



WATER
PROJECT

SG.PENCHALA OPEN CLASSROOM:
RIVERWALK
GUIDEBOOK

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NATIONAL LANDSCAPE DEPARTMENT

DIRECTOR'S MESSAGE

National Landscape Department has been appointed the custodian for the development of Malaysia's first federal park in Taman Tun Dr. Ismail, Kuala Lumpur following Government's decision in June 2007 for Malaysia to develop a large scale public park similar to Hyde Park in London. The department has then initiated various research and strategies aiming to make sure the proposal to be addressed as Kuala Lumpur's "green lung". Not only the 380-acre lush park with urban forest setting is strategically located amidst Kuala Lumpur, it is also blessed with active and genuine supports from community organizations, NGO's and residents surrounding the park. In August 2010, National Landscape Department was given the mandate to plan, administer and manage Bukit Kiara Federal Park as the 'Living Museum' exhibiting various forest collections and natural wonders for the visitors to explore and appreciate-thus various studies, new design master plan and management plan commenced ever since.

The comprehensive master plan implemented by National Landscape Department consists of 6 key development zones which include the arboretum, a riparian zone, family recreational zone, biodiversity hub and administration building following the principles based on natural forests concept. Emphasis was given towards the issues of urban greenery, recreation and health adversities, educational and research-

oriented, biodiversity protection, conservation, rehabilitation and enrichment of species, which can be viewed through the park's design especially of the riparian zone and 50 acres arboretum which houses distinctive and unique flora and fauna species such as ferns, herbs, bamboos, palms, gingers and many others.

The department and I would like to congratulate SPARK Foundation together with Global Environment Centre (GEC), Jabatan Pengairan dan Saliran and also Friends of Bukit Kiara (FoBK) upon this remarkable Sg.Penchala Open Classroom River Walk Guidebook. I am truly glad that we can be part of this significant collaboration in making sure our natural landscapes, rivers and wildlife are well protected and managed. The department is always in support of such community and environmental-oriented efforts and applauds this meaningful spirit of sharing. I am sure this guidebook shall inspire many others and involvement of all parties can be developed and nurtured in accordance with national aspiration of inculcating love for the landscape.

Hajah Rotina bt Mohd Daik

Director General

National Landscape Department, Malaysia

SPARK FOUNDATION

TRUSTEE'S MESSAGE

In Malaysia, more than 90 percent of our water supply comes from rivers. Unfortunately, almost half of our rivers are polluted due to urbanisation and irresponsible behaviour. As environmental stewards for planet earth, we need to act to help mitigate the pollution of our rivers for the sake of this generation and beyond.

Our award-winning Working Actively Through Education and Rehabilitation (W.A.T.E.R) Project, which was initiated in 2007 in partnership with the Global Environment Centre (GEC), is focused on rehabilitating our rivers in Malaysia. Through this community-based programme, we aim to raise awareness on protecting our water resources and eventually shift the mindset and empower Malaysians to take greater ownership of our rivers.



Our two-pronged approach are as follows:

EDUCATE: Education outreach campaigns that mobilise and reconnect these communities with the rivers that flow through their neighbourhoods.

COLLABORATE: Work hand-in-hand with government agencies to address the problems that threaten and pollute our rivers.

I'm pleased to note that over the last 10 years, we have successfully collaborated on river rehabilitation programmes in Selangor and Perak.

The source or head water of Sungai Penchala starts from Bukit Kiara Federal Park and we are fully aware of the importance of this ecosystem for the surrounding communities. Hence, we are indeed honoured to be given the opportunity to fund this programme because environmental protection is a vital part of effective river basin management.

At SPARK Foundation, we believe that everyone has a role to play in protecting our water resources. We hope this Riverwalk Guidebook will be useful and informative for the public.

On behalf of the SPARK Foundation, I wish to extend my sincere appreciation to the National Landscape Department, Department of Irrigation and Drainage, and GEC for their ongoing dedication in developing this guidebook.

We believe it only takes one spark to change the world. So, let's #betheSPARKnow.

Renuka Indrarajah
Trustee
SPARK Foundation

GLOBAL ENVIRONMENT CENTRE

DIRECTOR'S MESSAGE

Global Environment Centre (GEC) has been working on the protection of the Bukit Kiara Federal Park — specifically on water source within the park — since 2002. It is quite unique and amazing that a river has its source which is assessable and situated in an urban area that any interested party can visit.

We believe public participation in protecting the source is very important. Besides this, Sungai Penchala Open Classroom functions as great platform for the public to learn about various aspects of a river including river hydrology, natural river and living river concepts. Under SPARK Foundation's W.A.T.E.R. project, GEC conducts riverwalk activities to educate the public about the importance of a river as opposed to adopting a closed classroom-style of learning. Four learning stations — namely ***Source of the River, Voice of the Stream, Meandering and Water quality monitoring*** — are emphasized during a riverwalk activity. Trees, herbs and other key plants within the park is also highlighted and studied during the riverwalk activity.

The newly developed guidebook will serve as a useful reference for the public to learn more about the rich biodiversity in the park when the journey on this short 300 metre trail which we fondly call the Sungai Penchala

Open Classroom. The guidebook will help them identify important trees, useful herbs plus other valuable plants. Besides that, participants can also discover interesting fauna especially the benthic macroinvertebrates. These very small animals that are visible to the naked eye have an important role because they serve as an indicator of the quality of the river water.

I would like to register my highest appreciation to the National Landscape Department, SPARK Foundation, Friends of Bukit Kiara, and the Malaysian Nature Society (Selangor branch) for their generous support towards the development of this guidebook. I am confident this guidebook will become an important tool for creating awareness amongst the public. It is my hope that they will begin to appreciate the natural habitat that is around us and take the first step towards preserve our environment.

Faizal Parish
Director
Global Environment Centre

W.A.T.E.R. PROJECT

W.A.T.E.R. (Working Actively Through Education and Rehabilitation) is a project initiated by SPARK Foundation in 2007 in collaboration with Global Environment Centre (GEC) as the project implementer.

First phase focused Sungai Way River Rehabilitation Programme, where efforts were focused on improving the Sungai Way River water quality from a Class IV-V category to a Class III category.

In 2012, the W.A.T.E.R project expanded to Sungai Kinta as its second phase with a focus on river education outreach. The programme managed to attract many people from the surrounding communities, and the public's interest for river conservation in Silver State.

