



Sarawak
Biodiversity Centre

NATURE TRAILS

Guidebook

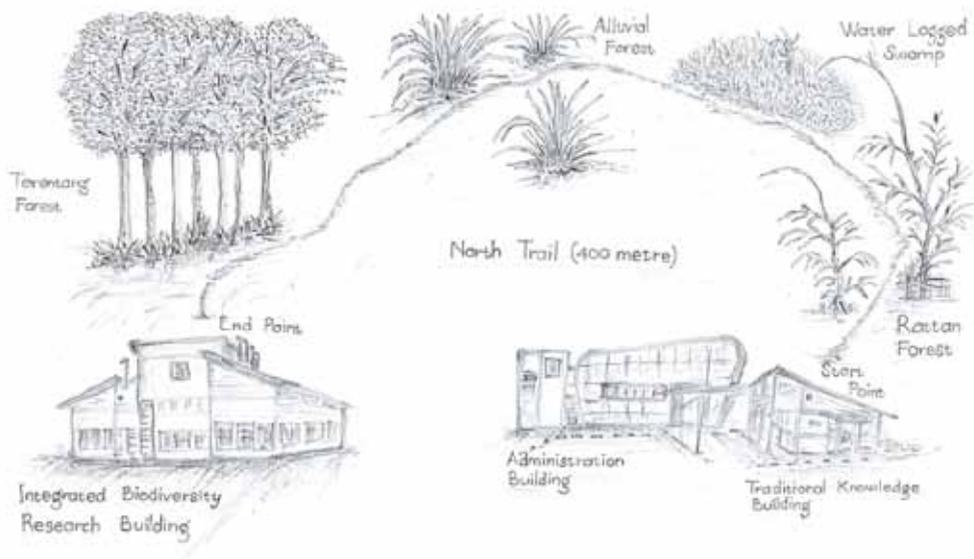
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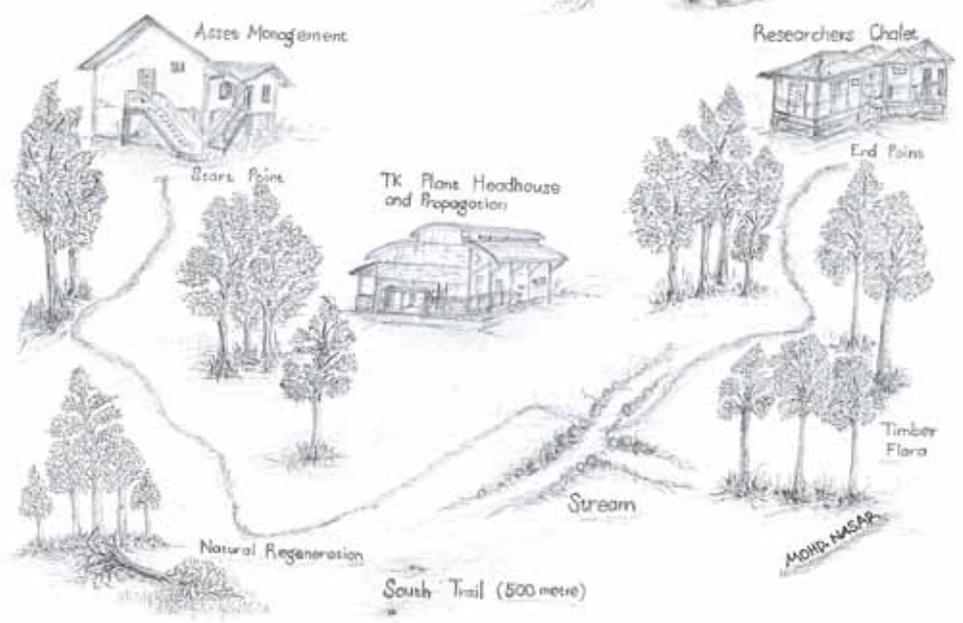
The Sarawak Biodiversity Centre thanks Dr Paul Chai P. K. for his valuable contribution in realising our jungle trails as well as for the write up for this trail booklet. SBC also acknowledges Rantai Jawa, Tinjan Kuda and Jugah Kudi for their assistance in marking out these two trails which are aimed at providing children, students and grown ups alike a learning and experiential jungle trek.

SBC also expresses gratitude to the Sarawak Forest Department and the Sarawak Forestry Corporation for the conservation of the Semenggoh Nature Reserve, within which SBC is situated.

SBC thanks the Sarawak Biodiversity Council, Chaired by State Secretary, Yang Berhormat Tan Sri Datuk Amar Haji Morshidi bin Abdul Ghani for his continuous support and encouragement in promoting appreciation and love towards Sarawak's natural heritage and forests.



Laila Taib Ethnobotanical Garden



Introduction

Sarawak Biodiversity Centre (SBC) South Trail and North Trail promote awareness in environmental education and conservation. This South trail - called the *Trail of Discovery* - is about 500 m long. It starts from a point in the north-west and comes out at the SBC's chalet in the north-east. The trail passes through a lowland rain forest which had been disturbed in the past, probably including some light logging for timber around the 1940s.

The forest of Semengoh is known as the mixed dipterocarp forest (MDF), so-called because members of the family Dipterocarpaceae make up some 30 to 60% of the timber volume. It is found on well-drained clay-loam soil, and its distribution in Sarawak stretches from the lowland to an altitude of about 500 metres above sea level. Above this altitude, the forest is called the hill dipterocarp forest. MDF has the richest diversity of flora and fauna compared to all other forest types. If you want to see a good forest in its original state, visit the arboretum in the Botanical Research Centre next door, managed by the Forest Department.

Members of the family, commonly called the dipterocarps are a valuable source of tropical timber, and help to make forestry the second most important earner of revenue in Sarawak after petroleum and natural gases. The timber species are known by their local names *meranti*, *selangan batu*, *keruing* and *kapur*.

South Trail - Trail of Discovery



Forest along the South Trail

The south trail forest may be divided into two sections. The terrain in the first section from the start point to 190-m is low and flat. The presence of many secondary species indicates that the forest has been partially cleared in the past, with additional disturbance caused by tree falls. Dipterocarps are rare and include *engkabang bintang* (*Shorea pinanga*) and *engkabang rusa* (*Shorea stenoptera*) planted by Forest Department some 60 years ago. These two species have flowered twice during the past several years, the more recent one around the end of 2014. Their dense seedlings are still visible on the forest floor.

The second section passes through MDF on gently ascending slopes, from after 190-m to the end of the trail. Past disturbance could have been due to selective tree felling for timber and collection of jungle produce. Many commercial-sized trees can still be found, such as species of *meranti*, *durian*, *gaharu*, *empili* and others.

Forest structure

The forest is multi-storey in structure, formed by trees occupying different canopy layers at different heights. The biggest and tallest trees form the emergent canopy, which is usually open and uneven because the trees are widely scattered. Below this emergent canopy is the main canopy where the majority of big and medium-sized trees are found. The third canopy layer below it consists of many trees and shrubs with smaller diameters. The fourth and lowest layer is the ground vegetation which is usually densely filled by countless small trees, saplings, seedlings and herbs.

The emergent and main canopy layers absorb most of the sunlight and protect the lower canopy trees which are less tolerant of sunlight. If the seedlings and herbs are suddenly

exposed to direct sunlight, many will suffer from water stress and die, especially the herbs which require a lot of water to survive. Studies have shown that in a primary forest, only about 5% of the sunlight reaches the forest floor. Another function of the tall canopy trees is to protect the smaller trees against damages by strong winds and surface soil loss.

Mechanism support

Trees and shrubs with woody stems secure anchorage with the help of a strong root system which can spread over a big area. In addition, many forest trees develop buttresses or stilt roots for additional mechanical support. Trees with buttresses and stilt roots tend to be quite common where the ground is swampy and unstable. Some non-woody plants also produce stilt roots, such as species of *pandan* (*Pandanus*).

