. Other anthropogenic impacts include clearing of understorey vegetation in recreational forest areas and clearing of roadside and wayside nectar plants, often using herbicides.

INTRODUCTION

Butterflies are beautiful and fascinating insects and are among the most studied insect groups in Peninsular Malaysia. A comprehensive account of the butterflies of Peninsular Malaysia was first published in 1934 (Corbet and Pendlebury 1934) with new editions published in 1956, 1978, 1992 and 2020. A stand-alone update to the fourth edition was published in 2006 (Eliot 2006). The book provides detailed morphological descriptions, keys and plates along with a checklist showing species and subspecies distributions across different subregions, islands, elevations and forest types. Several other less comprehensive books on Peninsular Malaysian butterflies or their early stages are also available, written by Morrell (1960), Fleming (1975a, 1975b, 1983), Yong (1983), Kirton (2020) and Goh (2024).

The taxonomy of butterflies in the Peninsula has been well studied in comparison to many other insect groups, despite the low number of taxonomists working on the subject. The number of additional species recorded from the Peninsula, which comprised new species described as well as new distributional records, numbered about 100 in the two approximately 20-year periods between the first, second and third editions of Corbet and Pendlebury (1934, 1956, 1978) (Table 1). In contrast, they numbered less than 30 (with some uncertainties) in the approximately 30-year period between the fourth and fifth editions (Corbet and Pendlebury 1992, 2020). This suggests the fauna is now relatively well documented.

Entomology Branch, Forest Research Institute Malaysia (FRIM), 52109 Kepong, Selangor.
***Corresponding author: phonchooikhim@frim.gov.my**

Table 1. Number of butterfly species recorded in each edition of the book, '*The Butterflies of the Malay Peninsula*' (Corbet and Pendlebury 1934, 1956, 1978, 1992 and 2020).

Year of publication	Number of years	Number of species recorded	Number of species added
1934		801	-
1956	22	898	97
1978	22	1,008	110
1992	14	1,031	23
2020	28	1,051	20
TOTAL	**86**		**250**

The first articles on conservation issues affecting butterflies in the Peninsula were published in 1961 and highlighted the need to protect island populations (Stubbs 1961) and small, localised populations of butterflies (Russell 1961). Some of the island populations were so different from mainland populations as to be named as subspecies. Subsequently, a more comprehensive overview of butterfly conservation in Peninsular Malaysia published 35 years ago identified two major threats to butterfly populations (Kirton 1991): destruction of natural habitats and human exploitation. To mitigate these threats, conservation of unique natural habitats was recommended, as well as permanent protection of a balanced representation of different habitats and geographical zones that support characteristic faunas. In addition, effective measures against human exploitation were advocated. This paper reviews the current status of butterfly conservation in Peninsular Malaysia with respect to those recommendations. The paper also examines the extent to which butterfly conservation has featured in research over the years, and new developments that either threaten or aid butterfly conservation in the Peninsula.

Development of baseline information on butterflies

Butterfly conservation requires baseline information such as comprehensive checklists and accurate distribution data. Priority regions and forest types identified in the previous overview of butterfly conservation in Peninsular Malaysia included Kedawi, the offshore islands of Peninsular Malaysia (as highlighted also by Stubbs 1961), highland regions, mangroves, peat swamps, and limestone outcrops (Kirton 1991). More than half of the 188 publications on butterflies in Malaysia in the past 35 years focused on diversity, assemblages, and distribution (Figure 1). Despite that, substantial gaps remain in our knowledge of the geographical distribution of butterfly species and their habitat requirements.

