THE MANAGEMENT PLAN
FOR THE CONSERVATION OF
PULAI TRAIL URBAN COMMUNITY FOREST

- A Consultative Report -

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Content

Executive Summary

Pulai Trail Urban Community Forest (PT) is currently managed by Free Tree Society together with other relevant stakeholders as an education and recreational forest. PT is a secondary forest that has established itself from a former rubber plantation. Notably, due to the steep terrain some of the indigenous tree species were left untouched during the establishment of the rubber plantation. These remnant indigenous tree species have successfully naturally regenerated and spread in the 6-ha plot.

The species composition and their carbon sequestration potential were determined in this study. The site has 44 indigenous rainforest tree species per ha and most of them are primary forest tree species. It has a Shannon diversity index of 3.4 which is higher than any secondary forests that have been documented. The evenness is high which means highly diversified according to its species distribution. An estimated sequestrated carbon in the stand is about 335.4 tC ha-1 and 1304.5 tCO_2eq ha-1. Based on an assumption of annual diameter at breast height growth of 1 cm $y^{-1}$the stand could sequestrate 13.31 tC ha-1y-1 and 48.81 tCO_2eq ha-1y-1 (carbon stock).

The most important environmental function of the PT is acting as a shield to reduce the risk of landslides to the residences of Bangsar Park and Bangsar Indah. The secondary forest plays an important role in soil conservation. Gully formations, however, can be found along damaged drainage descending from the hilltop facing Jalan Kedah and Jalan Kelantan. This could pose danger to slope stability and increase the risk of landslides.

In conclusion, the PT should be managed as a research-education recreation forest properly and management and development strategies of PT for its multipurpose uses are also discussed in this report.

CHAPTER 1

INTRODUCTION

1.1 Introduction and Justification

The Pulai Trail Urban Community Forest (PT) is located within Bukit Persekutuan (Federal Hill). The total greenspace of Bukit Persekutuan covers about 7.5-ha of mixed regrowth forest. This urban forest functions as a green lung for the city as established greenspaces help to offset carbon emissions and filter pollution from the heavy traffic in the city. The PT is one of the named greenspaces of Bukit Persekutuan consisting of 6-ha of secondary forest. It is made up of lowland natural forest tree species that have successfully established through natural succession in what was a former rubber estate. The rubber plantation was established in 1906 as part of the former SOCFIN estates that were later developed into a township in 1969 popularly known as Bangsar Park. Hence, the age of the secondary regrowth of PT is estimated to be about 100 to 117-year-old secondary forest. The site can be assessed easily as indicated in Map 1.1.

Map 1.1: The location of Pulai Trail Urban Community Forest that is highlighted in green.

The PT is currently managed voluntarily by Free Tree Society Kuala Lumpur (FTS) which is a non-government organization. FTS promotes awareness on the science and solutions of environmental degradation, approaches for rehabilitation of degraded ecosystems, and actively distributes resources like free planting stock (trees and plants) to empower the adoption of sustainable practices in the community.

The PT is a model of sustainable management practice to help the rehabilitation processes of a secondary forest and to optimize its environmental, ecological and educational functions. Presently, PT not only functions as a green lung to the community but also functions as a soil conservation site, a diverse tree depository, an urban habitat for fauna, and a carbon offset site.

The PT is currently being utilized as a greenspace for educational purposes by FTS and has successfully exposed over 600 members of the public to basics of conservation and rehabilitation of urban forests and allowed them to enjoy the fauna and flora located within this secondary forest. Fauna found in PT includes small mammals, snakes, frogs, birds, and insects that notably includes fireflies. In addition, PT is also used as a recreational site for nature lovers who access the forest using the 1km forest trails that are maintained weekly by FTS and FTS volunteers. Hence, FTS has been voluntarily sustainably managing the PT by executing a community-based conservation plan that not just manages the public's use and awareness of the site but optimizes its environmental services through active rehabilitation to prevent degradation and loss of function.

1.2 THE VISION

The vision is for the Pulai Trail Urban Community Forest (PT) forest site to be gazetted and managed for multipurpose use that includes conservation of biodiversity, research, education and recreation.

1.3 THE MISSION

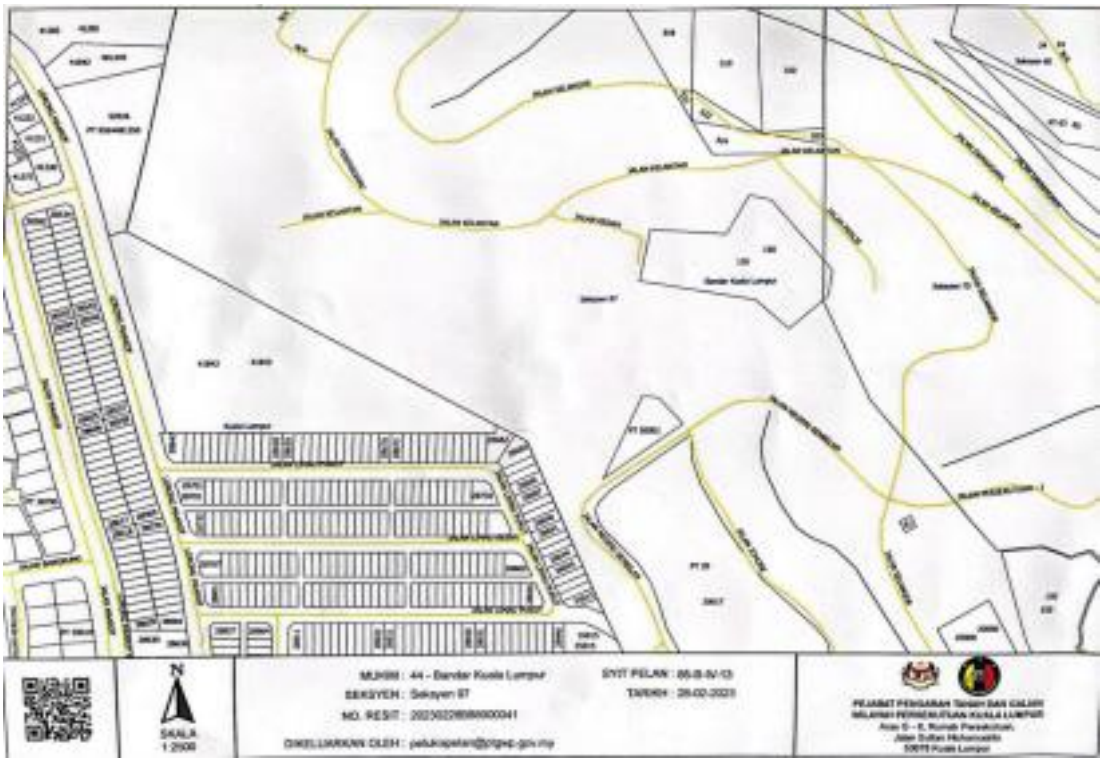
To manage PT systematically and sustainably to achieve the vision statement by developing and implementing a PT Management Plan that encompasses sustainable management of its conservation purposes.

The PT Management Plan would function as a formal planning tool that aims to design future desirable operations of the site. It is envisaged that PT shall be managed for the following beneficial purposes:

[1] A depository of Indigenous Red List tree species
[2] A green lung for carbon sequestration
[3] A research forest
[4] An education forest
[5] A recreation forest

1.4 THE RIGHT OF MANAGEMENT

The land of Pulai Trial is currently zoned as greenspace; thus, the owner is Pejabat Tanah dan Galian (PTG). Developers are eyeing the land and currently there is a Lot demarcated for development within the Pulai Trail (Map 1.2), that has been recently alienated (in early 2023). Hence, FTS does not have legal right for the management of the site.



Map 1.2: The lot PT50001 in Pulai Trail is being applied to be alienated for development.

Parties like FTS who are in favour of the conservation of PT would need to communicate with Pejabat Pengarah Tanah dan Galian (PPTG) and Dewan Bandaraya Kuala Lumpur (DBKL) any objection and implore the goodwill of said departments to help conserve the PT and ensure it remains undeveloped for the benefit of all.

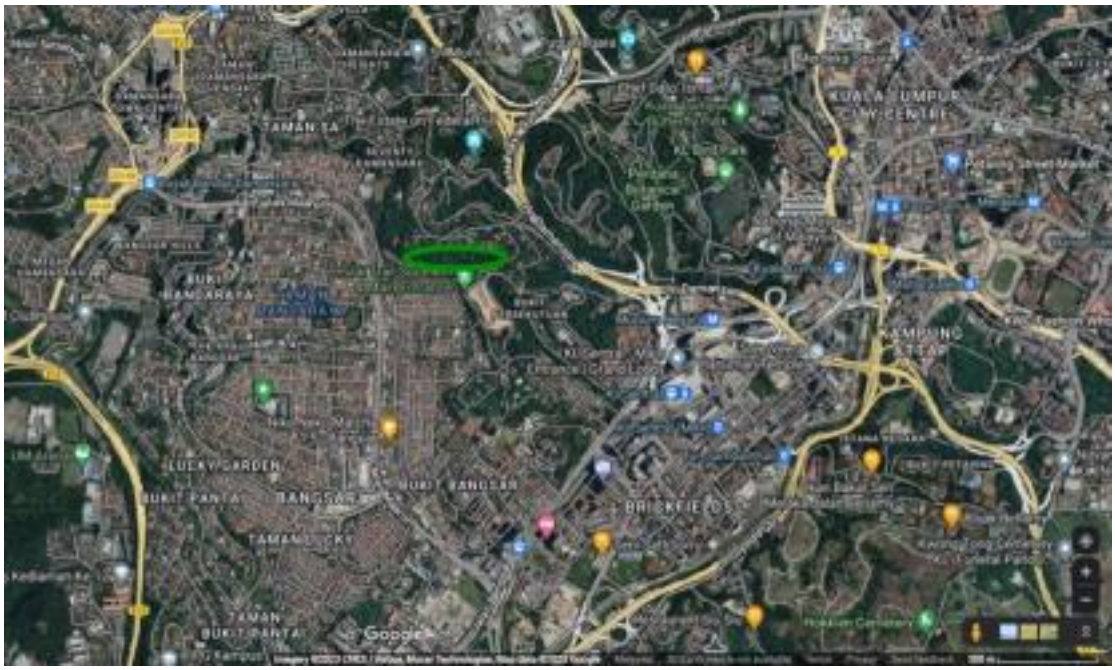
A strategic partnership with stakeholders of PT for the smooth implementation of a Management Plan would need to be created. It is recommended that a formal steering committee including the municipal, land office, city hall, and other relevant stakeholders be urgently created for the sustainable management of PT.

CHAPTER 2

TOPOGRAPHY

2.1 THE LOCATION

The location of the Pulai Trail Urban Community Forest is as shown in Map 2.1. The PT can be easily accessed through a trail from Bangsar that is located in front of Free Tree Society's Bangsar Nursery on Jalan Limau Purut. The main trail entrance is at Jalan Negeri Sembilan, located beneath a large Pulai tree. Another lesser used entrance is located at the road shoulders of an access road from Kelab Veteran Komando Malaysia which joins to Jalan Kelantan - Jalan Terengganu (Plate 2.1). Both entrances to PT are shown in the map provided in Chapter 7.



Map 2.1: The Pulai Trail Urban Community Forest is highlighted as green.

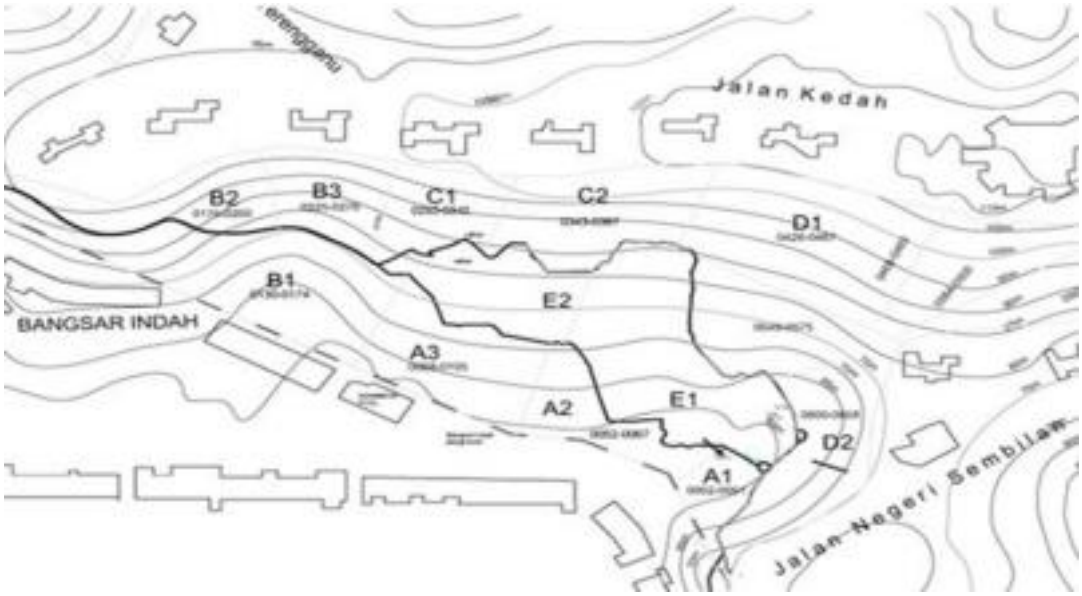
The boundary of PTGS is shown in Map 2.2. The green space is enclosed by housing development and also roads.

