PNHS Teraja Survey highlights

2010-2011

Final report May 2011

Prepared by Teraja survey participants, compiled and edited by Peter Engbers for the PNHS

The "second" Teraja waterfall, P. Engbers

The PNHS organized in 2010 and 2011 a survey to gather information on the conservation value and ecotourism potential of the Teraja area. The survey area, partly protected and partly proposed as a protected area, has still a lot of undisturbed primary forest, but is under threat by developments. We appraised the area in terms of hiking trails, photographic highlights, flora, fauna, folklore and history. The survey shows that the area has particular value because it has high biodiversity, a unique flora and fauna, and great eco-tourism potential.

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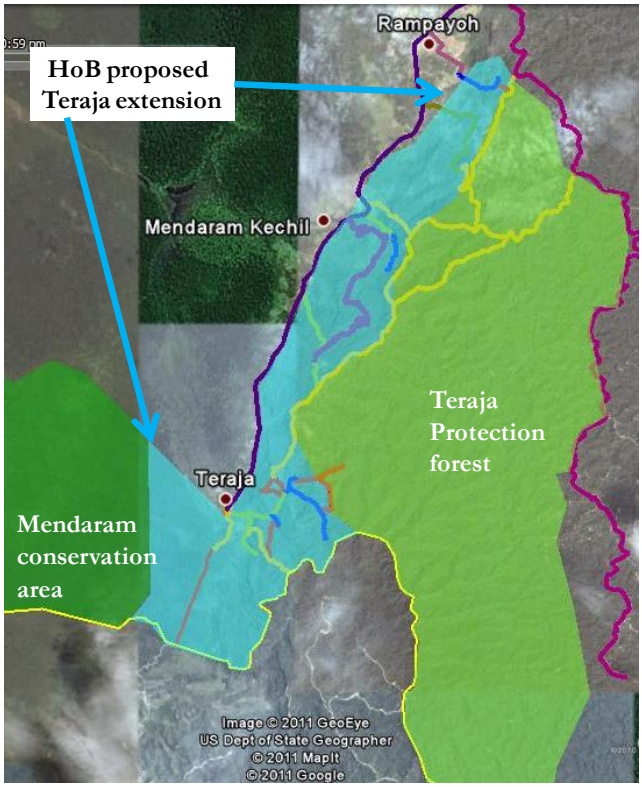
Areal view of the Teraja forest area (Teraja longhouse in the right side of the photo) at end of Labi road in 2007, H. Dols

Introduction

The "Teraja survey" was executed over various weekends in 2010 and 2011 by PNHS members and some invited scientific experts (e.g. UBD students/staff). It was the idea of Jacqueline Henrot, subsequenty worked out by a number of PNHS members. The survey appraises the area in terms of hiking trails, photographic highlights, flora, fauna, and folklore. The purpose is to gather information on the conservation value and ecotourism potential of the area in order to help the authorities concerned in taking the most judicious decision concerning the development, management, and long-term conservation of the Teraja area. The 'Teraja survey area' encompasses the Bukit Teraja Protection Forest and the Proposed Bukit Teraja Protection Forest Extension (a narrow strip from Teraja waterfalls via Bukit Teraja ridge up to Rampayoh).



Most of the survey (and most of the recorded trails) is in the proposed Protected Area extension of Bukit Teraja. This is a relatively small piece of land (ca. 2500 ha) that is of particular value because it has high biodiversity value and great eco-tourism potential. It is a piece of fairly undisturbed forest that is accessible by road and has many hiking opportunities. The area holds various habitats: swamps, ridges, waterfalls, rivers - therefore a diverse flora and fauna. The area is used by local people who still hold the traditional knowledge & legends. It is under threat by developments.

This map shows the explored trekking system. The Bkt Teraja Protection forest reserve and proposed extension area are in between the **Labi road** and **LoggingRoadEast.** There are many waterfalls and hiking treks (**Brown** = unmarked path, **Orange** = more difficult hike or animal trail, **Red**=hard trek, **Blue** = river scramble). Nearly all ridges have a kind of trail (orange) that is or has been used by seismic survey staff, military, poachers, or animals.

Map. Location of trails walked in the survey area (Teraja Protection forest and proposed extension). Note that most trails and waterfalls are within the proposed extension.

Participants & Topics

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Etienne Loubens	fishes
Ulmar Grafe	frogs
Sandra Goutte	frogs
Hanyrol Ahmadsah	frogs
Joseph Koh	spiders
Hans Dols	reptiles, trails
Axel Geisslinger	fish, mammals
Tom Crampin	birds
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Novi Yus	forest use, fish
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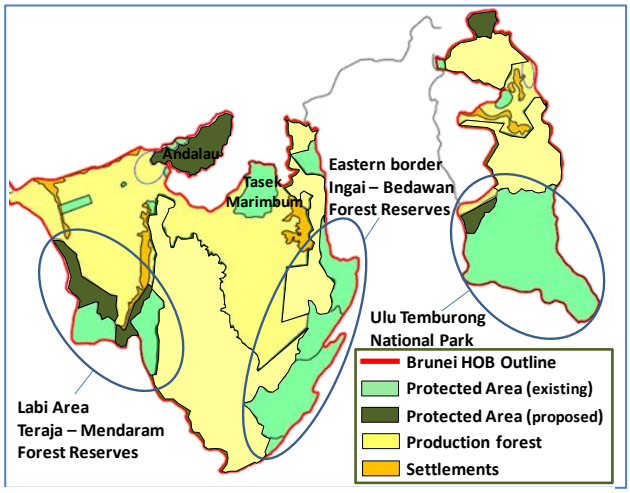
Background

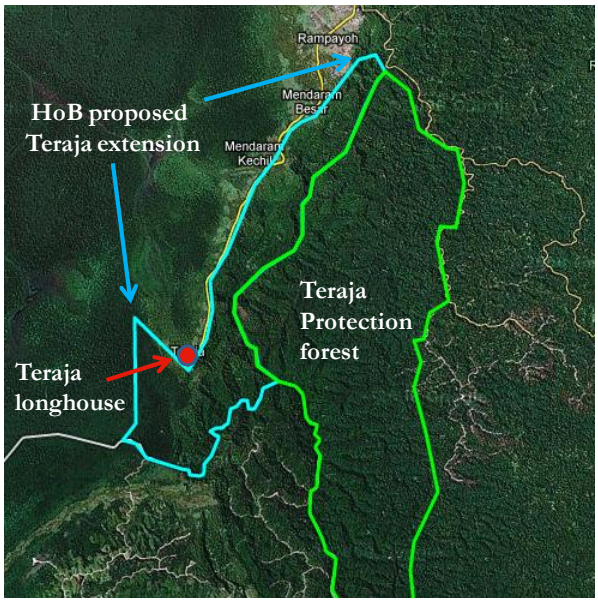
Brunei Darussalam is unique in the region because nearly half of the country is still primary forest. However, the primary forest cover is reducing and only 17% of the country's area is protected. The currently existing Protected Areas are mainly located in three regions; Temburong, the Ingai-Bedawan reserves, and the Labi area (Teraja-Mendaram). The Labi area has two separate Protected Areas; the Bukit Teraja Protection forest and the Ulu Mendaram Conservation Forest. Each has an extension area proposed in framework of the Brunei HoB project. The 'Teraja survey area' is composed of the Bukit Teraja Protection Forest and the Proposed Bukit Teraja Protection Forest Extension (a narrow strip from Teraja waterfalls via Bukit Teraja ridge up to Rampayoh).



Brunei Protected Areas and Production Forests in HoB

Scope and execution of Teraja survey

The proposed Protected Area extension of Bukit Teraja is a relatively small piece of land (ca. 2500 ha) but would be of particular value because it has high biodiversity value and great eco-tourism potential. It is a piece of fairly undisturbed forest that is accessible by road and has many hiking opportunities. The area holds various habitats: swamps, ridges, waterfalls, rivers - therefore a diverse flora and fauna. Several new species and endemics have been described from the area and researchers value the site. The area is used by local people who still hold the traditional knowledge & legends. It is under threat by developments. The proposed Protected Area extension will provide a connection from Bukit Teraja to the Ulu Mendaram Conservation Forest resulting in one large connected virgin rainforest with habitats varying from Peat swamp to Mixed Dipterocarp hill forest. This forest connectivity is important for forest plants and animals.



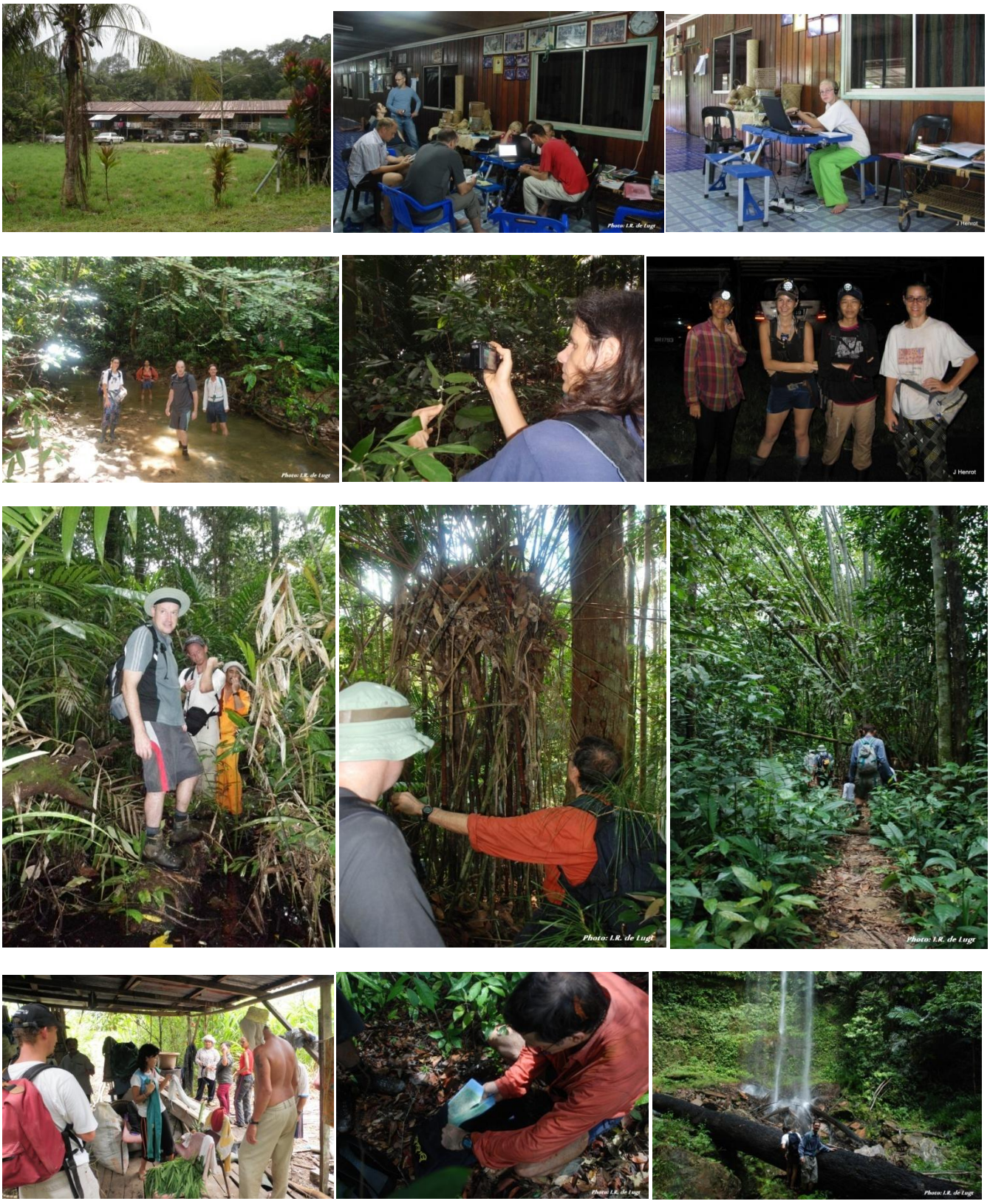
Teraja survey Area (Protection forest and Proposed Extension)

The survey purpose is to gather information on the conservation value and ecotourism potential of the area in order to help the authorities concerned in taking the most judicious decision concerning the development, management, and long-term conservation of the Teraja area.

The survey targets the appraisal of its flora, fauna, folklore, as well as an evaluation of its eco-tourism potential, in specific:

1. Highlight the flora and fauna in the area that are of 'special interest' either because of its rarity or its ecotourism interest. The output is an annotated checklists of biota, highlighting the biodiversity of the site, the species of conservation concern and the common species (likely to be spotted by tourists). Photographs and short description (aspect and habitat) of selected species is added.
2. Create maps of the sites of ecotourism interest and the trail system between the Teraja and the Rampayoh waterfalls.
3. Provide a report to the Heart of Borneo Council.

The survey was executed over various weekends in 2010 by PNHS members and some scientific experts (e.g. UBD students/staff). The Teraja longhouse provided a very friendly base camp and overnight stay. Groups of 3 or 4 went out to explore the rivers and ridges for interesting nature observations and to capture plant / wildlife photographic evidence.



Photos of the activities during the survey, by various PNHS members

Teraja area highlights

Waterfalls and trails. We have found 40 waterfalls and many trekking opportunities in the Teraja area. Within the proposed protection forest extension, the small Sungai Teraja basin just upstream from the Teraja longhouse has at least 11 waterfalls. The paths to the Teraja and Belaluk waterfalls are well trodden but unmarked. Pushing on from these paths through the rivers brings you to many more beautiful waterfalls. *The fourth Sungai Teraja waterfall, P. Engbers*

Frogs. Researchers from UBD recently found 36 species of frogs during a survey. Five frog species (Brown Bullfrog, Least Narrow-mouthed Frog, Peat Swamp Frog, Cricket Frog and Rough Guardian Frog) had never been recorded in Brunei. This brings the total number of frog species in Brunei to 81. *Pothole Narrow-mouthed Frog (left) and Least Narrow-mouthed Frog (right), Hanyrol*

Reptiles. About 10 species of snakes including Mangrove Cat Snake and Bornean Flatnose Pitviper were spotted at streams and on the road. Also seen were several Lizards and Turtles (e.g. the Softshell Turtle and Asian Leaf Turtle). Crocodiles are irregularly seen in the river next to the longhouse by the habitants. *Juvenile Mangrove cat snake, N. Yus*

Mammals. Among the mammals encountered in Teraja are the Gibbon, Red leaf monkey, Banded Palm Civet, Yellow Throated Marten, Longtailed porcupine, Slow Loris, Maroon Langur, and the Wild boar. Several deer species are known from the area. *Banded Palm Civet, S. Goutte*

Plants. The Teraja area shelters 19 plant species that are only known from Brunei (endemic), including 7 that, of the whole world, are only found there ('hyper endemic'). Six new species recently discovered in Teraja are in the process of being described, they will raise further the number of known endemic plants from the Teraja area. *A species of Hoya probably new to science, J. Henrot*

Fishes & shrimps. Fish species were distributed unevenly along the course of the streams, reaching a maximum in shallow forest streams downstream of the waterfalls. Diversity of fish decreased up stream above the waterfalls. Shrimps are abundant above waterfalls and less so below. This might be related to the presence of predatory fish species. *Fresh water shrimp, Hanyrol*

Butterflies. A total of 233 butterfly species have been recorded from the study area. The most significant butterflies on the current list are Rajah Brooke's Birdwing and Miranda Birdwing. These are both protected species according to the CITES treaty. Butterflies are known to be environmentally sensitive organisms, hence their use for conservation of Forest Reserves project. *Fivebar Swordtail, V. Hitchings*

Birds. The Teraja forests are very good areas for seeing forest birds in Brunei. A great variety of forest birds can be encountered with a recorded diversity of well over 150 species, from the common to the more elusive and rare. The forests are not the easiest habitat for bird-watching. However, the Labi ridge allows good views on the forest edge, but also undisturbed and close views on the forest canopy. *Bornean Bristlehead , endemic to Borneo attracts bird watchers from all over the world, F. Hindriks*

Biological highlights

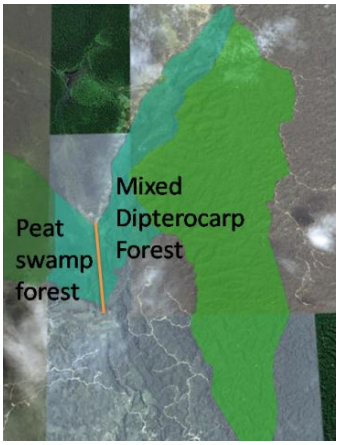
Plants

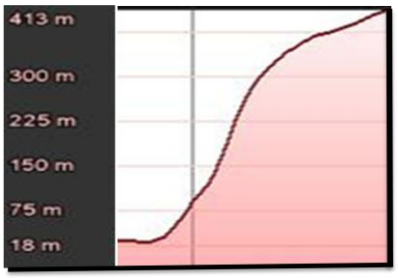
J. Henrot

The Teraja area has been for a long time a favorite for botanical exploration, with many species first described from the area, some not yet found elsewhere in the world: 19 of the plants endemic to Brunei are found in the Teraja area, including 7 with a distribution limited to Teraja. The area remains, however, under-documented, with only 650 plant species collected from the larger Teraja area (table 4, Checklist from 1996).

In addition to the well developed streams and the sandstone layers, what makes Teraja botanically interesting is also what makes it vulnerable: its topography. The PTPFE in particular stretches on a steep slope reaching 415 m of altitude, a topography unique in the Belait district. The implications for the site are 2-fold: a large variety of plant habitats like waterfalls, sandstone cliffs, river banks, and ridges but also a fragile area, prone to landslides if disturbed.

Waterfalls and cliffs have a distinct flora, with a diversity of aroids, gingers, gesneriads and begonias, all groups with a high level of endemic species. With further exploration, species new to science are expected from the area; a 3 day visit by an Aroid specialist last December yielded 4 new species, including 3 endemic to Teraja (a.o., *Homalomena terajaensis)*. Several species encountered in the course of the PNHS survey might be new to science, including a peculiar species of Hoya which is under study.





➔Topography of the PTPFE: because of the steep slope, the site is particularly rich in plant habitats but also prone to dramatic landslides if disturbed.

➔The 'Teraja area' (Teraja Protection Forest and HoB Proposed Extension) is almost entirely covered by 'Mixed Dipterocarp Forest' (MDF), with only 325 ha of the 7500 ha under Peatswamp forest (borders the Mendaram conservation area).

Apocynaceae: A peculiar Hoya. Most probably new to science and endemic to Brunei.

Hanguanaceae Hanguana sp. novo aff Hanguana bogneri Ticch & Sill. Not yet described.

Commelinaceae Amischotolype sphagnorrhiza. Endemic to Brunei

Zingiberaceae ***Boesenbergia armeniaca,*** *described from Rampayoh, regional endemic*

Zingiberaceae ***Tamijia flagellaris.*** *Regional endemic(, not on record yet at the Brunei Herbarium*

Orchidaceae ***Claderia viridiflora*** *Although common, orchids are rarely seen in flower*

Araceae ***Rhaphidophora typha,*** *Regional endemic* ***(****Brunei & Sarawak)*

Triuridaceae Sciaphila sp*. A delicate parasitic plant (no chlorophyll)*

Moraceae ***Ficus hemsleyana*** *Wild figs, important food source for the wildlife. A touch of color.*

Orchidantha holttumii: regional endemic

Tacca bibracteata: regional endemic

Some special plants.

All photos by J. Henrot

Frogs

Hanyrol, S. Goutte, U. Grafe

As part of their Master project, Sandra Goutte from France and Hanyrol from UBD, Brunei conducted 48 frog surveys at six selected streams within the proposed Teraja protection forest extension. The project started from the 1st of April 2010 to the 2nd of January 2011. Also joining the research team were supervisor, Dr Ulmar Grafe, UBD students, PHNS enthusiasts, and others.

They found 36 species of frogs during the survey belonging to 7 families (Table 1). Excitingly, 4 frog species (Brown Bullfrog, Least Narrow-mouthed Frog, Peat Swamp Frog, and Cricket Frog) that have never been recorded in Brunei were spotted during the survey. Two of these species were found just behind the Teraja Longhouse! This brings the total number of frog species in Brunei to 81.

Wallace's Flying Frog

Peat Swamp Frog

Pothole Narrow-mouthed Frog (left) and Least Narrow-mouthed Frog (right)

Jade Tree Frog

Striped Stream Frog

Sarawak Slender Litter Frog

All above Photos by Hanyrol

Black-spotted Rock Frog

Kuhl's Creek Frog

Kuhl's Creek Frog *Photos by J. Henrot*

More wildlife surveys will hopefully be conducted in the future to uncover more of the hidden treasures of the great Teraja area.

(Special thanks to field assistants; Farhan, Helfi and Kalmy)

Reptiles

Hanyrol, H. Dols

Among the reptiles encountered in Teraja were many snakes and several lizards and turtles (table 2). About 10 species of snakes including Mangrove Cat Snakes, and Bornean Flatnose Pitviper were spotted at streams and on the Labi road bordering the Teraja protection forest extension. Also worthwhile to mention are the Malayan Softshell Turtle and the Asian Leaf Turtle. Teraja longhouse inhabitants report crocodiles irregularly in the river next to their longhouse (as recent as in 2010).

Malayan Softshell Turtle, S. Goutte

Malaysian box shell turtle, J. Henrot

Asian Leaf Turtle, I. de Lugt

Juvenile Mangrove cat snake, N. Yus

Red-sided Keelback Snake, Hanyrol

Bornean Flatnose Pit Viper, Hanyrol

Giant Bent-toed Gecko, Hanyrol

A. Geisslinger

Great Angle-headed Lizard, Hanyrol

Snakes were found when fishing in the pond under Beluluk waterfall. We specifically found there the Ular Kendawan = Reedsnake (*Calamaria Lumbricoidea*). A particularly beautiful snake is the Waglers Pit Viper (*Tropidolaemus wagleri*) locally called the Ingkerudu = stupid snake since it sits in the same spot for a long time. The Kongkangmau = Mangrove snake Mangrove snake = Gold ringed cat snake (*Boiga dendrophila*) strikes at the light when approached to closely. It is found quite often in the Teraja river. Locals use yellow foil over a flashlight to hunt the snake. Although, there are many snakes, they are not so often seen. Most are not dangerous, and the chance of being bitten is very small.