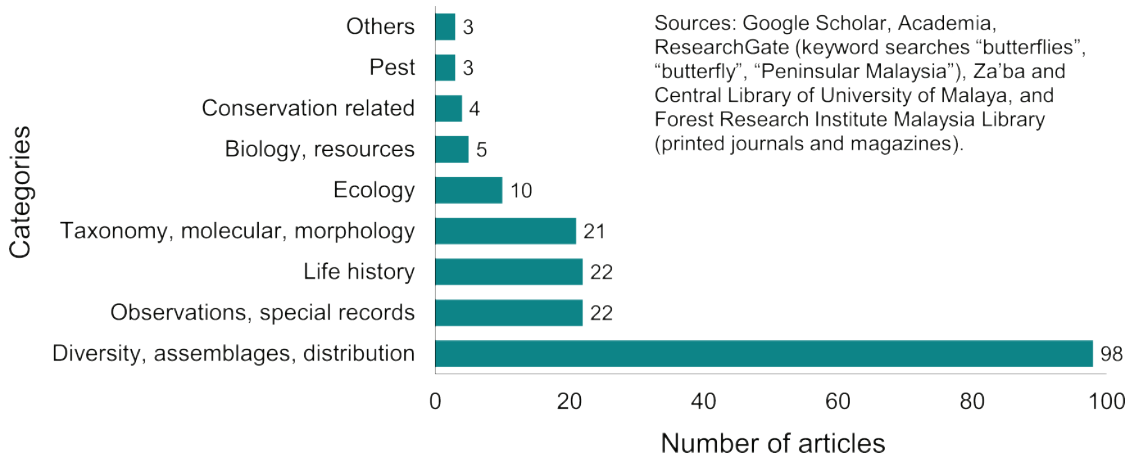

Figure 1. Numbers of published articles on butterflies in Peninsular Malaysia classified by subject between the years 1991 and 2025.

Some progress has been made for Kedawi. A preliminary checklist has been compiled for the Perlis State Park near Gunung Perlis (Noack 2002). Butterflies found on the Langkawi Islands are also indicated in the distributional checklist provided for Peninsular Malaysia in Corbet and Pendlebury (2020), but much forest loss has occurred on the main island of Langkawi since the lists were first compiled by Corbet and Pendlebury in 1956 and 1978 and by J.N. Eliot in 1992. More recent material from Langkawi, collected between 2012 and 2016 by Gary Ruben, is now deposited in the Forest Research Institute Malaysia (FRIM) Entomological Reference Collection, providing valuable baseline data. Progress has also been made for limestone areas. FRIM has recently completed butterfly inventories in selected limestone outcrops across Selangor, Perak, Perlis, Kelantan, and Pahang (Phon 2025).

Of the 188 articles on butterflies published between 1991 and 2025, only four had conservation as the primary objective (Figure 1). These articles stemmed from two studies. The first was conducted between 1996 and 2001 on the Swamp Tiger (*Danaus affinis*) at Kuala Selangor Nature Park, as a collaborative effort between the Malaysian Nature Society (MNS) and FRIM. It documented host plants, life history, habitat requirements, nectar sources, and population trends (Kirton and Azmi 1996, Kirton and Azmi 2004, Cheang 2005). The second was a study on the Rajah Brooke's Birdwing (*Trogonoptera brookiana*), which began around 2010. This work examined the population trends of the species (Phon *et al.* 2017), its geographical distribution and its preferred nectar plants, besides addressing taxonomic uncertainties on subspecies occurring in the eastern regions of Peninsular Malaysia (Phon *et al.* 2019).

The publications of naturalists have also been very useful in providing baseline information to support butterfly conservation in Malaysia. For example, the life histories of 191 butterfly species have been documented by Goh (2024), and useful observations on the biology and ecology of butterflies have been published by Liew (e.g., Liew 2025).

Conservation status assessments for butterflies

National-level butterfly conservation status assessments were proposed in the last review of butterfly conservation in Peninsular Malaysia (Kirton 1991). Implementation of assessments aligned with IUCN criteria and categories have only begun recently, starting with assessments of endemic species (C.-K. Phon, in prep.). The assessments await formal review.