Plate 2.1: The spot that can see the panoramic view of Bangsar Park was part of the Jungle Fowl Trail that now ends in front of Kelab Veteran Komando Malaysia.

Map 2.2: The boundary (Red) of Pulai Trail Urban Community Forest

2.2 TERRAIN

The landscape of Pulai Trail Urban Community Forest (PT) undulates from flat to steep terrain as shown on the contour map (Map 2.3).



Map 2.3: The Contour Map of Pulai Trail Urban Community Forest

The topography of the lowest terrain is 60 m above sea level (a.s.l) to the highest of 105 m a.s.l. The terrain is rolling and undulating. The slope ranges from <10% to > 30%. Three zones are classified according to their slope gradient (Table 2.1). Types A, B and C form the landscape of PT.

Table 2.1: Classification of Terrain

Type	Description	Zone
Low site nearly level (TYPE A)	The site is wet and waterlogged during rainy days. Some of the excess water was drained through the existing drainage systems along the boundary of houses in Bangsar Park. However, some parts are water-logged.	A1, A2 and A3 distributed below 60 m a.s.l.
Slope more than 5% but less than 15% (TYPE B)	The terrain is well-drained but some of the sites are affected by erosion due to the damaged drains that discharge surface water runoff during rainy days from the hilltop houses.	A2, A3, B1, E1, E2 and some portions of D2

Type	Description	Zone
Steep slope more than 15% to > 30% (TYPE C)	The terrain covers strongly rolling to very hilly portions.	Some portion of B1, B2, B3, C1, C2, C3, D1 and D2

2.3 A LANDSLIDE SHIELD

Pulai Trail Urban Community Forest has a low-lying site that is waterlogged during the heavy rains > 4 mm/day. The site with contour at 60 m a.s.l. will be waterlogged. The low-lying side is occupied with housing estates that are located at the North-West to South-West Direction.

The highest ground is located along the North-East to South-East direction of PT. The high ground is at about 105 m a.s.l. The highest point is at 110 m a.s.l. The hilltop of PT from 105 to 110 m a.s.l has been developed into buildings including Kedah Palace, government quarters, and offices (Plate 2.2). Hence, the developed areas discharge their surface water run-off through open concrete drains via the steep terrain to the North-West, West and South-West direction of the PT.

Plate 2.2: Some of the buildings on the contour of 105 to 110 m a.s.l. which forms part of the hilltop of Pulai Trail Urban Community Forest.

The contour of the lowest ground is below 60 m a.s.l. The damaged drainage from these buildings may pose dangers to the soil-holding capacity of PT and this would increase the risk of landslide (Plate 2.3).

The 6-ha PT is also acting as a sponge to retain the excessive rainfall during the monsoon season. PT is thus functioning as a protective shield to hold the soils of the steep terrain in its safe position and prevent increased risk of landslides. Removal of vegetation cover from the PT would increase the risk of landslides occurring. This will pose danger to the residences along the foothill of the PT.

Plate 2.3: The damaged drainage belongs to one of the buildings that pours its surface water runoff directly into the steep terrain of Pulai Trail Urban Community Forest. The formed gully erosion is filled with plant debris and waste.

Several open concrete drains located at the top and along the steep slopes are broken, blocked and thus defective, causing improper surface water runoff to erode gullies into the steep slopes. The risk of slope instability shall be increased if gully erosion is not ameliorated. Gullies that formed with more than 1 m width cut are caused by surface water downpouring along the gradient towards the direction of Bangsar Park. These gullies will be further enlarged, eventually destroying the slope stability of PT. Hence, urgent slope amelioration work needs to be carried out.

An early indication of danger would be observing any/more frequent uprooting of trees growing on the slopes following bouts of rain. This would indicate weakened soil strength caused by water saturation, when the trees are no longer able to root anchor firmly in water saturated soils.

Hopefully, PT will not be replaced by a concrete wall/slope in the near future (Plate 2.4) in lieu of remedial works to the drainage system. Without good soil conservation efforts on the steep slopes, a concrete wall would be the only way to minimize the risk of landslides at the cost of the numerous and necessary environmental services that the PT forest provides. Hence it is urgent that immediate measures are taken by authorities to repair and improve the drainage system into PT including informing potential affected houseowners about the gully erosions formed by damaged drains that will compromise slope stability (Plate 2.4).

Plate 2.4: Concrete retention wall is used to replace the natural regrowth on the slope. The slope is concreted to prevent surface erosion that may lead to landslide. The slope was behind the Club Veteren Komando Malaysia.

CHAPTER 3

TREE SPECIES COMPOSITION

3.1 INTRODUCTION

The ecological importance of PT shall be reflected in its biodiversity. PT is an isolated patch of greenspace that was cut off by surrounding development hence it is not a habitat for big mammals except for some wild dogs that are roaming there. Smaller fauna like insects, amphibians, reptiles, birds, monkeys and small rodents have made PT their habitat. The abundance of their population would need to be further confirmed through a proper study.

The floristic composition includes trees, palms, climbers, shrubs, seedling and herbaceous ground cover that form a vertical structure of 4-strata. The climbers are plenty, abundantly covering trees. Some climbers have eventually killed trees by covering the crown of the tree, cutting out sunlight to the leaves thereby reducing their physiological functions to synthesize food for growth.

The species composition of the flourishing growth of mixed tree species had yet to be determined, hence, a tree identification exercise was carried out. The following pages of this chapter shall reveal the composition of the tree species with diameter at breast height > 10 cm.

3.2 THE STUDY PLOT

Tree identification was carried out on tagged trees. The tree tagging exercise was carried out by FTS in conjunction with volunteering activities that was implemented as a knowledge sharing workshop with the public specifically on the role and importance of tree inventory as part of a conservation exercise.

It is noted that tree identification was not completed for all the tagged trees as some could not be located. In subsequent excursions identified tagged trees can be used to ascertain the identification of the missing tagged trees. On the flipside, some >10 cm diameter trees were missed during the tagging exercise, and these were tagged with a temporary tag during the field identification (Plate 3.1). The tree identification exercise was carried out without the presence of flower and fruit, hence, some of the species may have to be revised when fruit and flowers are available on subsequent identification exercises.

The identified tree species list is found in Appendix I. The list of indigenous trees with dbh >10 cm should be updated and revised biannually as the diameter increment of lower dbh class will grow into the dbh >10 diameter class. Some

trees were recorded without their GPS readings due to technical errors and this also needs to be updated in the next enumeration.

The tree species composition was determined for PT using a study plot of 1 ha. The trees in the 6-ha PT were tagged and 1 ha from the PT was demarcated for the purpose of this study (Map 3.1).

Plate 3.1: The tagged Meraga (*Adina eurhyncha*) and *Sterculia rostrata* was tagged with a temporary number T028.

Map 3.1: The location of the 1 ha study plot.

3.3 THE SPECIES COMPOSITION

3.3.1 SHANNON DIVERSITY INDEX (SDI)

The indigenous tree species composition was determined for the 1 ha plot study (Map 3.1). The rubber tree (*Hevea brasiliensis*) and its regeneration were excluded from the analysis. The diversity index was determined using the Shannon Diversity Index [Shannon,1948]. The diversity parameters of woody species were calculated using the index including the following:

H = SUM[(pi)x ln(pi)]

SUM = summation **S** = species richness = number of species

Pi = proportion of total sample represented by species i (divide number of individuals of species i by total number of samples)

High values of H would be representative of more diverse communities. A community with only one species would have an H value of 0 because Pi would equal 1 and be multiplied by ln Pi which would equal zero. If the species are evenly distributed, then the H value would be high. So, the H value allows us to know not only the number of species but how the abundance of species is distributed among all the species in the community (Shannon, 1948).

Hmax = Maximum diversity possible= ln(S) **EH** = Evenness = H/Hmax

The Shannon Evenness Index is a way to measure the evenness of species in a community. The term "evenness" simply refers to how similar the abundance of different species is in the community.

3.3.2 SHANNON DIVERSITY INDEX (H)

The 1 ha plot has 44 indigenous tree species that have a diameter at breast height >10 cm. The density of the indigenous tree species other than rubber tree (*Hevea brasiliensis*) is 126 stem/ha. Some tree species are from the lowland rainforest tree species. These tree species include *Dyera costulata, Cratoxylum cochinchinense, Dacryodes rugosa, Horsfieldia irya, Litsea umbellata, Aidia densiflora,* Adina eurhyncha, *Heritiera simplicifolia* and Garcinia *nervosa*. These are remnant rainforest tree species that most likely escaped destruction because of steep terrain being left untouched when the rubber plantation was developed in 1906. The indicator tree species for secondary elements such as *Alstonia angustiloba, Artocarpus elasticus, Porterandia anisophylla, Macaranga gigantea, Macaranga triloba* and Endospermum *malaccense* are commonly found in terrain TYPES A & B. *Falcataria falcata* is a neutral species that is adapted to grow in harsh sites and commonly found in the open site and secondary forest. Hence, these trees are found at the roadside, open space behind the buildings along the boundary and trails of PT.

Table 3.1: Shannon diversity Index

No	*Species*	Density	pi	ln(pi)	[pixln(pi)x-1]
1	*Adinobotrys atropurpureus*	1	0.008	-4.836	0.038
2	*Adenanthera bicolor*	1	0.008	-4.836	0.038
3	*Aidia densiflora*	2	0.016	-4.143	0.066
4	*Alstonia angustiloba*	4	0.032	-3.450	0.110
5	*Falcataria falcata*	1	0.008	-4.836	0.038
6	*Adenanthera pavonina*	1	0.008	-4.836	0.038
7	*Aporosa arborea*	1	0.008	-4.836	0.038
8	*Arthrophyllum diversifolium*	4	0.032	-3.450	0.110
9	*Archidendron ellipticum*	1	0.008	-4.836	0.038
10	*Artocarpus elasticus*	4	0.032	-3.450	0.110
11	*Artocarpus integer var. silvestris*	10	0.079	-2.534	0.201
12	*Artocarpus scortechinii*	7	0.056	-2.890	0.161
13	*Barringtonia scortechinii*	1	0.008	-4.836	0.038
14	*Chisocheton sp*	3	0.024	-3.738	0.089
15	*Microcos tomentosa*	1	0.008	-4.836	0.038
16	*Cratoxylum cochinchinense*	1	0.008	-4.836	0.038
17	*Dacryodes rugosa*	2	0.016	-4.143	0.066
18	*Diospyros lanceifolia*	2	0.016	-4.143	0.066
19	*Elaeocarpus petiolatus*	4	0.032	-3.450	0.110
20	*Endospermum malaccense*	2	0.016	-4.143	0.066
21	*Euodia glabra*	3	0.024	-3.738	0.089
22	*Gironniera nervosa*	6	0.048	-3.045	0.145
24	*Heritiera simplicifolia*	1	0.008	-4.836	0.038

No	*Species*	Density	pi	ln(pi)	[pixln(pi)x-1]
25	*Horsfieldia sucosa*	1	0.008	-4.836	0.038
26	*Ixonanthes reticulata*	1	0.008	-4.836	0.038
27	*Syzygium sp*	6	0.048	-3.045	0.145
28	*Baccaurea sp*	3	0.024	-3.738	0.089
29	*Vitex pubescence*	2	0.016	-4.143	0.066
30	*Litsea umbellata*	3	0.024	-3.738	0.089
31	*Macaranga gigantea*	4	0.032	-3.450	0.110
32	*Vitex quinata*	1	0.008	-4.836	0.038
33	*Nauclea maingayi*	3	0.024	-3.738	0.089
34	*Oroxylum indicum*	1	0.008	-4.836	0.038
35	*Knema sp*	2	0.016	-4.143	0.066
36	*Pellacalyx saccardianus*	3	0.024	-3.738	0.089
37	*Porterandia anisophylla*	2	0.016	-4.143	0.066
38	*Nephelium sp*	4	0.032	-3.450	0.110
39	*Sarcotheca griffithii*	1	0.008	-4.836	0.038
40	*Streblus elongatus*	19	0.151	-1.892	0.285
41	*Symplocos cochinchinensis ssp laurina*	2	0.016	-4.143	0.066
42	*UNKN1*	2	0.016	-4.143	0.066
43	*UNKN2*	1	0.008	-4.836	0.038
44	*Xerospermum noronhianum*	2	0.016	-4.143	0.066
	Subtotal	126	1.000	H	3.400
				EH	0.898

The character of PT is unique as it has primary elements of natural lowland rainforest tree species, i.e., remnants of indigenous tree species from what was once a forested Kuala Lumpur predevelopment. Some of the mother trees are growing in steep terrain > 30%.

The Shannon Diversity Index is high at 3.4 and denotes the high diversity within the species composition of the secondary forest.

