

# M A L A Y S I A N NATURALIST

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*Lambir Hills*  
Sarawak's Best Kept Secret

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# SARAWAK'S *BEST KEPT SECRET*

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"Just south of Miri in Sarawak, on a low range of hills, a small but precious piece of coastal lowland rain forest remains." This is how Rhett Harrison and Peter Ashton begin this informative piece about the Lambir Hills which has "more tree species than any comparable area in the Old World" and possibly on Earth. Read on and be another supporter of the effort to save the Hills.



MAIN PIC: Bukit Lambir at sunset. The ridge is composed of yellow sandstone laid down in the delta of a predecessor of the Baram.

INSET: A diversity of shapes and hues in the canopy at Lambir Hills.

The 80 m tall research crane built at Lambir Hills is one of a network of seven similar cranes in tropical forests around the world. The 70 m arm of the crane allows investigators to reach almost any leaf in the canopy over 1.5 ha of forest. In addition to studies of plant physiology and ecology, it is being used for the long term monitoring of the forest-atmosphere gas exchange, particularly important for understanding the effects of increased CO<sub>2</sub> levels and global warming.



**Coastal lowland rain forest** has disappeared from most of Sarawak, indeed from most of Southeast Asia. But just south of Miri on a low range of hills a small but precious piece remains. Driving towards Bintulu from Miri the road passes right through the forest, although from a car window the trees simply appear left-over; missed by the scythe of progress. The impression, however, is misleading. When botanists first explored Lambir Hills in the early 1960s, they recognized there was something very special about this forest and arranged for its preservation. It's a secret that Sarawak has coyly sheltered for far too long: this tiny fragment of forest has more tree species than any comparable area in the Old World, possibly on Earth.



A huge strangling fig tree (*F. kerkenhovii*). Known as Kara Nyangkan by the local Iban, these are the spirit trees of the forest and are revered for their power and fertility.

Tropical rain forests are the pinnacle of the diversity of life on land. In the Old World they extend in a discontinuous band from West Africa through Madagascar, the Indian subcontinent, southern Indo-China and Southeast Asia to New Guinea and northern Australia. But the richest is found in this forgotten corner of Sarawak. As the zenith of tree diversity in the Old World, Lambir Hills National Park unquestionably qualifies for UNESCO World Heritage status. It would be a marvellous asset to Miri, the state, and indeed all of Malaysia, if this aim could be achieved in Sarawak.

Unfortunately, as one so often hears, the future of Lambir Hills is far from secure. Since its construction in the early 1980s, the Miri-Bintulu road has cut a swath through the north end of the park, and has improved access to the area. Previously, the only route south from Miri was along a rough coastal jeep trail past Bakam that eventually entered timber concessions to the north of the present park. Approaching from the south one could attempt the perilously slippery Riam road, a journey that could involve a good deal of winching. When the national park was designated in 1975, the Forest Reserves extended from the present site of Miri Airport, southwest along the coast as far as the banks of the Sungei Sibuti, and inland in an unbroken sweep to the Riam road. They incorporated considerable areas of rich Kerangas and peat swamp as well as over 350 km<sup>2</sup> of lowland dipterocarp forest. The new road, however, opened up the area economically. While it has had obvious benefits, it has brought untold pressures to bear on the boundaries of the park. The first to go were the timber concessions around Lambir Hills. Then as several longhouses relocated along the road, large new areas of shifting cultivation were opened up. And most recently, extensive oil palm plantations have been established. Today, the only surviving primary forest is that within the boundaries of the park, which is only 65 km<sup>2</sup>. The last of the secondary forests, in the logged concessions that border the park to the north may soon be converted to oil palm estates. Even within the park all is not well. Illegal hunting and logging by local communities are perennial problems that continually erode the quality of the forest. Moreover, as recently as 1998, when a power line was constructed through the park, officially sanctioned developments have further whittled away at the remaining area of primary forest.

The case for conserving the forest at Lambir Hills is as cast iron as for any comparable area of the world. But if more is not done to protect what remains, by better law enforcement and establishing substantial buffer zones, the park will soon become just another remnant of degraded forest. That would be a sad loss to Malaysia.



ABOVE: An abundance of understory fan-palms (*Licuala*) is one of the characteristics of the forest at Lambir Hills National Park. Cutting of the stems of these palms to obtain the growing shoots threatens their populations. Rattans which were formerly very common in the park are now extremely rare as a result of uncontrolled collecting.