Subsequently, the Sungai Penchala River Education programme was initiated in 2015. The focus this time was on the 14-kilometre urban river, where Sungai Way is the tributary. Apart from leveraging the Sungai Penchala Open Classroom as a strategic platform for engaging stakeholders, the project also covers other facilities such as the Sungai Way Community Information Centre and Penchala River Education Centre were also refurbished for the benefit of the public.

In 2018, W.A.T.E.R. project launched its third phase focusing on water stewardship agenda. This phase covers mix of hard as well as soft approaches such as water saving thimbles installation, wetland cell creation, tree planting and outreach.



BUKIT KIARA FEDERAL PARK

Bukit Kiara Federal Park (*Taman Persekutuan Bukit Kiara*) was once a rubber estate before it was acquired by the government (Federal Territory of Kuala Lumpur) in 1980. On 27 June 2007, the Cabinet announced that it would be turned into a large scale public park (*Taman Awam Berskala Besar*) to be managed by the National Landscape Department, Ministry of Urban Wellbeing, Housing and Local Government.

Bukit Kiara Federal Park is now a secondary forest surrounded by residential and commercial estates such as Taman Tun Dr Ismail and Sri Hartamas. Taman Persekutuan Bukit Kiara is immensely popular amongst nature lovers, cyclists, runners and hikers. Thus, it is no surprise that the park receives about 4,000 visitors during the weekends alone!! Sungai Penchala's source or head water begins in this park and eventually joins into Sungai Klang at Desa Mentari, Sunway.



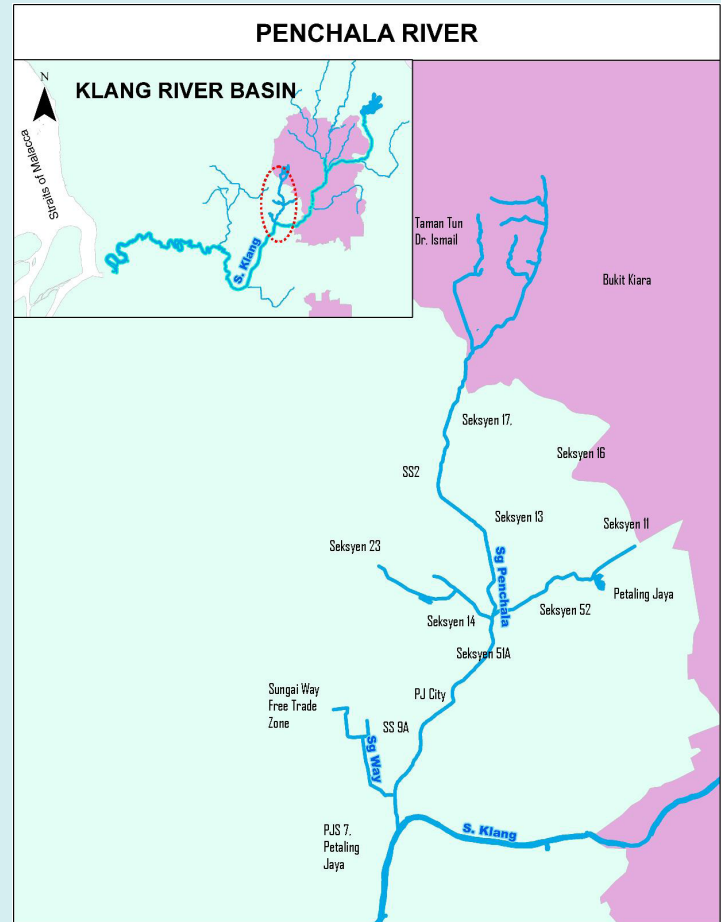
River Address:
Penchala River, Klang River Basin, Straits of Malacca.

SG. PENCHALA

Sungai Penchala flows through an urbanized area and is the tenth tributary of Sungai Klang. The length of Sungai Penchala is approximately 14 kilometres out of which 12 kilometres flow through the Petaling District and another 2 kilometres through the Damansara District. It has a tributary called Sungai Way -- a 2-kilometre river joining at Desa Mentari, Petaling Jaya.

Since Sungai Penchala flows through a highly developed urban area, the human population density is very high all the way from upstream to downstream. Highly populated areas that Sungai Penchala runs through include Taman Tun Dr. Ismail, SS20, Section 19, Section 14, Section 17, SS2, SS3 and SS9.

Sungai Penchala is classified as a Class III river due to pollution caused by human activities such as sedimentation impacts, domestic effluents, industrial discharge and poor solid waste management.



SG. PENCHALA OPEN CLASSROOM

Keladi Trail which is under the Riparian Zone in Bukit Kiara Federal Park, is earmarked as the Sungai Penchala Open Classroom. GEC together with DBKL and the Department of Irrigation and Drainage had in fact recognized Keladi Trail as an Open Classroom for river systems learning since 2001. It was officially launched as Sungai Penchala Open Classroom by National Landscape Department, Malaysia and Department of Irrigation and Drainage, Malaysia on 7 November 2015.

The Sungai Penchala Open Classroom aims to provide hands-on experiential learning of river systems, with the hope that this will enhance participants' knowledge and appreciation of the surrounding environment.

The Open Classroom relaunched officially on 7th November 2015 by National Landscape Department (JLN).

The river walk conducted at Sg. Penchala Open Classroom involves experiential learning covering:

- River Learning Stations
- the aquatic fauna (benthic macroinvertebrates)
- the surrounding flora



RIVER LEARNING STATIONS

Four stations along the Open Classroom path were set up to provide participants with a river walk experience that begins from its source to the life it has given. Each station points to the characteristics of a natural river, including its source, the voice or sounds that are heard from natural rivers, their shapes as well as the living things inhabiting within and around it.