The H-value for lowland dipterocarp forest and riparian forests are 4.84 and 3.38 respectively [Zani, et. al.,2013]. Another study in the same forest type, lowland forest of Kuala Keniam, recorded a lower H-value at the ranges of 3.42 to 3.97 [Suratman, et al., 2010]. In contrast, [Khairil et. al., 2011] reported a considerably higher H-value for inland, seasonal flood and riverine forest at Chini watershed forest, Pahang. The H-values for the three forests were 5.40, 5.10 and 5.08, respectively.

The secondary forest of the 1 ha study plot in PT had higher Shannon-Weiner value H than the secondary forest of Miombo Woodlands which is within the range of 1.29 to 1.50. [Isango, 2007] The low H-values of the secondary forests could be due to high intensity of deforestation that affected the tree species diversity in the forest. The degradation of site properties and lack of seed source are the main reasons for low natural regeneration. **The PT has a Shannon diversity index that is higher than any documented secondary forest.**

CHAPTER 4

CARBON SEQUESTRATION POTENTIAL

4.1 INTRODUCTION

Carbon sequestration plays an important role in climate change mitigation. The Kyoto Protocol under UNFCCC allows countries to receive credits for their carbon-sequestration activities in the area of land use, land use change, and forestry (LULUCF) as part of their obligations under the protocol. Such activities could include afforestation (conversion of non-forested land to forest), reforestation (conversion of previously forested land to forest), improved forestry or agricultural practices, and revegetation. According to the Intergovernmental Panel on Climate Change (IPCC), improved agricultural practices and forest related mitigation activities can make a significant contribution to the removal of carbon dioxide from the atmosphere at relatively low cost (IPCC, 2006). These activities could include improved crop and grazing land management—for instance, more efficient fertilizer use to prevent the leaching of unused nitrates, tillage practices that minimize soil erosion, the restoration of organic soils, and the restoration of degraded lands. In addition, the preservation of existing forests, especially the rainforests of the Amazon and elsewhere, is important for the continued sequestration of carbon in those key terrestrial sinks (Salin, 2019).

Hence, carbon sequestration projects are necessary to reach the UNFCCC Paris Agreement targets and limit the global average temperature increase to well below 2°C (Smith, 2016; UNFCCC, 2021). Planting trees is an effective way to capture and store carbon from the emission and many of such projects have steadily increased in the past decade (IPCC, 2006, Holl & Brancalion, 2020; Griscom, 2017), with the aim of both supporting livelihoods and sequestering carbon dioxide (CO_2) to be captured and stored for long duration (Smith, 2016).

The United Nation has encouraged tree growing for capture and storage of carbon with incentives, especially for degraded lands including ex-mines, acid sulfate idle land, abandoned agriculture land and grassland. Conserving forestlands like PT and growing trees on non-forested land would qualify for the claim of carbon credits. Growing trees is an approach of nature-based carbon capture and storage (IPCC, 2000, UNDER, 2021). However, the afforestation or reforestation projects require accreditation to ensure the net carbon sequestration of the man-made forest is ascertained (Lefebvre et al., 2021).

The secondary forest of PT also plays a role in contributing to the carbon dioxide sequestration in the area. Hence, carbon sequestration and carbon dioxide removal from the atmosphere by PT can be estimated using an established method.

4.2 METHOD OF ESTIMATION

The carbon stocks in above and belowground biomass were calculated using allometric equations for aboveground biomass (Chave et al., 2005) and belowground biomass (Pearson et al., 2005) depending on the wood density of each species. A stoichiometric conversion factor of 3.67 (44/12) was used to convert C to carbon dioxide equivalents (CO_2eq).

Aboveground Biomass (kg)= ρ x exp (-1.499+2.148 x ln(dbh)+ 0.207x(ln(dbh))2- 0.0281-(ln(dbh)3)

Below ground Biomass (kg)= Exp (-1.0587 + 0.8836 x ln AGB) AGB = Aboveground biomass (kg/tree)

ρ = wood specific gravity/ wood density (g/cm^3),

dbh= diameter at breast height measured at 1.4 m above ground level.

Carbon conversion ratio to Carbon dioxide (ton CO_2eq) =

Carbon/tree x (44/12=3.67)

4.3 CARBON SEQUESTRATION POTENTIAL

Based on the growth data collected from 1 ha plot of PT showed that the indigenous tree species have an estimated sequestrated carbon in the stand of about 335.4 tC ha^{-1} and 1304.5 tCO_2eq ha^{-1}(Table 4.1). PT removed atmospheric carbon dioxide higher than average inland and mangrove forests but lower than peat swamp forest. Higher estimate of atmospheric carbon dioxide removal by PT is due to its higher density of trees based on dbh>10 cm.

Norsheilla (2021) reported that the average carbon removal of 970 tCO_2eq ha^{-1}in inland forests, 1,527 tCO_2eq ha^{-1}in peat swamp forest and 972 tCO_2eq ha $^{-1}$in mangrove forest. The estimate was based on the harvested trees in inland and peat swamp forests that have dbh > 45 cm. The quantity seldom exceeds 50 stem ha^{-1}. PT removes greater atmospheric carbon dioxide compared to an average mangrove forest as normally harvestable size of trees from mangrove forest > 10 cm dbh. Nitanan et. al., (2018) estimated average carbon dioxide removal of 1040 tCO_2eq ha^{-1} of mixed dipterocarp forest based on trees with dbh>15 cm.

Another reason for higher atmospheric carbon dioxide sequestration of PT is due to its high species composition of fast-growing pioneer and late pioneer tree species. They normally have lower wood density but due to their higher growth rates they would offset relatively a greater amount of atmospheric carbon dioxide. The estimation of PT supported the finding of Hamdan (2021) on species with a lower wood density but has faster growth rate that make it

have greater capacity for removal of atmospheric carbon dioxide.

The total area of PT is about 6.0588 ha. Hence, PT is estimated to have carbon storage based on the indigenous tree species alone about 2155.5 tC and estimated carbon dioxide sequestered by the tree species is 7902.6 tCO_2eq.

An annual rate of carbon sequestration can also be estimated. An assumption is made for a mean annual increment of dbh of all the species is 1.0 cm y^{-1} and the PT shall sequestrate 13.31 tC $ha^{-1}y^{-1}$ and 48.81 tCO_2eq $ha^{1}y^{-1}$. The estimated carbon sink of PT is about 80.6 tC y^{-1} and removal of atmospheric carbon dioxide of 295.7 tCO_2eq y^{-1}. This means the 6- ha PT could sell the estimated carbon dioxide offset of about 387.1 USD y^{-1} (48.81 x USD7.93 t^{-1}).

4.4 Conclusive Remarks

The PT Management Plan should initiate further research on carbon storage potential by establishing a growth plot to monitor the dbh, total height, and the content of soil organic carbon. **The carbon offset of PT can be used to offset the carbon emission of Kuala Lumpur (Wilayah Persekutuan).** This will help to support the sustainable development goals of a greener city. Hence, the PT and the remaining Bukit Persekutuan greenspace should be conserved as a green lung on the merit of its carbon offset potential.

Table 4.1: Carbon sequestration of Pulai Trail Green Space

NO.	Species	dbh (cm)	Qty	Wood Density (g/cm^3)	dbh (cm)	Stem (kg)	Stem (t)	Stem C (t/tree)	Root t/ tree	Root C t/tree	TOTAL C (t/tree)	Total C (t/ha)	Total CO_2e (t/ha)
1	*Adenanthera bicolor*	52.5	1	0.8475	52.5	4207.9	4.2	2.1	1.25	0.62	2.73	2.73	10.00
2	*Adinobotrys atropurpureus*	17.5	1	0.705	17.5	207.8	0.2	0.1	0.09	0.04	0.15	0.15	0.54
3	*Adenanthera pavonina*	81.0	1	0.8475	81.0	11939.5	11.9	6.0	3.13	1.57	7.53	7.53	27.63
4	*Aidia densiflora*	57.0	2	0.865	57.0	5255.5	5.3	2.6	1.52	0.76	3.39	6.77	24.83
5	*Alstonia angustiloba*	137.5	4	0.355	137.5	16400.1	16.4	8.2	4.14	2.07	10.27	41.09	150.66
6	*Aporosa arborea*	51.0	1	0.73	51.0	3374.2	3.4	1.7	1.02	0.51	2.20	2.20	8.07
7	*Arthrophyllum diversifolium*	48.5	4	0.395	48.5	1607.8	1.6	0.8	0.53	0.27	1.07	4.28	15.69
8	*Artocarpus elasticus*	58.1	5	0.72	58.1	4587.3	4.6	2.3	1.34	0.67	2.97	14.83	54.37
9	*Artocarpus integer var. silvestris*	40.3	10	0.72	40.3	1851.7	1.9	0.9	0.60	0.30	1.23	12.27	45.01
10	*Artocarpus scortechinii*	71.4	7	0.72	71.4	7524.8	7.5	3.8	2.08	1.04	4.80	33.62	123.29
11	*Baccaurea sp*	34.0	3	0.79	34.0	1318.5	1.3	0.7	0.45	0.22	0.88	2.65	9.71
12	*Barringtonia scortechinii*	18.1	1	0.6475	18.1	208.6	0.2	0.1	0.09	0.04	0.15	0.15	0.54
13	*Chisocheton sp*	40.2	3	0.865	40.2	2208.6	2.2	1.1	0.70	0.35	1.46	4.37	16.02
14	*Cratoxylum cochinchinense*	35.0	1	0.48	35.0	860.6	0.9	0.4	0.31	0.15	0.58	0.58	2.14
15	*Dacryodes rugosa*	51.0	2	0.8025	51.0	3700.3	3.7	1.9	1.11	0.56	2.41	4.81	17.64
16	*Diospyros lanceifolia*	45.3	2	0.825	45.3	2832.0	2.8	1.4	0.88	0.44	1.85	3.71	13.60

NO.	Species	dbh (cm)	Qty	Wood Density (g/cm^3)	dbh (cm)	Stem (kg)	Stem (t)	Stem C (t/tree)	Root t/ tree	Root C t/tree	TOTAL C (t/tree)	Total C (t/ha)	Total CO_2e (t/ha)
17	*Elaeocarpus petiolatus*	54.6	4	0.625	54.6	3409.9	3.4	1.7	1.03	0.52	2.22	8.89	32.59
18	*Endospermum malaccense*	66.2	2	0.48	66.2	4185.8	4.2	2.1	1.24	0.62	2.71	5.43	19.89
19	*Melicope glabra*	76.3	3	0.5125	76.3	6280.6	6.3	3.1	1.77	0.89	4.03	12.08	44.30
20	*Falcataria falcata*	93.0	1	0.575	93.0	11155.4	11.2	5.6	2.95	1.47	7.05	7.05	25.86
21	*Gironniera nervosa*	39.8	6	0.6025	39.8	1497.6	1.5	0.7	0.50	0.25	1.00	5.99	21.97
22	*Heritiera simplicifolia*	120.0	1	0.9775	120.0	33618.3	33.6	16.8	7.81	3.91	20.72	20.72	75.96
23	*Horsfieldia sucosa*	37.5	1	0.49	37.5	1047.4	1.0	0.5	0.36	0.18	0.71	0.71	2.59
24	*Ixonanthes reticulata*	31.5	1	0.8475	31.5	1159.8	1.2	0.6	0.40	0.20	0.78	0.78	2.86
25	*Knema sp*	17.7	2	0.6725	17.7	204.2	0.2	0.1	0.09	0.04	0.15	0.29	1.06
26	*Litsea umbellate*	40.1	3	0.5525	40.1	1399.7	1.4	0.7	0.47	0.24	0.94	2.81	10.29
27	*Macaranga gigantea*	88.6	4	0.3825	88.6	6629.0	6.6	3.3	1.86	0.93	4.25	16.98	62.26
28	*Microcos tomentosa*	24.2	1	0.6575	24.2	454.2	0.5	0.2	0.17	0.09	0.31	0.31	1.15
29	*Nauclea maingayi*	24.5	3	0.6575	24.5	469.1	0.5	0.2	0.18	0.09	0.32	0.97	3.57
30	*Nephelium sp*	66.3	4	0.9775	66.3	8550.0	8.6	4.3	2.33	1.17	5.44	21.76	79.79
31	*Oroxylum indicum*	16.2	1	0.76	16.2	182.6	0.2	0.1	0.08	0.04	0.13	0.13	0.48
32	*Pellacalyx saccardianus*	78.1	3	0.555	78.1	7178.0	7.2	3.6	2.00	1.00	4.59	13.76	50.46
33	*Porterandia anisophylla*	43.3	2	0.6825	43.3	2091.9	2.1	1.0	0.67	0.34	1.38	2.76	10.13

NO.	Species	dbh (cm)	Qty	Wood Density (g/cm^3)	dbh (cm)	Stem (kg)	Stem (t)	Stem C (t/tree)	Root t/ tree	Root C t/tree	TOTAL C (t/tree)	Total C (t/ha)	Total CO_2e (t/ha)
34	*Sarcotheca griffithii*	128.5	1	0.745	128.5	29753.4	29.8	14.9	7.01	3.51	18.38	18.38	67.41
35	*Streblus elongatus*	48.6	19	0.97	48.6	3980.8	4.0	2.0	1.19	0.59	2.58	49.09	179.98
36	*Symplocos cochinchinensis ssp laurina*	24.5	2	0.491	24.5	348.4	0.3	0.2	0.14	0.07	0.24	0.49	1.78
37	*Syzygium sp*	44.8	6	0.7525	44.8	2512.3	2.5	1.3	0.79	0.39	1.65	9.91	36.32
38	*UNKN*	41.4	3	0.76	41.4	2086.8	2.1	1.0	0.67	0.34	1.38	4.14	15.16
39	*Vitex pubescence*	27.2	2	0.7925	27.2	738.6	0.7	0.4	0.27	0.13	0.50	1.01	3.69
40	*Vitex quinate*	28.8	1	0.7925	28.8	860.7	0.9	0.4	0.31	0.15	0.58	0.58	2.14
41	*Xerospermum noronhianum*	61.6	2	0.96	61.6	7045.1	7.0	3.5	1.96	0.98	4.50	9.01	33.03
	Total											**355.45**	**1304.49**

CHAPTER 5

RESEARCH FOREST

5.1 INTRODUCTION

Pulai Trail Urban Community Forest (PT) is suitable to be managed as a research forest to provide a model on rehabilitation of a secondary forest. Based on the species composition determined in Chapter 3, it has a relatively low primary rainforest tree species compared to a virgin lowland rainforest. This means the site properties are suitable for enrichment planting of indigenous tree species. The outputs of the research can be used to rehabilitate the rest of the greenspace in Bukit Persekutuan.