Butterflies

V. Hitchings

A total of 233 butterfly species have been recorded from the study area. The most significant butterflies on the current list are *Trogonoptera brookiana brookiana* - Rajah Brooke's Birdwing and *Troides miranda Miranda* - Miranda Birdwing. These are both protected species according to the CITES treaty. Butterflies are known to be environmentally sensitive organisms, hence their use in the Conservation of Bornean Forest Reserves project. The list of species in this study provides a baseline for any future butterfly studies for Labi-Teraja.

Pathysa antiphates itamputi *– Fivebar Swordtail,Longhouse,*

Graphium sarpedon luctatius *Bluebottle &* ***Graphium doson evemonides*** *– Common Jay, Paddy field*

Allotinus horsfieldi nessus *- Horsfield's Darkie*

Cirrochroa emalea ravana-*The Malay Yeoman*

Historical Records provide a wealth of data on the butterflies of the Teraja-Labi area and provide data from more field hours than could otherwise be undertaken in a short space of time. In 1986 R.R. Herd prepared a volume entitled 'A Photographic Reference List to Bruneian Butterflies'. The information was compiled to generate the list of the butterflies presented in the appendix. The list is not exhaustive and without doubt more species are to be found and recorded.

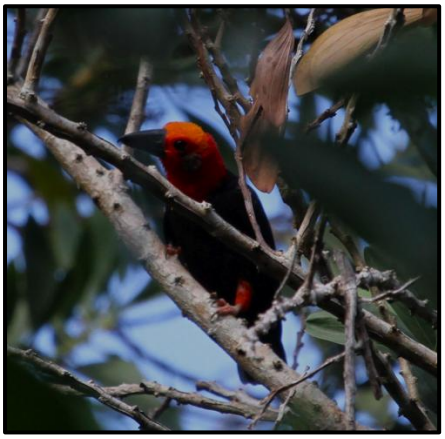
Caterpillars are often fascinating, but be aware, do not touch these hairy beasts. **J. Henrot**

Birds

F. Hindriks

The dipterocarp forests surrounding Labi and Teraja are one of the key areas for seeing forest birds in Brunei, as they still offer a relatively undisturbed habitat for typical lowland birds as well as birds that prefer hill forests. At the same time the area is relatively easily accessible from Bandar and Seria. The primary lowland dipterocarp forest is the richest ecosystem in Borneo and accounts for the greatest biodiversity. The Brunei forests around Teraja are no exception, and a great variety of forest birds can be encountered.

As only limited data was gathered in the Teraja area within a 1 year period no complete bird list of the area can be provided. For a more extensive record far more dedicated research should be conducted over a longer period of time. Nevertheless, recordings based on frequent visits to the Labi road area and records of former PNHS members clearly illustrate the diversity with well over 150 species recorded, from the common to the more elusive and rare.



Bornean Bristlehead , an endemic species to Borneo, that attracts bird watchers from all over the world

Asian Paradise Flycatcher, more common, but often elusive

Red-throated barbet, an uncommon barbet species that is still often heard in the forests surrounding Labi and Teraja.

Highlights include sightings of the Bornean Bristlehead, an endemic species to Borneo, that attracts bird watchers from all over the world to well known birding areas in Sabah, like Danum valley and Sepilok. This rare bird is still regularly seen in the forest along Labi road. New species are still added to the PNHS bird list on almost every visit to the area.

The forests are not the easiest habitat for bird-watching as the view is often obstructed and most birds are restless and allow the bird-watcher only a brief view. For many birdwatchers the forest edge is therefore a preferred location, as it allows a wider view to spot species. The Labi ridge, and likely the new Forestry road to Bukit Teraja, are also unique in this respect as there are numerous locations along this road that not only allow good views on the forest edge, but also undisturbed and close views on the forest canopy.

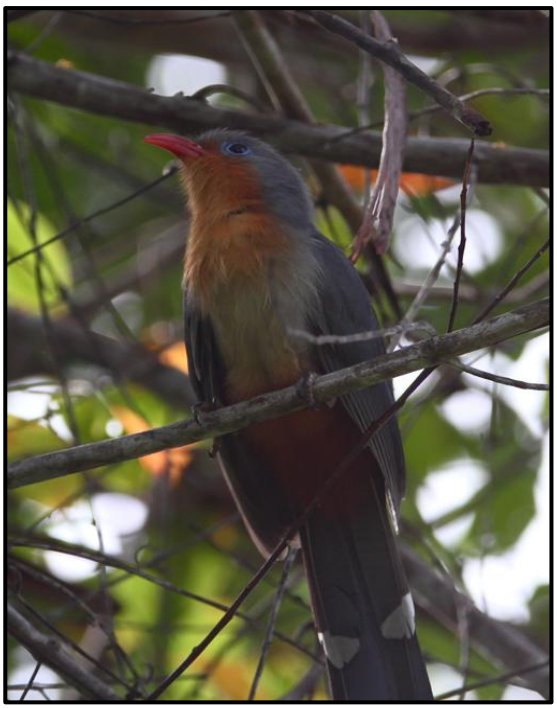
One concern is for bird-watching is the increased activity and development activities along the road. For now, Labi and Teraja remain still excellent areas for bird-watching, as long as one is prepared to have an early rise.

Jeremy Moore is greatly acknowledged and his bird documentation is used and quoted throughout this section, see link to his extensive Brunei birdwatching document below.

www.bsp.com.bn/PanagaClub/pnhs/Themes_files/Birds_files/Birdwatching%20J[1].Moore%202009.downl.pdf

Labi Ridge

This is one of the best bird-watching sites in Brunei. The view from the ridge is stunning and gibbons are still heard on every early morning visit. The access road to the ridge has been made much more accessible recently. See here a picture from a red-billed malkoha which, according to Myers Birds of Borneo, is the rarest of the 5 bornean malkoha species. This bird flew almost right up to me, and unlike most malkoha's allowed me a good view instead of quickly hiding away in the dense foliage.



Red-billed malkoha

Little Spiderhunter

All bird photos taken in Labi-Teraja area by F. Hindriks

Jeremy Moore provides the following description of the Labi ridge area:

"About 2 1/2 km before Labi village, there is a small red temple on the corner of a junction with a sandy track. This is the entrance to the Labi Ridge walk which is one of the best known access routes to the forest in the Labi area, although a solid fourwheel drive vehicle is essential. The track first crosses a small clearing (exit at the far righthand side) and then climbs very steeply for just over a km where there is a smaller track on the lefthand side. This is the best birdwatching route and can be driven with care unless the route is affected by rain. An alternative is to walk this route, parking directly opposite the entrance or about 200m further up the main route in a clearing at the top of the hill. This area can be very busy with logging trucks and in 2009 also with vehicles for the seismic survey so care is needed when driving and walking as these large vehicles cannot always stop easily on loose slopes. The side track is drivable for about 3km and a walking path continues further. Birdwatching is good at almost any point along the path and generally birds seen are similar to the 'seismic track' area although slightly easier to see due to the higher elevation of the path. Specialties seen here include Streaked Bulbul, Scarlet-rumped Trogon, Darkthroated Oriole, Brown Fulvetta, Verditer Flycatcher, Mountain Leaf Warbler, Asian Paradise Flycatcher and Yellow-breasted Flowerpecker. Rhinoceros and Bushycrested Hornbills are fairly common here too while Wreathed, White-crowned and Helmeted (only heard) have been recorded once each. Birds seem to be most active here in May and June when mixed flocks of feeding birds can be so large and active that it is impossible for one observer to look at everything."

Fishes and shrimps

N. Yus, E. Loubens, A. Geisslinger, N. Hoggmascall

Fish species were distributed unevenly along the course of the streams, reaching a maximum in shallow forest streams downstream of the waterfalls. Diversity of fish decreased up stream above the waterfalls. Shrimps are abundant above waterfalls and less so below. This might be related to the presence of predatory fish species. It is likely that we did not achieve a representative sampling of fish species, due to limited duration of fishing and sampling (fishing) techniques. More surveys are needed to support the result of the first quicklook survey.

Unknown species, N. Hogg

Lophocheilus lineatus, N. Hogg

unknown, Hanyrol

Excitingly, the 'Brunei Beauty', scientific name Betta Macrostoma was found. The fish has so far only been found in the Teraja and Marudi area. This extremely restricted area of distribution underlines the importance of protecting the Teraja forests. The rare 'Brunei Beauty' has has been classified as threatened in the IUCN listing.

Half Beak, A. Geislinger

Fresh water shrimp, Hanyrol

The presence of shrimp in Beludok waterfall is quite high as opposite to fish that were nearly absent. Upstream from the Teraja waterfall has quite high shrimp population while fish population was extremily low and only unique fishes are found here, such as Forest Snakehead fishes. Forest snakehead fish is found in young group of more than 20 fishes, at upstream area but not found in downstream river. They adapt very well to strong currents. As snakehead can have eggs in big numbers they might be a source of food for insect and shrimps in this area.

The difficult access to the forest area and small size of most fish make it unattractive as an economic resourse of food fish. However the river near Teraja Longhouse is actively netted by villagers. Potentially there would be a source of fish for the freshwater aquarium trade.

There has not been much research on the freshwater fish in Brunei, and forest streams even less studied than brackish water and coastal resources.

Several collected fishes, Novi Yus

Mammals

A. Geisslinger, H. Dols, P. Engbers

Mammals are more difficult to spot than most other animals. Nevertheless quite a few species could be observed during the Teraja Survey work, particularly at night: Red leaf monkey, Banded Palm Civet, Yellow Throated Marten, Longtailed porcupine, Slow Loris, Maroon Langur, Wild boar, Plantain squirrel. The Gibbon calls were heard but no individuals spotted during the survey. Making photos is very difficult as they are often far away and flee at any noise. The best way to capture a good photo would be by installing camera traps.

Banded Palm Civet, S. Goutte

Bornean Bearded Pig (Wild boar) on Labi road, H. Dols

Many animal traps are observed along the animal trails, particularly on the ridges. Hunting and poaching is actively going on. As recent as Dec 2010, the Brunei Times reports of a Clouded Leopard skin hung out to dry in one of the Belait Kampongs. This nocturnal cat is believed to be Borneo's largest cat, and is hunted for its cloud-patterned skin as well as its meat and bones. It is vulnerable to extinction, and is one of 34 species protected by Brunei law (protected animals include 2 mammals known from Teraja). Another recent sighting by a local man reported by Brunei Times is of a Clouded Leopard during daylight in a populated neighbourhood in Labi. It shows that this cat is disturbed and faces habitat loss.

Animal trap, I. de Lugt

An interview with Pak Jamit Ketua Rp Teraja and His son Kemarau anak Jamit of the Teraya longhouse regarding what animals they do observe in the forests produced an impressive list of mammals (including local names):

- Longtailed porcupine (*Trichys fasciculate*) = Ankis = like Landak. Short haired looks like a very large rat.
- Common Porcupine (*Hystrix brachyura*) = Landak Dudul. This is the one we spotted when frogging.
- Moonrat (*Echinosorex gymnurus)* = Haji Bulan. Like white haji cap. All white, very smelly.
- Yellow-throated Marten *(Martes flavigula)* = Menaleh
- Banded Linsang (*Prionodon-linsang)* = Pangkong Alang = Tupai like a Zebra
- Sunbear *(Helarctos malayanus)* = Beruang. Sometimes caught locally. 4 years ago at Sg Beluluk one reputedly as tall as a man was caught killed and eaten. Regularly marks are found on fruit trees close to the longhouse.
- Clouded Leopard *(Neofelis diardi)* = Benkuli = Harimau Bulan (protected under Brunei's Wildlife Protection Act).
- Short tailed Mongoose *(Herpestes brachyurus)* = Dumbang. Found in Rampayoh.
- Banded Palm Civet *(Hemigalus derbyanus)* = Bankang along = Musang. Small Civet cat often seen near Rp Teraja.
- Common Palm Civet *(Paradoxurus hermaphrodites)* = Musang malang. Many around the longhouse eating fruit.
- Sambar Deer *(Servus Unicolor)* = Rusa or Payau. *Status unknown will have to recheck if has been sighted there.*
- Common Barking deer *(Muntiacus muntjak)* = Kijang = Red Muntjac. Still sighted frequently.
- Greater mouse deer *(Tragulus napu)* = Pelanduk Lapak. Nicer to eat than Pelanduk simpur. Often seen in rain.
- Smaller (Lesser mouse deer) *(Tragulus javanicus)* = Pelanduk Simpur. Often caught close by the longhouse.
- Oriental small clawed Otter *(Aonyx cinerea) or* smooth Otter *(Lutra perspicillata)*= Ringin. Often seen eating fish.
- Slow Loris *(Nycticebus coucang)* = Inkat. Often seen (protected under Brunei's Wildlife Protection Act).
- Bearcat *(Arctictis binturong)* = Anturan = Binturong. *Unclear if these have been spotted near the longhouse or not.*
- Bornean Bearded Pig or Wild boar (*Sus barbatus*)
- Longtailed Macque (*Macaca facicularis*), Red leaf monkey (*Presbytis rubicunda*), Silvered Langur (*Presbytis cristata)*
- Gibbon (*Hylobates muelleri*)

Spiders

J K H Koh

Even without a more definite tabulation of spiders found in the Teraja-Rampayoh area, it is already obvious that the area is high in species richness, conservatively estimated at a minimum of 40 species falling under at least 11 families. Among them are numerous spiders recorded for the first time in Brunei Darussalam.

Spiders recorded for the first time in Brunei Darussalam include the strikingly coloured *Acusilas malaccensis* Murphy & Murphy 1983 which hides inside a rolled leaf shelter suspended in the hub of a sparsely spaced and incomplete orb web amongst low vegetation in moist areas in the forest. The discovery of the spiny *Phoroncidia lygeana* (Walckenaer 1841) along the trail towards the Wasai Rampayoh is another new record in Brunei. An active hunter that is noted for the first time in Brunei is the brown jungle lynx spider *Hamataliwa incompta* Thorell 1875. There are many more species that are probably new to science. There is also a possibly undescribed spitting spider closely related to *Scytodes pallida* Doleschall 1859. Among the more spectacular species that may not have been described previously is a large orange jungle huntsman spider of the highly diverse genus of *Heteropoda*, seen below here consuming a leech at night.

All above spider photos by J. KH Koh

New species of Heteropoda.

Female of Heteropoda species

Heteropoda boei, male, uncommon

Above spider photos by Hanyroll

Insects

J. Maskall

No systematic survey of the insects and other arthropods of Teraja has yet been undertaken but chance sightings produced photographs representing a range of families. Butterflies (see separate section) dance around the longhouse and padi fields, a trilobite beetle may be sitting on a log across your path and a firefly signals for a mate after nightfall. A late evening walk will also yield a variety of phasmids and centipedes, emerged from the leaf litter for a night's browsing or hunting. Dragonflies are abundant along the old Marudi road and around the padi fields while water boatmen and other aquatic arthropods may be seen in the many streams. Termite mounds and tubes advertise the presence of these essential insects. Other insects secrete themselves in crevices or under bark, and have to be sought out. The mosquitoes will of course always welcome you, so take some repellent. Interestingly enough, mosquitoes are quite limited through the Mixed Dipterocarp Forest (most of Teraja) but are abundant and fierce in the Peat swamp part of Teraja.

Selected insect photos. Left under is Lampyridae sp., a larval form of a firefly or glow worm also known as a lightning bug - because of the way some adults attract a mate (producing flashes of light from luminous organs in a pattern specific to their species). As this individual was actively producing light from the pale yellow patch near the end of the tail, it may be that it belongs to a species in which the female does not change from the larval form. They are in fact beetles, and adult males are more typically beetle-shaped. All photos by J. Henrot except the top left by Hanyrol.

Bug. J. Henrot

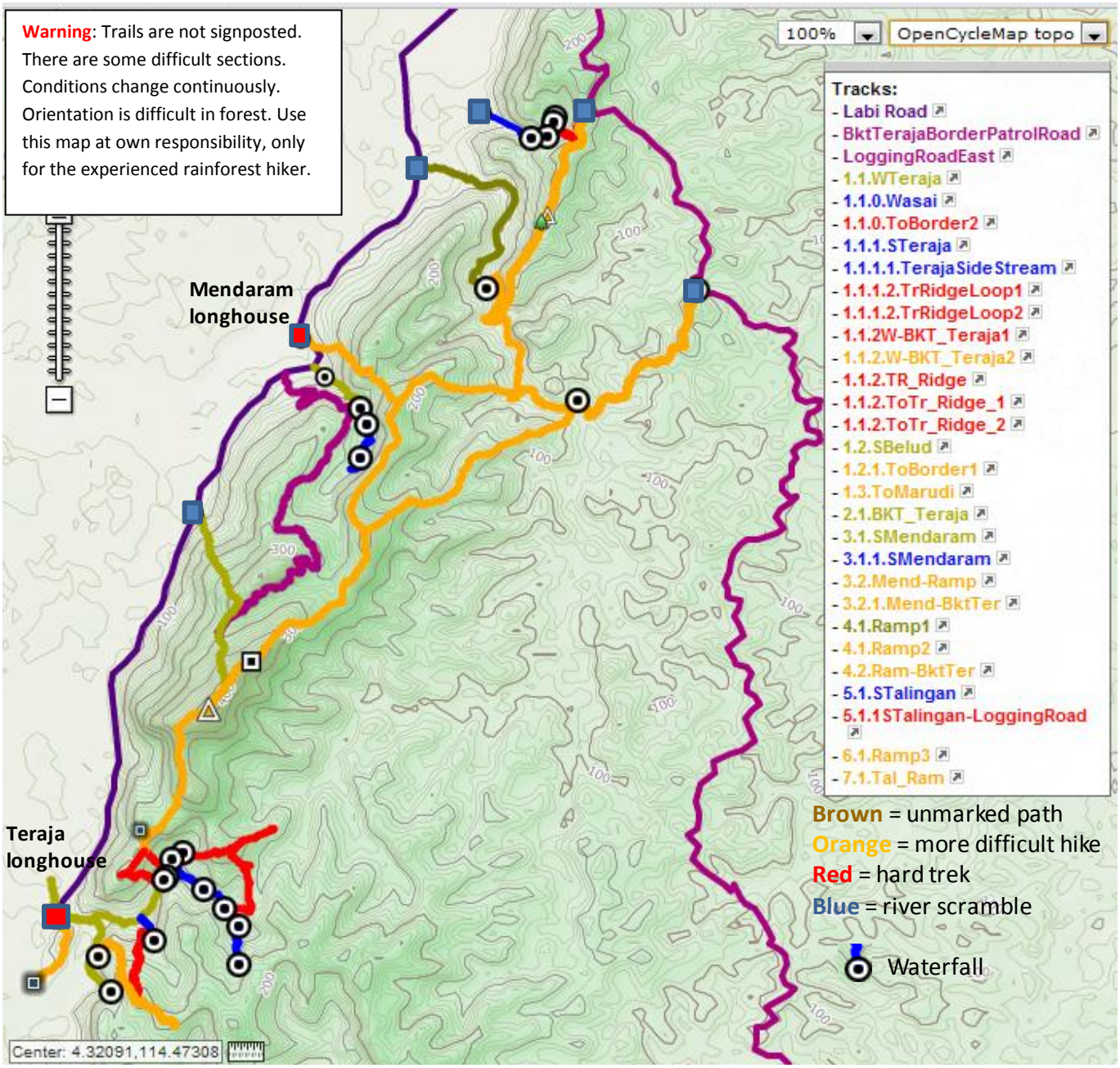
Scolopendrid centipede sp. The bite can be very painful. Hanyrol

Trail system, eco tourism, and natural highlights

Trail system

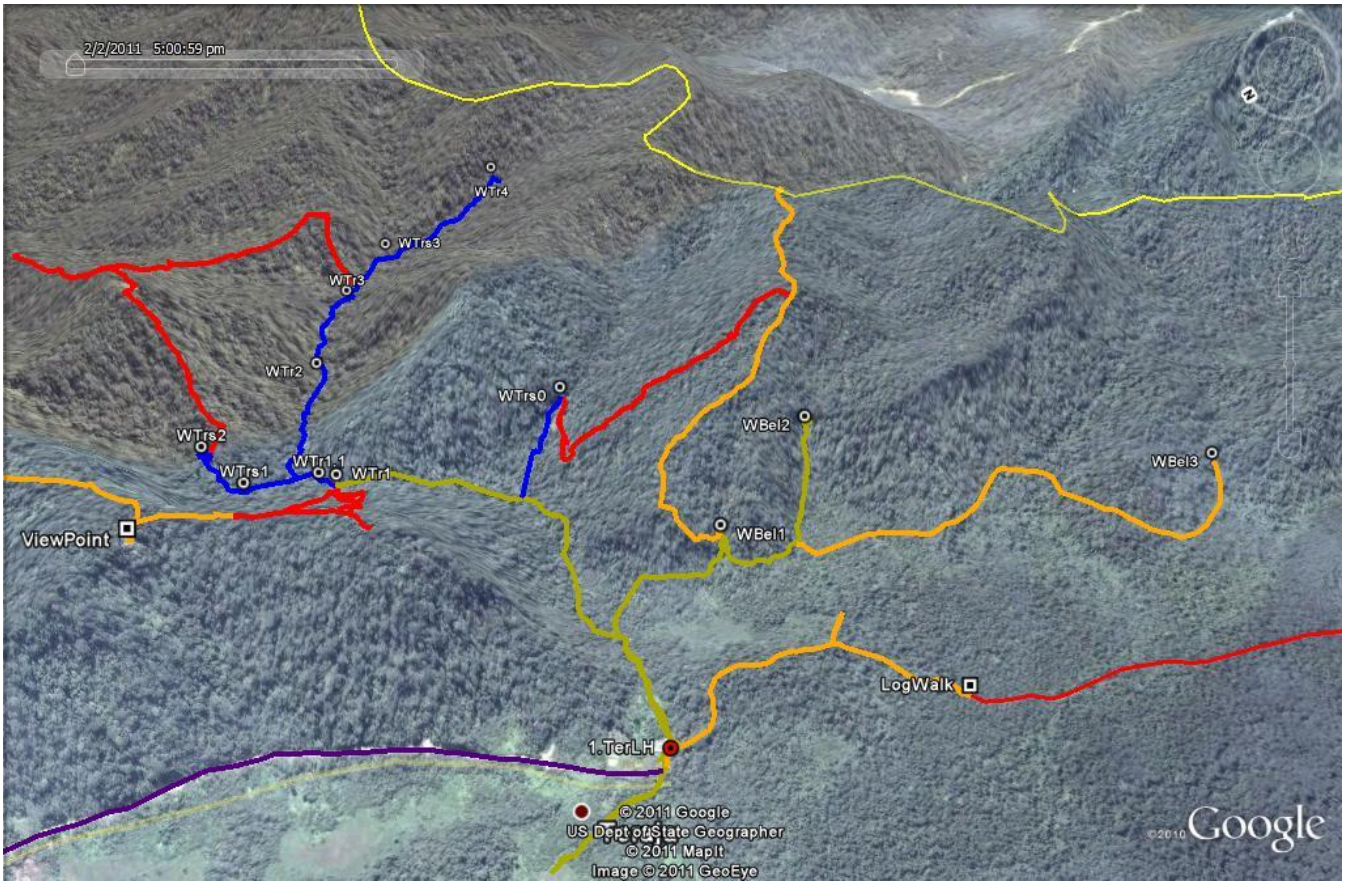
P. Engbers, H. Dols

The whole Teraja area, but particularly the proposed Protected Area extension of Bukit Teraja has many hiking opportunities. It has great eco-tourism potential. It is a piece of fairly undisturbed forest that is accessible by road. The area holds various habitats: swamps, ridges, waterfalls, rivers - therefore a diverse flora and fauna.