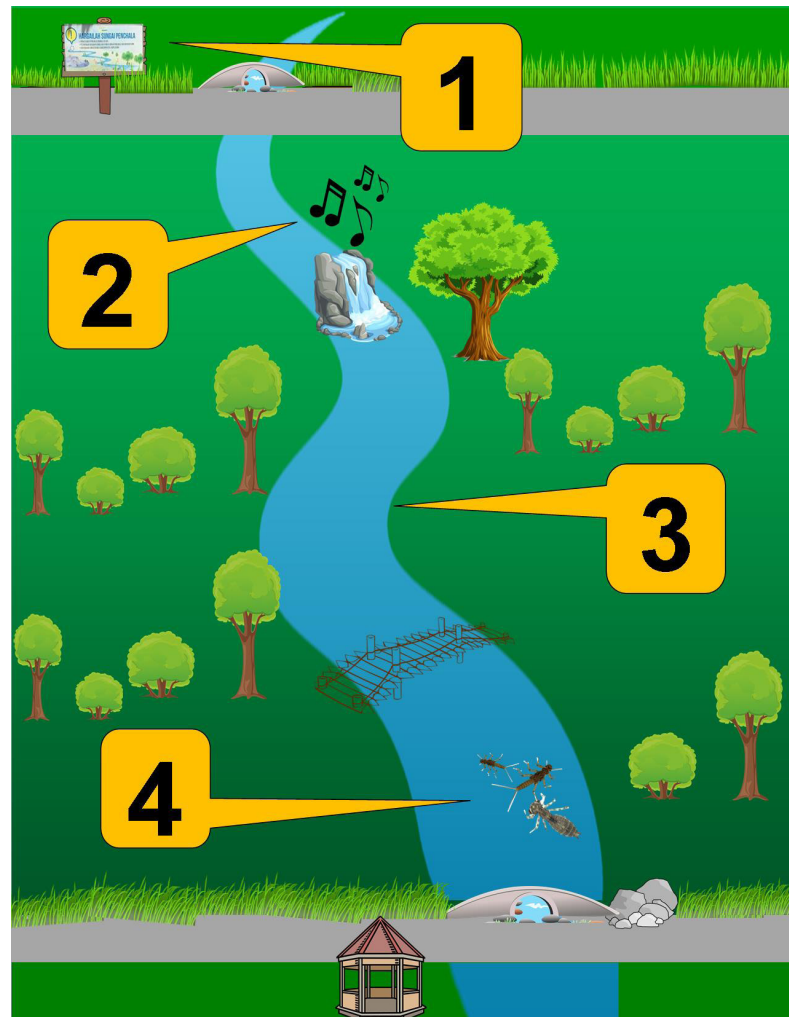
The river learning stations are:

Station 1 (Source of Sg. Penchala)

Station 2 (Voice of the Stream)

Station 3 (Meandering)

Station 4 (Water Quality Monitoring)



Map is not drawn to scale. Not to be used for navigation.

STATION 1: SOURCE OF THE RIVER

The rivers that you observe, whether they are vast or small bodies of water, long or short in length starts from sources such as lake, marsh, spring, glacier or hills. In Malaysia, our ample rainfall plays a main role starting trickles of water from the mountains/hills and slowly flowing down steep areas, bit by bit, forming stream/rivulet and larger flowing bodies of water we call rivers. At Station 1, try your best to uncover the trickle of water that forms the Open Classroom stream, which is the source of Sungai Penchala that eventually flows into the Klang River!

Interesting Facts:

- The source of the River Thames is spring.
- The source of River Nile is lake.

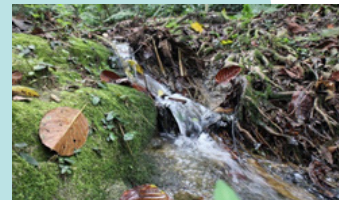


STATION 2: VOICE OF THE STREAM

Rivers and streams in natural settings have soothing sounds from the flowing water which people find it to be relaxing and one of the good aesthetic values. This natural 'sound' from the flowing water is called the "voice of the stream" signifying the rivers being a living entity and having their own 'voices'. Are the 'voices' produced from the water itself? Does water have sound?

Interesting Facts:

- Rocks and stones act as vocal cords to create the voice of the stream.
- Voice of the stream can be used to indicate the health of river.

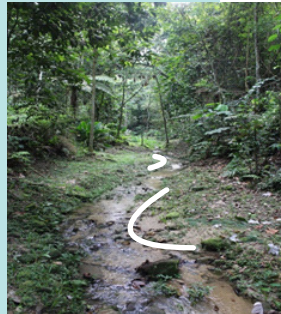


STATION 3: MEANDERING

Although this is a feature seen throughout the Open Classroom, Station 3 particularly highlights the importance of meanders. Meanders are the bends or curves in the shape of a river. Meanders are formed when flowing water is obstructed by land where it erodes the outer banks and form a wider path or new path. Meanders are an important feature in river ecosystems in relation to its water retention.

Interesting Facts:

- Living river should have meanders.
- Channelization is opposite to natural meandering.



STATION 4: WATER QUALITY MONITORING

Can be conducted through RIVER Ranger 2.0 programme.

Physical monitoring (using 9 categories to evaluate the river using physical senses)

Chemical monitoring (the most accurate and reliable testing method which involves physicochemical parameters to evaluate river water quality) and

Biological monitoring (a traditional yet interesting way of evaluating river health based on the diversity of benthic macroinvertebrates).

Interesting Facts:

- Physical monitoring will vary depending on viewers' observation.
- Benthic macroinvertebrates used to assess short term environmental variations.



AQUATIC FAUNA GUIDE

BENTHIC MACROINVERTEBRATES

- Type of animal without any backbones (includes insects, molluscs, crustaceans and annelids).
- Live underwater in the streams and rivers, and can be seen by the naked eye.
- Their diversity and sensitivity to pollution can determine the stream or river's health. Water quality is important to aquatic insects because they breed and live in water.
- Can be calculate using Biological Water Quality Index (BWQI).
- Their presence in the water are good indicators to the water conditions because they are:
 - > Sensitive species cannot survive in changed stream conditions such as the introduction of pollution, high levels of sediments, high water temperatures, or low levels of dissolved oxygen (environmental stressors). Tolerant species can.
 - > More likely to remain in a small area for most of their lives.

BIOLOGICAL WATER QUALITY INDEX (BWQI)

(Source: GEC Biomonitoring booklet)

There are many ways to calculate the biological richness of our waterways. One of it is Biological Water Quality Index (BWQI). This method uses a simple scoring system for each animal based on their sensitivity to polluted water. With indicators that fall under four categories (**very sensitive, sensitive, moderate and tolerant**) and non-indicators.

HOW TO CALCULATE BWQI

1. Find any macroinvertebrates using either one of these methods:

- **PEEK-A-BOO**

- Look for medium sized rocks/boulder/leaf and gently pick it up to search their bottom.
- Observe for any movements or try trickling some water over the rocks to find any macroinvertebrate.

- **SIFT AWAY!**

- Use a plastic, fine sieve to dig up sand in the river.
- Lift the sieve up and gently sift through the sands to find any macroinvertebrates.