Conservation status assessments require data on distributions and abundance. A substantial proportion of specimen data held in institutional collections has yet to be digitised or made publicly accessible, which poses a constraint to comprehensive assessments. Many naturalists now share their observations through online platforms, providing researchers with valuable locality records for numerous species. Such records represent an important data source for conservation status assessments. Advances in digital technology have certainly greatly increased the availability of butterfly occurrence data through online platforms such as GBIF and iNaturalist. However, conducting rigorous conservation status evaluations requires taxonomic and analytical expertise. Records from these sources need careful taxonomic verification and critical evaluation of reliability.

Habitat protection for butterflies

As of 2020, Malaysia retained approximately 55% of natural forest cover, equivalent to about 18 million hectares (Global Forest Watch 2025). However, forest loss continues to occur. For example, there has been extensive land-use change in the Cameron Highlands between 1984 and 2020, as Figure 2 illustrates. The ridges and summits of certain mountains in the highlands are ecologically important for butterfly hill-topping, a behaviour in which butterflies congregate at these elevated sites to enhance mating success. However, large swathes are often cleared of vegetation for electrical transmission lines and pylons. Heavy machinery is used, damaging the soil and landscape. Observations by local naturalists

indicate a decline in butterfly abundance at the summit of Gunung Jasar in Cameron Highlands, a well-known hill-topping site that deserves permanent protection. The establishment of transmission lines and pylons just below its summit and the loss of habitat in the lower slopes and valleys of the Cameron Highlands may be contributing factors to the decline in hill-topping on this mountain peak, others being over-exploitation by dealers and foreign collectors and the effects of climate change.



Figure 2. Extensive land-use change in Cameron Highlands between 1984 and 2020 shown in satellite images from Google Earth (2025).

Despite much forest loss, some progress has been made towards the conservation of natural habitats within different geographical zones since the last review of the status of butterfly conservation in Peninsular Malaysia (Kirton 1991). Several forest areas have been designated as state parks, high conservation value forests (HCVFs) or geoparks. Although these areas were not necessarily established to specifically cover representative geographical zones or habitat-types, they nonetheless play an important role in conservation.

However, in Peninsular Malaysia, conservation areas have differing levels of protection and are administered by multiple government agencies. The Department of Wildlife and National Parks (DWNP) oversees 35 protected areas, including national parks, wildlife reserves, wildlife sanctuaries, Ramsar sites, and wetlands (PERHILITAN 2025). The Forestry Department manages permanent forest reserves, HCVFs, eco-parks, recreational forests and certain state parks (JPSM 2025). Permanent forest reserves may still be degazetted for logging, agriculture or development. For example, 406.22 ha of Bukit Cherakah Forest Reserve in Selangor was recently degazetted for development (Selangor State Government 2022), which is being challenged by non-governmental organisations in court. Illegal activities further exacerbate the problem of protecting permanent forest reserves. Some state parks are administered by state-level statutory bodies, such as the Royal Belum State Park under the Perak State Parks Corporation and Endau Rompin National Park in Johor under the Johor National Parks Corporation. Geoparks, which are areas designated for their geological significance, lack any legal protection. Currently, approximately ten geoparks are recognised at the national level (Chew 2026), with two designated as UNESCO Global Geoparks in Malaysia (Global Geoparks Network 2025).

Gaps in the conservation of important geographical areas continue to exist and pose a concern for the conservation of many butterfly species. Localities that are already known to support high species diversity, rare taxa or populations that have very restricted distributions should be designated as Important Butterfly Areas in which to focus conservation efforts.

Some species that inhabit narrow ecological niches are particularly vulnerable to habitat loss and should be prioritised in conservation planning. For example, *Tongeia potanini*, which is currently known only from limestone outcrops in parts of Perak and Kelantan, warrants urgent conservation attention. Another clear example is the central-western subspecies of the Rajah Brooke's Birdwing, *Trogonoptera brookiana albescens*, a large and magnificent butterfly that has become a national icon. There continues to be no permanently protected areas within the range of this butterfly. It is a subspecies with complex ecological requirements because of the habit of males of congregating in large numbers at geothermal springs and seepages along the banks of certain rivers, a behaviour called puddling. Puddling sites are ecologically critical, as male birdwings obtain essential minerals and nutrients from them that are vital for physiological functioning and reproductive success.