Teraja Trail Map, to open click https://sites.google.com/site/peterengbersbrunei/important-documents/TerajaTracks.kmz

This above map shows the explored trekking system. The Bkt Teraja Protection forest reserve and proposed extension area are in between the **Labi road** and **LoggingRoadEast.** There are many waterfalls and hiking treks (**Brown** = unmarked path, **Orange** = more difficult hike or animal trail, **Red**=hard trek, **Blue** = river scramble). Nearly all ridges have a kind of trail (orange) that is or has been used by seismic survey staff, military, border patrol, poachers, or animals.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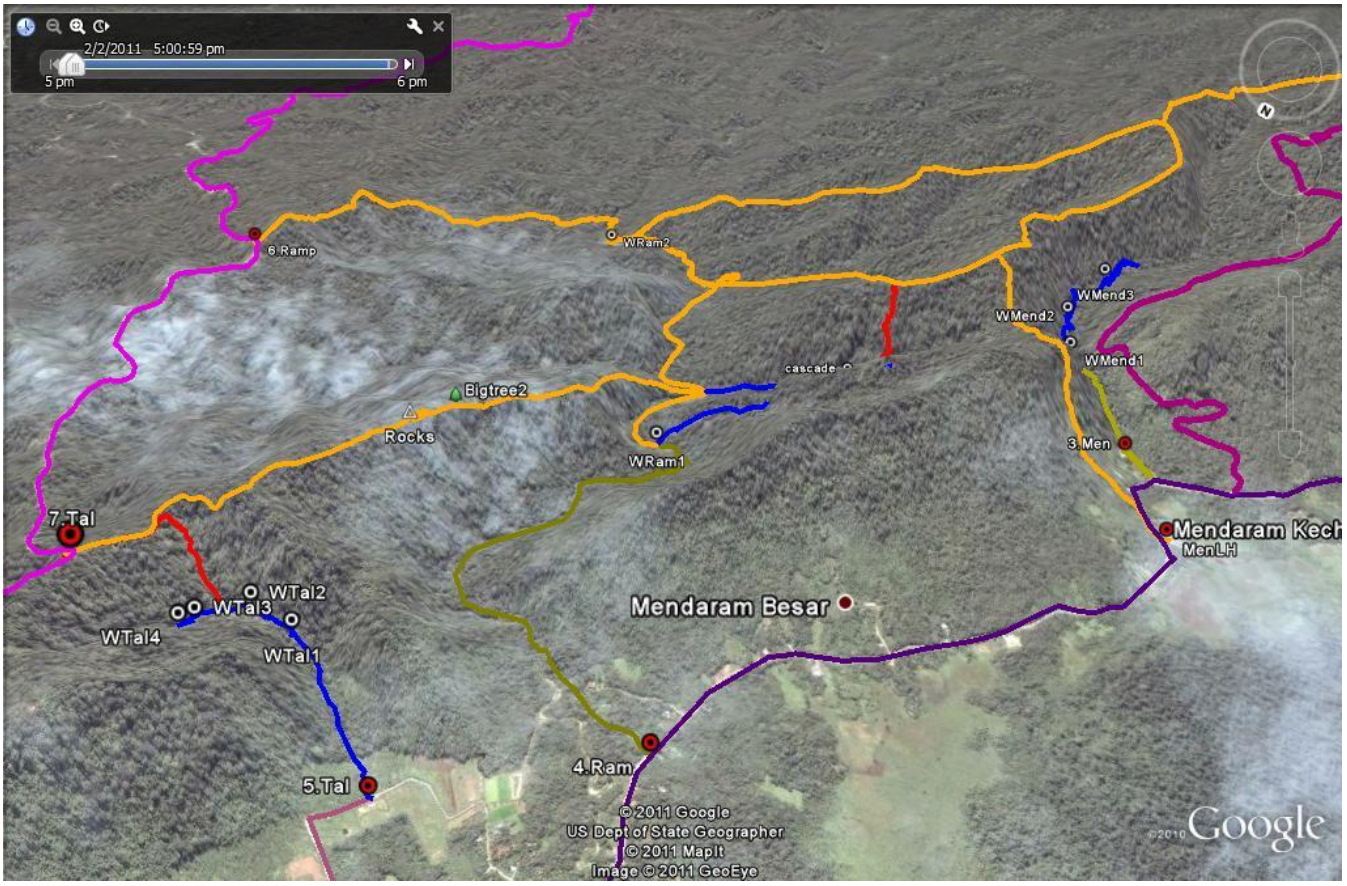
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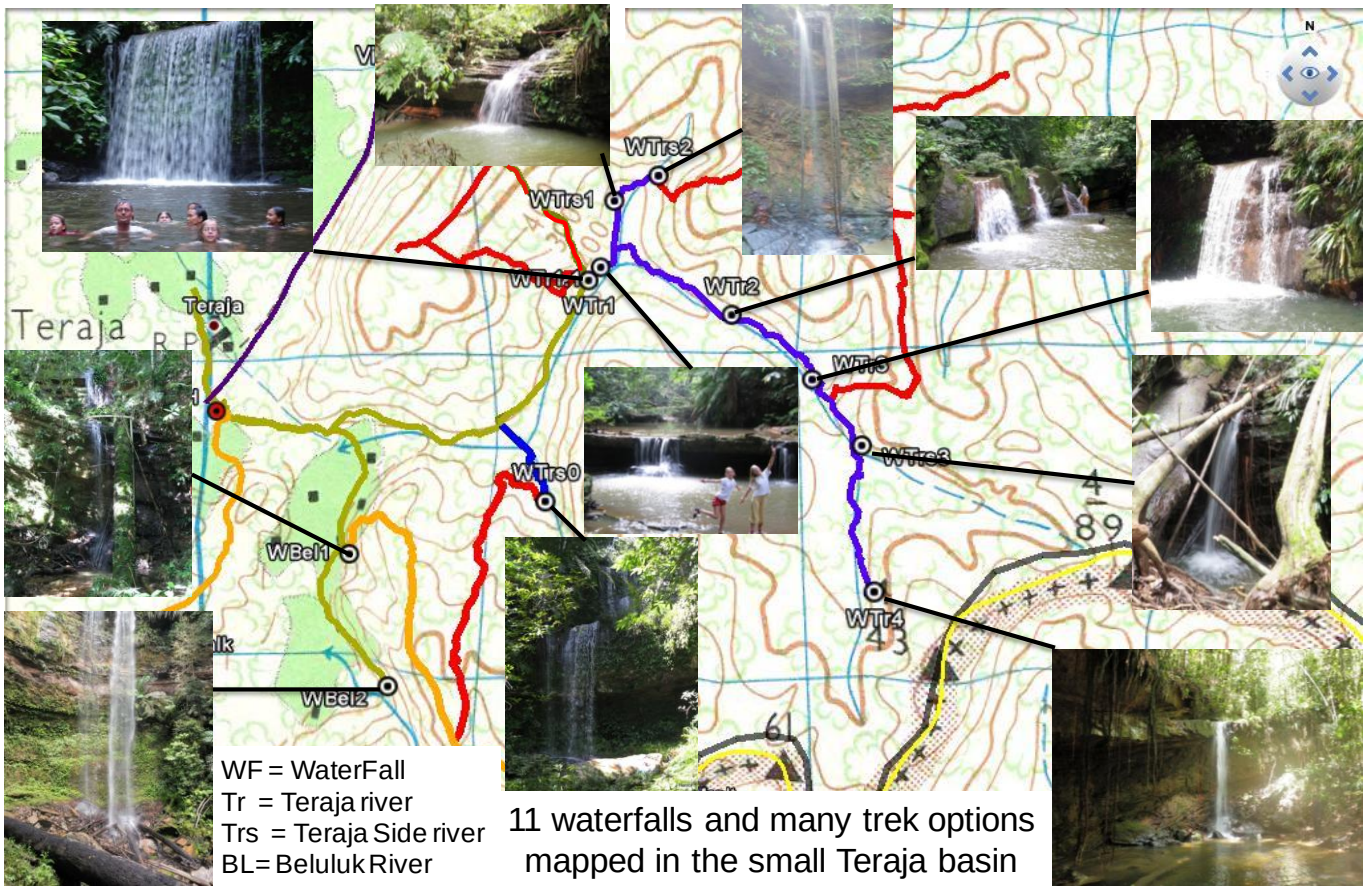
Image © 2011 GeoEye
Google

Waterfalls

P. Engbers

Sofar, we found 40 waterfalls in the Teraja area. 39 of these are in the proposed conservation forest. The small Sungai Teraja basin just upstream from the Teraja longhouse is of particular interest. We have explored the area extensively and found it particularly diverse, with at least 11 waterfalls (Waypoints with W=Wasai or Waterfall) and many trekking opportunities. The paths to the Teraja and Belaluk waterfalls are well trodden but unmarked. Pushing on from these paths through the rivers brings you to many more beautiful waterfalls. These river scrambles, climbing over rocks and swimming the many pools are great fun for the adventurous family. Most ridges have a kind of hiking or animal trail providing connection towards Bkt Teraja and other areas.



Sungai Teraja basin with many waterfalls and hiking treks (path, hike, hard trek, river scramble), mapping and compilation by P. Engbers

Enjoying a rest and a swim at the Rampayoh Waterfalls, a 2.5 hrs forest walk from the Labi road. *H. Dols*

See appendix 1 for a map and photos composition of all 40 waterfalls.

Ridges and Viewpoints

P. Engbers

The Teraja area is dominated by the Teraja ridge reaching to a height of 415 m at Bukit Teraja. Various viewpoints provide great views from the main Teraja ridges to the East or West. To the West, one can see over the Mendaram peat swamp forest up to the Lambir hills at clear sky. Towards the East, we see the whole Belait – Tutong basin up to the Limbang border. Towards the Southeast, the high Mulu Mountains are very impressive.

West- East profile through Teraja Forests

View from Teraja ridge to the West over Mendaram Peat swamps, H. Dols

View from Teraja ridge Eastwards to Mulu

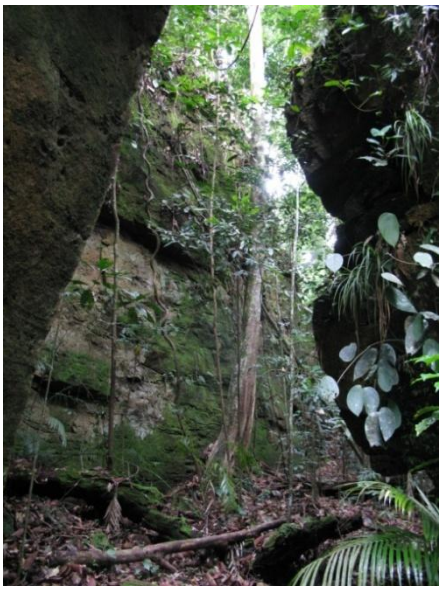
Sunset over Labi toward Bkt Teraja *D.de Vries*

View East wards over the Teraja Protection forest in the Rampayoh basin taken from Teraja ridge viewpoints P. Engbers

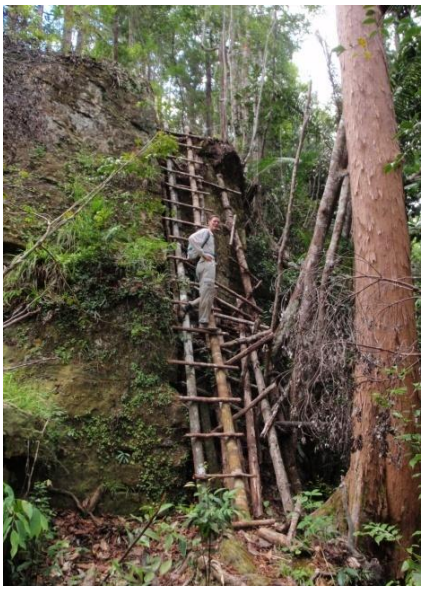
Sandstone Rocks and cliffs

P. Engbers

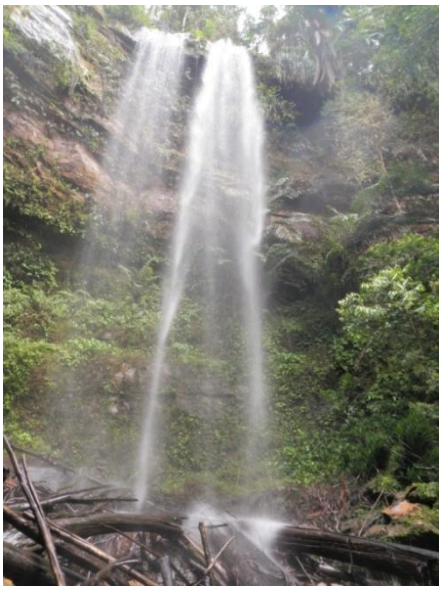
Many sandstone rocks can be found in the Teraja area. They are on ridges as cliffs or labyrinths and in the valleys where the hard sandstone layers either steer the river bends or cause the many waterfalls.



Rock labyrinth on ridge, P.Engbers

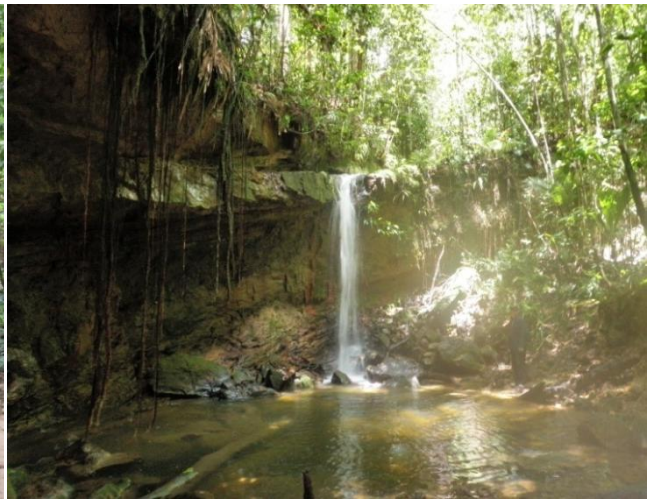


Rock cliff with ladder on ridge, ?

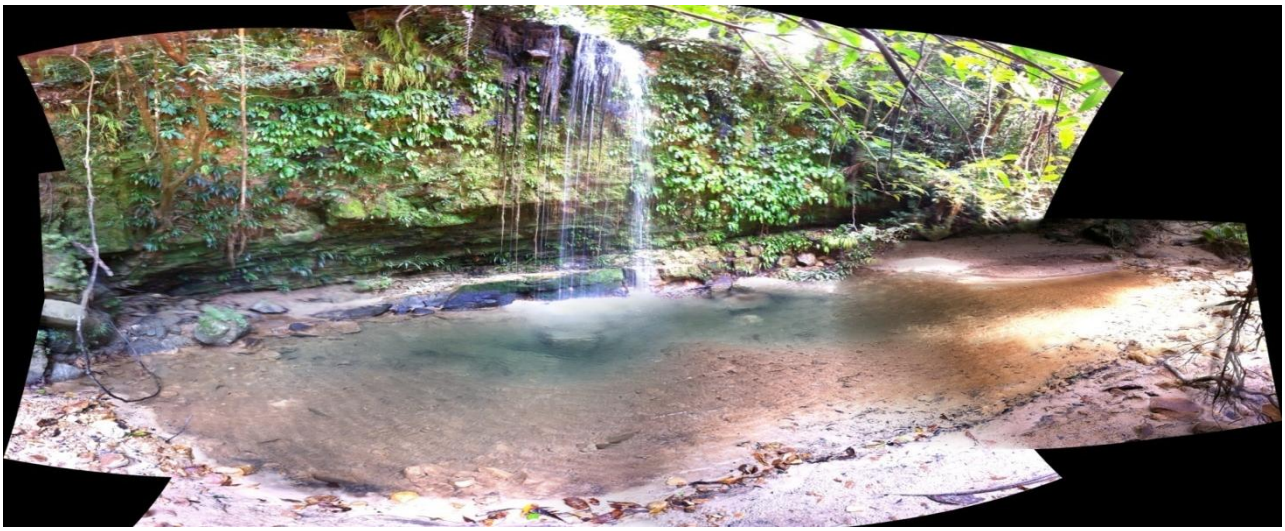


Rock layers causing waterfalls, P.Engbers

Rocks steering the river bends



Overhanging rocks with bats and waterfall. P.Engbers



Vegetated cliffs on the first Rampayoh waterfall. P.Engbers

Eco-tourism activities

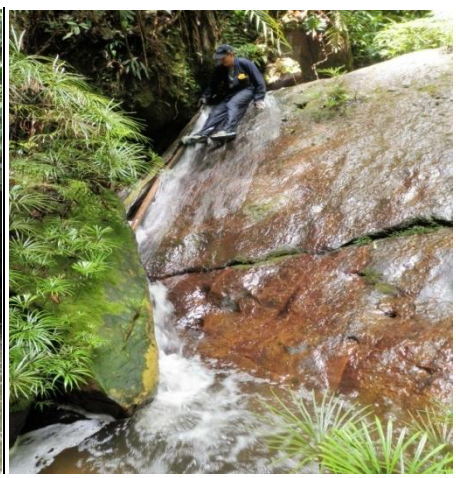
P. Engbers, J. Henrot

Many activities are possible in the Teraja area. They vary from following rivers- by foot, inflatable, or inner-tubes, scrambling the rocks or trees like in canyoning, as well swimming the pools and jumping, sliding, or abseiling the rock faces. Camping or bivaccing can be done in many places. Various multi-day hikes are possible setting up your own camp for the night. It is also possible to design and string together various multi-day eco-tourism activities in the forest and combine them with other activities in the Labi area (rice paddy visits, cycling, cultural visits, etc).

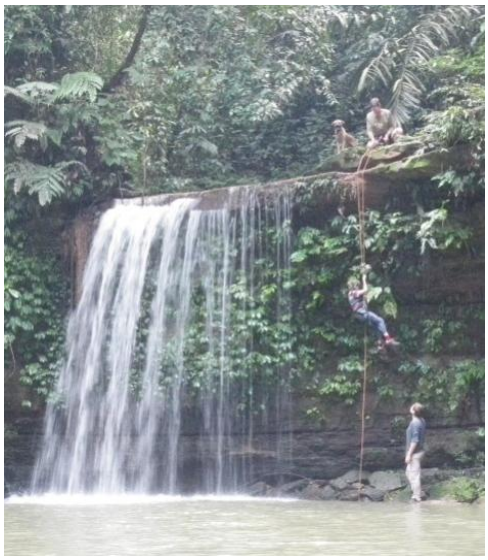

Floating down river with inner tubes and in inflatable boats. *J. Henrot*


Following the rivers, climbing the rocks and trees is not always easy, but big fun for adventurous family.
P.Engbers





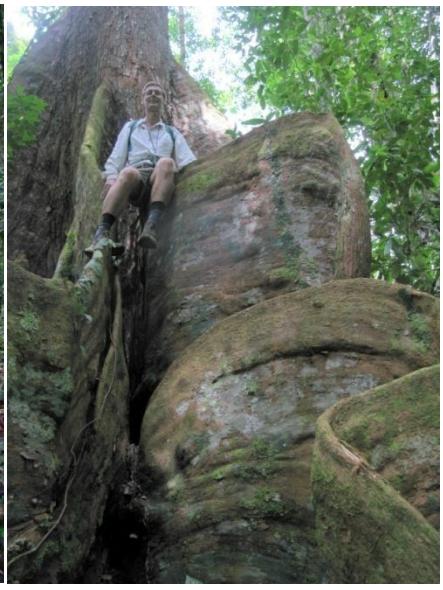
Going down the rivers, jumping or sliding the rocks needs some safety attention, but is fun. *J. Henrot*



Going down the rivers, abseiling the waterfalls is challenging and fun for the kids. *J. Henrot*


Setting up camp for the night. Hammocks are light, comfortable, and well protected with rain flysheet. *J. Henrot*





Trekking through the rainforest, enjoying impressive trees and varying undergrowth. *J. Henrot*

Labi-Teraja Longhouses and its traditions

P. Engbers, H. Dols (adapted from "Brunei Darussalam; a guide" by BSP, 2000)

Labi is a rural settlement with houses scattered on either side of the road. It is a centre for fruit production and other agriculture. Lime, orange, rambutan, jackfruit, cempedak, durian, and other tropical fruits are all grown in the area.