5.2 JUSTIFICATION

A research forest was first defined as "forest lands intended for research purposes such as research forest, research station, and continuous forest inventory (CFI) plot (Forest Department, 1977)." However, the definition is limited for a production forest.

The non-production functions of a forest such as environmental conservation, research and development, education and recreation are not included. Environmental conservation includes preventing soil erosion, coastal erosion, flood control and carbon sequestration which are all equally or even more important than any production aspect of forests in this era of climate change and extreme weather.

Present research forests only cover growth and yield, silviculture and Continuous Forest Inventory (CFI) plots in Peninsular Malaysia. Gazetted research forests include studies conducted in peat swamp forest in Pekan F.R, lowland plantation and natural forest of FRIM complex, and management of natural forest in Malaysia in Cherul F.R. Research forests that are managed by other agencies such as Forest Research Institute Malaysia (FRIM), Universiti Kebangsaan Malaysia (UKM), University of Malaysia (UM) and Universiti Putra Malaysia (UPM), include lowland dipterocarp forests in Pasoh F.R. (FRIM), Bangi F.R (UKM), Ulu Gombak F.R (UM), and Air Hitam F.R (UPM), respectively. The coastal forest in Muka Head F.R is also classified as a research forest which is managed by Universiti Sains Malaysia (Shamsudin et al, 2003).

The survey of literature indicates that there is no official site for a secondary forest gazetted for research purposes as yet. Hence, the management of Pulai Trail Urban Community Forest (PT) as a research forest would ensure a systematic collection of data to provide information for sustainable management of Malaysian forests to serve its functions in environmental

conservation, education, and recreation.

5.3 Some Important Research Scopes

Pulai Trail Urban Community Forest (PT) should be conserved as a depository of indigenous tree species. Hence, research focused on rehabilitation of the secondary forest should be implemented. A proper design research program on enrichment planting using threatened indigenous tree species in PT must be developed.

The uniqueness of PT is that of being the only secondary forest that has a mixture of primary tree species colonizing an abandoned former rubber estate in Malaysia. The ecological succession of the primary tree species such as *Artocarpus integer var. silvestris* found in PT and their dispersal agents should be identified. The species is only distributed uphill along the Pulai and Jungle Fowl Trails.

The regeneration of the secondary forest that has the primary elements needs to be properly managed. Some of the regeneration is abundantly found under the mother trees such as *Streblus elongatus, Artocarpus scotchniii, Aidia densiflora,* and *Chitosan species*.

Species composition and its changes after formation of gaps due to tree falls should also be studied.

The nutrient dynamics of the secondary forest that supports the existing vegetation in its enclosed system must also be part of the study scope.

The phenology and regeneration of the tree species are to be observed and recorded. Their phenology, succession and ecological functions are to be studied.

The forest is suitable to be used as a research plot for studies on natural regeneration, dendrology, nutrients dynamic, carbon cycle and carbon sequestration capacity of each species.

The information collected from the research outputs shall be useful to act as a guideline to provide management inputs to the similar greenspace in Bukit Persekutuan. PT should also be developed and studied as a demonstration plot for the enrichment of indigenous tree species in expediting the restoration process of the secondary forest.

The carbon sequestration potential of the PT should also be systematically monitored. The diameter growth of the tree species should be measured annually to determine its annual dbh growth rate.

Another research focus that should also be included is the impact on the stability of the slope due to gully formations. Some of the drainage from the

existing buildings along Jalan Kedah and Jalan Kelantan have been damaged. The excessive surface runoff could have adverse effects on soil conservation and slope stabilization.

Hence, **PT has a research value on its ecological restoration approach and environmental contributions as a green lung and also for soil conservation.**

5.4 Conclusive Remarks

Pulai Trail Urban Community Forest (PT) can be managed as a research station to demonstrate a model of rehabilitated rainforest in Bukit Persekutuan. It could serve as a field laboratory for students from secondary schools and nearby universities. The PT can also open for scientists from within and outside the country who are interested to study its ecological and environmental functions and contributions.

Managing the PT as a research forest for conservation purposes would also protect the existing indigenous tree species which are elements of lowland rainforest. This will serve as a genetic repository of the tree species. The PT shall also enlarge the genetic pool of tree diversity by introducing new sources of International Union for Conservation of Nature (IUCN) Red List indigenous tree species to the mix.

CHAPTER 6

EDUCATIONAL FOREST

6.1 Introduction and Justification

Education forest is defined as forest land for the purpose of educating and raising awareness among the general public of the importance of conserving and managing a forest sustainably.

Presently, FTS has been managing the forest for educational purposes. Members of the public and youth groups from universities and secondary schools have participated in the conservation workshops hosted twice a week by FTS. Being able to share learning opportunities and enjoyment of this unique secondary forest that houses the remnants of Kuala Lumpur's indigenous tree species with the community has been well received and the PT has become beloved by the local community. The PT should be highlighted to function as a model rehabilitated secondary forest.

Pulai Trail Urban Community Forest (PT) should be managed systematically, parallel as a research forest and also an education forest. The location of PT is ideal and easily accessed.

The gentle terrain portion of the PT is suitable to be used for educational programmes to demonstrate successful rehabilitation carried out by the research and development projects.

This means the enrichment planting and arboreta establishment must be only on the gentle terrain with contour lower than 70 m.s.l. and slopeless than 15%. However, the planting should also be on a well-drained site.

The upper slope of PT should be protected to minimize risks of potential landslides. This is to provide safety for the visitors.

6.2 Development of Education Programs

The Pulai Trail Urban Community Forest should be expanded for the educational purposes of urbanites through collaborations with educational institutions, government and non-government agencies, and corporations engaged in CSR to create complimentary programs to expose urbanites to knowledge sharing on the ecological and environmental contributions of an urban community forest.

Programmes on tree inventory could also be developed so that

participants are exposed to forest inventory tasks that could include tree tagging, growth measurement and also calculation on the carbon offsetting of each tree species. Activities like this help to promote a love for the forest and appreciate their contribution and role in nature.

The existing habitat for frog breeding should be upgraded and a proper pond of size 3-5 m^2 and 30- 45 cm deep should be constructed to collect rain/surface water to encourage a breeding habitat for frogs while also serving as a constant fresh water source for the fauna inhabiting the area (Plate 6.1). Some small native fish could be introduced to eradicate mosquito larvae.

Plate 6.1: The existing Frog Pond retaining surface water drainage at a minimal average of 12cm deep.

An arboretum should be established to house the IUCN Red List of indigenous tree species and their uniqueness should be highlighted. Their layout should be mapped and presented in a brochure.

Volunteer forest stewards could potentially be trained in how to manage the secondary forest sustainably for its ecological and environmental conservation.

An educational program of harvesting *Arenga pinnata* for its syrup could be developed for those who are interested. These sugar palms are found randomly distributed within PT (Plate 6.2). The technology of harvesting its syrup for commercial use is available (Plate 6.3).

Plate 6.2: Some Arenga *pinnata* palms found along the hill of PT facing the North-West direction or Jalan Kedah

6.3 Conclusive Remarks

The forest can be utilised for the purpose of educating and raising public awareness about the importance of greenspace conservation within the city and its sustainable management for multipurpose uses.

Educational programmes for public and students are also suitable. All these activities would need financial resources. Hence, part of the Management Plan would involve seeking funds, which could come as assistance from various multi-national companies supporting conservation and research programs as part of Environment, Social and Governance (ESG) practices. Companies are strongly encouraged to practise ESG. (The Edge, 2022).

Plate 6.3: Some economic uses of *Arenga pinnata*. Products such as juice sap, palm fruit, leaves, palm fibre, and stems can be harvested for various uses (Azhar *et al*., 2019).

CHAPTER 7

RECREATIONAL FOREST

7.1 Introduction

Pulai Trail Urban Community Forest (PT) is frequently visited by walkers, hikers and joggers from 9am to 4 pm. FTS provides walking sticks that are placed under a giant *pulai* tree (*Alstonia angustiloba*) at the Southern & Main Entrance (Plate 7.1). The purpose of managing PT for recreational purposes is to enhance the quality of existing trails, and also provide facilities for the safety and comfort of those who are using the forest for recreation.

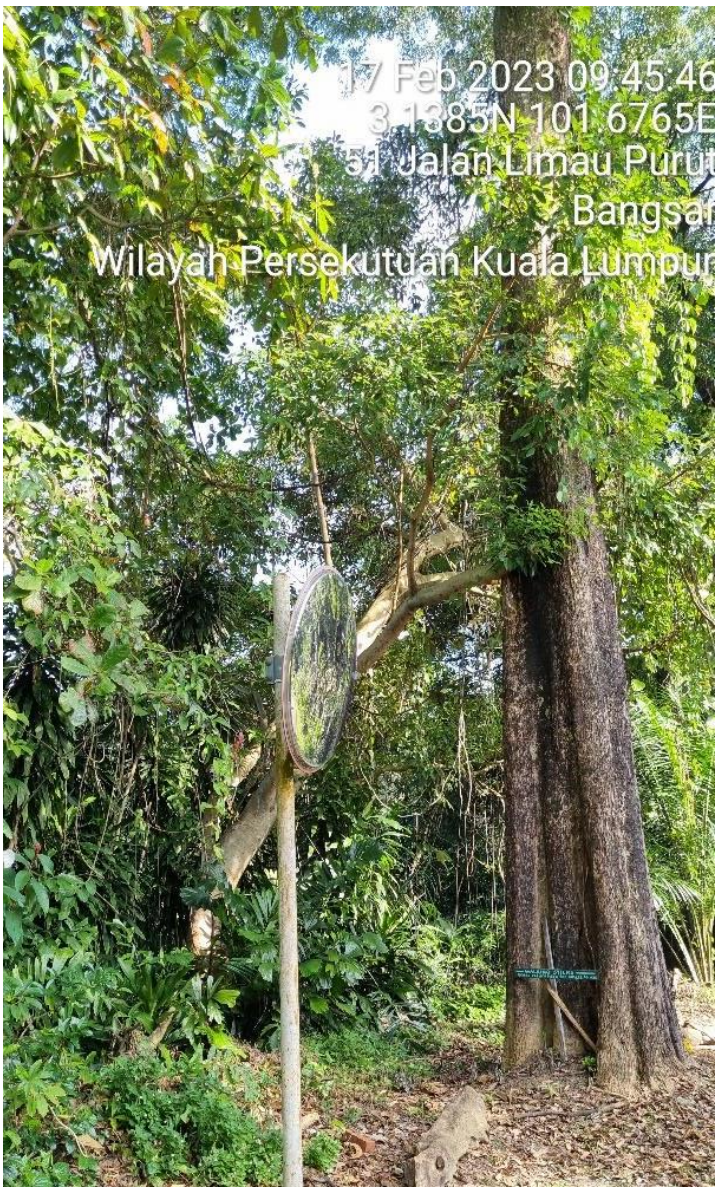
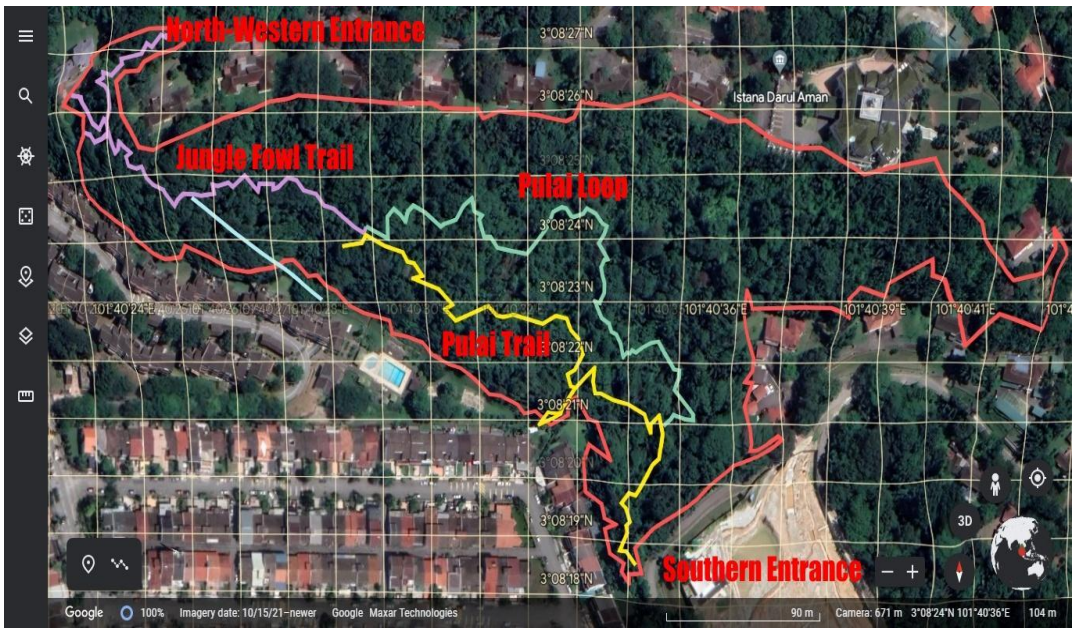


Plate 7.1: The walking sticks that place under the holder made for the Pulai tree (*Alstonia angustiloba*).