- **WHAT'S IN THE NET?**

- Put your net in and face against the water flow to catch any swimming organisms; or
- Hold your net just above the riverbed. Kick up some of the sand in front of your net and then lift up the net to see if anything caught.

2. Identify the macroinvertebrates found by referring to the *RIVER Ranger 2.0: River Care Action Guidebook*.

3. Cross-check and record the scores of each macroinvertebrates species and the amount of each type found.

4. Each score represent different types of water quality.

5. Total up the scores of all macroinvertebrates species and divides the total scores by total number of species to get the final score.

Table 1: Example of BWQI Calculation

Species	Individuals	Scores
River prawn	2	8
River crab	2	3
Mayfly (Nymph)	1	10
TOTAL	5	21
BWQI (Biological Water Quality Index):		Total Scores ÷ Total Number of Species = 21/3 = 7

6. Compare the final scores with the water quality categories as shown in Table 2.

Table 2: BWQI scores with their respective water quality

BWQI	Water Quality
7.6 - 10	Very clean water
5.1 - 7.5	Rather clean – clean water
2.6 - 5.0	Rather dirty water – average water
1.0 - 2.5	Dirty water
0.0 - 0.9	Very dirty water

BENTHIC MACROINVERTEBRATES EXAMPLES



**MAYFLY
(LARVAE)**

Found in freshwater river, may burrow in the sediment.

BWQI SCORE: 10
(EXCELLENT
WATER
QUALITY)



**RIVER
PRAWN**

Found in freshwater river, often in lush vegetation near the river bank.

BWQI SCORE: 8
(GOOD WATER
QUALITY)



COMMON DRAGONFLY (NYMPHS)

BWQI SCORE: 6
(GOOD WATER
QUALITY)

Found in freshwater rivers, streams around aquatic vegetation and crawl on the bottom, may burrow into the sediments.



CRANE FLY LARVA

BWQI SCORE: 5
(AVERAGE
WATER
QUALITY)

Found in fast flowing streams, hiding among the decaying vegetation along streams, forest floor.



FRESH- WATER SHRIMP

BWQI SCORE: 4
(AVERAGE
WATER
QUALITY)

Found in streams, at exposed live roots of trees along undercut banks or overhanging woody debris or stream vegetation.



RIVER CRAB

BWQI SCORE: 3
(AVERAGE
WATER
QUALITY)

Found in freshwater river, often in lush vegetation near the river bank.

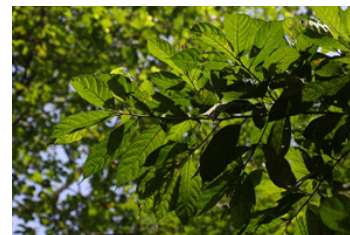
FLORA GUIDE

RIVERINE FLORA

Riverine refers to systems that are contained within a channel (e.g. river, creek or waterway) and their associated streamside vegetation. Hence, riverine floras are plants that live within the Riparian zone ie. the area bordering rivers or streams.

A Riparian zone is important as it supports and protects the aquatic environment from sedimentation, polluted surface runoff and soil erosion. The Riparian zone also provides shelter and food for aquatic animals such as macroinvertebrates. Additionally, the Riparian zones provide shade for aquatic animals as well as mitigate changes in stream temperature thus allowing some sensitive aquatic animals to thrive.

DESCRIPTION OF KEY TREES: STATION 1



ARA

NATIVE

Botanical name: *Ficus fistulosa*

Family: Moraceae (Mulberry Family)

Cauliflory Flowers are inside the fruits. One of the most important species of a forest-providing foods sources to variety of animals / birds. It is an all season fruit had been an attracting and sustaining many wildlife in the forest.



TONGKAT ALI

NATIVE

Botanical name: *Eurycoma longifolia*

Family: Simaroubaceae

It has a marked preference for acid, leached, well drained soil, and is a good and very distinctive indicator of such sites. The young leaves are eaten raw to relieve stomach pains. The roots are used as an aphrodisiac based mostly on folklore, and they also contain anti-malarial compounds. The roots are also used to induce vomiting, and poultice sores, ulcers, and wounds. A decoction of the root is used to reduce fevers, reduce high blood pressure, and relieve gastric pains. The bark is used for blood clotting in childbirth complications.



MEMALI

NATIVE

Botanical name: *Leea indica*

Family: Vitaceae (Grape family)

It has bird-Attracting fruits and its flower nectar used as food source for butterfly.

The leaves are used for treating body pains, cuts, fever, skin complaints, vertigo, and wounds. A decoction of the shoots is used to treat sores. The roots are viewed to be antipyretic and diaphoretic, and are used to relieve colic, diarrhoea, dysentery, muscular pain and to induce perspiration.



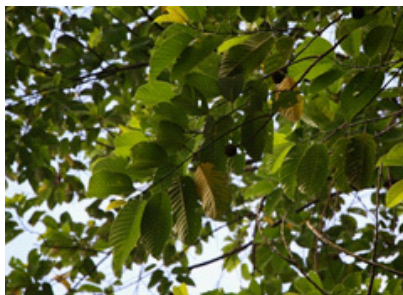
KELEM-PAYAN

NATIVE

Botanical name: *Neolamarckia cadamba*

Family: Rubiaceae (Coffee tree family)

It has scented orange flowers in dense globe-shaped clusters. The flowers are used in perfumes. The tree is grown as an ornamental plant and for timber and paper-making.



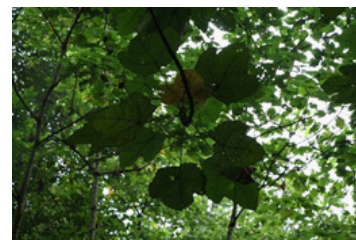
MAHANG GAJAH

NATIVE

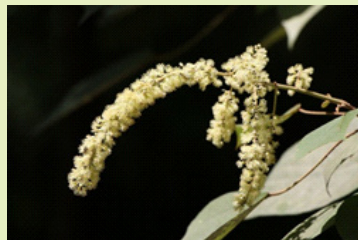
Botanical name: *Macaranga gigantea*

Family: Euphorbiaceae (Rubber tree family)

Very common in secondary forests and scrub. It is one of the earliest colonists of degraded land, but can also be found in large forest gaps within primary forest. Under good soil conditions this species can grow exceptionally quickly. It produces huge quantities of small seeds that are taken by a wide range of small birds and squirrels.