RIGHT: A rain forest giant. The buttresses of this massive *Dryobalanops lanceolata* completely dwarf a person. The lowest branch of this tree is 50 m above the ground and its top is probably 30 m above that.



At Lambir Hills it is the diversity of tree species that makes it so special. Only Yasuni in Ecuador ranks close.

There are two types of forest to be found at Lambir Hills. About one third of the park is Kerangas or heath forest that occurs along the crest of Bukit Lambir. It is dominated by *Gymnostoma nobile* (Casuarinaceae) and *Tristaniopsis obovata* (Myrtaceae) and is the only piece of sandstone-ridge Kerangas conserved in the northeast of Sarawak. However interesting, the Kerangas is relatively species-poor compared to the lowland dipterocarp forest that occurs over the other two thirds of the park. A walk

through this dipterocarp forest is a richly rewarding experience. One wanders along under a continuous canopy of tall, sometimes very tall, slender trees, with an open understory of seedlings, *Licuala* fan-palms, and patches of ginger. Big woody lianas, such as *Gnetum* or *Bauhinia*, drape over boughs or lie coiled on the ground, and a diversity of rattans wave their hooked tendrils. Figs are common and come in a myriad of forms. In fact, with 75 species and several varieties, figs are the most species-rich plant taxa in the park and their fruit are very important for wildlife. Indeed, a big fruiting fig tree is as good a place as any to see many of the park's birds and arboreal mammals. However, possibly the most impressive feature of the forest at Lambir Hills is the height of the canopy which is commonly over 50 m. One particularly awe-inspiring specimen of the emergent dipterocarp, *Dryobalanops lanceolata*, must be at least 80 m tall. Measured with climbing rope (and gallons perspired in reaching it), the lowest branch was 50 m high and the crown extended a further 30 m or more above that. The buttresses of this giant completely dwarf a person. But, notwithstanding the beauty of the forest at Lambir Hills, this is not the quality that separates it from other forests. Indeed, with minor adjustment its description could fit lowland dipterocarp forests as they occur throughout the region. At Lambir Hills it is the diversity of tree species that makes it so special.

Although botanists have known that the forest at Lambir Hills is rich in trees since at least the early 1960s, the true diversity of the forest has only recently become known. In 1992 a large scale research plot was established in the park by the Forest Department Sarawak and collaborators in the USA and Japan. It is part of a network of 17 such plots extending around the tropics (Lee et al., in press). In just 52 ha an amazing 1200 species of tree were recorded, making it the most diverse site in the network. Pasoh Forest Reserve in Negeri Sembilan came in second in the Old World with 800 species. One should take a moment to let those figures sink in. These large-scale plots are telling us that while the forests of Peninsular Malaysia are more diverse than other Old World sites, Lambir Hills has an extraordinary 50% more species. The only other plot that ranks close, with approximately 1100 species, is at Yasuni in Ecuador on the western edge of the great Amazonian forest.

Addressing the question, "Why are there so many species?" is to attempt to answer the Holy Grail of tropical ecology. Theories abound, but answers elude. Nevertheless, our understanding of patterns of diversity is improving and at least a basic account of why Lambir Hills has so many tree species is no longer beyond us. Species richness in any particular place derives from two fundamental components: how many species have evolved there or migrated to it; and how many species can co-exist in the landscape. The first factor is historical and leaves its footprint in the geographical distribution of species today. The second is ecological and more enigmatic.

### The biogeographic component

The forests of Malaysia and much of Indonesia are what remain of a once enormous green expanse that extended all the way from southern Thailand and Peninsular Malaysia to the Sunda Islands, incorporating Sumatra, Java and Borneo. During the Pleistocene glaciations 11,000 to 15,000 years ago sea levels dropped perhaps as much as 200 m and the sea floor between the mainland and the Sunda islands was forested. Thus, the present day distributions of many plants and animals reflect how they fared during this period and, subsequently, as the islands became isolated once again. For example, 89% of the land bird species



ABOVE: Flowers of an emergent tree, *Dryobalanops lanceolata* (Dipterocarpaceae). Walking through the forest one rarely sees flowers like these as they are always out of sight in the canopy. This species is pollinated by the Giant honey bee and smaller stingless bees.