7.2 Pulai Trail Urban Community Forest

The recreational features of PT are the existing 1km trails in the ambience of the tropical rainforest (Map 7.1). The trails are safe and usable on dry days. After heavy rainfall, the users should use only Pulai Trail and avoid Pulai Loop. There is a low site filled with muddy water which is about 30 m from the starting point of Pulai Loop. As ascending along the Northern direction Pulai Loop descends to join the Pulai Trail and then begins the Jungle Fowl Trail that leads to the Northern Exit, which was closed following a landslide, but where a new exit is marked for development.



Map 7.1: The Pulai Trail, Pulai Loop and Jungle Fowl Trail are the main trails of Pulai Trail Urban Community Forest.

7.3 Conclusive Remarks

The PT could be upgraded through improvement of a Management Plan and also improvement of its infrastructure to optimise its recreational function. More details on potential development shall be discussed in Chapter 8.

CHAPTER 8

MANAGEMENT AND DEVELOPMENT OF LANDSCAPE

8.1 Introduction

Pulai Trail Urban Community Forest (PT) can only be developed for the multipurpose uses that include a research, education and recreation forest if there is legal right to do so. This can be achieved through the establishment of a steering committee for conservation of the greenspaces of Federal Hill. The committee should be led by the Mayor's office (DBKL) and with other relevant authorities such as Municipal, residence associations, FTS, MNS, Land Office and other non-government agencies that have common interests to preserve the greenspace of Federal Hill.

Public awareness for the conservation of Federal Hill was made in the recent press release of WWF (FMT, 2022). No further opening of the greenspace should be carried out because of the risk of a landslides. Any development of infrastructure for PT could be brought up in the meeting of the steering committee for endorsement before being carried out.

8.2 Future Development

Sustainable management of Pulai Trail Urban Community Forest for multipurpose uses can only be materialised with some future development of the landscape that is supporting its functions for research, education and recreation. Any development should be minimised and of low impact to not disturb the integrity of the forest landscape.

8.2.1 Generate reliable Information

A comprehensive handbook should be produced to highlight some of the important flora and their ecological functions. The population of fauna needs to be scientifically determined and documented. In addition, the benefits of the environmental contribution of PT are to be scientifically determined and shared. Reliable information of PT on its site properties and their long-term influences on its ecological and environmental functions is needed.

8.2.2 INFRASTRUCTURE

Some infrastructure should be developed for promoting the recreational use of PT. For example, at a minimum, toilets and sheltered seats to cater to the needs of those working at the site would be required. Seating placed at strategic points for visitors to rest and enjoy the ambience.

Trees should be labelled, and suitable interpretive signs and maps created and posted within the educational site of PT. Potentially, infrastructure that serves as a venue for briefing, teaching and discussion could be erected. This could be as simple as an open pavilion should be constructed to cater for a small group of visitors numbering not more than 30 people. Picnic tables and a boardwalk should be constructed at the wet sites in zones A1 and E1. The wet sides should be rehabilitated and beautified with tree species that are suitable for growing at water-logged sites. Plant species such as Melaleuca *leucadendron, Pandanus utilis, Pandanus amaryllifolius,* and Cyrtostachys *renda* can be planted to enhance the waterlogged site with colours.

Pulai Trail Urban Community Forest (PT) can be further improved by building more infrastructure that includes a tree house in the giant trees such as *Kedodong matahari* and *Litsea* species.

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8.2.3 AN ARBORETUM

Establishment of an arboretum to house rare, endemic and threatened tree species should be carried out in well-drained sites A1, A2, A3, E2 and B3 (Map 8.1). However, some low-lying portions of A1 and E1 should only be planted with plant species that can adapt to the waterlogged site.

Map 8.1: The zones of B1 till E1 were designated for tree tagging purposes.

The density of planting should be at 500 stem/ha. The site preparation is to create an opening of 1 m radius for each planting point. Dig to the depth of 50 cm and backfill the earth to the planting hole to the depth of 10 cm. Remove the polybag and place the plating stock carefully to prevent damage to the root-ball of the seedling. Water the planted seedling to soil saturation point.

PLANTING THE RED LIST SPECIES (RLS)

Enrichment planting of the RLS in the available space after removal of invasive species should be carried out in the wet seasons. The species list of RLS for planting in gullies and appointed places is listed in Table 8.1. Other RLS that are available in the market shall be accepted for the enrichment planting despite that they are not listed in Table 8.1.

Table 8.1: Red List Species suitable for enrichment planting

No	Species	Threatened Category
1	*Dipterocaropus coriaceus*	Critically Endangered
2	*Dipterocaropus sarawakensis*	Critically Endangered
3	*Dipterocaropus semivestitus*	Critically Endangered
4	*Hopea auriculata*	Critically Endangered
5	*Hopea bilitonensis*	Critically Endangered
6	*Hopea bracteata var. penangiana*	Critically Endangered
7	*Hopea sublate*	Critically Endangered
8	*Parashorea globose*	Critically Endangered
9	*Shorea hemsleyana*	Critically Endangered
10	*Shorea lamellate*	Critically Endangered
11	*Shorea lumutensis*	Critically Endangered
12	*Shorea peltata*	Critically Endangered
13	*Shorea tesymanniana*	Critically Endangered
14	*Vatica flavida*	Critically Endangered
15	*Vatica yeechongii*	Critically Endangered
16	*Anisoptera marginata*	Endangered
17	*Cotylelobium melanoxylon*	Endangered
18	*Dipterocarpus acutangulus*	Endangered

No	Species	Threatened Category
19	*Dipterocarpus dyeri*	Endangered
20	*Dipterocarpus obtusifolius*	Endangered
21	*Dipterocrapus rigidus*	Endangered
22	*Dipterocarpus rotundiflorus*	Endangered
23	*Dipterocarpus sublamellatus*	Endangered
24	*Dipterocarpus tempehes*	Endangered
25	*Dryobalanops beccarii*	Endangered
26	*Hopea apiculata*	Endangered
27	*Hopea bracteata var. perakensis*	Endangered
28	*Hopea coriacea*	Endangered
29	*Hopea kerangasensis*	Endangered
30	*Hopea pachycarpa*	Endangered
31	*Hopea polyalthiodes*	Endangered
32	*Shorea atrinervosa*	Endangered
33	*Shorea bentongensis*	Endangered
34	*Shorea blumentesis*	Endangered
35	*Shorea curtisii*	Endangered
36	*Shorea dealbata*	Endangered
37	*Shorea falcifera*	Endangered
38	*Shorea henryana*	Endangered
39	*Shorea inappendiculata*	Endangered
40	*Shorea macrantha*	Endangered
41	*Shorea platycarpa*	Endangered
42	*Shorea singkawang*	Endangered
43	*Shorea uliginosa*	Endangered
44	*Vatica havilandii*	Endangered
45	*Vatica lobata*	Endangered
46	*Vatica pallida*	Endangered
47	*Vatica perakensis*	Endangered

No	Species	Threatened Category
48	*Vatica ridleyana*	Endangered
49	*Vatica scortechinii*	Endangered
50	*Vatica venulosa*	Endangered
51	*Anisoptera costata*	Vulnerable
52	*Anipsoptera laevis*	Vulnerable
53	*Anipsoptera megitocarpa*	Vulnerable
54	*Anipsoptera scaphula*	Vulnerable
55	*Dipterocarpus caudatus*	Vulnerable
56	*Dipterocarpus chartaceus*	Vulnerable
57	*Dipterocarpus concavus*	Vulnerable
58	*Dipterocarpus costatus*	Vulnerable
59	*Dipterocarpus elongatus*	Vulnerable
60	*Dipterocarpus eurynchus*	Vulnerable
61	*Dipterocarpus fagineus*	Vulnerable
62	*Dipterocarpus hasseltii*	Vulnerable
63	*Dipterocarpus kerii*	Vulnerable
64	*Dipterocarpus palembanicus*	Vulnerable
65	*Hopea galucescens*	Vulnerable
66	*Hopea helferi*	Vulnerable
67	*Hopea johorensis*	Vulnerable
68	*Hopea latifolia*	Vulnerable
69	*Hopea mengarawan*	Vulnerable
70	*Hopea myrtifolia*	Vulnerable
71	*Hopea nutans*	Vulnerable
72	*Hopea odorata*	Vulnerable
73	*Hopea pierrei*	Vulnerable
74	*Hopea pubescens*	Vulnerable
75	*Hopea semicuneata*	Vulnerable
76	*Shorea collina*	Vulnerable
77	*Shorea dasphylla*	Vulnerable

No	Species	Threatened Category
78	*Shorea exelliptica*	Vulnerable
79	*Shorea foxworthyi*	Vulnerable
80	*Shorea gibbosa*	Vulnerable
81	*Shorea gratissima*	Vulnerable
82	*Shorea johorensis*	Vulnerable
83	*Shorea longisperma*	Vulnerable
84	*Shorea materialis*	Vulnerable
85	*Shorea ochrophloia*	Vulnerable
86	*Shorea palembanica*	Vulnerable
87	*Shorea resinosa*	Vulnerable
88	*Vatica hullettii*	Vulnerable
89	*Vatica maingayi*	Vulnerable
90	*Vatica mangachapoi*	Vulnerable
91	*Vatica odorata*	Vulnerable
92	*Vatica stapfiana*	Vulnerable

8.2.4 A MOUSE DEER EX-SITU CONSERVATION CENTRE

Pulai Trail Urban Community Forest lacks fauna despite it housing a high tree number of tree species that can provide food for herbivorous mammals. The lack of small mammals found in the natural forest in PT is mainly due its discontinuity with other natural forests. In addition, it is without a permanent water source.

To enhance the suitability of PT as a habitat for wildlife, a man-made pond of size of 0.15-0.25 ha needs to be constructed at a suitable site located within zones A1 and E1, especially at the wet portion of Pulai Loop. The wet spot at the depression of Pulai Loop is due to the overflowing of the drainage at its foothill (Plate 8.1).

Plate 8.1: One of the drainages that leads to the lower sites of Pulai Trail-Pulai Loop at about 60 to 65 m a.s.l.

The discharge of the drainage during heavy rain could be collected for the man-made pool. The aeration of the pond can be improved with a solar powered pond aerator (Plate 8.2).

Plate 8.2: A type of solar powered pond aerator.

The man-made pond up to a depth of 1.5 to 2 m will collect rainwater and also provide a suitable water source for fauna. The construction of the man-made water body would be necessary if PT were to be managed for research/education-recreation forest and a potential attraction for Kuala Lumpur.

With an available good quality water supply that may support wildlife, the 6-ha secondary regrowth could be developed as a suitable habitat for the mouse deer family that includes Pelanduk (*Tragulus kanchil*) and Napuh (*Tragulus napu*) (Plate 8.3). The mouse deer species could be introduced to the PT after creating its habitat. Suitable plant species for producing edible leaf and fruit should be planted.

The PT steering committee could work with Perhilitan (Jabatan Perlindungan Hidupan Liar dan Taman Negara) to earmark the PT as a mouse deer centre. A blueprint for the mouse deer centre should be developed and presented to stakeholders for consideration as an added attraction.

Plate 8.3: Pelanduk and Napuh in the wild.

8.2.5 A Medicinal Plant and Culinary Herb Collection

There is potential for medicinal plants and herbs for culinary uses to be planted at the side of the trails along the Pulai Loop. This will improve the aesthetic value of the trails and also provide further educational information to the public. Some of these medicinal plants are already found within the PT site and their seedlings can be transplanted along the trails for more visibility, e.g. *Alstonia angustiloba*. (Rasadah et. al, 2017).

8.3 Security And Maintenance

8.3.1 Boundary maintenance

Boundary maintenance needs to be carried out regularly. Trees that are growing within 5 m of the boundary of PT from the existing buildings should be carefully monitored for their risks to the properties and also dangers to the residents. All the trees near the boundary of the residences must be fully tagged and GPS located. Trees that are not healthy and have signs of decay are to be marked for removal. Hence, an inspection/maintenance team needs to be formed for conducting the boundary survey. Large trees taller than 20 m that are growing near the boundary should also be inspected by an arborist to determine their health.