STATION 2



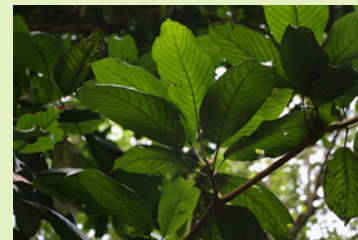
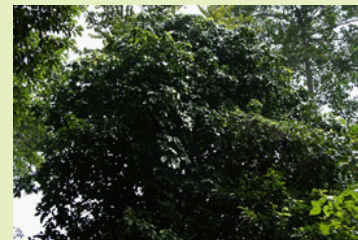
BALIK ANGIN

NATIVE

Botanical Name: *Mallotus paniculatus*

Family: Euphorbiaceae (rubber tree family)

Small tree of the lower part of the canopy of primary rain forest. The leaves (whitish underneath) is easily recognised from far when it is blow by wind.



RAMBAI

NATIVE

Botanical name: *Baccaurea motleyana*

Family: Phyllanthaceae

It has wild fruit trees. Small to medium tree. Crown big and dense. Its flowers are pollinated by insects. The fruits are eaten by mammals.



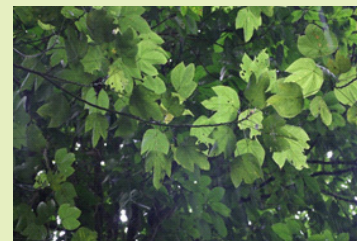
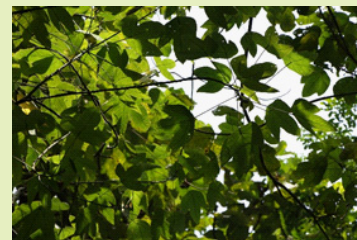
KOPI

NON-NATIVE

Botanical name: *Coffea canephora*

Family: Rubiaceae (Coffee family)

The seeds are used to produce about 20% of the world's supply of coffee. The seeds of *Coffea arabica* are used to supply the remaining 80%. *C. canephora* and *C. arabica* seeds are often blended together to make instant coffee. *C. arabica* is considered to produce coffee superior to that of *C. canephora*, having better flavor and aroma. However, *C. canephora* seeds contain more caffeine



MAHANG MERAH

NATIVE

Botanical name: *Macaranga triloba*

Family: Euphorbiaceae (Rubber tree family)

Most successfully genus making the transition from rain forest habitats on wind-gaps to man-made secondary forest. Can be found along roadside. Quick to colonise an open area. Twigs sometimes hollow and ant-inhabited. Symbiosis between ant and the tree. Tree provided habitat for ant and in return, ant protected the tree from invaders like insects. Plants inhabited by ants (myrmecophytes) is serves as inidicator for forest disturbances.

STATION 3



GETAH

NON-NATIVE

Botanical name: *Hevea brasiliensis*

Family: Euphorbiaceae (Rubber tree family)

Rubber tree originated from Brazil, South America. Its seeds were brought over from Brazil by H.N. Ridley and first planted in Malaysia in 1877 in Kuala Kangsar. Being introduced species, it produces natural rubber which is one among the most important commodities in Malaysia.



MEM-BULUH BULUH

NATIVE

Botanical name: *Pellacalix axillaris*

Family: Rhizophoraceae (Mangrove family)

Widely distributed mainly along streams and swampy habitat including secondary forest.



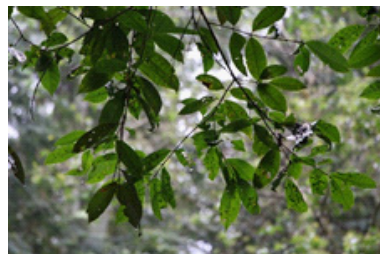
TUMBUH KELAPA

NATIVE

Botanical name: *Arthrophyllum diversifolium*

Family: Araliaceae

Small tree, which is up to 14m. Concoctions of the root and bark are reported to have medicinal properties, including a remedy for syphilis, and the plant has stupifying and poisonous properties.



JAMBU

NATIVE

Botanical name: *Syzygium* sp.

Family: Myrtaceae

Largest Genus in Malaya. It occurs on all part of the country. Many species are common in secondary forest. The flowers are pollinated by flies, beetles and butterflies. Monkey eat the flowers bud. Fruits are source of food to monkey, squirrels, birds and small fruit bats.



STATION 4



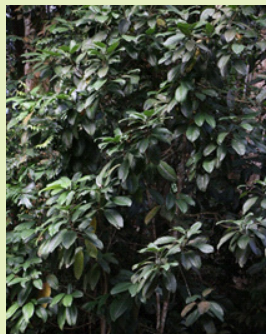
BIKU- BIKU

NATIVE

Botanical name: *Bhesa paniculata*

Family: Celastraceae

Leaves dried rolled towards middle. The Biku-biku tree is very common in Malaysia and can be found in primary and secondary forests — especially in well-drained, riverine, swampy, peat swamp forest, lowland and mountain areas.



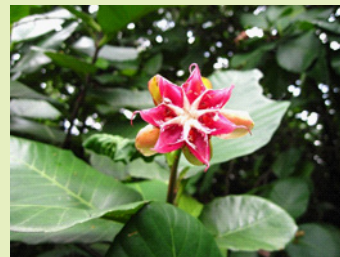
SIMPOH AIR

NATIVE

Botanical name: *Dillenia suffruticosa*

Family: Dilleniaceae (simpoh family)

It is a common belukar plant. It produces attractive but short-lived yellow flowers.



DESCRIPTION OF KEY PLANTS: STATION 1



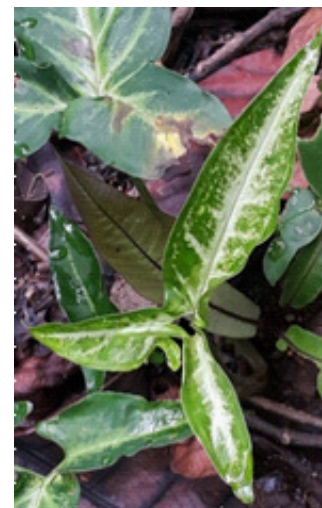
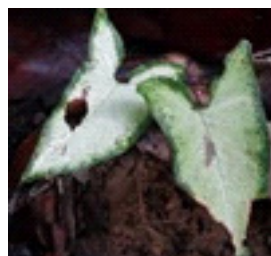
KASAI

NATIVE

Botanical name: *Pometia pinnata*

Family: Sapindaceae (Rambutan Family)

Red young foliage, attractive and conspicuous from far. Leaflet margin is dentate. Its flowers are insect-pollinated. Its fruits and seeds are probably eaten and dispersed by small mammals, bats and birds. The lowest pairs of leaflets, that are stipule-like, are usually inhabited by ants. Plant reported to have antiseptic properties (probably due to presence of saponins). Bark used by Malays and Indonesians to treat sores and wound infections. Leaves and bark used to make bathwater for fever. The fruit is somewhat like a lychee, is edible, and is a popular fruit for eating. General-purpose wood used for construction, furniture, flooring and various items. Wood also burnt as firewood and charcoal.