BELOW, RIGHT: An emergent dipterocarp in flower. Dipterocarps make up over 80% of the canopy and emergent trees at Lambir Hills. These trees flower and fruit at irregular intervals of three to five years probably in response to a rare, cool night-time temperature trigger. The lighter greens in this photo are patches of flowers.

found in Peninsular Malaysia also occur in the Sunda islands, while only 18% of Borneo's species are shared with Sulawesi, which despite its proximity was always separated from the Sunda region by a deep water channel (MacKinnon and Phillipps, 1993). Trees, however, are often poorer dispersers than birds and hence their pattern is more complex (Wong, 1998). Historically, large rivers and extensive peat swamp forests further divided up the landscape, isolating forests on coastal hills. There new species evolved. Then as the rivers meandered and the swamps retracted and expanded, the hills were periodically reconnected, enabling species to migrate in or out. Bukit Lambir was one such range of hills.

Four elements can be recognized in the tree flora at Lambir Hills. First, there is the widespread Sunda flora of species that occur throughout the region. Then there are the species typical of central Borneo and Sarawak to the west of the park, and of Brunei and Sabah to the east. Lambir Hills is right in the transition zone between these two floras and has inherited species from both. Finally, northwest Borneo constitutes the richest manifestation of a special flora known as the Riau Pocket (Corner, 1960; Wong, 1998). This flora is composed of species found mostly on coastal hills and in peat swamps, and the area includes parts of Pahang state, most of the eastern side of the Malay peninsular, islands off Sumatra including its namesake the Riau Archipelago, and northwest Borneo (Wong, 1998). It appears to have been the core of the Sunda region when the area was connected by a land bridge. Today, very little remains of this unique and diverse flora and Lambir Hills preserves the best remaining examples.

### The ecological component

Early ecological surveys in Brunei revealed that forests on sandy sediments were rich in endemic tree species and very different from those on sites with richer clay soils only 100 km away (Ashton, 1964). The question, therefore, arose as to whether these patterns might be the result of poor dispersal ability or adaptation to different soils. This is what led to the original botanical interest in Lambir Hills.



ABOVE: Bukit Lambir in the blue light of dawn.

BELOW: The distinctive trunk of Pelawan (*Tristanopsis*) on the waterfall trail.



Lambir Hills is one of only a few sites where these two soil types are juxtaposed. Just south of the park headquarters there is a road cut that illustrates this beautifully. The older rocks at the bottom are dark grey muddy deposits laid down when the area was under a shallow sea. The yellow-orange beds at the top, of which Bukit Lambir is also composed, are sandy river-delta deposits laid down by a predecessor of the Baram. Between the two are rocks of intermediate composition created when sand was first deposited above the muddy seafloor and mixed with it through, amongst other things, the action of burrowing marine organisms (Hazebroek and Morshidi, 2000). These rock types produce soils of very different character. On the sandier

sediments, deep soils with a surface layer of acid humus that are poor in available nutrients develop, while over the dark clay-rich beds shallower soils, richer in nutrients, form. The latter are also very slippery – you will quickly discover this if you go for a walk on some of Lambir's steeper slopes. The first botanists to visit the park laid out small plots on both soils and the recent 52 ha plot was deliberately placed to incorporate the transition from one soil to the other. What these and wider studies have revealed is that soils are extremely important in determining the composition of tree species that occur at a site (Potts et al., 2002). At Lambir Hills a whopping two thirds of species are specific to one or other soil type, even though they may be separated by less than 100 m. Moreover, each soil type supports a tree assemblage that is of similar species-richness to the forests of Peninsular Malaysia (Lee et al., in press). Thus, the exceptional diversity of Lambir Hills can in large part be ascribed to the fact that both soil types support a distinct, but individually diverse, plant community (Ashton in press).

As in tropical forests elsewhere, other ecological factors are also clearly important. One conundrum of tropical forests is how large numbers of closely related, and, therefore, presumably ecologically similar, species can co-exist. As mentioned earlier there are 75 species of fig at Lambir Hills, all of which belong to the genus *Ficus* (Harrison and Shanahan in press). Other big genera include *Shorea* with 56 species, *Syzygium* with 53 species, and *Diospyros* with 34 species (Lee et al., in press). However, if one investigates these suites of related species one often finds that they segregate out along simple but biologically meaningful gradients.