Natural regeneration

Natural regeneration is the means by which the forest renews itself by growing new trees. Tree fall and mortality are a common phenomenon, and may occur naturally, or may be caused by erosion, landslide, wind storm, lightning or diseases. Forest ecologists have found that gaps created by tree fall are important in helping to open up the forest and creating the necessary light condition and space for species to regenerate.

The gaps are at first filled by sun-loving and fast-growing secondary species, comprising shrubs, climbers and ferns. Tropical rain forest trees flower and fruit simultaneously at 3 to 5 years intervals. This phenomenon is known as 'mast flowering', and is believed to be triggered by a rise in the temperature. During this time, numerous seedlings will be produced. In the forest along the trail, recent heavy fruiting around the end of 2014 has filled the ground with a dense carpet of seedlings of mainly *engkabang bintang* and *engkabang rusa*.

In spite of large numbers of seedlings produced, mortality is very high due to overcrowding and competition for space, light and food, and disease attacks. Only a very small proportion of strong and healthy seedlings will survive to become mature trees. Regeneration will help to close the gaps, but new gaps will be formed with more tree deaths.

Inter-relationships between plants

Forest plants live close to one another in equilibrium and harmony, and their inter-relationships are not very obvious. However, there are many plants which must depend on other plants at some stages of their lives in order to survive and multiply. The following are some examples.

(a) **Climbers.** Climbers have weak stems and need a host plant for support. Most climbers begin life on the ground. Small climbers, e.g. wild pepper, members of the grape family Vitaceae and cucumber family Cucurbitaceae climb by roots or tendrils, which are borne on the stems. Big climbers, also known as lianas, climb by twining or coiling around the host trees. They often have to reach the tops of the trees in order to receive maximum sunlight for photosynthesis. Many fall back to the ground again when the host trees fall or die. Hook climbers are also common, such as some members of the coffee family Rubiaceae.

(b) **Rattans.** Rattans are climbing palms. They have two whip-like climbing devices, called the cirrus and flagellum, each often exceeding one metre long. Cirrus is a modified section or extension of the long leafy branch, while flagellum is a sterile inflorescence that is borne on the leaf sheath. They are armed with downward pointing claw-like spines which easily hook onto nearby tree branches or leaf shoots, allowing the rattan to climb to great heights. They are so strong that pulling down a rattan plant often requires great strength and effort.

(c) **Strangler figs.** Figs belong to the genus *Ficus* in the family Moraceae, which also includes the jack fruits *chempedak* and *nangka*. One group of fig trees is called the strangler figs or strangling figs which is dependent on a host tree. A strangler fig may begin life as a normal seedling on the ground, or as an epiphyte on the branch of a big tree, from seeds deposited by some birds or monkeys. The young plant attaches itself to the host tree by a system of aerial roots, which grows from the bottom up in the case of the plant on the ground, and from the top down in the case of the epiphyte. The roots cling tightly around the trunk while continuing to increase in size and strength, causing the host tree to be slowly 'strangled' to death. By this time, the 'hollow trunk' formed by the roots will be strong enough to support the fig as an independent tree. In Sarawak, fig trees are protected by law because their fruits are eaten by many forest animals, especially gibbons and hornbills.

(d) **Epiphytes.** Epiphytes are plants that grow on the trunks or branches of living trees, and sometimes also on dead wood. They are different from parasites because they possess chlorophyll and are able to manufacture food by photosynthesis. Common examples are orchids, ferns and aroids. In the bird's nest fern (*Asplenium*), the dead leaves remain attached to the living plant and help to store water and trap fallen leaves of other plants and dust particles, which will become food for the plant. Mosses and liverworts are a group of small epiphytes that grow on tree trunks. They are commonly called *lumut*.

(e) **Saprophytes.** These are plants that grow on dead organic matter such as rotten tree trunks and animal droppings. Fungi are common examples. There are many species of fungi in the forest, and become visible only when they produce fruit bodies which we call mushrooms. Many mushrooms are edible but others are very poisonous. Fungi play a very important role in breaking down dead organic matter in the forest.

(f) **Lichens.** When a fungus and an alga live together, they are called lichen. They are an example of two plants living together for mutual benefits. Lichens often attach themselves on the bark surfaces of living trees and appear as small irregular patches of grey, green, yellow or orange.

Inter-relationships between plants and animals

Plants and animals depend on each other in many ways. Forest plants provide shelter and food for the animals. Insects (bees, butterflies), birds and bats help to pollinate the flowers. Fruit eaters like monkeys, deer and birds help in seed dispersal. Other examples of inter-dependence between plants and animals are the ant plants (e.g. some species of rattan, *Macaranga*, *Hydnophytum*), and insectivorous plants like the pitcher plants (*Nepenthes*). Ant plants provide shelter or a home for the ants, and the ants in turn protect the plant from harmful pests. Insectivorous plants like pitcher plants trap insects for food.

Another form of plant-animal relationship exists on the forest floor and in the soil. It is made up of a complex community of plants (bacteria and fungi), and animals (termites, worms and beetles). They feed on dead leaves and animals and other organic matter which they help to break down and return to the soil as plant nutrients. Without them, dead trees and animals would pile up like mountains. Many termites and their mounds can be seen along the trail.

Species diversity

Our rain forest is extremely rich and diverse in plant species. In the mixed dipterocarp forest at Lambir Hills National Park in Miri, some 1,200 species of woody plants are present in an area of just 52 hectares, not counting the non-woody herbs, climbers and epiphytes. Animals are even more numerous, and include insects, mammals, birds, reptiles and amphibians. In spite of

their large numbers, ecological balance is maintained that allows them to live in perfect harmony. Man is often responsible for upsetting the equilibrium of the natural environment by destroying the forest and habitats, over hunting and fishing, and polluting the rivers and water.

Forest and man

From time immemorial, humans have depended on the forest for food, building materials and medicines. Agricultural crops like rice, corn, wheat and barley, and fruits and vegetables were once growing wild in the forest before they were domesticated. The same goes for the animals. Many modern medicines such as penicillin to treat viral infection and quinine for malaria have their origins in plants. Even today, many people living in developing countries continue to rely on herbal medicines because they are cheap and easily available. Herbal medicines have also gradually found a foothold in western countries in Europe and America.

In Sarawak, some 50% of the population that live in rural areas still depends on the forest for construction timber, forest produce, wild meat and medicines. Many of these plants can be found along the trail.

Man is often unaware or takes for granted the vital importance of forests and green plants. Through photosynthesis, green plants take in carbon dioxide to manufacture carbohydrates and release oxygen that is needed to sustain life. Forests help to check soil erosion and floods, and protect life and properties. When rainwater reaches the ground, it is filtered through the plant roots and comes out of the rivers and streams as clean potable water for drinking and agriculture. Without the forest cover, rainfall will hit the ground directly and wash away the soils, which will end up in rivers and cause pollution.

The forest also acts as a carbon sink, referring to its ability to store excess carbon in the trees and on the ground. Forest clearing and burning will release this stored carbon into the atmosphere in the form of carbon dioxide, along with other green house gases that come out of factories and vehicles. When these gases are trapped in the atmosphere, they will cause the temperature to rise, leading to climate change and global warming.



E1

E1. *Dipterocarpus geniculatus* (*keruing kerubong*)

Family: Dipterocarpaceae

Keruing is related to *meranti* and *selangan batu* (both belonging to the genus *Shorea*), and to *kapur* (*Dryobalanops*). They are all producers of valuable timber. About 32 species of *keruing* occur in Sarawak. This species has a straight trunk with no buttress, and the bark is fissured and covered in small lenticels. *Keruing* timber is harder than *meranti* timber and is preferred for heavy construction.



E2

E2. *Cinnamomum javanicum* (*medang tija*)

Family: Lauraceae

Cinnamomum or *medang tija* are recognized by spiral arrangement of the leaves which have 3 or sometimes 5 main veins, and the bark and fresh leaves are strongly aromatic. It is commonly known as cinnamon. The bark is used in Chinese medicine to improve energy and enhance blood circulation. *Kulit manis* is widely used in cooking and for making curry powder.