KAKI ANGSA

NON-NATIVE

Botanical name: *Syngonium podophyllum*

Family: Araceae

This is a climbing plant. A decoction of the crushed and boiled leaf is used as a wash to treat stomach aches. The milky-white sap from a broken stem is applied topically as a remedy for ant bites, specifically the Paraponera ants (more commonly known as the bullet ant). There are also claims that this species is effective in helping remove indoor air pollutants.



UBI BADAK

NATIVE

Botanical name: *Dioscorea alata*

Family: Dioscoreaceae (Yam Family)

A climbing plant that is able to tolerate low pH (acidic waters). Locals believe that this plant has properties that can help prevent or forestall a threatened miscarriage. The plant's root or tuber is grated, mixed with brown stout vinegar, and then spread onto paper and placed on the small of a woman's back.



DAUN KEPALA TUPAI

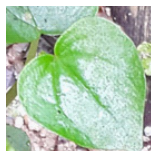
NATIVE

Botanical name: *Drynaria quercifolia*

Family: Polypodiaceae (Fern Family)

It has bird-Attracting fruits and its flower nectar used as food source for butterfly.

Its fruits attract birds and its flower nectar is a food source for butterflies. The plant extract is sprinkled on patients to relieve fever, and the leaf (after it's pounded into a mush) can be applied to treat swellings.



KETUM-PANG AIR

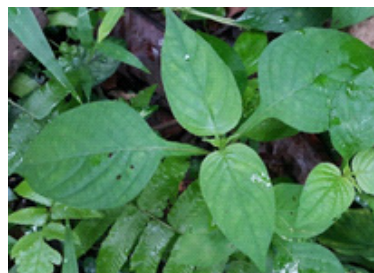
NATIVE

Botanical name: *Peperomia pellucida*

Family: Piperaceae (Pepper Family)

This herbaceous plant is a host for mealybugs (soft-bodied, wingless insects that often appear as white cottony masses on leaves) and the leaves are often eaten by slugs.

This plant has anti-inflammatory properties. In Indonesian folk medicine, bruised leaves are applied to the head to relieve headaches during fever. The juice obtained from the leaves is taken to treat symptoms of abdominal pain and colic. In the Philippines, the plant is applied as a poultice for abscesses and boils. In India, a whole plant decoction (crushed plant material boiled in water) is taken to stop bleeding. In Brazil, it is used to lower cholesterol and treat infections.



RUMPUT ISRAEL

NATIVE

Botanical name: *Asystasia gangetica*

Family: Acanthaceae

It has bird-Attracting fruits and its flower nectar used as food source for butterfly.

This herbaceous plant has fruits that attracts birds and its flower nectar is a food source for many butterflies. Some of the butterflies that you are likely to come across around this plant include the Great Eggfly (*Hypolimnna bolina*), Autumn Leaf (*Doleschallia bisaltide*), Blue Pansy (*Hypolimnna orithya wallacei*) and Jacintha Eggfly (*Hypolimnna bolina jacintha*). In Nigeria, the leaves are used for the treatment of asthma.





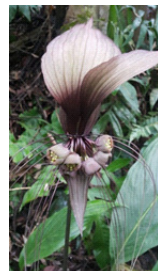
POKOK LEKIR / ELEPHANT FOOT YAM

NATIVE

Botanical name: *Amorphophallus sp.*

Family: Araceae

A herbaceous plant. It is pollinated by Carrion Insects, Carrion Fly, Carrion Beetle. The root is carminative, restorative, stomachic and tonic. It is dried and used in treating piles and dysentery. The fresh root acts as an acrid stimulant and expectorant, it is much used in India in treating acute rheumatism. The stem is cut, and the inside of the stem eaten raw to treat snakebites. The sap from the petiole is fermented and drunk to treat diarrhoea and dysentery. The tubers edible if cooked (toxic when raw), often found in Indian markets, and often used in curries and stews in several Asian countries, especially Indonesia. Leaves and leaf stalks also cooked and eaten as vegetable.



KELADI MURAI / BLACK LILY

NATIVE

Botanical name: *Tacca integrifolia*

Family: Dioscoreaceae (Yam Family)

A herbaceous plant. Its flowers are insect-pollinated. Their rhizomes used in Traditional Chinese Medicine to treat gastric ulcers, burns and high blood pressure and burns, as well as improve sexual function. In Malaysia, rhizome paste applied to treat skin rash caused by hairy stinging caterpillars, and onto wounds or heel cracks. Pounded berries mixed with water and drunk to treat dysentery and stomachaches. Leaf decoction taken orally with salt for bloody dysentery and acute diarrhoea. Their cut stems bundled up, wrapped with leaves, and roasted to extract juice that is applied as poison to arrowheads. Orang asli (aboriginal Malays) in Malaysia said to avoid looking into the "eyes" of the inflorescence for fear of death. Due to its almost all-black inflorescences, plant also regarded as inauspicious by the superstitious.

STATION 2



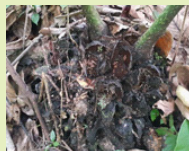
PAKU GAJAH/ GIANT FERN

NON-NATIVE

Botanical Name: *Angiopteris evecta*

Family: Marattiaceae

A fern. It is the food plant for caterpillars of the moths, grass webworm (*Herpetogramma licarsialis*) and *Spilosoma vandepolli*. The leaves are pounded to relieve coughs. The roots are used to stop bleeding after a miscarriage. The rhizome is used medicinally in Thailand.



RUMPUT TAHI AYAM

NON-NATIVE

Botanical name: *Ageratum conyzoides*

Family: Asteraceae

A herbaceous plant. The leaves contain insecticidal compounds that promote early metamorphosis and altered morphological development. The plant extract provides pain relief and increases mobility in patients with arthritis. The plant also has an antidiarrhoeal effect. Its essential oils have antibiotic properties. The plant is highly embryotoxic to *Dysdercus flacidis* and acts on embryonic development at an early stage. The juice of the fresh plant, or dried plant extract, is used to treat allergic rhinitis and sinusitis. The fresh juice is also useful in treating post-partum uterine haemorrhage. The plant can also treat constipation, infective hepatitis, eczema, epilepsy, fresh wounds, dizziness, diarrhoea, dysentery, sore eyes, fever, headaches, intestinal worms, filariasis, vomiting and nausea, wounds and cuts.