Along the road from Labi to Teraja are four Iban longhouses, the principal ones being Rumah Panjang Mendaram Besar (Rumah Panjang means longhouse) and Rumah Panjang Teraja. Longhouses are not permanent. When they start falling apart, the inhabitants simply build another a short distance away choosing a new site because they have to live in the old longhouse until the new one is complete. Each family member plays a part in the construction and each family is responsible for the building of its own 'door'. Longhouses in Labi are no longer built with palm leaves and the last traditional one in the area disappeared in the mid-1980s. Now longhouses are made from wooden planks with corrugated iron roofs. Modern staircases have replaced the traditional notched log that used to be common. Built to accommodate many families, the longhouse is divided into two main areas - a series of family rooms and a large open verandah which looks like a public thoroughfare but in fact is not. The public walkway is a metre wide path along the front of the building, of which lead all the 'family-room doors'.

Teraja longhouse P. Engbers

Traditional craftwork, J. Henrot

Rice paddy work, P. Engbers

Rumah Panjang Mendaram Besar has 12 doors and is home to some 100 people. It still has a wooden roof and the floor area comprises planks and split nibong palm.

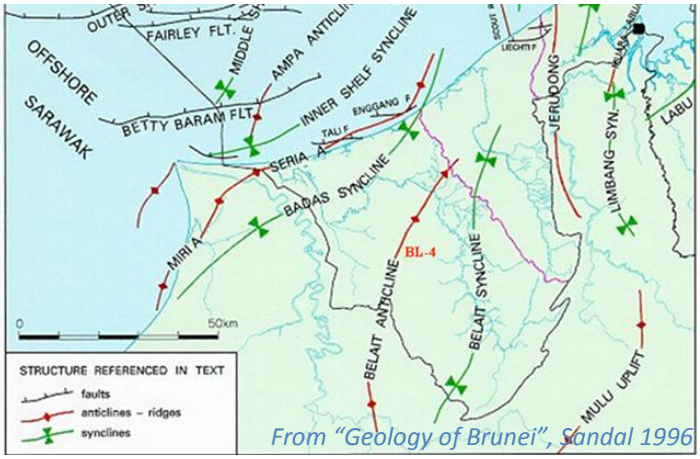
The six-door Rumah Panjang Teraja at the end of the Labi road was constructed in 1987 and is now home for 30 people. It is an interesting blend of old traditions and modern influences. If you are lucky to be granted a look inside you will find the place equipped with all thinkable modern facilities. It is quiet during the week with most men away working in Seria and Kuala Belait. It has a full complement only for important celebrations such as Gawai, the rice harvest festival, at the beginning of June when celebrations go on for a week and visitors are welcome. Children go to the local primary school but when they reach lower secondary level they have to go to school in Kuala Belait and live in hostels. The longhouse has its own generator and in 1991 completed a project to draw water from the first Belulok waterfall. The residents grow their own fruit and vegetables including pineapples, pumpkins, beans, durian, mangosteens and bananas and rear pigs and chickens. They also plant padi rice.

Social time on the veranda, P. Engbers

Geomorphology and Hydrocarbon Exploration history

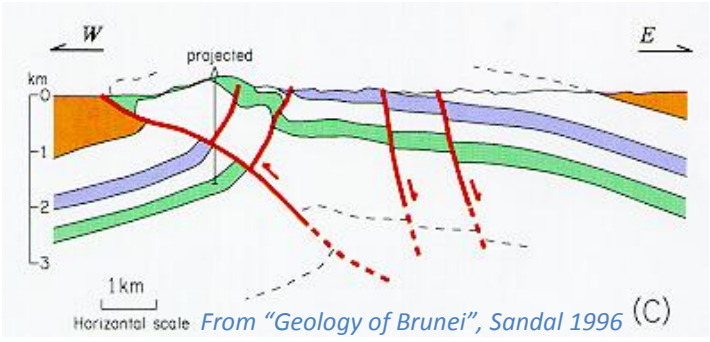
N. Hoggmascall, H. Dols

Geomorphology



From "Geology of Brunei", Sandal 1996

"When approached from the west, the Labi ridge rises abruptly from the absolute flatness of the Belait peatswamps. There is no significant range of Hills between Labi and Lambir National Park xkm away to the west in Sarawak and the views looking to the west from the logging track at Bukit Talingan are breathtaking. The eastern side of the ridge, dissected by steep gullies, dips more gently towards the floodplain and swamps of the Belait - Tutong drainage basin. From the ridge of the hill range, a 360 degree panorama is possible, encompassing all significant geomorphological features in Brunei and beyond, including Gunung Mulu, perhaps the most distinctive mountain within view.



From "Geology of Brunei", Sandal 1996

The Labi Hills have a marked asymmetry in cross section with an escarpment slope forming the steep western side and the eastern slopes representing a deeply eroded dip slope. The steepness of the western slope has a recent geological origin, being formed as the result of reverse fault movement along a pre-existing fault zone. The mountain building episode that affected all current hill ranges in Brunei can be demonstrated to have occurred up until very recently in geological time, perhaps less than 1 million years B.P. As a result of continued pulses of mountain building over the past 10 million years or so, the Labi hills have remained a young range of hills, with uplift keeping up with natural erosive processes.

The numerous steep gullies that dissect the range reflect the nature of the rock sequence that forms them. Along many parts of the logging trails outcrops of rock reveal sandstone and sandstone-claystone sequences of sedimentary rocks. In detail, depositional features indicate that these rocks were laid down in shallow water conditions, similar to those seen in the present Brunei bay.

In many of the narrow valleys that dissect the hills the natural processes of erosion can be seen in action. The main two processes are water erosion / chemical dissolution and rockfall / landslide. The first process is a continual one difficult to detect on the human scale. However rockfalls are instantaneous events and have a significant visual impact on the forest, causing tree falls, blocking jungle tracks and occasionally damming rivers. The breaks in the forest canopy are very quickly occupied by the rapid growth of tree saplings and such rockfalls are often difficult to detect five years after the event. Rockfalls are also a feature along some of the ridge tracks where natural fractures in the geological formations encourage the process.

One process that has a significant impact on erosion is human forest clearance. Along most logging tracks, the impact of forest clearing is very visible. Erosion is instantaneous following clearance and the sediment is delivered into the forest valleys very rapidly over a short period of time. The impact of this is very significant on local valley ecosystems, resulting in the silting up of forest streams and valleys and often death of a significant part of the valley bottom forest.

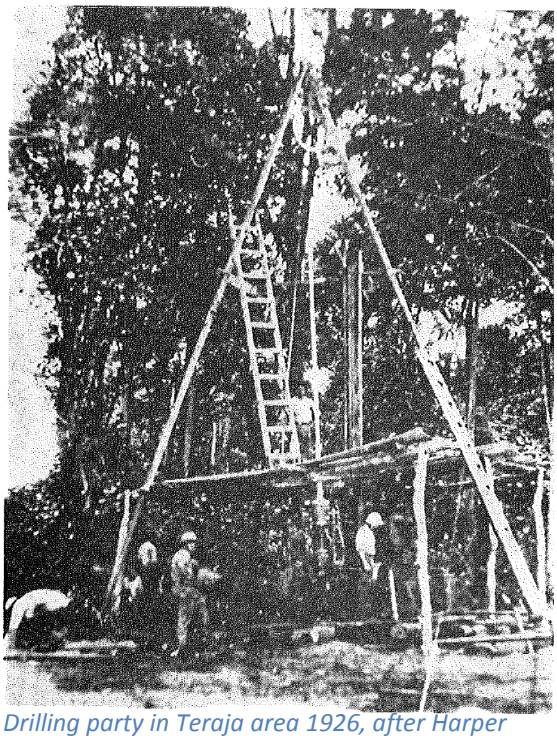
The sandstone and claystone rock layers dip gently to the west on the western slopes and gently to moderately to the east on the eastern slopes of the hill ranges; thus the hills are formed of a geological structure termed an anticline. Along the main logging track where bulldozing has exposed the rocks, discrete narrow zones can be seen where the rock layers are deformed vertically. These are the main faults that break up the geological layers throughout the Labi Hills. As more logging tracks are excavated, more fault zones can be discerned. Thus we can interpret the Labi Hills as a faulted anticline structure. In the future, with increased resolution of the digital

elevation data (e.g. LIDAR images), it may be possible to further map the geological fault zones across the Labi Hills by imaging through the forest canopy.

Evidence of the most recent uplift of the hills can be seen along the west boundary of the hills, where sand and clay eroded from the hills have been deposited as large alluvial fans (google earth image in here). These fans have spread over the peat swamp, resulting in a subtle change of forest. These fans have been exploited by the local communities who now grow a wide range of fruit, vegetables and rice on the deposits of the eroded hills. Observations in rivers and streams that flow through these fans indicate that the rivers now cut down through these deposits by up to two metres; the rivers must have originally been flowing on the surface of these deposits but have eroded down into them as the land they were deposited on them has uplifted."

Labi area Exploration History

Eighteen wells have been drilled in the Labi area between 1912 and 1988, but only the last ten (post-1953) were drilled deeper than1300 metres. Well 2 was the only significant producer. Reservoirs are very thick coastal plain sands with few marine intercalations. The Miocene sedimentary sequence is overall regressive from the deep marine, Setap Shale Formation at the base to the coastal plain sediments of the Belait Formation at the top.



Drilling party in Teraja area 1926, after Harper

Most exploration activity was in the Talingan area. The very sandy (main objective) sequence of the Belait Formation and the main regional cap rock, the Belait Clays, both crop out in the anticline. The structure is therefore prone to leakage in these areas as shown by numerous oil seeps. All parts of the Belait structure connect with potential oil kitchens on both flanks in the Badas and Belait synclines. These synclines contain thick coaly horizons (locally true coals) which are excellent source rocks. The deeper basinal Setap Shales could also contain good source rocks.

In the extreme south of the structure around Bukit Teraja, where well Belait 14 was drilled, uplift on the fault-zone is very considerable, as is removal of former overburden by erosion. Geological exploration of the Belait anticline began about 1911, with geologists of the British Borneo Petroleum Syndicate, mapping the area as far south as Bukit Teraja. The first well was spudded in 1912 at Bukit Puan, on the south bank of the Belait river, to satisfy license obligations. In 1913, the syndicate acquired the Rampayoh Mining Lease, covering an area of strong surface hydrocarbon indications. They started drilling at sites no. 2 and no. 3 in the Talingan area, at the crest of the Belait anticline, with oil impregnated outcrops nearby. The Anglo-Saxon Petroleum Company (part of the Shell group of companies) took over the drilling operations in 1914. They struck oil in well no. 2 at a TD of 559 metres; the first oil in Brunei.

The British Malayan Petroleum Company (Shell) took over the British Borneo Petroleum Syndicate concessions in 1924. Subsequently the area was remapped. Well no. 2 was put on production in 1924. Between 1924 and 1931 some 5,000 m3 of oil was transported by rail to Kampar and from there shipped down the Belait river. The company drilled six more wells from 1924 to 1931. Wells no 5, 8 and 9 appraised the producing Talingan area. They discovered mainly gas. Wells no. 6, 7 and 10 found new hydrocarbons, but none was considered commercial. Production and exploration activities stopped in 1931. The Seria oilfield provided better opportunities. Exploration returned in 1948 with a seismic survey at Medaram and Teraja, but without delineating new prospects. Wells Belait-11 to 14 drilled between 1953 and 1955 failed to find hydrocarbons. Exploration turned to the offshore in the late 1950's and only returned to the Belait area in the early 1970's. New seismic was acquired between 1975 and 1977 and two wells (Belait 15 and 16) were subsequently drilled in 1978. Belait 16 found interesting gas shows, but could not be tested because of technical problems.

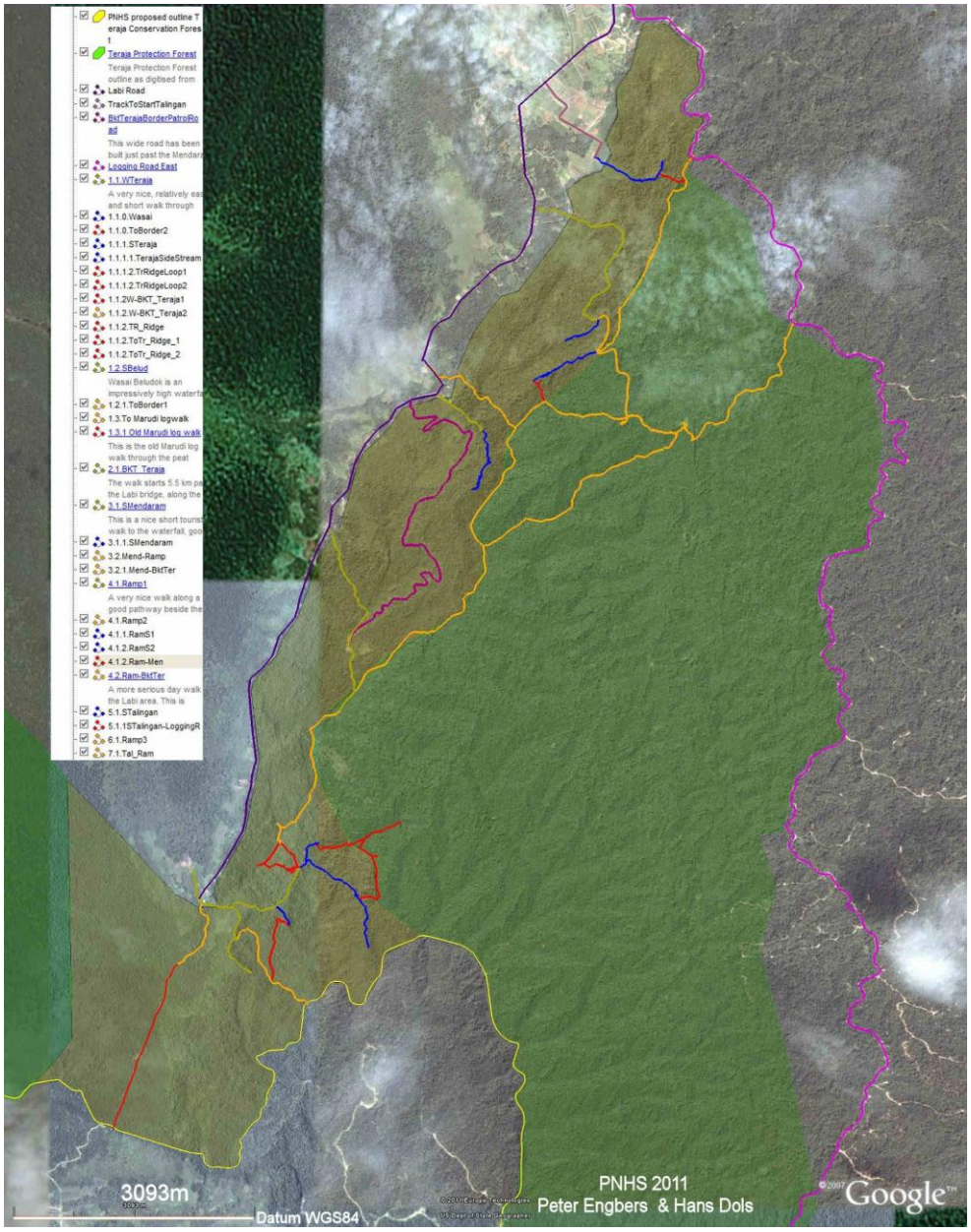
The Talingan area appeared to be the only one with further opportunities. New seismic was shot over this area in 1985 and Belait-17 was spudded in 1987 as a twin well of Belait-5. Belait-18 spudded in 1988 as a sidetrack of Belait-17 to evaluate the east flank of the Talingan accumulations. This well was the first one in 60 years with new, but non-commercial, hydrocarbons in the Belait area.

Teraja Conservation Forest Proposal

P. Engbers, H. Dols, J. Henrot

The PNHS proposes the establishment and gazetment of a Teraja Conservation Forest, with a purpose and outline slightly different from the earlier HoB proposed protection forest extension. A Conservation forest is an undisturbed forest set aside to preserve and conserve biodiversity for scientific, educational, and/or ecotourism purposes. The ecotourism should be low impact, small scale, and benefit the economic development of the local communities.

The suggested outline of a Teraja Conservation Forest is shown in below map with a transparent brown-yellow fill. The proposed conservation forest would provide a crucial connection between the existing Teraja Protection forest and the Mendaram conservation area (transparent green) and form a buffer zone between the more intensively used areas along the Labi road and the Teraja protection forest.



The proposed area measures 27.11 km² (2711 Ha) and includes Thirty-Nine (39 out of 40) mapped waterfalls and the highest point in the Belait province the Teraja Peak. Within the conservation forest the newly build 7 km enforcement road (Old Shell Road) could provide access to the surrounding area enabling low-impact ecotourism active-ties coordinated by the local community. As far as possible we have excluded the main Labi - Teraja road and the land close to, or under cultivation by the local community from the proposed conservation area. (at least as far as we could identify from the available satellite data). The exact interface is to be worked out between all local and government stakeholders.

Map of suggested outline of a Teraja Conservation Forest (transparent brown-yellow fill). The proposed conservation forest would provide a crucial connection between the existing Teraja Protection forest and the Mendaram conservation area (transparent green) and form a buffer zone between the more intensively used areas along the Labi road and the Teraja protection forest.

Ecotourism development suggestions for the Labi-Teraja area

P. Engbers, H. Dols, J. Henrot, A. Geisslinger

A definition of Ecotourism: Ecotourism is travel to fragile, pristine and usually protected areas that strives to be low impact and is small scale. It helps educate the traveler; provides funds for conservation; directly benefits the economic development and political empowerment of local communities; and fosters respect for different cultures and for human rights.

Recommendation for Teraja ecotourism development: We recommend starting small. Development should fully involve and align with the wishes of the local inhabitants. The people need training on how to deal with tourist and manage projects. It is advised to develop an ecotourism master plan for the area. Look at the example of very successful low impact local development of homestay trekking in Nepal and Ladakh and of nature tourism in Sabah. There is the opportunity to re-employ current poachers / hunters as committed and knowledgeable guides after they have been retrained. Ideally it should be entirely run by the local community with some support from the government and interested parties. The master plan and its implementation need expert consultant steer and advice to ensure low impact and environment/tourist friendly development.

Accommodation options: Homestays in local homes, rice paddy stay (see Bali examples), longhouse stay, and a Labi guesthouse.

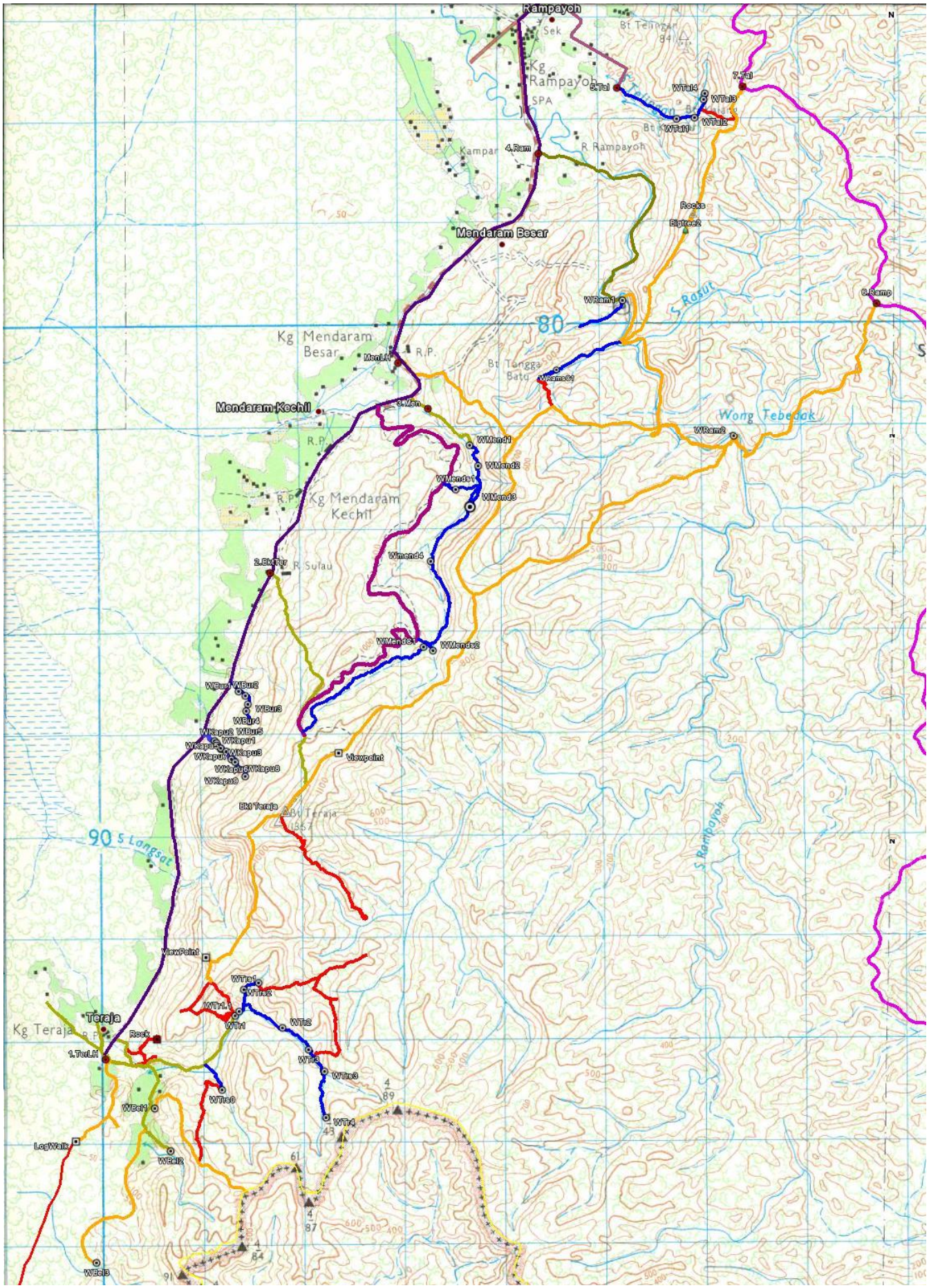
Possible activities:

- Cultural shows (longhouse).
- Rice paddy and agricultural demonstrations.
- Cycling Labi area and biathlon (cycle and walk) up Bukit Teraja.
- Short and easy jungle walks (can be done without guide). These are the brown trails on our map.
- Longer and more difficult jungle treks (need guide). These are the orange trails on map.
- River experiences (follow river, see blue tracks on map, need guide). Waterfall visits and swim in pools.
- Rainforest camping and/or bivac experiences. Rainforest survival training camps (need guide).
- Multi-day rain forest experience from Teraja longhouse to Rampayoh river (combine all trails from map) and includes rainforest bivac (need guide).
- Topical nature experiences (e.g. bird watching, butterflies, fish exploration, botanical walks, nightwalk for insects/frogs, need guide).