E3

E3. *Clerodendron adenophysum* (*kempahit udok*)

Family: Verbenaceae

This small shrub grows in sunny areas at the edge of the forest. The plant has young angular twigs, big heart-shaped leaves, white flowers and rounded fruits seated on star-shaped calyx. Traditional use by the Iban community is to bathe a prematurely born and weak baby with a solution of the leaves for seven consecutive days. The solution is also used to treat foot infection that causes the skin of the soles to crack, due to walking bare footed in the forest.



E4



E4. *Shorea pinanga* (*engkabang langgai bukit*)

Family: Dipterocarpaceae

The genus *Shorea* is divided into *Red meranti*, *Yellow meranti*, *White meranti* and *Selangan batu* groups based on the colours and properties of the timbers. Some of the best timbers are produced by *red meranti* and *selangan batu*.

One group of *meranti* is called *engkabang* or illepe nut in English. The nut is used to make *engkabang* oil or *minyak engkabang*. The oil solidifies into a yellow product but melts easily when dipped into hot rice, giving the rice a fragrant and oily taste. Its commercial use is for making chocolates and cosmetics. Supply is irregular as the trees flower and fruit only once in three to five years. This tree was planted by Forest Department around the 1970s.



E5



E5. *Artocarpus obtusus* (*pala musoh*)

Family: Moraceae

The local Iban name *pala musoh* means enemy's head, referring to the hairy fruit which resembles a shrunk human head when dried. It is a species of wild jackfruit which is related to *nangka* and *cempedak*. They all produce white or sometimes yellowish latex which is often thick and sticky, used by children to trap birds. To prepare a bird trap, a stick coated with the latex is placed on a tree branch for the bird to land on.



E6

E6. *Selaginella conferta* (paku merak)

Family: Selaginellaceae

This fern-like plant grows in clusters in damp or shaded areas. The spores are borne at the tip of the frond. Many species have found their way in home gardens due to their beautiful appearance and forms.



E7

E7. *Labisia pumila* (*kacip fatimah*)

Family: Myrsinaceae

Kacip fatimah is well known for its medicinal properties. It has a short semi-woody stem and can grow to 60 cm tall. The long pointed leaves are reddish on the underside, the flowers are pink and the fruits ripen into a red colour.

Drinking a tea of the root is said to help to repair and firm the uterus muscles after childbirth. Penan will hang a plant at the doorway to keep away bad spirits, and pound the leaves and add some coconut oil to massage on baby's abdomen to remove winds or *angin*. Iban apply a paste of the fresh leaves to treat boils, burns and skin diseases.



E8

E8. *Alstonia angustiloba* (*pelai lilin*)

Family: Apocynaceae

Members of this family comprise trees and climbers which all produce abundant white or milky latex. *Pelai* grows into a big tree but the wood which is soft, light and non-durable, is used for making toys, bottle corks, or sometimes small canoes. Local uses of the latex are to treat smallpox, shingles or *kayap*, boils and cholera.



E9

E9. *Strychnos borneensis* (akar kayas)

Family: Loganiaceae

This big woody climber can grow to 35 m. It has simple opposite leaves, each leaf with three main veins. The plant contains a poisonous compound or alkaloid called strychnine which is used as a pesticide. In small quantities, it is used as a stimulant and laxative, and treatment for stomach ailments.



E10

E10. *Tetracera macrophylla* (akar memplas)

Family: Dilleniaceae

Seedling of this woody climber is easy to recognize by the rough hairs on the leaves which feel like sand paper, and the leaf stalk is grooved. The leaves are used as natural sand paper for polishing blowpipe and *parang* sheath. Water from the stem is taken for diarrhoea and cough, the roots are boiled into tea to treat painful urination and blood in the urine.



E11

E11. *Artocarpus chempeden* (*chempedak*)

Family: Moraceae

Chempedak, *nangka* and *terap* belong in the same family. Its oblong heavy fruits are borne on the tree trunk and main branches. In the secondary forest, the trees may either have been planted or grown from seeds discarded by man and wild animals after eating the flesh. Iban apply a paste of the fresh inner bark to heal wounds and prevent infection.



E12. *Anisophyllea disticha* (*mertama ribu*)

Family: Anisophylleaceae

This tree is included as an example to show how some unique and interesting features of a plant may be used for naming the plant. In this case, the genus *Anisophyllea* which means 'unequal leaves', refers to the very unequal leaf shape, while the Iban name *mertama ribu* refers to the number of small leaves which are too numerous to count.



E13. *Artocarpus anisophyllus* (*bintawak*)

Family: Moraceae

Bintawak is also a relative of *chempedak*, and is recognized by its big pinnate leaves which are lobed and up to 1 m long. Iban mix a little ash of the leaf with cooking oil to treat cuts and wounds, while the Selako people would hang a leaf at the front door to keep out evil spirits.



E14

E14. Regeneration of *Shorea pinanga* (*engkabang langgai bukit*)

This dense community of young trees has regenerated in gaps left by fallen trees, from seeds that were produced several years ago. Notice that tree growth is uneven, and the ones that are too weak to compete for space, light and nutrients will die. This is an example of natural selection.



E15. *Artocarpus nitidus* (*selanking*)

Family: Moraceae

This tree is also a relative of *nangka* and *chempedak*. The timber is hard and suitable to be used as house posts. The fruits are edible but sour.

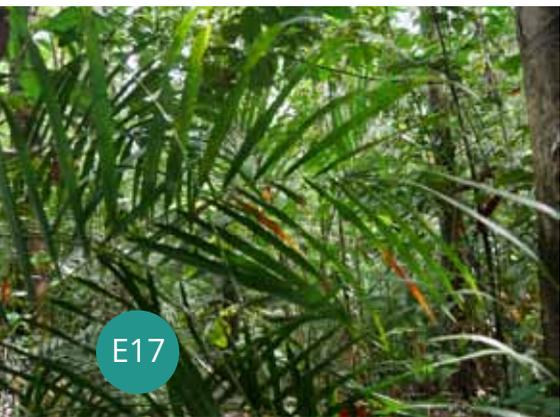


E16

E16. *Coscinium fenestratum* (akar badi)

Family: Menispermaceae

This climber has broad heart-shaped leaves which are whitish on the underside. One use among local communities is to chew a piece of the stem while drinking alcohol to avoid from getting drunk. The sap is applied to treat snake bites.



E17

E17. *Calamus* sp. (*wi dudok*)

Family: Arecaceae

This rattan is called *wi dudok* because it is stemless and 'sits' on the ground. It has pinnate leaves with narrow leaflets. The young shoots are eaten as vegetable.



E18. *Shorea macrobalanus* (*engkabang melapi*)

Family: Dipterocarpaceae

Engkabang merapi is actually a yellow *meranti* which is normally called *lun*. It is commonly found on clay-rich soil. The timber is good for general construction.



E19. *Ziziphus kunstleri* (*akar kuku menaul*)

Family: Rhamnaceae

The Iban name *kuku menaul* means eagle's claw, referring to the sharp thorns on the stems and branches. The leaves are alternately arranged with three main veins and finely toothed margin. In some species, sap from the stem is applied to treat mouth ulcer.



E20

E20. *Thottea rhizantha* (*sunti babi*)

Family: Aristolochiaceae

This is a small plant with moderate clustering habit. The semi-woody stem is often zigzag with swollen nodes. Dark red flowers are borne near the ground and often hidden in the leaf litter. There is a belief among the Iban that when a wild boar carries a piece of the plant back to its nest and a traveler steps on the plant by accident, he will suffer great pain on the leg, thus the name *sunti babi*.



E21. *Ceratolobus concolor* (*wi kijang*)

Family: Arecaceae

This rattan has big diamond-shaped leaflets with fishtail-like ends, and the leaflets are green on both sides. It can climb to 15 m using the long cirrus at the end of the leaf. The small cane may be used for tying and making baskets.