KELADI CINA / TARO

NATIVE

Botanical name: *Colocasia esculenta*

Family: Araceae

A herbaceous plant. This species has phytoremediation potential, because it could potentially accumulate mercury. The plant is antibacterial and hypotensive. A decoction of the leaves is drunk to promote menstruation. A decoction, together with some parts of other plants, is taken to relieve stomach problems and to treat cysts. The plant is used to treat wounds too. The scraped stem, together with some parts of other plants, is used to create an appetite. Their corms are edible if cooked (boiled, baked, fried etc, like potatoes).



SEN- DUDUK GAJAH

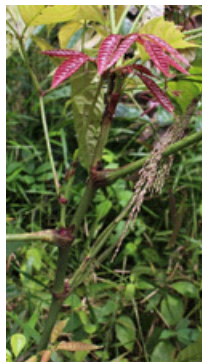
NATIVE

Botanical name: *Oxyspora bullat*

Family: Melastomataceae

A shrub. The plant parts which are roots and leaves can be made into drinks for decoction given after childbirth.

STATION 3



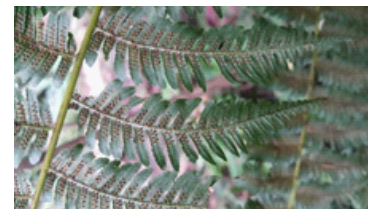
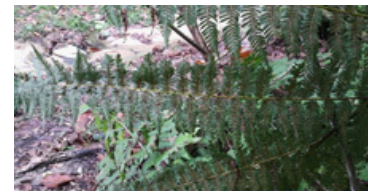
HEART- LEAF HEMP- VINE

NATIVE

Botanical name: *Mikania cordata*

Family: Asteraceae

A climber. It has ecological relationship with Malayan Gaur. A decoction of the leaves is used in the treatment of coughs. The leaves are used as a poultice for swellings, itches and wounds. It could be used as a cure for snake and scorpion bites. The leaf juice is used as a remedy for sore eyes. The infusion of plant is used in the treatment of affections of the stomach and intestines, including gastric ulcers. The plant has been used as a cover crop to prevent soil erosion, Leaves are edible often cooked and eaten in soups.



TREE FERN

NATIVE

Botanical name: *Cyathea sp.*

Family: Cyatheaceae

This fern is the only fern species with a trunk. There is no new formation of new woody tissue as trunk grows. Instead, the trunk is facilitated by a fibrous cluster of roots that expands as the tree fern grows.



JULUNG RIMBA

NATIVE

Botanical name: *Codonoboea platypus*

Family: Gesneriaceae

A herbaceous plant. It is also known as *Didymocarpus platypus*. This robust herb is found deep in the forest in shade, often near the edges of streams or other wet areas. It has white flowers with slightly purple-tinged lobes. Its name means "broadlyfooted", which could be referring to the shape of its leaves.



POKOK DUDAR / FISH TAIL PALM

NATIVE

Botanical name: *Caryota mitis*

Family: Arecaceae

A palm. It is a bird-attracting plants. The trunk contains a starch that can be used to make sago.



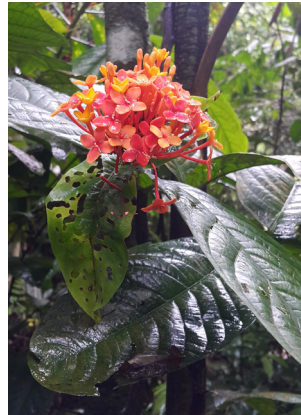


JEJARUM

NON-NATIVE

Botanical name: *Ixora coccinea*
Family: Rubiaceae (Coffee Family)

A shrub. The genus epithet 'Ixora' named after Malabar-Indian deity Iswara, who is associated with the sacred *Ixora coccinea* (Jungle Flame) and worshipped with its flowers. Various cultivar epithets and common names allude to the plant's unusual foliar structure, which resembles knotted ropes used in Indian rope tricks performed by magicians. It is also known to be an important extracts for gambier used as a tanning agent, a brown dye, a food additive and as herbal medicine.



STATION 4



PAKU BIAWAK

NATIVE

Botanical name: *Tectaria Singaporeana*

Family: Tectariaceae (Fern Family)

A fern. Latin *Tectaria*, roofed, referring to the complete indusium (a covering that protects the young sporangia), Latin *singaporeana*, from Singapore, referring to one of the natural geographical distributions of this species. It is used a cure for fever and as a post natal tonic in Malay folk medicine.





PAKU MIDIN / CLIMB- ING FERN

NATIVE

Botanical name: *Stenochlaena palustris*

Family: Blechnaceae (Fern Family)

A fern. The genus *Stenochlaena* means "narrow-cloak" and refers to the sporangia covering the entire surface of the linear fertile pinnae. Species *palustris* means "of swampy ground". The young fronds are collected as a vegetable and fried with sambal belacan. A durable rope can be made from the stems.



PAKU PAKIS

NATIVE

Botanical name: *Adiantum sp.*

Family: Pteridaceae

A fern. It is known as maidenhair fern. It has a wiry, dark, polished stem, making it almost invisible against the backdrop of the forest floor. Makes the leaflets look like they are floating in mid-air. Maidenhair fern is used for bronchitis, coughs, whooping cough, and heavy menstruation with cramps. It is also used to loosen chest congestion. Some people apply maidenhair fern directly to the scalp for hair loss and to make hair darker. Do not confuse maidenhair fern with maidenhair tree, which is another name for *Ginkgo biloba*.





MEROYAN TINGGAL / SILVER COMET

NATIVE



Botanical name: *Globba pendula*

Family: Zingiberaceae (Ginger Family)

A herbaceous plant. This plant has been used traditionally as a protective medicine after childbirth and for treating stomach complaints.