Development suggestions:

- Maintain and signpost the easy trails (brown trails on map).
- Facilitate building of guesthouse in local style in labi (example Telamba homestay near sg Telamba)
- Develop Bkt Teraja forestry road as a low impact tourist road with facilities at top. Desparately needs control (against poaching) now.
- Work together with Brunei Tourism. Set up Eco tourism support and advertisement (e.g. websites), but don't publicize before implementing basic protection measures and local guides.
- Provide Green guide training. Provide eco tourism training to interested locals (longhouse, etc) and help longhouses to set up for tourism.
- Work with all stakeholders and a consultant to make ecotourism master plan for the area. Have an experienced consultant who can steer activities and advise on what kind of environment the international visitors do expect before changing the natural environment (path clearing, big structures, etc.).
- Set up information corners and cultural displays in the two longhouses. This would turn the longhouses into impromptu visitors' centres where tourist can collect information before setting off.

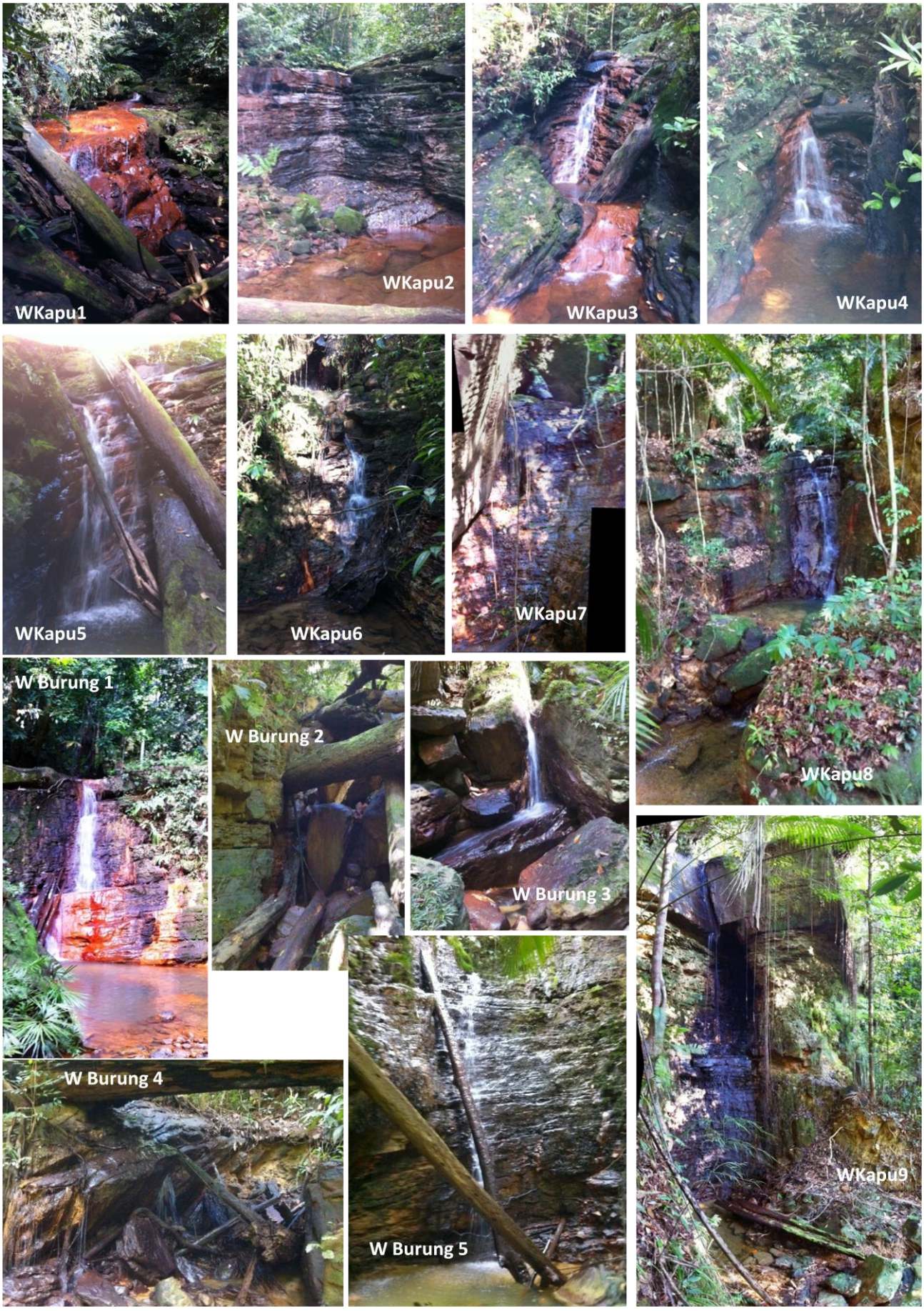
Appendix 1. Map, Waterfall composites, Tables, Reports



Map 1. Waterfalls and *potential trekking system in Teraja area. There are many waterfalls (Waypoints with W=Wasai) and hiking treks (**Brown** = unmarked path, **Orange** = more difficult hike or animal trail, **Red**=hard trek, **Blue** = river scramble). Warning: There are many difficult sections. Conditions change continuously. Orientation is difficult in forest. Only for the experienced rainforest hiker. Use at own responsibility. Prepared and walked by Peter Engbers, Jaqueline Henrot, and friends in the period 2007-2011.*

***Talingan - Rampayoh – Mendaram**; The 14 Northern Waterfalls out of a total of 40*

***Teraja – Belulok**; The 12 Southern Waterfalls out of a total of 40*



Kapu – Burong *(Western slope of Bukit Teraja); The 14 Central Waterfalls out of a total of 40*

Table 1. **Frog species recorded from Bukit Teraja Forests**. Conservation status follows the Global Amphibian Assessment (2007) listings of IUCN red list categories (LC = Least Concern, NT = Near Threatened, VU = Vulnerable). New records for Brunei Darussalam are shown in bold.

Family	Species	Common name	Conservation status
Bufonidae (True Toads)	*Phrynoidis aspera*	River Toad	LC
	Phrynoidis juxtaspera	Giant River Toad	LC
	Ingerophrynus divergens	Crested Toad	LC
	Ansonia albomaculata	White-lipped Slender Toad	NT
Megophryidae (Litter Frogs)	*Leptobrachium abbotti*	Lowland Litter Frog	LC
	Leptolalax gracilis	Sarawak Slender Litter Frog	NT
Microhylidae (Narrow-mouthed Frogs)	*Chaperina fusca*	Saffron-bellied Frog	LC
	Metaphrynella sundana	Tree Hole Frog	LC
	Microhyla perparva	**Least Narrow-mouthed Frog**	NT
	Microhyla petrigena	Pothole Narrow-mouthed Frog	NT
	Microhyla borneensis	Borneo Narrow-mouthed Frog	LC
	Kaloula baleata	**Brown Bullfrog**	LC
Ceratobatrachidae (no vernacular name)	*Ingerana baluensis*	Inger's Dwarf Frog	LC
Dicroglossidae (True Frogs I)	*Limnonectes kuhlii*	Kuhl's Creek Frog	LC
	Limnonectes leporinus	Giant River Frog	LC
	Limnonectes laticeps	Rivulet Frog	LC
	Limnonectes malesianus	**Peat Swamp Frog**	NT
	Fejervarya limnocharis	Grass Frog	LC
	Limnonectes ingeri	Greater Swamp Frog	NT
	Limnonectes ibanorum	Rough-backed River Frog	NT
	Occidozyga baluensis	Seep Frog	NT
	Occidozyga laevis	Pubble Frog	LC
Ranidae (True Frogs II)	*Hylarana signata*	Striped Stream Frog	LC
	Hylarana megalonesa	Large White-lipped Frog	LC
	Hylarana glandulosa	Rough-sided Frog	LC
	Hylarana baramica	Brown Marsh Frog	LC
	Hylarana nicobariensis	**Cricket Frog**	LC
	Hylarana erythraea	Green Paddy Frog	LC
	Staurois guttatus	Black-spotted Rock Frog	LC
	Staurois latopalmatus	Rock Skipper	LC
Rhacophoridae (Afro-Asian Tree Frogs)	*Philautus tectus*	Bush Frog	VU
	Polypedates macrotis	Dark-eared Tree Frog	LC
	Rhacophorus appendiculatus	Frilled Tree Frog	LC
	Rhacophorus dulitensis	Jade Tree Frog	NT
	Rhacophorus nigroplamatus	Wallace's Flying Frog	LC
	Rhacophorus pardalis	Harlequin Flying Frog	LC

Table 2. Reptiles of Teraja.

Family	Species	Common name	Bornean endemic
SNAKE			
Crotalidae (Pit viper)	*Trimeresurus borneensis*	Bornean Flatnose Pit Viper	χ
Colubridae	*Boiga dendrophila*	Mangrove Catsnake	χ
	Dryocalamus tristrigatus	Three-banded Bridled Snake	χ
	Pseudorabdionalbonuchalis	White-Collared Reed Snake	√
	Calamaria sp.	Reed Snake	unknown
	Xenochrophis trianguligerus	Red-sided Keelback Snake	χ
	Xenochrophis maculatus	Spotted Keelback Snake	χ
Elapidae	*Bungarus fasciatus*	Banded Krait	χ
	Calliophis intestinalis	Malayan Striped Coral Snake	χ
LIZARD, GECKO & SKINK			
Agamidae	*Gonocephalus grandis*	Great Angle-headed Lizard	
Gekkonidae	*Cyrtodactylus consobrinus*	Giant Bent-toed Gecko	χ
	Cyrtodactylus pubisulcus	Grooved Bent-toed Gecko	√
Scincidae	*Tropidophorus brookei*	Brooke's Water Skink	√
Varanidae	*Varanus salvator*	Water Monitor	χ
TURTLE			
Trionychidae	*Amyda cartilaginea*	Malayan Softshell Turtle	χ
Geoemydidae	*Cyclemys dentata*	Asian Leaf Turtle	χ
	Cuora amboinensis	Malayan Box Turtle	χ
	Heosemys spinosa	Spiny Turtle	χ

Table 3. Taxonomic List of the Butterflies of the Labi-Teraja Area

Family: Papilionidae – Swallowtails and Jays.

Trogonoptera brookiana brookiana – Rajah Brooke's Birdwing
Troides miranda miranda- Miranda Birdwing
Atrophaneura neptunus doris - Yellow Clubtail
Atrophaneura nox noctis – Malayan Batwing
Pachliopta aristolochiae asteris- Common Rose
Chilasa paradoxa telesicies- Great Blue Mime
Papilio demolion demolion – Banded Swallowtail
Papilio helenus enganius – Red Helen
Papilio nephelus albolineatus - Black & White Helen
Papilio helenus enganius- Red Helen
Papilio iswara - Great Helen
Papilio fuscus daycus- The Fuscous Swallowtail
Papilio memnon memnon - Great Mormon
Papilio acheron- Bornean Mormon
Papilio karna carnatus- Jungle Jade
Papilio palinurus – The Banded Peacock
Pachliopta aristolochiae asteris – The Common Rose
Graphium agamemnon agamemnon – Tailed Jay
Graphium sarpedon luctatius – Common Bluebottle
Graphium doson evemonides – Common Jay
Graphium empedovana
Graphium bathycles bathycloides – The Striped Bluebottle
Graphium ramaceus ramaceus – Pendlebury's Zebra
Pathysa antiphates itamputi- Fivebar Swordtail
Paranticopsis delessertii delessertii- The Malayan Zebra
Paranticopsis ramaceus ramaceus
Meandrusa payeni bruni- Yellow Gorgon
Lamproptera curius – The White Dragontail

Family: Pieridae – White, Sulphurs and Yellows

Subfamily: Pierinae

Leptosia nina malayana- The Psyche
Prioneris cornelia
Cepora iudith hespera- Orange Gull
Appias nero chelidon- Orange Albatross
Appias paulina Athena- Common/White Albatross
Appias cardena cardena – Malay Puffin
Appias indra aemila- Plain Puffin
Appias nero chelidon – Orange Albatross
Appias paulina athena - The Common Albatross
Saletara liberia distant- Malaysian Albatross
Hebomoia glaucippe borneensis- The Great Orange Tip
Pareronia valeria lutescens – The Wanderer
Prioneris philonome vollenhovi
Saletara panda Malaysian Albatross

Subfamily: Coliadinae

Dercas gobrias – Notched Yellow
Catopsilia pomona pomona – The Lemon Emigrant
Catopsilia pyranthe evangelina – The Mottled Emigrant
Eurema hecabe latilimbata – Common Grass Yellow
Eurema ada ada
Eurema sari sodalist- The Chocolate Grass Yellow
Eurema taliha gradiens
Eurema alitha - Scalloped Grass Yellow
Eurema andersonii andersonii- One-spot Grass Yellow
Eurema nicevillei nicevillei

Subfamily: Limenitidinae

Moduza procris agnata – The Commander
Neptis hylas sopatra – The Common Sailer
Neptis duryodana duryodana
Neptis nata nata - Clear Sailor
Neptis leucoporos cresina - Grey Sailor
Neptis harita mingia - Chocolate Sailor
Neptis clinia – The Clear Sailer
Neptis nata nata - The Clear Sailer
Neptis omeroda omeroda
Neptis magadha plautia – The Spotted Sailer
Pantoporia hordonia dora- Common Lascar
Pantoporia paraka paraka - Perak Lascar
Pantoporia aurelia aurelia- The Baby Lascar
Lasippa heliodore dorelia - Burmese Lascar
Lasippa tiga - Burmese Lascar
Athyma kanwa kanwa - Dot-dash Sergeant *Athyma nefte matthioia* - Colour Sergeant
Athyma larymna elisa - The Great Sergeant
Pandita sinope sinope – Orange Band
Lebadea martha paduka – The Knight
Parthenos sylvia borneensis - The Clipper
Tanaecia aruna pardalis
Tanaecia munda munda
Tanaecia clathrata caerulescens
Tanaecia iapis ambalika - Horsfields-Baron
Tanaecia godartii vacillaria
Tanaecia orphne
Tanaecia pelea vikrama
Euthalia monina bipunctata - Malay Baron
Euthalia canescens
Euthalia evelina
Dophia (Euthalia) evelina eopmta - The Redspot Duke

Subfamily: Cyrestinae

Cyrestis nivea nivalis- Straight Line Mapwing
Chersonesia rahria rahria - Wavy Maple
Chersonesia intermedia intermedia - Intermediate Maplet
Dichorragia nesimachus derdas – The Constable

Subfamily: Apaturinae

Eulaceura osteria jembala - The Purple Duke
Euripus nycetelius pfeiffarae – The Courtesan

Subfamily: Charaxinae

Polyura hebe ganymedes - Plain Nawab
Charaxes solon echo- The Black Rajah
Charaxes distanti thespius
Charaxes borneensis borneensis
Charaxes bernardus pseudofervens- The Tawny Rajah
Polyura athamas uraeus - Common Nawab
Polyura moori saida – The Malayan Nawab
Agatasa calydonia mahasthama - The Glorious Begum

Family: Riodinidae - Silvermarks

Zemeros emesoides eso
Paralaxita telesia telesia - the Red Harlequin
Paralaxita orphna orphana - The Banded Red Harlequin

Eurema lacteola - Scarce Grass Yellow
Gandaca harina elis- The Tree Yellow

Family: Nymphalidae – Brushfoot Butterflies

Subfamily: Danainae

Parantica agleoides terilus- The Dark Glassy Tiger
Parantica aspasia shelford - The Yellow Glassy *Tiger*
Ideopsis (Radena) vulgaris interposita - Blue Glassy Tiger
Ideopsis gaura daos- The Smaller Wood Nymph
Idea stolli virgo - Common Tree-nymph
Euploea sylvester tyrianthira- The Double-branded Crow
Euploea camaralzeman scudderi- Malayan Crow
Euploea algea zonata- Long branded Blue Crow
Euploea eyndhovii stryx- Striped Black Crow
Euploea crameri crameri – Spotted Black Crow
Euploea diocletianus (radamanthus) lowii – Magpie Crow
Euploea midamus clorinde - Blue Spotted Crow
Euploea modesta lorzae
Euploea mulciber porita - Striped Blue Crow
Euploea sylvester tyrianthia - Double-branded Crow / Two-brand Crow

Subfamily: Satyrinae

Elymnias panthera labuana - Tawny Palmfly
Elymnias hypermnestra nigrescens- Common Palmfly
Elymnias nesaea hypereides - Tiger Palmfly
Elymnias panthera labuana – The Tawny Palmfly
Elymnias penanga konga - Pointed Palmfly
Lethe delila
Neorina lowii lowii - Malayan Owl
Mycalesis marginata - The Common Bush Brown
Mycalesis patiana - Malayan Bush Brown [VHH]
Mycalesis anapita
Mycalesis maianeas
Mycalesis mnasicles
Mycalesis oresis borneensis- Purple Bush Brown
Mycalesis fusca adustata - Malayan Bush Brown
Mycalesis mineus macromalayana - Dark Brand Bush Brown
Mycalesis intermedia intermedia- Intermediate Bushbrown
Erites argentina argentina
Coelites euptychioides euptychioides
Ragadia makuta umbrata - Striped Ringlet
Ypthima pandocus Sertorius - Common Three-Ring
Ypthima fasciata – Small Ring [VHH]
Xanthotaenia busiris burra- The Yellow-barred/ The Uncertain Satyr

Subfamily: Morphinae

Amathusia schoenbergi
Thaumantis odana panwila - Godart's Jungle Glory
Thaumantis klugius – The Dark Blue Jungle Glory
Thaumantis noureddin chatra – Dark Jungle Glory
Discophora necho cheops
Faunis kirata – The Dark Faun
Faunis stompax

Subfamily: Biblidinae

Ariadne ariadne ariadne - Angled Castor

Subfamily: Heliconiinae

Laxita teneta

Family: Lycaenidae – Gossamer-wings

Subfamily: Poritiinae

Simiskina pheretia mama
Simiskina pharyge pharyge

Subfamily:Miletinae

Liphyra brassolis abbreviate - The Moth Butterfly
Miletus gopara eustatius
Spalgis epius epius - The Apefly
Allotinus apires
Allotinus horsfieldi nessus – Horfield's Darkie
Allotinus leogoron normani
Logania malayica malayica - Malayan Mottle
Logania regina regina
Logania massalia drucei - Pale Mottle

Subfamily: Curetinae

Curetis tagalica jopa
Curetis regula

Subfamily: Polyommatinae

Discolampa ethion icenus - Banded Blue Pierrot
Caleta elna elvira - Elbowed Pierrot
Neopithecops zalmora pertimidus - The Quaker
Megisba malaya sikkima - The Malayan
Jamides celeno luwasa - The Common Cerulean
Jamdes cunilda cunilda
Jamides talinga
Jamides caeruleus caerlueus - Sky Blue
Jamides elpis virgulatus - Glistening Caerulean
Jamides limes
Jamides alecto ageladas - The Metallic Cerulean
Nacaduba kurava nemana - The Transparent Six-line Blue
Nacaduba berenice akaba - The Rounded Six-line Blue
Prosotas dubiosa lampura - The Tailless Lineblue
Catopyrops ancyra almora - Ancyra Blue
Anthene emolus goberus - The Ciliate Blue
Arhopala pseudocentaurus cervidius - Centaur Oak Blue
Arhopala kinabala
Arhopala lurida - Lesser Disc Oakblue
Arhopala dajagaka
Arhopala denta
Arhopala elopura elopura
Arhopala aurea
Flos anniella anniella – The Darky Plushblue
Iraota distanti nilelia - Distant's Silverstreak
Amblypodia narada sylvia
Spindasis syama frigidus - Club Silverline
Drina cowani
Drina maneia
Loxura cassiopeia amatica - The Larger Yamfly
Cheritra freja ochracea – Common Imperial
Ritra aurea aurea - Orange Imperial
Drupadia theda umara - Dark Posy
Drupadia cinesia
Horaga syrinx maenala - The Yellow Onyx
Dacalana vidura azyada - The Double Tufted Royal
Britomartis cleoboides igarashii
Manto hypoleuca martina - Green Imperial
Hypolycaena merguia skapane
Bindahara phocides phocas - The Plane

***Vagrans egista creaghana* – The Vagrant**
***Vindula dejone dajakorum* – The Cruiser**
***Cirrochroa emalea ravana* - The Malay Yeoman**
Cirrochroa malaya calypso
***Cirrochroa satellita illergeta*- Satellite Yeoman**
***Cirrochroaorissa orissides* - The Banded Yeoman**
***Cethosia hypsea hypsea* - Malay Lacewing**
***Phalanta alcippe alcippe* –The Small Leopard**
Terinos clarissa nympha
***Terinos terpander terpander* – Royal Assyrian**

Subfamily: Nymphalinae

***Hypolimnas bolina bolina*- Blue Moon Butterfly/ Common Eggfly**
***Hypolimnas anomola olada* - Malayan Eggfly**
***Bassorana dunya mahara* – String of Pearls**
***Bassarona teuta* – The Banded Marquis**
***Lexias canescens canescens* - Yellow Archduke**
***Lexias pardalis dirteana*- The Archduke /Common Archduke**
***Rapala varuna saha* - The Indigo Flash**
***Araotes lapithis uraweila* - The Witch**

Family: Hesperiidae - Skippers

Subfamily: Pyrginae

***Tagiades japetus balana* – The Common Snow Flat**

Subfamily: Hesperiinae

***Pithauria marsena* - Banded Straw Ace**
***lambrix stellifer* – The Starry Bob**
Koruthaialos rubecula rubecula
***Ancistroides nigrita mura* - Chocolate Demon**
***Notocrypta paralysos varians* - Common Banded Demon**
***Notocrypta curvifascia* - Restricted Demon**
Quedara monteithi
Isma protoclea iapis
Taractrocera ziclea
***Potanthus omaha maesina* - Lesser Dart**
***Potanthus confucius yojona* - Chinese Dart / Confucian Dart**

Notes:

The taxonomy used above follows that of Corbet and Pendlebury, 1978 with the exception that the Nymphalidae classification has been updated to follow currently accepted arrangements.