E22

E22. *Willughbeia anomala* (akar kupal)

Family: Apocynaceae

This big climber and the big *pelai* tree *Alstonia* belong to the same family and produce abundant white latex. The latex is applied to the skin to treat shingles or *kayap*. Some species produce nice and sweet *kupal* fruits while others do not. Penan will often cut down the host tree in order to get to the fruits on the tree top.



E23. *Koompassia malaccensis* (*menggris*)

Family: Fabaceae

There are two species of *Koompassia*, the other one is called *tapang* or *Koompassia excelsa*. They are the tallest forest trees often exceeding 60 m in height, and the crowns are rounded and massive. The two species are easily recognizable because *menggris* has reddish bark, while *tapang* has whitish bark. Both trees are protected in Sarawak as homes for the honey bees, as honey is an important minor forest produce. The timber is good for heavy construction such as railway sleepers.



E24

E24. *Pandanus kamiae* (kerupok)

Family: Pandanaceae

This wild *pandan* does not have a stem and grows on swampy ground up to 5 m tall. It is sometimes cultivated for its leaves which are used for making baskets and mats.



E25. *Goniothalamus longistipes* (*selukai*)

Family: Annonaceae

Species of *Goniothalamus* are generally called *selukai* or *kayu hujan panas*. They are all small trees of the understorey, and are related to *durian belanda* or soursop. The bark is aromatic, strong and stringy. The dry bark is sold as *kulit selukai*, and burnt to keep mosquitoes and evil spirits away. Penan chew the leaf stalk and swallow the juice as a relief for stomachache.



E26. *Shorea stenoptera* (*engkabang rusa*)

Family: Dipterocarpaceae

About 23 species of red *meranti* are collectively called *engkabang*. Eight species with big fruits are high in oil content, in particular *engkabang jantong* (*Shorea macrophylla*). *Engkabang rusa* is a medium-sized tree which is quite rare, and the nuts are relatively small. The timber is good for general construction.



E27

E27. *Goniothalamus macrophyllus* (*selukai*)

Family: Annonaceae

This species of *selukai* is recognized by its long big leaves. Like other species in the family, the tree is aromatic and the bark is stringy. The leaf stalk may be chewed and swallowed to relieve stomachache.



E28

E28. *Ficus* sp. (*akar engkuyal*)

Family: Moraceae

This is a young strangler fig tree which begins life as a climber on the host tree. The small roots that wrap around the tree trunk will grow and tighten and eventually 'strangle' the host tree to death.



E29

E29. *Aquilaria microcarpa* (*gaharu daun kecil, gaharu mit*)

Family: Thymelaeaceae

Gaharu produces a valuable scented wood also known as agarwood. The scented wood is actually a product of fungal infection which causes the wood to rot and produce the scent. Top quality *gaharu* is worth up to RM 30,000 in the global market, used for medicines, incense and ornaments like bracelets. Collecting *gaharu* is destructive because the tree is often cut down in order to know if the wood is infected. Wild resource is getting scarce, and countries like Malaysia, Indonesia, China, Vietnam and have developed plantations and inject the trees with fungal solutions.



E30. *Palaquium pseudorostratum* (*nyatoh babi besai*)

Family: Sapotaceae

This big tree with low plank-like buttresses also grows in the peat swamp forest, and produces slow-flowing white and sometimes light yellow latex. *Nyatoh* timber is used for furniture making and light construction. The fruits are eaten by wild animals like wild boar and civet cat.



E31. *Gnetum gnemon* (*akar dundun*)

Family: Gnetaceae

This plant belongs to a primitive group of plants called the gymnosperms, and has two forms. As a small tree, it is called *sabong*, and as a climber it is called *akar dundun*. Young *sabong* leaves are eaten as a vegetable. The seeds are also edible, and are called *emping* in Indonesia.



E32. *Pandanus* sp. (*pandan jankar*)

This terrestrial *pandan* has developed stilt roots for mechanical support. Stilt roots are commonly associated with plants growing on low swampy and unstable ground. The long leaves are arranged like a spiral, from which the English name 'screw pine' is derived.



E33

E33. *Garcinia brevipes* (*kandis susu*)

Family: Clusiaceae

This wild mangosteen has edible but sour fruits. The latex that exudes from the fresh bark is thick and whitish in colour, and the leaves are unusually big. Notice that the branches are uniform in size and much smaller than the main trunk. This kind of branching is called monopodial branching.



E34 & E35. Termite mounds

There are no less than 500 species of termites living in the forest. They are responsible for breaking down dead organic matter but also attack and kill living trees. Many build their nests in the ground, while others build mounds of various shapes and sizes, usually of clay and plant materials.



E36

E36. *Calamus comptus* (*witunggal*)

Family: Arecaceae

This small rattan has no cirrus at the end of the leaf and climbs with the help of flagellum, which is in fact a sterile inflorescence attached to the leaf sheath. Fertile inflorescences bearing many small greenish flowers hang from the mother plant. In some rattan species, the scaly fruits produce a red dye called 'dragon blood' which was traded with Chinese merchants in the 1800s. Some rattan shoots are eaten as a vegetable.



E37



E37. *Piper muricatum* and *Scindapsis*

Two epiphytic climbers are seen growing here on a young tree of *engkabang rusa* (*Shorea stenoptera*). The wild pepper *lada hutan* (*Piper muricatum*) has thin stem and small leaves, while *Scindapsis* (Araceae) has thicker stem and bigger leaves. Wild pepper root is used in Chinese medicine to treat joint pain and rheumatism.



E38

E38. *Pinanga crassipes* (pinang)

Family: Arecaceae

This handsome palm with a short stem is common in the forest in Semengoh. Young seedling leaves are light green and variegated. Short inflorescences bearing yellowish flowers are produced near the ground; the fruits are small and oblong, and turn bright red when ripe.



E39

E39. *Artocarpus elasticus* (*tekalong*, *pedalai*, *terap*)

Family: Moraceae

This is a common tree of lowland forest with plank-like buttresses, and is called *tekalong* or *pedalai* in Iban and *terap* in Malay. The leaves are big and deeply lobed at the young stage and later become entire. Each big hairy fruit contains many seeds with edible flesh.



E40



small nest of stingless
trigonid bees

E40. Epiphytes

The *tekalong* tree in E39 is laden with four species of epiphytic ferns and one aroid *Scindapsis*. The ferns comprise two bird's nest ferns or *rajang* (*Asplenium* and *Drynaria*), the edible *paku midin* (*Stenochlaena palustris*), and *Lindsaea* with small unequal fronds or leaves. Notice also that there is a small nest of stingless trigonid bees at the base of the tree trunk. Trigonid bees (*Trigonia*) are very important pollinators of rain forest trees.



E41

E41. *Callerya nieuwenhuisii* (akar belum)

Family: Fabaceae

This thick climber of the bean family has a rounded stem and can grow to 30 m tall. Inflorescences with numerous small pink flowers are borne on the stem. The pods or fruits are large and bean-like, the seeds are big, flattened and hard. The woody stem may be used to make *parang* handle.



E42

E42. *Bauhinia crudiantha* (akar temuai)

Family: Fabaceae

This is another climber of the bean family with flattened stem, and the big leaves are partly split in the middle into two incomplete lobes. In some species, the root is made into a drink to treat blood in the stool, high blood pressure, stomach ailments and diarrhoea.



E43. *Shorea macrophylla* (*engkabang jantung*)

Engkabang jantung typically grows on alluvial soil along the banks of many inland rivers, and is a protected species. Its big fruits or nuts are made up of some 50% oil, which is used to make *minyak engkabang*, or exported and made into chocolates and cosmetics. However, supply is not regular as the tree flowers only once in 3 to 5 years. The timber is good for boat building and general construction, and the fruits are an important food for river fish including *ikan semah*.