8.3.2 Safety of Users

Falling trees are common in PT especially during episodes of heavy rainfall (Plate 8.4) Hence, users of PT must not use the trails during rain. Some form of control needs to be taken to provide speedy help in times of emergency. Visitors to the Pulai Trail should have emergency numbers on hand that they can call in times of need.

The Pulai Trail, Pulai Loop and Jungle Fowl Trail should be marked at 50m intervals so that if there is any emergency situation, prompt rescue can be provided. The distant marker for the first 50 m for Pulai Trail (PT), Pulai Loop (PL) and Jungle Fowl Trail (JFT) should be as follows: PT1, PL1 and JFT1, respectively.

Plate 8.4: Fallen trees are real danger for the trail users (left photo). Hence, the trails are to be closed during the rainy days. FTS has properly managed the trails by removal of the fallen trees promptly (right photo).

8.3.3 A CLEAN FOREST

A measure of controlling illegal rubbish dumping (fly tipping) into the forest is needed to ensure that PT does not continue to be a dumping site along its boundary. Unfortunately, PT is being treated as a dumping ground for household and garden debris by some residential houses along its boundaries (Plate 8.5) and by illegal fly tipping episodes. This rubbish increases mosquito numbers by creating a breeding ground as some of the waste retains rainwater.

Plate 8.5: The dumping of the building materials and household items in PT.

8.4 RULES AND REGULATIONS

Notice boards at both entrances to Pulai, Pulai Loop and Jungle Fowl Trails for visitors should be created containing some rules and regulations to help maintain the natural environment of PT.

- Leave plants and other natural objects in their place.
- Refrain from picking flowers, fruits and seeds.
- Avoid harming or killing wildlife or any fauna.
- Avoid vandalism on all signs and plant labels.
- Stay on trails when strolling through the forest.
- Be considerate of other visitors and do not disturb others.
- Do not litter.
- PT management committee is not liable for injury/loss of life due to accidents and damages/loss of personal belongings.

8.5 FRIENDS OF PULAI TRAIL

Consider forming a group such as a Friends of Pulai Trail Group. Less formal than a committee, a group is for all who are supporting the management of PT for multipurpose uses.

Registration could be through a dedicated website and visitors to PT should be encouraged to register as a Friends of Pulai Trail Group, whereby registration or membership is free of any charge.

The group would be a valuable way of disseminating information as pertains specifically to activity at PT.

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***Appendix I: List of tree species in Pulai Trail Urban Community Forest.**