Table 4. Plant taxa from Teraja + Rampayoh + Mendaram

Data from: 'A Checklist of The Flowering Plants and Gymnosperms of Brunei Darussalam'. 1996. Coode MJE, Dransfield J, Forman LL, Kirkup DW, Idris m Said

Acanthaceae	*Ptyssiglottis frutescens*	Burseraceae	*Dacryodes rugosa*	Ebenaceae	*Diospyros borneensis*	
Actinidiaceae	*Saurauia bruneiensis*	Burseraceae	*Santiria apiculata var. apiculata*	Ebenaceae	*Diospyros cf. bantamensis*	
Actinidiaceae	*Saurauia sp. indet.*	Burseraceae	*Santiria mollis*	Ebenaceae	*Diospyros elliptifolia*	
Alangiaceae	*Alangium griffithii*	Burseraceae	*Santiria tomentosa*	Ebenaceae	*Diospyros euphlebia*	
Anacardiaceae	*Buchanania arborescens*	Burseraceae	*Triomma malaccensis*	Ebenaceae	*Diospyros mindanaensis*	
Anacardiaceae	*Campnosperma squamatum*	Buxbaumiaceae	*Diphyscium sp.*	Ebenaceae	*Diospyros pilosanthera*	
Anacardiaceae	*Parishia maingayi*	Callicostaceae	*Hookeriopsis sp.*	Ebenaceae	*Diospyros pseudomalabarica*	
Anacardiaceae	*Parishia sp. nov.*	Calymperaceae	*Calymperes sp.*	Elaeocarpaceae	*Elaeocarpus clementis var. clemensiae*	
Anacardiaceae	*Pentaspadon motleyi*	Calymperaceae	*Mitthyridium sp.*	Elaeocarpaceae	*Elaeocarpus cupreus*	
Anisophylleaceae	*Anisophyllea corneri*	Calymperaceae	*Syrrhopodon sp.*	Elaeocarpaceae	*Elaeocarpus ferrugineus ssp. ferrugineus*	
Anisophylleaceae	*Anisophyllea disticha*	Cecropiaceae	*Poikilospermum cordifolium*	Elaeocarpaceae	*Elaeocarpus floribundus*	
Annonaceae	*Cyathocalyx magnificus*	Cecropiaceae	*Poikilospermum oblongifolium*	Elaeocarpaceae	*Elaeocarpus hochreutineri*	
Annonaceae	*Dasymaschalon clusiflorum*	Cecropiaceae	*Poikilospermum tangaum*	Elaeocarpaceae	*Elaeocarpus mastersii*	
Annonaceae	*Desmos dumosus*	Celastraceae	*Bhesa paniculata*	Elaeocarpaceae	*Elaeocarpus mutabilis*	
Annonaceae	*Disepalum anomalum*	Celastraceae	*Lophopetalum beccarianum*	Elaeocarpaceae	*Elaeocarpus nitidus*	
Annonaceae	*Enicosanthum paradoxum*	Celastraceae	*Salacia sp. 2*	Elaeocarpaceae	*Elaeocarpus pachyophrys*	
Annonaceae	*Goniothalamus malayanus*	Chloranthaceae	*Chloranthus erectus*	Elaeocarpaceae	*Elaeocarpus roslii ssp. terajanus*	
Annonaceae	*Goniothalamus sp. 2*	Chrysobalanaceae	*Parinari metallica*	Elaeocarpaceae	*Elaeocarpus stipularis*	
Annonaceae	*Goniothalamus sp. 3*	Chrysobalanaceae	*Parinari oblongifolia*	Elaeocarpaceae	*Elaeocarpus submonoceras ssp. lasionyx*	
Annonaceae	*Goniothalamus umbrosus*	Combretaceae	*Combretum creaghii*	Elaeocarpaceae	*Elaeocarpus truncatus*	
Annonaceae	*Goniothalamus velutinus*	Combretaceae	*Combretum sundaicum*	Elaeocarpaceae	*Sloanea javanica*	
Annonaceae	*Mezzettia sp.*	Combretaceae	*Combretum tetralophum*	Erythroxylaceae	*Erythroxylum sp. indet.*	
Annonaceae	*Monocarpia sp. nov.*	Combretaceae	*Terminalia foetidissima*	Escalloniaceae	*Polyosma sp. 4*	
Annonaceae	*Phaeanthus crassipetalus*	Commelinaceae	*Amischotolype griffithii*	Euphorbiaceae	*Antidesma aff. venenosum*	
Annonaceae	*Polyalthia cauliflora*	Commelinaceae	*Amischotolype marginata*	Euphorbiaceae	*Antidesma brachybotrys*	
Annonaceae	*Polyalthia cauliflora var. beccarii*	Commelinaceae	*Amischotolype mollissima*	EUPHORBIACEAE	*Antidesma cf. neurocarpum*	
Annonaceae	*Polyalthia flagellaris*	Commelinaceae	*Amischotolype sphagnorhiza*	Euphorbiaceae	*Antidesma leucopodum var. leucopodum*	
Annonaceae	*Polyalthia hookeriana*	Connaraceae	*Cnestis palala*	Euphorbiaceae	*Antidesma leucopodum var. platyphyllum*	
Annonaceae	*Polyalthia insignis*	Cornaceae	*Mastixia trichotoma var. maingayi*	Euphorbiaceae	*Antidesma montanum*	
Annonaceae	*Polyalthia sp. 1*	Costaceae	*Costus paradoxus*	Euphorbiaceae	*Antidesma neurocarpum*	
Annonaceae	*Polyalthia sp. 2*	Costaceae	*Costus speciosus*	EUPHORBIACEAE	*Antidesma stipulare*	
Annonaceae	*Polyalthia sumatrana*	Cyperaceae	*Cyperus iria*	Euphorbiaceae	*Antidesma venenosum*	
Annonaceae	*Polyalthia tenuipes*	Cyperaceae	*Fimbristylis globulosa*	Euphorbiaceae	*Aporusa benthamiana*	
Annonaceae	*Popowia pisocarpa*	Cyperaceae	*Fimbristylis littoralis*	Euphorbiaceae	*Aporusa elmeri*	
Annonaceae	*Uvaria ovalifolia*	Cyperaceae	*Fimbristylis pauciflora*	Euphorbiaceae	*Aporusa frutescens*	
Annonaceae	*Xylopia malayana*	Cyperaceae	*Fimbristylis schoenoides*	Euphorbiaceae	*Aporusa grandistipula*	
Annonaceae	*Xylopia sp. indet.*	Cyperaceae	*Gahnia javanica*	Euphorbiaceae	*Aporusa lucida*	
Apocynaceae	*Chilocarpus beccarianus*	Cyperaceae	*Mapania cuspidata*	Euphorbiaceae	*Baccaurea javanica*	
Apocynaceae	*Chilocarpus obtusifolius*	Cyperaceae	*Mapania hispida*	Euphorbiaceae	*Baccaurea membranacea*	
Apocynaceae	*Leuconotis eugeniifolius*	Cyperaceae	*Mapania longiflora*	Euphorbiaceae	*Baccaurea pyriformis*	
Apocynaceae	*Tabernaemontana macrocarpa*		Cyperaceae	*Mapania monostachya*	Euphorbiaceae	*Baccaurea racemosa*
Apocynaceae	*Willughbeia coriacea*	Cyperaceae	*Mapania palustris var. palustris*	Euphorbiaceae	*Baccaurea sp. indet.*	
Aquifoliaceae	*Ilex sp. 5*	Cyperaceae	*Mapania sp. indet.*	Euphorbiaceae	*Blumeodendron sp. indet.*	
Araceae	*Aglaonema nitidum*	Cyperaceae	*Paramapania radians*	Euphorbiaceae	*Blumeodendron tokbrai var. borneense*	
Araceae	*Aglaonema simplex*	Cyperaceae	*Pycreus pumilus*	Euphorbiaceae	*Bridelia glauca*	
Araceae	*Alocasia sp. D*	Cyperaceae	*Scleria motleyi*	Euphorbiaceae	*Claoxylon longifolium*	
Araceae	*Amydrium medium*	Cyperaceae	*Scleria purpurascens*	Euphorbiaceae	*Cleistanthus bakonensis*	
Araceae	*Anadendrum cordatum*	Cyperaceae	*Scleria sp. indet.*	Euphorbiaceae	*Cleistanthus coriaceus*	
Acanthaceae	*Ptyssiglottis frutescens*	Burseraceae	*Dacryodes rugosa*	Ebenaceae	*Diospyros borneensis*	
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Anacardiaceae	*Buchanania arborescens*	Burseraceae	*Triomma malaccensis*	Ebenaceae	*Diospyros mindanaensis*	
Anacardiaceae	*Campnosperma squamatum*	Buxbaumiaceae	*Diphyscium sp.*	Ebenaceae	*Diospyros pilosanthera*	
Anacardiaceae	*Parishia maingayi*	Callicostaceae	*Hookeriopsis sp.*	Ebenaceae	*Diospyros pseudomalabarica*	
Anacardiaceae	*Parishia sp. nov.*	Calymperaceae	*Calymperes sp.*	Elaeocarpaceae	*Elaeocarpus clementis var. clemensiae*	
Anacardiaceae	*Pentaspadon motleyi*	Calymperaceae	*Mitthyridium sp.*	Elaeocarpaceae	*Elaeocarpus cupreus*	
Anisophylleaceae	*Anisophyllea corneri*	Calymperaceae	*Syrrhopodon sp.*	Elaeocarpaceae	*Elaeocarpus ferrugineus ssp. ferrugineus*	
Anisophylleaceae	*Anisophyllea disticha*	Cecropiaceae	*Poikilospermum cordifolium*	Elaeocarpaceae	*Elaeocarpus floribundus*	
Annonaceae	*Cyathocalyx magnificus*	Cecropiaceae	*Poikilospermum oblongifolium*	Elaeocarpaceae	*Elaeocarpus hochreutineri*	
Annonaceae	*Dasymaschalon clusiflorum*	Cecropiaceae	*Poikilospermum tangaum*	Elaeocarpaceae	*Elaeocarpus mastersii*	
Annonaceae	*Desmos dumosus*	Celastraceae	*Bhesa paniculata*	Elaeocarpaceae	*Elaeocarpus mutabilis*	
Annonaceae	*Disepalum anomalum*	Celastraceae	*Lophopetalum beccarianum*	Elaeocarpaceae	*Elaeocarpus nitidus*	
Annonaceae	*Enicosanthum paradoxum*	Celastraceae	*Salacia sp. 2*	Elaeocarpaceae	*Elaeocarpus pachyophrys*	
Annonaceae	*Goniothalamus malayanus*	Chloranthaceae	*Chloranthus erectus*	Elaeocarpaceae	*Elaeocarpus roslii ssp. terajanus*	
Annonaceae	*Goniothalamus sp. 2*	Chrysobalanaceae	*Parinari metallica*	Elaeocarpaceae	*Elaeocarpus stipularis*	
Annonaceae	*Goniothalamus sp. 3*	Chrysobalanaceae	*Parinari oblongifolia*	Elaeocarpaceae	*Elaeocarpus submonoceras ssp. lasionyx*	
Annonaceae	*Goniothalamus umbrosus*	Combretaceae	*Combretum creaghii*	Elaeocarpaceae	*Elaeocarpus truncatus*	

Asclepiadaceae	*Hoya sp. indet.*	Dipterocarpaceae	*Shorea sp. indet.*	Euphorbiaceae	*Macaranga praestans*	
Begoniaceae	*Begonia bruneiana var. labiensis*		Dipterocarpaceae	*Vatica sarawakensis*	Euphorbiaceae	*Macaranga sp. indet.*
Begoniaceae	*Begonia leucotricha*	Dipterocarpaceae	*Vatica badiifolia*	Euphorbiaceae	*Mallatos penangensis*	
Bombacaceae	*Durio carinatus*	Dipterocarpaceae	*Vatica havilandii*	Euphorbiaceae	*Mallotus griffithianus*	
Bombacaceae	*Durio excelsa*	Dipterocarpaceae	*Vatica micrantha*	Euphorbiaceae	*Mallotus macrostachyus*	
Bombacaceae	*Durio graveolens*	Dipterocarpaceae	*Vatica umbonata*	Euphorbiaceae	*Mallotus penangensis*	
Boraginaceae	*Pteleocarpa lamponga*	Dipterocarpaceae	*Vatica umbonata ssp. umbonata*	Euphorbiaceae	*Mallotus wrayi*	
Burmanniaceae	*Burmannia sp. indet.*	Dracaenaceae	*Dracaena angustifolia*	Euphorbiaceae	*Omphalea malayana*	
Burseraceae	*Dacryodes expansa*	Dracaenaceae	*Dracaena elliptica*	Euphorbiaceae	*Pimeleodendron griffithianum*	
Burseraceae	*Dacryodes macrocarpa var. patentinervia*	Dracaenaceae	*Dracaena terniflora*	Euphorbiaceae	*Pimelodendron griffithianum*	
Euphorbiaceae	*Trigonostemon polyanthus*	Leguminosae-Caesalpinioideae	*Caesalpinia latisiliqua*	Myrtaceae	*Syzygium palawanense*	
Fagaceae	*Quercus sp.*	Leguminosae-Mimosoideae	*Archidendron sp. indet.*	Myrtaceae	*Syzygium sp. indet.*	
Fagaceae	*Castanopsis hypophoenicea*	Leguminosae-Papilionoideae	*Callerya nieuwenhuisii*	Nepenthaceae	*Nepenthes ampullaria*	
Fagaceae	*Castanopsis motleyana*	Leguminosae-Papilionoideae	*Callerya sp. indet.*	Nepenthaceae	*Nepenthes rafflesiana*	
Fagaceae	*Lithocarpus blumeanus*	Leguminosae-Papilionoideae	*Fordia splendidissima ssp. splendidissima*	Ochnaceae	*Euthemis leucocarpa*	
Fagaceae	*Lithocarpus conocarpus*	Leguminosae-Papilionoideae	*Ormosia bancana*	Ochnaceae	*Ouratea serrata*	
Fagaceae	*Lithocarpus pulcher*	Loganiaceae	*Fagraea belukar*	Ochnaceae	*Sauvagesia calophylla*	
Fagaceae	*Lithocarpus sp.*	Loganiaceae	*Fagraea blumei*	Ochnaceae	*Sauvagesia serrata*	
Fagaceae	*Lithocarpus sundaicus*	Loganiaceae	*Fagraea spicata*	Olacaceae	*Ochanostachys amentacea*	
Fagaceae	*Lithocarpus urceolaris*	Lowiaceae	*Orchidantha holttumii*	Oleaceae	*Chionanthus curvicarpus*	
Fissidentaceae	*Fissidens sp.*	Magnoliaceae	*Magnolia ashtonii*	Oleaceae	*Jasminum kostermansii*	
Flacourtiaceae	*Casearia rugulosa*	Malvaceae	*Urena lobata ssp. lobata var lobata*	Oleaceae	*Jasminum melastomifolium*	
Flacourtiaceae	*Casearia sp. indet.*	Marantaceae	*Donax cannaeformis*	Orchidaceae	*Bromheadia finlaysoniana*	
Flacourtiaceae	*Flacourtia rukam*	Marantaceae	*Phacelophrynium maximum*	Orchidaceae	*Bulbophyllum sp. indet.*	
Flacourtiaceae	*Hydnocarpus borneensis*	Melastomataceae	*Cyanandrium sp. nov.*	Orchidaceae	*Coelogyne sanderiana*	
Flacourtiaceae	*Osmelia philippina*	Melastomataceae	*Dissochaeta beccariana*	Orchidaceae	*Dendrobium lobbii*	
Flagellariaceae	*Flagellaria indica*	Melastomataceae	*Dissochaeta celebica*	Orchidaceae	*Dendrobium sp. indet.*	
Gesneriaceae	*Aeschynanthus sp. indet.*	Melastomataceae	*Dissochaeta rostrata*	Orchidaceae	*Eria megalopha*	
Gesneriaceae	*Aeschynanthus tricolor*	Melastomataceae	*Macrolenes stellulata var. stellulata*	Orchidaceae	*Liparis wrayii*	
Gesneriaceae	*Aescynanthus tricolor*	Melastomataceae	*Medinilla crassifolia*	Orchidaceae	*Neuwiedia veratrifolia*	
Gesneriaceae	*Cyrtandra cf. hoseana*	Melastomataceae	*Melastoma beccarianum*	Orchidaceae	*Oberonia anceps*	
Gesneriaceae	*Cyrtandra digitaliflora*	Melastomataceae	*Memecylon acuminatissimum*	Orchidaceae	*Plocoglottis acuminata*	
Gesneriaceae	*Cyrtandra glomeruliflora*	Melastomataceae	*Memecylon amplexicaule*	Orchidaceae	*Plocoglottis sp. indet.*	
Gesneriaceae	*Cyrtandra hololeuca*	Melastomataceae	*Memecylon scolopacinum*	Orchidaceae	*Podochilus tenuis*	
Gesneriaceae	*Cyrtandra hoseana*	Melastomataceae	*Neodriessenia scorpioidea*	Oxalidaceae	*Dapania racemosa*	
Gesneriaceae	*Cyrtandra lacerata*	Melastomataceae	*Ochthocharis ovata*	Palmae	*Areca insignis var. insignis*	
Gesneriaceae	*Cyrtandra lambirensis*	Melastomataceae	*Phyllagathis sp. 3*	Palmae	*Calamus sp. nov. 1*	
Gesneriaceae	*Cyrtandra penduliflora*	Melastomataceae	*Pogonanthera pulverulenta*	Palmae	*Daemonorops microstachys*	
Gesneriaceae	*Cyrtandra sp. 2*	Melastomataceae	*Pternandra cogniauxii*	Palmae	*Daemonorops periacantha*	
Gesneriaceae	*Henckelia cf. diffusa*	Melastomataceae	*Pternandra crassicalyx*	Palmae	*Eugeissona minor*	
Gesneriaceae	*Henckelia diffusa*	Melastomataceae	*Pternandra hirtella*	Palmae	*Licuala bidentata*	
Gnetaceae	*Gnetum sp.*	Melastomataceae	*Pternandra multiflora*	Palmae	*Licuala sp. indet.*	
Gramineae	*Sphaerocaryum sp.*	Melastomataceae	*Pternandra rostrata*	Palmae	*Oncosperma horridum*	
Gramineae	*Axonopus affinis*	Melastomataceae	*Pternandra sp. indet.*	Palmae	*Pinanga lepidota*	
Gramineae	*Eragrostis unioloides*	Meliaceae	*Aglaia aspera*	Palmae	*Salacca vermicularis*	
Gramineae	*Imperata conferta*	Meliaceae	*Aglaia coriacea*	Pandaceae	*Galearia fulva*	
Gramineae	*Lophatherium gracile*	Meliaceae	*Aglaia cumingiana*	Pandanaceae	*Pandanus borneensis*	
Guttiferae	*Calophyllum ferrugineum var. orientale*	Meliaceae	*Aglaia sp. indet.*	Pandanaceae	*Pandanus discostigma*	
Guttiferae	*Calophyllum griseum*	Meliaceae	*Dysoxylum rugulosum*	Pentaphragmataceae	*Pentaphragma acuminatum*	
Guttiferae	*Calophyllum multitudinis*	Meliaceae	*Heynea trijuga*	Pentaphragmataceae	*Pentaphragma spatulisepalum*	
Guttiferae	*Calophyllum nodosum*	Meliaceae	*Sandoricum caudatum*	Pentaphragmataceae	*Pentaphragma viride*	
Guttiferae	*Cratoxylum arborescens*	Meliaceae	*Trichilia sp. indet.*	Piperaceae	*Piper muricatum ? "Bl. var."*	
Guttiferae	*Cratoxylum sp. indet.*	Menispermaceae	*Limacia oblonga*	Piperaceae	*Piper sp. indet.*	
Guttiferae	*Garcinia beccarii*	Moraceae	*Artocarpus nitidus ssp. nitidus*	Piperaceae	*Piper vestitum*	
Guttiferae	*Garcinia lateriflora*	Moraceae	*Ficus chartacea var. chartacea*	Polygalaceae	*Epirhizanthes elongata*	
Guttiferae	*Garcinia maingayi*	Moraceae	*Ficus condensa*	Polygalaceae	*Epirhizanthes sp. indet.*	
Guttiferae	*Garcinia nervosa*	Moraceae	*Ficus deltoidea var. borneensis*	Polygalaceae	*Polygala venenosa*	
Guttiferae	*Garcinia sp. 8*	Moraceae	*Ficus fulva var. fulva*	Polygalaceae	*Xanthophyllum adenotus*	
Guttiferae	*Garcinia sp. indet.*	Moraceae	*Ficus schwarzii*	Polygalaceae	*Xanthophyllum ellipticum*	
Guttiferae	*Kayea cf. elmeri*	Moraceae	*Ficus sp. indet.*	Polygalaceae	*Xanthophyllum ferrugineum*	
Guttiferae	*Kayea elmeri ssp. nov.*	Moraceae	*Ficus stolonifera*	Polygalaceae	*Xanthophyllum flavescens*	
Guttiferae	*Kayea scalarinervosa*	Musaceae	*Musa campestris*	Polygalaceae	*Xanthophyllum reticulatum*	
Guttiferae	*Kayea sp. indet.*	Myristicaceae	*Endocomia virella*	Polygalaceae	*Xanthophyllum sp. indet.*	
Guttiferae	*Ploiarium alternifolium*	Myristicaceae	*Gymnacranthera forbesii var. forbesii*	Proteaceae	*Heliciopsis artocarpoides*	
Hanguanaceae	*Hanguana sp. indet.*	Myristicaceae	*Horsfieldia polyspherula var. sumatrana*	Rhamnaceae	*Alphitonia excelsa*	
Hymenophyllaceae	*Trichomanes sp. indet.*	Myristicaceae	*Knema curtisii var. curtisii*	Rhamnaceae	*Ziziphus borneensis*	
Hypnaceae	*Ectropthecium sp.*	Myristicaceae	*Knema galeata*	Rhizophoraceae	*Pellacalyx symphiodiscus*	
Hypoxidaceae	*Curculigo latifolia*	Myristicaceae	*Knema latericia ssp. ridleyi*	Rosaceae	*Prunus sp. indet.*	
Hypoxidaceae	*Curculigo sp. indet.*	Myristicaceae	*Knema stenophylla ssp. longipedicellata*	Rubiaceae	*Acranthera involucrata*	
Icacinaceae	*?Gomphandra sp. indet.*	Myristicaceae	*Myristica borneensis*	Rubiaceae	*Acranthera sp. 2*	
Icacinaceae	*Gomphandra cumingiana*	Myristicaceae	*Myristica smythiesii*	Rubiaceae	*Acranthera sp. indet.*	