E44

E44. *Santiria apiculata* (*seladah teh*)

Family: Burseraceae

This tree is a relative of the *dabai* fruit. Members of the family produce colourless or white resinous sap which is weakly or strongly aromatic. In this species, the young leaves may be made into tea after boiling, but the small fruits are not edible.



E45. *Barringtonia macrostachya* (*putat*)

Family: Lecythidaceae

There are 19 species of *putat* in our forest, ranging from small shrubs to big trees. They produce long inflorescences that hang from the main branches. The fresh bark is used as a 'fish poison' if pounded and thrown into the river. According to the Penan, the sap in bark does not kill the fish but irritates the eyes and makes them easy to catch.



E46. *Dillenia suffruticosa* (*simpor gajah, buan*)

Family: Dilleniaceae

This is a common secondary species in open areas along roadsides and at edges of the forest. The bright yellow flowers are conspicuous and attractive. Before plastic bags were invented, the big leaves were widely used as a wrapper for all types of food like cooked rice, bean curd, bean sprouts, fresh curry paste and cakes, and are still used today. One reported medicinal use is to drink a decoction of the roots for epilepsy.



E47



E47. *Syzygium polyanthum* (*bungkang*)

Family: Myrtaceae

Bungkang is related to *jambu air* and *jambu batu* and is normally found along inland river banks, and produces small white flowers and fruits. It is well known for its small young leaves which are slightly fragrant and used for flavouring food including *kasam* and *pansoh*.



E48

E48. *Musa flavida* (pisang engkadan)

Family: Musaceae

Some wild bananas grow in shady or swampy areas, while others are found in open degraded sites along logging roads and in young secondary forest after shifting cultivation. This species has a solitary habit and dies after flowering and fruiting. Water from the stem may be taken as an antidote for snake bites.



E49. *Ardisia lanceolata* (merjimah)

Family: Myrsinaceae

This small shrub is also called *patah dahan* because it is easy to detach a branch from the main stem by pushing it to one side with a slight force. The tree is believed to have some protective power. If a piece of the stem is kept in the house, an enemy who comes to the house intending to kill the owner will hesitate and keep on postponing and finally forget about his intension.



E50. *Xylopiya ferruginea* (*sengkajang*)

Family: Annonaceae

This tree grows on swampy ground and produces stilt roots for additional support. The bark is stringy and strong, and can be used to make chicken coops and baskets.



E51. *Gigantochloa levis* (*buloh parin*)

Family: Poaceae

Bamboos are actually grasses, and there are many species of different sizes and forms. The stems are very versatile and have a wide range of uses for scaffolding, flooring, bridges, and for making into furniture, mats, blinds, baskets, shirts and socks, etc. Local fish and meat dishes (*kasam*, *pansoh*) and *lemang* are cooked in bamboo stems; and the leaves are used for wrapping and cake making. Bamboo shoots are well known and widely eaten.



E52. *Licuala furcata* (*gerenis*)

Family: Arecaceae

This small fan palm is called *gerenis* in Iban. It has small leaves which are divided into leaflets, but in many species the leaves are undivided and rounded like a big fan. Some fan palms can grow to over 3 m tall. The leaves are used by forest dwellers like the nomadic Penan in the past to make temporary shelters and to cover themselves during rain, and for making mats, baskets and food containers. Many have been cultivated for their beauty and ornamental values.



E53. *Scindapsis* sp. (*akar gemalong*)

Family: Araceae

This common root climber is widespread in the lowland forest. Here it is sharing the host tree (*engkabang jantong*) with a species of wild pepper which is also a root climber.



E54. *Homalomena sagittifolia* (kemuyan)

Family: Araceae

This is a shade-loving herb on damp soil, and common near river banks. The broad heart-shaped leaves are seated on reddish soft stems. Sap from the underground tuber is applied to treat snake bites. When the tuber is dried and burnt, it will fill the room with a nice fragrance, which is believed to ward off negative energy and evil spirits.



E55. *Curculigo villosa* (lemba)

Family: Hypoxidaceae

This common stemless herb grows to 1 m tall and is sometimes mistaken for a terrestrial orchid. It is also called *lemba babi* because wild boar likes to feed on the fruits and sometimes also the plant. Small star-shaped yellow flowers are borne near the ground and often concealed by the leaf litter. The small, round and white fruits are edible with a sweet taste. The leaves and roots are used to treat fever, body pain and cough; fine fibres from the leaf blade are used to make *pua kumbu*.



E56

E56. *Gonystylus areolatus* (*ramin daun besar*)

Family: Gonystylaceae

There are 26 species of *ramin* which are mostly small to medium-sized and found in a variety of forest types. The most valuable timber species is *ramin telor*, *Gonystylus bancanus*, found at the edge of peat swamp forest. Its timber is used for indoor construction like flooring and panelling, and for making into a wide range of products like broom sticks, dowels and toys. This species is a small tree with big thick leaves and no known uses.



E57

E57. *Labisia pumila* (*kacip
Fatimah*)

See E7 - South Trail



E58

E58. *Durio testudinarium* (*durian kura*)

Family: Bombacaceae

This wild *durian* is different from other *durian* trees by having its fruits borne on lower stem near the ground. It is called *durian kura* because land turtles love to feed on the flowers and seeds.



E59

E 59. *Durio excelsus* (*durian burong*)

Family: Bombacaceae

This is another relative of the *durian* but the fruits have little or no flesh and cannot be eaten. The timber is used for construction.



E60. *Xerospermum laevigatum* (*tundun biawak, ilat*)

Family: Sapindaceae

This relative of *rambutan* is a medium-sized tree growing to 10 m tall. The fruits are smaller than the cultivated rambutans and are also edible. In the forest they are eaten by monkeys, squirrels and bats.



E61

E61. *Shorea leprosula* (*meranti tembaga*)

Family: Dipterocarpaceae

Meranti tembaga belongs to the red *meranti* group which produces some of the best timbers for export. This species is frequently found in clay-rich soils throughout Sarawak, and is relatively fast growing.



E62

E62. *Fibrauea* sp. (*akar badi*)

Family: Menispermaceae

Members of this family are climbers. This species is recognized by its heart-shaped leaf with a long leaf stalk. The sap of this and some other species is known among the forest dwellers as an antidote for snake bites.



E63

E63. *Camposperma auriculatum* (terentang telinga)

Family: Anacardiaceae

This tree belongs in the same family as mangoes or *asam* and *rengas*. It is a secondary species on low swampy land and in degraded sites. Buttresses are well developed. The long leaf has two small ears at the base of the leaf stalk. The tree is fast-growing and the soft timber is not very durable.



E64. *Castanopsis borneensis* (*berangan padi*)

Family: Fagaceae

The family Fagaceae includes the oak or chestnut trees. There are many wild species in the forest, and some are edible. As wild fruits they are widely eaten by animal especially wild boar and deer. Annual fruiting often coincides with mass migration of wild boar which roams the forest to feast on the fruits. The nuts are enclosed in a spiny fruit wall.



E65. *Coelogyne* sp. (orchid)

Family: Orchidaceae

There are probably no less than 1,000 species of orchid in our forest. Most species are epiphytes growing on trees, like this small plant with greenish flowers. They are a complex and difficult group of plants to study, but many hybrids have been produced by horticulturalists for the flowers which is a huge global business.



E66

E66. *Shorea elliptica* (*meranti lang*)

Family: Dipterocarpaceae

Meranti lang is a member of the red *meranti* group that produces valuable timber for many uses. This species is relatively rare with a restricted distribution in Sarawak.



E67. *Barringtonia
macrostachya*

See E44 - South Trail



E68. *Cratoxylum arborescens* (*geronggang*)

Family: Clusiaceae

This tree is recognized by its usually tall straight trunk with reddish-brown and fissured to scaly brittle bark. The timber which is not very durable is suitable for indoor construction.



E69

E69. *Quercus gaharuensis* (*empili*)

Family: Fagaceae

This species of *empili* is very rare and has been recorded only twice on Gunung Gaharu near Serian and here in Semengoh. An *empili* tree of this size is also very rare. Many types of *empili* fruits are an important food for wild boar and deer.