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
2	**1364**	20221003	3.13856	101.67644	34.1	*Microcos tomentosa*
3					38	*Sapium baccatum*
4	**1319**	20221003	3.13842	101.67638	15.3	*Streblus elongatus*
5	**1320**	20221003	3.13848	101.67638	14.8	*Streblus elongatus*
6	**429**	20230306	3.13852	101.67636		*Aidia densiflora*
9	**1322**	20221003	3.13864	101.67634	14.5	*Streblus elongatus*
11	**1321**	20221003	3.13867	101.67632	19.1	*Streblus elongatus*
12	**1323**	20221003	3.13872	101.67636	34.7	*Euodia glabra*
15	**1324**	20221003	3.13876	101.67628	22.2	*Streblus elongatus*
18	**1326**	20221003	3.13886	101.67627	13.1	*Streblus elongatus*
19			3.1389	101.67639	14	Mati
27	**1331**	20221003	3.13896	101.67632	15.1	Mati
28	**1330**	20221003	3.13904	101.67641	24.4	*Hevea brasiliensis*
30	**1328**	20221003	3.13891	101.67645	14.2	*Streblus elongatus*
31	**1329**	20221003	3.13895	101.67645	19.7	*Streblus elongatus*
32	**1338**	20221003	3.139	101.6765	25.3	*Streblus elongatus*
35	**1332**	20221003	3.13908	101.67632	19.1	*Arthrophyllum diversifolium*
35	1332	**20221003**	3.13908	101.67632	19.1	*Arthrophyllum diversifolium*
37	**1333**	20221003	3.13909	101.67647	12.6	*Szyzgium sp*
38	**1334**	20221003	3.13911	101.67647	20.7	*Arthrophyllum diversifolium*
38	1334	**20221003**	3.13911	101.67647	20.7	*Arthrophyllum diversifolium*
39	**1335**	20221003	3.13912	101.67647	17	*Antidesma sp*
40	**1336**	20221003	3.13909	101.67654	20.4	*Gironniera nervosa*
41	**1337**	20221003	3.13905	101.67659	14.6	*Xerospermum noronhianum*
44	**1341**	20221003	3.13917	101.67645	29	*Artocarpus elasticus*
47	**1342**	20221003	3.13912	101.67629	16.2	*Oroxylum indicum*
48	**1342**	20221003	3.13918	101.67627	12.4	*Oroxylum indicum*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
49	**1340**	20221003	3.13916	101.67646	13.1	*Oroxylum indicum*
51	**1339**	20221003	3.13918	101.67649	14.2	*Pternandara anisophylla*
58	**1344**	20221003	3.13938	101.67611	26.4	*Oroxylum indicum*
62	**1346**	20221003	3.1394	101.67577	54.1	*Endospermum malaccense*
63	**1345**	20221003	3.13933	101.67575	47.1	*Szyzgium sp*
68	**1347**	20221003	3.13946	101.67556	88.5	*Delonix regia*
69	**1349**	20221003	3.1394	101.67549	55.7	*Szyzgium sp*
70	**1348**	20221003	3.13942	101.67543	33.7	*Szyzgium sp*
71	**1350**	20221003	3.13946	101.67543	44.9	*Campnosperma squamatum*
72	**1351**	20221003	3.13949	101.67541	83.7	*Alstonia angustiloba*
75	**1356**	20221003	3.13969	101.67544	43.3	*Artocarpus elasticus*
76	**1357**	20221003	3.13969	101.67541	43.6	*Chisocheton sp*
77	**1355**	20221003	3.13955	101.67543	13.7	*Macaranga gigantea*
80	**1352**	20221003	3.13954	101.67533	21	*Endospermum malaccense*
81	**1358**	20221003	3.13957	101.67533	33.1	Mati
82	**1360**	20221003	3.13977	101.67534	22.6	*Gironniera nervosa*
83	**1354**	20221003	3.13968	101.6753	48.7	*Artocarpus scortechinii*
84	**1353**	20221003	3.13958	101.67522	29.9	*Mati*
88	**1359**	20221003	3.13975	101.6753	14.6	*Streblus elongatus*
89	**1361**	20221003	3.13982	101.67527	65.9	*Artocarpus scortechinii*
91	**1498**	20221019			15.9	*Euodia glabra*
93	**1497**	20221019			17.5	*Canarium sp*
94	**1496**	20221019			14.6	*Streblus elongatus*
95	**1495**	20221019			17.2	*Streblus elongatus*
96					24.2	*Ixonanthes reticulata*
97					16.6	*Streblus elongatus*
98					13.1	*Hevea brasiliensis*
99	**1499**	20221019			27.4	*Streblus elongatus*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
100	**1325**	20221003	3.13883	101.67627	16.6	*Mallotus paniculatus*
101	**1502**	20221019			17.8	*Mallotus paniculatus*
103					29.9	*Streblus elongatus*
131	**1503**	20221019			30.9	*Streblus elongatus*
134					40.1	*Artocarpus scortechinii*
135					24.5	*Adinobotrys atropurpureus*
136	**1506**	20221019			44.6	*Dyera costula*
137	**1507**	20221019			18.1	*Artocarpus scortechinii*
138	**1509**	20221019			29.9	*Hevea brasiliensis*
139	**1510**	20221019			12.7	*Diospyros sp.*
140	**1508**	20221019			15	*Hevea brasiliensis*
141	**1511**	20221019			87.2	*Alstonia angustiloba*
142	**1505**	20221019			37.9	*Artocarpus scortechinii*
143	**146**	20230222	3.13977	101.67474	84.2	*Pterocarpus indicus*
144	**147**	20230222	3.13991	101.67471		*Ficus sp*
145	**148**	20230222	3.13993	101.67466	27.4	*Artocarpus scortechinii*
146	**1515**	20221019			13.5	*Paratocarpus sp*
147					16.7	*Gironniera nervosa*
148					16.2	*Streblus elongatus*
149	**1558**	20221025	3.13998	101.67476	13.5	*Canarium sp*
150	**1513**	20221019			23.4	*Mangifera sp*
151	**1514**	20221019			36.6	*Hevea brasiliensis*
151	**173**	20230222	3.14009	101.6743		*Aidia densiflora*
152	**1559**	20221025	3.14013	101.67461	13.2	*Canarium sp*
153	**1530**	20221019			18.1	*Artocarpus elasticus*
154	**1529**	20221019			41.4	*Symplocos racemosa*
155	**1528**	20221019			24.4	*Symplocos racemosa*
156	**1520**	20221019			25	*Mati*
157	**1519**	20221019			16.2	*Chisocheton sp*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
158	**1518**	20221019			38	*Artocarpus elasticus*
159	**1527**	20221019			30.2	*Palaquium sp*
160	**1526**	20221019			15	*Annonaceae*
161	**1517**	20221019			14.3	*Dyera costula*
161	**149**	20230222	3.13998	101.67454		*Dyera costulata*
162	**1523**	20221019			13.8	*Mallotus paniculatus*
163	**1522**	20221019			38.8	*Artocarpus scortechinii*
164	**1521**	20221019			22	*Hevea brasiliensis*
165	**1524**	20221019			22.6	*Ixonanthes reticulata*
166	**1525**	20221019			28.3	*Fagraea racemosa*
167	**153**	20230222	3.14003	101.67431		*Pternandra echinata*
168	**1533**	20221019			28	*Euodia glabra*
169	**1532**	20221019			16.2	*Gironniera nervosa*
171	**163**	20230222	3.14013	101.67424	20.9	*Neonauclea sp*
172	**1531**	20221019			13.8	*Chisocheton sp*
173	**1535**	20221019			12.9	*Diospyros argentea*
175	**1536**	20221019			14.3	*Syzygium microcalyx*
176	**1537**	20221019			16.9	*Endospermum malaccense*
177	**1538**	20221019			10.5	*Eleaeocarpus ferrugineus*
178	**159**	20230222	3.14035	101.67405	13.1	*Arthrophyllum diversifolium*
180	**1540**	20221019			13.8	*Elaecarpus petiolatus*
181	**1564**	20221025	3.14024	101.67402	51.3	*Artocarpus scortechinii*
185	**1563**	20221025	3.14024	101.67407	26.4	*Hevea brasiliensis*
186	**1562**	20221025	3.14031	101.67421	27.7	*Hevea brasiliensis*
187	**1561**	20221025	3.14036	101.67423	20.1	*UNKN1*
188	**1544**	20221019			39.5	*Euodia glabra*
189	**1541**	20221019			15	*Arthrophyllum diversifolium*
190	**1542**	20221019			15	*Chisocheton sp*
191	**1543**	20221019			13.7	*Syzygium spp*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
192	**1560**	20221025	3.14031	101.67425	109.8	*Arthocarpus elasticus*
195	**1568**	20221025	3.14044	101.67422	17.5	*Nauclea maingayi*
196	**1567**	20221025	3.14043	101.67432	27.1	*Artocarpus scortechinii*
197	**1565**	20221025	3.14046	101.67432	17.2	*Arthrophyllum diversifolium*
198	**1566**	20221025	3.14045	101.67428	13.4	*Szyzgium sp*
199					15.3	*Syzygium sp*
230	**1573**	20221025	3.14037	101.67436	13.4	*Chisocheton sp*
231	**1575**	20221025	3.14037	101.67447	23.9	*Arthrophyllum diversifolium*
232	**1574**	20221025	3.14044	101.6744	16.6	*Arthrophyllum diversifolium*
234	**1572**	20221025	3.14048	101.67446	13.7	*Arthrophyllum diversifolium*
235	**1569**	20221025	3.1405	101.67436	15.3	*Chisocheton sp*
238	**1571**	20221025	3.14048	101.6745	11.8	*Chisocheton sp*
239	**1570**	20221025	3.14051	101.67446	16.2	*Szyzgium sp*
240	**1576**	20221025	3.14047	101.67445	16.2	*Elaeocarpus petiolatus*
241	**1578**	20221025	3.14014	101.67457	20.2	*Szyzgium sp*
242	**1577**	20221025	3.14027	101.67458	15.4	*Nauclea maingayi*
243	**1579**	20221025	3.14024	101.67464	17.8	*Gironniera nervosa*
244	**1580**	20221025	3.14031	101.67471	19.1	*Pellacalyx saccardianus*
245	**1581**	20221025	3.14029	101.67477	22.6	*Hevea brasiliensis*
250	**1598**	20221028	3.14013	101.67483	56.7	*Litsea megacarpa*
251	**1599**	20221028	3.14014	101.67483	28.7	*Litsea megacarpa*
252	**1600**	20221028	3.14021	101.67497	16.2	*Ganua curtisii*
253	**1583**	20221025	3.14036	101.67484	15.9	*Nuclea sp*
254	**1584**	20221025	3.14031	101.67489	39.2	*Hevea brasiliensis*
255	**1586**	20221025	3.14033	101.67493	34.4	*UNKN1*
256	**1585**	20221025	3.14039	101.67492	13.4	*Xanthophyllum sp*
257	**1589**	20221025	3.14039	101.67496	15.9	*Mati*
258	**1587**	20221025	3.14037	101.67485	22	*Streblus elongatus*
260	**1594**	20221025	3.14051	101.67501	34.7	*Evodia roxburghiana*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
261	**1595**	20221025	3.14048	101.67499	32.5	*Alstonia angustiloba*
263	**1592**	20221025	3.14043	101.67498	22.6	*Streblus elongatus*
264	**1593**	20221025	3.14053	101.67494	25.1	*Streblus elongatus*
265	**1628**	20221028	3.14045	101.67513	17.5	*Artocarpus scortechinii*
266	**1591**	20221025	3.14042	101.67497	17.2	*Pellacalyx saccardianus*
267	**1590**	20221025	3.14037	101.6749	28	*Streblus elongatus*
269	**1634**	20221028	3.14031	101.67507	21.5	*Porterandia anisophylla*
270	**1597**	20221025	3.14024	101.67484	22.3	*Gironniera nervosa*
271	**1633**	20221028	3.1403	101.67497	14.3	*UNKN2*
272	**1596**	20221025	3.14026	101.67503	13.7	*Garcinia nervosa*
273	**1601**	20221028	3.14015	101.67499	23.2	*Nauclea maingayi*
267	**1590**	20221025	3.14037	101.6749	28	*Streblus elongatus*
269	**1634**	20221028	3.14031	101.67507	21.5	*Porterandia anisophylla*
270	**1597**	20221025	3.14024	101.67484	22.3	*Gironniera nervosa*
271	**1633**	20221028	3.1403	101.67497	14.3	*UNKN2*
272	**1596**	20221025	3.14026	101.67503	13.7	*Garcinia nervosa*
273	**1601**	20221028	3.14015	101.67499	23.2	*Nauclea maingayi*
274	**1602**	20221028	3.14017	101.67499	29.6	*Nauclea maingayi*
275	**1603**	20221028	3.14012	101.67505	29.6	*Nauclea maingayi*
276	**1604**	20221028	3.1401	101.67486	30.2	*Adinobotrys atropurpureus*
283	**1605**	20221028	3.14009	101.67493	17.5	*Heritiera simplicifolia*
284	**1606**	20221028	3.14011	101.67506	19.9	*Szyzgium sp*
285	**1607**	20221028	3.14013	101.67504	19.6	*Garcinia nervosa*
289	**1610**	20221028	3.14007	101.67515	15.3	*Aidia densiflora*
290	**1608**	20221028	3.1401	101.67505	25.5	*Nauclea maingayi*
291	**1611**	20221028	3.14012	101.67516	22.3	*Litsea sp.*
292	**1631**	20221028	3.14033	101.67508	28.7	*Pellacalyx saccardianus*
293	**1615**	20221028	3.14032	101.67512	13.1	*Nauclea maingayi*
294	**1612**	20221028	3.14011	101.67517	17.2	*Baccaurea sp*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
295	**1613**	20221028	3.14021	101.67515	17.4	*Nauclea maingayi*
296	**1609**	20221028	3.14003	101.67522	93	*Falcataria falcata*
297	**1614**	20221028	3.14014	101.67521	23.2	*Endospermum malaccense*
298	**1616**	20221028	3.14028	101.67518	38.2	*Artocapus integer var. silvestris*
299	**1625**	20221028	3.14035	101.67524	15.9	*Artocarpus scortechinii*
300	**1624**	20221028	3.14035	101.67519	110.5	*Alstonia angustiloba*
301	**1626**	20221028	3.14039	101.67511	22.3	*Artocarpus scortechinii*
302	**1627**	20221028	3.14041	101.67517	15.3	*Chisocheton sp*
303	**1629**	20221028	3.14038	101.67518	20.1	*Myristica sp/Knema sp*
304	**1630**	20221028	3.14037	101.67518	25.9	*Streblus elongatus*
305	**1618**	20221028	3.14043	101.67521	17	*Artocarpus integer var. silvestris*
306	**1619**	20221028	3.14044	101.67525	74.5	*Dacryodes rugosa*
307	**1620**	20221028	3.14047	101.67527	35	*Cratoxylum cochinchinense*
308	**1622**	20221028	3.14048	101.67539	24.2	*Microcos tomentosa*
309	**1621**	20221028	3.1405	101.67532	55.7	*Artocarpus elasticus*
310	**1623**	20221028	3.14044	101.67539	26.9	*Vitex pubescence*
311					15.6	*Mati*
312	**1642**	20221101	3.14027	101.67536	52.5	*Adenanthera bicolor*
313	**1617**	20221028	3.1404	101.67524	27.4	*Dacryodes rugosa*
314	**1647**	20221101	3.14034	101.67541	13.7	*Streblus elongatus*
315	**1648**	20221101	3.14036	101.67548	27.4	*Vitex pubescence*
319	**1650**	20221101	3.14018	101.67551	140.4	*Alstonia angustiloba*
321	**1649**	20221101	3.14022	101.67551	22.1	*Streblus elongatus*
322	**1644**	20221101	3.14031	101.67549	22.6	*Pellacalyx saccardianus*
323	**1645**	20221101	3.14034	101.67548	15.3	*Myristica sp*
324	**1646**	20221101	3.14034	101.67543	17.2	*Gironniera nervosa*
325	**1643**	20221101	3.14033	101.67532	20.4	*Nauclea maingayi*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
326	**1641**	20221101	3.14024	101.67539	42.7	*Artocarpus integer var. silvestris*
327	**1639**	20221101	3.14024	101.67539	20.2	*Litsea umbellata*
328	**1640**	20221101	3.14012	101.67532	22.4	*Baccaurea sp*
330	**1635**	20221101	3.14013	101.67535	28.5	*Gironniera nervosa*
331	**1636**	20221101	3.14011	101.67545	15.6	*Szyzgium sp*
332	**1637**	20221101	3.14006	101.67546	18	*Nauclea maingayi*
333	**1638**	20221101	3.14015	101.67543	12.9	*Symplocos cochinchinensis ssp laurina*
334	**1651**	20221101	3.14021	101.67558	42.7	*Xerospermum noronhianum*
335	**1653**	20221101	3.14021	101.67566	28.8	*Vitex quinate*
336	**1652**	20221101	3.14017	101.67566	15.8	*Pellacalyx saccardianus*
337	**1654**	20221101	3.1401	101.67559	31.5	*Ixonanthes reticulata*
338	**1656**	20221101	3.14012	101.67565	15.1	*UNKN3*
340	**1655**	20221101	3.14022	101.67569	15.3	*Hevea brasiliensis*
341	**1658**	20221101	3.14015	101.67559	18.1	*Barringtonia scortechinii*
342	**1657**	20221101	3.14003	101.67562	0.8	*Adinobotrys atropurpureus*
343	**1659**	20221101	3.14005	101.67571	18.9	*Artocarpus integer var. silvestris*
363	**1867**	20230113	3.14042	101.67587	19.6	*Arthrophyllum diversifolium*
365	**1868**	20230113	3.14039	101.67586	13.7	*Arthrophyllum diversifolium*
367	**1864**	20230113	3.14032	101.67602	41.1	*Archidendron ellipticum*
369	**1866**	20230113	3.14036	101.67609	18.6	*Mati*
369	1877	**20230113**	3.14005	101.6759	58.5	*Artocarpus integer var. integer*
370	**1865**	20230113	3.14031	101.67612	63.2	*Adina eurhyncha*
374	**1863**	20230113	3.1402	101.67595	17.5	*Artocarpus integer var. silvestris*
375	**1862**	20230113	3.14018	101.676	31.5	*Syzygium sp*
377	**1861**	20230113	3.14021	101.67606	28	*Arthrophyllum diversifolium*