Ulu Geroh in Perak is one such site where numerous male Rajah Brooke's Birdwings congregate densely at just a few small locations along the river. It is a spectacular phenomenon that attracts ecotourists and provides income to local indigenous guides. The vulnerability of these puddling sites is illustrated by an incident in December 2009, when an old-pipeline salvage project along the riverside at Ulu Geroh almost obliterated the puddling sites. The threat was ultimately mitigated through timely intervention involving local villagers, the media, MNS, parliamentarians, the Forestry Department, FRIM and DWNP (Phon *et al*. 2011). The site recovered and birdwings returned to puddle.

Effective measures against human exploitation of butterflies

At present, about 30 butterfly species in Peninsular Malaysia are protected under the First Schedule of the Wildlife Conservation Act (2010). Many of these species are popular with collectors and traders, but most of them are relatively abundant and widespread species that tolerate some forest degradation. They are also mainly from the families Papilionidae and Nymphalidae. In contrast, some butterfly species that have restricted distributions or occupy specialised habitats are heavily collected but not protected, such as certain *Delias* species of the family Pieridae that are found only on mountain tops. Therefore, there is a need to review the national list of protected species so that protection is given to species that truly need it. It is envisaged that future lists will be guided by national conservation assessments as these gradually become available.

Species in Peninsular Malaysia that are protected internationally under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) continue to be exported from the country (Table 2). Most specimens are sourced directly from wild populations. Butterfly ranching, in which butterflies are sourced from natural habitats that have been enhanced to increase wild populations should be encouraged and developed. This would help meet trade demands while reducing pressure on wild populations. Neighbouring countries such as Indonesia have begun implementing this (UNEP-WCMC 2012).

Exploitation of Malaysian butterflies occurs not only through formal trade mechanisms, but also by foreign collectors who engage local assistance to collect and bring back large numbers of specimens to their own countries for exchange and sale (pers. obs.). Rare species are often targeted. Although private collecting on a small scale is unlikely to have a significant impact on butterfly populations, sustained collecting of specific rare and localised species by multiple collectors can reduce populations, a concern also expressed by Russell (1961). Together with other population pressures such as habitat loss, this can be

detrimental to the survival of species. While responsible collecting within existing regulatory provisions, whether by local or foreign collectors, should be encouraged for the purpose of obtaining specimens for taxonomic study and data for conservation assessments, there is a need to prevent over-collecting of localised and rare species. This may require both improved legislation and stricter application of existing laws.

Table 2. Numbers of CITES-protected species exported from Malaysia, and Malaysia's percentage share of the world export of these species between the years 2017 and 2020 (CITES Secretariat and UNEP-WCMC 2023).

Species	2017	2018	2019	2020	Share of Export (%)
Trogonoptera brookiana	20	27	0	1,018	98.3
Troides aeacus	40	0	0	200	100.0
Troides amphrysus	28	0	9	14	72.5
Troides cuneifera	20	0	0	0	100.0
Troides helena	118	90	137	414	45.5

Anthropogenic impacts on butterflies

Anthropogenic impacts, that is, environmental changes caused directly or indirectly by humans, have a greater effect on butterfly populations than is generally realised. Over the years, methods of managing roads, rural landscapes, agricultural plantations, and parks and recreational areas situated in forests have changed to the detriment of butterfly populations. Many forest recreational areas such as camping and glamping grounds have been established in recent years, sometimes with little regulatory oversight. Little or no attention is given to planning such spaces in a way that preserves or encourages invertebrate wildlife. Undergrowth is usually cleared from the forest, leaving only tall trees, while natural vegetation at the sides of rivers is almost entirely removed. Sometimes cement is used to make pools or landings.