E70

E70. *Willughbeia anomala*
(akar kupal)

See E22 - South Trail



E71. *Korthalsia hispida* (*wi semut*)

Family: Arecaceae

This rattan is called *wi semut* which means 'ant rattan' because it has small pockets on the stem that are inhabited by one species of small ant. The ant pockets are called ocrea. Tiny holes in the ocrea allow the ant to move in and out of its home. The plant provides a home for the ant, and the ant in turn protects it from harmful pests.



E72. *Agrostistachys longiflora* (*malau pucok*)

Family: Euphorbiaceae

This small shrub with a slender stem grows to 2 m tall, often forming moderate clusters. The local name *malau pucok* refers to the resinous sap that hardens into dammar (*malau*) and form a protective cover over the young terminal bud (*pucok*). The bud will grow out of the thin crust into a new leaf.



E73

E73. *Dracaena* sp. (*sabang ensluai*)

Family: Agavaceae

This tall herb with semi-woody stem grows in clusters. A short cut stem planted in the soil or placed in a jar with some water can easily grow into a new plant. Many species with colourful leaves are kept as house plants.



E74. *Smilax hypoglauca* (daun merudang)

Family: Smilacaceae

This small vine has a creeping or climbing habit. It produces long thin tendrils which coil around twigs or other nearby small objects for support. The leaves are usually heart-shaped with 3 to 5 main veins. In this species, the leaves are white on the underside. In some species, the young leaves are eaten as a vegetable. An interesting use among the highland Lun Bawang community is if a person accidentally swallows a piece of broken glass, boil a piece the stem in water to drink to dissolve the glass. It is called *udut udah batoh* in Lun Bawang and Kelabit languages.



E75. *Polyalthia cauliflora* (*semukau*)

Family: Annonaceae

Like other species in the family, this small tree has a stringy bark with strong aromatic smell. One use among the Iban community is to apply a solution of the leaves to treat eye disease. The treatment is said to be a bit painful but effective.



E76. *Rennellia elliptica* (*sabar bubu*)

Family: Rubiaceae

This small shrub belongs in the same family as the coffee plant. Its yellowish roots are used as wild ginseng and can be made into a health drink. Another local species in the family with medicinal value is *mengkudu* (*Morinda citrifolia*). A drink made from it is sold by the trade name *Noni*.



E77

E77. *Myristica gigantea* (*kumpang kiong*)

Family: Myristicaceae

This is a wild nutmeg tree but the nut is not edible. *Buah pala* and nutmeg oil are produced from the species *Myristica fragrans*. All *kumpang* species produce blood red or pinkish latex. In some species, the wood burns well even when wet, while others are slow to catch fires. Iban call the latter *kumpang lusoh* or 'lazy *kumpang*'.



E78

E78. *Nepenthes ampullaria* (*periok kera*, pitcher plant)

Family: Nepenthaceae

There are about 15 species of pitcher plants in Sarawak. Some pitchers are very small while the biggest ones may be up to 30 cm long. The pitchers act as a trap to catch insects and other small animals. Fallen animals will drown in the solution inside the pitcher and become food for the plant. Many species begin life on the ground and become a shrub or climber, while some grow on trees as epiphytes.



E79

E79. *Ploiarium alternifolium* (*somah*)

Family: Theaceae

This small tree thrives on nutrient-poor sandy soil in open *kerangas* forest and is also found along roadsides with very poor soils. The straight slender poles are often used for simple construction and fencing, or as hangers for drying clothes and other objects, but are not durable if exposed. The white flowers are quite prominent and attractive.

North Trail - Ecology Trail



The theme for this trail is 'ecology trail'. The trail passes through two distinct ecosystems in the alluvial forest and old lowland secondary forest. Also of ecological interest is the development of the lowland forest itself. The original primary lowland mixed dipterocarp forest in this area is believed to have been cleared around the Japanese occupation some 70 years ago, most likely for farming. The structure, tree size and species composition of the secondary forest are distinctly different from those of a primary forest, which is dense and dominated by large trees in the emergent and main canopy layers. The alluvial forest is located in low flat land that is liable to flash flooding.

Semengoh was the first forest reserve established in 1920. There were early reports that some parts of the reserve had been cleared for farming and probably also selectively for timber. Following this, Forest Department carried out trial planting in the cleared areas after the War, using local species like *belian*, *engkabang* and *jelutong*, as well as the exotic big-leaf mahogany (*Swietenia macrophylla*). One mahogany plantation is located in front of the Botanical Research Centre office down the road, while another is found in the alluvial forest along this trail at 250-m point. The late Hj. Bojeng Sitam of Forest Department was remembered as the Forest Officer who took charge of the planting.

It is also possible that the *taungya* system was introduced to reclaim the land that was farmed. In this system, trees are planted in the agricultural land where the farmers are allowed to continue to plant their crops until the planted trees are fully grown.

Around 1980, Forest Department planted several species of rattan mainly on alluvial soil, i.e. *wi lepoh*, *wi segah*, *wi jelayan* and *wi letik*. A more recent planting in 2013 consisted of several rows of *meranti binatang* (*Shorea argentifolia*), with seeds brought back from Bakun hydro dam.

Forest ecosystems

The trail passes through old secondary lowland forest on low gentle slopes on the left side and alluvial forest on a flat plain on the right side. Disturbance in these forests has been caused by tree and rattan planting in the past, while natural damage is due to tree fall.

Forest on alluvial soil

This forest is called the alluvial forest because it grows on alluvial soil. The soil consists of mainly sand and clay that are deposited during heavy rain and flash floods, and is wet and water-logged. The forest is called *hutan emperan* in the Iban language, and is very common in many flood plains in interior Sarawak. The most extensive alluvial forest is found in the Gunung Mulu National Park in Ulu Batang Tutoh, Miri Division. Owing to its rich soil and location near rivers, the forest has been cleared for farming and settlement by many rural communities.

At 70-m along the trail, a water-filled swampy area is encountered, and is colonized by the sedge *Scleria purpurescens* (*madang*) and scattered small trees of *somah* (*Ploiairium alternafolium*), *geronggang* (*Cratoxylum*) and *empaling* (*Norrisia malaccensis*). *Pandan kerupok* (*Pandanus kamiae*) grows at the edge. In time, this simple vegetation may be invaded by other small plants like ferns, but woody species will find it hard to thrive unless the water-logged condition is improved.

Further up the trail, the alluvial soil is more compact and better drained. The stable ground is able to support a richer forest of bigger trees and shrubs. Due to past disturbance, the vegetation is made up of a mixture of primary and secondary species. For example, at around 140-m point, recorded species are *empaling* (*Norrisia malaccensis*), *terentang* (*Camptosperma auriculatum*), *simpor* (*Dillenia suffruticosa*), *sintak nyabor* (*Baccaurea minor*), *pudau* (*Artocarpus kemando*), *rabong* (*Gynotroches axillaris*),

puloh (*Pternandra hirtella*), and *pinang palm* (*Pinanga crassipes*) (see E31). Tree canopy height is around 15 m.

At the point between 250-m and 290-m, a *terentang* forest comes into view on the right side. Such a *terentang* forest with big trees is quite uncommon in Sarawak. *Terentang* has soft timber and is fast-growing. The trees have attained 25 m tall and 50 cm diameter, and are easily recognized by their light yellowish bark, prominent and spreading buttresses, and oblong obovate leaves with two small 'ears' at the end of the winged leaf stalk. The soft timber is not very durable and can be used for indoor construction if properly dried and treated.

The *terentang* is mixed with planted mahogany, which can be recognized by its dark chocolate brown and fissured bark. Although the mahogany trees are smaller than *terentang* in size, they are probably older and could have been planted before the fast-growing *terentang* made its appearance. Associated local tree species are *pala musoh* (*Artocarpus obtusus*), *Norrisia malaccensis*, and *benuah* or *purang* (*Macaranga conifera*). Rattan and *pandan* are common among the non-woody flora. Some of the rattan were planted.