378	**1860**	20230113	3.14014	101.67605	20.9	*Streblus elongatus*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
379	1870	**20230113**	3.14016	101.67595	52	*Artocarpus scortechinii*
380	**1871**	20230113	3.14009	101.6759	31.2	*Streblus elongatus*
387	**1883**	20230113	3.14005	101.67584	12.1	*Artocarpus integer var. silvestris*
388	**1881**	20230113	3.14004	101.67585	19.7	*Elaeocarpus petiolatus*
390	**1884**	20230113	3.14004	101.67591	13.1	*UNKN3*
391	**1873**	20230113	3.14011	101.67603	17.2	*Streblus elongatus*
392	**1872**	20230113	3.14006	101.67592	14	*Streblus elongatus*
426	**1812**	20221116	3.14007	101.67633	16.9	*Syzygium sp*
427	**1810**	20221116	3.14009	101.67635	32.3	*Macaranga triloba*
428	**1811**	20221116	3.1401	101.67636	11.6	*Aidia densiflora*
429	**1809**	20221116	3.14014	101.67638	21.4	*Ochanostachys amentacea*
436	**1808**	20221116	3.14008	101.67645	20.4	*Pellacalyx saccardianus*
437	**1807**	20221116	3.14007	101.67645	33.7	*Nauclea maingayi*
439	**1804**	20221116	3.14007	101.67653	18.1	*Arthrophyllum diversifolium*
440	**1803**	20221116	3.14004	101.67655	20.2	*Macaranga gigantea*
442	**1802**	20221116	3.14	101.67657	16.9	*Arthrophyllum diversifolium*
446	1815	**20221116**	3.14006	101.67666	54.1	*Artocarpus scortechinii*
447	**1816**	20221116	3.14005	101.67667		*Vitex pubescence*
470	**1790**	20221116	3.13996	101.67674	67.2	*Artocarpus scortechinii*
474	**1788**	20221114	3.13997	101.67684	17.8	*Nauclea maingayi*
475	**1787**	20221114	3.13998	101.67677	124.2	*Alstonia angustiloba*
477	**1786**	20221114	3.14001	101.67691	22	*Porterandia anisophylla*
480	**1785**	20221114	3.13998	101.67701	12.7	*Hevea brasiliensis*
481	**1782**	20221114	3.13998	101.6771	70	*Artocarpus kemando*
482	**1784**	20221114	3.13995	101.67709	16.9	*Canarium sp*
493	**1765**	20221111	3.13991	101.6769	22.4	*Macaranga gigantea*
494	**1766**	20221111	3.1399	101.67692	45.8	*Artocarpus scortechinii*
500	**1776**	20221114	3.13988	101.67724	18.8	*Porterandia anisophylla*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
503	**1778**	20221114	3.13982	101.67737	104.1	*Alstonia angustiloba*
504	**317**	20230223	3.13979	101.6773		*Pellacalyx saccardianus*
505	**1780**	20221114	3.13993	101.67738	61.4	*Alstonia angustiloba*
525	**330**	20230223	3.13988	101.67795		*Pellacalyx saccardianus*
526	**329**	20230223	3.13992	101.67797		*Macaranga gigantea*
527	**306**	20230223	3.13975	101.677		*Pellacalyx saccardianus*
533	1779	**20221114**	3.13985	101.67738	17.2	*Antidesma forbesiii*
534	**1777**	20221114	3.13984	101.67738	37.2	*Euodia glabra*
535	**1775**	20221114	3.13971	101.67707	65.9	*Alstonia angustiloba*
536	**1760**	20221111	3.13974	101.67689	120.3	*Falcataria falcata*
538	**308**	20230223	3.13971	101.67701		*Alstonia angustiloba*
540	**1771**	20221114	3.13976	101.67701	16.9	*Baccaurea sp*
541	**1774**	20221114	3.13976	101.67707	13.7	*Palaquium maingayi*
542	**1772**	20221114	3.13968	101.67703	22	*Macaranga gigantea*
543	**1773**	20221114	3.13967	101.67703	32.5	*Macaranga gigantea*
544	**1763**	20221111	3.13981	101.67694	21.6	*Alstonia angustiloba*
545	**1379**	20221003	3.13911	101.67682	14.3	*Sterculia sp*
549	**1761**	20221111	3.13982	101.67684	61.1	*Strombosia sp*
552	**1762**	20221111	3.13976	101.67681	47	*Alstonia angustiloba*
553	**1770**	20221114	3.13975	101.67677	13.7	*Porterandia anisophylla*
554	**1769**	20221114	3.13979	101.6767	25	*Microcos tomentosa*
555	**1789**	20221116	3.13975	101.67663	20.7	*Microcos tomentosa*
557	**1792**	20221116	3.13984	101.67661	20.1	*Xanthophyllum sp*
558	**1793**	20221116	3.13982	101.6766	26.4	*Porterandia anisophylla*
559	**1791**	20221116	3.13989	101.67663	24.5	*Szyzgium sp*
563	**1795**	20221116	3.13987	101.67657	31.5	*Vitex pubescence*
565	**1801**	20221116	3.13995	101.67657	49.3	*Litsea sp.*
566	**1796**	20221116	3.13989	101.6766	20.1	*Streblus elongatus*
568	**1798**	20221116	3.13997	101.67653	44.9	*Alstonia angustiloba*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
569	**1799**	20221116	3.13996	101.67648	12.1	*Streblus elongatus*
570	**1797**	20221116	3.13994	101.67648	23.9	*Gironniera nervosa*
571	**1800**	20221116	3.13999	101.67648	30.4	*Streblus elongatus*
573	**1805**	20221116	3.13995	101.67644	13.5	*Ochanostachys amentacea*
574	**1806**	20221116	3.14003	101.67644	12.7	*Euodia glabra*
575	**1817**	20221116	3.14002	101.67623	20.1	*Mati*
601	**1822**	20221116	3.13983	101.67634	16.7	*Hevea brasiliensis*
602	**1820**	20221116	3.13992	101.67625	13.1	*Kompassia excelsa*
603	**1819**	20221116	3.13989	101.67623	21	*Symplocos cochinchinensis ssp laurina*
604	**1821**	20221116	3.13981	101.67628	16.7	*Macaranga triloba*
605	**1831**	20221116	3.13963	101.67632	22.9	*Streblus elongatus*
606	**1829**	20221116	3.13966	101.67637	12.7	*Streblus elongatus*
607	**1830**	20221116	3.13962	101.67633	13.5	*Streblus elongatus*
608	**1833**	20221116	3.1396	101.67644	15.9	*Baccaurea sp*
609	**1767**	20221114	3.13951	101.67644	18.5	*Cryptocarya sp*
616	**1768**	20221114	3.13968	101.67654	65.6	*Artocarpus elasticus*
617	1794	**20221116**	3.13979	101.67654	25.5	*Arthrophyllum diversifolium*
618	**1757**	20221111	3.13951	101.67685	20.1	*Oroxylum indicum*
619	**1750**	20221111	3.13943	101.67673	22.6	*Arthrophyllum diversifolium*
620	**1751**	20221111	3.13945	101.67672	77	*Alstonia angustiloba*
621	**1749**	20221111	3.13944	101.67666	22.6	*Oroxylum indicum*
622	**1748**	20221111	3.13941	101.67673	18.8	*Pellacalyx saccardianus*
624	**1752**	20221111	3.1393	101.67673	29.6	*Artocarpus scortechinii*
625	**1755**	20221111	3.13932	101.67678	22.9	*Oroxylum indicum*
626	**1753**	20221111	3.13939	101.67671	15.3	*Alstonia angustiloba*
627	**1754**	20221111	3.13916	101.67672	13.5	*Pellacalyx saccardianus*
629	**1381**	20221003	3.13903	101.6766	30.6	*Chisocheton sp*
630	**1382**	20221003	3.13913	101.67659	22.9	*Pellacalyx saccardianus*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
633	**1367**	20221003	3.13895	101.67683	101.2	*Artocarpus scortechinii*
634	**1369**	20221003	3.13894	101.67685	18.1	*Oroxylum indicum*
635	**1368**	20221003	3.13891	101.67683	15	*Sterculia parvifolia*
636	**1373**	20221003	3.13906	101.67683	29.9	*Sandoricum koetjape*
637	**1374**	20221003	3.13911	101.67675	25.5	*Micocos tomentosa*
638	**1370**	20221003	3.1391	101.67693	17.4	*Cinnamomum iners*
639	**1372**	20221003	3.13913	101.67692	82.5	*Falcataria falcata*
640	**1371**	20221003	3.13915	101.67691	94.5	*Falcataria falcata*
641	**1378**	20221003	3.13921	101.67694	16.2	*Durio ziberthinus*
642	**1377**	20221003	3.13914	101.67693	16.9	*Artocarpus hetrophyllus*
643	**1376**	20221003	3.13913	101.67693	35	*Chisocheton sp*
644	**1375**	20221003	3.13917	101.67688	20.9	*Chisocheton sp*
646	**1380**	20221003	3.13906	101.67674	28.3	*Kompassia excelsa*
647	**1383**	20221003	3.13891	101.67653	16.6	*Palaquium sp*
648	**1385**	20221003	3.13898	101.67651	28	*Streblus elongatus*
650	**1386**	20221003	3.13889	101.67653	36.3	*Nephelium eriopetalum*
651	**1387**	20221003	3.13884	101.67657	32.2	*Nephelium eriopetalum*
652	**1366**	20221003	3.13882	101.67659	159.2	*Alstonia angustiloba*
653	**1388**	20221003	3.13871	101.67651	24.8	*Artocarpus elasticus*
654	**1384**	20221003	3.13886	101.67641	17.8	*Pellacalyx saccardianus*
656	**1365**	20221003	3.13884	101.67644	12.4	*Palaquium sp*
657	**1363**	20221003	3.1386	101.67646	74.5	*Terminalia catappa*
658	**1362**	20221003	3.13863	101.67648	46.8	*Ficus sp*
713	**1891**	20230217	3.13938	101.6761		*Sterculia macrophylla*
714	**1885**	20230217	3.13941	101.67629		*Szyzgium sp*
715	**1886**	20230217	3.13946	101.67627		*UNKN5*
716	**1887**	20230217	3.13942	101.6763		*Pouteria malaccensis*
717	**1888**	20230217	3.13941	101.67635		*Hevea brasiliensis*
718	**1889**	20230217	3.13939	101.67631		*Symplocos sp*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
719	**1832**	20221116	3.13951	101.67636	72	*Myristica sp*
720	**1827**	20221116	3.13962	101.67628	119	*Horsfieldia irya*
720	**1892**	20230217	3.13964	101.67625		*Horsfieldia superba*
721	**1828**	20221116	3.13962	101.67621	128	*Artocarpus kemando*
721	**1893**	20230217	3.1396	101.67619	crownless	*Artocarpus elasticus*
722	**1894**	20230217	3.13972	101.67618		*Kedodong*
723	**1825**	20221116	3.13973	101.6762	148	*Alstonia angustiloba*
724	**1826**	20221116	3.13968	101.67615	97.5	*Litsea umbellata*
726	**1849**	20230113	3.13963	101.67598	91.5	*Hevea brasiliensis*
727	**1848**	20230113	3.13965	101.67601	78	*Arthrophyllum diversifolium*
729	**1844**	20230113	3.13977	101.676	58	*Elaeocarpus petiolatus*
729	1847	**20230113**	3.13958	101.67599	58	*Nauclea maingayi*
730	**1839**	20230113	3.13979	101.67606	60.5	*Garcinia nervosa*
732	**1841**	20230113	3.13978	101.67602	37.5	*Elaeocarpus petiolatus*
733	**1840**	20230113	3.13985	101.67606	63.5	*Artocarpus integer var. silvestris*
734	**1856**	20230113	3.13983	101.67613	45.5	*Streblus elongatus*
735	**1855**	20230113	3.13991	101.67608	73	*Streblus elongatus*
740	**1842**	20230113	3.13975	101.67609	46	*Streblus elongatus*
741	**1824**	20221116	3.13975	101.67616	64.5	*Arthrophyllum diversifolium*
742	1823	**20221116**	3.13986	101.67631	58	*Artocarpus elasticus*
743	**1818**	20221116	3.13999	101.6763	187	*Falcataria falcata*
744	**1854**	20230113	3.13996	101.67607	118	*Euodia glabra*
745	**1853**	20230113	3.14	101.67606	51.5	*Gironniera nervosa*
747	**1880**	20230113	3.13994	101.67597	53.5	*Gironniera nervosa*
748	**1879**	20230113	3.13993	101.67586	63.5	*Artocarpus integer var. silvestris*
749	**1878**	20230113	3.13999	101.67587	43	*Artocarpus elasticus*
750	**1875**	20230113	3.14004	101.67585	107.5	*Artocarpus elasticus*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
751	**1876**	20230113	3.14001	101.67596	41	*Nauclea maingayi*
752	**1874**	20230113	3.14009	101.67594	62	*Streblus elongatus*
753	**1859**	20230113	3.14012	101.67605	150	*Alstonia angustiloba*
754	**1851**	20230113	3.14014	101.67616	48.5	*Streblus elongatus*
755	**1858**	20230113	3.14004	101.6761	39	*Canarium sp*
756	**1852**	20230113	3.14005	101.67604	41.5	*Streblus elongatus*
758	**1813**	20221116	3.14013	101.67623	35	*Porterandia anisophylla*
760	**1906**	20230217	3.13996	101.67565	48.5	*Streblus elongatus*
761	**1907**	20230217	3.13991	101.67579	47.5	*Streblus elongatus*
762	**1905**	20230217	3.1399	101.67556		Mati
763	**1908**	20230217	3.13999	101.6757	73	*Adina eurhyncha*
764	**1912**	20230217	3.13991	101.67561	56.5	*Nephelium sp*
765	**1910**	20230217	3.14	101.67557	150	*Artocapus scortechinii*
766	**1905**	20230217	3.1399	101.67556		*Artocapus scortechinii*
767	**1914**	20230217	3.13999	101.67549	42	*Artocapus scortechinii*
768	**1913**	20230217	3.13995	101.67547	57.5	*Chisocheton sp*
769	**1911**	20230217	3.13995	101.6755	53.5	*Dispyros lanceifolia*
770	**1909**	20230217	3.14004	101.67553	62.5	*Bacaurea sp*
771	**1913**	20230217	3.13995	101.67547	36	*Symplocos cochinchinensis ssp laurina*
772	**1915**	20230217	3.14003	101.67549	41	*Aidia densiflora*
773	**1916**	20230217	3.14003	101.67544	128.5	*Sarcotheca griffithii*
775	**1917**	20230217	3.13992	101.67544	37.5	*Strebulus elongatus*
776	**1918**	20230217	3.13992	101.67542	51	*Aporosa arborea*
777	**1919**	20230217	3.13992	101.67543	86	*Strebulus elongatus*
778	**1921**	20230217	3.1399	101.67544	149	*Alstonia angustiloba*
779	**1920**	20230217	3.13993	101.6754	115	*Strebulus elongatus*
780	**1922**	20230217	3.13991	101.67545	61	*Strebulus elongatus*
781	**1903**	20230217	3.13984	101.67549	78	*Strebulus elongatus*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
805	**1899**	20230217	3.13985	101.67539		*Porterandia anisophylla*
808	**1902**	20230217	3.13984	101.67545		*Macaranga gigantea*
809	**1897**	20230217	3.13985	101.67538		*Mangifera sp*
810	**1898**	20230217	3.13986	101.67535		*Arthrophyllum diversifolium*
811	**1896**	20230217	3.13972	101.67542		*Chisocheton sp*
812	**1901**	20230217	3.13985	101.67544		*Euodia glabra*
813	**1900**	20230217	3.13986	101.67548		*Macaranga gigantea*
814	**1895**	20230217	3.13966	101.67545		*Medang*
T001	**1758**	20221111	3.13949	101.67703		*Ficus sp*
T002	**1764**	20221111	3.13985	101.67691	190	*Artocarpus integer var. silvestris*
T002	1764	**20221111**	3.13985	101.67691	160	*Alstonia angustiloba*
T003	**1781**	20221114	3.13998	101.67738	140	*Alstonia angustiloba*
T003	1781	**20221114**	3.13998	101.67738	145	*Artocarpus integer var. integer*
T004	**1783**	20221114	3.14015	101.67722		*Euodia glabra*
T007	**1845**	20230113	3.13975	101.67582		*Heritiera simplicifolia*
T009	**1846**	20230113	3.13981	101.6759		*Artocarpus integer var. silvestris*
T010	**1870**	20230113	3.14016	101.67595		*Artocarpus elasticus*
T011	**1882**	20230113	3.13998	101.67579		*Eleaeocarpus petiolatus*
T011	**1869**	20230113	3.14033	101.6758		*Streblus elongatus*
T012	**1890**	20230217	3.13949	101.6765		*Macaranga gigantea*
T015	**348**	20230223	3.1396	101.67836	55	*Ficus sp*
T016					30	*Streblus elongatus*
T019	**364**	20230223	3.13987	101.67868		*Artocarpus elasticus*
T028					38.5	*Sterculia rostrata*
T029	**611**	20230306	3.13859	101.67639	31.5	*Adina eurhyncha*
NT1	**162**	20230222	3.14025	101.67405	20	*Ochanostachys amentacea*
NT2	**150**	20230222	3.14018	101.67426		*Diospyros argentea*

TAG #	GPS NO	GPS DATE	GPS [N]	GPS [E]	Dbh (cm)	*Species*
NT3	**121**	20230222	3.14073	101.67366		*Vitex pubescence*
NT4	**120**	20230222	3.14076	101.67362		*Peltophorum pterocarpum*
NT5	**119**	20230222	3.14078	101.67369		*Microcos tomentosa*
NT6	**118**	20230222	3.1408	101.67375		*Litsea sp*
NT7	**265**	20230223	3.13861	101.67653		*Alstonia angustiloba*

*The list of tree species was identified based on their field characteristics of bark and leaf only (KM Kochummen and Wyatt-smith, 1979; Corner, 1952). Hence some of the species would need to be verified through the collection of their flowers and fruits. Some tagged trees could not be located and hence were not identified. Some trees were untagged (NT) but were GPS located and identified. Some trees were tagged with a temporary tag (T).