LUMBAH RIMBA

NATIVE

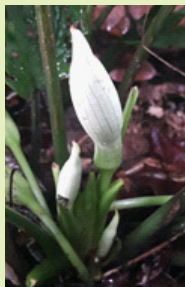


Botanical name: *Molineria latifolia*

Family: Hypoxidaceae (Star Lily Family)

A herbaceous plant. Its flowers are insect-pollinated. A decoction of the rhizome is used in menorrhagia and ophthalmia. Their fruits are edible and can whet the appetite. Curculin, an artificial sweetener, is extracted from the fruits too. The leaves may be employed to pack fruits, or rolled into string. Fibres extracted from the leaves can be used to make fishing nets.





MATA BISUL / CAMOU- FLAGE PLANT

NATIVE

Botanical name: *Agloenama pictum*

Family: Araceae

A herbaceous plant. A famous household ornamental plants. Its flowers are insect-pollinated, and its fruits are probably dispersed by birds or mammals.



MON- KEY'S POTATO

NON-NATIVE

Botanical name: *Plectranthus monostachyus*

Family: Lamiaceae

A herbaceous plant. In Africa, this species is used in rituals related to pregnancy. According to folk medicine, the leaf sap is taken internally for fever, cough, headache, colic and convulsions. It is thought to have a calming, sedative effect, as well as improving appetite and strengthening the stomach. In Africa, the leaves are boiled as a vegetable.



KADOK

NATIVE

Botanical name: *Piper stylosum*

Family: Piperaceae (Pepper Family)

A herbaceous plant. The root is used as a poultice or decoction medicinally after confinement. The leaves use as a vegetable and seasoning.



KACIP FATIMAH

NATIVE

Botanical name: *Labisia pumila*

Family: Primulaceae (Primrose Family)

A herbaceous plant. In Malaysia, plant extracts are used to help induce childbirth and promote recovery after childbirth. The extracts may also protect skin from the aging effects of UVB irradiation and could potentially be used in cosmetic products. The plant's extract has also been commercially formulated for consumption in capsule and tablet form, as well as an ingredient in energy drinks.





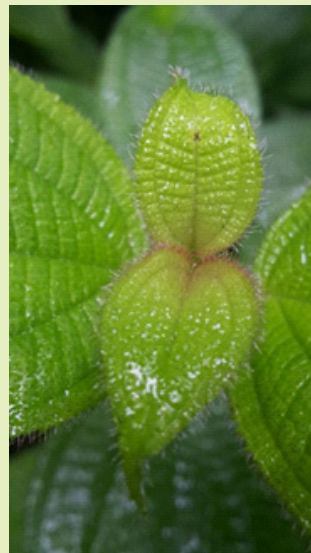
DAUN LIDAH

NATIVE

Botanical name: *Aglaonema nitidum*

Family: Araceae

A herbaceous plant. Its flowers are pollinated by flies and fruits are eaten by birds. In Malaysia, the roots are used as a tonic for children and as anthelmintic, and a decoction of the roots is drunk to treat fever and dropsy. In the Moluccas, heated leaves are used to reduce swellings, but this sometimes results in sores. *Aglaonema* species are commonly grown as ornamental plants for their variegated foliage and bright red fruits, e.g. *A. commutatum*, *A. nebulosum*, *A. simplex*, *A. nitidum* and *A. crispum*. In tropical regions, they are cultivated in gardens and also commonly grown as an indoor pot plant there and in temperate regions.



SEN- DUDUK BULU

NON-NATIVE

Botanical name: *Clidemia hirta*

Family: Melastomataceae

A shrub. It has been widely introduced as an ornamental plant. This plant reproduces by seed, which are principally dispersed by fruit-eating birds. Other animals moving through thickets of this species may carry seeds away with them (e.g. feral pigs) and the fruit are also dispersed by floodwaters. Long distance dispersal may also be brought about by human activities.

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APPENDIX

WETLAND PLANTS

In general, the most significant functions of wetland plants in water purification are the physical effects brought by the presence of the plants.

These plants provide a huge surface area for attachment and growth of microbes. The physical components of the plants stabilize the surface of the beds, slow down the water flow thus assist in sediment settling as well as trapping process and finally increasing water transparency.

Wetland plants play a vital role in the removal and retention of nutrients and help in preventing the eutrophication of wetlands. For instance, water hyacinth (*Eichhornia crassipes*) and duckweed (*Lemna minor*) are common floating aquatic plants which have shown their ability to reduce concentrations of BOD, TSS and Total Phosphorus and Total Nitrogen. The Common Reed (*Phragmites* spp.) and Cattail (*Typha* spp.) play a vital role in the removal and retention of nutrients.

Type	Common name	Scientific name
Floating plant	Water gentian	<i>Nymphoides indica</i>
	Water mimosa	<i>Neptunia oleracea</i>
	White primrose	<i>Ludwigia adscendens</i>
	Water lily	<i>Nymphaea nouchali</i>
	Water hyacinth	<i>Eichhornia crassipes</i>
Emergent plants	Common duckweed	<i>Lemna minor</i>
	Tube sedge	<i>Lepironia articulate</i>
	Phragmites karka	<i>Common reed</i>
	Scirpus mucronatus	<i>Bog bulrush</i>
Marsh	Spike rush	<i>Eleocharis dulcis</i>
	Greater club rush	<i>Scirpus grossus</i>
	Typha angustifolia	<i>Cattail</i>
	Common Hanguana	<i>Hanguana malayana</i>
Shallow marsh	Fan grass	<i>Phylidrum lanuginosum</i>
	Sumatran scleria	<i>Scleria sumatrensis</i>
	Golden beak sedge	<i>Rhynscospora corymbosa</i>
	Spike rush	<i>Eleocharis variegata</i>
	Asiatic pipewort	<i>Eriocaulan longifolium</i>
Submerged plants	Water trumpet	<i>Cryptocaryne cordata</i>
	Common bladderwort	<i>Utricularia bifida</i>



Water hyacinth
(*Eichhornia crassipes*)



Cattail
(*Typha angustifolia*)



White primrose
(*Ludwigia adscendens*)



Common reed
(*Phragmites karka*)

ACKNOWLEDGEMENT

This guidebook is an important milestone in our conservation efforts of Sungai Penchala source particularly since 2001. The open classroom which places on source of Sungai Penchala houses variety of flora and aquatic fauna which mostly were documented in this book. Many agencies, organizations and individuals have contributed to the work of this journey. We are grateful to:

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JABATAN LANDKAMP NEGARA
KEMENTERIAN KESELIAHTERAHAN ISKANDAR,
PERUMAHAN DAN KESALAMAN TERESTRIAL



JABATAN PENGALIRAN DAN SALIRAN
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