Lowland forest on clay-loam soil

This is the forest on gentle hill slopes located on the left side of the trail. The clay-loam soil is well-drained and generally quite shallow. The age of this secondary forest is estimated at around 70 years. In the early stages of natural regeneration, the first group of plants to colonize clearings and forest gaps would be small herbaceous flora such as ferns, ginger and some small semi-woody species. They would be followed by small woody shrubs like *kemunting* or *engkodok* (*Melastoma malabathricum*) and *ara* or fig trees (*Ficus* species). All these short-lived plants would in time be replaced by bigger trees and shrubs, e.g. *benuah* (*Macaranga*) and *geronggang* (*Cratoxylum*).

It would take many years for primary forest species to make

their appearance, especially members of the Dipterocarpaceae like *meranti*. The forest is dominated by mostly small to medium-sized trees, while big trees are rare and scattered. Natural tree fall has created many small gaps, but regeneration is poor probably due to lack of seeds. Climbers and herbs are moderately common.

Rattan flora

The forest is a good habitat for rattan, which is a climbing palm. Altogether nine species have been identified along the trail including the planted ones. In addition, there are four species of *Pinanga* and one fan palm *Licuala*. Rattan climbs by two long whip-like spiny devices, which are present in some species and absent in others. The climbing device at the end of the leaf is called the cirrus, while the other one attached to the leaf sheath is called the flagellum, which is actually a sterile inflorescence. Forest travelers are liable to be caught and injured by the sharp spines as they trek through the dense undergrowth. Some species of rattan have very few or no spines on them, while some are without a stem, which the Iban called *wi duduk*.

Rattan is a very important minor forest produce that was traded with Chinese merchants around the 17th Century, including the fruits known as 'dragon blood', which is used to make a red dye. Even today, Penan and other rural women still boil strips of rattan with the fruits in a pot to produce a red colour for making *tambok*. High quality canes are much sought after for making furniture, mats and baskets, but the resource is becoming scarce due to habitat destruction. Rattan trade in Sarawak has declined considerably due to lack supply.



E1. *Durio zibethinus* (durian)

Family: Bombacaceae

Durian is popularly known as the 'king of fruits'. This young tree has probably grown from a discarded seed. There are many varieties of *durian* which differ in quality and taste, and many are growing wild. Choosing a good *durian* is an art which requires much experience. Many products have been made from it, like *durian* cakes, sweets and ice cream. *Tempuyak* is made by adding salt to the flesh and left to ferment. It is eaten with rice.



E2

E2. *Arenga brevipes* (aping)

Family: Arecaceae

This palm has a big woody stem up to 15 m tall and large pinnate leaves. Rural communities use the leaves for roofing or atap, and the midrib of the leaflet for making blowpipe darts. The young shoot or cabbage may be eaten as a vegetable.



E3



E3. *Pternandra hirtella* (puloh bulu)

Family: Melastomataceae

This shrub is recognized by its simple opposite leaves with three main veins, and the undersurface of the leaves and young twigs covered in dark brownish hairs. An interesting traditional use among the Iban people is to consume the ripe fruit to treat sore eyes. Eating one fruit will keep the eyes healthy for one year, two fruits for two years, and so on.



E4

E4. *Alstonia angustifolia* (*pelai tikus, mergalang*)

Family: Apocynaceae

There are four species of *Alstonia* or *pelai*, all with soft light wood and producing free flowing white latex. A big tree may be made into a small boat; other uses are for toys, floats and corks for bottles. The latex is applied directly to treat shingles (*kayap*) and boils (*bisol*).



E5

E5. *Ixonanthus petiolaris* (*inggi burong*)

Family: Ixonanthaceae

This tree with a diameter of 45 cm is one of the biggest trees in the forest. It is included to show the structure of the tree trunk which is deeply fluted (*belimbing*-like) at the base. In some big trees, up to one-third of the trunk may be fluted, making it unsuitable as a timber tree.



E6. *Calamus* sp. (*wi tunggal*)

Family: Arecaceae

This is a solitary rattan with small cane and opposite leaflets. This species has a flagellum but no cirrus, but in some other species both cirrus and flagellum are present. The cane may be used for making baskets or binding.



E7

E7. *Daemonorops oxycarpa* (wi tedong)

Family: Arecaceae

This clustering rattan can attain 15 m tall and produces a big cane. It is recognized by its kneed leaf sheath, alternate leaflets and long yellow spines. Cirrus is present. The cane is of medium quality.



E8

E8. *Daemonorops fissa* (wi)

Family: Arecaceae

This species of rattan produces a big cane and grows to 10 m tall. The leaflets are alternately arranged. Both flagellum and cirrus are present.



E9

E9. *Cratoxylum cochichinensis* (*patok tilan*)

Family: Clusiaceae

This tree is sometimes called *geronggang*. It is a secondary forest species found also near alluvial forest. Its distinguishing character is reddish flaky bark which rolls into a scroll. This type of bark is called a scrolled bark.



E10. *Pinanga crassipes* (pinang)

Family: Arecaceae

This common palm also occurs in the south trail. It has a very short stem, and inflorescences are borne at the base of the stem. The fruits are oblong and turn bright red when ripe. The seedling leaf is variegated.



E11

E11. *Blechnum finslaysonianum* (*paku kelindang*)

Family: Blechnaceae

This big terrestrial fern is common on wet ground and in shaded areas, and often forms moderate clusters. A paste of the young frond is applied to draw out pus from boils.



E12



E12. *Goniothalamus rufus* (*selukai*)

This small aromatic tree has slender stem and leaves covered in brownish hairs. The fresh leaf stalk may be eaten to relieve stomach ache. In some species the bark is dried and burnt to ward off mosquitoes.



E13. *Sarcotheca diversifolia* (*piang*)

Family: Oxalidaceae

This tree is quite rare and belongs in the same family as the star fruit. The base of the stem is fluted. The fruits are edible but sour.



E14. *Korthalsia rostrata* (*wichit*)

Family: Arecaceae

In this slender rattan, the leaflets are diamond-shaped with fish-tail like ends, and cirrus is present. One species of small ants live inside the ocrea, which is a small pocket attached on the stem. The relationship is mutually beneficial as the rattan provides a home for the ants and the ants in turn protect it from harmful pests.



E15. *Calamus pilosellus* (wi)

Family: Arecaceae

This rattan is very rare. The leaf sheath is swollen at the base and covered in fine scales or hairs. The long leaf is armed with long cirrus at the end, and flagellum is also present. The cane is of moderate quality.



E16. *Gnetum gnemon* (*sabong*)

Family: Gnetaceae

This species belongs to a primitive group of plants known as the Gymnosperms, in which the seeds are naked and not enclosed within an ovary as in the Angiosperms. The plant may exist as a big climber (called *akar dundun*), or as a small treelet (called *sabong*). The young leaves of *sabong* are eaten as a vegetable. The oblong fruits are widely eaten in Indonesia, where it is called *emping*. It is made by crushing the fruit to flatten it, dried and deep fried. It is crunchy like keropok with a slightly bitter taste.



E17. *Baccaurea oligoneura* (*jelintek*)

Family: Euphorbiaceae

Euphorbiaceae is a very big and diverse family of the rain forest, with members including the rubber tree, tapioca or *ubi kayu*, *cangkok manis*, and *tampoi* and *rambai* fruits. In this species, the fruit wall splits open when ripe, thus the Iban name *jelintek* meaning 'explode'. Depending on the varieties, the flesh may be red or yellow.



E18

E18. *Licuala petiolulata* (biru)

Family: Arecaceae

In this big fan palm, the leaf is split into many leaflets. The leaves may be used to make *atap*, small containers, and mats and baskets. Many fan palms have been planted as garden or house plants for their form and beauty.