Roads through forested areas are now built larger and wider, cutting through hills instead of strictly following the hillside contours, resulting in drastic alterations to the landscape. Such large roads also require stabilisation of slopes by concrete and cement -work or by planting exotic grass species. As a result, native vegetation is lacking in the gaps between the bisected forests, making them uninhabitable barriers to dispersal. Even where roads are small, the clearing of wayside herbaceous growth has become more intensive and is often aided by herbicides. As a result, roadside nectar plants on which butterflies depend as a regular source of sustenance are largely eliminated (pers. obs.). Increasing numbers of vehicles using the roads also result in numerous road-kills of crossing butterflies (Muñoz *et al.* 2015).

Forest paths used as hiking trails are also sometimes intensively managed by clearing wide swathes of vegetation. On the mountain peaks and ridges where butterflies congregate to establish territories and seek mates, trees and low vegetation are often slashed down by hikers to provide views or to create platforms for photography. This could potentially have a great impact on butterfly and other insect populations that depend on these habitats for hill-topping as part of their reproductive behaviour.

Widespread pesticide usage in agricultural areas is also threatening butterfly populations (Quandahor *et al.* 2024). In Peninsular Malaysia, many forests border agricultural landscapes, and butterflies from these adjacent forests enter the edges of agricultural plantations seeking nectar and may be inadvertently poisoned. Pesticides and effluents from industries also contaminate rivers, destroying puddling sites along riverbanks. However, siltation is a bigger problem in upstream rivers due to logging, agriculture and development that occur along the watershed.

Light pollution is yet another anthropogenic impact that is detrimental to butterflies because many butterflies are crepuscular, being active at dawn and dusk and hence being readily attracted to light. Insects that are attracted to light often become prey to birds and lizards, putting pressure on their populations (Owens and Lewis 2018).

Climate change is an increasingly urgent threat to butterfly conservation. Rising temperatures, altered rainfall patterns, and prolonged droughts are among the effects of climate change that affect butterflies. Rising temperatures are expected to shift butterfly distributions along elevational gradients (Habel *et al.* 2023). Lowland species may begin to populate higher elevations, while species confined to mountain tops face an increased risk of extinction.

The impacts of anthropogenic pressures on butterflies remain poorly studied, both locally and globally. In Peninsular Malaysia, studies on the effects of climate change on butterflies are scarce due to the need for long-term datasets that require continuous research and funding commitments.

CONCLUSION

The last review of the status of butterfly conservation in Peninsular Malaysia written 35 years ago emphasised the importance of conserving unique habitats and a balanced representation of different habitats from different geographical zones, as well as effective measures to prevent over exploitation. Despite some progress being made, many important habitats and geographical zones in the Peninsula remain unprotected or poorly protected. Even our knowledge of the geographical distribution of butterfly species and their habitat requirements remain limited, and very few studies have been conducted on the conservation of butterflies. At the same time, recent advances in digital photography and digital online platforms are providing researchers with valuable locality records for numerous species. We recommend that localities known to have high diversity, rare taxa or geographically restricted populations be designated as Important Butterfly Areas that receive priority for conservation efforts. In particular, we propose that the conservation of Malaysia's most well-known butterfly, the Rajah Brooke's Birdwing, *Trogonoptera brookiana*, be given greater attention, as the central western race is distributed in forest areas that lack adequate protection. Targeted over-collecting of localised and rare species is a threat that also needs to be addressed. A review of the national list of protected species is greatly needed so that the species listed are those that truly need protection. National conservation assessments are also needed, as they can guide the selection of protected species. Greater attention to anthropogenic impacts in butterfly populations is also needed. Planning of reserves, parks, roads, recreational areas and hiking trails should take into account the preservation of wayside plants and the understorey vegetation so as to minimise impact on invertebrate populations. Greater study is needed on these aspects of butterfly conservation as well as the effects of other anthropogenic threats such as climate change.

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