Icacinaceae	*Phytocrene sp. indet.*
Icacinaceae	*Sarcostigma sp. indet.*
Lauraceae	*Actinodaphne borneensis*
Lauraceae	*Actinodaphne glomerata*
Lauraceae	*Cryptocarya sp. indet.*
Lauraceae	*Endiandra sp. indet.*
Lauraceae	*Litsea accedens*
Lauraceae	*Litsea cf. pallidifolia*
Lauraceae	*Litsea ferruginea*
Lauraceae	*Litsea grandis*
Lauraceae	*Litsea lancifolia*
Lauraceae	*Litsea oppositifolia*
Lauraceae	*Litsea rubicunda*
Lauraceae	*Litsea sessilis*
Lauraceae	*Litsea sp. indet.*
Lauraceae	*Nothaphoebe heterophylla*
Lauraceae	*Potoxylon melagangai*
Lecythidaceae	*Barringtonia acutangula ssp. acutangula*
Lecythidaceae	*Barringtonia sp. indet.*
Leguminosae-Caesalpinioideae	*Bauhinia campanulata*
Leguminosae-Caesalpinioideae	*Bauhinia sp. indet.*
Rubiaceae	*Lasianthus retosus*
Rubiaceae	*Lasianthus stipularis*
Rubiaceae	*Morinda rigida*
Rubiaceae	*Morinda sp. indet.*
Rubiaceae	*Myrmeconauclea strigosa*
Rubiaceae	*Nauclea sp. indet.*
Rubiaceae	*Nauclea subdita*
Rubiaceae	*Neonauclea sp. indet.*
Rubiaceae	*Ophiorrhiza winkleri*
Rubiaceae	*Pavetta multiflora*
Rubiaceae	*Pleiocarpidia paniculata*
Rubiaceae	*Porterandia anisophylla*
Rubiaceae	*Porterandia pauciflora*
Rubiaceae	*Porterandia sp. indet.*
Rubiaceae	*Prismatomeris robusta*
Rubiaceae	*Psychotria ovoidea*
Rubiaceae	*Psychotria sp. 1*
Rubiaceae	*Psychotria viridiflora*
Rubiaceae	*Psydrax sp. indet.*
Rubiaceae	*Rennellia elliptica*
Rubiaceae	*Steenisia borneensis*
Rubiaceae	*Tarenna arborescens*
Rubiaceae	*Tarenna sp. indet.*
Rubiaceae	*Timonius eskerianus*
Rubiaceae	*Timonius flavescens*
Rubiaceae	*Uncaria gambir*
Rubiaceae	*Uncaria sp. indet.*
Rubiaceae	*Urophyllum arboreum*
Rubiaceae	*Urophyllum hirsutum*
Rubiaceae	*Urophyllum nigricans*
Rubiaceae	*Urophyllum sp. indet.*
Rubiaceae	*Xanthophytum brookei*
Rutaceae	*Acronychia sp. indet.*
Rutaceae	*Euodia latifolia*
Rutaceae	*Tetractomia tetrandrum*
Sapindaceae	*Allophylus cobbe*
Sapindaceae	*Lepisanthes fruticosa*
Sapindaceae	*Nephelium ramboutan-ake*
Sapindaceae	*Xerospermum noronhianum*
Sapotaceae	*Palaquium sp. indet.*
Sapotaceae	*Payena sp. indet.*
Scrophulariaceae	*Brookea sp. indet.*
Scrophulariaceae	*Brookea tomentosa*
Simaroubaceae	*Eurycoma longifolia*
Sterculiaceae	*Sterculia megistophylla*
Sterculiaceae	*Sterculia rubiginosa*
Sterculiaceae	*Sterculia shillinglawii*
Sterculiaceae	*Sterculia sp. indet.*
Sterculiaceae	*Sterculia stipulata*
Symplocaceae	*Symplocos adenophylla*
Symplocaceae	*Symplocos crassipes*
Symplocaceae	*Symplocos crassipes var. ernae*
Symplocaceae	*Symplocos fasciculata*
Symplocaceae	*Symplocos sp. indet.*
Taccaceae	*Tacca bibracteata*
Theaceae	*Adinandra dumosa*
Theaceae	*Camellia lanceolata*
Theaceae	*Eurya acuminata*
Theaceae	*Eurya sp. indet.*
Theaceae	*Gordonia sp. indet.*
Myristicaceae	*Myristica villosa*
Myrsinaceae	*Ardisia borneensis*
Myrsinaceae	*Ardisia breviramea*
Myrsinaceae	*Ardisia korthalsiana*
Myrsinaceae	*Ardisia sp. 1*
Myrsinaceae	*Ardisia sp. 2*
Myrsinaceae	*Ardisia sp. 3*
Myrsinaceae	*Ardisia sp. indet.*
Myrsinaceae	*Ardisia steiranthera*
Myrsinaceae	*Embelia sp. indet.*
Myrsinaceae	*Labisia pumila*
Myrsinaceae	*Maesa ramentacea*
Myrsinaceae	*Maesa sp. indet.*
Myrtaceae	*Syzygium castaneum*
Myrtaceae	*Syzygium caudatum*
Myrtaceae	*Syzygium confertum*
Myrtaceae	*Syzygium fastigiatum*
Myrtaceae	*Syzygium hirtum*
Myrtaceae	*Syzygium incarnatum*
Myrtaceae	*Syzygium lineatum*
Myrtaceae	*Syzygium megalophyllum*
Verbenaceae	*Sphenodesme triflora var. riparia*
Verbenaceae	*Teijsmanniodendron simplicifolium*
Verbenaceae	*Teijsmanniodendron sp. indet.*
Verbenaceae	*Vitex sp. indet.*
Vitaceae	*Ampelocissus imperialis*
Vitaceae	*Ampelocissus winkleri*
Vitaceae	*Cissus sp. indet.*
Vitaceae	*Pterisanthes grandis*
Vitaceae	*Pterisanthes polita*
Vitaceae	*Tetrastigma pedunculare*
Zingiberaceae	*Alpinia glabra*
Zingiberaceae	*Alpinia havilandii*
Zingiberaceae	*Amomum coriaceum*
Zingiberaceae	*Amomum sp. C*
Zingiberaceae	*Boesenbergia grandis*
Zingiberaceae	*Boesenbergia orbiculata*
Zingiberaceae	*Boesenbergia parva*
Zingiberaceae	*Boesenbergia sp. B*
Zingiberaceae	*Boesenbergia sp. C*
Zingiberaceae	*Boesenbergia sp. indet.*
Zingiberaceae	*Elettaria sp. B*
Zingiberaceae	*Elettariopsis sp. B*
Zingiberaceae	*Elettariopsis sp. C*
Zingiberaceae	*Etlingera velutina*
Zingiberaceae	*Globba atrosanguinea*
Zingiberaceae	*Globba brachyanthera var. rubra*
Zingiberaceae	*Globba sp. indet.*
Zingiberaceae	*Hedychium muluense*
Zingiberaceae	*Hornstedtia reticulata*
Zingiberaceae	*Hornstedtia scottiana*
Zingiberaceae	*Plagiostachys crocydocalyx*
Zingiberaceae	*Plagiostachys strobilifera*
Zingiberaceae	*Zingiber longipedunculatum*
Zingiberaceae	*Zingiber sp. D*
Rubiaceae	*Aidia sp. nov.*
Rubiaceae	*Argostemma hameliifolium*
Rubiaceae	*Argostemma sp. 5*
Rubiaceae	*Canthium confertum*
Rubiaceae	*Canthium horridum*
Rubiaceae	*Chassalia chartacea*
Rubiaceae	*Chassalia sp. indet.*
Rubiaceae	*Diplospora sp. indet.*
Rubiaceae	*Gaertnera vaginans ssp. junghuhniana s.l*
Rubiaceae	*Geophila pilosa*
Rubiaceae	*Gynopachis jambosoides*
Rubiaceae	*Hedyotis capitellata*
Rubiaceae	*Hedyotis congesta*
Rubiaceae	*Ixora brachyantha*
Rubiaceae	*Ixora caudata*
Rubiaceae	*Ixora pyrantha*
Rubiaceae	*Ixora sp. indet.*
Rubiaceae	*Ixora urophylla*
Rubiaceae	*Lasianthus borneensis*
Rubiaceae	*Lasianthus chryseus*
Rubiaceae	*Lasianthus longifolius*
Theaceae	*Gordonia sp.5*
Theaceae	*Schima wallichii ssp. crenata var crenata*
Thymelaeaceae	*Amyxa pluricornis*
Thymelaeaceae	*Aquilaria beccariana*
Thymelaeaceae	*Gonystylus borneensis*
Tiliaceae	*Microcos cinnamomifolia*
Tiliaceae	*Microcos henrici*
Tiliaceae	*Microcos hirsuta*
Tiliaceae	*Pentace erectinervia*
Trigoniaceae	*Trigoniastrum hypoleucum*
Triuridaceae	*Sciaphila densiflora*
Triuridaceae	*Sciaphila sp. indet.*
Ulmaceae	*Gironniera hirta*
Ulmaceae	*Gironniera nervosa*
Ulmaceae	*Gironniera parvifolia*
Urticaceae	*Elatostema sp. 2*
Verbenaceae	*Callicarpa havilandii*
Verbenaceae	*Callicarpa pentandra*
Verbenaceae	*Clerodendrum myrmecophilum*
Verbenaceae	*Clerodendrum sp. indet.*
Verbenaceae	*Sphenodesme racemosa var. racemosa*
Verbenaceae	*Sphenodesme sp. indet.*

Full Reports

Butterflies by V. Hitchings

Two data sources have been used to compile a list of butterflies for the Teraja- Labi area, field visits and a review of historical data. The information was compiled to generate the list of the butterflies presented here.

The field visit was made on 18th April 2010 from 09.30 to 16.00. The area examined was chiefly around the Teraja Longhouse and the adjacent forest along the river and the paddy fields.

Historical Records provide a wealth of data on the butterflies of the Teraja-Labi area and provide data from more field hours than could otherwise be undertaken in a short space of time. In 1986 R.R. Herd prepared a volume entitled 'A Photographic Reference List to Bruneian Butterflies'. This volume compiled a photographic record of set specimens from the butterfly collections of R.R. Herd, Gys Boot, Rodger Fullbrook, Mickle Schreurs, Richard Stewart and Alan Stubbs. Nine of the locations in the volume are encompassed by the current area of interest or are sufficiently close to be significant. The locations are as follows:

1. Labi Road - Belait River, 60m, all the collecting that I have done here was along the dirt road. The surrounding vegetation is secondary forest and scrub.
2. Kampong Ubok Ubok, 60m
3. Milestone R.10 (Sungai Rampayoh milestone), 100m, an area of primary forest bordering a logging track
4. Labi Ridge, 200m, Primary lowland forest.
5. Labi, 60m, A cultivated area amongst secondary forest and scrub
6. Labi - Rv. Rampayoh, 60m, there is a path here that leads to 'the waterfall' - both lowland primary and secondary forest is located here.
7. Labi - Rv. Menderam, 60m, there is a path here leading to two waterfalls. Both lowland primary and secondary forest is located here. Past Labi on Roadside, 60m. Once the Labi Road crosses Sungai Rampayoh it becomes a dirt road, bordered by scrub and secondary forest. Behind this vegetation lies swamp forest to the west and lowland primary forest to the east.
8. End of Labi Road and Sungai Teraja, 120m, lowland primary forest.
9. Bukit Teraja, 442m, lowland primary forest.

The species list that includes the locations above includes a list of 170 butterflies in the area. Under the Darwin Initiative a collaborative project was undertaken between the Universities of York and Leeds, in the U.K., the natural History Museum in London, the Institute for Tropical Biology and Conservation Universiti Malaysia Sabah and the Forest Research Centre Sabah Forestry Department. The aim was to develop predictive tools for targeting Conservation Efforts in Bornean Forest Reserves. As part of the initiative a database, dubbed D2B2, was created with distribution information for butterflies on Borneo (i.e. Malaysia (States of Sabah and Sarawak), Indonesia (Kalimantan) and Brunei Darussalam). Data contained within the database were extracted from information on the labels of museum specimens. Data were collected in 2006-07 from a total of 10 museums in Malaysia, Brunei, UK, and the Netherlands. Additional information was also obtained from 12 published Journal papers, two field reports and two University PhD theses. It should be noted that these data cover three butterfly families, the Papilionidae, Pieridae and Nymphalidae). Three locations occur within the Labi-Teraja area:

1. Rampayoh mixed dipterocarp forest
2. Labi Road [adjacent to Rampayoh]
3. Bukit Teruja

The list of butterflies from these locations has been extracted from the database (table 3). Field work by the author added several species to the list from historical records and these are marked [VHH]. In total 233 species have been recorded from the study area.

Pathysa antiphates itamputi – Fivebar Swordtail,Longhouse, Teraja

Graphium sarpedon luctatius Bluebottle & ***Graphium doson evemonides*** – Common Jay, Teraja, Paddy field

Allotinus horsfieldi nessus - Horsfield's Darkie, Teraja

Cirrochroa emalea ravana-The Malay Yeoman, Teraja

Conclusions

- ✓ **A total of 233 butterfly species have been recorded from the study area**. It should, however, be noted that this list is not exhaustive and without doubt more species are to be found and recorded.
- ✓ **The most significant butterflies** on the current list are ***Trogonoptera brookiana brookiana*** Rajah Brooke's Birdwing and ***Troides miranda Miranda*** The Miranda Birdwing. These are both protected species according to the CITES treaty.
- ✓ Butterflies are known to be environmentally sensitive organisms, hence their use in the Conservation of Bornean Forest Reserves project. The list of species **in this study provides a baseline for any future butterfly studies for Labi-Teraja.**

References

Herd R.R. 1986, 'A Photographic Reference List to Bruneian Butterflies'. PNHS Collection.

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Teraja Fish survey 17-18 April 2010 recorded by Novi Yus

Team led by Etienne. Participants: Nick, Novi, Amelie, Rainette

Program:

Wasai Teraja 17 April. Stop at 4 different fishing areas
Time: 13.00 pm finish at 15:00 pm; cloudy and some times rain.

Wasai Beludok 18 April. Stop at 3 different fishing areas.
Time 9:00 am finish at 11:00 am

Equipment:

Small net held by 2 long poles, 1 m wide; wide throw net, 2,5m long and 5m wide, with long rope at the end of the net; 2 small round nets, each 30 cm wide, 40 cm high; 2 buckets

Ecology and Habitat:

Wasai Teraja

Wasai Teraja is fed by several streams with waterfalls from the drainage area up to the watershed between Teraja Protection forest and Brunei national border. The forest beside the river was rich in vines and undergrowth, Plant debris litters the forest floor and many big log have fallen across the river. The canopy is thick and continuous, the soil damp and sandy in most places. Stream was clear but in some places slightly muddy from soil erosion.

We started to walk from Teraja Longhouse follow the foothpath to the forest, first stop in the wide river near the landslip that exposed a rocky slope. Then continue to sandy area where the path crosses the sg not far from the first stop. The third stop was at the first Teraja waterfall which is quite far from the first and second sample area's. The fourth stop is imediately upstream from the waterfall, which required a short climb.

1. First stop, after the secondary forest mix with bamboo forest. Soil and rock erosion is prevalent. Several treefalls both on the land and in th river result result is stagnant water ponds, that form a safe hiding place for the fish. We used a large throw net and caught many fishes from 1 family. 3 times netting with the same result we decided to move on.

One family, 8 fish specimen, size from 4 to7 cm. Family: Cyprinidae Genus Puntius

2. Second stop, resembled a sandy beach area, with sandy soil at the flat open area and muddy fine clay on the sides and bottom river, here the forest had opened up. The river runs clear, 30cm to 1 meter deep and 2-4 m wide river. Low current were some places along the river are calm and near stagnant. We used both the throw net and fish net here. The halfbeak fishes were caught easily by small net, after observing its movement from above. The bigger fish from Cyprinidae family were caught in deeper water using the throw net.

Two different familis, have 3 different species and more than 10 specimens. Fishes range from 5 cm to 17 cm. Family: Hemiramphidae and Cyprinidae

3. Third stop, at the Teraja waterfall. The bottom stream is silt, with rounded sandstone pebbles and smooth porous friable sandstone rocks covered with algae. The water is slightly muddy. Wide open area and on bothe sides the waterfall has thick forest canopy. We used the bottom net; (a long net weighed down with stones, resting on the bottom of the river). Leave it for an hour and collect it later. Also use throw net and netting. We didn't find any fish here. In front of the deep pool, the river passes a shallow rocky, stoney area were water become clear and in some places had strong current especially at narrow stream where the turbid water moves around big rocks. The water vegetation with wide spread branches and small leaves, has strong spread roots rooting in the rocky soil under the water. Etienne throw net several times at several places on this area. But we didn't catch any fish here.
Note: when swimming in the waterfall several times previously, we saw small fishes and shrimp in the water nearby us and felt the pinch from their bites, the absence of the fish on the research day probably due to a flash

flood caused by the heavy rain the night before on 16 April 2010.

4. Fourth stop upstream above the waterfall. Here few cascading small waterfalls and calm stream. The bottom of the stream is smooth sandstone, slippery from algae. As the stream near to the end of waterfall the movement of the water is quite fast as a result is no detritus found in the bottom, only in a few places were it caught by roots. Observed from above it has small prawn and small fishes which we can't identify and could not catch as they were very agile. We uses throw net and catch school of young fish.

Family: Channidae, more than 20 specimens some we released back to the water.

Beludok Waterfall

Is a more than 30m meter high rocky waterfall with debris of logs, branches, stones and big rocks at the bottom, no distinct pool, the stream is not wide with shallow water about 20 cm to 60 cm deep. Surrounded by large rocks and thick forest. We start from the waterfall as the first sample location, then the small stream nearby. The third stop is nearby the waterfall as well but at wider stream.

1. First stop is on the Beludok Waterfall area, the area is littered with many logs and rocks, and the stream water is shallow, clear and appears calm. The bottom of the stream is rocky, subrounded gravel, at some part under the big rocks area is sandy soil about 20cm to 40 cm deep, were small shrimps and small fish find a hiding area. We observed the fish from above and caught using the small net.

One Family: Cyprinidae 1 specimen; 4 cm long and we released the specimen back to the water after taken a photograph. Later we can't determind the genus of this small specimen, should keep the specimen for further identification. The other fish is Genus: Rasbora

2. Second stop not far from the waterfall, has a lot of logs, branches and debris. The bottom is rocky, stone as well gravel and falling trees

1 family: Cyprinidae, 1 speciment and we released back to the water after photograph.

3. Third stop is on the stagnant water like a pond, the canopy is open up with many palm and rattan trees. The water is calm; the bottom of the stream is muddy, clay soil with debris from florest floor, many fallen leaves and dead branches. This area is rich with small fishes as many detritus at the bottom of the stream. It is a deep stream with many hiding places for the fishes making it very dificult to catch, try several times with throw net but the net was caught by spiny vegetation and dead branches beside the narrow river. We should use different method and equipment in the future. Caught 1 juvenile, possible halfbeak fishes and released back after the photograph. Didn't determine the family of this fish as it is dificult to identify the juvenile fish's size less than 1 cm.