E19



E19. *Daemonorops oblata* (wi)

Family: Arecaceae

This rattan produces moderate clusters and grows to 10 m tall. Its distinguishing character is the reflexed spines on the leaf sheath around the stem. The cane has no known use.



E20

E20. *Pinanga* sp. (*pinang*)

This small palm has a solitary habit, and the slender stem is supported by small stilt roots. Some wild *Pinanga* species have edible fruits while others are poisonous.



E21. *Pandanus kamiae* (kerupok)

This is a stemless *pandan* on swampy ground. Its long leaves which are widely used for making mats and baskets. It is sometimes cultivated in villages.



E22. *Calamus sarawakensis* (wi)

Most rattans are spiny, but in this one species, the leaf sheath has no spines or is only sparsely spiny. It is a slender rattan with both cirrus and flagellum for climbing. The cane is good for binding.



E23. *Polyalthia* sp. (*semukau*)

Family: Annonaceae

In this small tree, the young twigs and undersurface of the leaves are covered in fine hairs, and the bark is aromatic. To treat red eyes, Iban people warm the young leaves over fire and squeeze the juice into the eyes.



E24

E24. Water-logged swamp

This small swampy area located at 70-m point is dominated by the sedge *madang* (*Scleria purpurescens*), along with several tree species like *somah* (*Ploiarium alternifolium*) and *geronggang* (*Cratoxylum arborescens*). The root of *madang* may be made into a drink and used by Selako people to treat diarrhoea, by Kayan to relieve painful urination, and by Bidayuh to get rid of bladder stones.



E25. *Castanopsis borneensis* (*berangan padi*)

Family: Fagaceae

Berangan padi has small edible nuts which are an important food source for wild animal like wild boar and deer. There are many species of *berangan* in the forest. During mass fruiting, wild boar will travel in mass to feed on the fruits. The nuts are contained in a spiny fruit wall.



E26. *Terminalia phellocarpa* (*kedandi*)

Family: Combretaceae

This tree at 50 cm diameter is quite rare and widespread. Its spreading plank buttresses may be up to 1.5 m high, and the bark surface is reddish and shallowly fissured. The hard timber is suitable for heavy construction but supply is limited.



E27

E27. *Tristaniopsis whiteana* (*selunsor puteh*, *belaban*)

Family: Myrtaceae

Selunsor, also known as *belaban*, is related to the Australian eucalyptus tree. Its distinctive character is the flaky bark which rolls into a long scroll, and is referred to as a 'scrolled bark'. Depending on the species, the new bark may be white, red, or sometimes variegated and colourful. There is an old Iban belief that the tree produces a mysterious stone, and if a person is lucky to find one through a dream, he will remain youthful and live a long healthy life. This is related to the fact that the tree stays fresh and young by constantly shedding off its old bark. Pregnant Kedayan women will drink a tea of the bark one month before giving birth to ease labour pain.



E28. *Elaeocarpus stipularis* (*pensi, emperdu*)

Family: Elaeocarpaceae

The local name *emperdu* means 'gall bladder', referring to the fruit that turns black when ripe and resembling a gall bladder. This tree has fluted stem and low buttresses, and hooped and reddish bark surface. The fruit is edible but not very tasty.



E29

E29. *Pandanus* sp. (*rasau*)

Family: Pandanaceae

This *pandan* has a straight slender stem and commonly grows in swampy areas and near rivers. The fruits are spiny and turn red when ripe.



E30

E30. *Polyalthia insignis* (*selukai pangkor*)

Family: Annonaceae

Some *selukai* bark is dried and burnt to produce a thick smoke to ward off mosquitoes and bad spirits. The Iban word *pangkor* or 'stubborn' refers to the root which is strong and very difficult to pull out with the hand.



E31

E31.

At around this 140-m point, the alluvial soil is better drained, and the forest is richer in species, e.g. *empaling* (*Norrisia malaccensis*), *terentang* (*Camptosperma auriculatum*), *simpor* (*Dillenia suffruticosa*), *sintak nyabor* (*Baccaurea minor*), *pudau* (*Artocarpus kemando*), *rabong* (*Gynotroches axillaris*), *puloh* (*Pternandra hirtella*), and *pinang* (*Pinanga crassipes*). The presence of many secondary species indicates that the forest is relatively young.



E32. *Cratoxylum sumatrana* (*patok tilan*)

Family: Clusiaceae

An interesting feature of this tree is the presence of thorns on the stem of a young tree, but the thorns will disappear when the tree grows older. The bark surface is flaky and pale yellow. *Cratoxylum* is usually associated with old secondary re-growth and is light tolerant.



E33. *Cratoxylum arborescens* (*geronggang*)

Family: Clusiaceae

This is the biggest tree in the genus *Cratoxylum*, and has tall straight stem with fissured to scaly and brittle bark. The timber which is not very durable may be used for indoor light construction.



E34. *Korthalsia ferox* (widanan)

Family: Arecaceae

This species of rattan produces a thick durable cane which is suitable for making furniture like chairs and coffee tables. Its distinctive characters are fish-tailed leaves and presence of ocrea on the stem.



E35

E35. *Terentang* forest (at M-250 to M-260)

This part of the alluvial forest features a good forest dominated by big trees of *terentang* (*Camposperma auriculatum*) up to 50 cm diameter, recognized by the light yellow bark and prominent buttresses extending into long surface roots. Other local species include *simpor* (*Dillenia*), *empaling* (*Norrisia*), *podau* (*Artocarpus rigidus*), and *benuah* or *purang* (*Macaranga conifera*). The planted mahogany with dark chocolate brown bark also grows among them. *Terentang* timber is suitable for light construction and may be made more durable if treated.



E36. *Dillenia reticulata* (pru)

Family: Dilleniaceae

This tree has small stilt roots and long hairy leaves, and produces good light-weight timber when fully grown. It is rare and localized in clay-rich or sandy clay soil.



E37. *Swietenia macrophylla* (big-leaf mahogany)

Family: Meliaceae

This timber-producing tree from South America was introduced into Sarawak during colonial time probably around mid-1940s, but no commercial plantation has been established. Numerous flat and winged seeds are borne in big brown heavy fruits that point sky-ward. The seeds which have a very bitter taste are eaten directly or made into tea, to bring down high blood pressure, reduce cholesterol and prevent diabetes.



E38. *Calamus ornatus* (*wi jelayan*)

Family: Arecaceae

Wi jelayan is a big solitary rattan growing to 40 m or more. The leaves are up to 4 m long, and the massive flagellum to 10 m long. The high quality cane is good for furniture making.



E39

E39. *Entada borneensis* (akar beluru)

Family: Fabaceae

This is a rare climber of old secondary forest and can attain 15 cm in diameter. When the bark is pounded and mixed with a little water it produces a whitish lather which is used as a shampoo and to get rid of dandruff and head lice. Penan in Ulu Baram also use it for the same purpose and call it *laka kemelut*.



E40

E40. *Melanochyla beccariana* (*rengas*)

Family: Anacardiaceae

This tree is quite rare in mixed dipterocarp forest. It produces an aromatic colourless sap which turns black on exposure to air. In some *rengas* species the sap is poisonous and can cause the skin to swell and become very hot and painful, but only persons who are allergic will be affected.



E41

E41. *Curculigo villosa* (lamba)

Family: Hypoxidaceae

This herb has been described under E55 of South Trail. It is a common stemless herb growing to 1 m tall. It also called *lamba babi* because wild boar feeds on it. Small star-shaped yellow flowers are borne near the ground and often hidden in the leaf litter. The small round white fruits are edible with a sweet taste. The leaves and roots are used to treat fever, body pain and cough; fine fibre from the leaf blade is used to make *pua kumbu*.



Sarawak Biodiversity Centre

KM20, Jalan Borneo Heights, Semengoh, Locked Bag No. 3032,
93990 Kuching, Sarawak, Malaysia

Tel: +6 082 610610 **Fax:** +6 082 611535

Website: www.sbc.org.my **Email:** biosar@sbc.org.my