In Lambir Hills a study of the genus *Macaranga*, pioneer species that quickly invade gaps showed, in addition to soil preferences, that species occupied different light environments. Some prefer the high-light conditions near the middle of gaps while others were tolerant of quite shady conditions at the edge of gaps or even in the understorey (Davies et al., 1998). Similarly, hemi-epiphytic figs at Lambir Hills specialise in different canopy strata, some preferring the well lit crowns of emergent hosts while others are found in the shaded sub-canopy (Harrison et al., 2003).

Another critical aspect is pollination. Because of the high species-richness, trees of the same species are often widely scattered. However, most tropical trees are dependent on insects for pollination. Thus, pollinators such as stingless bees or the Giant honey bee (*Apis dorsata*), capable of flying long-distances, are very important. At Lambir Hills it was found that about 40% of the plant species were pollinated by these bees (Momose et al., 1998).

Various other factors could be mentioned. However, while these may be necessary or contributing conditions for the co-existence of so many species, they are unlikely to be important in explaining why it is that Lambir Hills has so many more species than, say, Pasoh. Clearly, two critical factors are the rich potpourri of species created by Lambir's unique biogeographical position and the fact that there are two, largely independent but diverse, tree communities on the different soils.

A Green crested lizard (*Bronchocele cristatellus*) eyes the camera while merging with the green hues of the forest understorey.

## Its botanical worth makes it one of Malaysia's most important parks.

Lambir Hills does not contain enigmatic wildlife such as Orangutans, or plants like *Rafflesia* that have a high emotive value. Nor, because of its small size and hunting problems, does it support large populations of wildlife. Thus, according to the usual conserva-

tion priorities it does not rate highly. However, its enormous botanical worth definitely makes it one of Malaysia's most important parks.

Lambir Hills is also extremely valuable for education and research. Since the early 1990s the park has been the focus of an intensive research effort by international and local scientists. Hence, we probably now know more about Lambir Hills than any other site in Borneo. This research will be valuable for developing sustainable forestry and conservation management in the region, and also as a contribution to the educational role of the park. Its easy access from Miri means Lambir Hills is visited by large numbers of people including day trippers, school groups and nature enthusiasts. Many people come to picnic at the beautiful Latek waterfall or hike to the summit of Bukit Lambir to enjoy its spectacular views up the Baram valley to Gunung Mulu. But its use by school groups and special interest parties, including the Malaysian Nature Society, indicate a potentially pivotal role in environmental education.

To preserve the forest at Lambir Hills it is essential that populations of important mutualists, particularly seed dispersers, such as hornbills, gibbons, fruit bats, and flying squirrels, are protected. Not only are these important to the forest but they would also be a valuable asset to the park from a recreational perspective. Unfortunately, these animals are becoming increasingly difficult to see. A recent survey of vertebrates suggests that three species have probably become extinct since 1984. These include the charismatic Helmeted hornbill (*Buceros vigil*). However, with active management the situation is definitely reversible.

Up until about 1995, when hunting in the park really took off, one quite commonly saw primates, flying squirrels, Argus Pheasant (*Argusianus argus*), hornbills including the Rhinoceros hornbill (*Buceros rhinoceros*), Binturong (*Arctictis binturong*) and so on. The more recent survey still recorded 223 bird species and 55 mammals, although a number were seen only rarely (Shanahan and Debski, 2002). If hunting were effectively curtailed within the park the populations of most of these species would recover, and probably quite quickly. Many species are good dispersers and easily capable of re-colonising small parks such as Lambir Hills, given sufficient protection. In fact, in 1998 a large roost of flying foxes appeared near the Latek waterfall having not been seen in the park for several years.

Other forms of illegal encroachment also occur. Logging is frequent along several of the borders and has removed many large trees near the edge of the park, while uncontrolled rattan collecting has so depleted densities that one can now walk a whole day without seeing a mature stem. Just five years ago these were very common within the park. Hacked open trunks of Gahru (*Aquilaria microphylla*) and cut palm stems of Nibong (*Oncosperma*, *Licuala*, and *Calamus*), whose shoots are sold openly along the road and in local markets, indicate these are the latest victims in the assault on Lambir.