Appendix 2. Preparation and HSE

PNHS Teraja survey weekend April 17-18 2010 preparation notes

Meeting point: Teraja longhouse at 10.30 on Saturday

Program for the weekend April 17,18 (times are indicative/flexible):

On the weekend April 17,18, we plan a short program discussion at the Teraja longhouse, an initial screening of the area, and we will start the survey. The survey can be continued in follow-up weekends as appropriate per survey topic.

10.30 Arrive at longhouse; Discussion of objectives, program, area and organization of survey
12.00 Lunch at longhouse
13.30 Easy walk to waterfalls and start of survey by participants
17.30 End of main program and option to return home

For those who stay overnight:

Dinner
Possibility of night walk
Next day: Continue initial survey.

Organisational responsabilities

Overall coordination	Peter Engbers & Jacqueline Henrot & Hans Dols
Longhouse liaison	Hans Dols & Novi Yus
Scientific program coordination	Jacqueline Henrot
HSE coordinator	David Mendes
Journey Management & Welcome	Silene Engbers
Food managers	Folkert Hindricks, Tom Crampin

Expected outputs of the survey:

1. Annotated checklists of biota, highlighting the biodiversity of the site, the species of conservation concern and the common species (likely to be spotted by tourists. Photographs and short description (aspect and habitat) of selected species.
2. Annotated trail maps of the Teraja area, with length, hardship, habitats, highlights etc.
3. Teraja biodiversity photo album, checklists and selected trail maps (printer friendly) downloadable maps from the PNHS website.

Goals of the survey:

The survey should result in an appraisal of its flora, fauna, folklore, as well as an evaluation of its eco-tourism potential, in specific:

- raise the profile of the area to promote its conservation,
- gather scientific evidence of its value for conservation,
- provide an overview of the ecotourism potential of the area
- involve the local community in the conservation effort and the ecotourism development

By explicitly describing its value in terms of biodiversity and potential for ecotourism, we hope to have leverage material to lobby for its conservation/protection.

Significance of the Teraja area:

- It is a piece of fairly undisturbed forest that is quite accessible and eco-touristically interesting
- It is used by local people who still hold the traditional knowledge & legends
- New plant taxa have been described from the area and researchers value the site.
- It holds various habitats: swamp, ridge, waterfalls, rivers - therefore a diverse flora and fauna.
- It is under threat by developments as highlighted in PNHS report to the HoB council

Participation for weekend April 17,18 (status as per April 10)

		First Weekend			Further work	
Name	Topic	17-Apr	18-Apr	night 17@ longhouse	Period	High Sens GPS
Vic Hitchings	Butterflies	N	Y	N		?
Joseph Koh	Spiders	N	N	N	later	?
Etienne Loubens	Freshwater fishes	Y	Y	Y		?
Ulmar Grafe	Frogs	Y	N	N	Early April	?
Sandra Goutte	Frogs	Y	N	N	Full Month April	Y
Hanyrol Hanyzan	Frogs	?	?	?	Full Month April	?
Hans Dols	Reptiles, Trail mapping, Geo	Y	Y	Y		Y
Axel Geisslinger	Mammals	Y	Y	Y		?
Tom Crampin	Birds	Y	Y	Y		?
Folkert Hendricks	Birds	Y	Y	Y		?
David Edwards	Ferns	N	N	N	later	?
Hajah Kamariah Abu Salim	Angiosperms	N	N	N	later	?
Joffre	Angiosperms	N	N	N	later	?
Arifin	Angiosperms	N	N	N	later	?
Mohamed Abdul Majid	Bryophytes (mosses & liverwo	N	N	N	later	?
Kushan Tennakoon	Parasitic Plants, Land use	N	N	N	later	?
Jacqueline Henrot	Plants	Y	Y	Y		?
Nick Hoggmascall	Fishes	Y	Y	?		?
Novi Yus	Forest use /Local folklore	Y	Y	Y		?
Jackie Maskall	Forest use /Local folklore	Y	Y	?		?
Peter Engbers	Trail mapping, Field assistant	Y	Y	Y	Need follow up for long trails	Y
Douwe de Vries	Trail mapping, Field assistant	Y	Y	Y	Need follow up for long trails	Y
David Mendes	Trail mapping, Field assistant	Y	Y	Y	Need follow up for long trails	Y
Iwan de Lugt	Trail mapping, Field assistant	Y	Y	Y	Need follow up for long trails	?
Silene Engbers	Journey Management	Y	Y	Y		
Rainette Engbers	Field assistant	Y	Y	Y		
Intan Dols	Field assistant	Y	Y	Y		
Coenraad Dols	Field assistant	Y	Y	Y		
Aru Dols	Field assistant	Y	Y	Y		
		20	**19**	**16**		

Team composition for April 17/18

Teams	Team suggestion April 17-18		Trail mapping (HS GPS)	
In field	**Team composition**		**Mapping + Track**	
Butterflies + Plants	Vic Hitchings	Jacqueline Henrot	David Mendes	Jackie Maskall
Freshwater fishes	Etienne Loubens	Novi Yus	Nick Hoggmascall	
Frogs	Ulmar Grafe	Hanyrol Hanyzan	Sandra Goutte	
Mammals + Reptiles	Axel Geisslinger	Iwan de Lugt	Hans Dols	Peter Engbers
Birds	Tom Crampin	Folkert Hindricks	Douwe de Vries	
Dedicated Trail mapping Team 1	Peter Engbers	David Mendes	Iwan de Lugt	
Dedicated Trail mapping Team 2	Hans Dols	Douwe de Vries	Axel Geisslinger	
At longhouse				
Geology & history	Nick Hoggmascall	Hans Dols		
Forest use (food, medicine, crafts)	Novi Yus	Jackie Maskall		
Local folklore /legends	Novi Yus	Jackie Maskall		

Role of the PNHS:

- liaise with the Teraja longhouse (which would host the survey and will be paid for their help)
- contribute as field assistants
- compile & if necessary edit the survey reports
- publish the survey results on its website
- map the trail systems

Cost

Participants are expected to volunteer their time, expertise, survey equipment, and make own transport arrangements (car pooling!?). The PNHS will cover the cost of food & accommodation & services as provided by the longhouse (for weekend Apil 17-18)

Organisation

All participants are responsible for own transport to longhouse. Suggest to car pool. We can make arrangements on pre-meeting.

All people should take their own survey material and tour/safety provisions. All teams should take first aid equipment, safety provisions, some food, and water.

The night at longhouse is on the public front area floor. Please take your own mattress and sleeping needs. There is no shower. Washing can be in the river.

PNHS will together with longhouse take care of lunches, breakfast, and dinner.

Suggested Items to bring:

1. Global Positioning System (GPS)
2. Personal First Aid Kit
3. Whistle and Pocket knife
4. Insect repellent
5. Flashlight (spare bulb and extra batteries) or Head lamps, strong night lamp
6. Camera (extra batteries), binoculars
7. Leech Socks and extra socks
8. Hat and Rain Coat
9. (Long) Sleeved T-Shirts, (Long) Pants for during trekking, Swim wear, and towel
10. Extra clothes
11. Slippers, Trekker Boots
12. Spare Plastic Bags (to store camera in case of rain and to pack clothing)
13. Drinking Water
14. Garbage Bags , Water tight proof bags
15. Backpack
16. Mattress and sheet bag (blanket/sleeping bag for cold blooded)
17. Personal Toiletries (tooth brush, paste, body soap, shampoo, toilet paper and etc.)
18. Personal Items (plastic food container i.e. plate, fork, spoon and cup?)
19. High energy snacks (+lunch box?)
20. Survey equipment

Suggested shopping list (1 dinner, 1 breakfast, 2 lunches) for food management team

- Water
- Coffee/Tea/Sugar/Milk
- Juice
- Drinks
- Bread
- Jam
- Peanut butter
- Carrots
- Apples
- Snacks and energy bars
- 1 Evening meal (together with longhouse food??)
- Toilet Paper

Trails recommended for survey and trails to explore

Trails recommended for survey (see maps). These are recorded and available for download to GPS:

- Teraja waterfalls
- Bkt Teraja from road and from Teraja waterfalls
- Mendaram waterfalls
- Rampayoh waterfalls
- Telingan waterfalls

Trails to explore and record:

- Beludok waterfall from longhouse
- Further continue along Teraja river past waterfalls towards border
- Confirm trail from Teraja waterfalls upto ridge on way to Bkt Teraja
- Old Teraja-Marudi log walk (tracks into peat swamp)
- Tracks through rice paddies opposite longhouse
- Bkt Teraja- Rampayoh waterfalls (full day)
- Mendaram- Rampayoh waterfalls
- Record new Bkt Teraja forestry road
- Any entrances from East (Belait ridge logging road)?
- Any other?

Trail info to prepare:

- GPS track
- Category
- Length and time
- Points of interest (viewpoint, waterfall, etc)
- Habitat and natural history points of interest
- Special points (warnings, risks, highlights)

Participants & Topics

Vic Hitchings	butterflies
Etienne Loubens	fishes
Ulmar Grafe	frogs
Sandra Goutte	frogs
Hanyrol Ahmadsah	frogs
Joseph Koh	spiders
Hans Dols	reptiles, trails
Axel Geisslinger	fishes, mammals
Tom Crampin	birds
Folkert Hindricks	birds
Jacqueline Henrot	plants
Nick Hoggmascall	fishes
Novi Yus	forest use, fishes
Jackie Maskall	Insects, forest use
Peter Engbers	trail mapping, ecotourism
Douwe de Vries	photography
David Mendes	HSE, photography
Iwan de Lugt	photography
Alex Cobb	

<u>Support</u>
Silene Engbers
Rainette Engbers
Amelie Loubens
Intan Dols
Coenraad Dols
Aru Dols

Best regards,

For PNHS,

Peter Engbers, Jacqueline Henrot, Hans Dols,

HSE Plan prepared by David Mendes

Emergency contact directory:

Gov. Ambulance emergency -	991 – coordinated by KB hospital – nearest ambulance
BSP emergency	337-2999 or 3229999
Panaga Medical emergency	337 2200 – can coordinate a medical emergency
Government BOMBA -	995
Search and rescue coordination center (army)	998
Switchboard	2423901 / 2459500

Other contacts:

SG Liang Clinic		32304287 /438
24 hours ambulance; Doctor –office hours		
Labi Clinic (Thursday s only)		3233210 /216
Panaga Duty Doctor		337 3779
BSP Bomba-Control Room		337-4116
Belait District Officer		
Hj Jamain B Hj Momin	Office	:3334566
	(D/L)	3331600
	Home	:3334269
	Fax	:3331848

What to do in case of emergency @ location? Personal injury.

- Raise alert to base camp if possible
- Make area safe and ensure your own safety before intervening
- carry any injured person to safety
- Take your position on GPS and try to establish contact with base camp via sms / radio providing details of emergency and GPS coordinates
- Assess situation and best course of action (head back / wait for help)
- Communicate your decision to base camp and plan.
- You may have to look for signal in high areas or call for help in no communication possible – care should be taken not to get lost.
- Any victim should be accompanied by another person at all times
- Stretcher available at base camp
- Bomba and search and rescue team can be activated in serious case

What to do in case of emergency @ base camp

- Obtain details of injury and exact coordinates (confirm by repeating back)
- Assess situation and call for ambulance / bomba if required.
- Obtain information from medical team if needed on what to do.
- Call all teams to base camp to head count and support any rescue.
- Ultimately Search and rescue team can be activated.

What to do not to get lost:

- Ensure that you have registered at the base camp and provided details of you plans and expected time back
- Always stick to the group (min 3 pax) and do not wander on your own.
- Monitor compass to have a feel for your bearing
- Return to base in case of GPS failure
- Watch for other members of the team and do not allow them to split from group.
- Carry extra supplies of energy food and extra water and or purifying tablets

What to do in case you get lost

STOP > Sit, Think, Observe and Plan.

- **Stay Calm and Stay Where You Are.** If nobody is in danger, then don't move. Wandering in the forest only befuddles those searching for you.
- **Take note of your position.** Try to establish contact with base camp and provide your position or last known position / area.
- **Prepare Your Own Signals.** Be aware of rescuers trying to signal and make contact with torchlights, whistles, tree drumbeats or shouts.
- **Take an Inventory of Supplies.** Water, food, dry clothes and material for shelters are all essential items.
- **Conserve Body Heat and Energy.** Do not risk getting cold or wet to allow hypothermia to creep up; wear multiple layers and stay under shelter.
- **Move Away From Hazards.** Don't risk your safety being exposed to strong winds, rain or lightning, move nearby and leave a sign - trail tag or rock marker - at your last stop.
- **At Dark, Get Rest.** Don't travel at night and light a fire if possible; switch-off on guard duty to watch for rescue signals.

How to deal with:

Snake Bite:

Signs of Snake Bites

If you have to walk in high water, you may feel a bite, but not know that you were bitten by a snake. You may think it is another kind of bite or scratch. Pay attention to the following snake bite signs.

Depending on the type of snake, the signs and symptoms may include:

- A pair of puncture marks at the wound
- Redness and swelling around the bite
- Severe pain at the site of the bite
- Nausea and vomiting
- Labored breathing (in extreme cases, breathing may stop altogether)
- Disturbed vision
- Increased salivation and sweating
- Numbness or tingling around your face and/or limbs

What To DO if You or Someone Else is Bitten by a Snake

- Remain calm. Two out of 3 victims are injected with very little or no venom. In the latter case, no specific treatment is required. Venomous snakes use their venom to kill their prey. If molested, they bite in defence, and usually do not inject their venom.

- Identify the snake if it is safe to do so. This is very important if the doctors are to give the right antidote. Injecting the wrong type of antivenin is not only useless, but may also endanger the victim's life.
- Apply first aid if you cannot get the person to the hospital right away.
    - Lay or sit the person down with the bite below the level of the heart.
    - Tell him/her to stay calm and still.
    - Cover the bite with a clean, dry dressing.
- DO NOT attempt to cut or suck the wound. Apply a simple bandage and keep the bitten area lower than the level of the heart if possible. Go to the hospital, do not await the development of symptoms. If you are the victim and all alone, then walk slowly. Do not run for help.
- The correct antivenin is the only treatment of proven value. Panaga Health Centre stocks antivenin of all commonly encountered snakes in Brunei, and doctors are capable of treating snakebites and cases of adverse serum reaction and shock.
- Prompt medical treatment, reassurance and bed-rest are the keys to a full recovery.

Insect bites and stings (severe reactions):

1. Bites on mouth or throat / multiple bites – return to base.
2. Check the person's airways and breathing. If necessary, call emergency and begin rescue breathing and CPR.
3. Reassure the person. Try to keep him or her calm.
4. Remove nearby rings and constricting items because the affected area may swell.

General steps for most bites and stings:

1. Remove the stinger if still present by scraping the back of a credit card or other straight-edged object across the stinger. Do not use tweezers -- these may squeeze the venom sac and increase the amount of venom released.
2. Wash the site thoroughly with soap and water.
3. Place ice (wrapped in a washcloth) on the site of the sting for 10 minutes and then off for 10 minutes. Repeat this process.
4. If necessary, take an antihistamine, or apply creams that reduce itching.
5. Over the next several days, watch for signs of infection (such as increasing redness, swelling, or pain).

Risk assessment matrix

Ref.	Guide word / Hazard	Threats / consequences	Controls	Recovery	Team Review	Actions
1.	Communications	1. Unable to call for help timely in case of an emergency 2. Rescue team unable to locate party to be rescued 3. Unable to contact emergency line / hospital	Teams of 3 Radio with sufficient battery GPS (2 for long journey) Mobile phone SMS including base camp Mark trail with paper? Long trails/		Is SMS a realistic communication means? How are we gng to communicate for the longer trails? No radios ok, but in case victim cannot move one party needs to obtain rescue or attempt to establish contact via SMS/phone and provide coordinates. Other party to stay with victim Whistle included as part of the equipment list.	1. Borrow radios? – check TSW 2. Provide mobile phone number @ the base to all participants 3. All participants to carry and provide their mobile phone number. 4. Establish protocol for GPS coordinates 5. Briefing: Ask personnel if they can obtain coordinates from the GPS – right format 6. Brief all on protocol for GPS coordinates. 7. List of emergency contacts at base camp 8. Base camp has a phone? Number? 9. Prepare emergency contacts list - david 10. Emergency contacts list to be available at the base camp 11. Carry toilet paper to mark trail
2.	Evacuation	4. Unsure on what to do in case of an emergency /@ location/ @ base camp 5. Unable to carry casualty to safety / ambulance 6. Ambulance taking too long to arrive at teraja 7. Unable to establish the best / shortest method to recover casualty	Guideline " What to do in case of emergency" Briefing at the start of the survey Portable Stretcher available Establish best means of evacuation depending on condition of casualty Identify nearest ambulance (Telisai bomba?) Journey plan for long expedition and possible evacuation points	Stretcher at the base camp 1 First aid kit First aiders(if possible) Teams of minimum 3 people Pre-defined itinerary to allow for quick rescue GPS protocol via SMS Radios Emergency numbers at base camp; team members numbers at base camp Organise rescue party but without adding any risks Ultimately Contact Bomba / Army	Nearest medical clinin is at Mukim Labi 3233210 next nearest is at Bukit Sawat 3239673 http://www.information.gov.bn/bruneidiary_content/hospital_clinic/hospital.html	12. Prepare guideline What to do in case of emergency" to be given to all participants 13. Collect portable stretcher from panaga clinic (emergency section) 14. Carry out briefing at the start of the survey to include all participants on what to do in case of an emergency 15. Call Mukim Labi clinic to verify contact and resources available at the labi clinic (doctor + ambulance?) 16. Prepare journey / evacuation points prior to journey (long trails)
3.	Overall management of teams	8. Confusion on where people are, what they are doing and what time they are returning / 9. false emergency/ failing to identify an emergency	Registration point (POB) for anyone going into/out of the forest. Team composition, sign in sheet with Time in/location/ expected time out Central Board to reflect location of different teams " Planned itinerary" sheets			17. Prepare registration sheets 18. Brief personnel on sign-in/out rules 19. Carry and install board at base camp 20. Prepare "planned itinerary" Template sheets to be placed at the base camp. 21. Brief key personnel on emergency communications -

1.	Personnel getting distracted and lost Failure of GPS/ not knowing how to use it	1. Unable to find way back 2. Diverting too far from the planned itinerary 3. Extended period in jungle	Getting lost guidelines Use paper to mark itinerary Carry compass			1. Prepare guidelines if lost 2. Brief all on Guidelines if lost. 3. Brief – recommended to carry extra energy food / water/ purifying tablets 4. Add compass + purifying tablets to list of equipment
2.	Environmental Hazards					
	;swelling water at the rivers /				No issue?	
	Rocky / slippery trails around river, waterfall plateau	4. Ankle injuries / fractured limbs / head injury	Team of Experienced trekkers Shoes with good grip No haste in any instance Care for less experienced members	Refer to Evacuation		5. Each team to carry first aid kit – will try to borrow from TSW 6 sets 6. Each team to have a first aider (if possible) 7. Identify first aiders among team members (any?) 8. Prepare journey plan for long journeys
	slippery slopes; water fall plateau and ridge	5. Fall and injury; inability to rescue / recover person		Rope at base camp? Evacuation	Maybe an issue on ridge and waterfall plateau areas	9. Brief of personnel to take care on waterfall plateau and ridge; look out for one another; shout for any hazards 10. Purchase rope? To be available at base camp?

	poisonous plants and animals;.	1. Health hazard / skin/ eye reactions			Possible due to nature of work	1. Brief all: not to touch if not sure; communicate to others accidental contact / reaction Go to base camp if any reaction develops Contact medical team
	lightning strikes;	2. Electrocution	Relocate to lower areas Stay away from major trees until storm passes		It is a possibility on ridge / primary forest	2. Mention in briefing / briefing notes
	bee and wasp stings; snake, spider, centipede	3. Anaphylactic shock; blocked airways (bites in mouth or throat); Death 4.	Snake bites or multiple bites; bite in mouth or throat – evacuate immediately to base camp – remain calm avoid exertion Take anti-histaminic if needed (insects) Sigle bite – observe follow guidelines	Retreat to base camp / evacuate / contact medical support on what to do	Low risk but possible	3. Brief personnel on mouth and throat bites, multiple bites and snake bites 4. Prepare guideline on snake / insect bites. 5. Provide anti-histaminic for base camp (David Mendes)
	and leech bites;				No issue	
	rattan thorns;	5. Eye injury; Infection	No Haste Warn others of hazards	Tweezers / FA kit Remove any thorns ASAP to prevent infection		6. Tweezers available at base camp / personal kit
	overexposure to wind, rain or sun;				Not an issue	
	cold and wetness;		Wind break/poncho/ spare dry shirt		May be an issue under rain or immobilized person due to injury	7. Add light poncho to list of equipment dry shirt for long trails
	tainted or no water		Carry extra water and water purifying tablets			8. Carry water purifying tablets (long trails)
1.	*Equipment Hazards*					
	improper jungle clothes				May be an issue for long trails with dense vegetation	9. Ensure adequate clothing for long trails
	; faulty torchlights; ill-fitting backpacks;					10. Carry spare batteries / bulb + ,more than one flashlight per team
	missing equipment parts; GPS ; Compass					11. Prior to departure use equipment list as a Checklist of equipment and check working condition
	poor footwear;	6. Common that old footwear's sole detaches				12. Note to check old footwear sole condition (long trails)
	too heavy gear;					13. Advise to travel light (long trails)
	lacking food and water supplies					14. Briefing notes - List recommended energy food to bring 15. Advise to take extra energy food just in case.
2.	*Human*					
	jungle experience;				Any participants with no jungle	16. Add question to indemnity form