Undoubtedly, the National Parks and Wildlife Office has an extremely difficult and unenviable task, and they are to be congratulated for their considerable efforts in developing and implementing the "Master plan for wildlife in Sarawak" (Anonymous, 1996). In addition to vigorous policing, public education and employment opportunities, other recompense will be required if the support of local communities is to be gained (Milner-Gulland et al., 2003). To achieve this there needs to be a much greater level of political and institutional support for national parks in Sarawak and the job of protecting them. With respect to Lambir Hills, the idea of a fence was floated in the past, with an offer of funding. Given the limited resources of National Parks & Wildlife it may be the only effective way of protecting the borders in the short term.

Long-term security of Lambir Hills, and surely a requirement if it is to achieve UNESCO World Heritage status, will also depend on establishing effective buffer zones. The most obvious of these would be to bring the park's borders up to the road along its southern boundary and further extend it westward along the road to the oil palm. This would make it much easier to police. Currently, this

is forest under shifting cultivation. But the rich clay soils are more productive than the sandy soils over most of the park and, hence, would be important for fruit production and for maintaining populations of seed dispersers. Enlarging the park on the other side down to the coast and including the heavily logged concessions to the north should be relatively easy as most of the land is poor and uncultivated. It would add an area that, although now severely degraded, previously supported rich Kerangas forest and would considerably increase the park's potential for recreational use. The beach, which includes cliffs with fossils, could be opened as a second entrance to the park, and paths over the hill to the current headquarters would increase the possibilities for longer hikes. It would also enable the park guards to prevent hunters entering the forest from the north side. Finally, if any remains, the Kerangas forest on the edge of the Baram peat swamp to the east of the park should be included. This was another area of exceptionally rich heath forest with several endemic species. The financial costs of these extensions can easily be justified in terms of protecting Miri's water supply. The rocks of Lambir Hills are porous and provide the main water reservoir for Miri. During the 1998 drought Miri's water ran out for several weeks causing enormous inconvenience and considerable financial loss to the state. Without doubt, better protection of the forest in these areas around Lambir Hills would be a very economic way of securing Miri's water supply in the future.

Other things could also be achieved in collaboration with the research groups working at Lambir Hills. For example, the borders of the road, which are currently an eyesore, could be restored using the research on reforestation conducted at Bakam; judicious planting of fruit trees, particularly hemi-epiphytic figs, could be used to support larger populations of seed dispersers. Also, Lambir Hills badly needs an adequate interpretation centre. This is an obvious area in which the Malaysian Nature Society could make a significant contribution as they have with the Visitor's Centre and Education Programme at Kuala Selangor. Indeed, MNS Miri Branch already runs a weekend nature education course for the local teacher training college each year. Some years ago it produced a short trail guide but much more could be achieved.

**BELOW, LEFT:** The Latek waterfall after recent rain. The waterfall is the most visited feature of the park and a dip in its cool waters is very refreshing after a day's hiking around the trails.

**BELOW, RIGHT:** The hacked-open trunk of Gahru (*Aquilaria microphylla*), a recent victim of the uncontrolled collecting at Lambir Hills National Park.



## A question of choice

Lambir Hills has reached a fork in the road. The default path, if things just continue as they have, will lead, in another five or ten years, to the local extinction of most of the more interesting wildlife and the depletion or extinction of many of Lambir's characteristic plants. The larger trees may survive longer, reminding people of what the forest once was. But without the appropriate mutualists and with ever shrinking tree populations the forest faces genetic decay and the gradual extinction of rarer species. The alternative path, to preserve the diverse forest at Lambir Hills in perpetuity, requires a concerted effort to protect the park. We will need to establish buffer zones and develop its recreational and educational potential. These are things that will require commitment of resources and political will.

Over the past few years a great deal of money has been invested in Miri to develop it into a resort city. As a world heritage site Lambir Hills would add enormously to the city's resources. Just thirty minutes drive from the city people would be able to see Rhinoceros hornbill, Sarawak's state bird, and other animals in the wild. They would be able to hike, take guided tours, visit the park museum and so on. Since Mulu became a world heritage site it has been enormously beneficial to the local economy and there is every reason to suppose Lambir Hills would make a similar contribution. Already it is important as a place to escape the city and enjoy nature for an afternoon. It could be much, much more.

The forest at Lambir Hills is the richest forest in the Old World and possibly on Earth. Its botanical credentials entitle it to UNESCO World Heritage status. We hope the Sarawak authorities rise to the task and we urge the Malaysian Nature Society to take up the mantle ■

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